



CHINA COUNCIL FOR INTERNATIONAL
COOPERATION ON ENVIRONMENT
AND DEVELOPMENT

Policy Research Report on Environment and Development

MANAGEMENT AND
INSTITUTIONAL INNOVATION
IN GREEN DEVELOPMENT

2014



**China Council for International Cooperation
on Environment and Development**

Policy Research Report on Environment and Development

Management and Institutional Innovation in Green Development 2014

CCICED Policy Research Report on Environment and Development

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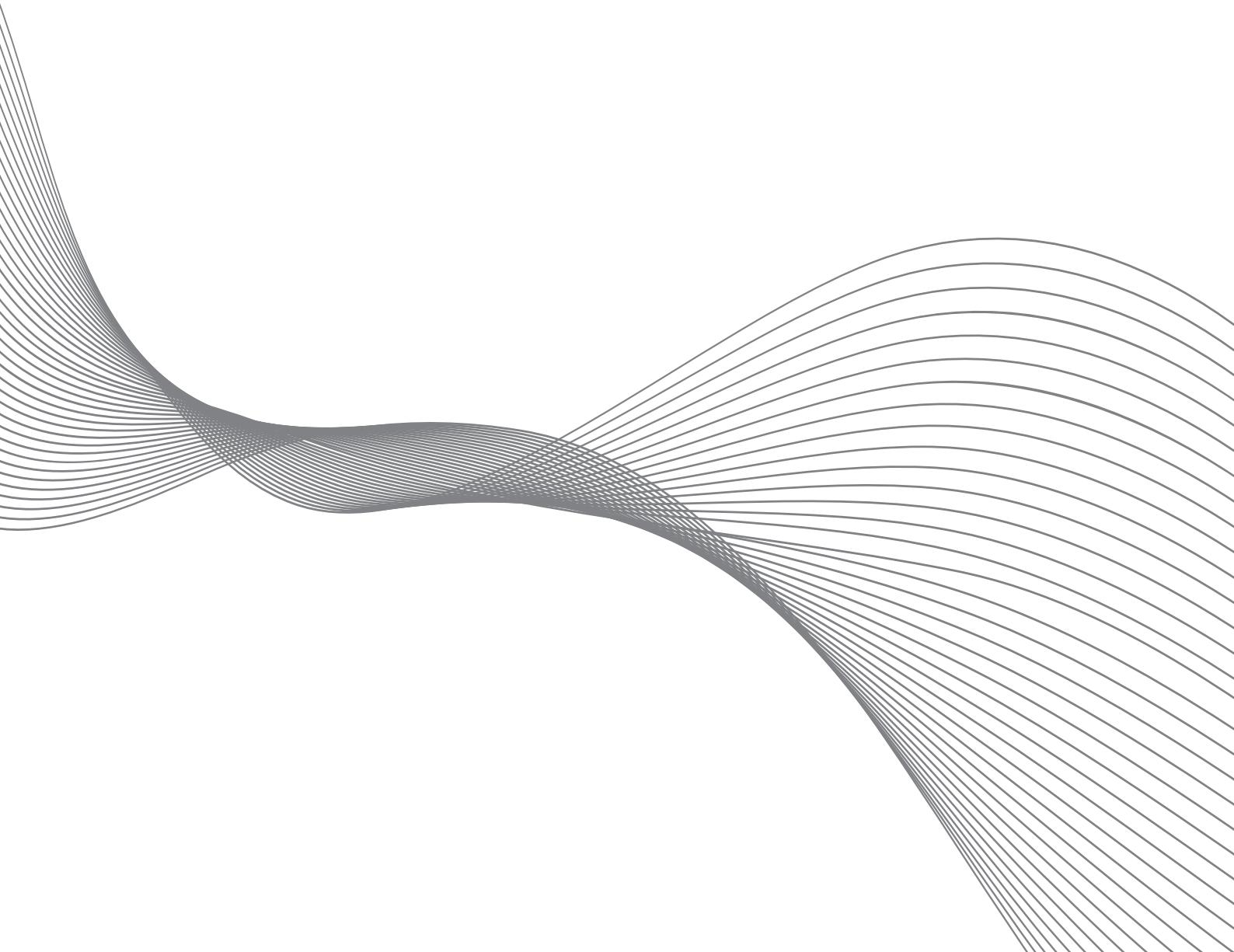
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NOTE ON THIS VOLUME

2014 marks a significant year for China's environment and development. Convened in November, the 4th plenary session of the 18th National Congress of the Communist Party of China examined and adopted the *Decision of the Central Committee of the Communist Party of China on Major Issues Concerning Comprehensively Promoting Law-based Governance*. The Decision emphasizes the need to put in place a strict legal system to protect the environment, and establish expeditiously the legal framework to support ecological civilization. This will ensure that development activities are regulated and green development promoted. It will also support a number of important policies, including circular development, low-carbon development, strengthen the producer's legal liability for environmental protection, and significantly raise the penalties for violating the law.

A number of other measures were put forward to promote ecological civilization, including establishing natural resource property rights, enshrining in law national land use planning, and finally putting ecological compensation, and the control of soil, water and air pollution on a sound legal foundation. There is a strong conviction that with the emphasis on governance and rule of law, there can be effective safeguards for environment and sustainable development in China.

Against this backdrop, the China Council for International Cooperation on Environment and Development (CCICED) held its 2014 Annual General Meeting (AGM) on the theme of "Management and Institutional Innovation in Green Development". Six research projects including "Evaluation and Prospects for a Green Transition Process in China", "Ecological Civilization and Innovation of Environmental Management System", "Good City Models under the Concept of Ecological Civilization", "Institutional Innovation of Eco-Environmental Redlining", "Performance Evaluation on the Action Plan of Air Pollution Prevention and Control and Regional Coordination Mechanism", and "Green Accounting and Environmental Performance Evaluation" reported their research findings to the AGM. In addition, council members and experts were able to exchange views during two parallel forums on the themes of "Institutional Innovation in Ecological Civilization" and "Green Transformation and Prospects". Policy recommendations were finalized based on AGM deliberations where the opinions of council members and experts were openly aired.

Mr. Zhang Gaoli, Member of the Standing Committee of Political Bureau of CPC Central Committee, Vice Premier of the State Council, and Chairperson of CCICED, delivered a keynote speech at the opening ceremony. He commended the CCICED for its achievements and the important role it has played, promoting China's environment and development for over 20 years since its foundation. He stated that the Chinese government will remain steadfast in its support of the CCICED, adding he hopes the CCICED will continue to make important policy contributions and to serve as a platform to discuss the green development of China and the world.

CCICED council members believe China has a window of opportunity to realize a development transformation. As China is entering the “new normal”, decision makers need to safeguard against potential crisis, maintain high standards of environmental protection and raise key targets, thus paving the way for accelerated green transformation. China must seize this opportunity in order to resolve existing tensions between social and economic development as well as environmental protection and resource conservation. China is in a position to establish a system described as “ecological civilization”, by reforming its environmental protection system, and making major innovations in the area of environment and development.

This policy research report of environment and development incorporates the CCICED’s 2014 policy research findings, the CCICED 2014 policy recommendations to the Chinese government, and a study of major policy progress on China’s environment and development (2013-2014). We trust it will prove useful to decision-makers at all levels, experts, scholars and anyone interested in environment and sustainable development.

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CHAPTER 1

POLICY RECOMMENDATIONS TO THE GOVERNMENT OF CHINA

The 2014 Annual General Meeting of the China Council for International Cooperation on Environment and Development (CCICED 3rd AGM of Phase V) was held from 1 to 3 December 2014 in Beijing with the theme of *Management and Institutional Innovation for Green Development*.

Over the past year, CCICED members have noted the progress of comprehensive reforms in China, such as those for decentralization, the *hukou* system and family planning policies. With decisions of the 4th Plenary Session of the 18th CPC Congress in October 2014, CCICED members believe that “comprehensively deepening reform” and “rule of law” together can provide an appropriate pathway and a strengthened institutional framework for an Ecological Civilization.

In the field of environment and development, China has achieved impressive economic progress such as a reasonable growth rate with steadily growing employment and implementation of policies for restructuring and stimulation of markets. A strictest-ever Environmental Protection Law revision has been issued, the Air Pollution Control Action Plan is showing some preliminary achievements, and most mandatory targets in the 12th Five Year Plan (FYP) are being achieved within the planned schedule. A national strategy of new urbanization has been developed with considerable focus on environmental protection and management.

The recent success of the APEC meeting has indicated the value of China playing a proactive and important role concerning regional and global environmental, economic and social development agendas. Furthermore, the air quality control actions taken during the APEC meetings confirmed that China’s pollution control strategy have the potential to achieve desired effects—but only if very strong efforts are put in place on a more continuous basis. CCICED members also observed that the APEC *Beijing Declaration* fully embraces green, circular, low-carbon development with green supply chains, as well as showing commitment for GHG emission reduction by the USA and China. All these green approaches are topics on which CCICED has provided policy recommendations to the government of China. We are pleased to see the advice translated into action.

We believe that China’s government has made great efforts to move China towards a green transition and has achieved some promising results. However, generally speaking, the green transition in China is still in its early and very challenging stage with unprecedented and complicated situations both domestically and internationally. Internationally, the pace of global economic recovery is slow, the new order of international politics is yet to be formed, and there are difficulties in reaching consensus on the post-2015 sustainable development agenda and climate change objectives.

Within China, it is critically important to address multiple challenges, including adjustment of the structure and growth rate of the economy, absorbing the effects of previous stimulus policies, handling emerging social conflicts while respecting the limits set by natural resources and the environment. The overlap and interaction of

both national and international issues is becoming a “new normal” situation for environment and development in China. And so is the gradual reduction in economic growth.

In the context of these “new normal” conditions, the problem of environmental protection lagging behind economic development still has to be solved. Some of the environmental problems have been accumulating towards tipping points which once reached will inflict significant damage. The smog pollution in recent years is an example of such a tipping point. Similar trends are also found in terms of water and soil pollution, with the potential to seriously damage ecosystem services. If not timely and effectively addressed, such problems will become key obstacles and risks for the achievement of a well-off society. Thus, the challenge is to turn the tipping into turning points by continuously improving political willingness to solve environmental issues, maintaining comprehensive and deepening reform, and enhancing strict environmental protection enforcement.

We emphasize the coming 15 years as the time frame required for a Green Transition Strategy in China. This period spans the 13th FYP to 2030. It is a period when energy and material use will peak, and when new “clean tech” opportunities will abound. It is the critical time for completion of major infrastructure and urban development projects. Importantly, it is the time when globally and in China it is possible to achieve significant improvements in the War on Pollution, protection of ecological services and biodiversity and to reduce the risks associated with climate change. If this window of opportunity for successful environmental protection is lost, there can be little guarantee of long-term prosperity.

Over this 15 year period we believe it should be possible to reach turning points: in the War on Pollution, and particularly on air pollution; on adjusting the fossil-fuel-dominant energy mix; on very significant improvement within a decade for protection of ecological services and biodiversity through mechanisms such as ecological red lines; and, by 2025 to 2030, full utilization of improved environmental technologies now under development. Beneficial results over the coming 15-year period will depend highly on success with green urban development, implementation of green market-based instruments, green supply chains, and the emergence of an environmentally sustainable domestic economy.

This year’s theme of *Management and Institutional Innovation for Green Development* is the next step in CCICED’s examination of policy needs to place China on a path towards becoming an Ecological Civilization. Two task forces were established under this theme: *Institutional Innovation for Environmental Protection in the Context of Ecological Civilization*, and *Evaluation and Prospects for a Green Transition Process in China*. In addition, four special policy studies have been conducted, including: *Performance Evaluation on the Action Plan of Air Pollution Prevention and Control and Regional Coordination Mechanism*; *Good City Models under the Concept of Ecological Civilization*; *Institutional Innovation of Eco-Environmental Redlining*; and *Chinese Environmental Audit System for Government Officials*.

As 2015 is the last year of the 12th FYP and a critical time for developing the 13th FYP, CCICED is forwarding six recommendations that we hope will be useful for the new plan as well as for other purposes. Policy Recommendation 1 addresses an overall environment and development strategy for the 13th FYP. The other 5 recommendations relate to our work on several priority topics leading from the 3rd and 4th Plenums of the 18th CPC National Congress.

1.1 RECOMMENDATION 1. The Chinese government should grasp the current window of opportunity within the 13th FYP to comprehensively deepen reform, strengthen enforcement, and accelerate the green transition progress.

1.1.1 Decision makers should be made aware of the serious consequences of delays in addressing the environmental crisis and understand that a window of opportunity has emerged.

For the 13th FYP period, decision-makers at all levels should develop a strong awareness that “unresolved crises will create more crises” and that it is possible to “achieve overall improvements if the current window of opportunity is used well”. Under the “new normal” situation, with economic development shifting to a new form and pace, environmental targets should be further tightened so as to accelerate the green transition.

1.1.2 The Five Year Plan title, “National Economic and Social Development Plan”, should be changed to “National Economic, Social and Environmental Development Plan”.

Change of the title of national five-year plans and the incorporation of greatly strengthened approaches to environmental and ecological management will give clearer signals for environmental protection, and will help ensure concrete implementation of the provision for “harmony between economic and social development and environmental protection” as noted in the new Environmental Protection Law. An independent chapter on “the construction of ecological civilization” should be included and address environmental and ecological protection with emphasis on the targets of environmental and ecological improvements and public health.

1.1.3 Develop a longer-term roadmap for a Green Transition Strategy.

China’s green transition overlaps very significantly with its economic, demographic and social transitions. The task of green transition in China has to be centred on the “greening” of traditional economic and social transitions. This will be a long-term task which requires the Government of China to develop a roadmap and timetable for a green transition over the next 10-20 years, including issues like air, water, and soil pollution, peaking of greenhouse gas emissions by 2030 at the latest, safeguarding and enhancing ecosystems and ecological services, and achieving various environmental quality turning points as soon as possible. This roadmap also should provide insight into China’s needs for improved environmental spatial planning and sustainable domestic consumption, especially in China’s rapidly expanding urban areas.

1.1.4 Speed up institutional development and reform for Ecological Civilization and improve environmental governance capacity.

- a) The first task deals with the establishment of high-level leading and coordinating mechanisms. A Central Ecological Civilization Construction Leading Group and a State Council Environmental Protection Committee are possible options for such mechanisms.
- b) The second task is to clarify the responsibilities for the establishment of an efficient eco-environmental management system with adequately allocated functions, optimized structures, and properly-matched power and responsibilities. Pollution prevention and control functions that are currently scattered across various

departments should be integrated and unified supervision be carried out for all pollution sources, pollutants and environmental media.

- c) The third task is to reinforce integrated supervision responsibility for environmental protection and independent enforcement power with improved implementation capacity. The national supervision of local environmental protection performance should be strengthened; and environmental quality should be treated as an important part in the local government's performance appraisal system. Third party independent evaluation of the performance of sectors should be organized periodically, with the results publicly disclosed.
- d) The fourth task aims for changes in economic, social and cultural fields to accommodate eco-environmental protection reforms, following requirements put forward by the “five-in-one” approach. Innovations should be sought that will boost coordinated development of environment, economy and society.

1.1.5 Achieve breakthroughs in comprehensive reforms in the field of environment and development during the 13th FYP period.

- a) Implement market reforms and economic restructuring towards green transition, and correct the relationships among environment, energy and development;
- b) comprehensively reform and upgrade environmental protection institutions, promote modernization of the environmental governance system and enhance its capacity;
- c) speed up the implementation of the new urbanization strategy, explore urbanization models under the concept of Ecological Civilization, and develop specific policy measures and ensure their full implementation;
- d) develop a more comprehensive regional air pollution control mechanism and enhance synergy of GHG and air pollutants emission reduction; and
- e) strengthen environmental laws and speed up the introduction and implementation of some important governance systems such as eco-redlining and environmental performance audits.

1.2 RECOMMENDATION 2. Reform the environmental protection institutional system towards the objective of creating an Ecological Civilization.

Modernization of the national governance system should strengthen the authority of environmental departments through a more powerful environmental ministry. Importantly, the role of environmental responsibilities needs to be clarified for the many sectoral agencies and departments, and where necessary additional capacity must be developed. A government-led multi-stakeholder governance mode should be established to promote transition and innovation in various fields of environmental management. Therefore, we recommend that the Government of China:

1.2.1 Promote modernization of the national environmental governance system and strengthen governance capacity.

- a) **Build a modernized national environmental governance system, and strengthen national environmental governance capacity.** Establish an integrated system of national environmental protection institutions, management system and implementation mechanism during the 13th FYP period according to the principles of checks-and-balance, fairness and efficiency. Develop an effective check and balance mechanism, including

balances among the components of the organizational, policy and implementation system, implement appropriate supervision measures and balancing among the key governance actors; and ensure fairness among governance actors and between current and future generations. These improvements should be designed to enhance environmental, economic, social and administrative efficiency.

- b) **Strengthen the legal framework covering the construction of an Ecological Civilization.** First, basic laws related to environmental protection should be revised to incorporate relevant organizational systems, mechanisms and policy tools required for Ecological Civilization into the texts of laws to enhance legitimacy and binding authority. Traditional sectoral laws such as civil, economy, criminal and administrative laws should be revised to embrace basic principles of ecosystem management within the individual pieces of legislation.

Second, reform and improve the functioning of the environmental judiciary system and strengthen the judicial practice. Promote coordination between environmental departments and judicial departments. Strengthen the capacity of environmental courts and judges to increase environmental judicial ability.

Third, speed up the development of detailed implementation rules for the newly amended environmental protection law. Establish a mandatory, authoritative, and independent enforcement system and explore joint-action mechanisms involving environmental department and police department cooperation to improve the effectiveness of enforcement and supervision.

- c) **Match environmental protection departments' authority, capacity, and resources to their supervision and management functions and tasks.** First, implement the provision of “unified supervision and management” as stipulated in the revised Environmental Protection Law. The State Council should formulate relevant administrative rules and regulations specifying the responsibilities, authorities and work procedures of environmental protection departments to supervise the environmental management activities of other departments at corresponding and lower levels of government, and consolidate sectoral coordination.

Second, establish a unified environmental information platform to achieve timely, public accessible and accurate data sharing. Engage the National Bureau of Statistics in reform and improvement of the environmental statistical system.

Third, increase fiscal investments in environmental scientific research, monitoring and information gathering, as well as supervision and enforcement capacities. Increase the overall number and capability of civil servants in environmental protection departments to match their increased workload and statutory responsibilities. Speed up judicial interpretation of due diligence exemption for environmental enforcement personals.

1.2.2 Strengthen social governance of environmental protection and develop a multi-stakeholder governance approach and various models.

- a) **Develop and implement systems for public participation, information disclosure and environmental litigation.** Draw on the best and most appropriate international experiences of public participation and multi-stakeholder governance models. Implement open and transparent environmental information reporting and disclosure systems.
- b) **Encourage environmental protection social organizations and create an enabling social environment.** Develop rules and regulations to protect legal rights of social organizations and to provide some basic guidance for their activities. Establish mechanisms to facilitate public or private funding to, and where appropriate encourage governmental service procurement from some social organizations.

- c) **Encourage grassroots organizations to focus on environmental management issues.** Embrace the public's environmental demands, develop community bylaws for environmental protection, and advocate green lifestyles. Draw on international experiences and models of public participation.
- d) **Modernize corporate governance.** First, corporate governance for businesses in China should modernize by focusing on increasing the transparency and comparability of enterprises' financial and non-financial (environmental and social) performance. Second, businesses in China should over time adopt and implement a standardized reporting framework for *Financial and Non-financial Performance* that includes the assessment of climate risk and risk reduction strategies. And third, business enterprises should integrate climate and other environmental risks into their core decision-making tools and practices.

1.2.3 Reform environmental management institutions to improve efficiency and effectiveness.

- a) **Reform and continue the total emission control system.** Study and develop a comprehensive total emission control system for primary pollutants, coal consumption and CO₂ emissions. Explore and implement regional, river-basin and sectoral total emission control systems that are based on each region's environmental carrying capacity.
- b) **Develop relevant laws, regulations and implementation methods for an emission permit system that covers all pollution discharging entities.** Reform the environmental impact assessment (EIA) system to achieve better coordination with the pollution permitting system. A pilot effort might be initiated to integrate EIA and pollution permit approval. Apply the EIA system to a greater extent on strategies, plans and policies, as well as on situations such as cross-regional, coastal zone and river basin projects that may have significant ecological impacts.
- c) **Improve environment and health related institutions.** Include environmental health risk assessment in the making of policies and standards. Improve the environmental public interest litigation system and the ecological environment damage compensation and accountability systems. Strengthen responsibility and capacity of the judicial system to investigate environmental violations that result in injury to people.

1.2.4 Establish incentive mechanisms to promote environmental protection.

- a) **National fiscal, taxation, pricing and financial policies that encourage environmental protection should be expeditiously implemented.** The central government should take the leading role in ensuring that the growth rate of the central fiscal budget for environmental protection is not lower than the national overall growth rate in revenue. Special environmental pollution remediation funds should be set up. For the construction and operation of environmental infrastructure, models of public-private partnerships (PPP) should be used to leverage social capital and technology, make full use of market mechanisms, reduce the cost of investment and improve operational performance.
- b) **Establish an enterprise environmental credit evaluation system.** Reward enterprises that go beyond mere compliance with environmental protection laws and regulations. Strengthen the capability of small and medium sized enterprises (SMEs), through provision of a platform with information about pollution treatment services and access to finance. Actively promote voluntary pursuit of good environmental performance on the part of industries and enterprises. Conduct training on corporate social responsibility and environmental information disclosure.

- c) **Accelerate and improve the eco-compensation system.** Strongly adhere to the principles of “polluter pays”, “those who damage must compensate”, and “those who protect receive benefits”. These principles can help to mobilize greater enthusiasm on the part of local governments towards protecting the environment, especially in those areas experiencing fiscal difficulties.

1.2.5 Implement environmental audits for government and party leading officials.

- a) **Develop a road map for implementing governmental environment audit.** Carry out environmental audits for key regions taking into account the implementation of the Air Pollution Control Action Plan. Develop audit methods and processes and identify key CPC and government leaders at different levels as the objects of environmental audits. Enhance the independency, openness and transparency of the government’s environmental auditing system. Explore the possibility of implementing an integrated governmental environment and resource audit system under the National People’s Congress and under the Provincial People’s Congress system.
- b) **Establish and improve the legal basis for government environmental audits.** First, revise the existing Audit Law and other relevant auditing guidelines, and improve relevant regulations on disclosure of auditing results. Second, revise existing environmental protection laws and regulations with new provisions related to environmental audit. Third, strengthen communication and cooperation between the Chinese National Audit Office (CNAO) and Ministry of Environmental Protection to jointly issue *Guidance on Government Environmental Audit*. Eventually auditing institutions must assume full and independent control of the environmental audit systems.
- c) **Develop technical guidelines for government environmental audit.** First, study the establishment of various types of governmental environmental audits. Second, develop governmental environmental audit criteria, technical guidelines and methodologies. Third, strengthen coordination between the government’s environmental audit system and other environmental evaluation systems in order to improve the efficiency of government environmental audits, including reporting system from governments to the People’s Congress, environmental information disclosure system; and public consultation system.
- d) **Strengthen government environmental audit capacity.** First, strengthen the organizational and human resource capacity. Second, enhance the independency and authority of government environmental audit. Third, strengthen capacity in terms of information technology and training and strengthen cooperation with the international audit community. Fourth, initiate a series of government environmental audit pilot initiatives. Increase the investment for capacity building of the government environmental audit system.

1.3 RECOMMENDATION 3. Formulate green transition policies and rebalance the economic structure.

The core of China’s green transition strategy must be the green transition of the economy. To achieve a green transition of economy, there is a need for a breakthrough in terms of “structure adjustment” and “pathway choice”, especially for energy consumption. According to the GHG emission reduction targets recently agreed upon by the USA and China, China plans to reach its CO₂ emission peak by 2030 at the latest. To achieve this target and others requires more robust restructuring and accelerated economic reform measures. Therefore, we recommend that China:

1.3.1 Correct the imbalance of the economy and industrial structure (low domestic consumption and over-investment in heavy industry) in a way that fully and explicitly takes into account environment and development concerns.

- a) **Adjust the ratio of savings-investment-consumption structure to a proper level.** It is recommended that China should increase the ratio of consumption to GDP by 10 percentage points and reduce the ratio of investment to GDP by 10 percentage points before 2020 to re-balance the economic structure; and should promote sustainable consumption.
- b) **Adjust other policies to promote a re-balance between investment and consumption.** Promote reform of the fiscal and the taxation system, administration system, *hukou* system and social security system to rationalize the expenditure structure of local governments, reduce overinvestment and improve social security and public service. Improve income allocation structure, and reduce the income gap.
- c) **Promote green transition of industrial structure.** Appropriately lower the proportion of heavy industries, and encourage expansion of the service sector. Eliminate or restructure a series of special subsidies to industrial sectors. Ensure equality in pricing for land and electricity, equality in tax and interest rates.

1.3.2 Reform resource taxes and prices, and adopt environmental taxes and other economic tools that can be used to promote green transition.

- a) **Reform resource tax.** Apply a 10 to 15% resource tax for petroleum depending upon resource grades. Apply the same level of resource tax for imported petroleum. A differentiated 10 to 15% tax should be collected on coal and the same rate applied to imported coal. The resource tax for natural gas could remain at 5%, and imported natural gas could be exempted from resource tax. Establish a water resources tax and determine a differentiated tax rate based on prices. Resource taxes should be collected on an *ad valorem* basis.
- b) **Reform the consumption tax on automobiles.** Increase the progressive tax based on the assessed level of vehicle fuel consumption.
- c) **Reform pricing mechanisms.** Except for household electricity and agricultural electricity quotas, all electricity should be sold to end users at the same price, with the price set by the market without exceptions. Water price should be established based on the full life-cycle cost of water consumption.
- d) **Adopt environmental tax.** Adopt an environmental tax based on the level of pollution emissions, following the “Polluter Pays” principle.

1.3.3 Adopt total energy consumption control targets, and build demand-based energy policies.

- a) **Adopt a total energy consumption control policy.** Control China’s total energy consumption to below 4.8 billion tonnes of coal-equivalent and coal consumption below 4.0 billion tonnes in order to achieve peaking of greenhouse gas emissions before 2030.
- b) **Set out strategic objectives for energy structure adjustment.** Significantly reduce the consumption of coal below peak level by 2020 and manage the increase of crude oil use so that it might peak as early as 2025. Non-fossil fuel consumption increase should be higher than fossil fuel increase by around 2025, and total fossil-fuel consumption should start to decline by or before 2030.

- c) **Build demand-based renewable energy development policies.** Use mandatory laws and regulations to promote production and utilization of renewable energy. The proportion of non-fossil fuel should be increased by at least 0.7 percentage points every year, in order to reach the recently announced goal of over 20% of total energy consumption to be derived from renewable sources by 2030. Hopefully it would be possible to do better than this.
- d) **Establish and implement an energy consumption quota trading system.** It is recommended that laws or regulations for a national energy consumption quota trading system be developed. Establish a flexible quality control objective system, and assign energy trading quotas for different regions based on principles of efficiency and fairness; and gradually implement the system nationwide.

1.3.4 Build a green finance system to provide financial support for China's green transition.

- a) **Study the establishment of a China Green Bank.** Use green bonds as the main source to establish a green bank under the leadership of the government. The bank should focus on green investment. Fully utilize the leverage effects of green bonds and scale effects of professional evaluation capacity.
- b) **Improve the fiscal interest-deduction mechanism to encourage green credit.** Financial departments, reform and development commissions and bank supervision departments should cooperate with financial institutions to develop a set of scientific, effective and easy to use reduced interest plans for green projects.
- c) **Establish a risk-based green credit system for banks and appraisal companies.** Bank and appraisal companies should introduce environmental risk factors into their loan assessments in order to establish a green credit system. Strengthen environmental risk control for bank loans to reduce the cost of financing for green project.
- d) **Establish a public environmental cost information system** that highlights the use of natural resources and environmental costs associated with industries to provide information for decision-makers and all investors.
- e) **Enforce mandatory green insurance for certain sectors**, such as exploitation of petroleum and natural gas, petro-chemical industries, iron and steel, and plastic sectors.
- f) **Establish environmental information disclosure mechanism for listed companies and bond-issuance enterprises.** All listed companies and bond-issuance enterprises should be required to publish corporate social responsibility reports periodically to disclose their environmental information.

1.4 RECOMMENDATION 4. Explore new urbanization models in the context of creating an Ecological Civilization.

China is undergoing a massive and rapid urbanization process with a relatively short window of opportunity for policies. Cities will serve as engines for growth, as models for innovative development, as leaders in creating better environmental protection, and as places that have a high quality of life, prosperity, and health. Good cities can be built through good governance processes, so that they can take more responsibility in steering China towards an Ecological Civilization. Therefore, we recommend that China:

1.4.1 Use integrated spatial planning to set objectives and limits for urbanization development.

- a) **Establish a dual provincial and local level spatial regulation system.** Establish a spatial regulation system at the provincial level based on ecological security and environmental protection. By drawing on provincial spatial control systems, it should be possible to institute integrated urban and rural plans for mega-city regions and town clusters; determine the urban growth boundaries; and, on the basis of the spatial plans, optimize the ecological, production, commercial and living spaces.
- b) **Build urban areas that strengthen the health of the environment and of residents.** Establish health-centered city planning, construction, and management systems. Instead of continuous sprawl, develop multi-centered urban and town clusters and protect their green cores. Promote development of green transportation.
- c) **Strictly implement national standards regarding per capita built-up area.** For cities of which urban built-up land is projected to exceed 30% over the national standard per capita, the central government should issue a policy to limit new construction sites. Strictly control irrational and disorderly urban sprawl; encourage the use of the existing stock of urban construction land and utilization of old buildings; and strictly restrict urban expansion within the boundaries set by ecological redlining.
- d) **Promote multi-department cooperation, and enhance regional co-governance and pilot initiatives for testing Ecological Civilization urbanization patterns. Incorporate these urban Ecological Civilization pilot efforts into a national Ecological Civilization pilot system.** In particular, introduce regional collaborative pilot mechanisms in the Beijing-Tianjin-Hebei area, Yangtze River Delta region and Pearl River Delta region. Promote pilots of various Urbanization Models for Ecological Civilization.

1.4.2 Plan for a financially sound fiscal and taxation system and an adaptive development mode.

- a) **Financing for local government operations and initiatives must become independent from selling and developing land.** Alternatives should be explored such as transfers from the central budget according to objective allocation rules. Introduce local property taxation or other urban development and construction fees to replace the fiscal source from land revenue. When land markets are set up in China, ensure that environmentally sensitive or high priority green space lands remain in public control.
- b) **Greater attention should be given to climate resilience.** Establish risk assessment frameworks for climate change adaptation and fiscal emergency response fund.
- c) **Encourage participation of private investment through the green bond market mechanism.** Establish long-term effective fiscal and taxation incentive mechanisms, reduce resource and energy consumption in urban living, and address the challenge of an aging society.

1.4.3 Adhere to people-centered urbanization that also fully respects ecosystems, ecological services and green space.

- a) **Provide administrative officials, especially party secretaries and mayors, more in-depth training on urban development.** Enhance their knowledge on green, low-carbon and circular economy development. Establish incentives and performance evaluation mechanisms. Develop Ecological Civilization information and education systems for the public.

- b) **Let the human scale prevail in urban design.** Promote and ensure cities' own identities through deliberate protection of natural and cultural heritage. Encourage small-scale, incremental, multi-stakeholder involvement in urban regeneration. Preserve the historical context and collective memory.
- c) **Establish a system to monitor and assess urban green development in relation to environmental quality, efficient resource use and quality of life.** Projections of future health risks to the urban population from air, water and soil pollution, climate change impacts and adaptation should be regularly updated and made available to the public. Such results should be used as an important basis for performance evaluation and accountability of government officials.

1.5 RECOMMENDATION 5. Develop a broader regional air pollution control mechanism robust enough to stop severe air pollution and to restore air quality.

To improve air quality and protect public health, China has adopted an Air Pollution Control Action Plan, with the strictest controls so far seen in the country. In order to achieve the emission reduction targets of the Action Plan, China should carry out coordinated control efforts for multiple pollutants and emission sources in different regions, and adopt control measures that can complement the process of adjusting the energy structure, improving energy efficiency and enhancing end-of-pipe pollution control. Therefore, we recommend that China:

1.5.1 Build an air quality-based air pollution management system.

- a) **Immediately strengthen the legal status for improved air quality compliance.** The *Air Pollution Control Law* should explicitly require the implementation of a compliance-based air environment protection target responsibility system and a performance evaluations system. For non-containment zone areas, significant and quantitative air quality improvement targets within the next five years should be established and made mandatory and enforced according to the new environmental protection law.
- b) **Adopt a science-based regional approach for atmospheric management.** Develop air quality models for air quality improvement, and conduct scientific region classification for atmospheric environmental management. Within any one region, there should be regional coordination organizations and mechanisms, unified laws and regulations, and unified management and enforcement of air quality to enhance overall regional efforts to meet air quality objectives.
- c) **Establish a scientific performance appraisal system for air pollution control.** Develop pre-implementation, annual and final appraisal systems for the Air Pollution Control Action Plan.

1.5.2 Improve the organization and effectiveness of the regional joint air pollution prevention and control mechanism.

- a) **Establish a unified standard compliance and enforcement program.** Develop regional air quality compliance plans, and define schedules, targets and feasible measures for each defined region to achieve the objective of overall regional air quality compliance.
- b) **Establish a clear unified and integrated regional air pollution control and management mechanism.** Build a regional unified environmental decision and consultation mechanism; promote information sharing and improve communication mechanisms; establish regional EIA consultation mechanism; improve regional joint environmental law enforcement mechanisms; and implement joint emergency response for episodes of heavy pollution.

- c) **Establish regional decision support and planning organizations.** Establish regional planning organizations funded by various ministries and commissions with overall guidance from the Ministry of Environmental Protection. Organize fundamental research on tracking of sources, transport and transformation, and source identification of regional air pollution. Select suitable, widely applied air pollution control techniques to support regional air pollution control.

1.5.3 Improve policies for regional air pollution control.

- a) **Promote clean, efficient and sustainable use of coal, and accelerate adjustment of the energy structure.** It is preferable to use coal only in large-scale facilities with high-efficiency end-of-pipe control technologies. China should make great efforts to improve the energy efficiency of major coal-consuming sectors, such as power plants and industry. China should continue to increase the proportion of coal washing and promote only clean coal technologies.
- b) **Improve economic incentive policies for motor vehicle pollution control.** It is proposed that motor vehicle fuel surcharges should be introduced at a proper time in order to lower the intensity of vehicle use. A new air pollution control fund could be funded from the fuel surcharge to support infrastructure construction such as for expansion of local public transportation and for air pollution mitigation projects. The most stringent vehicle emission standards should be applied under the condition of improved fuel quality. Use fiscal and taxation measures to promote the phasing out of yellow label and old vehicles.
- c) **Enhance coordinated control over various sources of pollution and contaminants.** In order to meet the air quality and air pollutant emission control goals, China should stick to the strategic concept of “coordination”, “integration” and “joint action”, i.e., carry out coordinated control over pollutants including SO₂, NO_x, primary PM_{2.5}, VOCs and NH₃. Regarding control of various pollution sources, China should launch comprehensive pollutant control of industrial sources, domestic and rural non-point sources, and mobile and non-road equipment sources. China should implement differentiated air pollution control strategies reflecting regional differences.

1.6 RECOMMENDATION 6. Implement a National Ecological Protection Red Line System (EPRL System).

The 3rd Plenum of the 18th CPC National Congress called for the rapid implementation of an ecological redlining system. In general, the implementation of eco-redlines still faces multiple challenges, e.g., inconsistent understanding of the eco-redline concept and its content; lack of policies, organizations and regional coordination mechanism; and lack of standards for eco-redline protection. Therefore, we recommend that the Government of China:

1.6.1 Set into law the National Ecological Protection Red Line (EPRL) System and relevant systems.

- a) **Clarify the contents and composition of the EPRL system.** An ecological protection red line (EPRL) defines the minimum spatial area within which strict development controls ensure sustainable provision of ecosystem or environmental services vital for national, regional or local needs. The ecological redlining needs to ensure the integrity of the key ecosystems' functions and avoid the fragmentation of the habitats of priority species. Further research is recommended to clarify the concept and system of eco-redline with the aim of achieving a single definition, and start pilot activities on eco-redline identification.
- b) **Establish a national target of China's appropriate land area to be within an EPRL.** Designation should be on the basis of ecological problems, ecological sensitivity and important spatial characteristics of ecosystem

services in China. A target in the range of 35% of China's land area is technically justifiable. This total will include some but likely not all of the existing Protected Areas.

- c) **An ecological protection red lining law should be passed within 3 to 5 years.** It is recommended that the State Council develop *Management Methods for Ecological Protection Red line* to specify definition and content of ecological protection red lines, classification method and management system.

1.6.2 Improve spatial land use planning and marine use planning system with clear identification of EPRLs.

- a) **Improve land use planning system.** Add a new category of ecological lands in the existing land use planning system to form a new system including categories such as agricultural land, construction land, and ecological land, but no longer include a category labeled wasteland or unused lands since such lands generally hold ecological value. Incorporate ecological protection red line into spatial planning to highlight the importance of ecological protection red lines.
- b) **Identify ocean EPRLs.** Identify ocean EPRLs through ocean ecological function zoning classification and other ocean spatial planning to ensure the health and security of ocean ecosystems and coastal wetlands.

1.6.3 Establish a new national coordinating mechanism for ecological conservation and for monitoring and enforcement.

Establish a nature ecological protection management organization to carry out a unified management approach over the major types of nature protection areas such as nature reserves, national parks, ecological function protection areas, etc., and to strengthen supervision on EPRLs.

1.6.4 Improve the nature protection area system, integrate ecological protection red lines and nature protection area system, and establish a management system by departments, types and categories.

- a) **Improve nature reserve system.** Further clarify and integrate various types of protection areas in terms of functions and management system, establish a nature protection area system consisting of nature reserves, national parks, scenic parks, agricultural species resources protection areas and ecological function protection areas.
- b) **Establish an EPRL management system by departments, types and categories.** Integrate EPRL and nature reserve system and incorporate ecological protection redline area into the nature protection area system, and carry out a unified coordination and a management system by departments, types and categories for EPRLs within nature reserve protected area system.

1.6.5 Improve eco-compensation and incentive mechanism based on EPRLs.

Establish a long-term eco-compensation mechanism and directly pay the impacted landowners or operators. Allocate key ecological improvement projects mainly to the ecological protection redline areas. Improve ecological protection fiscal transfer to match with the area and effectiveness of EPRLs protection. The finalization of the red lines will take time. During that period China needs to take appropriate steps to ensure that protection options are not irrevocably lost and that the nation is not subject to unreasonable claims for compensation after a decision is made. This may require a freeze on land development of proposed ecological red line areas so that there is not a rush to develop other uses before they are officially designated.

CHAPTER 2

CCICED 2014 ISSUES PAPER¹

FROM TIPPING POINT TO TURNING POINT

2.1 INTRODUCTION

China has looked into the future and desires change. That point clearly emerged during the November 2013 Third Plenum of the CPC 18th Party Congress. By more aggressively tackling sensitive issues such as corruption, market-based development and environmental improvement, the new leadership of China has laid out a pathway towards continued prosperity, social development and ecological security. The goal is a “Beautiful China” and, ultimately, a shift towards an Ecological Civilization (*Shengtai Wenming*).

The “Five in One” approach, as articulated during the 3rd Plenum, is to place progress in addressing Ecological Civilization at the same top policy level as the other four key policy themes so that there is adequate progress (*jinbu*) in dealing with: economic development, social development, political development and cultural matters. Thus Ecological Civilization, a concept that has been discussed since at least 2007 in Chinese government and political circles, will bring new perspectives and priority to environment and development policies and action. Most recently, at a meeting of officials on 2 September 2014, Premier Li Keqiang kicked off planning for the 13th Five Year Plan (2016-2020), indicating that it is “the final dash” to a comprehensive well-off society.² He said that officials should “support initiatives that promoted social development, environmental protection and improved people’s livelihood as well as measures to promote fairness and efficiency.”³

2013 was marked by an extreme environmental situation in China, a *tipping point* in terms of hazardous levels of urban air quality. Unless the environment and development effort is substantially more successful in the years ahead, perhaps even more devastating environmental tipping points could occur. Such tipping points can express themselves suddenly and severely, and cost a great deal to address effectively.⁴ Some possible examples include disasters related to mining sites and tailing ponds, soil and groundwater contamination, effects related to climate change, and disruptive pest and disease situations. Will such a gloomy outlook for China necessarily become an inevitable outcome? Hopefully not.

Many other nations have experienced severe environmental tipping points⁵—where an event crystalizes public fear and anger and makes it essential that government act effectively to address the challenge. In China’s case the response to overtly awful air pollution is a “War on Pollution” declared in March 2014⁶, with a comprehensive Air Pollution Action Plan (2014 to 2017), and the expectation that two other environmental action plans (water pollution, soil pollution) will be initiated in 2014 and beyond.

1 The Issues Paper is prepared each year by the CCICED Chief Advisors, Arthur Hanson and Shen Guofang with inputs from the Chief Advisors Group and from others.

2 China Daily. 5 September 2014. *Li: Plan to be Driving Force of Economy*.

3 South China Morning Post. 5 September 2014. *State Council Kicks Off Drafting of Five-Year Plan*.

4 Environmental tipping points on environmental matters may have one or more of the following characteristics: *There is a threshold beyond which an abrupt shift of ecological states occurs, although the threshold point can rarely be predicted with precision; the changes are long-lasting and hard to reverse; there is a significant time lag between the pressures driving the change and the appearance of impacts, creating great difficulties in ecological management.* (Observations from Biodiversity Information System for Europe. <http://biodiversity.europa.eu/topics/tipping-points>). Alex Wang. 2012. *China’s Environmental Tipping Point*. Chapter 5 in *China in and beyond the Headlines*. Timothy Weston, Lionel Jensen, eds. Rowman and Littlefield Publishers. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2130452

5 See examples in the database of the Resilience Network. <http://www.resalliance.org/index.php/database>

6 <http://www.reuters.com/article/2014/03/05/us-china-parliament-pollution-idUSBREA2405W20140305>

On this more hopeful note, and with a broad range of commitments (see Table 2-2-1) being made by China's top-level leaders, a *turning point* may be reached, where there is gradual, or perhaps even dramatic shifts toward improved environmental quality, sustainable development and progress made along new pathways towards Ecological Civilization. An obvious concern is to ensure that the current large gaps between national expectations for environmental improvements and local capacity to deliver results are reduced or eliminated. To secure this turning point will require massive effort in the form of a Green Transition and new Green Development patterns. These elements of change will be in line with the current efforts taking place at the global level towards a post-2015 identification of sustainable development goals and action, and other efforts such as those being discussed globally by the United Nations for climate change, biodiversity and other environment and development concerns.

Thus China continues to be at a crossroads: tipping point or turning point on key environment and development issues. China has a *window of opportunity* right now that may not occur easily again.

This window has occurred in part because of public concern over environmental issues. A recent Pew survey⁷ in some 40 countries of 5 top global threats revealed that a third of the 3,000+ Chinese respondents listed pollution and environment as the leading global threat. This is one of the highest levels recorded worldwide, and was the largest single concern among the five for Chinese. The focus on governance reform by China's current administration almost immediately after taking office is a second reason. Third is the widespread recognition of the ecological and environmental damage in relation to quality of life and economic cost. And, fourth, China is paying a reputational price internationally, especially as incident after incident of air pollution and other problems are reported. The impact is on tourism, potentially on China's ability to stay competitive, and on China's ability to attract high caliber businesses and expertise needed for the next phase of economic growth.

This year's CCICED work is related particularly to the institutional innovation and other changes needed to accelerate movement towards Ecological Civilization and Green Development.⁸ Hopefully such changes can lead to good turning points, and to a new environment and economy relationship consistent with the moderately well-off *Xiaokang Society* desired by 2020, and with better prospects for creating an Ecological Civilization in subsequent decades.

CCICED is well placed to provide inputs during this window of opportunity for policy changes. Indeed, the current work program is directed at identifying policy recommendations that can be implemented swiftly and effectively regarding priorities arising from the 3rd Plenum. The four Special Policy Studies for 2014 particularly address items from the Plenum and subsequent action.⁹ But there is also a need to set out longer-term perspectives consistent with Ecological Civilization. The two 2014 Task Forces are intended to address this major need.

The CCICED Task Force on Evaluation and Prospects for a Green Transition Process in China has examined the compatibility of selected economic policy actions taken in the past decade and their impact on pollution so that new, more appropriate economic decisions might be proposed for the future. The Task Force on Institutional Innovation for Environmental Protection in the Context of Ecological Civilization has examined the inadequacies of the current institutional structure in terms of addressing future needs, and has examined key innovations from experiences within China and internationally.

⁷ <http://www.pewglobal.org/files/2014/10/Pew-Research-Center-Dangers-Report-FINAL-October-16-2014.pdf>

⁸ The 2014 CCICED AGM theme is *Management and Institutional Innovation in Green Development*.

⁹ The 4 CCICED SPS topics are: *Performance Evaluation on the Action Plan of Air Pollution Prevention and Control and Regional Coordination Mechanism; Institutional Innovation of Eco-Environmental Redlining; Good City Models under the Concept of Ecological Civilization; and Chinese Environmental Audit System for Government Officials*.

2.2 A WINDOW OF OPPORTUNITY IN CHINA

This past year will likely be viewed as one of the most transformative periods of China's policy change. A window of opportunity has opened in an unprecedented fashion. Several issues of long-standing social and economic concern are being addressed, such as the *hukou* system of place of residence restrictions, introduction of property taxes, softening of one-child family rules, deregulation and market based reforms, action to avoid heavy industry overinvestment, promotion of the service economy, domestic consumption, and a shift to improved urbanization models.¹⁰

The passing of a major revision to China's Environmental Protection Law, slated to come into effect in January 2015, is a major achievement that addresses key concerns such as much more severe punishment for environmental pollution and other actions that damage the environment, improved public participation and transparency in environmental information disclosure, and more effective involvement of enterprises on environmental improvements.¹¹ Over this past year, rarely has a week gone by without important improvements to environment and development policies and actions (see Table 2-2-1 for examples). The budgets in place or proposed for addressing environmental protection issues continue to rise, sometimes dramatically—as in the case of funding for the Air Pollution Action Plan.

**Table 2-2-1. Selected Environment and Development Initiatives
Announced November 2013 – October 2014**

- NPC approval of revised Environmental Law (March 2014)
- “War on Pollution” action including Air, Water Soil Action Plans (Air in March 2014, others pending)
- Lifetime accountability for officials’ environmental performance (July 2014)
- Ecological redlining to serve as a baseline for protecting ecological functions and environmentally-fragile areas (December 2013)
- Strengthened role of courts and appointment of judges to assist in the court system’s capacity development and competency regarding environmental matters (July 2014)
- Green procurement through purchase of electric vehicles by government agencies; waiving of 10% purchase tax for EVs; significant government investment in national network of charging stations for EVs (August-September 2014)
- Green Market Supply Chains / Procurement Centers, Tianjin and APEC (May 2014)
- Guidelines on Urbanization including environmental protection criteria (December 2013)
- State Council Reaffirmation of China’s Climate Change Goals to 2020 (September 2014)
- First draft Revision of China Air Pollution Act released for comment (September 2014)
- National Carbon Market projected to begin in 2016 (August 2014)

The unprecedented level of attention over this past year to pollution control, green development and ecological construction is quite remarkable, as is the overall governmental attention to Ecological Civilization. This level of attention is driven in part by public concern, but also by a deeply-held belief that past models of Chinese economic development are inadequate for the future, more comprehensive and integrative approaches required for sustainable development. For some issues, the credibility of the CPC is at stake and therefore a matter of concern to the governance system at all levels.

Given the current level of governmental responsiveness, it is a time when swift action is not only possible but also politically desirable. It means that a window of opportunity now exists to implement environment and development

10 See Barry Naughton. July 2014 ‘Deepening Reform’: *The Organization and the Emerging Strategy*. Hoover Institute. China Monitor No. 44. <http://www.hoover.org/sites/default/files/research/docs/clm44bn.pdf>

11 Numerous articles are available concerning the details of the revised law, including:

http://www.npc.gov.cn/englishnpc/news/Legislation/2014-04/25/content_1861275.htm; <http://www.chinalawinsight.com/2014/05/articles/compliance/environmental-protection-law-big-changes-in-2014-2>; http://switchboard.nrdc.org/blogs/bfinamore/new_weapons_in_the_war_on_poll.html; http://news.xinhuanet.com/english/china/2014-04/24/c_133287570.htm; <http://asiafoundation.org/in-asia/2014/05/28/chinas-environmental-protection-law-lays-groundwork-for-greater-transparency>

ideas that in the past have faced political or bureaucratic acceptance difficulties. Comprehensive changes toward introduction of an environmental tax system would be a potential case. Another is the greater opening of environmental assessments and other planning mechanisms to broader public scrutiny. A third is full participation by the financial sector in assessing environmental risks and performance, such as in the granting of major loans.

The list of needed improvements is actually much longer, and it is fair to imagine that the window of opportunity might continue almost indefinitely. Yet windows open and close in response to many pressures. It is wise to take full advantage while the opportunity is available. Fortunately, the timing is excellent for the 13th FYP in particular. Great advances could be made during this special period leading up to completion of 2020 goals set up as early as the turn of this century.

There are, however, some important linkages not yet fully made in the current effort on reforms. One is the establishment of a fundamentally stronger relationship between environment and economy. These two topics are now interlocked so that changes in environmental conditions affect the economy and vice versa. Yet the current round of economic reform does not fully recognize or act on these connections. This is particularly the case for the market reform packages now being proposed. Environmental externalities cannot be fully addressed under the current reforms on pricing, corporate sanctions and incentives, and by the current capacity for structural reform in the economy. Thus, economy—whether driven by foreign trade or by greater domestic consumption—is still not anywhere near a harmonious relationship with the environment. Ecological debt load and human health consequences within China are still on the rise to an extent that is rather poorly understood and therefore dangerous.

The second major linkage that needs to be considered more fully is the cross-sectoral environmental impacts that can seriously affect development. This is a long-standing concern, but integrative, comprehensive efforts are still not fully identified. Another way to state this dilemma is that environmental problems cannot be completely solved by environmental agencies since they are so much weaker than powerful sectoral ministries, large SOEs, and other interests.

Third is the need for much greater clarity on the role of ecosystem integrity and ecological services in social, economic and political decision making. This is a concern where China's government is now very active, but in many ways the mechanisms are still inadequate, for example, administration and management of nature reserves, although expectations are very high regarding new mechanisms such as ecological redlining.

Throughout these early years of the new leadership, considerable emphasis has been given to “top-level” guidance. This is understandable, given the emphasis on change, enhanced performance, elimination of corruption and other aspects of China's governance. There has been considerable discussion about the need for strengthening and innovation of environmental institutions as part of this. Perhaps the most notable aspect has been the administrative structure for Deepening Reform¹², which has established a *Deepening Reform Leadership Small Group* headed by Xi Jinping, with six subsidiary groups including one on *Economic System and Ecological Civilization*, which for the first time explicitly links economy and environment. The important question is how this leadership effort will be shadowed in organizational reforms that take place at other levels and within government departments and other structures.

The Issues Paper cannot answer this question directly, of course, but it is very clear that a central theme of environment and development reform, and indeed China's overall reform, is how to bring about a more integrated and inclusive approach to governance and development. This is a topic also of concern to post-2015 agendas globally—for new sustainable development goals, climate change negotiations, and efforts directed to green growth

¹² A useful discussion is provided by Barry Naughton in his article *'Deepening Reform': The Organization and the Emerging Strategy*. China Leadership Monitor. No 44.

and green economy within various countries, and on the part of businesses and international organizations. The topic of institutional innovation and reorganization will be particularly important as reforms related to Ecological Civilization mature. Given that Ecological Civilization must find space within existing policy debates on four other key themes (the “5 in 1” approach), there will need to be changes in many laws and regulations, adjustments in market reforms, and important matters related to behavioural change of institutions and by individual households and citizens and in decisions made in the governance of their communities. Some of these shifts are examined in the key issues discussed in this paper.

2.3 INTERNATIONAL TRENDS ON ENVIRONMENT AND DEVELOPMENT

2015 is the target year for some key international negotiations on environment and development, with 2014 serving as a key testing time for countries to determine how far they are prepared to go in moving away from entrenched positions, and to decide collectively they will act to break the impasse on growing problems, especially climate change, and on social matters such as poverty reduction and its relationship with sustainable development efforts.

Regrettably at the national level there have been some serious signs of backpedalling on environment and development, such as the cancellation of the Australian carbon tax, the struggle most European countries are having to reach EU energy and climate 2020 targets¹³, the USA difficulties in bringing about almost any kind of agreement involving Congress on serious environmental matters, and the continuing failure to slow tropical deforestation such as the burning of forests in Southeast Asia for planting of oil palm, rubber and other commodity crops in high international demand. In general, it has not been a good year or two for the environment at this time of economic struggle and prolonged recovery in many parts of the world. In some instances, there has been substantial retrenchment in expenditure, downsizing and consolidation within environmental agencies, and a lessening of monitoring and other important activities.

One consequence of national level problems has been a rise in the level of environmental initiatives at the local level, especially in cities. This trend is reflected in the heightened contribution of cities and provinces towards achieving important objectives such as reduction in greenhouse gases. This is the case for example in Canada but also in other parts of the world. Much has been made of the potential role of cities as innovators. The C40 Cities network of megacities committed to climate change action is an example, along with networks for eco-cities, and ICLEI (Local Governments for Sustainability) initiatives.¹⁴ These and other urban networks are rising in significance on a number of environmental issues, and their actions and voice will be reinforced in the coming years as urban migration continues to increase in countries throughout the world.

The preparations for the 2015 International Conference on Climate Change in Paris have included the Climate Change Summit organized in September 2014 by the UN Secretary General.¹⁵ This meeting provided an important testing of the waters and highlighted a willingness of countries to listen, but did not lead to any major breakthroughs towards consensus, or full agreement on the part of major greenhouse gas emitters. Just prior to this summit, the Global Commission on the Economy and Climate¹⁶ released an important new report *Better Growth Better Climate* with a 10-point action plan for low carbon economic growth. The Action Plan notes that

13 *Trends and Projections in Europe 2013 – Tracking progress towards Europe’s climate and energy targets until 2020*. European Environment Agency (EEA). <http://www.voxeurop.eu/en/content/article/426331-europe-united-failure>

14 <http://www.iclei.org>; <http://www.c40.org>

15 IISD. *A Summary Report of the 2014 Climate Summit*. Climate Summit Bulletin. 26 Sept 2014. <http://www.iisd.ca/download/pdf/sd/crsvol172num18e.pdf>

16 <http://newclimateeconomy.report/global-action-plan/>

Decision-makers must integrate climate and other environmental impacts into their core economic, development and investment strategies. Taking a long-term approach, integrating these factors into investment and business decision-making, can reduce investor risk without harming performance. The key message is that such economic growth will be sustainable—and will indeed prove to be the best way into the future, while reducing the massive destruction and costs from climate change.

The second major item on the international agenda, but with progress still limited, is the development of post-2015 sustainable development goals—the follow-up to the Millennium Development Goals. This is a process-driven effort guided by the Rio+20 outcome document. Many consultations have taken place, based on sectors such as water and on regional concerns. The proposed post 2015 goals are to be submitted to the 68th session of the UN General Assembly.

Not surprisingly, considerable attention is being given to financial aspects of sustainable development. For example, the Intergovernmental Committee of Experts on Sustainable Development Financing has recently completed a report as input to the post-2015 effort.¹⁷ UNEP has initiated an Inquiry into the Design of a Sustainable Financial System.¹⁸ It is intended to provide an understanding of how to fund the transition to a green economy globally. The green economy transition costs are high, and the challenges great, given the precarious state of the global economy. However this work is badly needed since climate change, biodiversity protection and many green economy efforts have stalled due to difficulties on financing, especially North-South initiatives.

The global business community continues to build a larger stake in green growth and green economy initiatives. In many ways progressive enterprises are showing leadership through their investments, technology development and public-private partnerships. The World Economic Forum released a *Green Investment Report* at the 2013 Davos meeting¹⁹ suggesting that the private sector would have to raise most of the USD700 billion per year required to address the additional green investment for holding climate change to 2 °C. The ratio might be 5:1 private to public funding.

A relatively new concept being explored internationally is green bonds. Largely a tool so far being used on a limited basis by The World Bank and IFC and some other development organizations, the idea is to tap into the huge pool of investors interested in the bond market (\$80 trillion dollars). Green bonds are defined by the World Bank as *fixed income, liquid financial instruments that are used to raise funds dedicated to climate-mitigation, adaptation, and other environment-friendly projects*. A major push is underway to increase knowledge of their potential value to cities, corporations and countries. And to make them well understood as safe investment options. With considerable publicity in 2014, it is possible that green bonds may reach a level of USD 30 to 40 billion in 2014, mostly for infrastructure, forest, watershed management, clean tech, renewable energy, or other tangible sustainable development projects.²⁰

Another important financial initiative—announced at the time of the 2014 Soccer World Cup in Brazil—is the BRICS Development Bank being established in Shanghai with a capitalization of USD50 billion with equal capital input from each of the five BRIC countries and a contingent reserve arrangement of USD100 billion, with 41% of this from China.²¹ The aim is to provide additional financing to developing countries for meeting infrastructure and sustainable development needs from the “New Development Bank” and the contingent reserve to be used

17 <http://sustainabledevelopment.un.org/content/documents/4588FINAL%20REPORT%20ICESDF.pdf>

18 <http://www.unep.org/NEWSCENTRE/default.aspx?DocumentID=2758&ArticleID=10698>; http://www.unep.org/greenconomy/financialinquiry/Portals/50215/Inquiry_summary_final%20June%202014.pdf

19 http://www3.weforum.org/docs/IP/2013/ENVI/WEF_GreenInvestment_Report_2013.pdf

20 <http://www.worldbank.org/en/topic/climatechange/brief/green-bonds-climate-finance>

21 <http://www.economist.com/news/finance-and-economics/21607851-setting-up-rivals-imf-and-world-bank-easier-running-them-acronym>

for members that might have financial difficulties. This is at an early stage and bears watching in terms of its contribution to environmental aspects of sustainable development.

2.4 FRAMEWORK FOR STRENGTHENING ECOLOGICAL CIVILIZATION POLICIES AND PRACTICES

The concept of Ecological Civilization should, over time, provide strong guidance to the people and institutions of China for development and for other important decisions that will influence production and consumption, and attitudes towards the type of economic growth, social development and political decision-making that will shape China's future. At this crucial point, two years after this overarching concept was firmly embraced as part of China's governance model, it is appropriate to think about factors that may affect progress on its implementation. The discussion below is based on many conversations, review of written materials, and also on observations arising from the meetings and materials of CCICED's research teams.

Some implications of building an Ecological Civilization include the following:

- Building respect for nature throughout society, both rural and urban; on the part of government bodies, enterprises, social organizations, across all sectors, and on the part of media, educators and others entrusted to provide guidance and oversight.
- Recognizing ecological integrity and the maintenance/enhancement of ecological services as a fundamental requirement for meeting China's basic needs, quality of life and prosperity, and for contributing to global sustainable development.
- Building cooperative and effective working relationships on environment and development among sectors and institutions at all levels from local to national, regional and global.
- Promoting ecologically and environmentally sound decisions on the part of individuals and households on all matters within their control, and ensuring the enabling policies are in place to allow this to happen.
- Protecting cultural values and recognizing differences in the sustainable development choices made by people depend on their circumstances and needs.

These implications remain consistent with the "putting people first" concept of China. However they also require that protection of environment and ecosystems must also be given high priority. Only then can "putting people first" survive as a long-term priority. Ultimately, Ecological Civilization is a concept that is remarkably different from a society focused on short-term priorities.

Today's institutions within China and elsewhere generally are ill-suited for constructing an Ecological Civilization. Objectives, operational methods, incentives, or governance are inadequate for the tasks. Other problems include slow-moving action, limited human or financial capacity, and managerial issues. What needs to be done?

A vision of institutional reform for Ecological Civilization to take hold should be built around a number of general and specific points (by no means a complete list):

General:

- Base all planning and environmental management decisions on Ecological Civilization criteria and monitoring.
- Create a sufficient legal basis for Ecological Civilization implementation.
- Shift towards an ecological-economic approach to development decisions.

- Create an integrated and optimized spatially-implemented approach to planning related to all aspects of environmental management, including urban design, land use, resource development, pollution control industrial development, transportation and disaster prevention. Despite impressive investments and improvements in recent decades, the approaches currently in place are inadequate. Maintain strict observance of ecological red lines, pollution control and environmental standards with swift action when violations occur.
- Carry out institutional framework for environmental protection and management to provide top-level coordination, efficient and trusted action at all levels, and create supervision by the public. Ensure full accountability on the part of government officials.
- Create an institutional framework for providing incentives and other enabling mechanisms for Ecological Civilization innovations and for green development. This aspect will need to be coordinated with market-based economic reforms.
- Transform financial sector institutions by enabling them to: stop making environmentally and socially unsound loans of any sort, but instead give preferential treatment to ecologically and environmentally sound initiatives; adequately address environmental risk reduction, for example, by climate adaptation; foster eco-innovation technology and services; contribute to eco-compensation (insurance, ecosystem restoration).
- Build a strong sense of responsibility on the part of enterprises towards natural and community environmental conditions, and strengthen their interest and capacity in technological, managerial and investment innovation for Ecological Civilization.

Some Specific Priorities Needed:

- Factor 10 eco-efficiency in manufacturing, production, and natural resource exploitation (including mineral processing, water and fertilizer use in agriculture, fisheries).
- Extreme levels of Circular Economy action.
- Sustainable consumption, green procurement, and green market supply chains.
- Eco-city and low carbon cities.
- Integration of human environmental health objectives into Ecological Civilization objectives and action plans such as those associated with air, water and soil pollution.
- Mountain to sea ecological services planning for water basins and coastal zones.
- Nature reserve and ecological redlining conservation and management.
- Institutional strengthening for meeting very difficult climate change adaptation and mitigation objectives and transformative changes in the energy sector.

A governance system based on Ecological Civilization should be transparent, open and fully accountable to people. The governance framework must recognize the need for capacity development, including how to build new working arrangements between the government and people, and the need to create a much stronger ability of enterprises to take on major responsibilities and provide much of the funding necessary to make Ecological Civilization a reality. Governance of urban areas provides some of the greatest opportunities for China to realize new paths to green development and therefore for the rapid emergence of Ecological Civilization.

The time period for anything resembling an Ecological Civilization must cover major development transitions: the 13th FYP; the 2015-2030 mid-term green transition period including important energy transitions such as peak coal, peak fossil fuel use, major ramping up of renewable energy use; 2030-2050 for longer term opportunities and actions. Over such a long time span there undoubtedly will be many course corrections, introductions of

important new technologies, and other hard to predict challenges and opportunities. Thus Ecological Civilization still needs to be treated as an important organizing concept but one where there is a need to continue seeking answers to key questions about its implementation.

Thus, this section will end with a number of important questions that may be used to clarify what must be considered as feasible for constructing this new approach. These provide a flavor for what may happen in coming years, but the list of questions below is a sample rather than an exhaustive list.

- A key question is how can Ecological Civilization and associated green development *transitions* be accelerated so they help to avoid environmental tipping points while maintaining economic and social development goals?
- How can fulfillment of Ecological Civilization needs be helped through improved governance, including efforts to stamp out corruption, enhanced models of regulation and market incentives, political reform, and public participation/supervision of development?
- What level of expectations should arise from the “Five in one” approach to policy development? What should be key priorities among the many possible combinations concerning the relationship of Ecological Civilization to the other four? For example, should most of the effort in the coming several years be devoted to the definition of a new relationship between ecology and economy (as the Brundtland Commission recommended globally in 1987²², but has so far not been fully achieved, whether in China or elsewhere)? Or should it be a more balanced approach involving all four others?
- What is required to genuinely make environmental action an equal to economic development? Despite good intentions it has not happened so far within China, or elsewhere to a desired level.
- Institutional innovation for Ecological Civilization requires coordinated approaches to development, including highest-level guidance, monitoring and to some extent, integrated planning and management. How can super-ministry or other approaches at a national level help with coordination and other needs to ensure comprehensive approaches to planning and management for Ecological Civilization? What is needed in addition to environmental auditing in order to ensure full accountability for Ecological Civilization Progress?
- How can China’s commitment to massive urbanization contribute effectively to realization of an Ecological Civilization?
- Ecological redlining is viewed as an important process to safeguard and improve ecological goods and services, and, overall, to protect ecological and environmental security. However, it is only one element and mechanism for the broad achievement of Ecological Civilization. What additional steps are needed to fully protect ecosystems and their contribution towards an Ecological Civilization approach, especially in relation to behavior of the public, enterprises, community leaders, and government bodies?
- Is there a need for extensive legal reform to ensure that a wide array of laws and regulation are updated to take Ecological Civilization needs and approaches into account? And is there a need for a national law on Ecological Civilization in the same way that earlier laws were set in place to guide the development of Circular Economy?
- How much of China’s success on implementing Ecological Civilization concepts is likely to be influenced by perceptions outside of China, for example on matters related to Green Market Supply Chains, energy transitions? How much effort should China put into making Ecological Civilization ideas a key part of its Going Out strategy?

2.5 KEY ISSUES

In a time of green transition, which inevitably China must embrace in its efforts toward achieving green development, there will be mixed signals about progress. Undoubtedly there will be continued efforts on the part of some vested interests to slow the pace of change. It will be tempting to avoid transformative modes of change that tend to be disruptive. Progress towards an Ecological Civilization will be stalled if that is the case, and environment will not be mainstreamed in development decisions to the extent necessary. Fortunately, the resolve to meet and resolve challenges, and to take advantage of the current window of opportunity appears to be present.

In this section ten major issues are highlighted. All are important, but some stand out for the most urgent attention, especially Issues 1, 5 and 10, the foundation stones of a modern governance system, safeguarding of ecological services, and the critical matter of a green transition that will firmly address the move from tipping points to environmental turning points. The ten issues are clustered into four themes: innovation in governance (Issues 1-4), ecological services (Issue 5), sustainable production and consumption (Issues 6-7), regulations and incentives (Issues 8-9), and trimming green transition times (Issue 10).

2.5.1 Innovation in governance

Issue 1. Creating a more efficient and inclusive governance system

Institutional change for environment improvement is lagging behind other societal changes and economic development.

Examples include environmental protection and management enforcement effectiveness, green tax reform, cap and trade for climate change, coordination across sectors and at different levels of government. The current system is one dominated by government rather than a modern governance system in which enterprises and social institutions play a significant role. The governmental administrative system is inadequate in relation to the level of need, both in terms of the number and capacity of personnel available to address critically important matters such as air pollution, the quality and quantity of financing, the worth of current regulatory tools, and long-term strategy to manage the transition towards environmental quality—currently this strategy is a patchwork. Implementation of environmental action generally lags years, or even decades behind China's rapid economic growth and economic development shifts in policy. China is implementing its environmental protection action based on western models from the 1970s rather than models that might be more appropriate to its own circumstances today and for the future.

This issue may be partially alleviated by the more definitive action being proposed or implemented by the current leaders. However the signs of past delays and problems are apparent. For example, only one of the three pollution action plans is fully underway. There have been problems in achieving the more stringent energy and greenhouse gas emission targets of the 12th FYP, and there may well be problems in achieving air pollution controls such as for nitrogen compounds. These matters are indicative of the need to bring important sectoral players into the tent of pollution control and prevention.

The debate about whether a superministry for environment and natural resources will be a robust or sufficient institutional answer is probably the wrong one to be having. Perhaps more important is whether China can develop a set of robust mechanisms for integrated management at all levels of government in order to break down decision-making silos on environment and development matters. This is a long-standing problem, and it is by no means one found only in China. There is an apparent need for a long-term, top-level coordinating institution that can provide authoritative guidance on matters related to environment and economy.

A second major part of the institutional strengthening problem is the time taken to introduce environmental market based reforms, especially a system of green taxes, improved pricing that takes into account environmental externalities (negative and positive), and modifications to the regulatory framework to provide for sufficient penalties and the enforcement required. The virtue of such an approach is administrative efficiency and coverage across a wide range of targets. Until such a system is in place, cost of environmental action will remain higher and be less effective than it should be.

The broader governance issue is an urgent problem to be tackled since it directly links to social and political concerns such as the model of public and enterprise involvement to be pursued. Public participation is addressed in Issue 2 below. For enterprises the need is to have a much greater, more sophisticated, and more effective role in finding and helping to pay for the solutions to environmental problems related to their money-making activities. Companies large and small need to address environmental risk to their operations in addition to basic legal compliance. Although there are now significant levels of investment by some businesses towards a green transition, with innovative technologies²³ and management, it is still quite far from what is needed for a green and prosperous business-driven approach. Solutions such as widespread closures of factories, temporarily or permanently can help in the short run, but not for the longer-term.

Issue 2. Increasing social governance of decisions

Important contradictions in policies remain, or are developing, regarding the supervisory role of the public towards environmental performance of government, regarding information disclosure, communications regarding environmental risk assessment, and transparency of decision making on matters related to project approvals, environmental planning and impact assessment.

Building public participation into the governance model has been underway for a time, and the efforts to build the necessary environmental information disclosure, whistle-blower and complaint channels are important but still insufficient measures to guarantee the public's desired role in the supervision of environment and development. Hebei Province recently has drafted regulations on public participation regarding environmental matters. It is a model approach that is very explicit and helpful in many ways.

However there is a sticking point that may always be present in such efforts, and that is the inclusion of clauses regarding responsibility on the part of public participants. Clearly there is a nervousness about public demonstrations, but there is a fine line between those that are poorly informed, or perhaps embarrassing to local officials, and those that are truly dangerous to public safety or other more legitimate reasons to call for punishment of those involved. In other countries it has often taken a considerable level of public courage to turn development away from ecologically destructive towards a more environmentally friendly approach. This point needs to be kept in mind as China builds its expanded public role. The fine line may be adjusted through courtrooms as well as on the streets.

A matter of growing need is to have more well trusted independent platforms (organizations, websites and individuals) that can provide authoritative information and take on a role in making information disclosure work well). For example, full environmental assessments or other planning documents may be lengthy and technically difficult to review and understand. Good “third party” bodies can help to make such information accessible and can also comment on particular types of problems, such as chemical plants, or work locally on environmental improvements.

²³ See the *China Greentech Report 2014*. <http://www.china-greentech.com>

Issue 3. Developing adaptive planning and management

Ambitious pollution control and other environmental action plans are untested and require an adaptive management approach that is not yet fully worked out. It is important not to take inflexible approaches that may lead to “blind alleys” and limited return on investment.

The danger of short-term action plans is that they will come with high price tags, high expectations, and perhaps untested or poorly integrated approaches. The air pollution action plan is an example. On the other hand, plans with a long time horizon, for example China's Biodiversity Action Plan²⁴, which sets out an agenda until 2030, could be set on a track that is too inflexible for shifting conditions, such as those related to climate change impacts, and could avoid hard decisions by pushing some items into the future when action should be taken at an early stage. All of the action plans being proposed, or likely to be proposed, are precedent setting, and therefore must be monitored closely for their performance. It should be presumed that implementation efficiency must be constantly improved. They should be adjusted according to changing needs, of course, but these may be hard to determine over short time periods. If plans genuinely are lagging behind serious and rapid environmental degradation, cumulative impacts are likely to expand in size and complexity. This is a concern, for example, with soil pollution or ground water depletion and pollution.

In the case of the air pollution action plan, clearly one of the most difficult aspects is how to bring about robust, cost-effective regional solutions, without which there is very little hope for long-term success. Also, there are political and public expectations of considerable progress within a matter of a very few years. Obviously the problem is so serious that there appears to be little choice other than to articulate such a hope. What is the consequence if the results cannot be delivered on a reliable basis, as may well be the case? The public will be far less interested in average annual declines in key pollutants than in whether there are far fewer days of severe air pollution, such as those that afflicted Beijing in October 2014. Given that it likely will be a 15 to 20 year battle to bring about fully satisfactory conditions for air quality, the preparations and initiatives that will follow the current action plan, the nature of the public dialogue (locally and regionally) and the innovation in financing and other mechanisms that may need to be strengthened deserves considerable attention. Some of the attention needs to be placed on co-benefits and synergies that will help to justify accelerated action and recognition that there may be a broader set of benefits being achieved, even if skies still appear grey.

For initiatives such as the long-term Biodiversity Action Plan, there is an opportunity to link this plan closely to progress on Ecological Civilization. However the Action Plan preceded the current political effort, and therefore the Plan will require updating. Furthermore, while there are some successes, China's biodiversity conservation is facing serious threats, and some life forms have already reached tipping points where local or regional extinctions already have occurred. In the oceans, there is drastic reduction of some species and prospects of further decline. The situation could significantly worsen during the coming decade as a consequence of China's economic prosperity that has lowered the country's natural wealth, and also from the partitioning of habitat through urbanization and transportation infrastructure and from excessive land reclamation in coastal areas. Worldwide the situation is at a crisis point, with a roughly 50% decline in population sizes of some 10,000 monitored populations of animals between 1970 and 2010 according to WWF International.²⁵

Issue 4. Reducing corruption impacts on environment

Environmental impact assessments and other aspects of permitting and regulation are susceptible to falsification, selection among contradictory laws and regulations, cover-ups and many other corrupt practices especially at local levels.

24 China National Biodiversity Conservation Strategy and Action Plan (2011-2030).

25 http://www.livingplanetindex.org/projects?main_page_project=LivingPlanetReport&home_flag=1

The current campaign against corruption within China has not placed any particular emphasis on environmental matters. There is no published estimate of how much corrupt practices cost in terms of pollution damage or in other environmental damages. Indeed, there are no published studies that comprehensively cover the subject of corruption and the environment in China. Much of the available information is anecdotal, often directed at local officials.

Minister Zhou Shengxian noted in a December 2006 interview with Xinhua News Agency²⁶ concerning reviews of a number of projects that might affect air pollution, *fraud in project approval was prominent with many projects passing their environmental assessment without fulfilling the necessary criteria*. Other common local problems in the past have included failure of power generation stations and various kinds of manufacturing facilities to run installed pollution control equipment—except sporadically, or when inspections were likely.

In November 2013, after a large-scale review by the Ministry of Environmental Protection of organizations licensed to carry out environmental impact studies, 34 were penalized by MEP for “falsifying documents” or the “poor quality” of environmental reports. Some had licenses revoked for “obtaining qualifications by deception.”²⁷

There are many reported instances of illegally constructed golf courses that depend upon approval at local levels.²⁸ This is one of many types of corruption involving land use. In a Financial Times article²⁹ it is noted that:

Some local governments even use state funds earmarked for green belts, parks or environmental protection and rehabilitation projects to build golf courses, despite the damage they can cause to the environment.

Zhang Jing at Nottingham University China Policy Institute recently wrote that *intensive pollution in China is not simply an environmental or economic problem, it also relates to corruption and dereliction of duty.*³⁰ Unlike earlier studies by the World Bank and others on the subject of pollution havens, Zhang (2014)³¹ claims that incoming FDI to China is more likely to be drawn to provinces with relatively weak environmental regulations...I find that the negative impact of FDI would become positive when more effort is put into fighting against corruption...However, the current average anti-corruption effort is too low to compensate the negative environmental impact of FDI.

The range of potential sources and methods of corruption that might destroy the effectiveness of environmental efforts is very large and might be carried out at various scales. Transparency International³² and others have drawn up lists that include falsification of shipping documents in order to bring hazardous waste products into China for reprocessing; fish and other products such as animal parts that have been illegally caught. Products such as ozone depleting substances have been illegally exported from China in the past.

Corrupt practices certainly will undermine Chinese efforts to develop an Ecological Civilization. There is a need for a new, morally solid approach that would not rely only upon investigation and punishment, even though those aspects are important, but more fundamentally on societal functioning in a way that makes environmental crimes and the accompanying corruption abhorrent.

The proposed environmental audit process to be applied as local officials leave their post is an example of at least one approach to help with this transformation. By making this audit and any consequential action a permanent

26 See *Fraud Blamed for Worsening Air Quality*. http://www.chinadaily.com.cn/china/2006-08/20/content_669082.htm

27 <http://www.cleanbiz.asia/news/china's-environmental-watchdog-punishes-assessment-agencies#.VEiOp751RLF>

28 Washburn, Dan. 2014. *The Forbidden Game. Golf and the Chinese Dream*. Oneworld Publications Ltd.

29 <http://www.ft.com/cms/s/0/e514b5cc-74d7-11e0-a4b7-00144feabdc0.html#axzz3FzOXljWv>

30 <http://blogs.nottingham.ac.uk/chinapolicyinstitute/2013/04/16/environmental-protection-and-anti-corruption-in-china/>

31 Zhang Jing 2014. *Foreign Direct Investment, Governance, and the Environment in China: Regional Dimensions*. Palgrave Macmillan.

32 U4 Anti-corruption Resource Centre www.u4.no

part of their record should help to change behavior. Over the coming years, effective use of new legal sanctions under the newly revised national environmental protection law should provide a powerful new means to root out illegal actions that are fostered by corruption.

2.5.2 Ecological services

Issue 5. Preserving eco-environmental quality and values

Environmental quality issues are becoming long-term threats to human health and wellbeing, while damage to ecosystems is causing difficult and costly remediation situations that are not being adequately addressed.

The concerns include loss of ecological services, vulnerabilities that can turn into disasters, loss of human and ecological productivity, reputational loss that affects tourism, trade and investment, recruitment and retention difficulties to get skilled people to live in polluted areas, especially for those with young children. There is harm to older citizens who are highly vulnerable to the levels of pollution found in many cities.

The cumulative environmental and ecological debt found in China today is generally underestimated since it is difficult to monetize all ecological services, and understanding of health impacts is still quite limited. Certainly these factors need to be brought into decision-making much more than at present. Cleanup costs elsewhere in the world, for example, in brownfields and abandoned mine sites can reach levels of a billion dollars or more for a single site. In China there are thousands of sites requiring remediation.

In countries such as Japan—which suffered through high levels of pollution in the 1950s to 1970s—there were well-documented cases, for example the *Yokkaichi asthma* linked to that city's extensive petrochemical industry started in the mid-1950s. The rates of COPD, bronchitis and other lung problems resulted in a mortality rate from such diseases 10 to 20 times higher than surrounding areas.³³ Similar issues could be found in countries such as Germany in the Rhine River and in various parts of the USA. Public knowledge about these problems is one of the most significant drivers for environmental improvement—just as the various problems with food quality have led to reforms in China. China is still at an early stage of determining how to deal with environmental health in the many legacy sites found throughout the country, and in relation to environmental planning for new industrial developments.

China's ecosystem degradation is to some extent being held in check through massive investment under various eco-compensation schemes. The forestry, grassland and wetland restoration efforts are thought to be the largest such programs in the world today.³⁴ As President Xi Jinping has noted in his new book *The Governance of China*, more effort is needed.³⁵ *Ecological redlining* plus more attention to the existing designation of *ecological functional zoning* is intended to be a definitive step forward. All of these efforts are to be praised.

Yet there is considerable concern about whether there will be sufficient monitoring, enforcement and funding to ensure designated areas are respected for their ecological values. Ecological redlining may require setting aside some 35% of China's area for ecosystem protection. There are various points of view about how to deal with peri-urban and suburban areas, since these are also areas that often are sought after by developers.

33 Mortality And Life Expectancy Of Yokkaichi Asthma Patients, Japan: Late Effects Of Air Pollution In 1960–70s. Environmental Health Journal. (as cited in http://en.wikipedia.org/wiki/Yokkaichi_asthma)

34 Scherr, S.J. and Bennett, M.T. 2011. *Buyer, Regulator, And Enabler—The Government's Role in Ecosystem Services Markets: International Lessons Learned for Payments for Ecological Services in The People's Republic of China*. Asian Development Bank. <http://www.greengrowthknowledge.org/sites/default/files/downloads/resource/adb-buyer-regulator-enabler.pdf>

35 Xi Jinping. 2014. *The Governance of China*. Foreign Language Press. http://www.china.org.cn/arts/2014-09/28/content_33640716.htm

Also, questions must be asked about adequacy of biodiversity conservation in even very large areas where there is also a growing level of tourism and recreation such as ski areas. An example is the internationally recognized Changbaishan Reserve in Jilin Province. This spectacular volcano and alpine lake complex now receives huge numbers of visitors and includes recreational activities such as skiing. As recently as a few decades ago this reserve held numbers of Siberian tigers and other large predators. However numbers have plummeted or reached the point of local extinction for several mammals and perhaps other animals.³⁶

2.5.3 Green production and consumption

Issue 6. Higher returns from R&D industrial investment

Getting full value from China's large science and technology investment on clean technology, renewable energy, and other environment and sustainable development initiatives continues to be a significant difficulty since implementation capacity is limited and entrenched interests slow down transformative change efforts.

China's great success related to Circular Economy, solar and wind power, and, hopefully, many other complex transitions to Green Economy and Green Growth options are lessons to others about what can be accomplished. Compared to even a decade ago, China has gradually set a path that places it well along a pathway of innovation regarding environmental, energy and green infrastructure initiatives. However the cost is high and there is a need for more rapid and consistent commercialization of scientific and technological knowledge and discoveries. Perhaps half of the programs now underway through specially designated funding in one way or another have environmental or sustainable development connotations. This is remarkable. But the trip from lab bench to proving grounds and then to full implementation within society is difficult. Hydrogen economy is an example internationally, and the reception of the EV (electrical vehicle) whether in China or elsewhere in the world demonstrates how the process can take much longer than expected.

Part of the problem is the skewed nature of incentives and of organizational structure. China's continuing high use of coal for electricity generation is an example, where the complex problems of coal pricing, the difficulties of establishing smart grids for transmission optimized for use of wind and solar sources, and various institutional problems have slowed the progress of shifting from coal as the principal source. The peak use of coal could come quickly or be delayed for a decade or more depending on the resolution of the problems of implementing alternatives, as well as on developing stringent demand reductions.

Another side of the science and technology issue is the great opportunity to more quickly bring about the new green economy that is more reliant on the digital revolution, and with higher value-added for most activities, but with extreme reductions in energy and material use in manufacturing and service sectors. The coming agricultural revolution in China must not be based on excessive chemical and water use.

Issue 7. Seeking environmentally sustainable consumption

The shift towards expanded domestic consumption requires much more effort to avoid unsustainable consumption patterns emerging, especially in urban populations.

The stimulus for increasing domestic consumption in China is understandable from a strategic economic perspective but it is not clear how much of the projected consumption can either help to stimulate a green transition, or indeed be classified as sustainable consumption. The increased flow of CITES-sanctioned wildlife parts such as ivory, rhino horn and many other items into China is linked to the rise in wealth. Changes in Chinese diet to include much more meat has impacts on demand for agricultural lands and water, and with resulting pollution and

36 http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/Changbaishan_BR_GLOCHAMOST-2011.pdf

other environmental impacts both inside and outside of China. The rapid rise of Chinese travellers to destinations within and outside of China has raised serious questions about carrying capacity at parks and other natural areas, and other travel related issues such as greenhouse gases, since the uptake of carbon offsets on travel has not been a major success yet in China, or elsewhere.

Issues such as land and water consumption by golf courses and ski resorts, the proliferation of second, third or more residential properties, and other examples of high consumption lifestyles are widely debated. However existing policies are not fully enforced, or perhaps are even to some extent unenforceable. Projected forward a decade or more, it may be the conspicuous consumption problems created by high incomes are some of the most severe facing China, just as they have in some western countries.

The love for the automobile in China appears no less than in many other countries. Already the larger cities have been given over to the auto. The implications for both environment and energy use are well understood, but still not fully addressed, either in terms of very stringent controls on ownership, use or advanced fuel and pollution control systems. Surely this will come about, but it is happening more slowly than should occur.

Impressive gains in understanding green market supply chains and acting on this knowledge have been made in recent years. An example is the case of Tianjin and its efforts to build its new financial district with specifications related to good environmental planning such as making public transportation very easy to access, and ensuring that buildings are constructed with design and material use based on green market supply chains. Similarly inspiration can be seen in some of the advanced efforts of Shenzhen. However these examples are still the exception rather than standard practice.

Overall the challenges of domestic sustainable consumption are daunting and perhaps the most pressing aspect for the people of China to embrace as part of their journey towards green development and Ecological Civilization.

2.5.3 Regulations and incentives

Issue 8. Legal basis for an ecological civilization

The current patchwork of environmental law is not a sufficient basis for meeting Ecological Civilization legal needs. Nor is there a strong enough legal basis for market reforms related to environmental management. The revised Environmental Protection Act is a good starting point for a modern approach.

It has taken more than half a decade to reach agreement on the newly revised Environmental Protection Act passed by the National People's Congress in early 2014. This revised Act might best be considered as the wedge that will help to drive changes in attitude and achieve results against recalcitrant polluters, open the way to greater transparency on the part of government and provide various means for people to have a greater voice on environmental matters, including via court action. It likely will require follow-up regulations that may take time to put in place. Further revisions in the environmental protection act may be desirable within a relative short time, perhaps only 3 to 5 years, since there was not agreement on all of the important points that might have been included.

The slow process of legislative reform on environment across key sectors is likely to hold back implementation progress overall. The thin edge of the wedge is now in place. But many, perhaps most environmental matters have important ramifications in other legislation such as on water, land, industry, energy, urban and rural development. In addition central agencies such as the Ministry of Finance play an important role, for example in green taxes and emissions trading. Changes in the administration of justice through the existing court system is starting to occur, but not at the desired pace. Adequate enforcement policies are not yet in place even though it is now possible to set meaningful fines.

A broader and important issue is to determine the type of legislative base that should underpin new initiatives associated with Ecological Civilization. Would such legislation be primarily to enable such initiatives—or would there be regulatory and punitive aspects? How would legislation on this subject relate to existing economic, social or environmental law, regulations and market based approaches? Perhaps a good starting point would be to define the most relevant existing laws and examine them against Ecological Civilization criteria and expectations. Then consider whether there is a need for reform of the existing statutes, or development of new laws.

The case can be made that rather than draw up too many new laws and regulations, the most important need is to fully utilize existing laws, well enforced, and to improve the capacity of the courts to do a proper job on cases brought either by the state or by individuals and organizations as permitted under the revised environmental protection law. However it is unlikely Ecological Civilization could be made into an operational concept without the backstopping provided by the rule of law, properly applied.

Issue 9. Developing a financial system for a green transition

Level of investment and capacity required to successfully implement Ecological Civilization are not well understood, nor are the funding sources fully identified.

Investment and financing for environment and sustainable development are undergoing considerable scrutiny as noted in an earlier section of this report. Partly this interest is driven by the need to find substantial levels of funding for addressing climate change adaptation and mitigation. However, with the massive needs of infrastructure necessary for quality of life in burgeoning cities, and in a green transition concerning energy, agriculture and transportation trillions of dollars are needed globally, and particularly in the countries of the South.

China is more fortunate than many other nations, in part because its investments over recent decades have laid the groundwork for the even larger challenges ahead. Still China will have a difficult time to raise the roughly USD250 billion needed annually to meet its desired level of investment in green development. The Development Research Centre (DRC) of the State Council and IISD (the International Institute for Sustainable Development) are examining the current capacity of the financial system to understand green economy financial needs and how to support them in an innovative fashion. The preliminary findings in this report³⁷ suggest that the situation is still at an early stage. While there has been considerable progress regarding some mainstream aspects of green development, *green finance flows remain far below what is needed, and carbon- and natural resource-intensive investments continue to rise, in China and elsewhere.*

Furthermore, in China: (1) *There is not yet a comprehensive understanding of a green financial system, covering definitions and standards, institutions, policies and sequencing for specific contexts.* (2) *Policies to develop a green financial system can in many instances be advanced at local and national levels, but in some instances need to be established at regional and international levels.* (3) *Institutional arrangements, and individual and organizational competencies, are currently inadequate, and so need major upgrading to effectively advance a green financial system.* All of these problems are found in other countries, so China is by no means unique.

What sets China apart is the scale of possible future action. Quite likely China may become the world's largest investor in green development. This is dictated not only by its sheer size but also for its massive infrastructure needs for rapid green urbanization, energy and transportation networks. In addition there are considerations related to investment in Clean Tech and other new green industrial development.

The transformation towards Ecological Civilization could be expensive, or not. Partly it depends on the accounting, especially in relation to the value of ecological services that can be preserved or enhanced as a consequence of a

³⁷ http://www.iisd.org/pdf/2014/greening_china_financial_system_en.pdf

more robust relationship between ecology and economy, and in the eventual value to human health and ecosystem productivity. Unquestionably, financial investment must also benefit the economy. Then what might otherwise be seen as simply an add-on cost can then be seen as having a positive and substantial return to society and perhaps even to individual and institutional investors. This is the premise of green bonds, for example.

During the next decade the picture of Ecological Civilization approaches to development will become clearer, as will many of the experiments for funding low carbon initiatives, and other “modern” approaches to solving environment and development concerns. The danger will be if innovation fails and the existing mainstream of conventional high energy and material use once again takes hold whether in China or in other countries. In this regard, China cannot alone be expected to do the job on its own. Investment and trade policies are very important, as is ensuring that new technologies are not kept out of markets by unreasonable barriers. International financing mechanisms and international cooperation are important bedfellows for green development, and undoubtedly, also for China’s success with Ecological Civilization.

Issue 10. Trimming green transition times

Green transition time frames currently are longer than desired and need to be shortened while not reducing effectiveness.

As China moves into the last phase towards meeting its goal of a moderately prosperous *Xiaokang Society* by 2020, it should be very apparent that a truly prosperous society depends on environmental objectives keeping up with economic and other development objectives. Clearly that has not been the case, a point made throughout this paper. Transformative change for environmental protection in particular has been much harder to put in place than either social or economic changes.

For the future, it will be essential to trim green transition times substantially. It likely will not help to simply use the guideline that reduced economic growth rates will help a lot. The reason for this statement is related to the overall size and complexity of China’s economy now. Even a relative small increase in the economy from year to year results in considerable environmental damage by comparison to past high growth rates of a much smaller economy, even though decreased pollution and energy intensities can help to mitigate this aspect. Environmental damage tends to be cumulative, especially if not dealt with quickly. There also are delayed and recombinant effects ($PM_{2.5}$ is an example of the latter). If the benefits of accelerated green transition can be reached over five-year periods rather than 10 or more years, there is hope that the catch-up game of environment and economy could become less serious.

Another important point to be made on this subject is the urgent need to create rapid green transitions in China’s urbanization, expected to reach peak levels during the next 10 or 15 years. First, the attention given to environmentally-driven spatial and infrastructure planning could help immensely with meeting all other aspects of urban development, such as energy consumption, and reduction in use of materials such as steel and cement. Overall such planning will be linked to the need to put people first, as desired by Premier Li Keqiang and other senior leaders, since cities will be planned around criteria for quality of life, as well as economic and social considerations. Eco-city and other good city models can provide the basis for this once in a generation opportunity to accommodate in an environmentally friendly way the needs of China’s peak in urban migration and development.

In general, the projected turning points and peaking of resource and energy use needed for green transitions in the economy and development should be contained to the period of 2020 to 2030 rather than later.³⁸

38 See, for example, Fergus Green and Nicholas Stern. 2014. *An Innovative and Sustainable Growth Path for China: A Critical Decade*. <http://www.cccep.ac.uk/Publications/Policy/docs/An-innovative-and-sustainable-growth-plan-for-China-a-critical-decade.pdf>

2.6 CONCLUSIONS

Environmental management has lagged behind economic growth—where targets often have been exceeded. Cumulative loads on China’s environment are reaching *tipping points*, or thresholds, where very severe and difficult to remedy conditions become visible. Air pollution is only one of several that may be expected to reach a crisis stage in coming years. Soil and groundwater contamination may present even greater difficulties. Climate change effects may result in other environmental tipping points within China.

Given that the damage to ecosystems and to health will require long time frames to fully repair, Chinese people’s trust in government may be severely tested. Therefore it is important to reach *turning points* where it is quite obvious to the general population that problems are being successfully addressed, even if much more time is needed for the solutions to be fully realized. In particular, the “War on Pollution” must turn into a long-term effort that should define and achieve major turning points in the national struggle for adequate environmental protection. This will require time periods that extend well past 2020 in most cases.

The recent actions to Deepen Reform, stamp out corruption, promote Ecological Civilization, and to implement new concepts such as Ecological Red Lining, plus the newly revised Environmental Protection Law, provide a strong foundation for China’s future environment and development. What is missing is a coherent medium term strategy for green development. A huge window of opportunity exists to define and put in place such a strategy—a *Green Transition Strategy*—as discussed in the conclusions noted below. Fortunately in this time of policy flux within China and the concern on the part of both the public and government for reform, there is a very clear window of opportunity to build a sustainable future. China can lead by example, and its efforts will be essential to global green growth.

2.6.1 Green Transition Strategy

A *Green Transition Strategy* should span from 2015 to 2030. While the “final dash” to a moderately well-off society can be accomplished via the 13th Five Year Plan, the real environmental marathon has started now but will take at least three five-year plans to secure. In China there are few action plans or other goals related to the environment for this longer time frame.

China will need to accelerate its progress towards an early peak in use of coal and oil during this time frame. Indeed this is a key point for transformative structural change to green development for industry, eco-urbanization, and for truly sustainable forms of expanded domestic consumption. The coming 15 years is the time to take fullest advantage of available green technologies that will shape a substantial part of China’s new green economy.

2.6.2 Pace of Reform

Environmental progress must keep up with other fast-moving reforms. While much has been said about this, it has not actually happened during the last decade. This is a problem not only in China but globally. Ecological debts have been building rapidly, and unsustainable development patterns continue.

The most important aspect is to ensure that market based reforms are recognized more clearly to be an essential part of environmental innovation reforms. Resource pricing policies, green tax reform, and subsidy reform are needed. Innovations such as green bonds for urban infrastructure, and full implementation of national emissions trading systems, including carbon are important.

2.6.3 Financing

Increases in the rate of investment on environment protection must match or exceed the economic growth rate for some time to come. In part this investment is required to address the ecological debt and environmental shortfall created by past rapid economic growth. But most importantly, it is needed in order to put a halt to continued degradation, and to ensure that the huge new investments in urban infrastructure follow best practices.

While the cost of a green transition will be substantial, these costs can be shared between government and business. Moreover they likely will be much less than the cost of continued environmental degradation. The new economic benefits of a green economy and the social benefits of green development will help in the construction of an ecological civilization. The level of investment for environmental protection should rise to at least 3% of GDP. By contrast, a recent estimate of the cost to GDP of climate change in China is about 12%, highest of any large country.³⁹

A diverse set of green financial mechanisms is required. The elements include: a shift towards a green taxation system with the funds raised put back into environmental improvements; green bonds for infrastructure development especially where fees can be charged to recover costs; accelerated implementation of a carbon emissions trading system; special funds based on the polluter pays principle to cover problems such as brownfield restoration; removal of the right for cities to engage in land sale transactions that result in loss of “greenfield” development, or that are based on land reclamation in coastal areas; and new forms of environmental public-private partnerships.

2.6.4 Green Market Supply Chains

To achieve substantial environmental dividends from China’s promotion of domestic consumption will require a different culture of consumption. The cities will make or break this element of Green Transition. Leading efforts such as Green Procurement in construction of the new Financial District of Tianjin provide important examples of what city administrations and publicly funded projects throughout China should do.

Ordinary citizens still do not have access to trustworthy certification of a full range of green products and other information to make environmentally-informed decisions for most of their purchases, including major ones such as appliances, furniture, and building products such as paints, and food items such as palm oil. They must have better awareness of the value of green purchasing habits, good information on the qualities that separate green goods from those that are more damaging to the environment, easy access to suitable products at reasonable prices.

Green market supply chains most often will be international in their nature and extend beyond retail sales to include the whole life cycle from procurement of raw materials, manufacturing to material recovery after use.

Environmentally sustainable consumption will be important for trade competitiveness as well. Green market supply chains should be worked into important new trade linkages being established by China. In particular, the exciting and important commitment to revitalizing the ancient routes of trade through a modern “Silk Road” connection to Central Asia and to Europe, and the “Maritime Silk Road” to other parts of Asia, the Middle East and Africa, is a special opportunity to highlight the need for sustainable development practices. It can be a good means for China to take the concept of Ecological Civilization well beyond its own borders.

³⁹ Global Commission on Economy and Climate. 2014. *Better Growth Better Climate*. <http://newclimateeconomy.report/#;> <http://www.economist.com/news/briefing/21618682-policies-slow-down-warming-may-be-more-attractive-if-framed-ways-speeding-up-growth-try>

2.6.5 Implementation of Modernized Law

The capacity to fully enforce the elements of a modernized legal framework for environment and development, and to seek fair treatment from a fully informed judiciary is necessary. Weak links in the rule of law, and also corrupt practices affecting the environment must be addressed as quickly and effectively as possible at local levels, especially provinces. Only if these measures are taken can the public play its supervisory role well. Stronger regulations for environmental planning and management require standard setting, long-term monitoring, improvement in data analysis and communication of results in a relevant and easy to understand way. While there have been improvements, these issues are still dealt with inadequately.

2.6.6 Protecting Ecological Lands and Strengthening Regional Environmental Management

China is now well aware of the need to protect ecological services and therefore the concept of ecological redlining is a major step forward and builds upon decades of effort to create protected areas. Yet this new initiative may set off major battles between those who wish to protect ecologically fragile areas, and those who wish to do otherwise. Great swaths of land in China are still classified as wastelands, opening their use to almost any economic or social purpose. In reality all lands have some broadly defined ecological services. It would be sensible to eliminate the term wastelands, and to start with the assumption that unless land is already allocated to agriculture or within certain other categories for restricted use, it should be considered as part of China's ecological lands. And then further designate highly significant areas within the category of ecological red lined areas.

Taking a regional approach to addressing environmental management is one of the most important innovations required for ecological civilization. China should move in this direction on a number of concerns ranging from the existing Air Pollution Control Action Plan and other pollution plans yet to be implemented, water basin management, coastal zone and sub-regional ocean planning and management, eco-compensation, and specific regional development efforts such as those in central and western China.

It is now time to consider the entire eastern part of China as a whole for regional environmental management. Within this eastern part there should be unified planning, for example in considering regional air pollution impacts of new projects; and an integrated approach taken for economic and energy restructuring, urbanization and mobility. A regional joint enforcement mechanism should be put in place. An integrated system of basic scientific research and monitoring should be set up to meet the regional information needs at national and provincial levels.

2.6.7 Innovation in Environmental Institutions

Institutional reform requires strategic transformations. Among them: a modernization of relationships between government, market and society into a multi-stakeholder governance system; unified supervision of environmental issues; and a higher degree of accountability through environmental audits. Of these matters, social governance should be given very high priority. All State Council institutions should undergo pressure tests to ensure their capacity and readiness for addressing ecological civilization and green transition priorities.

By design and capacity, or through being overshadowed by economic interests, corrupt practices and by outdated approaches, environmental protection and management administrations have long been in a weak position. They operate without adequate authority, and encounter resistance from various sectors and local governments. The construction of ecological civilization demands even more from the existing network of environmental institutions, with on-going coordination at the top level in order to provide unified supervision.

Pollution prevention and control functions and ecological protection functions that currently are scattered across various departments and administrations should be placed into strengthened bodies nationally and provincially with more adequate authority, plus human and financial resources required to successfully lead the “War on Pollution” and other high priorities for environmental action. One such priority should be a strengthened environmental impact assessment process made less vulnerable to corrupt practices and with the additional focus of strategic assessment of policies and major plans.

The accountability of officials in this strengthened system should be judged in a fair way based on an environmental audit system that can serve the dual purpose of measuring progress on meeting environmental objectives and on individuals' performance. The results should be based on independently verified information, and using well tested approaches already available internationally. The results of such audits should be reported to the National People's Congress in addition to other bodies of government and the CPC. And, of course, they should be accessible to the public.

2.6.8 China Environment and Development Outlook

The information base currently published through government is not broad enough in scope, especially for some pollutants and for the new efforts that would part of a Green Transition. Furthermore, the information presented is not necessarily in a form that is usable or trusted by members of the public. An Outlook on Environment and Development for China should provide a coherent picture of progress towards achieving an Ecological Civilization. This will require a thorough look at existing, generally inadequate indicators, and determine a robust set of more appropriate ones. It is essential to strengthen the quality of monitoring and analysis in order to provide much more credible information. The technical tools to do so are now much more available than in the past. In particular, spectacular gains have been made on crucial information for spatial planning and management at a very fine-grained level. A properly done national Outlook will have to rely on a combination of modeling and scenario development that has so far not been fully developed in China in relation to topics such as Ecological Civilization, and a comprehensive and finely worked out examination of the relationship for environment and economy.

CHAPTER 3

EVALUATION AND PROSPECTS FOR A GREEN TRANSITION PROCESS IN CHINA

CCICED Task Force Report

CCICED 2014 Annual General Meeting

December 1-3, 2014

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SUMMARY OF KEY FINDINGS

China has made important progress towards a ‘Green Transition’ in the past 10 years, with numerous major policy initiatives and growing public awareness. This is reflected in key indicators such as energy intensity, which has continuously improved alongside sustained GDP growth. Yet at the same time, it is clear that China’s overall environmental situation has been deteriorating. This is evidenced in phenomena such as the rising air pollution challenge in a growing number of major cities, as well as rapidly increasing fossil energy use and carbon emissions.

The government has mainly relied on administrative controls to tackle pollution, and has yet to expand the use of measures which affect behavior via the market. Some of the primary barriers to China’s Green Transition process lie in economic policy settings. Over-investment in heavy industries has led to excessively high levels of energy consumption, compounded by the absence of appropriate market-based instruments. International experience shows that a combination of regulatory and market-based approaches will be most effective. We therefore propose a range of economic and pricing instruments as part of an integrated policy framework to promote the Green Transition.

The imbalance in investment-consumption structure over the past 10 years is one of the major causes of worsening air pollution, because it has led to excessive and wasteful energy consumption. If China can increase consumption whilst slowing investment within an appropriate range, there will be no impact on GDP growth but energy consumption and air pollution will be reduced significantly. A smaller share of investment in GDP growth may even produce stronger GDP growth, due to enhanced demand for green products, efficiency improvements and improved air quality.

At the same time as making this adjustment, it is also critical to ensure that both investment and consumption follow a sustainable path. Investment in China will still be at considerable levels even if the adjustment is made; it should be channeled into the huge and growing opportunities for green growth – including the widespread application of clean technologies in industry, renewable energy, smart grids, construction of efficient cities, ecological protection and public transport infrastructure. Amongst other measures, this will require green reforms in the finance sector. A shift to sustainable consumption is just as important to limit energy demand growth in the medium term, especially in China’s cities.

China urgently needs to push forward economic transition toward a new, more sustainable development model. Excessively high saving and investment, as well as various preferential policies to promote industry, have maintained the rapid growth of heavy industries, and stunted development in the service sector which offers larger job opportunities in the future. Meanwhile, overcapacity is undermining the competitiveness of China’s heavy industries. The emphasis on physical investment has also led to under-investment in human capital and the education and health sectors, as well as ecological and environmental protection.

China can take great steps towards a Green Transition in the 13th Five Year Plan. Worsening air pollution has greatly increased public awareness about the seriousness of the problems and the need for change. With further growth of the urban middle class, domestic demand for a better environment is rising. China can draw on lessons from other countries as seeks to ‘decouple’ economic growth from the negative environmental impacts; especially the need for integrated, cross-cutting approaches that tackle the root causes. The Leadership has promised to push forward a new round of institutional reforms. If the government incorporates high quality policies aimed at structural changes and green development, China can continue its 7-8% GDP growth rate over the next few years and boost economic productivity alongside a significant improvement in environmental conditions.

SUMMARY OF MAIN POLICY RECOMMENDATIONS

The Task Force strongly recommends that the government focuses on reducing China's tendency to over-invest in physical industrial capacity with its associated excessive energy consumption and air pollution. Based on scenarios developed by the Task Force, an indicative 10 percentage point reduction of the share of investment in GDP and a corresponding increase in the share of consumption in GDP could reduce energy demand by around 13% by 2030, compared to a 'business-as-usual' scenario (BAU). This would promote structural adjustment between heavy industry and the service sectors.

A range of policy adjustments are needed to rebalance the investment-consumption structure, including fiscal and financial sector reforms; measures to address income distribution; and strengthening of the social safety net. These policies will also help ensure that a growing share of investments in China is directed to green sectors, technology and infrastructure. A transformation in government functions is required to reform financial and administrative systems: reducing government investment in heavy industry, and increasing public service and social security spending. A new inter-departmental coordinating mechanism could be introduced to manage this process, involving not only sector ministries but also core departments, such as planning, finance and trade.

A higher resource tax should be imposed on fossil fuels, including coal, as well as environmental taxes on electricity and automobile consumption in cities which face severe air pollution. Scenarios presented to the Task Force suggest that green fiscal policies could reduce fossil fuel consumption by a further 6.1% in 2030, with an 8.4% reduction for higher carbon, highly polluting fossil fuels (coal and oil). This could also provide significant source of revenue for local and the national government.

In recent years, stronger policies on the demand-side have successfully expanded the domestic market for renewable energy in China. With sustained attention and some policy adjustments to reduce uncertainty, scaling up renewables could avoid 5% of fossil energy consumption in 2020, compared to the BAU scenario developed by Task Force members. For other green technologies, policies are still focused on the supply side; clearer demand-side policies should now be applied more broadly, to expand all green technology markets and help address overcapacity in green industries.

Urbanization continues apace in China, and efficient cities and green buildings are critical to manage future energy consumption growth and reduce pollution. Scenarios presented to the Task Force suggest that fully enforcing compulsory building standards for energy efficiency and expanding inter-city and urban rail transport could lower energy consumption by an estimated 5 to 12% in 2030, compared to the BAU scenario. Further savings are possible if China promotes the use of 'zero-energy' buildings.

China is a leader in some areas of 'Green Finance', but broader reforms are needed to ensure the financial system actively facilitates the Green Transition. All financial institutions should incorporate environmental considerations in their profit calculations; ensuring allocation of financial resources reflects environmental factors and risks, avoiding polluting activities and creating opportunities for green growth. With careful planning and coordination, mandatory 'green credit guidelines' could be introduced and China could establish a 'green bank', funded by green bonds.

We suggest that China adopts a "National Quantity Target Control" system to control energy consumption as soon as possible, with clear distribution of the "caps" for localities and industries. For the energy mix we propose a "three-step" target: 1) Renewable energy should grow faster than other energy sources including natural gas by 2020; 2) Non-fossil energy could grow faster than fossil fuels by 2025 in absolute terms; 3) Fossil energy consumption could peak in the 2030s at 4.6 – 5.2 billion tons of standard coal equivalent (SCE). Consumption of higher carbon fossil fuels could peak between 2025 and 2030 at 4.0 – 4.8 billion tons SCE, and then decline in absolute terms.

According to projections presented to the Task Force, full implementation of the Green Transition policies and reforms proposed in this report could result in a reduction in fossil energy demand of 26% in the 2030s, relative to the BAU scenario. SO₂ and NOx emissions could fall by around 15% in 2020 and around 30% in 2030 compared to BAU. Fossil energy consumption and carbon emissions could peak in 2037 (at around 4.0 billion tons SCE and 9.5 billion tons CO₂ respectively), and then decline. Consumption of higher carbon, highly polluting fossil fuels (coal and oil) could peak by 2020, at around 3.4 billion tons SCE. Coal consumption could also peak by the end of the 13th Five Year Plan in 2020. These goals are more ambitious and challenging than the targets proposed in the previous paragraph, but achieving them would put China firmly on the road to an Ecological Civilization.

BACKGROUND AND IMPLEMENTATION OF THE TASK FORCE

Over the past decade, China has made important progress towards a Green Transition. The government has formulated the core framework for a Green Transition, including a national development concept, the strategic targets and approach, and a specific implementation plan.

The 13th Five Year Plan is the critical window of opportunity for the Green Transition, and will be the litmus test of China's commitment to pursuing an ecological civilization. Action is urgent, because air pollution and other environmental challenge pose a serious threat to China's development goals. Action is possible, because the economic reform program and the strong response to the air quality crisis present huge opportunities to align environmental and economic policy at the strategic level.

Against this backdrop, it is both pressing and necessary to evaluate and summarize the process of Green Transition in China in the past decade, analyze the obstacles and bottleneck in the transition process, envisage future opportunities and challenges, and propose a new strategic framework to further promote the green transition process.

The report focuses on energy use and 'local' air pollution, rather than carbon dioxide and global climate change. The main consideration behind this framework is that local pollution has become a political lightning rod in China. We aim to use this opportunity to provide policy-makers and other stakeholders with practical solutions.

This Task Force is not focused solely on environmental issues: it is highly concerned with the sustainability of China's future economic development; the impact of structural change on the environment; future structural changes; and the interaction between policies and structural changes. Each of these aspects deserves in-depth studies, but has been given inadequate attention in previous research. Our research focuses on the role of economic policies and measures to regulate and solve imbalances, to sustain economic growth and to improve the environment.

Since the inception of this project in August 2013, five Task Force meetings and an overseas study tour have been organized. Throughout the research, Chinese and international members have had brain-storming sessions and discussed key issues in detail, including the key policy recommendations, findings and conclusions, scenario forecasting work and analytical methodologies and frameworks. The output of this project includes this research report and nine background papers.

3.1 GREEN TRANSITION IS AN URGENT PRIORITY FOR CHINA

3.1.1 Economic performance and the current growth model

China has made tremendous progress on economic development, lifting millions out of poverty in the process. After several decades of growth, China's GDP reached 56.9 trillion RMB (9.2 trillion USD) in 2013, placing it second in the world with about 12% of global output. China is now considered a lower middle-income country; its per capita GDP was 6800 USD in 2013, ranked 77 in the world⁴⁰.

An economic structure characterized by dominant state-owned banks, strong state intervention and controls on interest rates has proved remarkably successful in China: it mobilized savings and resources, and allocated capital to key strategic sectors during the economic take-off⁴¹. Yet this model has also led to over-investment and decreasing returns on capital, as well as widespread over-capacity in China's energy intensive sectors.

Today, China's development model continues to rely heavily on energy and resource consumption. Rapid industrialization and urbanization are accompanied by unprecedented investment in heavy industries, which require a large volume of materials and energy. Industry accounts for around 70% of China's energy consumption, much of it from coal⁴². This lies behind many of the undesirable impacts of China's development, such as severe pollution and the accompanying welfare loss.

The hard truth is that the benefits of this model are fading – and eventually they will be outweighed by the rising associated costs. Yet with development processes far from complete in China, forging a new development path is an urgent and unavoidable task for China's leaders and society. Per capita incomes are still significantly lower than developed countries, and by 2020 another 100 million people are expected to move into China's cities in the next great wave of urbanization – a significant challenge for job creation as well as for infrastructure development and the environment⁴³. Meanwhile, China still needs to develop its western regions in a sustainable way.

3.1.2 Major policy efforts on environmental protection and energy-saving

The downsides of China's development model have not gone unnoticed: its leaders have made considerable efforts to tackle the serious and growing environmental impacts which have accompanied the country's resource-intensive economic development.

Laws to encourage environmental protection were gradually put in place from the beginning of the opening up period in the late 1970s, but it was the 11th and 12th Five Year Plan (FYP) periods that saw a significant increase in policy action to tackle environmental problems (Table 3-1-1). Of the initiatives on energy conservation and environmental protection, perhaps the most important are the Cleaner Production Law and Renewable Energy Law; the mandatory energy intensity targets for local governments and companies; and the newly revised Environmental Protection Law.

40 World Bank definition of 'lower middle income country'. GDP figures presented are in current USD. Adjusted for purchasing power parity, GDP per capita in China was 11,904 USD. In PPP terms, China was close to parity with the US in 2013.

41 World Bank, Development Research Center of the State Council, 2013. *China 2030: Building a Modern, Harmonious, and Creative Society*, <http://www.worldbank.org/content/dam/Worldbank/document/China-2030-complete.pdf>

42 China Statistical Yearbook gives a value of 71% in 2011. Due to different accounting methods, industry accounts for a smaller share in some international assessments. In the IEA World Energy Outlook 2013, industry is responsible for 48% of final energy consumption in 2011.

43 Wall Street Journal, March 16th 2014, *China Unveils Urbanization Plan*. Available: <http://online.wsj.com/news/articles/SB1001424052702303287804579444112058812626>

Government spending on resource conservation and environmental protection also increased significantly. China has invested approximately 800 billion RMB in major ecological construction projects since 1998, including returning farmland to forests, returning grazing land to grassland and controlling sandstorms that affected Beijing and Tianjin. Ecological compensation capital grants awarded by the government increased from 2.3 billion RMB in 2001 to 78 billion RMB in 2012. Grants for energy conservation and environment protection granted reached 1,014 billion RMB in 2012, having grown at an average annual rate of 24.1% from 2008.

Table 3-1-1. Major Policy Initiatives on Energy Efficiency & Environmental Protection

Policy or Target	Compliance period	Brief description
<i>Broad goals</i>		
Construction of Ecological Civilization	2013	Includes a strategic plan to promote protection of the ecological environment and proposed a roadmap and timetable for speeding up ecological civilization system construction.
Twelfth FYP Energy intensity target	2011-2015	By 2015, non-fossil energy share of total primary energy consumption should reach 11.4%, the per-unit GDP energy consumption should be reduced by 16% compared to 2010, and carbon dioxide emissions per unit of GDP should be reduced by 17%.
Eleventh FYP Energy intensity target	2006-2010	Required a 20% reduction in energy intensity at the national level, with intensity targets assigned to individual provinces.
Circular Economy Promotion Law	2008	Raising resource efficiency and protecting and improving environment via resource recovery in production, circulation and consumption, amongst other measures.
Construction of Energy-efficient and Environmentally-Friendly Society	2005	Developing recycling economy, protecting the ecological environment, accelerating the construction of resource-saving, environment-friendly society, promoting coordinated development of the economy and population, resources and environment.
Scientific Development View	2003	Adhering to the people-oriented principle, establishing comprehensive, coordinated, sustainable development view, promoting the economic society and people's overall development in accordance with overall urban and rural development, regional development and economic and social development. Enhancing harmonious development between man and nature and opening to the outside world.
Sustainable Development	1992	A formal national development strategy, which organized the implementation of the 'three rivers, three lakes' pollution prevention project, the grain to green program, and natural forest resource conservation.
<i>Energy</i>		
Renewable Energy Law	Oct.26, 2009	Putting the development and utilization of renewable energy as priority areas of energy development, taking corresponding measures and promoting the establishment and development of the renewable energy market
Clean Production Law	Oct.28, 2007	Clearly defining energy conservation as the basic national policy, setting up the strategy of "National implementation of conservation and energy development".
<i>Water pollution control</i>		
Law on Prevention and Control of Water Pollution	Feb.28, 2008	By the end of 2010, the state has promulgated more than 80 pieces of local laws and regulations, provincial government regulations and regulatory documents more than 700 pieces. Its scope includes the management of water resources, river basin and water environment protection, etc.
<i>Air pollution control</i>		
Law on the Prevention and Control of Atmospheric Pollution	Sep.1, 2000	The basic law for the prevention and control of atmospheric pollution areas.
<i>Ecological protection</i>		
Environmental Protection Law	1979, Revised 1989 & Apr. 25, 2014	Amongst other measures, the 2014 revision establishes the principle that environmental protection takes precedence; removes the upper limit on fines; imposes fines for each day a breach has occurred; clarifies the right of environmental organizations to initiate lawsuits; strengthens requirements for environmental impact assessments; and increases transparency over environmental data.
Chinese Biodiversity Conservation Strategy and Action Plan	Sep.17, 2010	Incorporating biodiversity conservation into plans for national economic and social development and planning department.

Policy or Target	Compliance period	Brief description
National Ecological Function Region-alization	Aug.14, 2008	The Ministry of Finance issued “national key ecological function areas”. In 2010, 451 counties implemented national key ecological function zones.
National Ecological Fragile Zone Protection Plan	Sep.27, 2008	Determining the distribution and state of ecologically fragile areas, and setting principles and tasks for the restoration and reconstruction of ecologically fragile areas.
National Biological Species Resources Protection and Utilization Plan	Dec.10, 2007	Clearing utilization of biological species and resources protection in key area, putting forward strategic tasks.

These top-down long-term strategies, plans and policies have made some headway towards a Green Transition. Energy and carbon intensity⁴⁴ both improved by 19% over the 11th Five Year Plan period, while China's considerable economic growth rate was maintained. Energy consumption per unit GDP fell by 52% between 2001 and 2013, and carbon emissions per unit GDP by 43%.

China's economy has also been gradually reducing its overdependence on heavy industry. The share of tertiary sectors in GDP reached 46.1% in 2013, surpassing the contribution of industrial sectors for the first time. Within the industrial sectors there has also been a gradual shift towards less resource-intensive, higher value-added activity: the proportion of high energy-consuming industries fell from 70.5% of output in 2009 to 68.8% in 2012.

Meanwhile, a new green industry has been emerging in China, ranging from the manufacture of pollution abatement equipment, renewable energy and sustainable transport technology to a wide variety of environmental service companies. The growth rates of investment on sustainable transportation and pollution control reached 53.8% and 41.7% respectively in 2005 and 2007. The government plans to invest \$277 billion between 2013 and 2017 in pollution control.

Renewable energy industries have developed rapidly in recent years to the extent that China is now the global leader in and major exporter of renewable technology components and parts (see section 3.2.3). China is by far the largest investor in renewable energy. New investments in clean energy in China totaled 54.2 billion USD in 2013, and a record 19.3 billion was achieved in the second quarter of 2014⁴⁵. China installed around 12 GW of solar PV in 2013 – roughly a third of the global total.

Emissions of some major pollutants (such as SO₂) have already peaked and chemical oxygen demand (COD) figures also indicate falling levels of organic pollution in water⁴⁶. Investments in pollution control rose steeply in the 11th FYP period, from 111 billion RMB in 2005 to 825 billion RMB by 2012. Overall, SO₂ emissions fell by 11% between 2005 and 2010, due to flue-gas desulphurization in power plants and vehicle technology standards⁴⁷. Among the seven major river drainage basins, the percentage of water quality better than Grade III increased from 41% in 2005 to 64% 2012, while the percentage worse than Grade V declined from 27% to 10.2%.

The newly revised Environmental Protection Law, which will come into effect in 2015, will bring new opportunities to accelerate the Green Transition. Amongst other measures, it will remove the cap on fines that can be imposed on polluters and clarify the ability of environmental organizations to initiate legal action. It also requires greater transparency on environmental data and more rigorous environmental impact assessment processes.

⁴⁴ Defined here as ‘consumption of energy and CO₂ emissions per unit GDP’, respectively.

⁴⁵ Bloomberg New Energy Finance, 15 July 2014, *Global Trends in Renewable Energy Investment*. Presentation available from BNEF website.

⁴⁶ COD is an indirect compound measure of organic pollutants in water.

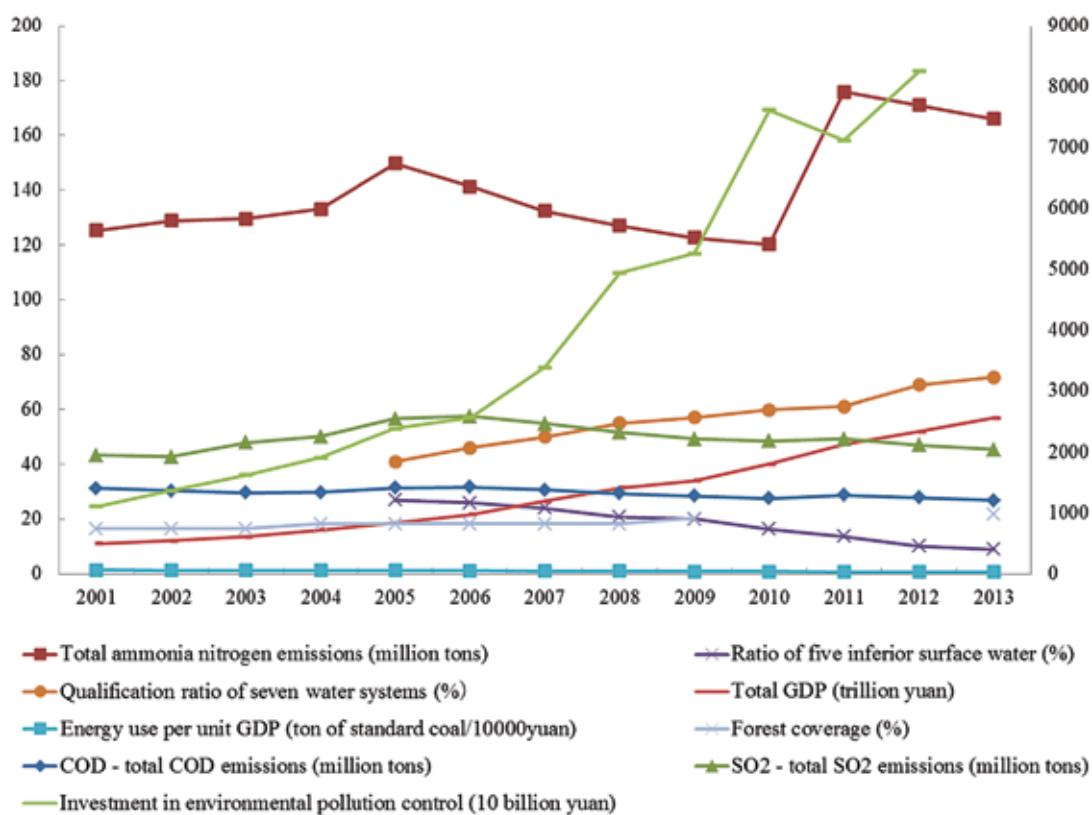
⁴⁷ Qiang Zhang, Kebin He and Hong Huo, 2012, *Cleaning China's Air*. Vol 484 Nature 161-162. Comment Piece.
(Improvements in the power sector were offset by an increase in emissions from heavy industry).

3.1.3 Environmental-economic problems persist

While these policies and measures have helped address some of the negative impacts of China's growth, they have proved insufficient to shift the country onto a Green Transition pathway. The country faces rising and very serious environmental problems, many of which stem from the use of coal in the energy sector and by heavy industries, as well as the use of oil in the transport sector. Figure 3-1-1 shows the rise in energy use and air and water pollution in China from 2001 to 2013.

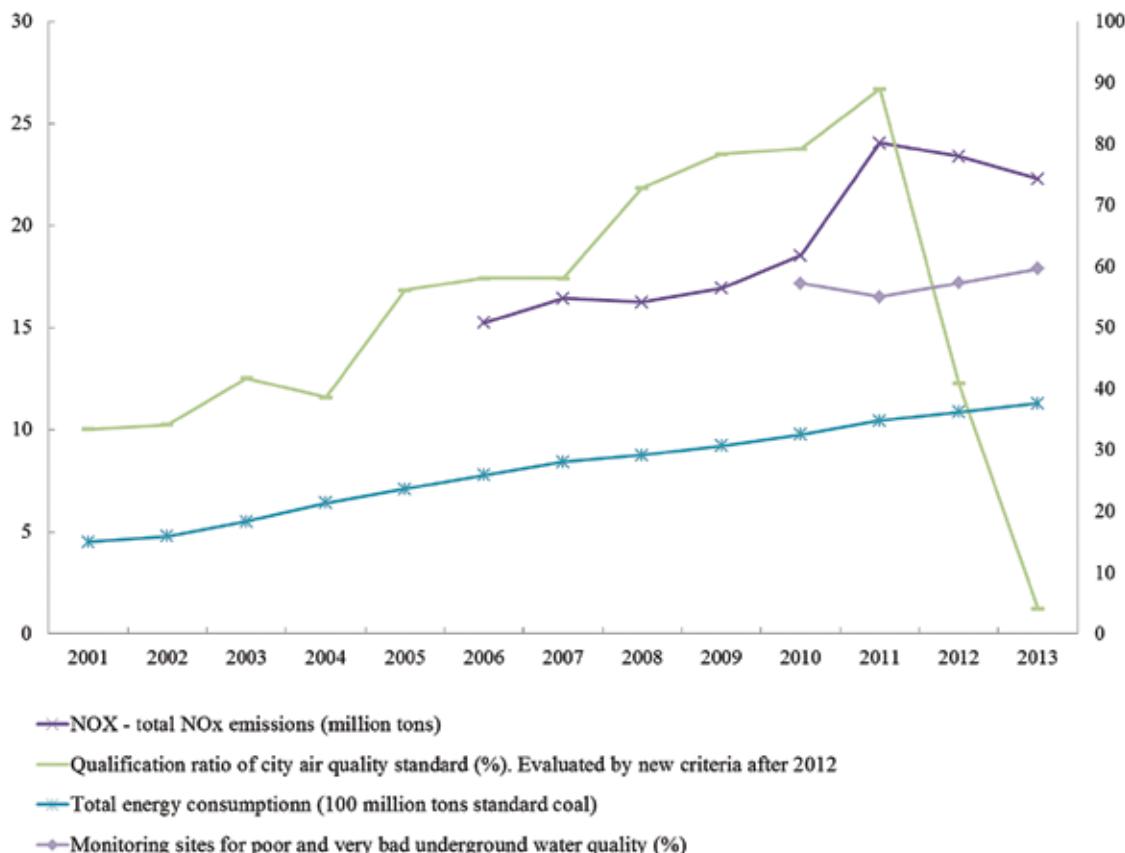
Continuing urbanization has exposed a growing number of people to air pollution. In urban areas, fog and haze (PM2.5) are increasingly severe. Coal accounts for about two thirds of total primary energy consumption in China, and about 90%⁴⁸ of fuel consumed in power generation. As a result, greenhouse gas emissions and associated local pollutants such as sulfides, nitrides and particulates have risen with energy consumption, not only reducing productivity but also endangering public health.

Figure 3-1-1. China's Environmental Status during 2001-2013



48 The latest figure is 88.2% in IEA, 2014, World Energy Outlook 2013. p620

Figure 3-1-1. China's Environmental Status during 2001-2013 (continued)



In 2013, total energy consumption in China reached 3.75 billion tons SCE (standard coal equivalent), exceeding the US level for the first time. Energy intensity will continue to decrease in the future, but total energy consumption will rise to some degree in absolute terms. Under a business-as-usual scenario, energy consumption in 2030 could be close to double the 2013 level. Such a pathway would clearly be unsustainable for China, and for the world.

The environmental impacts are not restricted to air quality and climate change. Ecological degradation, deforestation, soil pollution, solid wastes and water pollution are also undermining China's future sustainable development. The 'western development plan', for example, is based on shifting industries from eastern to western regions, where the ecosystem is relatively more fragile and ecological damages might be even more costly.

3.1.4 China needs a new, sustainable growth model

China's great challenges today represent a historic window of opportunity. On the one hand, the very serious health consequences of deteriorating air quality have already led to a new 'war on pollution', backed by a plan to invest 277 USD billion in abatement measures between 2013 and 2017.⁴⁹ On the other, the economic reform plans announced at the Third Plenum present important possibilities for delivering green growth.

To seize the window of opportunity and unlock the Green Transition, government should draw on assistance from a broad range of stakeholders in the 13th Five Year Plan. International experience is clear that an effective strategy

⁴⁹ Sue-Lee Wee, ed. Ron Popeski, Jul 24, 2013, China to invest \$277 billion to curb air pollution: state media, Reuters, <http://www.reuters.com/article/2013/07/25/us-china-pollution-idUSBRE96O01Z20130725>

for private sector engagement is a vital ingredient, and the public will play a key role.⁵⁰ Effective coordination and clearer incentive structures between government ministries, and between the national and local levels is also critical (see section 3.2.5).

China is in a race against time to define a more potent mix of regulatory and market-based measures that will effectively, sustainably and most of all quickly address the root causes of local air pollution, greenhouse gas emissions and other environmental challenges. Although the challenges cannot be fixed overnight, the 13th Five Year Plan must chart a clear course to a new sustainable growth model – what we call a ‘Green Transition’.

Innovation – whether in technology, in finance or in institutions – will play a critical role. Given China’s current phase of economic development and its resource endowment, economic growth will be accompanied with a growth in coal use in the near term unless major technology breakthroughs occur. However, a Green Transition and a low energy, low pollution pathway is possible in the middle and long term, especially if imbalanced development with distorted investment behavior can be corrected. ‘Peak coal’ could be achieved by 2020 if a range of policy changes are made (see section 3.2.6).

As this report shows, Green Transition is a viable alternative model that offers a new relationship between the economy and the environment. Through a Green Transition, China can maintain economic growth in coming decades whilst avoiding the risk of serious environmental deterioration. It means a shift of investment away from polluting industries towards green sectors, service industries and social protection, together with a range of policies and measures to change investor and consumer behavior and drive technological and institutional innovation.

A less ambitious, less sustainable pathway closer to ‘business-as-usual’ would be fraught with unacceptably high risks. First, it would quickly lead to instabilities in economic development, whether due to the environmental shocks, hard water scarcity constraints, the health costs of air pollution or rising fossil fuels imports. Second, it would represent a huge missed opportunity for China, which can remain the world leader in green goods and services as global markets for such products continue to expand. Finally, a high energy consumption pathway would undermine China’s contribution to ensuring global climate security, as well its claim to leadership in promoting an ecological civilization.

3.1.5 ‘Green Transition’ describes a process to deliver Ecological Civilization

In this report, the term ‘Green Transition’ refers to the change we are proposing for China’s growth model, which puts more emphasis on ecologically balanced economic growth. As a developing country, China still needs growth – whether measured in terms of income or material quality of life or employment – but the country has reached a stage where putting a higher value on human and ecological well-being is necessary and desirable.

The concept of Green Transition builds on ‘green growth’ and ‘green economy’ studies, but places a stronger focus on the processes of ‘structural change’ and development ‘pathways’. Drawing a historical parallel with the “Great Transformation”, we focus on the essential steps to a Green Transition, highlighting in particular the need to restructure our world before reaching the tipping points where irreversible environmental damages occurs.

The ‘Green Transition’ concept is proposed as a way to deliver China’s ‘Ecological Civilization’. This concept was first proposed by President Hu Jintao in his report to the 17th National Congress of the CPC. It is a ‘future-oriented’ guiding principle based on recognition of the extremely high price China has paid for its economic miracle. Ecological Civilization reflected an important change in the government’s understanding of development. Rather

⁵⁰ For supporting evidence for arguments made on international experience in this report see two background papers for the Task Force: “Latest policies and measures for green transition in the world”, by Sheng Fulai, and “Historic review of green transition in selected countries” by Laszlo Pinter.

than emphasizing economic construction as the core of development as it did in the past, China's leaders have come to realize that development, if sustainable, must entail a list of elements including the right relationship between people and nature.

3.1.6 About this Task Force report

The Green Transition is a necessary step for China, but it is also a difficult process with great complexity. There are many issues related to the Green Transition, such as water, soil, noise, air, ecological conditions and climate changes. It will require planning over time and involves many different issues and stakeholders.

We are not able to address all potential aspects of the Green Transition in this study, so it is necessary to narrow the scope and choose an approach according to our own specialties. Other experts are examining, for example, the political economy of special interest groups, rule of law and legal enforcement; popular participation and social organization; value systems and morality; education, social responsibility and awareness or consciousness.

This study examines policy issues related to environment protection and Green Transition from an economics standpoint; we consider the impact of “tuning” key economic variables – changes to the structure of China’s economy and industrial mix – on the environment. We also focus on how to promote green transition with economic policies and instruments. This includes economic incentives (such as taxation), changes to pricing mechanisms, and new green financial tools. We include demand-side policies and market creation for clean energy technology, as well as absolute national and regional energy consumption targets.

There are many other means available to promote Green Transition, from administrative measures and legal action to investment in innovation and increasing stakeholder participation. There are also important challenges for the enforcement of existing rules and regulations. Collectively, these policy and regulatory tools may be even more important than the economic measures examined in this study. However, as this report shows, wider economic measures can make an important contribution to the Green Transition, and their role deserves further attention from policy makers.

The report focuses on energy use and ‘local’ air pollution, rather than carbon dioxide and global climate change. The main consideration behind this framework is that local pollution has become a political lightning rod in China. We aim to use this opportunity to provide policy-makers and other stakeholders with practical solutions. Efforts to reduce local pollution will often – though not always – help to reduce greenhouse gas emissions, since the major pollutants such as particulates (PM2.5) and SO₂ etc. are often a by-product of fossil energy consumption.

The study draws on 9 background papers prepared by Task Force members and research support team in their organizations.

Section 3.2 of this Task Force report explains the root causes that stand in the way of China’s Green Transition and highlights opportunities to address these barriers. There is a key role for economic restructuring, but also for greater use of environmental taxation and green finance, as part of an integrated policy framework. International experience highlights the importance of inter-departmental mechanisms to guide systemic changes, as well as key roles for the private sector and the general public.

The section draws on a combination of scenarios analysis, economic calculations and international experiences. The result of scenario analysis is summarized in section 3.2.6. Methodologies used for the analysis are explained in Appendix 1, and Appendix 2 shows the tables of results.

Section 3.3 summarizes the key conclusions of the Task Force. China should seize the window of opportunity represented by the political visibility of growing environmental pressures and the range of systemic reforms expected

in the 13th Five Year Plan. The key goal is greening China's Great Reform Program: incorporating the Green Transition concept into China's mainstream reform plans, to ensure progress towards ecological civilization. The government should 'level the economic playing field' by reducing the unfair advantages enjoyed by heavy industry, and correct the root causes of environmental externalities. Information plays a critical role in ensuring economic approaches and tools are effective; it will enable the private sector to pursue green innovation and investments.

Section 3.4 provides a set of policy recommendations.

3.2 TACKLING THE ROOT CAUSES: Towards a Green Transition

3.2.1 The Structure of Economic Growth

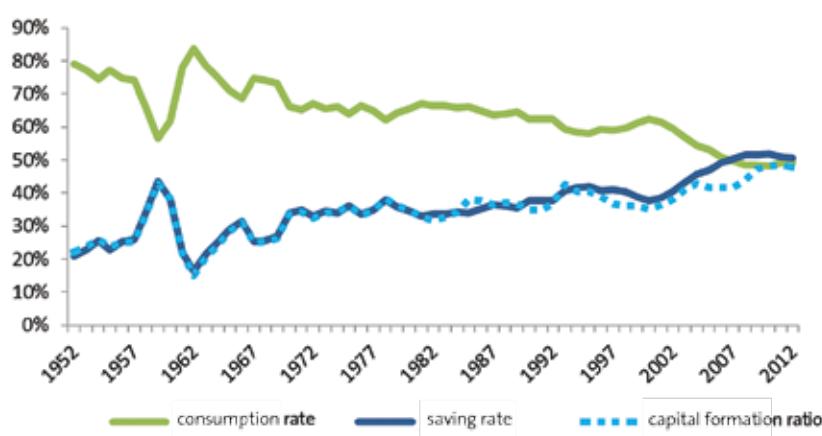
3.2.1.1 The imbalance in investment and consumption

Too little attention has been paid to the critical role that overinvestment plays in China's environmental crisis. The high energy and resource intensity of China's economy is inseparable from long-term over-investment in heavy industry as well as the long-term distortions in saving behavior.⁵¹

The saving rate and the share of capital formation in GDP have been rising since the 1960s, and the trend accelerated in the last decade. In 2012, China's capital formation ratio was 47.7% of GDP – two-and-a-half times of the world average (see Figure 3-2-1). China's unbalanced income distribution contributes to a decreasing proportion of residential consumption in GDP. Between 2000 and 2013, the share fell by 10 percentage points to 36% of GDP, while total capital formation increased by 12 percentage points over the same period.

In the past these high saving and investment rates have been positive for China's development. The high savings rate made it possible to utilize and satisfy most of the investment requirements of China's industrialization and urbanization, especially in the early stages, and helped to stimulate and sustain economic growth. Spurred by high savings, cheap finance, low resource prices, and export-oriented policies, China has maintained a high growth rate for three decades, and has been catching up with major western countries when it comes to PPP-adjusted GDP.

Figure 3-2-1. China's Consumption Ratio, Saving Rate and Capital Formation Ratio



Data source: calculated based on data from National Statistical Bureau (NBS) website⁵²

51 Cultural factors are also relevant – most East Asian countries have high savings rates (for example, South Korea at 35%), although China's savings rates are even higher.

52 See <http://www.stats.gov.cn/enGliSH/>

But the excessively high savings and investments also led to the rapid growth of heavy industries, and stunted the development of services. Due to the emphasis on physical investment there has been low investment in human capital, education and health sectors, as well as ecological and environmental protection⁵³.

Overcapacity in the industrial sectors, which is driven by excess investment, is also undermining the competitiveness of China's heavy industries. By the end of 2012, capacity utilization in the iron and steel, cement, electrolytic aluminum, flat glass and shipbuilding sectors ranged from 72% to 75% – significantly lower than the international average⁵⁴. With a large amount of idle production capacity, many enterprises cannot generate reasonable returns on investments and are increasingly faced with losses and operational difficulties.

Although the government has taken many measures to address this situation, new capacity continues to emerge and the 'overcapacity trend' is intensifying. Today, the investment rate continues to rise, while the consumption rate continues to decline. Long-term investment is growing faster than GDP, while household consumption has grown slower than GDP except for the last few years. Under these conditions, there will continue to be insufficient demand to support a rapid expansion of production capacity. The result is that a large part of China's investments are unproductive, and productivity is in decline (see Box 3-2-1).

In addition, if secondary industry continues to make up an excessive share of GDP, and tertiary industry (the service sectors) too small a share, there will be fewer job opportunities in China. The capital intensity of manufacturing is bound to increase over time, while labor intensity is falling. Meanwhile a significant part of the service industry will remain labor intensive. Today, the share of the secondary sector in China's GDP is 8 percentage points larger than the average of upper middle income countries, while the service industry is 11 percentage points lower. The gap with high-income countries is even wider: the share of service industry is 27 percentage points above China's⁵⁵.

The key reasons for the structural imbalances in investment, consumption and saving include:

- Government investment has been excessive, and there is a shortage of public service expenditure as a result.
- High income inequality is contributing to the excessively high saving rate, due to diminishing marginal propensity to consume. China's Gini coefficient is now about 0.47.
- The lack of an efficient social security and public service system has encouraged precautionary saving and exacerbates the existing structural imbalance.

It has long been recognized that another significant factor in the high rates of investment in China's heavy industry sectors is the availability of land and energy at preferential rates⁵⁶. As the World Bank and DRC noted in the 'China 2030' report, a large share of state enterprise profits comes from a few state enterprises, where 'profitability is often related to limits on competition and access to cheaper capital, land, and natural resources.' They use Ministry of Finance figures to show that the gross revenue from the sale of state owned land use rights rose to 2.9 trillion

53 In the 'China 2030' report, World Bank and DRC find that based on international benchmarks, China may need to increase public expenditures by 1–1.5 percentage points of GDP for education, 2–3 percentage points for health care, and another 3–4 percentage points to fully finance the basic pension pillar and to gradually meet the legacy costs of existing pension obligations... This would bring China's aggregate "social expenditures" by 2030 to near the lower end of the range of high-income countries.

54 Iron & steel (72%); cement (73.7%); electrolytic aluminum (71.9%); flat glass (73.1%); Shipbuilding production capacity (75%). Source: The State Council, *Guiding Opinions of the State Council on Resolving Serious Production Overcapacity Conflicts*, Oct. 2013.

55 Data from the World Bank, 2012, and the National Bureau of Statistics of China, 2014.

56 Huang Yiping, 2010, Dissecting the China Puzzle: Asymmetric Liberalization and Cost Distortion, Asian Economic Policy Review, Volume 5, Issue 2, pages 281–295

RMB in 2010, equivalent to 7.3 percent of GDP⁵⁷. Fossil-fuel subsidies have been gradually reformed in China, but they were still as high as 882 billion CNY in 2010⁵⁸. ‘Leveling the playing field’ – including incorporating environmental externalities – will therefore make an important contribution to Green Transition, and is in line with China’s market-oriented reforms.

Tackling over investment must be an essential part of China’s reform plans. But the problems can only be solved through systemic approaches to tackle the root causes: to reduce excessive investment, improve the taxation system, reform social security, change the household registration system, rebalance the current investment-consumption structure, alleviate income inequality, continue with land reforms and enhance energy conservation and environmental protection. The far reaching nature of these examples shows that the goal of Green Transition has to be integrated into the heart of the reform program.

Box 3-2-1. Overinvestment and the decline in capital productivity

The co-existence of excessive investment and the decline in household consumption rate suggest that even after exports are accounted for, excessive production capacity is created and part of the increased investment becomes ineffective. Table 3-2-1 shows the growth rate of capital stock, the capital-output ratio and incremental capital-output ratios since 2000. Capital growth increased rapidly from 2000 to 2013, while the GDP growth rate has tended to decline.

The capital-output ratio is the inverse of capital productivity (the higher the ratio, the lower the capital productivity). Between 2000 and 2013, the ratio increased from 2.69 to 4.24, while the incremental capital-output ratio rose from 5.18 to 9.76, indicating an unusually dramatic drop in capital productivity.

Table 3-2-1. Rapid fall in Capital Productivity

Year	GDP growth rate (%)	Capital stock growth rate (%)	Capital-output ratio	Incremental capital-output ratio
2000	8.4	9.1	2.69	5.18
2001	8.3	9.1	2.81	4.56
2002	9.1	9.8	2.82	2.99
2003	10.0	11.7	2.93	4.27
2004	10.1	12.4	3.05	4.22
2005	11.3	13.2	3.21	4.81
2006	12.7	14.1	3.34	4.31
2007	14.2	14.4	3.37	3.68
2008	9.6	14.0	3.69	18.34
2009	9.2	17.2	3.79	5.08
2010	10.4	17.1	3.93	5.81
2011	9.3	16.3	4.24	9.76
2012	7.7	16.2		
2013	7.7	16.2		

Data source: Calculated based on data from National Statistical Bureau (NBS) website

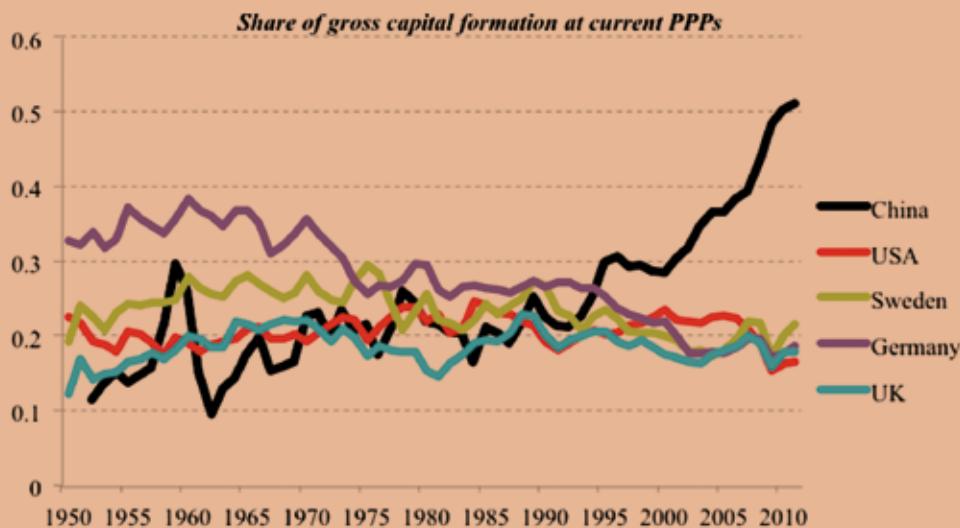
57 World Bank and DRC, 2013, The authors of the report note that ‘because a substantial share of such revenues is paid out in the form of compensation to displaced residents, the net proceeds from such sales are lower [than 2.9 trillion RMB] but still significant.’

58 Lin Boqiang and Ouyang Xiaoling, 2014, ‘A revisit of fossil-fuel subsidies in China: Challenges and opportunities for energy price reform’. Energy Conversion and Management 82, 124–134.

These rapid increases in the capital-output ratio in China are abnormal compared with past experiences of developed countries. Figure 3-2-2 provides a comparison of long-term change in capital-output ratio between China (1952-2011) and the averages of 22 OECD countries (1960-2001).

The average share of gross capital formation of the OECD countries has a stable pattern, fluctuating around 15-30 % over 40 years instead of a constantly increasing trend, while that of China steadily increases from 10 to 50 %. Although China has not completed its process of industrialization, its economy remains unusual in that its capital-output ratio is now higher than that of most OECD countries.

Figure 3-2-2. Comparison of share of gross capital formation: China and selected OECD countries



Data sources: Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2013), "The Next Generation of the Penn World Table" available for download at www.ggdc.net/pwt. Note: the data source is different from table 3.3, but these differences in value do not affect our trend analysis.

3.2.1.2 Over-investment and over-capacity contribute to environmental deterioration

Overcapacity of production implies not only the waste of capital, but also a huge waste of energy and raw materials. Based on data for 2011 and 2012, the total added value of the non-metallic mineral products industry, ferrous metal smelting and rolling processing industry and non-ferrous metal smelting and rolling processing industry was only about 5.5% of GDP in total, but their energy consumption accounted for 30% of aggregate energy consumption. Their energy intensity is 5.4 times that of other industries.

The imbalance in the investment-consumption structure over the past 10 years is one of the major causes of worsening air pollution. Driven by the acceleration in investment in fixed assets, fossil fuel consumption increased rapidly in the 2000s (see Table 3-2-2). Investment grew at 20.8% per year (in constant prices) over this period – much faster than the rate of 13.9% in the 1990s. This led to a rapid expansion of high-energy investment goods, such as steel, cement, flat glass, and non-ferrous metal, imposing a heavy cost on the environment.

In 2013, total energy consumption in China reached 3.75 billion tons SCE, exceeding the US level. Even though energy intensity will continue to decrease in the future, total energy consumption will inevitably rise. Under a business-as-usual scenario it could reach around 1.7 times the 2013 level by 2030, with severe consequences for the environment.

Table 3-2-2. Acceleration of fossil energy consumption with investment growth

Year	Fossil energy consumption (SCE 100 mil. Tonnes)	Period	Growth of Fossil energy consumption (%)	GDP growth (%)	Growth of investment in fixed assets (%)
1980	5.82				
1990	9.37	1981-1990	4.9	9.3	10.9
2000	13.62	1991-2000	3.8	10.4	13.9
2010	29.70	2001-2010	8.1	10.5	20.8
2013	33.83	2011-2013	4.4	8.2	18.0

Data source: Calculated based on data from National Statistical Bureau (NBS) website

There is still considerable room for industrial development and service sector expansion in China, even if investment levels decline. Enhanced human resources and technical innovation, for example, can greatly increase total factor productivity while capital inputs fall. Our proposed program of structural adjustments and systemic reforms to support Green Transition would help to reduce the bias in income distribution, lower the saving rate and raise the income and consumption level of residents on middle or low incomes.

The headline conclusion is that *if China increases consumption whilst investment slows, there will be a non-negative impact on GDP growth but energy consumption and air pollution will be significantly reduced*. A smaller share of investment in GDP may even produce stronger GDP growth, due to efficiency improvements and improved air quality. These positive effects will be reinforced if the remaining investment is directed to green technology and infrastructure, and if consumption is oriented towards environmentally friendly goods and services (see section 3.2.4).

3.2.1.3 Structural changes can make a valuable contribution to Green Transition

Using a combination of macroeconomic forecasting based on statistical analysis, institutional/experiential analysis and CGE modeling, the task force has examined the impact of addressing the challenges outlined in the two previous sub-sections. Details of the methodologies used can be found in Appendix 1.

We use a “business-as-usual” (BAU) scenario as a baseline. In our BAU scenario we assume that basic conditions and economic/environmental policies do not deviate significantly from the past trend. We then forecast the effects of reforms and policy changes on economy, energy and environment, using the methods mentioned above, and impose these effects on the BAU scenario to shed light on the impacts of and contribution to Green Transition.

In the BAU scenario, based on China’s historical data up to 2013, we forecast that the high-speed growth of the past three decades cannot be maintained. China will maintain a relatively moderate economic growth rate, but GDP in 2020 and 2030 will still reach 80 and 130 trillion RMB respectively (in 2010 constant price). The industrial structure will change only gradually: the proportion of second industry declining and the share of the tertiary industry increasing. The population will peak at about 1.45 billion in 2030 and decrease thereafter. The urbanization rate will increase to 60% in 2020 and 66% in 2030. Fossil energy consumption and carbon emissions will follow the current trend. The results are summarized in Table 3-2-3.

Table 3-2-3. Key simulation results of Business as Usual Scenario

Year	2013	2020	2030	2040	2050
GDP (tn RMB, based on 2010 price level)	50.9	80.4	130.5	184.3	238.3
Annual growth rate of GDP (%)	7.7	6.7	5.0	3.5	2.6
Primary industry share in GDP (%)	10	8.8	7.2	6.2	5.7
Secondary industry share in GDP (%)	43.9	39.9	36.1	34.1	33.1
Tertiary industry share in GDP (%)	46.1	51.3	56.7	59.7	61.2

Year	2013	2020	2030	2040	2050
Population (end of year, 100m people)	13.6	14.1	14.5	14.6	14.5
Urbanization rate (%)	53.7	61.1	67.1	71.0	73.0
Energy consumption(0.1 bn t standard coal)	37.5	48.7	62.6	73.4	81.2
Fossil Energy consumption (0.1 billion t standard coal)	33.8	42.8	53.0	59.6	63.4
Proportion of fossil energy consumption in total energy consumption (%)	90.2	87.9	84.6	81.3	78.0
Total emission (0.1 billion t CO ₂)	84	105.2	127.9	142.4	149.4

Data source: Forecasted by authors based on the data of the National Bureau of Statistics of China.

These results are consistent with recent UNEP-sponsored research on China's green economy, although there are small variations related to GDP growth, energy consumption and CO₂ emissions (see Table 3-2-4 below). The UNEP study has a lower GDP growth rate, especially after year 2025 but higher energy efficiency leading to lower total energy consumption and CO₂ emissions.

Table 3-2-4. Green economy baseline scenario from a UNEP study

Year	2020	2025	2030	2040	2050
GDP (tn RMB, based on 2010 price level)	85	110	136	193	235
Annual growth rate of GDP (%)	7.1	4.8	4.1	2.9	1.2
Primary industry share in GDP (%)	6.3	5.1	4.4	3.4	2.9
Secondary industry share in GDP (%)	45.6	45.6	43.2	35.7	31.9
Tertiary industry share in GDP (%)	48.1	49.3	52.5	60.9	65.1
Population (end of year, 100m people)	14.1	14.3	14.5	14.3	13.8
Urbanization rate (%)	61	63.5	66.0	70.5	75
Energy consumption(0.1 bn t standard coal)	48.8	54.1	57.3	64.0	66.1
Proportion of non-fossil energy consumption in total energy consumption (%)	11.1	13.3	17.2	21.2	25.6
Total emission (0.1 billion t CO ₂)	107	114	115	120	116

Data source: UNEP, modeling China's green economy 2010-2050, 2014

In our 'consumption – investment structure change' scenario, it is assumed that 2015 to 2025 is a period of reform and policy adjustment for structural rebalancing. Reforms of the budgetary and taxation systems, government administration, monopolistic industry administration, social security and public services will take place during this period, in order to improve the patterns of income distribution, government expenditure, and investment-consumption structure. These measures help to raise the consumption rate by 10 percentage points and lower the saving and investment rate by 10 percentage points. The share of total consumption in GDP therefore climbs from 50% at present to 60% in 2025. The share of investment (capital formation) declines from 48% to 38% in 2025.

The results of this forecast show that during the adjustment period, GDP growth slows slightly before recovering, and eventually outpaces the BAU scenario. Meanwhile, there is a far more significant impact on energy use and emissions. Fossil energy consumption and carbon emissions both decrease by 9.7% in 2030 compared to the BAU scenario. All atmospheric pollutants fall by at least 10% compared to BAU⁵⁹. Meanwhile household consumption will be 30% higher than under BAU, indicating that overall social welfare levels increase significantly (see Appendix 2 for details).

Under the BAU scenario, China's industrial structure will not reach the average level of upper-middle income countries until 2030. The proportion of the first, second and tertiary industries in GDP changes from 10:44:46 in 2013 to 7:36:57 in 2030. But if China adopts market-oriented reforms to reduce hidden subsidies (such as for cheap land, low-price electricity and low-interest loans to secondary industry), removes barriers to entry and

⁵⁹ Figures for local air pollutant reductions in this report are 'theoretical reductions' excluding the effect of desulfurization and denitrification. After desulfurization and denitrification the pollution levels will be significantly lower, but predicting these effects is complex and depends on the local situation.

improves the market environment for tertiary industry, the rebalancing of industrial structure can be accelerated compared with BAU.

Our next forecast examined the impact of accelerating structural adjustment in China. In this case, the proportion of first, second and tertiary industries would lie somewhere between the upper-middle-income countries level (7:36:57) and high-income countries (1:25:74) – our estimate for China is 5:30:65⁶⁰.

Our calculations show that the above industrial structure changes would reduce energy consumption by 6.7% in 2030 compared to the BAU scenario. There is a risk of double counting here, because rebalancing the investment-consumption structure itself affects the industrial structure. Our rough estimate is that this effect accounts for about half of the reduction in energy consumption, and the remaining 3.3% of the energy-saving effect should be attributed to changes in industrial structure alone. Detailed results are provided in Appendix 2.

These results are consistent with International Energy Agency (IEA) analysis. The IEA finds that ‘the main contributing factor to energy savings in the New Policies Scenario, compared to the Current Policies Scenario, is the more intense shift in the Chinese economy from energy-intensive industries to light industry and services’⁶¹.

As noted above, a key conclusion from these forecasts is that shifting towards consumption and reducing the role of investment in fixed assets and heavy industry will have a non-negative impact on economic performance in the middle and long-run, but will deliver significant reductions in energy and emissions. These reductions are far from sufficient to shift China onto a green economy by themselves, but they can make a valuable contribution as part of a package of policies and measures.

3.2.2 Underuse of market-based policies & price-based environmental policy instruments

3.2.2.1 Lack of effective enforcement of environmental laws and regulations

The benefits of the investment-consumption shift described in the previous section can be reinforced by complementary policies to enhance efficiency, invest in green technology and innovation, adjust China’s industrial structure and encourage sustainable consumption.

Policy implementation in China faces growing administrative challenges. The bulk of existing policies are based on regulatory approaches, which have a heavy administrative burden. Managing this framework and ensuring compliance has become increasingly costly as the coverage of environmental policy has expanded and deepened and become more complex. In important areas this has resulted in weak enforcement of environmental policies in China, including for local air quality.

The gap between central government policies and their implementation in provinces and cities is another well-known challenge. Slow decision-making and strategic deployment problems among local state sectors are common, due to a lack of capacity but also their concerns about the impact of tough enforcement. Local governments are often more concerned about short-term economic growth than long-term, environmentally sustainable economic development.

One of the challenges the authorities face is that local enterprises have a significant information advantage. These persistent information asymmetries make it difficult to set policies at the appropriate level, leading to cost-inefficiencies as well as uncertain environmental outcomes. In many cases, it is less expensive for enterprises to pay environmental fees than for them to reduce polluting activities (Box 3-2-2).

⁶⁰ Compared to the BAU scenario, the proportion of secondary industry in 2030 would be 6% lower and the proportion of the service industry 8% higher.

⁶¹ IEA, 2014, World Energy Outlook 2013, p242. Paris: International Energy Agency.

Box 3-2-2. China's pollution levy system

China's pollution levy system started in 1982 and is one of the most extensive in the world, covering atmospheric and water pollutants, solid waste discharge and noise (Yang and Wang, 1998). The central government determines the rates charged and the levy structure, while the local (municipal) environmental authorities (Environmental Protection Bureaus - EPBs) are responsible for collecting the levies from polluting facilities.

Under the pollution levy system, all enterprises are required to self-report their pollution to the local EPB. The EPBs inspect the firms from time to time, and if firms are found to submit false reports they must pay a certain penalty. Since implementation is solely dependent on the enforcement of local authorities and firms' self-reporting, the effective levy rate varies remarkably among firms across the country: some pay 100% of the pollution fees that they are responsible for, while others pay only a small portion. Levy enforcement and the effective levy rate also depend on negotiation between firms and the local EPB, which in turn are influenced by the local pollution situation, prevailing economic conditions and growth objectives (Dasgupta, 1997; Wang and Wheeler, 2000; Want et al., 2003).

Because the effective levy rate is usually lower than the marginal abatement cost, it is economically rational for firms to pay the levy instead of reducing pollution (Wang and Wheeler, 1996, 1998; Florig et. al, 1995; CRAES, 1997). About 70-80% of levy funds are returned to enterprises as 'refunded emissions payments for environmentally beneficial activities', such as purchasing abatement equipment or improved environmental management. The rest are used to meet the EPBs' own administrative costs (Sterner and Coria, 2012).

To address the ineffective nature of the current levy system, China's Ministry of Finance has submitted an environmental tax reform plan to the State Council Legislative Affairs Office, and is currently in a consultation phase.²³ The goal of the reform plan is to shift from a pollution levy approach to taxes. In comparison, the tax scheme is expected to be easier and less costly to enforce, and therefore able to cover a broader range of pollutants. For instance, as a key pollutant in China, sulfur dioxide (SO_2) has been regulated from the 11th Five Year Plan Period. However, the reduction in SO_2 did not bring a decline in PM2.5 emissions, nor in NOx and other pollutants which act as precursors to PM2.5. Correspondingly, the environmental tax system should have a broad base, covering a range of pollutants.

3.2.2.2 Expanding the role of economic policy measures

While command-and-control measures remain the most common approach to tackling environmental challenges in China, in recent years, environmental taxation policies have been given a growing role. International experiences in many countries have shown that these market-based economic policies can be more effective in comparison with the administrative control policies – in part because they help address incentive conflicts, but also because they tend to have a lower administrative burden⁶³.

Economic instruments or policies provide incentives for people to change their energy consumption behavior by adjusting market signals – such as prices. In contrast, command-and-control mandates depend on government targets, technical requirements and permitting. Both have merits and pitfalls: market-based instruments may be less likely to work if the market itself is not mature and transparent or if clarity in property rights and enforcement are lacking; command-and-control may be costly but effective if there is asymmetric information regarding energy conservation, or if there is an alarming environmental situation that requires an immediate response.

54 62 'Environmental tax proposal completes first round of comments. Carbon dioxide tax is the focus of the debate', finance.ifeng.com, 29 November 2013. http://www.gov.cn/zwgk/2011-10/10/content_1965540.htm

63 Two background papers for the Task Force provide supporting evidence for arguments made on international experience in this section. See: "Latest policies and measures for green transition in the world", by Sheng Fulai, and "Historic review of green transition in selected countries" by Laszlo Pinter.

China should develop an appropriate framework for green transition that incorporates both market based instruments, other economic measures and regulatory approaches. Other countries have successfully developed policy regimes that combine elements of flexible, market based instruments with well-planned and strictly enforced regulatory measures. This will result in a diverse portfolio of policies, and provides scope for policy experimentation and learning (see section 3.2.5).

The Task Force has identified three policy areas where economic and pricing instruments could help accelerate Green Transition in the 13th Five Year Plan period: strengthening China's resource tax; encouraging sustainable transportation; and correcting problems in electricity pricing. These examples highlight how economic approaches can help to address the root causes of environmental problems, whilst supporting economic development.

Multiple regulatory instruments are described in this subsection, including mandates, taxes and permit trading. International experience shows that it will be important to clarify the tax base and coverage of each instrument and to design linkage mechanisms between these policies. It will also be important to ensure environmental goals and targets are linked with market based and regulatory policies, with scope for adjustment in case the policy tools chosen do not deliver the required results.

Resource taxes

The Chinese government started to collect 'resource taxes' on coal, crude oil and natural gas in 1984. One of the shortcomings of the current system is that tax rates have been left unchanged for many years. After a long period of double-digit GDP growth, inflation and higher energy prices, the tax rate – which is paid per tonne of production – is now far too low to influence behavior.

Recent reforms for oil and gas shifted these fossil fuels to an ad-valorem tax – 5 percent of the sales price. As well as creating a stronger incentive for energy-saving, this generates a revenue stream for local government. However, considering the very high profit margin in this sector compared with other industrial sectors with full market competition, this tax level is clearly insufficient both to achieve a competitive market and to tackle inefficient energy use.

Coal remains on a unit tax. This is set at 8-20 RMB per tonne for coking coal and just 0.3-5 RMB for other types of coal⁶⁴. Introducing a more effective tax regime for coal in China would have important policy implications for China, as well as for the rest of the world: China accounted for more than half (50.22%) of global coal consumption in 2013⁶⁵.

The first and perhaps foremost function of resource taxes is distributional: to ensure that 'extra' benefits generated from the country's resources are taken away from the users of the resources and redistributed across the nation, which is the owner of the resources. A resource tax will however also enhance environment protection if, on resources which cause pollution (such as fossil fuels), it is set at a higher level than required to encourage redistribution alone.

Increasing taxes on fossil fuel sales would increase the energy price in such a way that it is difficult to evade compared to other indirect taxes, thus it may also bring significant fiscal benefits when informal sectors are considered. Bento et al.⁶⁶ argue that when considering these effects the optimal tax is higher than the Pigouvian level – whereas earlier analysis had posited that it is less than the Pigouvian level due to negative tax interaction effects⁶⁷.

64 State Council (2011) 'Decision of the State Council on Amending the 'People's Republic of China resource tax regulations'. State Council Website http://www.gov.cn/zwqk/2011-10/10/content_1965540.htm

65 BP Statistical Review of World Energy, June, 2013, <http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf>

66 Bento, Antonio, Mark Jacobsen, and Antung A. Liu, 2012, *Environmental policy in the presence of an informal sector*. 1-29

67 Bovenberg, Lans and Ruud A. de Mooij, *Environmental levies and distortionary taxation*, American Economic Review, 1994, 84 (4), 1085–1089; Bovenberg, Lans, *Environmental taxation and employment*. De Economist, 1995, 143, 111–140; Goulder, Lawrence, 1995 *Environmental taxation and the 'double dividend': a reader's guide*. International Tax and Public Finance, 2 (2), 157–183.

The impact of resource taxes will be limited if exceptions are regularly granted to heavy industry. For example, according to OECD analysis, several oil and gas fields or extraction methods in China currently benefit from reduced rates of resource tax which push the effective rate below the benchmark 5% ad-valorem rate.

Analysis by the Task Force indicates that full implantation of resource tax reforms can have a significant impact on energy consumption and help improve China's energy mix. With an average rate of 13% for coal and oil in 2025, the combination of the price effect and substitution effect (into clean energy) will lead to a reduction of coal and oil consumption of 8.9% and 6.2% respectively⁶⁸. In total, this reform could reduce fossil energy consumption by around 6% (the total of coal and oil would fall by around 8.5%). Air pollution and carbon emissions would decrease by 7-8% (see Appendix 2). Moreover, the reforms will have a positive impact on income distribution.

Green taxes in the transport sector

Vehicle emissions have increased significantly in China in recent years due to rapidly rising vehicle ownership, and have contributed to the severe urban smog and haze (PM2.5 emissions). There are several objectives for transport policy which can have different but overlapping objectives, such as reducing fuel use, air quality improvement and reducing congestion. Box 3-2-3 explains the approach taken in Singapore to limit urban traffic.

Box 3-2-3. Singapore's vehicle quota system

In Singapore, the authorities use a Vehicle Quota System (VQS) and vehicle ownership tax to moderate the growth of the vehicle population at a rate that can be supported by the domestic road network. Given the country's small size, it was thought that building more roads alone would not be able to ensure smooth flowing traffic. The government also preferred a market-based mechanism as a means of keeping the car population at levels supportable by road infrastructure as well as sustaining planned developments in public transport and traffic management systems.

Under the VQS, anyone who wishes to register a new vehicle in Singapore must first obtain a Certificate of Entitlement (COE), which represents the right to own a vehicle for 10 years, and the number of COEs released onto the market at any time is based on the VQS allocation for that period. COEs are awarded after competitive bidding in a closed auction. In addition, a bevy of taxes such as excise duties and additional registration fees add a significant percentage to the cost of the vehicle.

The VQS has been effective in managing the vehicle population at a sustainable level (at a compounded annual growth rate of about 3% since its implementation) since it was first introduced. However, with the pace of road expansion slowing down by half, the annual vehicle population growth rate has also been reduced by half from 3% to 1.5% p.a. since May 2009 for 3 years to ensure that it is sustainable. The vehicle growth rate was recently reviewed in 2011 and it will be further reduced to 0.5% p.a. from February 2013 to January 2015.

Source: Singapore Ministry of Transport, 2014

To combat pollution and cut China's energy dependence, reforms to the vehicle tax could differentiate between vehicle sizes and technology, for example by imposing a progressive block pricing regime for different vehicle engine size (higher tax for vehicles with 3.0L than 2.0L).

Fuel taxes and congestion fees are alternative incentive-based market policies, designed to increase the price of fuel and incorporate congestion externalities. The policy outcome for a given tax level depends on drivers' elasticities on fuel demand and driving decisions. Fuel demand is determined not only by income and fuel prices, but also by other factors, such as access to public transport and demand for vehicles.

⁶⁸ See Background Paper on *Intrinsic Logic and Approach Options for the Current Reform of Resource Tax and Environmental Tax in China* by Fan Gang, Li Quan, Liang Qiang, Lv Dianyao and Ma Jia

Gasoline taxes may be effective in terms of reducing gasoline use, while less effective in reducing congestion. To address both externalities, therefore, it is important to implement both pricing regimes. A long-running concern in the developed world is that resistance to fuel taxes is partly due to concerns that such taxes have regressive impacts. Using a CGE model we examined the fuel tax reform in 2009: by combining the CGE results with NBS household survey data, we find the total burden of gasoline tax is actually progressive, not regressive as is the case in some western countries.

In terms of political feasibility, a vehicle tax based on engine size is relatively easy to implement given existing legislative and administration structures. In the medium term, international experience suggests it would be more effective to implement a carbon-based fuel tax – perhaps in combination with a road pricing system in major cities that takes into account the environmental standard of vehicles.

Electricity price reform

Electricity pricing in China has recently undergone reforms in both the industrial and residential sectors. On average the electricity price has increased substantially, although it has remained under some government regulation whilst coal prices are liberalized⁶⁹.

China's electricity pricing system is a vestige of the planned economy. Prices are set according to the sector: residential, agricultural, large industrial, commercial, non-industrial, general industrial and non-residential lighting. Electricity prices are also adjusted based on the energy intensity of individual enterprises: a system known as Differentiated Electricity Pricing (DEP). Under this policy, firms are grouped into four categories: encouraged, permitted, restricted and eliminated. The goal is to gradually eliminate inefficient enterprises while encouraging efficient ones⁷⁰.

Block pricing has been introduced for the residential sector. One study used household data to estimate the electricity elasticity for different income groups. These ranged from -0.60 (median group) to -0.90 (low and high income group)⁷¹. This indicates that a small price increase will lead to high electricity savings, especially in the long run. The high income group has higher elasticity, suggesting a block pricing regime would perform well and help achieve energy conservation targets.

The problem with the current approach is that tariff revenue goes to the grid company, rather than the general budget. If block pricing currently brings the total revenue of power stations and grid to an equilibrium level, this suggests that further reforms are required so that the consumer price of electricity reaches the equilibrium level.

An environment tax on electricity could be introduced gradually alongside pricing reform in order to shift all revenues from block pricing to the state budget, and to environmental purposes such as promotion of clean technology or to fund a feed-in-tariff to subsidize renewables. The electricity reform should also be aligned with China's plans to introduce a national carbon trading scheme.

69 Liu, M.-H., Margaritis, D., and Zhang, Y., 2013, *Market-driven coal prices and state-administered electricity prices in China*. *Energy Economics*. 40, 167-175. OECD, 2010, *Taxation, Innovation and the Environment*, OECD, Paris.

70 Chinese central government (2006) Notification of State Council promulgation of Development and Reform Commission advice on improvement of differential pricing policy, SCS No 77 (17 September 2006). http://www.gov.cn/zwgk/2006-09/22/content_396258.htm (Chinese);

Chinese central government (2006) Development Research Center spokesman answers questions regarding the 'Notification of State Council promulgation of Development and Reform Commission advice on improvement of differential pricing policy' on Chinese government website (23 October 2006). http://www.gov.cn/ztzl/yzn/content_479489.htm (Chinese)

71 Cao, J., X. Wang, and X. Zhong, 2014, *Did Driving Restrictions Improve Air Quality in Beijing?* China Economic Quarterly, 13(3), 1091-1126 (Chinese).

3.2.2.3 Administrative measures remain important

Although we argue for greater use of economic policies to achieve a Green Transition, command-and-control mandate polices will remain important for achieving government targets. For example, previous CCICED Task Force reports have highlighted the role of technology standards in phasing out outdated industrial capacity in China – a particularly serious problem for the steel, automobile, cement, electrolytic aluminum, stainless steel, pesticide, solar and glass sectors⁷².

It is important to recognize that command-and-control policies (such as technology mandates) are still dominant in many developed countries and have led to most of the progress in environmental protection. Historically, market-based instruments have played an important but overall more limited role in environmental regulation in industrialized countries.

In the 12th Five Year Plan, the government set two particularly important administrative targets, for energy intensity and carbon intensity improvements. The State Council issued a draft law in September 2014 indicating that a cap on the quantity of fossil fuels (or total energy) consumed could be introduced in the 13th Five Year Plan⁷³. Although the level of the cap has not been announced at the time of writing, this could be a very significant measure, encouraging a shift in energy consumption to alternative energy options and achieving a cleaner energy mix.

A combination of quantity targets, intensity targets and carbon trading schemes can be expected to deliver synergies that lead to additional environmental improvements, in particular for air quality – these effects have not been modeled by this Task Force. Carbon trading schemes are currently being piloted in seven areas, but could be rolled out nationally in the 13th Five Year Plan. When multiple regulatory instruments are introduced, including mandates, taxes and permit trading, it will be important to clarify the tax base and coverage of each instrument.

Statistical analysis for the Task Force indicates that under an ‘energy saving’ scenario, fossil fuel consumption can be controlled to 3.9 to 4.2 billion tons of standard coal by 2020 and 4.4 to 4.8 billion tons of standard coal by 2030 (see Box 3-2-4 below). Fossil fuel consumption should peak at between 4.6 and 5.2 billion tons between 2030 and 2040, after which fossil energy consumption will enter a period of decline. The peak for higher carbon, highly polluting fossil energy (oil and coal) consumption is likely to come sooner at about 2025-2030, with total quantity control around 4.0 billion tons of standard coal. After this time, higher carbon fossil energy consumption will decline.

Specific measures are needed to accelerate the transition in the energy sector. First, as described above, government should set long-term caps for national energy consumption and implement them accordingly. Power stations that ‘self-supply’ industrial areas (rather than feeding power to the grid) should be prohibited in key regions. Projects with new coal consumption should be allowed only if coal consumption is ‘offset’ by reductions of at least an equal amount of coal consumption elsewhere in the same region.

Second, government should accelerate the development of natural gas. The use of natural gas should be increased in the residential sector as a substitute for coal, and the efficient use of natural gas as distributed generation should be encouraged. Due to the limited supply of natural gas for China, the use of natural gas in chemical projects should be restricted. The use of natural gas power plants as peaking resources may be expanded.

Third, the development and utilization of hydropower, geothermal energy, wind energy, solar energy, biomass energy and nuclear power should be expanded in an efficient and safe manner. The capacity of running nuclear power will reach 50 GW, and non-fossil energy’s share in the energy mix will rise to 13% in 2017.

72 CCICED Task Force reports on ‘China’s Pathway Towards a Low Carbon Economy,’ 2009 and ‘China’s Low Carbon Industrialization Strategy,’ 2011

73 The State Council published a draft version of a law on air pollution control using a coal consumption cap on 9th September 2014. The cap was also mentioned by Vice Premier Zhang Gaoli at the UN Climate Summit on 23rd September in New York.

Fourth, increases in the proportion of coal washing and the construction of new coal washing facilities are both required to reduce ash content of coal and enhance efficiency. Existing coal mines should accelerate the pace of their construction, and strengthen coal quality management. Officials currently expect coal washing rates to increase to more than 70% in 2017.

Fifth, government should promote an improvement in oil quality, and strongly encourage refining enterprises to upgrade their production facilities and speed up diesel and oil supplies for grade V (five) standard cars.

Box 3-2-4. A scenario analysis of energy saving

China's strategic goal for 2050 is to become a mid-developed economy whilst remaining a beautiful country. An analysis of how to meet these goals should take into account future technological potential and prospects, including economic, energy and environmental governance. We also need to analyze energy demand and structural changes, and understand the supply potential and demand constraints of different energy options.

China's energy efficiency still has significant room for improvement and energy saving policy will continue to bring important benefits. Along with the elimination of outdated technology and accelerating structural upgrading, China's consumption of energy per unit GDP will gradually move closer to the international advanced level. At current exchange rates, China's energy productivity (economic output per unit energy consumption) is about 70-80% the developed world average, and only 50-60% if using purchasing power parity.

With ongoing development and the deepening reform and opening-up processes, China's commodity prices will also gradually align with international prices: that is, the actual number is likely to be in between these two results in the medium term. In our reference case, by 2050 China will become a mid-developed country and energy intensity will drop by about 70% relative to the 2010 level.

Coal: Coal resources are relatively abundant in China, but coal is one of the most polluting energy sources; achieving a 'beautiful China' means addressing coal use. In future, coal will mainly be used in industries like power generation, steel and coal-to-chemicals. Our study indicates that coal consumption will peak between 2020 and 2025 at about 4.2 billion tons, then gradually decline to 3.2 billion in 2050.

Oil: China's potential oil demand growth is huge, but supply is restricted due to limitations in geological reserves and exploration, and the upper limit of domestic supply is about 0.22 billion tons. Therefore, oil security will remain a major policy concern. It is estimated that electric vehicles will enter the market at large scale and gradually substitute for conventional vehicles near 2030. So we expect oil consumption to peak at around 0.8 billion tons between 2030 and 2040, and fall to 0.75 billion tons around 2050.

Natural Gas: With more stringent atmospheric pollution control and energy structure changes, natural gas will develop at a faster pace. We expect its output to peak around 250 billion cubic meters. Other non-conventional gases such as coal gas and shale gas will also develop quickly, and may exceed 130 billion cubic meters. There may also be imports of liquid natural gas from North America. We expect demand for natural gas to reach 580 billion cubic meters in 2050, about four times the level of 2012.

Fossil and non-fossil energy: Nuclear and hydro power will continue to develop rapidly, and other renewables such as wind, biomass, geothermal and others will play an important role in China's future's energy structure.

Under this scenario, consumption of fossil energy and higher carbon, highly polluting fossil fuels (coal and oil) will peak between 2030 and 2040. China's total energy consumption is expected to be 4.8 billion tons of standard coal in 2020, 6.0 billion tons in 2030, and no more than 6.6 billion tons between 2030 and 2040. Fossil energy and higher carbon fossil fuels will peak between 2030 and 2040. China's total energy consumption would be 4.8 billion tons of standard coal in 2020, 6.0 billion tons in 2030, and no more than 6.6 billion tons between 2030 and 2040.

Table 3-2-5. Energy conservation scenario: energy consumption and mix change

	2012	2020	2030	2040	2050
Energy consumption (0.1 billion t standard coal)	36.2	48.0	60.0	66.0	66.0
Coal (%)	66.6	59.5	50.5	44.0	37.0
Oil (%)	18.8	17.0	16.9	16.8	16.7
Gas (%)	5.2	8.6	11.0	11.6	12.2
Non-fossil energy (%)	9.4	15.0	21.6	27.7	34.1

With the energy structure shifting towards a low-carbon, less polluting pathway, non-fossil energy will gradually become the pillar of energy structure. With the strategic natural gas plan focusing on domestic production and imports, natural gas consumption would reach 450-500 billion cubic meters by 2030, and the share of total energy could exceed 11%. Total non-fossil energy is expected to account for 15% and 21% of total primary energy consumption in 2020 and 2030, and 34% in 2050.

3.2.3 The need to improve demand-side policies for green technology

3.2.3.1 Policies for clean and renewable energy have focused on the supply side

Clean technology and renewable energy will make a decisive contribution to China's Green Transition, but today the industry is facing a range of challenges that stem from a lack of demand-side policy support in the past, combined with strong production incentives and a weaker than expected global market.

The extraordinary expansion of renewables manufacturing in China in the past few years was largely the result of a range of supply-side policies, in particular tax incentives and fiscal interest subsidies. Some of the key supply side incentives include:

- a) **Tax deduction.** At the national level this includes VAT refunds, tariff deduction and export tax rebates amongst other measures. From Oct 1 2013 to Dec 31 2015, there is a direct VAT rebate of 50% for solar-energy based electronic products. Imported PV technology and power technology equipment are exempted from import tariffs and VAT.
- b) **Low interest loans.** The clean power equipment and construction industry are listed as important industries which are encouraged to develop, so these companies are also eligible to apply for low-interest loans.
- c) **Low land prices and other policy support.** A big incentive to attract clean energy industries is provided by local government support with obtaining land at relatively cheap prices. Some local governments even provide direct financial support to PV-related scientific research and technology diffusion, for example.

The demand for renewable energy was largely created by demand-side policies in developed countries – not least the feed-in tariffs in Germany and elsewhere in Europe. With government encouragement, Chinese renewables manufacturing therefore developed to capture the growing export opportunities. China's production capacity of crystalline silicon modules, batteries and polycrystalline silicon took up 70.7%, 70.8% and 38.4% of global production capacity in 2013. Although the market is changing fast, developed countries continue to account for the bulk of solar PV installations⁷⁴.

Today, there is widespread over-capacity in solar PV manufacturing, partly because the international market performed less well than expected. Globally, new investment in renewable power and fuels was around \$214 billion in 2013, 14% lower than 2012, and 23% below the record high set in 2011⁷⁵. In part, these falls were due to the rapidly

⁷⁴ Bloomberg New Energy Finance, 2014, 'Global trends in renewable energy investment 2014'. Frankfurt School – UNEP Collaborating Centre for Climate and Sustainable Energy Finance.

⁷⁵ ibid.

falling costs of renewable energy in the past few years, which have added to the competitive pressure for manufacturers. The profit rate of domestic PV firms declined sharply from 139% in 2007 to 20% in 2013. Among the more than 500 domestic PV firms in China, about one third of the small- and medium-sized enterprises operate at just 20-30% of their manufacturing capacity, putting them on the verge of shutting down or suspending production⁷⁶.

Whilst the Chinese renewables industry is expected to go through a round of consolidation, over time the excess capacity problem can also be tackled by the expansion of domestic demand. The government has responded to this challenge in the 12th Five Year Plan period, introducing stronger policy support for renewables installations – partly in response to the overcapacity problem but also to help meet targets for clean energy. Solar installations are now encouraged by feed-in tariffs and by regulations to ‘ensure that grid companies buy all the solar power produced in their regions’⁷⁷. China’s targets for installing solar PV have been raised many times, and currently stand at 35GW of PV by 2015.

There has also been a focus on addressing the long-standing problems with grid connection that have affected wind power projects in particular. Due to under-investment in the network, grid expansion has struggled to keep up with growth in turbine installation and there was often a lag before wind farms were connected to the grid. Even after a connection is installed, it is sometimes not possible to feed electricity into the grid due to an inability to handle intermittent demand in some areas⁷⁸.

As a result of the improved policy environment, and the falling costs of renewable energies, in 2013, new renewable power capacity additions in China surpassed new fossil fuel and nuclear capacity for the first time. Investment in renewables projects in China were at \$56bn, larger than the whole of the EU⁷⁹. China installed 12 GW of solar PV capacity in 2013, an increase of 232% relative to the previous year. This is equivalent to 31% of PV capacity added globally, placing China first in the world.

Despite these successes, shifting from a BAU scenario to a Green Transition will require the scaling up of renewables investment in China to continue at a rapid pace. There is still huge potential for expansion: ‘new energy’ accounted for only 5.2% of total electricity production in 2013. However, there are concerns that demand growth in China to 2020 could be weaker than hoped, due to policy uncertainty and the availability of finance. The IEA noted that ‘integration challenges remain for large amounts of new onshore wind, and questions have emerged over whether conditions are favorable for an ambitious planned expansion of distributed solar PV’⁸⁰. One of the features of the Chinese market is that whilst asset finance and spending on distributed systems is strong, there is ‘almost no contribution from public markets or venture capital and private equity’ (see Section 3.2.4)⁸¹.

Preliminary estimates by the Task Force indicate that China can overcome these challenges in the 13th FYP through strong and sustained policy support on the demand side. With these policies, the annual increment of the proportion of non-fossil energy in total energy consumption can be increased from the rate of about 0.5% seen in recent years to 0.7%. As a consequence, in 2030 the proportion of non-fossil energy in total energy consumption would increase to more than 21%, whereas under the current pathway it would be around 17%. This could result in a 5 percentage point reduction in fossil fuel consumption, avoiding 230 million tons of standard coal of energy consumption per year compared to BAU (see Appendix 2).

⁷⁶ See Task Force background paper on ‘Demand-side policy and creating market for increasing use of renewable clean energy’.

⁷⁷ Bloomberg New Energy Finance, 2014, ‘Global trends in renewable energy investment 2014’. Frankfurt School – UNEP Collaborating Centre for Climate and Sustainable Energy Finance.

⁷⁸ UNEP, 2013, China’s Green Long March: A Study of Renewable Energy, Environmental Industry and Cement Sectors, pp. 1-36

⁷⁹ Ibid.

⁸⁰ IEA, 2014. Renewable Energy Market Analysis and Forecasts to 2020: Medium-Term Market Report 2014.

⁸¹ Ibid.

In the medium term, China's manufacturing sector will also benefit from a scaling up of renewables in developing countries, which China can play an important role in encouraging through technical cooperation and investment. At the UN Climate Summit in September 2014, Vice Premier Zhang Gaoli said that China would double its annual financial commitment for its south-south co-operation fund on climate change and pledged an additional \$6m for UN efforts to promote UN south-south cooperation on climate change. Cooperation projects are already underway in Ghana, for example⁸², and Chinese firms have made investments in projects in South Africa.

Box 3-2-5. International experience of promoting solar PV demand

PV industry policies in the United States include tax discounts, an initial installation subsidy and tariff for the power network. They also include funding or approval support policies, such as the Business Energy Investment Tax Credit (ITC), Accelerated Depreciation Method (MACRS), 1603 Treasury Program, DOE Loan Guarantee Program, and Renewable Portfolio Standards. Subsidies at state level include cash refund of investment, electricity subsidy, tax discount, green electricity license and so on. The form and degree of subsidies differs across states.

Accompanied with support from US government, the PV industry has created several new financing models to solve the funding problem on the demand side. These models include the Utility-scale Power Purchase Agreement Model, Host-owned Model, and Third-party Financing Model.

Germany's PV industry is another successful model. Between 2004 and 2008, Germany's share of the global PV market was the largest in the world. The rapid development of PV industry in Germany largely benefited from domestic industrial policies. For instance, the Renewable Energy Sources Act (EEG) introduced in 2000 (replacing the Electricity Feed-In Law of 1991) funded Feed-In Tariffs and shifted responsibility for purchasing electricity at premium prices from the utilities to grid operators.

In 2004, the government revised the EEG regime and made adjustment in pricing system. To avoid increasing fiscal expenditure and the burden of national renewable energy surcharge, the German government revised EEG again in 2008 by decreasing the new tariff of electric network by 15% starting from 2009. In 2010 the government lowered the solar power subsidies again. Over time the price of electric network has declined from 4 RMB/kWh in 2000 to less than 1.5 RMB/kWh, but it is still higher than the price in China. In terms of financial support, the German Development Bank also provided a large volume of subsidized loans for investment in the PV industry.

PV industry policies in both the United States and Germany emphasized stimulating the demand side, especially supporting the use of distributed PV power generation. In the United States, demand-side policies have yielded some new successful business models and encouraged various economic agents to participate actively in the PV industry. Germany's fixed tariff policy concentrates more on residents and civil buildings.

China has started to explore the role of demand side policies. Early industrial policies to encourage PV development included the 'demonstration project of solar PV building application' and 'Golden sun' demonstration project. Both provided subsidies on the demand side of PV markets. Between 2012 and 2014, a new series of policies were gradually issued to support the PV industry, with a greater focus on stimulating demand. This included establishing a solar power benchmark price, specifying the duties and obligations of power grid enterprises, and using legal action to force power grid enterprises to help PV projects link with the grid.

3.2.3.2 Other green sectors could be developed with stronger demand side policies

Many 'green technology' sectors could benefit from lessons learned in China's renewables sector and from international experience on the important role of demand side policy incentives – such as green tax incentives, technology performance standards and targeted public procurement. This section is not designed to be comprehensive, but provides some examples of important clean technologies, especially in the context of China's ongoing urbanization.

⁸² UNDP, A pact signed to boost South-South cooperation, 8th September 2014, www.gh.undp.org/content/ghana/en/home/presscenter/pressreleases/2014/09/08/a-pact-signed-to-boost-south-south-cooperation/

Policies to promote highly efficient or ‘near-zero emissions’ buildings are some of the most critical for supporting China’s Green Transition⁸³. There is huge potential for achieving energy saving in the medium term, with another 100 million Chinese expected to move to cities by 2020, and outdated infrastructure also being replaced over this period. Buildings already account for about a quarter of all energy consumed in China⁸⁴, and this is likely to gradually move towards the global average of 40% as cities and incomes grow, and the role of heavy industries becomes less prominent.

There are huge opportunities to develop a world-class green buildings sector, not least due to the large investment needs: according to modelling by the Energy Research Institute, China would need to invest 670 billion RMB per year by 2030 under their low carbon scenario. Yet at present, despite a range of certification schemes, voluntary standards and some mandatory standards for public buildings, most green buildings in China are in demonstration projects⁸⁵. Demand-stimulating policies such as buildings and technology standards can help deliver scale up the construction of green buildings and catalyze domestic markets for the associated technologies and services.

The Light Emitting Diode (LED) lighting industry in China has faced similar challenges to renewables, with huge overcapacity and quality control problems. Domestic incentives to switch to LED bulbs have so far proved insufficient, and around 60-70 per cent of LED manufacturing capacity in China is currently geared to exports⁸⁶. In October 2012 China started to phase out traditional incandescent bulbs, following the example set by the EU, the United States and Japan⁸⁷. Nevertheless, China’s lighting market could rise to a value of \$20 billion in 2015, about 18% of the global market – incentives and standards are needed to ensure that lighting is predominantly from highly efficient LEDs⁸⁸.

For electric vehicles, there are challenges for both supply and demand in China. Support for production has not yet led to successful technology breakthroughs, and demand has been weak – partly due to cost, but also because charging infrastructure is not widely available in China’s cities. There were around 40,000 electric vehicles on the road in March 2013 – and four-fifths of these were used for public transportation⁸⁹. It has been reported that China is considering spending 100 billion RMB on electric-vehicle charging facilities in order to stimulate demand for clean cars⁹⁰.

Experiences in developed countries, in particular in Europe, show that developing inter-city and intra-city rail transport systems has very significant impact on energy-saving and pollution-reduction, because this is much more energy-efficient than private vehicles. China should make great effort to develop these systems as early as possible.

Preliminary estimates by the Task Force show that fully implementing buildings standards and expanding large scale inter-city and intra-city rail transport system could reduce energy consumption of around 5%-12% in

⁸³ Jiang Kejun, 2011, China’s Investment Pathway to 2030, Energy Research Institute (ERI). www.e3g.org/docs/Annex_A_China%20%80%99s_Investment_Pathways_to_2030.pdf

⁸⁴ Christina Nelson, April 1, 2012, China’s Green Building Future, <http://www.chinabusinessreview.com/chinas-green-building-future/>

⁸⁵ Yifei Li and Julia Currie September 2011, Green Buildings in China: Conception, Codes and Certification, Institute for Building Efficiency, an initiative of Johnson Controls, www.institutebe.com/InstituteBE/media/Library/Resources/Green%20Buildings/Issue_Brief_Green_Buildings_in_China.pdf

⁸⁶ Charlie Zhu, Feb 8, 2013, Analysis: Failing firms cloud China’s LED lighting vision, *Reuters*, <http://uk.reuters.com/article/2013/02/08/us-china-led-idUSBRE91701H20130208>

⁸⁷ Xinhua, October 18, 2012, China moves to phase out incandescent bulbs, [china.org.cn http://www.china.org.cn/environment/2012-10/18/content_26829256.htm](http://www.china.org.cn/environment/2012-10/18/content_26829256.htm)

⁸⁸ LEDinside: China’s Lighting Market to Reach \$20B by 2015, <http://lighting.com/china%20%80%99s-lighting-market-20b/>

⁸⁹ Jack Perkowski, 6/24/2013, The Reality Of Electric Cars In China, *Forbes*, Business, <http://www.forbes.com/sites/jackperkowski/2013/06/24/the-reality-of-electric-cars-in-china/>

⁹⁰ Aug 27, 2014, China Weighs \$16 Billion Car-Charging Fund, <http://www.bloomberg.com/news/2014-08-26/china-said-to-consider-16-billion-ev-charging-funding.html>

2030, compared to a BAU scenario (see Section 3.2.1.3 for details of BAU). Although this indicates that buildings standards are important, it was not possible to do a detailed analysis, so these potential savings are approximate and may well be an underestimate⁹¹. There are clearly even larger opportunities available by promoting stronger standards. China could join the EU and Japan, for example, in requiring new buildings to be ‘near-zero’ energy from 2020 or as soon as possible⁹².

3.2.4 Financial sector reform and Green Finance

3.2.4.1 Towards green investment and sustainable consumption

China has overinvested in heavy industry and infrastructure, but this does not mean that all investment should be scaled back to support the Green Transition. In the words of the Global Commission on the Economy and Climate, ‘tackling the challenge of strong, equitable and sustainable growth will require huge new investments and shifts in resource use’ in all countries⁹³. There is a clear rationale for urgent policy action in China to unwind misallocation of resources toward more efficient and sustainable uses.

The Commission notes that low-carbon forms of infrastructure ‘are essential to reduce current emissions and energy-use trajectories,’ and that investment in energy efficiency has huge potential to reduce demand, especially in buildings, transport and better urban design. How these changes are managed will shape future patterns of growth, productivity and living standards, especially in fast-growing countries like China. Preliminary analysis by the Task Force suggests that efficient buildings and expansion of intercity and intra-urban rail infrastructure could save up to 12% of total energy demand in 2030, compared to a BAU scenario⁹⁴.

For many countries, as the Commission argues, the additional investments in infrastructure needed to make the transition to a low-carbon economy will be modest and will lead to medium term benefits. Since investment levels in China are already too high, the goal should be to direct part of the excess investment into the infrastructure and technology required for Green Transition – such as capital intensive renewable energy, grid expansion, energy efficiency and sustainable transportation. Investments in these areas will need to be around 2.83 trillion RMB (\$453 billion) each year by 2030 under a low carbon scenario, according to modelling by the Energy Research Institute⁹⁵. One study identified a further 1.2 trillion RMB of investment needs in other environmental sectors such as wastewater treatment and soil remediation (see Table 3-2-6). In addition, large investments are needed in natural capital – including in sustainable agriculture and forestry, ecological conservation and the national parks system.

In other words, the quality and composition of investment is of great importance for the Green Transition. China will need to invest in a new generation of capital: in clean technology, in natural capital, in green skills for human capital and job creation. There will be a key role for investment and lending guidelines and institutions, to ensure that projects that support the transition are financed, whilst phasing out lending to unsustainable activities at home and abroad.

91 In the latest IEA scenarios for China, compared to ‘current policies’ savings in buildings are responsible for an 8% drop under new policies scenario, and 22% in the ‘450ppm’ scenario. Source: WEO, 2013.

92 In the EU, all new buildings must be ‘near-zero energy’ by 2020. In Japan, new public buildings must be net zero by 2020, and new commercial buildings by 2030. <http://online.wsj.com/articles/japan-pushes-zero-energy-structures-1411745117>. The US is focused on rolling out ‘zero-energy buildings’ by 2025. See: <http://www.nrel.gov/docs/fy06osti/39833.pdf>

93 The Global Commission on the Economy and Climate, September 2014, Better Growth, Better Climate: The New Climate Economy Report

94 As for buildings efficiency above, this result is an estimate rather than a detailed assessment.

95 Jiang Kejun, 2011, China’s Investment Pathway to 2030, Energy Research Institute (ERI). Annex A of: Amal-Lee Amin, Shin Wei Ng and Ingrid Holmes ‘China’s Low Carbon Finance and Investment Pathway’ E3G Policy Paper www.e3g.org/docs/Annex_A_China%20%99s_Investment_Pathways_to_2030.pdf

Table 3-2-6. Investment demand for environmental protection industry (RMB bn)

	Investment demand	Operating cost of new projects	Operating costs of all facilities
Urban wastewater treatment	436	33	57
Contaminated soil remediation	315	N/A	N/A
Desulfurization and denitrification	135	42	103
Urban garbage disposal	94	12	87
Environmental regulation and emergency capacity	70	30	30
Other	151	44	63
Total	1202	161	342

Source: Wang et al., 2010, in UNEP⁹⁶

Likewise, although a structural shift away from intensive industry and towards consumption will tend to reduce energy use and emissions, China's Green Transition risks being undermined by unsustainable consumption in the medium term. Choices made in urban design, buildings and lifestyles, for example, will have a huge impact on future energy use in China⁹⁷. The energy consumed by urban residents has already reached 13% of total consumption. Today, urban residents use 3.7 times as much energy as rural residents, while their power consumption is 4.6 times higher⁹⁸. Meanwhile, the disposable income of urban citizens has risen from RMB 6280 to RMB 19109, an increase of 170%⁹⁹. Much of this has been spent on larger living spaces and on energy consuming technologies, as well as food¹⁰⁰.

3.2.4.2 Finance sector is not fully supporting Green Transition

China has made significant steps towards introducing 'green finance', with notable success in renewable energy and energy efficiency. Yet the broader financial sector still requires deep reforms; finance currently plays a critical role in deterring the Green Transition by allocating financial resources to polluting activities. At present, China also lacks the range of accessible financial tools that private sector new entrants will need to spur innovation and green investment (see Box 3-2-6).

Reforms are needed to encourage financial institutions to take environmental considerations into their profit calculations, ensuring more financial resources to green industries and less to polluting activities. From an economic perspective, such reforms would correct distortions arising from the fact that green investment – which has a positive externality – is under-developed, while investments in polluting activities with negative externalities are over-developed. Such distortions cannot be fully resolved by market pricing mechanisms at present, because China's current pricing system does not fully reflect the positive externality of green projects. Continued efforts to reduce fossil fuel and other subsidies for heavy industry¹⁰¹ and successfully establishing a national carbon trading scheme in the 13th Five Year Plan period¹⁰² would help to correct this situation.

96 UNEP, 2013, China's Green Long March: A Study of Renewable Energy, Environmental Industry and Cement Sectors, pp. 1-36

97 This paragraph is based on report of the CCICED Task Force on *China's Low Carbon Industrialization Strategy*, 2011.

98 Data provided by China's NBS and Agricultural Department

99 The per capita net income of rural residents was just 30% that of urban citizens in 2010

100 The per capita housing area increased from 20.3m² in 2000 to 31.6m² in 2010. Family cars owned by every 100 families increased from 0.5 to 13; air conditioners from 31 to 112 and refrigerators from 80 to 97.

101 Lin Boqiang and Ouyang Xiaoling, 2014, 'A revisit of fossil-fuel subsidies in China: Challenges and opportunities for energy price reform'. *Energy Conversion and Management* 82, 2014, 124–134.

102 Kathy Chen and Stian Rekley, Aug 31, 2014, China's national carbon market to start in 2016 –official, *Reuters*, <http://uk.reuters.com/article/2014/08/31/china-carbontrading-idUKL3N0R107420140831>

The *Green Credit Guidelines* released by China Banking Regulatory Commission (CBRC) require banking financial institutions to develop standards for environmental and social risk assessment, and conduct dynamic assessment and classification on the environment and social risks of customers. The results could serve as an important basis for credit rating, credit access, management and exit. Banking financial institutions should also take differentiated risk management measures with respect to the ‘three checks’: loans, loan pricing and economic capital allocation. However, at present the guidelines lack legal effect, and they have not been properly implemented by the vast majority of commercial banks.

Inadequate or expensive environmental impact information is a major bottleneck for many institutions interested in green investment. The government should provide publically available data to quantify the environmental costs of companies and projects arising from air pollution emissions, water consumption and waste generation, and to assess the scale of “externalities” not reflected in the current market price. This system should ideally include a complete and constantly updating database about environmental cost of major sectors, companies, and products. In addition to policy makers, the information system provides a reference for all investors, including banks, non-bank financial institutions, private equity funds, and non-financial corporations in the analysis and investment decisions.

Because of the huge social benefits, we suggest that the work is undertaken by Chinese institutes (such as the Chinese Academy for Environmental Planning or Environment and Development Research Center of the Chinese Academy of Social Sciences) and/or a network of investors commissioned by the authorities through government procurement of services. The database should be publically available at low or no cost.

A new Platform for Green Finance has recently been proposed to enhance integration between the financial reform process and policies for pollution control and low carbon development. Such a platform could be modelled on the Conference of Chinese Banking Industry on Settlement of Excessive Capacities and Practice of Green Credit, which was sponsored by China Banking Association and involved experts from the Ministry of Environmental Protection, the International Finance Corporation (IFC) and WWF alongside the CDB, ICBC and CIB¹⁰³.

One reason for convening such a platform is that careful planning is required before mandating “green investments” among commercial banks. They will need sufficient clarity on and capacity to implement the rules, to identify enough bankable projects that satisfy the criteria as “green” and are financially viable. In addition, defining “green” projects without clear guidance is not straightforward and project sponsors will have incentives to “green wash” projects. If the government provides guarantees for “green” projects that have high risk in terms of financial viability, this may cause a moral hazard problem, as market discipline is lost and banks do not have incentives to conduct proper due diligence. Due to these concerns, without careful planning, mandating “green investments” could lead to inefficient use of public resources.

Box 3-2-6. Green financial instruments and institutions

Green Loans. Green loans occur when banks provide low interest loans for projects that are environmentally friendly and abate negative environmental effects. For the consumer-client oriented loan business, green loans include mortgage debt, loans for green vehicles and green credit card services. For corporate-client oriented businesses, green loans include loans for clean technology and energy, and for commercial construction of green buildings. Green loans policy is at a preliminary stage in China. Current policies focus on restricting loans to high-pollution and high-energy consumption enterprises, but rarely involve loans to environmental protection and environmentally friendly industries. At the end of 2012 green loans accounted for only 1.5-2.5% of the national loan balance sheet, so there is much room for expansion.

103 See: Lee Amin, Shin Wei Ng and Ingrid Holmes, 20 November 2013, ‘China’s Low Carbon Finance and Investment Pathway’ E3G Policy Paper. www.e3g.org/library/financing-chinas-low-carbon-investment-agenda

Green Private Equity and Venture Capital. From 2007 to the first half of 2013 there were 694 investments of VC/PE in the field of clean energy, amounting to 8.2 billion dollars. The amount was highest in 2011. Many enterprises are now listed in domestic and overseas markets. In the last two years PE/VC hit bottlenecks in China (see section 2.3.1) and direct investment in clean energy consequently declined.

Green ETF and Mutual Funds. In foreign financial markets there are many green financial products with good liquidity, such as ETF indexes and funds and derivatives of carbon emissions. The most well-known international green indexes include the S&P Global Clean Energy Index, Nasdaq Clean Edge US Index, WilderHill New Energy Global Innovation Index and FTSE Japan Green Chip 35 Index. In China, the Green ETF and mutual funds were recently established, but there are only a few fund products in the A-share market (i.e. denominated in RMB), such as A-share Wells Fargo Low Carbon Fund and the Zhonghai New Energy Fund. They are relatively small, and investment is not strictly restricted to environment protection.

Green Bonds. ‘Green Bonds’ are fixed-income debt securities issued by governments, banks, multilateral development banks, corporations and projects in order to raise the necessary capital for an asset which contributes to Green Transition. Globally, 75% of climate bonds have an implicit or explicit backing from a government entity. China is the largest single country for Green Bonds, according to HSBC, due to the inclusion of China Railway Corporation. To help ensure corporate green bonds have environmental integrity, CICERO (Center for International Climate and Environmental Research – Oslo) has established a network of organizations to provide independent assessments.

Green Banks. In 2012, the United Kingdom founded the first investment bank in the world dedicated to accelerate transition to green economy: the UK Green Investment Bank. It funds green projects, on commercial terms, in areas such as offshore wind, waste recycling, energy-from-waste and non-residential energy efficiency. Currently the bank can invest through debt, equity and bond guarantees, but does not offer soft loans, venture capital or subsidies. Third parties are able to make joint investments.

A more established mechanism for raising funds for green infrastructure is State Revolving Funds. In the US, the Clean Water State Revolving Fund (CWSRF) helps communities in meeting targets of the Clean Water Act. Through the CWSRF program, each state maintains revolving loan funds to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects. Funds to establish the CWSRF are provided through federal government grants and state matching funds. Today, building on a federal investment of over \$26 billion, the CWSRFs has provided more than \$100 billion in funding to support water quality infrastructure projects.

Green Insurance. Green insurance is a tool for environmental risk management, which can help enterprises by providing financial compensation and environmental remediation if unforeseen accidental pollution incidents arise. In addition, mandatory green insurance is one way to cover future environmental costs, and to help enterprises internalize the externality of environmental risks – eliminating potential costs from excessive environmental risks. Even without a mandatory system, clarifying liability for environmental damages would encourage the development of green insurance.

104 Task Force analysis based on: Zero2IPO Research Center, China PE Annual Report, 2007-2012, China VC Annual Report, 2007-2012. See Task Force background paper on *Green Financial Policy and Practice*.

105 Kaminker, C., et al., 2013, *Institutional Investors and Green Infrastructure Investments: Selected Case Studies*, OECD Working Papers on Finance, Insurance and Private Pensions, No. 35, OECD Publishing.

106 HSBC, 2014, *Bonds And Climate Change: The State Of The Market In 2014*.

107 27th November, 2013, CICERO Second Opinions on Green Bond Investment Frameworks, <http://www.cicero.uio.no/webnews/?id=11984>

3.2.5 Insufficient integration and participation

3.2.5.1 Cross-cutting responsibility for the Green Transition

Today, China's "environmental federalism" acts as a barrier to its Green Transition. Central government drafts major policies and pollution control targets, but local governments typically have less incentive to implement the measures due to pressure for higher GDP growth. They often divert resources to support energy intensive sectors at the expense of environmental protection.

Meanwhile, ensuring environmental quality has largely been seen as the responsibility of the Ministry of Environmental Protection (MEP) and its local agencies. Since this Task Force is focused on economic measures and instruments, many of its key proposals would fall under the remit of economic and finance ministries. Yet there are important implications for many other parts of government – industrial policy, resource extraction, trade, innovation and education are among the issues discussed in this report.

One of the benefits of more market-based approaches (see section 3.2.2) could be a reduction in the administrative burden for issuing permits, monitoring progress and checking compliance, which would free up resources and provide more flexibility to innovate with policy making. It would also generate new revenue streams for central and local government. China should learn from the challenges faced by other countries when implementing economic levers, such as fiscal policies and 'emissions trading' schemes.

There will be a vital role for the private sector in the Green Transition, with government playing a guiding role. In addition to regulating the heavy industry and stimulating 'green technology' sectors, more policy attention should be given to sectors which have a small direct footprint but can strongly influence China's development pathway. As described in section 3.2.4, the finance sector is perhaps the most important case. Information technology, the new materials industry and urban planning are other relevant examples.

Individuals and communities will play an important role in China's Green Transition, through their lifestyles and through their consumer choices. Their contribution can be made more effective through greater transparency over the environmental impacts of products and investment projects, and greater access to information on environmental quality, in line with the principle of 'open government information'¹⁰⁸. Reducing such information asymmetries can also help ensure that market-based incentives (such as those proposed in this report) have the desired effect.

3.2.5.2 Need for integrated approaches

The range of economic, financial, institutional and sector-specific measures required to support a Green Transition strongly suggest that action is required across a range of departments which have not traditionally pursued green approaches. The responsibility for delivering the transition cannot lie with the Ministry of Environmental Protection alone, although it will play a key role in environmental enforcement and coordination.

The need for better coordination of policy implementation between China's central and provincial governments has been well documented, but it grows more urgent as environmental pressures build. Top-down laws and regulations have not always been fully implemented at the provincial level, undermining national progress towards a Green Transition. Some of this can be addressed by strengthening institutional capacity for delivery – and by introducing policy measures that require less bureaucratic effort and shift incentives, such as the economic measures discussed in section 3.2.2.

¹⁰⁸ 'Li Keqiang: There are hundreds of millions of micro-blog users. Government information must be disclosed in a timely manner'. sina.com.cn, 26 March 2013 <http://news.sina.com.cn/c/2013-03-26/193226648402.shtml>

It may be necessary to redefine the incentive structures for local government. Pursuing short term economic growth without due regard for environmental problems has had immediate term air quality consequences, but also threatens to constrain medium term development goals and undermines progress towards ecological civilization. In order to ensure local governments are able and willing to implement policy, their ability to raise the necessary financing may need to be strengthened.

Given the enormous complexity of China's environmental problems, there is a clear need to move towards integrated approaches rather than 'issue specific' measures, and towards wider stakeholder involvement (see section 3.2.5.3). Otherwise, the risk is that narrowly focused, non-integrated policies will be unable to take cross-sector implications, tradeoffs and synergies into account.

As other countries have found, this can mean that environmental action is weaker than intended, or alternatively the problem is shifted elsewhere – to other regions or to the future – without addressing the root cause. While China's policy arsenal includes integrated approaches in some areas, such as the Circular Economy Law, in practice many of the policy responses are reactive and integrated policies remain weakly implemented.

3.2.5.3 Responsibilities of individual industries, companies and consumers

The green transition will require strong leadership and policy guidance from central government, but it will also involve a wider range of stakeholders and a key role for the private sector, in line with China's market-oriented reforms.

Coalitions between the government and key industrial groups often lie at the center of other countries' strategies for Green Transition. Depending on how this relationship is managed, it can either constrain or facilitate environmental policy, since existing market players often have a strong interest in maintaining the status quo. In some cases a very close relationship between government and business (such as in South Korea or the Netherlands) has been a factor in delayed responses, due to high costs and reluctance to recognize liabilities.

Getting this relationship right, however, can unlock investment and innovation. In the case of the Netherlands, government and businesses with similar problems formed clusters to collaborate in finding common solutions. Business participation was catalyzed by understanding that no progress would draw mandatory measures and government found that involving business was less confrontational. Formalized voluntary agreements or 'covenants' played a key role in fostering trust in government-business communication in this case.

Encouraging small and medium-sized enterprises (SMEs) and foreign firms to make green investments will be ever more important. It is critical to remove barriers to entry that are based on the size or geographical origins of companies, and to encourage companies with technology prowess and strong environmental performance¹⁰⁹. As this report argues, government can encourage private sector activity through economic and other incentives, as well as by supporting green finance (see Section 3.2.4.2), but it will also need to persist with structural changes and regulatory measures, to address the dominance of state owned enterprises.

The general public has an important role to play in catalyzing the Green Transition, but so far their role has been limited. Government could require public release of environmental information associated with products; and it could publish disclosed data on polluting and resource intensive firms, as well as highlighting firms with a positive ecological footprint. The management of sustainable consumption would be made more open and transparent, and the public would take up a supervisory role. Non-government institutions such as the media and NGOs will also play an important role in guiding and promoting the idea of sustainable consumption.

¹⁰⁹ LCIS Task Force, 2011, 'China's Low Carbon Industrialization Strategy', Report of the Task Force for the China Council for International Cooperation on Environment and Development.

Strong accountability measures such as those described above, can help secure government and private-sector commitment to policy implementation and to achieve agreed outcomes¹¹⁰. They can help secure support and commitment from individuals, communities and cities. Finally, they will also help address the information asymmetries which undermine the utility of some economic policy instruments.

3.2.6 Summary of calculations

In this section we summarize the different measures described in this report and how they would support China's Green Transition. We add up five the effects of the five scenarios one by one and compare them with the BAU scenario.

These scenarios are based on a combination of macroeconomic forecasting based on statistical analysis, institutional/experiential analysis and CGE modelling. Note that the scenarios are not the outcome of a single modeling result. Please see Appendix 1 and 2 for methodologies and further explanation.

- Promoting structural rebalancing of investment-consumption and lowering investment rate as well as raising consumption rate by 10 percentage points will reduce energy consumption by 9.7% in 2030.
- Accelerating industrial structure rebalancing can further reduce fossil energy consumption by 3.3% in 2030 (after double counting with the investment-consumption rebalancing has been removed).
- Promoting resource tax reform and electricity price reform reduces fossil energy consumption by 6.1% in 2030, but high-carbon fossil energy (coal and oil) consumption will decrease by 8.4%.
- Demand-side policy incentives to promote renewable energy development decrease fossil energy consumption by 5.1% in 2030.
- Urban and inter-city rail transportation systems and fully implementing mandatory building energy saving standards lead to a reduction of 5-12% in fossil energy consumption in 2030 (estimated at a conservative 5% here).

The above measures result in a combined reduction in energy consumption of 20% compared to BAU in 2030, or from 6.26 billion tons of standard coal to 5.01 billion tons of standard coal. Fossil energy consumption reduces by 26% relative to BAU – a reduction from 5.3 billion tons SCE to 3.92 billion tons SCE. The reduction in high-carbon (coal and oil) fossil energy consumption is larger, at 28% (from 4.58 billion tons SCE to 3.30 billion tons SCE).

CO₂ emissions decrease from 12.8 billion tons to 9.4 billion tons, with a reduction of 3.4 billion tons, or 27%. The theoretical emissions (before desulfurization, denitration, dust and other pollution reducing measures) of atmospheric pollutants (sulfur dioxide, nitrogen oxides, total suspended particulates and respirable particulate matter) is estimated to have a reduction of not less than 27%¹¹¹.

In combination, these measures would have a major impact on China's future energy consumption, carbon dioxide and local air pollutant emissions. Without such measures, fossil energy consumption and carbon dioxide emissions will continue to rise, and may not peak before 2050. In 2030, fossil energy consumption will reach 5.3 billion tons of standard coal, and in 2050 will exceed 6.3 billion tons of standard coal. Carbon dioxide emissions in 2050 will reach 15 billion tons, and both will continue to rise.

If all the proposed Green Transformation policies are put in place, China's fossil energy consumption and carbon dioxide emissions is estimated to peak around 2036-2037 (at about 4 billion tons of standard coal), after which time it is expected to decline in absolute terms. High-carbon fossil energy consumption could peak significantly

¹¹⁰ Najam and Halle, 2010, Global Environmental Governance: The Challenge of Accountability. Sustainable Development Insights paper. Available: <http://www.bu.edu/pardee/files/2010/04/UNsdkp005fsingle.pdf>

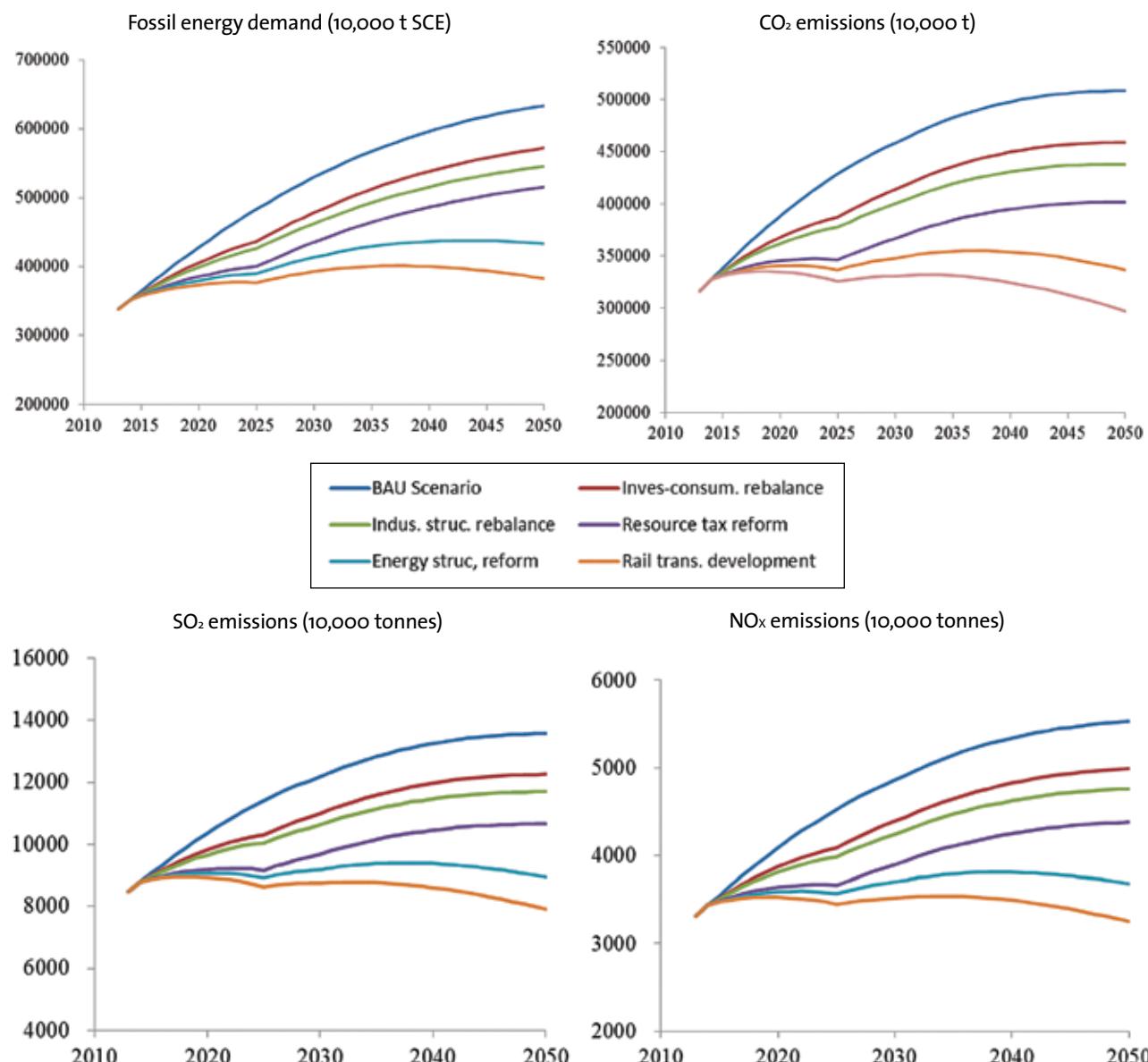
¹¹¹ Figures presented for local air pollutants (SO₂ and NO_x) exclude the effect of desulfurization and denitration. After desulfurization and denitration pollution levels will be significantly lower, but predicting these effects is complex and depends on the local situation.

earlier – at around 3.36 billion tons in 2019 (coal also peaks around 2020). This is because the transition process expands the consumption of the relatively clean natural gas resource, but slows down the coal and oil consumption. These results are illustrated in Figure 3-2-3 below.

In each scenario, there is a turning point of both fossil energy consumption and carbon emissions at around 2025, after which there is a slight rebound. This is because we assume that the investment-consumption structure rebalancing and resource tax reform will be implemented during the next 10 years, and completed in 2025. So in the period after 2025, the ‘transforming efforts’ may be smaller. However, this situation is only a theoretical assumption, which may not necessarily happen; there may also be new transformation factors (such as energy conservation and emissions reduction due to technical innovation).

It also should be noted that, the five kinds of transformation scenarios listed here do not include all possible transformation measures, only the important and measurable policies we have identified. We cannot rule out the possibility that through the efforts in other aspects and additional efforts of the above aspects, the pace of green transformation will further accelerate, bringing about the earlier arrival of peak fossil energy consumption, carbon emissions and pollution emissions, followed by a decline in absolute terms.

Figure 3-2-3. Combined effect of Green Transition Policies on energy & pollution



3.3 CONCLUSIONS

Seizing the window of opportunity

The 13th Five Year Plan is the critical window of opportunity for the Green Transition, and will be the litmus test of China's commitment to pursuing an ecological civilization. Action is urgent, because air pollution and other environmental challenge pose a serious threat to China's development goals. Action is possible, because the economic reform program and the strong response to the air quality crisis present huge opportunities to align environmental and economic policy at the strategic level.

In other countries, environmental crises have played a key role in 'tipping the scales' of the governance system towards systemic and comprehensive action. The London Smog of 1952 in the UK prompted the passing of the country's first Clean Air Act. In Germany, specific pollution events at home, such as fish kills in the Rhine, as well as overseas events such as the Chernobyl disaster, were pivotal moments. In Japan, Minamata disease triggered environmental action at local and national levels in the 1970s, as did Cadmium contamination related health problems in the Onsan region in South Korea.

The question for China is whether it can turn the risks and costs associated with environmental events into opportunities for strategic renewal. Responses to these challenges elsewhere were most effective when they combined regulatory might, economic measures and political will with recognizing and engaging major stakeholders. Key elements of successful strategies included well-managed relations with industry; integrated, long-term planning around acceptable outcomes; and building the legal and institutional infrastructure necessary not only to establish but also to systematically monitor and enforce laws.

Greening China's Great Reform Program

The 13th Five Year Plan will define China's approach to a market-oriented and innovation-led economy. This is a unique opportunity to put Green Transition principles at the center of the country's economic program and institutional reforms.

As this report shows, some of the primary barriers to China's Green Transition process lie in economics: they are closely related to economic factors and economic policy issues, from the excessively high level of energy consumption resulting from over investment to the absence of appropriate market-based instruments. At the same time, there is little doubt that slow progress on this agenda will bring many economic risks. The latest assessment places the cost of China's air pollution at 10% of GDP, the highest in the world¹¹².

We show that policies to accelerate a shift in the economy away from investment and towards consumption are effectively growth-neutral, but they lead to positive environmental and employment benefits. We also identify a set of key economic policies and financial tools that would support green investment and accelerate innovation whilst cutting unnecessary energy use and emissions. The environmental and resource taxation schemes proposed in this report could also generate significant revenue.

These are by no means the only policies that China has at its disposal, and by themselves they will not be sufficient to deliver a green transition. We argue that China should make more use of economic and pricing policies, but as part of a comprehensive, integrated strategy. In particular, there remains a vital role for strong regulatory intervention, due to imperfect information flows, the role of state owned enterprises in the economy and the continuing need to tackle outdated production capacity.

¹¹² The Global Commission on the Economy and Climate, September 2014, Better Growth, Better Climate: The New Climate Economy Synthesis Report. p21

In many areas, policy implementation is hampered by poor coordination and competing incentives. In line with the experience of other countries, China will need stronger inter-departmental coordinating mechanisms to ensure that Green Transition principles are integrated into key economic, finance and planning decisions.

Levelling the economic playing field

Subsidies enjoyed by heavy industries in the form of land, energy, water and cheap finance stand in the way of Green Transition; they lead to excessive energy use and emissions; they increase barriers to entry for more innovative small and medium size enterprises; and they would blunt the effectiveness of the green economic policies we propose. Subsidies for clean technologies should also be phased out once they are fully market competitive.

Information flows can help fuel the green transition. First, information asymmetries often favor incumbent firms which have an interest in the status quo. This hampers effective decision making and target-setting, and increases costs for local authorities. Second, better information would help investors to identify green business opportunities and enable innovators to spot new market opportunities. Third, it would help consumers to select firms with high environmental performance. Finally, making environmental costs and risks transparent is necessary to ensure that enterprises are valued appropriately, avoiding systemic risks.

3.4 POLICY RECOMMENDATIONS

The Task Force has identified six sets of concrete policy recommendations. These priorities are designed to seize the window of opportunity and steer China onto a Green Transition pathway during the 13th Five Year Plan period and beyond.

Recommendation 1: improve economic structure with less and better targeted investment

Within China's reform program, government should prioritize institutional reforms and policy adjustments which rebalance China's economic structure. Over investment in heavy industry is a major cause of China's air pollution problem. An adjustment in the order of a 10 percentage point increase in the share of consumption in GDP by 2025 is proposed, with a corresponding decrease in the share of capital formation in GDP. This will not slow GDP growth, but it will reduce pollution as well as wasted capital and energy. A target could also be set and gradually increased for the proportion of capital investment spent on green sectors including renewable energy, low-carbon infrastructure and construction and ecological protection.

Government should ensure that the performance management system for all ministries reflects a new responsibility to accelerate Green Transition, with appropriate monitoring and reporting. We also recommend introducing a strong inter-departmental coordinating mechanism, involving not only sector ministries but also core departments, such as planning, finance and trade. There will be a key role for MEP to ensure the environmental integrity of Green Transition policies. Investments in capacity building and training will be required to ensure that government officials can become leaders and innovators of the green transition.

Government should remove the unfair advantages currently enjoyed by industrial sectors. China should phase out preferential policies for heavy industry, including cheap land, low electricity prices, low interest loans and tax incentives. Such support has contributed to over-investment in the industrial sectors. Once different renewable energies become fully cost-competitive, subsidies should also be gradually phased out for these sectors. These measures will help eliminate resource allocation distortions caused by preferential policies, realizing fair competition as part of the Green Transition.

Recommendation 2: promote a shift in resource use via green taxation

Government should increase the use of economic tools and measures to achieve an ecological civilization, focusing on resource taxation and electricity pricing reforms. We recommend the following measures to incorporate environmental externalities and help to reduce excessive resource use. These resource taxes and environment taxes represent a major source of fiscal revenue under a Green Transition.

Resource tax. The unit based tax for coal should be replaced with an ad valorem resource tax, and the tax rate raised to at least 10 and preferably 15% in three steps by 2025, applying the same rate to imports. For oil, the ad valorem tax on domestic and imported fuel should rise from 5% to 10-15%. For natural gas, the rate can be maintained at 5%, and imported natural gas should be exempted.

Electricity price reform. Except for household electricity and the agricultural electricity quotas, all electricity should be sold at the same price, and the price should be set by the market without any exceptions. A new electricity tax should also be levied through a tiered pricing system, based on the amount of consumption.

Automobile tax. Introduce a new tax based on engine size, as larger engines tend to have higher emissions.

Recommendation 3: financial sector reforms to catalyze Green Transition

Ministry of Finance, in coordination with NDRC, MEP and other ministries and regulatory bodies, should introduce a new framework for green investment. The goal is to ensure that the finance sector accelerates the Green Transition by efficiently allocating resources to green projects and firms, and ceases to support polluting activities. Drawing on existing investment guidelines (such as the green credit guidelines of CBRC), rules could be established via legislation; and a single appropriate supervisory body could be given a clear mandate to enforce the rules. Within this framework, it is critical that all economic actors are able to participate, and in particular to ensure SMEs have access to finance and can operate effectively.

Regulators should ensure that lenders, insurance and rating agencies fully reflect the potential risks of unsustainable investments: to ensure firms' long term viability but also to protect China's medium term development pathway from potential dislocations due to environmental pressure or resource price volatility. 'Environmental risk factors' should be incorporated into Banks' and Rating Companies' project evaluation methodology, as part of the framework described above. 'Environmental risk insurance' should be mandatory in the 'forced insured' industries of offshore oil exploration and inland waterway transportation, as well as other industries like oil and gas exploration, petro-chemistry, and steel and plastics.

The government should establish a Green Investment Bank for China. There is an urgent need to accelerate investments in green infrastructure – such as smart grids, green buildings, mass transit and charging infrastructure for electric vehicles. Green bonds (and in future, carbon trading revenues) should be the primary financing source. As an alternative to setting up a new institution, the government could explore turning China Development Bank into a bank responsible for Green Transition. In collaboration with the Green Bank, government departments should cooperate with regulators and financial institutions to fast-track support for green projects.

Recommendation 4: stimulate demand for clean tech via targeted policies

Government should maintain and reinforce demand side policies to support renewable energy industry roll out. The framework has been improved in the 12th FYP period to accelerate demand for renewables: to increase the share in the energy mix, but also to address overcapacity in the renewables sector. However further attention is needed to capitalize on the potential for growth in the 13th FYP. This includes further improving grid capacity;

strongly encouraging the installation of solar technology in industrial and public buildings; and expanding the range of green finance instruments (see recommendation 3).

Full implementation of existing building energy efficiency standards will make a key contribution to energy saving, and will also support rapid development of the green buildings technology sector. The government should also consider adopting a new target for a percentage of new buildings to be ‘near-zero energy’ in 2020, meaning that buildings are highly efficient and also generate their own energy from renewables. This would help to drive domestic demand for efficient building technologies and ensure Chinese firms are ready to benefit from global business opportunities. Large-scale development of city and intercity rail transit systems is another opportunity to make major energy savings and air pollution improvements, compared to passenger vehicles.

As well as expanding the domestic market for clean technology, China could scale up cooperation with developing countries to expand their markets for green goods and services. Facilitated by MOFCOM, NDRC and key financial institutions such as CBRC, China EximBank and the BRIC bank, this could include joint ventures with local firms to manufacture abroad and technical cooperation. This would deliver on China’s commitments to help countries in Africa and elsewhere move up the value chain, as well as providing medium term growth opportunities for Chinese firms.

Recommendation 5: stringent caps on fossil fuel consumption

A ‘National Quantity Target Control’ system for total energy consumption should be introduced as soon as possible in the 13th Five Year Plan period. If our policy proposals are successfully implemented, consumption of higher carbon, highly polluting fossil fuels (coal and oil) could peak by 2020 at 3.4 to 4.0 billion tons SCE. Coal consumption (separately) could also peak by 2020. Total fossil energy consumption peaks later in the 2030s at 4.6 – 5.2 billion tons SCE, reflecting an expanded role for gas. Greenhouse gas emissions level off after 2020, so that the peak in the 2030s is just above the 2020 level. Given the urgency of Green Transition, China would benefit from implementing targets at the ambitious end of these ranges.

The national energy ‘cap’ should be broken down to regional quotas (supplemented by certain industry quotas), and appropriate administrative measures and legal means should be in place to enforce such practice. Targets should be set each year, with reference to the existing energy and carbon intensity targets.

Recommendation 6: enhance information flows to stimulate investment and innovation

MEP and the ministry of Finance should develop a constantly updated database on the environmental impacts of major sectors, companies, and products, including for air pollution, water consumption and waste generation. The database should be publically available, at low or no cost. This database system would provide a reference for all investors, including banks, non-bank financial institutions, private equity funds, and non-financial corporations in their analysis and investment decisions. For small firms in particular, it would reduce barriers to entry and enable them to capture green business opportunities.

Enhanced information availability would also help to reduce the administrative burden on local government, and improve the capacity of local and national institutions and regulators to properly guide the Green Transition. Finally, enhanced information is important for the general public to be able to make green consumer choices, and to better understand the environmental performance of different firms.

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APPENDIX 1: Methodologies for Scenarios Analysis

I. General methodologies

Scenario analysis in this report is based on several different analytical methodologies: macroeconomic forecast based on statistical analysis, institutional/experiential analysis and CGE modelling. The CGE results are generally consistent with other result in the *direction* of the effects, however, we found it overestimated the cost of green transition and underestimated the benefits, for the following reasons:

1. Model forecasts on future economic growth and energy consumption are based on a long term trend of past growth, but have not fully incorporated recent changes, such as China's slower economic and energy consumption growth, and more rapid growth of renewable energies, which we believe indicate a new trend.
2. The CGE model is based on a pre-assumption that the economy is in a general equilibrium situation, which is not fully consistent with the real situation of the Chinese economy given the structural imbalances.
3. The policy adjustments we recommend in the report are based on a wide range of institutional reforms, which beyond the scope of a CGE model. The model can only simplify these changes as external shocks, which unavoidably result in some efficiency losses in the estimated outcomes.

With consideration of these facts, we mainly adopted the results of macroeconomic forecasting based on statistical analysis, combined with some useful outcomes from the modelling analysis.

II. Scenarios

1. ‘Business-as-usual’ scenario

In the economic forecast, we considered the recent trends of less rapid economic growth and acceleration of renewable energy growth between 2008 and 2013 to be the ‘new normal’. We predict lower GDP growth rates in the future (6.7% for 2014-2020, and 5.0% for 2021-2030). Thus the estimated 2030 GDP is 130 trillion RMB (2010 constant prices) instead of 161 trillion RMB from the CGE model, and total energy consumption 6.3 billion tons (standard coal equivalent) instead of 8.2 billion from the CGE model.

Further economic analysis indicates that higher GDP and energy consumption is not achievable. For reference, this growth forecast is close to, but slightly lower than, the forecast by the World Bank and Development Research Center of the State Council (2012): *China in 2030*.

2. Investment-consumption rebalance scenario

The rate of capital formation (to GDP) in China is 2.5 times the world average, and 20 percentage points higher than the average of middle-income countries. As indicated by estimates of current capital inefficiency, we estimate that a 10 percentage point reduction of capital formation in GDP and a 10 percentage point increase in consumption in GDP by 2025 will generally have a non-negative effect on economic growth, and will result in a 9.7% reduction of fossil energy consumption, according to calculations using the national input-output table data.

Compared to this, the CGE model gives a 4%-7% energy reduction (and also a 2%-4% reduction of GDP) as the 10 percentage point reduction in capital formation is not fully reached due to auto-readjustment of the model. The result of GDP reduction is an overestimation of the transitional cost, as the model does not include the effect of efficiency increases in the transition. These problems are due to the limitation of the model setting, as stated earlier. The former outcome is therefore adopted.

3. Industrial structural rebalance scenario

Changes in industrial structure are forecasted based on previous changes in China, with more emphases on recent changes in the past decade. The scenario for acceleration of structural rebalance is based on both international experiences and our analysis of possibilities in China. The effect on energy saving is calculated using China input-output table parameters.

4. Resource tax reform scenario

The result of our economic forecast is also more effective than the CGE modeling result, as we found the latter underestimated the substitution effect between fossil energy and renewable energy. It is therefore the former outcome which is adopted. In the statistical analysis, we use 0.35 for both the price elasticity of demand and the price elasticity of supply for fossil energy. There are different estimations of price elasticity in the literature, and some are greater than 0.35. Greater price elasticity of demand means greater demand response to tax-price changes, therefore greater effect on energy saving. Therefore our estimation may be relatively conservative.

5. Rail transportation system and energy-saving building scenario

There is insufficient data to support the scenario analysis for development of urban and inter-city rail transportation systems and fully implementing mandatory building energy saving standards. The 5%-12% reduction of fossil energy by 2030 is estimated based on experience in developed countries and newly-industrialized countries.

APPENDIX 2: Tables of results

Additive Effect of Green Transition Policy on Total Energy Consumption
(0.1 billion t standard coal)

	2013	2020	2030	2040	2050
BAU	37.5	48.7	62.6	73.4	81.2
Investment-consumption structure rebalancing	37.5	46.1	56.6	66.3	73.4
Industrial structure rebalancing	37.5	45.4	54.7	63.5	70.0
Resource tax reform	37.5	44.5	52.8	61.4	67.9
Rail transport-building energy saving	37.5	43.7	50.1	56.3	60.0
Aggregated energy consumption reduction	0.0	5.0	12.5	17.1	21.3

Data source: Forecasted by authors based on the data of National Bureau of Statistics of China

Additive Effect of Green Transition Policy on Fossil Energy Consumption
(0.1 billion t standard coal)

	2013	2020	2030	2040	2050
BAU	33.8	42.8	53.0	59.6	63.4
Investment-consumption structure rebalance	33.8	40.5	47.8	53.9	57.2
Industrial structure rebalance	33.8	39.9	46.2	51.6	54.6
Resource tax reform	33.8	38.5	43.5	48.6	51.5
Energy structure reform	33.8	38.0	41.3	43.6	43.3
Rail transport-building energy saving	33.8	37.4	39.2	40.0	38.2
Aggregated energy consumption reduction	0.0	5.5	13.8	19.7	25.1
Degree of reduction, with benchmark as 100 (%)	0.0	12.7	26.0	33.0	39.7

Additive Effect of Green Transition Policy on CO₂ Emission
(0.1 billion t)

	2013	2020	2030	2040	2050
BAU	84.0	105.1	127.9	142.4	149.4
Investment-consumption structure rebalance	84.0	99.5	115.5	128.6	134.9
Industrial structure rebalance	84.0	97.9	111.6	123.2	128.7
Resource tax reform	84.0	94.1	104.1	115.0	120.4
Energy structure reform	84.0	92.8	98.8	103.1	101.0
Rail transport-building energy saving	84.0	91.3	93.8	94.5	89.2
Aggregated CO ₂ emission reduction	0.0	13.8	34.1	47.9	60.2
Degree of reduction, with benchmark as 100 (%)	0.0	13.1	26.7	33.6	40.3

CHAPTER 4

INSTITUTIONAL INNOVATION FOR ENVIRONMENTAL PROTECTION IN THE CONTEXT OF ECOLOGICAL CIVILIZATION

CCICED Task Force Report

CCICED 2014 Annual General Meeting
December 1-3, 2014

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GLOSSARY OF KEY CONCEPTS

In order to help readers understand this report, key words are defined below:

National environmental governance system refers to the overall body of national and local environmental laws and regulations, environmental management entities and policies and operational measures. It provides the basis for action, defines enabling systems and establishes the modes of environmental governance.

Internationally, the term ‘governance’ addresses all the processes used to set and achieve goals and includes roles played by government, industry and society. Environmental governance is defined to include the cooperation among these multiple stakeholders, in environmental management. Institutions provide the foundation for close cooperation among stakeholders and effective environmental management and influence overall governance capacity.

National environmental governance is discussed in this report in the context of ecological civilization and as a theoretical basis for understanding required system innovations. This report focuses primarily on recommendations for reforms related to pollution prevention and control and ecological environmental protection including social governance related matters.

Environmental protection institutions (or measures) refer to the laws, policies and regulations found in the national environmental governance system, including pollution control, environmental quality management, biodiversity and ecological system conservation, and the preservation and development of various natural resources (water, land, forest, grassland, wetland and mineral resources).

Ecological and environmental protection management systems refer to the administrative arrangements supporting environmental governance, including the structure of various entities and the allocation of governmental responsibilities for environmental protection among agencies and levels of government.

Environmental management in this report refers to the management activities (including law enforcement) of environmental protection departments at both the central and local government levels.

Key Words: Ecological Civilization, Environmental Protection, Institutions, Innovation, Reform

SUMMARY OF KEY FINDINGS

Serious environmental problems expose gaps in environmental governance.

The 18th National Congress of the Chinese People’s Congress (CPC) identified that increasing resource constraints, severe pollution and a deteriorating ecosystem make it critical that China establish an ecological civilization awareness that respects, accommodates and protects nature and the need for comprehensive institutional reform. While there have been some promising improvements, the current institutional arrangements are not sufficient to achieve the ambitious environmental targets and integrated reforms that are being announced by the Premier as part of the ‘war on pollution’ and maintain a commitment to economic growth that is balanced, coordinated and harmonized with environmental and cultural considerations.

Governance at both the national and local levels in China is deeply influenced by a traditional management model and the planned economy. Decision makers often are very powerful and fail to strictly enforce the implementation of environmental laws. Enterprises pursue economic benefits, sometimes lack social responsibility, and often ignore environmental laws and regulations resulting in damage to the environment. Civil society has little consciousness of its environmental rights and has limited capacity to participate in environmental governance or pursue legal redress.

Change to the environmental governance system needs to focus on both institutional and capacity related issues. Modernization of the national environmental governance system and strengthening of governance capacity require continuous improvements and streamlining of institutional arrangements, management systems and operational mechanisms and reallocation of responsibilities and resources to better align with the objectives of ecological civilization and respond to changes in policies and priorities. Government needs to lead and also model the desired changes. The communist party and governments at all levels should set examples, complying with the environmental laws in their own operations and enforcing them. This is crucial for the environmental improvements necessary to achieve ecological civilization.

Problems in the existing environmental protection institutions:

(i) The environment was sacrificed in efforts to achieve high-speed economic development resulting in high environmental costs; (ii) environmental protection departments have lacked influence, capacity, resources and authority and have been hindered by local governments that have prioritized and been rewarded for the pursuit of GDP growth; central government lacks the mechanisms to effectively supervise local governments on environmental protection; the allocation of environmental management functions among various departments is dispersed, overlapping, uncoordinated and in some cases inappropriate and the departments often fail to fulfill their environmental protection functions without real consequences; (iii) environmental performance evaluations of party and government leaders has not been given adequate attention; some environmental regulations are poorly designed and difficult and costly to enforce; penalties for violations are too low; local environmental departments lack mechanisms for enforcement, supporting effective public participation and protecting environmental rights, and supervision of governmental and enterprise compliance.

The modernization of environmental governance requires a redefinition of key relationships, roles and accountabilities. Priority areas are:

(i) Relationships between government, market and society; (ii) relationships between regulatory/supervisory and economic/resource use departments; and, (iii) roles and responsibilities of central and local governments. Reform should give priority to the following: establishment of institutional measures to ensure that environmental considerations are incorporated in strategic decision making; ensuring compliance with environmental laws; strengthening the oversight and supervision of economic/resource use departments based upon a more powerful and authoritative environmental ministry and environmental departments; clarifying the environmental responsibility of central and local governments, especially economic departments; adopting subsidiarity based approaches that are guided and supervised by the national government but consider regional variations and promote innovative solutions; establishing accountability mechanisms that include environmental quality as a key performance measure; improving inter-jurisdictional coordination and mechanisms for the central government's supervision and regulation of local governmental behavior; strengthening the independence, compliance monitoring and effectiveness of ecological environmental supervision; and creating the appropriate pre-conditions and incentives to improve environmental performance of enterprises and active engagement of third parties in environmental improvement initiatives.

Reform requires strategic transformations, including adjustments to and changes in environmental management objectives, methods and priorities.

Significant reform in the environment started under the 12th Five Year Plan. During the 13th Five Year Plan, environmental management activities should focus on environmental quality improvements. This will require a rebalancing of priorities and mechanisms to maximize environmental, economic and social outcomes in all key

policy matters and resolve disputes between government entities. It needs to be guided by strong research and science that can provide options to more effectively link land and resource use activities to carrying capacity. It needs to create the necessary mechanisms to facilitate the active engagement of enterprises and the community in environmental improvement and move beyond the strong reliance on command and control measures. It needs to be supported with high quality, timely, respected and integrated data to monitor and publicly progress and help build and maintain consensus. To further enhance transformative changes, a strengthening of theoretical policy research, the establishment of an economic system that supports environmental quality improvements, and the promotion of institutional innovations in environmental management should be further progressed.

Social governance is the weakest link and needs to be strengthened.

International experience has demonstrated the potential benefits of increasing public participation and engagement in environmental policy, planning and implementation in building awareness, consensus and public confidence and improving environmental performance. Institutional measures are needed to establish a multi-stakeholder joint governance system for environmental protection, which fosters multiple stakeholder participation and multiple governance methods and channels.

The general direction of environmental management institutional reform.

The new environmental law is a key institutional innovation. Government at all levels must lead by example in complying with environmental laws, and must make urgent institutional changes to ensure that government entities and decision-making processes reflect and actively promote the objectives of an ecological civilization. Successful further reform will be dependent on raising the strategic position of ecological civilization through a range of institutional measures and incorporating ecological civilization into all aspects of economics, politics, culture and society. Institutional changes will certainly face some opposition and take time. Reform efforts need to be focused on areas of greatest risk, public concern and potential gains and be guided by the comprehensive gap-analysis of existing arrangements undertaken by this task force.

The general direction of environmental management institutional reform should be to: follow the rule of law and set clear laws and prescriptions to protect the environment; encourage and mobilize all stakeholders to engage in environmental protection in order to form a multi-stakeholder governance system involving the government, the market and society; and increasingly use an environmental management approach under which the ‘State provides macro guidance and supervision, while localities focus on independent innovation.’

SUMMARY OF MAIN POLICY RECOMMENDATIONS

Recommendation 1:

Mobilize governmental, social and economic resources and forces to build an ecological civilization. Clearly define responsibilities, establish coordination mechanisms and policies, develop integrated goals, and form synergies. According to the requirements of the 18th National Congress of the Communist Party of China (CPC), ecological civilization is not the task of a single environmental protection department. All State Council departments must act together to incorporate ecological civilization into all activities promoting economic, political, cultural and social progress. Priority actions are as follows:

- (i) The State Council should develop plans which clarify the ecological civilization responsibilities and functions of all governmental departments (especially central government and economic departments). This should mandate the consideration of environmental factors. Local government should be required to make

improvements to the quality of the environment. Third party independent evaluation of the performance of ministries under the State Council and local governments should be organized periodically, and the results should be publicly disclosed.

- (i) A State Council Environmental Protection Committee (or State Council Sustainable Development Committee), with a relevant State Council leader acting as chairman, should be established. The Committee should be responsible for coordinating the environmental management activities of various departments, coordinating regional and river-basin ecological protection and pollution prevention and control, and incentivizing and penalizing ministries under the State Council and local governments according to their environmental performance.
- (ii) Pollution prevention and control functions and ecological protection functions which are currently scattered across departments should be integrated into a more unified structure that provides independent supervision and enhanced enforcement power.

Recommendation 2:

Establish incentive mechanisms to promote environmental protection. Move beyond the reliance on command and control mechanisms and adopt a balanced use of ‘carrots and sticks’ including the following:

- (i) National fiscal, taxation, pricing and financial policies that encourage environmental protection should be expeditiously implemented. This needs to be reflected in general revenue and transfer payments. The central government should take the leading role in ensuring that the growth rate of the central fiscal budget for environmental protection is not lower than the growth rate in revenue. Special environmental pollution remediation funds should be set up (e.g., a soil contamination remediation fund) to raise funds for pollution control. For the construction and operation of environmental infrastructure, models of public-private partnerships (PPP) should be used to leverage social capital and technology, make full use of market mechanisms, reduce the cost of investment and improve operational performance.
- (ii) Establish an enterprise environmental credit evaluation system to reward enterprises that comply with environmental protection laws. Strengthen the capability of small and medium sized enterprises (SMEs), through provision of a platform with information about pollution treatment services.
- (iii) Actively promote industries and enterprises’ voluntary pursuit of good environmental performance, through programs like those found internationally—the Green Supply Program and the Top Runner Program.
- (iv) Strongly adhere to the principles of ‘he who pollutes pays, he who damages compensates, he who protects benefits,’ speed up the promotion of and improvements in the eco-compensation system, and mobilize the enthusiasm of local governments for protecting the environment, especially in areas experiencing fiscal difficulties.

Recommendation 3:

Strengthen social governance of environmental protection and develop a multi-stakeholder governance model. A multi-stakeholder governance model led by government is fundamental to solving environmental problems in China. Priority should be given to the following:

- (i) Developing and implementing systems for public participation, information disclosure and environmental litigation as required by the new Environmental Protection Law. Implement open and transparent environmental information reporting and disclosure of pollution discharges, pollution treatment and potential environmental risks and ensure effective enforcement.

- (ii) Encourage environmental protection social organizations to play a role and create a social environment and the legal conditions to facilitate their development.
- (iii) Encourage grassroots organizations to focus on environmental management issues, embrace the public's environmental demands, develop community by-laws for environmental protection, and advocate green lifestyles.

Recommendation 4:

Match environmental protection departments' authority, capacity, and resources to their supervision and management functions and tasks. Strengthening supervisory authority and enforcement capacity of environmental departments is one of the main priorities of environmental institutional innovation. Priorities should focus on the implementation of the new environmental law as following:

- (i) The State Council should formulate relevant administrative rules and regulations specifying the responsibilities, authorities and work procedures of environmental protection departments to supervise the environmental management activities of other departments at corresponding and lower levels of government.
- (ii) Establish a unified environmental information platform to achieve timely and accurate data sharing. Set up a national environmental quality monitoring network under the management of the Ministry of Environmental Protection.
- (iii) Increase fiscal investments in environmental scientific research, monitoring and information gathering, and supervision and enforcement capacities. Encourage provision of environmental services through market mechanisms.
- (iv) Increase the overall number and capability of civil servants in environmental protection departments to match their workload and statutory responsibilities. Expedite work to prescribe the duties of environmental law enforcement staff supported by appropriate training.

Recommendation 5:

Integrate environmental management institutions to improve efficiency and effectiveness. The existing institutional arrangements need to be modified to reduce uncertainties, delays, communication and access difficulties surrounding key data. Regulatory measures need to be better integrated to facilitate implementation, monitoring and compliance improvements. There is a need to strengthen the scientific basis of decisions and develop integrated information systems across government agencies. Enforcement efficiency needs to be strengthened by better integrating implementation mechanisms and revising environmental protection laws and policies based on the most recent developments in scientific research and in response to environmental management needs. Several policies should be considered:

- (i) Study and develop a comprehensive total emission control system for primary pollutants and CO₂ emissions from the consumption of fossil fuels. Explore and implement regional, river-basin and sectoral total emission control systems that are based on each region's environmental carrying capacity.
- (ii) Develop relevant laws, regulations and implementation methods for an emission permit system that covers all pollution discharging entities. Reform the environmental impact assessment (EIA) system to achieve more effective integration with the pollution permitting system. Apply the EIA system on strategies, plans and policies, as well as cross-regional and river basin projects that may have significant ecological impacts.

(iii) Improve environment and health related institutions, the environmental public interest litigation system and the ecological environment damage compensation and accountability systems. Strengthen investigative efforts and penalties for environmental matters involving criminal liability to ensure sanctions reflect the seriousness of the offense.

Recommendation 6:

Recommendations for further CCICED studies:

- (i) Study on promoting the environmental governance system and strengthening governance capacity, especially social governance;
- (ii) Study on third party evaluation of the environmental performance of government, and the institutions of environmental credit rating of enterprises;
- (iii) Study on top-level design and construction of environmental protection institutions;
- (iv) Study on incentive policies and mechanisms to promote environmental protection;
- (v) Study evaluating the reform and implementation of the pollution control institutions;
- (vi) Study on the Aarhus Convention and international experiences on public participation of environmental protection and multi-stakeholder governance.

BACKGROUND AND APPROACH OF THE PROJECT

The 18th CPC National Congress established ecological civilization as one of the five pillars of socialist modernization and called for integration of its core principles into the economy, politics, culture and society. The ‘Decision on Some Major Issues Concerning Comprehensively Deepening the Reform’ (hereinafter referred to as the ‘Decision’), stated that the overall goal of deepened, comprehensive reform is ‘to improve and develop socialism with Chinese characteristics and to promote the modernization of the national governance system and capacity.’ In the area of ecological civilization, the Decision points out: ‘We must establish a complete and integrated ecological civilization institutional system...and use rules to protect the environment.’ These provisions are of great importance for improving the national environmental governance system and promoting environmental governance capacity.

For over 30 years since China’s reform and opening up and rapid industrialization, resource and environmental problems have become increasingly prominent. The seriousness of environmental pollution has caused strong reactions from the public; society is united in calling for improving environment quality. There are many flaws and gaps in the current environmental governance system and relevant institutional structures. They are not able to deal effectively with the new environmental pollution control and ecological and environmental protection challenges.

In 2014, the CCICED established a Task Force with both Chinese and international members to conduct a study on ‘Institutional Innovation for Environmental Protection in the Context of Ecological Civilization’. The Task Force analyzed existing research on environmental protection institutional reform and conducted field visits to both eastern and western China to solicit feedback from local environmental authorities and enterprises. The Task Force conducted a study tour to Europe to study European experiences in environmental institutional reform. Meetings were held with governmental and non-governmental environmental organizations and experts in the European Union. The Task Force also established a Chinese expert advisory group which provided comments during the report’s preparation.

The Task Force identified the prerequisites of ecological civilization and undertook a comprehensive analysis of the existing environmental governance system, the institutional structures that currently support it and the nature of the current environmental problems being experienced in China. They compared institutional structures with best practices both domestically and internationally having regard for China's key needs and culture. Drawing on both domestic and international experiences and lessons, some specific recommendations related to the modernization of China's environmental governance system and the reform and innovation of its environmental protection institutions are made. Chinese and international case studies provide practical guidance relevant to the transformation of China's environmental governance system, improving governance capacity, and developing an over-arching and strategic design for environmental management.

The Task Force aims to provide recommendations on: (1) promoting the reform of the national environmental governance system and enhancing national environmental governance capacity; (2) institutional and management regime innovation for environmental protection, which is necessary for a real improvement in environmental quality; (3) a top-level design for the strategic transformation of the environmental management system.

The Task Force research included six subtopic reports: (1) Theoretical Framework and Modernization of the Environmental Governance System; (2) Improving Social Governance Capacity for Environmental Protection; (3) Reform of the Ecological Environmental Protection Management System; (4) General Thoughts for Institutional Innovation for Environmental Protection; (5) Transformation of Environmental Management; (6) International Experiences and Cases.

Key International Lessons Regarding Institutional Innovation

- (i) **Science driven policy making** that drives a strong environmental governance system that is flexible, dynamic, evidence driven and outcome oriented is best placed to deal with the problems that more traditional systems have not been able to address.
- (ii) **Data availability and transparency** are key elements of effective environmental governance. Data needs to be reliable, accessible and ideally in an integrated form to properly assess problems and monitor progress, effectively monitor and enforce compliance, drive innovation and assist in promoting social governance by empowering society to become involved in social supervision
- (iii) **Nationally systemized methods and standards for environmental performance assessments and independent arbitration bodies** help to fairly ensure the interests, authority and objectives of each implementing entity. An example is the U.S. Toxic Release Inventory identified as one of the single most important changes to clean up toxic pollutants.
- (iv) **Monitoring, assessing, and evaluating policy implementation and progress and adjusting institutional measures where appropriate** are central to continuous performance improvements. These mechanisms have been critical in achieving Germany's ambitious energy reforms through its *Energiewende*.
- (v) **Enhancing awareness of environmental protection needs enhances the potential for constructive public involvement.** A central contribution of the U.S. National Environmental Protection Policy Act (NEPA) 1969 was its role in enhancing awareness of environmental protection throughout the federal government and ensuring that environmental values were taken into account in the decision making of agencies and departments. This required federal agencies to prepare environmental impact assessments (EISs) for all 'major federal actions significantly affecting the quality of the human environment' bringing transparency and public engagement and analysis of environmental impacts and evaluations of alternatives for federal actions with large scale effects on land use, energy production, transportation and management of ecosystems and critical habitat.
- (vi) **Strengthening incentive structures** has successfully changed behaviors as demonstrated in the Top Runner Program in Japan that has reduced energy use.

- (vii) Policies and institutions for governing regional transport of pollutants are important to achieving improved environmental quality. Under the U.S Clean Air Act, the EPA successfully led air quality improvements that relied both on in-state emission reductions and regional scale controls for pollution transported across state boundaries. This involved regulations imposing emissions controls on nitrogen oxide, sulfur dioxide the main precursor to ozone and PM.
- (viii) Policy coordination within federal systems is critical. Both Australia and the United States have successfully introduced statutory measures to address regional and catchment based environmental challenges through the Australian National Water Act, 2007 and the U.S Clean Air Cooperative federalism Framework.

4.1 ECOLOGICAL CIVILIZATION AND THE NATIONAL ENVIRONMENTAL GOVERNANCE SYSTEM: The context

4.1.1 Ecological Civilization and Implications for Environmental Protection

The 18th CPC National Congress established ecological civilization as one of the five pillars of socialist modernization together with the economy, politics, culture and society, stating: ‘Promoting ecological civilization is a long-term task of vital importance to the people’s wellbeing and China’s future. Faced with increasing resource constraints, severe environmental pollution and a deteriorating ecosystem, we must establish an ecological civilization awareness that respects, accommodates and protects nature. We must give high priority to ecological civilization progress and incorporate it into all aspects and the whole process of advancing economic, political, cultural and social progress, to achieve the objective of building a beautiful China and sustainable development of the Chinese people.’

The objectives of ecological civilization are not only to realize modernization, attain the level of a moderately developed country and allow all people to enjoy a high quality material and cultural life, but also to build a beautiful China, achieve harmony between humans and nature, and secure sustainable development for the people.

The call for ecological civilization puts environmental protection into an increasingly important position and provides broad and strong support for environmental protection. Progress towards an ecological civilization is reliant on effectively addressing China’s serious environmental problems and resource constraints and making economic development harmonious with environmental protection. The main tasks in the short-term must continue the focus on: optimizing national land development plans, conserving and efficiently using and recycling resources, strengthening ecological environmental protection and enhancing ecological civilization institution building.

The third plenary session of the 18th CPC National Congress laid out a strategic plan for advancing ecological civilization: ‘In order to promote ecological civilization, we must establish a complete and integrated institutional system, implement the strictest resource protection, damage compensation and accountability system, and improve the environmental governance and ecological restoration system, and use institutions to protect the ecological systems and the environment.’ This indicates that the most pressing task in ecological civilization is institutional improvement. Ecological civilization construction will effectively promote innovations in environmental protection institutions. Comprehensive and strictly implemented environmental laws and programs would not only help address severe environmental problems, but also safeguard the progress of ecological civilization.

The Standing Committee of the 12th National People’s Congress adopted the amended ‘Environmental Protection Law of the People’s Republic of China’ on April 24, 2014, the most important institutional innovation progress made to date in the area of environmental protection. It opens a new era for institutional innovation linked to concept of ecological civilization and the modernization of China’s environmental governance system and capacity.

4.1.2 Environmental Problems Highlight Gaps in the National Environmental Governance System

Since the process of reform and opening up began, China has experienced rapid economic growth. In 2010, China's GDP exceeded Japan's for the first time, becoming the second largest in the world. Blemishing this impressive achievement are increasingly serious environmental problems: (1) Emissions remain high. Since 2005, China tops the world in the total discharge of many key pollutants, such as SO₂, and in the seriousness of water pollution (as measured by Chemical Oxygen Demand or COD). Pollutant discharges in many regions are beyond the carrying capacity of the local environment; (2) Environmental quality is not good. Only 3 of 74 cities that were monitored in 2013 achieved the new air quality standards (with a non-attainment rate of over 95.9%). Water quality in the 10 major river basins is generally categorized by light pollution, but 8.9% of 704 monitored river sections are worse than Class V national standards. 59.6% of monitored groundwater sampling point areas had poor or very poor water quality. 16.1% of soil quality monitoring points did not meet standards, and 19.4% farmlands are considered polluted. Heavy metals (such as Hg) and persistent organic pollutants are becoming serious environmental problems that are drawing high levels of public attention. (3) Social problems caused by environmental degradation are worsening. Major unexpected environmental accidents such as the pollution of the Songhua River are occurring. The frequency of environment-related mass protests (such as against the PX Project in Xiamen) is increasing. Environmental pollution damages people's health, has caused strong reactions from the public, and has significant impacts on social and economic wellbeing.

The severity of environmental conditions exposes flaws in China's environmental governance system. Environmental governance institutions are inadequate. The environmental management system is un-coordinated and insufficiently integrated and governance mechanisms are incomplete. There is lack of mutual support and there are not enough incentives and checks-and-balances among and between institutions, the management system and implementation mechanisms. This has resulted in an inability to address existing environmental challenges and to take preventative measures. Opportunities to capture co-benefits of an integrated pollution control approach are not being captured.

The current environmental governance system lacks the capacity to support sustainable development. The true environmental and social costs of growth are not adequately accounted for. Mechanisms to provide government leaders with the best available evidence to balance economic, environmental and social costs to maximize outcomes are often lacking. Modernization of the environmental governance system is urgently needed.

4.1.3 Promote the Modernization of the National Environmental Governance System and the Strengthening of Governance Capacity

The third plenary session of 18th CPC National Congress defined the overall goal of comprehensive reform in the short-term as improving and developing socialism with Chinese characteristics and promoting the modernization and strengthening the capacity of the national governance system.

4.1.3.1 National Environmental Governance System

The national environmental governance system incorporates the overall body of national environmental laws and regulations, environmental management systems, and operational mechanisms. It provides the basis for action, defines enabling systems and establishes the modes of environmental governance. It is an important component of the broader national governance system.

Environmental protection institutions are the package of laws, regulations, policies and guidelines formulated by the state in order to meet environmental protection objectives and establish requirements and procedures.

Environmental protection institutions provide the foundation, guidelines and directions for the overall environmental governance system.

The environmental protection system refers to the organizational, functional and authoritative arrangements found among governmental departments, enterprises and social organizations in the area of environmental protection.

Environmental protection mechanisms are the processes and operations by which various actors involved in environmental governance interact for the purpose of achieving environmental protection objectives and requirements. They are key to effectively implementing environmental protection policies and laws.

Combined, environmental protection institutions, the environmental protection management system, and governance mechanisms must form an integrated and harmonized environmental governance system. The objective of building and promoting a national environmental governance system is to: protect ecosystems and the environment, safeguard environmental security, provide environment-related public services, improve environment quality and bring benefits to the people.

The theoretical basis of environmental governance is found in the theories of sustainable development, ecological system valuation, natural ecosystem balance and evolution, and public governance, among other theories. It lays a theoretical foundation for the progress of civilization and the harmonious development of human society and nature. Environmental governance actors include governments, enterprises, social organizations and the general public. The government includes the Communist Party of China, legislatures, judiciaries, other political parties, and central and local governments. Enterprises include state-owned, privately-owned, and foreign-invested enterprises, joint ventures and individually-owned businesses. Social organizations include trade unions, industrial associations, educational institutions, scientific research institutions, social groups and the media. The general public includes individual citizens and their self-governing organizations.

4.1.3.2 National Environmental Governance Capacity

National environmental governance capacity is the ability to bring the functions and roles of actors in the national environmental governance system into full play to effectively protect ecological systems and assure environmental quality. National environmental governance capacity is not simply the sum of all governmental environmental protection management capacities, but the overall capacities of all actors involved in governance processes.

National environmental governance capacity is the comprehensive capacity to address and govern all public environmental matters closely related to the interests of the whole country and all citizens. This includes the capacity for producing and supplying environmental services and products, allocating and coordinating environmental resources, formulating and implementing environmental policies, safeguarding national environmental security, and addressing international environment issues. It includes distribution of environment-related public services, social education, the degree of social organizational development, the public's ability to participate and its degree of social awareness and cohesion.

With the growing demand for environmental service, rapid economic growth and societal progress, and increasingly complicated environmental problems, the environmental governance system has to deal with interrelated problems that the traditional government management system cannot address. It must be able to forecast and control new emerging environmental problems. Environmental governance institutions and capacity should correspond to the environmental problems that must be addressed and thus require periodic changes.

Environmental governance capacity must also be suited to national conditions and the scale of environmental problems that need to be solved. Drawing on other countries' experiences can serve China's environmental management and sustainable development needs.

4.1.3.3 Modernization of the National Environmental Governance System and Capacity Enhancement

Firstly it is necessary to consider what is meant by the term modernization in this context. Put simply, the aim is to ensure that there are the necessary institutional tools, structures and capacity available to effectively address key problems facing China while at the same time maximizing longer term outcomes including sustainability.

These goals can only be achieved through continuous improvements to environmental protection institutions, better coordination, communication and information exchange and a strengthening of operational mechanisms. Industry partners consistently seek certainty from government decision-making processes and a clear articulation of rules. This may require the introduction of statutorily based provisions and processes to increase transparency and public confidence.

To evaluate the modernization of environmental governance capacity, the presence, extent, or effectiveness of the following indicators can be used for reference (based on Chinese and international experiences):

- (i) **Harmony** in relationships within and among various actors of environmental governance and public trust in key decisions;

Key Property: Roles and responsibilities are clearly allocated.

- (ii) **Checks and balances** among institutions and actors, within the management system and its implementation mechanisms, including supervision and enforcement efforts. Striking a balance in relation to the extent of reliance on command and control versus market or other incentive measures.

Key Property 1: Integration, to ensure the balanced consideration of environmental, economic and social factors, to capture co-benefits and align various functions and services to ensure accountable delivery of programs that both protect the environment and provide for economic and social wellbeing.

Key Property 2: National Interests and Subsidiarity. National interest considerations so that where appropriate a national approach is adopted in preference to diversity across jurisdictions, and at the same time, subsidiarity where responsibility lies with the lowest level of government possible allowing flexible approaches to improving problems.

- (iii) **Stability** in the implementation of environmental governance objectives to respond to changing scientific knowledge and circumstances;

Key Property: Adaptability, in responding to changing scientific knowledge and circumstances.

- (iv) **Fairness** between actors of environmental governance and between current and future generations;

Key Property: Inclusiveness, through mechanisms and structures to enable the participation and engagement of enterprises and community in environmental improvement efforts

- (v) **Efficiency** through the simultaneous realization of improved environmental conditions and economic, social and administrative performance.

Key Property 1: Fiscal sustainability at the national, regional and local levels of government

Key Property 2: Integrated and accessible information systems to improve reliability, accuracy and exchange between departments, industry and the community and drive evidence based decision making and assist in consensus building.

The ideology guiding environmental governance has changed over the course of history from a focus on the management of public hazards in the first half of the twentieth century, to a greater attention to pollution prevention and control in the second half of the twentieth century, to sustainable development since 1992, and green development and public participation at the start of this century. There is also now more emphasis on the voluntary cooperation of enterprises, third party supervision and public participation.

Greater emphasis needs to be given to incentivizing good environmental behavior and promoting innovation both in government and the broader community. Environmental protection institutions should also be improved. It is necessary to improve China's current environmental governance institutional system, to build social responsibility and awareness of the rule of law, and on this basis, to promote cooperation, institute appropriate checks and balances and drive innovation.

Strategic environmental impact assessments should be employed to provide political leaders with scientifically based and independent advice about the impact of new and existing policies on the environmental, economic and social objectives underpinning eco-civilization and to shift the historical weighting given to economic considerations.

4.2 CURRENT SITUATION AND CAUSES OF ENVIRONMENTAL PROBLEMS

4.2.1 Achievements

The environmental protection institutions discussed in this chapter refer to the mandates and guidance of environmental protection laws and regulations. Due to time constraints the scope of this report is limited to pollution prevention and control and ecological environmental protection.

Environmental reform commenced through the 'Environmental Protection Law (trial)' of 1979, which established the first environmental protection institutions, including environmental impact assessments for construction projects, pollutant-discharge fees and the 'Three Simultaneities'. Along with the promotion of environmental legislation, environmental legal institutions have been strengthened, a series of new environmental protection institutions has been developed and old institutions have been improved. The revised 'Environmental Protection Law' adopted in 2014 establishes new systems, such as the environmental protection target performance evaluation and eco-redline systems, and promotes the development of environmental protection instruments. By the end of 2013, the National People's Congress had issued 10 environmental protection laws and 20 environmental resource protection laws. The State Council had promulgated more than 20 administrative rules and regulations on environmental protection. Local people's congresses have also developed hundreds of local environmental protection laws and regulations. There are already about 30 environmental protection laws and regulations: 5 are linked to governmental environmental responsibilities, 19 to pollution prevention and control, and 9 to biodiversity and eco-system protection. See Table 4-2-1.

Over the past 30 years, China's environmental protection institutions have gradually become more comprehensive as part of the strong commitment by government to achieve pollution prevention and control and eco-system protection and environment quality improvements. They have played an indispensable role in supporting and ensuring environmental protection but many problems remain.

Both the 11th and 12th Five-Year Plans expanded the coverage and impact of pollution prevention and control related measures and defined mandatory total pollutant discharge levels and increased the types of key pollutants to be controlled. As a result, the discharge of primary pollutants did not increase but dropped even while the economy has grown. The State Council formulated a stricter 'Plan of Action for Prevention and Control of Atmospheric

Pollution' and initially established a jointly controlled coordination mechanism to address growing concerns about health impacts related to pollution, which prescribed legal steps to be taken. For example, in key cities which fail to reach air quality standards, 'plans should be developed for attaining the standards within the time limit... and even more strict measures should be applied to meet such standards within the time limit.' For the purpose of ensuring effective implementation of environmental protection institutions, efforts have been made to reform the environmental management system and improve the capacity and authority of environmental protection departments. At the beginning of this century, the state environmental protection department has also set up regional offices to strengthen supervision and inspection of local governments and enterprises in relation to the implementation of environmental protection laws and regulations, plans and standards. In 2008, the State Council established the Ministry of Environmental Protection (MEP) and gave it responsibility to provide environmental input into decision-making related to national economic and social development.

Table 4-2-1. Major Environmental Protection Measures

Scope	Name of Law or Regulation
Governmental responsibility	<ol style="list-style-type: none"> 1. Environmental liability scheme targeting information disclosure* 2. Environmental protection performance evaluation* 3. Cross-regional pollution coordination system 4. State of Environment
Pollution prevention and control	<ol style="list-style-type: none"> 1. EIA 2. Pollution phase-out system 3. Pollution fees 4. Total emission control 5. Three Simultaneities 6. Extended producer environmental responsibility system 7. Environmental pollution investigation, monitoring and remediation* 8. Restricted transfer of pollution-intensive equipment 9. Pollution discharge registration 10. Environmental liability regime* 11. Pollution permit 12. Environmental and health monitoring and risk assessment* 13. Time-bound pollution treatment 14. Compensation for pollution damage* 15. Polluter implementation of hazardous waste treatment
Biodiversity and ecological environment protection	<ol style="list-style-type: none"> 1. Wildlife ownership vested to state 2. Nature reserves classification 3. Catalogue of Protected Wild Plants and Animals 4. Nature reserve management 5. Special hunting permit 6. Eco-redline* 7. Special harvest permit 8. Eco-compensation* 9. Water conservation and soil erosion control plans

* Institutions established or improved by the revised 'Environmental Protection Law' adopted in April 2014

These institutional measures have improved environment quality. In the first decade of this century, the SO₂, NO₂ and inhalable particles (PM₁₀) in the environment of cities at the prefectural level decreased by various degrees even while there was rapid economic growth. The pollution levels of the Huaihe and Liaohe rivers noticeably decreased and water quality improved. The proportion of worse-than-grade-five water quality monitoring sections of the seven major water systems dropped by 15%. But environmental pollution is still serious in China. The discharge of some pollutants is increasing, with increasing environmental risks. Health problems are frequently reported in the press. The need for institutional reforms to improve environmental quality remains an urgent priority.

4.2.2 Major Problems in China's Environmental Protection Institutions

4.2.2.1 Effectiveness of Environmental Protection Institutions and Principles

To be effective in achieving the goal of ecological civilization, institutional measures must be able to improve environmental outcomes in an efficient and effective manner. This must be part of a broader framework that seeks to optimize economic, social as well as environmental outcomes. Effectiveness depends on many factors, including scientific design, reasonableness, suitability to the national situation, and implementation capacity and will. It needs to have regard to the economic and social context, be risk focused, equitable, flexible and provide for the necessary checks and balances. If measured by these broad principles, China's environmental protection institutions still have significant and urgent problems warranting reform.

4.2.2.2 Defects in Existing Environmental Protection Institutions

4.2.2.2.1 Gaps in governmental responsibility institutions

Mismatch between Governmental Authority, Responsibility and Resourcing. Environmental protection laws give government entities at both the national and local levels extensive statutory responsibilities to protect the ecological environment. However, there is a mismatch between authority and the provision of resources to manage these reserves. For example, Article 11 of the *Regulations on Nature Reserves* specifies that 'nature reserves are divided into national nature reserves and local nature reserves,' indicating that nature reserves are managed at different levels. Article 23 of the Regulations specifies that 'the expenses needed for the management of the nature reserves shall be arranged by the people's government at or above the county level of the region where the nature reserves are located. The state shall subsidize the management of national nature reserves appropriately.' The mismatch between the government's environmental authority and responsibility can also be seen in Article 11, which specifies that nature reserves are divided into national nature reserves and local nature reserves, and states that the expenses needed for the construction and management of nature reserves should be provided by the governments at each respective level and in accordance with legal principles. This means that for nature reserves at both the national and local levels, the governments of the region where the nature reserves are located are expected to cover necessary expenses. Many of these areas have less developed economies and are facing financial difficulties. Such an arrangement gives the central government the authority over national level nature reserves, but fails to provide the necessary financial support to the host region to manage the reserves; this is neither legally rational nor consistent with ecological civilization goals.

Lack of Binding Governmental Commitments to the Environmental Improvement Measures. The previous 'Environmental Protection Law' and various specialized laws have specified that local governments shall be responsible for the environmental quality within areas under their jurisdictions and take measures to improve environmental quality. There is, however, no clear mandatory provision concerning what measures should be taken by the government to improve environmental quality. There are also no provisions defining the government's responsibility for the deterioration of environmental quality and how a government can be held accountable. Although the revised 'Environmental Protection Law' further clarifies the environmental responsibilities of governments, problems still exist. For example, in relation to the governmental environmental responsibility institution, the General Provisions only state that governments: 'shall be responsible for the environment quality within areas under their jurisdiction,' 'shall increase their fiscal input in environmental protection,' 'when developing economic and technical policies, ...shall take into full account their environmental impacts,' and 'shall make plans to meet the standards within the time limit.' There are no substantially binding commitments for government to meet these environmental responsibilities nor liability if they do not do so. This diminishes the potential effectiveness and credibility of the new environmental laws.

Governmental environmental responsibility is closely related to social public service and public health, as well as ecological civilization progress and sustainable development. If governments do not accept any liability for their own actions or inactions, the core environmental responsibility system will be effectively hollow.

4.2.2.2 Inadequate pollution control institutions

Even though the institutional system for pollution control has produced some encouraging results, there remain substantial gaps, such as with EIAs. When the Environmental Impact Assessment Law was drafted in 2001, there was a proposal to expand EIA coverage to include not only construction projects but also important potentially environment-impacting plans and policies. It was clear that policies developed by governments and relevant departments may have more persistent and broad impacts on environmental conditions than specific construction projects. Proposals to implement strategic environmental assessments were however not adopted due to the conflicting views and interests of some departments and local governments.

Pollution control measures currently lack a clear scientific basis, and detailed procedural rules, significantly undermine their effectiveness. For example, there are no detailed legal provisions for the pollution permit system, and thus it has not been effectively implemented; the ‘Three Simultanities’ system was not well-designed. Penalties are set too low, enforcement is difficult and permits are sometimes viewed as irrelevant.

Box 4-2-1. US EIA System for Policy and Major Projects

The United States National Environmental Policy Act (NEPA) was enacted in 1969. Its goal was to enhance awareness of environmental protection throughout the federal government and to assure that environmental values were taken into account in the decision-making of all agencies and departments. NEPA achieves this goal by requiring federal agencies to prepare an environmental impact statement (EIS) for all ‘major federal actions significantly affecting the quality of the human environment.’ Because of the broad scope of this requirement, it has become practice to develop a short ‘environmental assessment’ (or EA) to assess whether the impacts of a proposed action are sufficiently severe to warrant a more comprehensive EIS. As a result, production of EISs has been limited to manageable numbers, in the range of 400-600 per year.

It took several years for federal agencies to develop the political will, expertise and infrastructure to comply with NEPA. The courts initially played a critical role in enforcing NEPA requirements against recalcitrant agencies in response to suits by citizens concerned about the harmful environmental effects of large federal projects. NEPA’s signal accomplishment has been to bring transparency and public engagement to the analysis of environmental impacts and evaluation of alternatives for federal actions with large-scale effects on land use, energy production, transportation and management of ecosystems and critical habitat.

4.2.2.3 Gaps in ecological protection institutions

There are gaps and defects in the field of ecological protection institutions:

- a) There is no special or specific law concerning ecological protection, i.e. a direct legal basis for ecological protection institutions is lacking;
- b) Although the institutions that are urgently needed for ecological protection, such as an eco-redline system and ecological compensation system, have addressed by the revised Environmental Protection Law, they lack specific content and procedures. Specific regulations are still needed for implementation.
- c) Existing ecological protection institutions are few in number and have narrow coverage, making it difficult to achieve broad ecological protection.

Box 4-2-2. 'Functional extinction' of Yangtze River dolphins

The Yangtze River dolphin is listed in the first rank of wildlife placed under special state protection. Special hunting and catching licenses are required. Despite this, the Yangtze River dolphins and other rare aquatic mammals are threatened with 'extinction.'

Research shows that about 300 Yangtze River dolphins lived in the Yangtze River in the 1980s, but only a few dozen were left in the mid- to late- 1990s. In 2006, relevant research institutions conducted a joint investigation of the Yangtze River dolphin. They found no Yangtze River dolphins in the water bodies from Yichang to the Shanghai Estuary. In 2007, the government announced the 'functional extinction' of Yangtze River dolphins.

In order to protect species, China formulated the Law on the Protection of Wildlife in 1988 and revised it in 2004. The law protects 'the species of terrestrial and aquatic wildlife which are rare or near extinction and the species of terrestrial and aquatic wildlife which are beneficial or of important economic or scientific value.' This Law has established lists of wildlife owned by the state that are under special state protection, or require special hunting and catching licenses. The government is prioritizing the protection of rare, endangered and high-value animals; yet, the institutions to implement these goals are too weak and narrowly focused.

Measures focusing on the protection of endangered species such as hunting and poaching controls are useful, however, they fail to give adequate consideration to habitat protection despite this constituting the major risk to species survival in many instances. More comprehensive approaches to ecological protection focusing on the retention of key habit and ecosystems both within and outside of the formal reserve system are crucial.

4.2.2.3 Defects of the Environmental Protection Institutional System

In accordance with the 18th CPC Decision, various environmental protection measures have been established, but they still require a clearer scope, statement of goals and main principles, and balance of authority and responsibility between executive and implementing agencies. The overall design should be stable, but flexible, so that it can be improved and amended as situations change.

Many environmental protection measures were established prior to the ecological civilization concept, and therefore, the ideologies guiding institutional designs were not oriented by it. They fail to fully reflect the core ideas of respecting, obeying and protecting nature.

As previously noted the coverage of pollution prevention and control institutions is relatively comprehensive adopting an end-to-end approach. However, there are obvious institutional gaps in terms of natural ecological protection, governmental environmental responsibility, as well as social environmental governance. Many badly needed institutions for ecological protection, such as an ecological compensation system, have yet to be implemented. A comprehensive and integrated set of institutional measures for ecological protection is urgently needed.

Too often, pollution prevention and ecological measures are vague in terms of procedures and regulations and do not find an effective balance between the responsibility and authority of regulators and those being regulated. These defects restrict overall performance.

4.2.3 The Root Causes of the Problems with Environmental Protection Institutions

4.2.3.1 Phases in Economics, Social Development, and Environmental Management

At the beginning of the process of opening up and reform, China's national economic foundation was weak and overall social development lagged behind the global average. China accounted for only 2% of the global economy

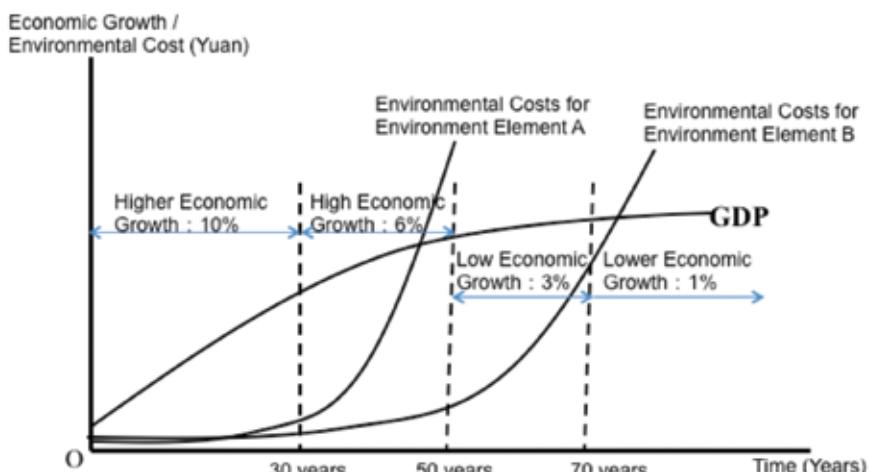
with 25% of the world's population. The Chinese people have strongly desired reform and economic development. China thus followed a course 'centering on economic construction,' which not only satisfied the requirement for a stable social order, but also conformed to the people's call for a better life.

In the early stage of development, China's technological level was low and the country engaged in simple processing and manufacturing. The demands for labor and environmental resources were relatively great. After a long period of economic stagnation, China still had resources and relatively good environmental conditions. Large amounts of environmental resources were used as inputs for economic production. The result was an obvious marginal output, which contributed to social dependence on environmental resources and to the idea that environmental resources are inputs for economic development.

Due to the tolerance and self-purification ability of ecosystems, the characteristics of environmental pollution are cumulative and delayed. Great economic benefits can be obtained through the inputs of environmental resources, but such activities often have insufficient regard to ecosystem thresholds. The consequences of environmental damage often do not emerge immediately. Therefore, the benefits of economic development and the costs of environmental damage are asynchronous. In the early stages of high-speed economic development, this asynchronous development provided greater economic benefits than environmental costs, thus a huge environmental dividend was obtained. This environmental dividend is also known as the capacity environmental dividend, as shown in Figure 4-2-1. Weak environment protection institutions provided huge institutional environmental dividends, known as a capacity environmental dividend, as shown in Figure 4-2-2.

Environmental resources are a public good; their utilization and consumption are not exclusive, so any economic organization or individual may obtain environmental dividends by utilizing the environment. During the early period of high-speed economic development, public demand for environmental resources was mainly for the purpose of ensuring survival. This has made it very difficult to shake society's belief in 'GDP-oriented' development despite the degradation in environmental quality.

On the whole, there is a close causal relationship between China's historical stage of development and the fact that environmental governance has developed slowly since the reform and opening-up process began. However, as environmental carrying capacity is approaching its limits, the marginal economic benefits of the environmental



Asymmetry and Non-synchronicity between Economic Growth and Environmental Costs

- (1) Economic growth: real-time, short-term, private; Environmental Costs: Cumulative, lagged, public
- (2) Short-term: Economic Growth > Environmental Costs;
Long-term: Economic Growth < Environmental Costs.

Figure 4-2-1. Environmental Dividends, Economic Growth and Environmental Cost

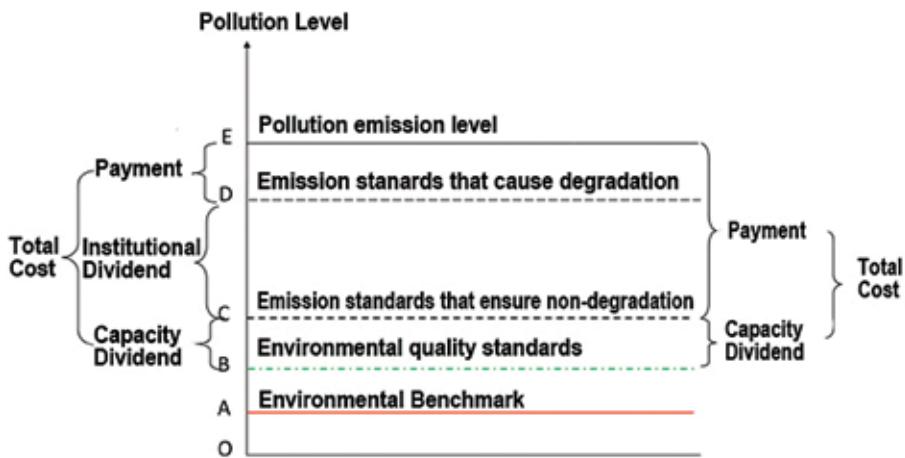


Figure 4-2-2. Institutional Environmental and Capacity Environmental Dividends

dividend are falling sharply. The effects of environmental damage have gradually become more prominent and the view that 'environmental protection's role is that of an escort for economic development' which formed in the early stage of high-speed economic development is now facing great challenges.

Entering the new century, China has adopted a series of measures to strengthen environmental protection and promote pollution control yet many problems remain. International experience attests to the difficulties in establishing and maintaining effective environmental governance systems. No jurisdiction can rightfully claim that the task is complete. Reform cannot occur in one campaign as circumstances change, requiring ongoing betterments to meet new challenges. From the start, the development of environmental protection in China has been affected by the global context and compared to the situation when developed countries were at similar levels of economic development, the challenges facing China are great. Given China's high development goals, strict environmental targets, and high public demands for improved living and environmental quality, reforming China's environmental protection institutions will be a major task.

4.2.3.2 Root Causes of Problems

4.2.3.2.1 A governmental system which has its main responsibility as boosting growth means environmental protection often gives way to economic growth

It is very important for a developing country to promote rapid economic growth for substantial periods of time in order to maintain national stability and improve people's living standards, as well as achieve social development and progress. There must be a clear definition of the government's functions and responsibilities. Due to the needs for economic growth, local governments have gradually evolved into important investment and business operation targets. For long periods of time, trade and investment promotion and the acceleration of GDP growth have been the main areas of focus of local governments and the main indicators used in the performance assessment and promotion appraisal system.

The authority and ability of environmental protection departments have been limited by their institutional arrangements. In the functional allocation of various government departments, the environmental protection departments have been put into an inferior position; it is difficult for them to form systems and mechanisms for independent regulation. They are not able to implement the management duties prescribed to them by the law. And, although economic departments in charge of comprehensive economic management have important decision-making power, their environmental protection responsibilities are not clear even though they have functional responsibilities for environmental protection. They have ignored these responsibilities internally and failed to effectively conduct comprehensive decision-making and coordination of environment and development.

4.2.3.2.2 The allocation of functions relating to ecological and environmental protection across governments is fragmented, duplicative and fails to clarify rights and responsibilities

A rational functional allocation would have each department undertake the function that most closely matches its management objectives, but not undertake functions that are directly in contradiction to those management objectives. At present, however, the horizontal allocation of functions for ecological and environmental protection is not rational. Despite the basic legal principle calling for a ‘unified supervision combined with management by multiple departments,’ this kind of management system has not actually been established.

In terms of unified supervision, the environmental protection departments are lacking in authority and means. In the process of governmental reform in 1998, the Environmental Protection Committee under the State Council was shut down. Its functions were transferred to the State Environmental Protection Administration (SEPA). SEPA was made responsible for the coordination of all regions and departments and for solving major cross-regional and inter-basin environmental issues. But, as SEPA is not part of the State Council, it is difficult for SEPA to coordinate major environmental and development issues involving many departments and regions. With its limited authority, it is difficult for SEPA to influence national economic and social development policies in relation to environmental protection or promote the incorporation of environmental elements into the performance assessment or policy directions of other departments. For example, it has no right to decide to introduce policies that promote good environmental outcomes nor give inputs on key decisions regarding state-investment projects. Its supervision of government departments at the same and lower levels exists in name only.

Box 4-2-3. Shanghai Environmental Protection and Construction Coordination Committee

In 2013, Shanghai established the first Environmental Protection and Construction Coordination Committee in China. This inter-departmental body integrates administrative, legal and policy resources, and is responsible for coordination, communication, inspection and evaluation of environmental protection works. It provides a platform to promote a series of actions, including the ‘Three-year Environmental Protection Plan’, the national and local ‘Clean Air Action Plan’ and the still to be issued ‘Clean Water Action Plan’ and ‘Clean Soil Action Plan’, urban environmental function zoning, and establishment of an eco-redline system.

Some supervisory and management functions tied to ecological and environmental protection have been granted to various sectoral departments. This leads to three problems. First, the competent departments responsible for resource management tend to be responsible for managing assets. They prefer to consider the economic interests of their own departments, and as a result environmental benefits tend to be relegated to a secondary position. Second, it is difficult for various departments to form joint regulatory efforts due to the decentralized functions of ecological and environmental protection among various departments. According to a report of the Chinese Research Academy of Environmental Sciences, the central government has 53 ecological and environmental protection functions, the environmental protection department takes responsibility for 40%, and the other nine departments have responsibility for 60%. Among the 21 functions undertaken by the environmental protection department, 52% are independently undertaken by the environmental protection department, and 48% are functions shared with other departments. Third, there is a departmentalization and fragmentation of relevant legal institutions for ecology and the environment. For example, there is an arbitrary division of institutions for the protection of water resources and water pollution prevention and control that have the same function or are connected to each other: there is a water function zones classification system and a similar water environment functional zoning system; there are indicators of water carrying capacity and also indicators of water environmental capacity and indicators of total water environmental capacity, etc. Similar problems also exist in the environmental monitoring system, which is to act as a supporting system for environmental management.

4.2.3.2.3 The division of powers between the central and local governments is unclear, and supervisory capacities are weak

Legally, China is a unified state with a single governance system. Local governments have relatively great powers while central government departments basically offer operational guidance to local governments and relevant department. These are the characteristics of a ‘strong horizontal administration and weak vertical administration’.

Box 4-2-4. Federal Policy Coordination

Water shortage is an important issue in Australia. The Millennium drought in 2007 brought scarcity and resource degradation to the forefront and was a catalyst for changes in policy and institutional arrangements. Governments were collectively unable to address key questions about water resources, creating a growing perception of failure of joint governance. The National Water Act introduced in 2007 established the Murray Basin Plan framework. This Act had bipartisan support. It was a response to drought and the potential impact of climate change, and also aimed to fulfill Australia’s international environmental obligations. For the first time a single independent expert national government body assumed responsibility for holistically planning the management of water resources of the Basin in a way that best meets the social, economic and environmental needs of the basin and its communities. Water accountability was based in the national environment portfolio rather than in a resource use portfolio potentially captured by water use interests. This was a significant change in ministerial accountabilities and critical to the advancement of reforms. Many states also established dedicated Offices of Water with responsibility for developing water-sharing plans under state legislative requirements as water owner.

The separate and shared powers of the central and local governments are not clearly demarcated. In the past several years, the central ministries and commissions have taken several measures in order to urge local governments to implement the environmental policies formulated and promulgated by the State Council. These include establishing regional supervision institutions, strengthening the functions of basin water resources protection agencies, as well as implementing dual leadership for the leading cadres of local environmental protection departments at all levels (relying mainly on the management of local CPC Committees); at the same time, the target responsibility system has been implemented to strengthen central guidance and supervision over local environmental protection works. But for various reasons, these institutions have not really played their expected role. As an example, due to the lack of an independent monitoring, statistical and assessment system, the central government has had trouble getting real environmental protection data, compromising the target responsibility system.

4.2.3.2.4 Personnel, equipment and financial allocations for environmental protection are very weak

Due to the low priority accorded to environmental protection, both in the central and local governments, the environmental protection departments’ personnel, equipment and financial allocations are inadequate to satisfy either the existing statutory responsibilities or meet the new demands required under the new environmental legislation. The State Ministry of Environmental Protection has just 311 administrative staff. Even taking into consideration the staffing of government affiliated institutions in the National Environment Monitoring Station and the regional supervision centers, the staff number is still less than 1,000. In comparison, the staff number of the United States Environmental Protection Agency is almost 16,000. The same disparity applies to relative budget levels as shown in Box 4-2-5.

The staffing shortages are even more apparent among lower levels of government which require more technically skilled staff and capacity but have limited budgets, staff, and management capabilities. In recent years, the governments at all levels have strengthened the capacity of their technical teams and introduced more monitoring. However, in the central and western regions which are areas of significant biodiversity value the local management and law enforcement abilities are still very weak, and in many cases, officials are reluctant to or unable to manage their environmental responsibilities.

Box 4-2-5. Environmental Agency Staffing and Budgets in Several Developed Countries

The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) is charged with the environmental portfolio. The ministry has a staff size of about 1,200. In 2014 it had an allocated budget volume of 3.6 Billion Euros. The German Federal Environment Agency (UBA) has a staff of about 1,400. The German Federal Agency for Nature Conservation has a staff of about 290. The German Federal Office for Radiation Protection has a staff of 708. The German Federal Office for Building and Regional Planning and the integrated Federal Institute for Research on Building, Urban Affairs and Spatial Development have together a staff of approximately 1,250.

The United States Environmental Protection Agency (EPA) is the highest level agency in the United States charged with an environmental portfolio. The agency had a workforce of 15,913 and a budget of about 7.9 billion US Dollars in fiscal year 2013. The Agency has 12 offices, with each supervising multiple sub-offices. In addition, it has 10 regional offices, which are tasked with relevant policies in their areas. Apart from conducting environmental assessments, research, and education, the EPA has the responsibility for maintaining and enforcing national standards under a variety of environmental laws.

The Ministry of the Environment in Japan employed a staff of 2010 in 2012. It includes a Waste Management and Recycling Department, Environmental Policy Bureau, Environmental Health Administration, Environmental Management Bureau, Nature Conservation Bureau and Nuclear Regulation Authority.

4.2.3.3 Root Causes of Problems Relating to Institutional Arrangements

4.2.3.3.1 Inadequate supervision and environmental performance evaluation of party and government policymakers

The GDP-oriented government performance evaluation system continues to be the dominant performance assessment system. Resource consumption, environmental damage and ecological effects have not yet been fully incorporated into economic and social development assessment systems. The weight given to environmental protection in the performance evaluation system for party committees and governments at all levels is too low. Local governments thus lack an adequate sense of their ecological protection responsibilities; environmental inaction and administrative interference in environmental law enforcement have long been problems. Protectionism, which is very prominent at the local level, makes it difficult for environmental protection departments to enforce the law.

4.2.3.3.2 Existing laws and policies are unable to adapt to current environmental management and regulatory requirements

Pollution fees are too low and fail to reflect regional differences and the pollution permit system is not effective. Some standards for pollutants discharge are outdated, and there are few industrial and ambient pollutant discharge standards. The environmental impact assessment (EIA) of projects and the system of ‘Three Simultaneities’ have not been effectively implemented, and there is a serious problem of unauthorized construction taking place before EIA approval. The high costs of law enforcement, the low costs of breaking the law, weak regulatory and supervisory mechanisms and other problems are prevalent and hamper effective implementation of statutory measures. Despite compulsory administrative measures and environmental protection department responsibilities even before the ‘Environmental Protection Law’ was amended, there were many implementation problems at the local level. The laws and regulations did not serve as effective deterrents to illegal enterprise activities. Currently, in environmental cases, the plaintiff has to apply to the people’s court for enforcement; however, enforcement of court decisions is at times compromised because of local protectionism. In addition, there may be limited judicial attention to pollution cases, relatively long enforcement times, and limited ability to enforce decisions. As a result, violations are not being promptly corrected.

4.2.3.3.3 There is no mechanism for determining a role division and relations among the government, market and general public

There is growing recognition of the important role of market mechanisms and broader fiscal measures in environmental protection. But there has not been sufficient use of market mechanisms and institutions that can accurately reflect the values of ecosystem services and natural resources and support good environmental performance. Natural resources remain undervalued despite commitments to introduce market mechanisms to send appropriate price signals. As a result, the cost of enterprises' resource utilization and environmental pollution costs are 'socialized' or 'externalized'. Resource and energy intensive production is encouraged, and enterprises are lacking in motivation and fiscal incentives to nurture the environment and save resources.

Achievement of ecological civilization is dependent on successful engagement with industry and community. Citizens' rights to the environment have not been fully embodied in the law, and there are barriers to effective participation and a lack of effective institutional safeguards. Additional institutional arrangements are needed to promote and aid societal participation in environmental governance. Relevant laws and regulations must exist that give third parties the ability to carry out environmental services and participate in the monitoring of enterprise and government environment performance while also protecting their legitimate rights and interest.

4.2.3.4 The need for policy changes to redefine the relationship between economic development and environmental protection

4.2.3.4.1 Economic development takes precedence over environmental protection

Economic development has taken precedence over environmental protection in China's resource and environment protection laws and regulations, plans and policies. For example, the 'Water Pollution Prevention Law' specifies that the government 'shall, in line with the national standards for water environment quality and the country's economic and technological conditions, establish the national standards for discharge of water pollutants.' As a developing country, water pollution emission standards are currently limited by technological and economic considerations. In many regions in northern China, there is no annual surface runoff, and thus extremely limited water self-purification capacity. Meanwhile, due to the pressure brought about by local competition for development, localities almost never automatically establish more stringent standards to control the discharge of pollutants. With the increase in the number of enterprises in these areas, there is often deterioration of environmental quality even though enterprises meet pollution emission standards. Under the Regulation on Pollution Fee Collection and Use, pollution fees are set taking into consideration the economic and technological conditions as well as the capacity of enterprises. Thus, pollution fees are **set at levels lower than the cost of pollution treatment**. As a result, many enterprises have preferred to pay pollution fees rather than invest in pollution treatment because it is cheaper to do so.

4.2.3.4.2 The benefits from economic development are greater than the cost of environmental damage

For poor areas with less developed economies and substantial environmental carrying capacity, economic development leads to incomes from economic development far exceeding the short term costs of environmental damages. This short-term phenomenon strengthens society's recognition of the rationality of 'pollution first, treatment later.' However, this approach to development threatens the potential for long-term and sustainable development due to diminishing marginal returns and increasing marginal costs from environmental damages. China has entered a peak period of environmental pollution damage. The degradation of environmental quality is causing damage to public health and the ecological environment and huge social and remediation costs. At present, some institutional measures that emphasize the priority of environmental protection have been introduced, but they

are still limited in their approach. They often do not adopt a more systemic approach rebalancing and integrating environmental values with economic and social decision making.

4.2.3.4.3 Current economic benefits outweigh future environmental costs

When future environmental costs give way to current economic benefits, an environmental dividend is created which is instant, short-term and privately beneficial, while the damage is delayed, long-term and of a public nature. Due to intense social competition and the desire for growth, many local governments, enterprises and the public are eager to acquire quick success and benefits even when doing so has negative environmental implications. Due to the short-term and private nature of benefits and the delayed and public nature of damages, most members of society are not willing to give up the pursuit of current environmental dividends because of damages to be felt by future generations.

Weak environmental laws and policies can result in significant environmental dividends while covering up the low efficiency of economic growth, undermining the incentives for technological progress, and even reducing overall competitiveness. In the future, a very high economic price will have to be paid for these environmental debts unless remedial action is urgently taken. International experience in Europe, the USA, Canada and Australia have utilized stringent EIA processes to assess relative risks and benefits relating to development to make these considerations more transparent to government, industry and the community.

4.3 POLICIES AND PRINCIPLES FOR THE REFORM OF THE ENVIRONMENTAL PROTECTION INSTITUTIONAL SYSTEM

4.3.1 Guiding Ideology and Basic Principles for the Reform of Environmental Protection Institutions

Environmental protection institutional innovation will require a systematic focus and the courage to break down institutional barriers and establish environmental protection institutions that promote integration and harmony between environmental quality improvements and economic development and social progress. Some priority areas are:

4.3.1.1 Guiding Ideology and Goals of Reform

The reform of environmental protection institutions should be guided by the spirit of the 18th CPC National Congress and the third plenary's 'Decisions' and with the goal of improving environment quality and constructing an ecological civilization. It will be necessary to create new awareness regarding environmental protection; change behaviors; improve the scientific basis, applicability and effectiveness of institutions; and focus on the integration and coordination of institutions at the policy, planning and operational levels. By 2020, significant achievements will need to be made in key environmental protection areas and in the construction of new institutions that can optimize environmental. Sound, standardized and effective environmental protection institutions should be formed, which can provide institutional support for achieving good environmental quality in harmony with a well-off society.

4.3.1.2 Basic Principles of Reform

The reform of environmental protection institutions should follow these guiding ideologies and insist on the following basic principles:

Harmony between human and nature. The innovation of environmental protection institutions should adhere to the basic idea of ‘harmony between humans and nature,’ establish awareness and move forward implementation of ‘eco-redline’ protection; adhere to the basic principles of respecting, complying with and protecting nature; abandon the problematic idea of ‘conquering nature’; and promote the construction of a resource-saving and environment friendly society.

Expand coverage and enhance effectiveness. Innovation should seek to supplement, improve and develop existing institutions, eliminating institutional gaps and forming a robust ‘institutional chain’ across the fields of ecological and environmental protection, the government’s environmental responsibility system, and the social governance of the environment. Priority also should be made to strengthen existing pollution control institutions and enhance their efficiency and effectiveness with supportive regulations. This needs to be supported by strong scientific research on complex interactions that can be used to make timely policy and regulatory revisions to adapt to new pollution prevention needs.

System integration and synergies. A system wide redesign of environmental protection systems should occur. There needs to be better alignment and coordination between the responsibilities, policies, procedures and laws and mechanisms developed to enable the integration of economic, social and environmental considerations and resolution of any potential disputes.

Synergies should be developed to promote coordination and cooperation. Importance should be attached to coordination and synergies between various environmental protection institutions and other institutions. This will be a difficult but essential part of the reform.

Clear functions and integration of responsibilities and authority. Effective institutional structures require clear lines of authority and responsibility and sufficient financial and human capacity to meet expectations. Equity and fairness principles should apply.

4.3.2 Classification and Construction of Environmental Protection Institutions

Studies have reaffirmed the need to adopt a systematic approach to environmental protection to provide greater leverage and alignment. According to the objectives and principles discussed above, future environmental protection institutions can be classified into three categories based on their objectives, content and coverage: pollution prevention and control; ecological protection and restoration; common and basic institutions.

4.3.2.1 Pollution Prevention and Control

Pollution prevention and control institutions should address source prevention, process management and end-of-pipe treatment. Some of the following institutions may apply to more than one stage.

- Environmental Impact Assessment
- Registration of pollutant discharge
- Pollution permit management system
- Total emission control
- Phase-out of pollution facility, processes and products
- Regional approval suspension
- Cleaner production
- Pollution auditing system
- Time-bound pollution treatment
- Pollution fee/environment tax
- Pollution damage compensation
- Penalty for non-compliance with emission standards/administrative punishment system

4.3.2.2 Ecological Protection and Restoration

- Eco-redline
- Prohibit development in eco-redline regions
- Performance evaluation system to protect eco-redline regions
- Accountability system for destruction in eco-redline regions
- Nature reserve and national park system
- Ecological compensation system*
- Main Functional Zoning system
- List of key protected wildlife
- Special hunting license system for key protected wild animals
- Special harvesting license system for key protected wild plants
- Ecological restoration institution
- Natural recovery institution

4.3.2.3 Common and Basic Environmental Protection Institutions

- Environmental target responsibility system
- Environmental protection performance evaluation
- Environmental audit and life-time accountability
- Emergency responses for environmental accidents
- Environmental monitoring
- Environmental standards
- Environmental enforcement and fiscal support system
- Corporate environmental information reporting and disclosure
- Compensation of environmental damage
- Life-time accountability system for environmental damage (administrative, civil and criminal)
- Enterprise environmental credit system
- Environmental information disclosure
- Tip-off system of public, legal persons and other organizations
- Environmental public interest litigation
- Public participation and supervision system
- Social organization's right protection system
- Social organization management system

* Institutions established or improved by the revised 'Environment Protection Law' adopted in April 2014.

These environmental laws, systems, and measures are part of the more comprehensive environmental protection institutional system. Further study is required to address key implementation challenges.

4.3.3 Reform of the Ecological Environment Protection Management System

4.3.3.1 The reform of the ecological environment protection management system should deal with three relationships

The reform of the ecological environment protection management system will involve an extremely complex set of objectives and tasks. In order to speed up reform and promote the establishment of an ecological environment protection management regime suitable for dealing with complex social and economic transformations and changing natural and social conditions, it will be necessary to seriously study and properly handle the relationships described below:

There should be a clear articulation of the responsibilities of the government, enterprises and society, especially how enterprises and society can support the government's functions. This is a precondition for promoting ecological

and environment protection management system reform as well as for the effective functioning of markets, which rely on governments to reduce uncertainties by establishing rules and procedures and providing information. Governments can reduce risk by defining authority, structures, responsibilities, rights and procedures.

In a market economy, one of the important responsibilities of the government is to provide public goods or quasi-public goods that are not provided by the traditional market economy, such as environmental quality, ecosystem services and natural resource conservation, and help enterprises to internalize their external behaviors, bear the costs of their externalities, and take on their social responsibilities. This is necessary to achieve a reasonable allocation of resources.

In China, the government's responsibilities and commitment to environmental protection are clear. But, because the government has multiple functions and goals in many fields, the government still needs to balance the relationship between environmental protection and other functions. What is most crucial in this situation is to properly handle the relationship between environment and development. Due to long-term environmental debts, the government needs to rebalance environmental protection and economic development, greatly increasing the weight of environmental protection, as well as seeking an optimal path to achieve multiple objectives. Another key problem is determining how to cultivate and strengthen the environmental protection powers of market actors, social organizations and individuals so as to give full play to the role that people can play and find a reasonable allocation of environmental protection functions across actors.

4.3.3.1.2 Relationship between unified management and separate specialized management

Agency structures historically draw boundaries based on various resource use categories such as water, mining and forests. This approach acknowledges the unique challenges involved in their management but fails to sufficiently regard obvious biophysical and spatial connections and broader ecosystem considerations tied to their use. It is very important that institutional mechanisms enable the adoption of comprehensive ecological and environmental protection management approaches that have the ability to address the characteristics of each ecosystem. There is pressing need to better articulate boundaries between environmental regulatory/supervisory entities and natural resource use agencies. The clear allocation of functions is important so that an integration of elements, functions and measures can be achieved. Many models have been pursued in other countries wherein environmental agencies are part of broader organizational clusters or remain as separate stand-alone agencies. Arrangements differ internationally regarding the co-location or separation of ecological environmental responsibilities from pollution control related functions. According to international experience, there are success stories with both management modes. Whether a comprehensive 'super ministry' or various professional independent regulatory agencies should be established is not clear. As countries increasingly realize the importance of eco-system integrity and the systematic nature of problems concerning resources, ecology, and the environment, there is a trend to restructure governmental departments into broader fields or related clusters of resources, the ecology, and environment. Many patterns of restructuring can be seen.

The placement of ecosystem management functions should reflect the fact that natural resources have multiple attributes. For example, forests have both economic and ecological attributes. Many resource agencies have areas of significant conservation significance under their control. International experience favors the co-location of related functions to remove administrative inefficiencies, reduce duplication, improve coordination, minimize poacher game keeper issues, improve monitoring and compliance and facilitate cooperation, communication and information exchange between key entities. Direct support from national government leaders is usually necessary to successfully implement ambitious environmental protection targets especially when they require the engagement of other levels of government, markets and the community. Whether ecosystem management functions,

should be integrated with the regulation of natural resources or the function of environmental protection, is a theoretical question that can have broad implications. In China's present reality, the protection of natural resources and ecosystems is most urgent. This Report has highlighted the urgent need to strengthen regulatory oversight and effectively monitor and enforce compliance. This should be a guiding principle. The preferred choice may be to unify responsibility for the functions of protecting natural resources, controlling environment pollution and managing ecosystems, which are currently scattered across various departments.

4.3.3.1.3 Division of powers between the central and local governments

In most of the major developed countries in the world, the division of powers between the central government and local governments is relatively clear. National governments have retained or introduced powers in relation to some water, air quality and climate change issues as well as to inter-regional issues in response to various crises or as issues gain in priority while most environmental issues tend to be managed by local governments. Central governments have specific administrative and financial control measures as well as directives and action plans to regulate implementation at the local level. There are also some corresponding institutions, such as regional and basin commissions, or regulatory agencies, which coordinate and supervise the behavior of state/local governments to better align national objectives. One of the problems of China's environmental protection management system is that there is insufficient coordination between the central and local governments, and no system or mechanisms to effectively guide and supervise local environmental behavior.

China is a very large country, so ecological and environmental problems have obvious regional and trans-regional characteristics. Thus, the system of environmental protection found in federal states can be used as a reference, i.e. while retaining jurisdiction of major national and trans-regional and inter-basin issues, other ecological and environmental problems should be delegated for local management. At the same time, a system and mechanisms of administrative supervision and fiscal restraint to guide and supervise local governments in the effective implementation of laws, plans, and planning processes and to prompt local governments to really shoulder the responsibilities of ecological protection is critical.

4.3.3.2 Key Direction for the Reform of the Environmental Protection Management System

Reform of China's environmental protection management system should be in accordance with the framework set by ecological civilization institutional reforms and follow the basic rules of nature and ecological systems as well as the laws of management science. In addition, a stronger ministry of environmental protection and stronger environmental protection departments are needed so that both unified and specialized management arrangements can be further improved. Priority needs to be given to defining relevant environmental protection responsibilities of the central environmental protection and other departments, especially the department for comprehensive economic and social development, and establishing a mechanism for assigning them responsibilities and auditing their environmental performance. The mechanisms for coordinating across administrative/biophysical regions and for central government supervision of local governments should be improved, noting that internationally, jurisdictions have moved from administrative to legislative entities to strengthen accountability. This will restrict the ability of local governments at various levels and their relevant departments to interfere with the effective implementation of environmental protection laws and regulations or national environmental targets.

Reforms should establish appropriately authorized monitoring and oversight mechanisms at the leadership level with the authority to resolve any disputes between government entities. They should require regular reports to leaders and the broad community on implementation, monitoring, and supervision.

Box 4-3-1. Independent Monitoring and Policy Evaluation

High level oversight and evaluation mechanisms to review and monitor policy implementation and progress and adjust institutional measures where appropriate are now viewed as critical to achieving Germany's Energiewende. In Germany, the scale of changes demanded by the Energiewende have led to calls for new governance instruments. Greater attention is starting to be paid to the development of low-carbon energy plans, to coordination between the federal and the Länder (state) governments, and to the views of the public. Information exchange, dialogue, critique, support, and monitoring are viewed as essential to a smooth transition towards a low-carbon energy system. It is recognized that coordination of goals, plans, and instruments will be necessary to minimize redundancies and costs. This requires coordination both vertically—from the national to the state and communal level, as well as horizontally, among and between towns and cities and the Länder. It also means a need for systematic monitoring of the Energiewende, a task now being carried out by an independent body that is commissioned by the government. Their report, Energie der Zukunft (Energy of the Future) assesses progress and challenges with meeting Energiewende targets and makes recommendations for improvements.

4.3.4 Reform of Environmental Management Institutions

Strategic transformations in environmental management are needed as discussed below.

4.3.4.1 Key Directions for the Strategic Transformation of Environmental Management

4.3.4.1.1 Necessity and key directions

The strategic transformation of environmental management needs to build on the legal, policy and institutional foundations that have been introduced over the past decade but supplement these with innovative new ideas and approaches to environmental management taking into account current and emerging economic, social and environmental problems that China could face in the future while at the same time showing progress on key environmental targets announced by the government. The objectives, methods and focus of environmental management will require adjustments to deal with different environmental problems than those of earlier phases of social and economic development.

Environmental management should be shifted from a focus on improving environmental quality while continuing to control total emissions. The main areas to consider are:

- (i) Overall environmental conditions. There are many pollutants that can affect environmental quality. Only focusing on a few major pollutants will not adequately address environmental quality problems; an integrated approach has the potential to capture greater co-benefits for the environment at lower overall costs.
- (ii) Environmental quality improvement as the ultimate objective. Different regions will have different natural environmental conditions, industries, and major pollutants. Using environmental quality as an indicator will provide pressure on local governments, and also leave them enough flexibility to reduce administrative costs; drive market innovations and emerging technology.
- (iii) Focus on monitoring and reporting progress and changes. Environmental conditions are relatively simple to grasp by monitoring changes in environmental quality. With this information, it will be easy to reward and punish in a fair manner based on local governments' environmental assessments. At the same time, improved environmental quality will speak to the people's demands.
- (iv) Total emission control is only one of many means that need to be explored to achieve the objective of improved environmental quality.

It is worth noting that total emission control is still an important starting point for pollution control. The total emission control system should be improved by aligning it with broader environmental quality improvement objectives. These ideas can be a guide for environmental management reforms in the 13th Five Year Plan and beyond.

4.3.4.1.2 General ideas underpinning the strategic transformation of the environmental management system

Before the 12th Five-Year Plan, China's environmental management orientation gradually shifted from a general pollution prevention focus to the total emission control of key pollutants. Improvements in environmental conditions occurred. At the end of the 11th Five-Year Plan and early in the 12th Five-Year Plan, China started to pay attention to issues such as heavy metals and PM2.5 and focused more on risk control based on environmental quality, public health and environmental issues.

During the 12th Five-Year Plan, there was also a stronger focus placed on environmental quality improvements and risk prevention. In the 13th Five-Year Plan and beyond, China should incorporate environmental quality management into all fields. Clear improvements in environmental quality and overall achievements in obtaining the target of a well-off society can be expected. Pollution control, environmental quality management and risk prevention will need to be increasingly integrated within each region with a growing focus on environmental quality protection and risk prevention.

4.3.4.2 Enabling Institutions

4.3.4.2.1 Further defining and enhancing the strategic position of environmental management transformation

Environmental departments at various levels should make clear the importance of the strategic transformation of their environmental management systems for eco-civilization construction. They should continuously innovate their management concepts and transform their management ideas. Efforts should be made to further enhance research. By defining the importance of the strategic transformation of environmental management for environmental protection and eco-civilization, there will be a shift in emphasis towards management for environmental quality improvements, a target which could be taken up in the 13th 'Five-Year Plan'.

4.3.4.2.2 Speeding up the establishment of an economic system favorable to improving environmental quality

First, environmental quality improvement should be a goal incorporated into all relevant economic and social development policies. During the development and implementation of strategies for the environment, planning, and industrial policies, the ability to meet state, regional, and river basin environmental quality improvement requirements should be taken into full consideration in order to reduce stress on and radically improve environmental quality. It needs to be guided by strong research and science that can provide options to more effectively link land and resource use activities to carrying capacity. Second, in combination with the objective of improving environmental quality of the air, water, and soil and taking into consideration the industrial structural characteristics of river basins and regions, traditional industrial structures and development modes should be adjusted. Third, investment should be promoted so as to support the transition towards newly emerging green strategic industries and to develop a green economy. Technologies for environmental protection and cleaner production favorable to the environment should be transformed into productivity. Fiscal, financial, and pricing incentive structures as well as ecological compensation and other economic policies should be used to promote environmental protection and resource saving.

Box 4-3-2. Eco-compensation in Basin

From 2009, Hebei province implemented the policy of ‘Responsibility for water quality in river sections and eco-compensation fund’, which set the following regulations for overproof fine: When inflow water quality reach the standard, 100,000¥ for 0.5 times excess of COD in outflow, increase by excess degree, 1500,000¥ for 2.0 times excess of COD in outflow. When inflow water quality exceed the standard, 200,000¥ for 0.5 times excess of COD in outflow, increase by excess degree, 3000,000¥ for 2.0 times excess of COD in outflow. In 2013, 170 million eco-compensation fine was collected to reward the waterhead areas and upstream areas which protected the water environment. This policy effectively improved the basin water environment.

4.3.4.2.3 Promoting Strategic Transformations and Institutional Innovations in All Fields of Environmental Management

Reform and improve environmental protection with environmental quality management as a guiding vision. First, the 13th Five-Year Plan should emphasize the principles of regional management and propose indicators for regional environmental quality. Second, research should be carried out in the fields of environmental science and technology and environmental monitoring to improve relevant standards, monitoring methods and measures. It needs to be supported with high quality, timely, respected and integrated data to monitor and publicly progress and help build and maintain consensus. When implementing various pollution control institutions, such as the EIA system and the total emission control system, environmental quality improvements and environmental risk control should be regarded as the starting point and the ultimate goal of institutional implementation. Finally, it is important for governments at all levels to use environmental quality as a basis for environmental performance assessments.

4.3.5 Reform of Social Governance Institutions

During China’s gradual shift from a planned to a market economy, social organizations lacked vitality and autonomy and citizens had little understanding of self-governance. As a result, the environmental governance system has been dominated by administrative directives. Administrative mechanisms have been stronger than market mechanisms, and both mechanisms have been far stronger than social mechanisms, resulting in a very unbalanced state. This has resulted in weak supervision of enterprises and repeated instances of illegal construction and illegal discharges. There is insufficient public understanding and involvement. Environmental problems have also been behind many cases of public protests. There is urgent need to enhance the weak sectors in the environmental governance triangle, and improve social governance for environmental protection.

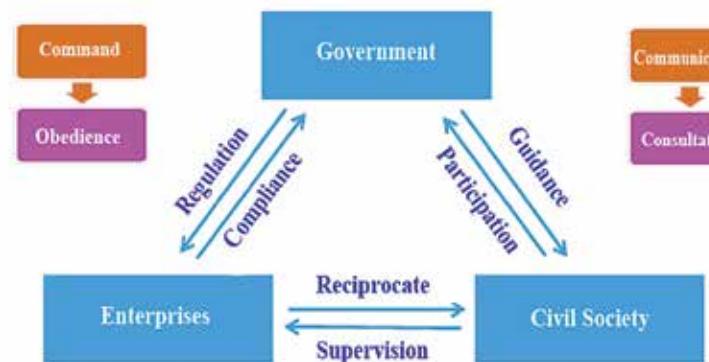


Figure 4-3-1. Multi-stakeholder Environmental Governance

Currently, the reform of environmental protection institutions focuses on restructuring towards an **environmental governance model led by the government but with joint governance by multiple stakeholders**. The government still plays the leading role in environmental protection as it is obliged to provide environmental public services. Beyond this, government-enterprise-public dialogue and cooperation can be strengthened so as to bring into full play the capabilities and roles of different actors, thereby promoting effective environmental governance.

The three features of ‘joint governance’ are: 1) **There are multiple governance actors**. Government should provide institutional guarantees and platforms so that enterprises, social organizations and the public will have wider, more direct and effective access to environmental governance. In particular, the government should create a favorable external environment for all kinds of civil environmental protection organizations. 2) **There are multiple forms of governance**. Apart from traditional administrative regulation, the role of market mechanisms should be enhanced. Extensive dialogue and consultation with all social sectors will become an important means of advancing environmental governance. Committees of villagers, urban resident committees and home owner associations should be encouraged to pay attention to and participate in environmental protection in order to fully achieve self-governance of the community environment. 3) **There are multiple channels of governance**. Beyond disclosing environmental information according to the law, opportunities and channels for the public to participate in social governance of the environment should be established. The government should also establish a regular and long-term mechanism for dialogue and consultation with social sectors, encouraging them to be actively involved in the process of setting up, advancing and implementing environmental policies, plans and projects. Other measures like purchasing services from society and promoting third-party pollution treatment can also be used to support and offer an activity space to enterprises and social organizations so that they too can be involved.

Environmental protection responsibilities should be borne by government and society (including all levels of party organizations, legislative and judicial agencies, various social organizations, enterprises of all types, etc.). Institutional innovation is dependent on moving away from a model that relies largely on one minister or agency in government acting as the sole guardian or advocate for environmental protection and management to one that embeds accountability across all agencies and levels of governments in partnership with industry and community.

4.3.6 General Ideas Supporting Environmental Protection Institutional Reform

In summary, innovations in environmental protection institutions should aim to make adjustments and improvements in line with the overall requirements of ecological civilization construction and promote the establishment of a new relationship between man and nature. Two important questions must be answered: What are the overall requirements of ecological civilization construction? How should the system be adapted to the new requirements and which innovations in environmental protection institutions should be promoted?

4.3.6.1 Overall Requirements of Ecological Civilization

According to the 18th CPC National Congress, there are three main requirements for ecological civilization construction:

- (i) **Raise the strategic position of ecological civilization** and a beautiful China by deepening reforms, promoting a new pattern of modernization, and realizing a national strategy of development that secures a harmonious balance between man and nature. To do this, China will have to pursue economic development under stricter resource and environmental constraints and moving away from the looser resource and environmental constraints of the past. Important changes must be carried out. Weak institutions should be strengthened in order to reduce the large gap between execution capacities and responsibilities.

- (ii) **Incorporate ecological civilization construction into the four major constructions.** Ecological civilization construction should be incorporated into all aspects and processes tied to advancing economic, political, cultural and social progress and society should contribute to building a beautiful China. Achieving a new relationship between man and nature will require inputs beyond environmental and resource conservation departments. The power of the entire society must be mobilized. The government cannot achieve this alone; a new structure of social governance should be built.
- (iii) **Strengthen the system to protect the ecological environment.** The third plenary session of the 18th CPC National Congress stated that ‘in order to promote ecological civilization, we must establish comprehensive and integrated institutions and implement the strictest possible resource protection institutions, damage compensation institutions and accountability institutions. We will also improve environmental governance and ecological restoration institutions, and use institutions to protect the ecological environment.’ This statement highlights the importance of institutions in ecological civilization construction. Institutions take precedence over funds and technologies, as well as morality and self-discipline. Ecological civilization construction will alter economic and social development approaches, touching upon people’s vested interests, and as a result it will encounter challenges. Institutions are an effective way to overcome conflicts of interest and resistance. Ecological civilization construction will take a long time, so it is necessary to establish a long-term mechanism and stable institutions to safeguard progress.

4.3.6.2 General Thoughts Related to the Innovation of Environmental Protection Institutions

Institutional reform of environmental protection institutions shall be based on the following:

First, use legal and regulatory institutions to protect the environment. Research must be conducted and a scientific basis must underpin environmental laws, regulations and standards to ensure their feasibility and effective implementation. Existing laws, regulations and standards need to be revised and amended to adapt to environmental protection needs.

Second, encourage and mobilize all stakeholders to engage in environmental protection in order to form a multiple stakeholder (government, market and society) governance system. Improve implementation mechanisms for stakeholder cooperation and for a system of checks and balances to achieve overall improvements in the effectiveness of environmental protection institutions.

Third, increasingly make use of an environmental management approach where the ‘state provides macro guidance, while localities focus on independent innovation.’ Given the different natural environment and economic development levels of regions, it is important to encourage all areas to explore solutions tailored to their situation. National environmental protection departments should strengthen macro-level guidance, provide fundamental laws, regulations and standards, and minimize the prescription of unified approaches that are applied to all regions. The creativity and initiatives of local environmental departments should be encouraged so that they can fulfill their responsibility to protect and improve local environmental quality. The development of important environmental policies should be based on pilot projects conducted in different places.

4.4 POLICIES AND RECOMMENDATIONS FOR ENVIRONMENTAL PROTECTION INSTITUTIONAL REFORM

The previous sections of this report have analyzed the present status and problems of environmental protection institutions in China, discussed the principles behind an ecological civilization, introduced key principles

(including international experiences), and proposed general directions for reform. This section will propose specific policies and recommendations for much needed reform. Environmental protection institutions are the foundation of environmental protection. A variety of reforms in environmental protection institutions and policies will be needed. The Task Force has focused on reforms relating to pollution prevention and control and ecological and environmental protection. The Task Force suggests policy recommendations related to 5 key areas for institutional reform and further specifies 17 more specific suggestions. In the Task Force's opinion, there has not been sufficient attention paid to several of these key points. These points should now be urgently emphasized. Other points are raised as innovative examples of institutional reforms coming from international experiences; they can serve as practical and feasible ideas and reference points. Other important ideas related to institutional reform covered by special studies of CCICED will not be included here.

4.4.1 Mobilize All Stakeholders to Engage in Ecological Civilization, Clarify Responsibilities, Coordinate Policies and Integrate Objectives

According to the requirements proposed by the 18th National Congress of CPC, ecological civilization is by no means simply the task of environmental protection departments. All departments of the State Council must act to incorporate ecological civilization into their activities tied to advancing economic, political, cultural and social progress. Considering the problems tied to the lack of clarity in the delineation of departmental responsibilities, the fragmented approach to achieving ecological civilization objectives, lack of coordination on river basin and regional environmental issues, and inefficiencies in existing policies, institutional reforms should focus on the following:

- (i) The State Council should further clarify responsibilities linked to an ecological civilization for all governmental departments (especially the economic departments) by developing new responsibilities and functional plans, which define responsibilities, organizational structure and staff size. This would push the responsible authorities to more effectively implement their functions in a resources-saving and environmental-friendly manner. Improvement of environmental quality shall be defined as a hard requirement for local governments. Third party independent evaluation of the performance of relevant ministries under the State Council and local governments should be organized periodically, and the results should be publicly disclosed.
- (ii) Establish a State Council Environmental Protection Committee (or State Council Sustainable Development Committee), with a relevant State Council leader acting as chairman. The Committee shall be responsible for guiding and coordinating environmental protection responsibilities, objectives and tasks of departments; coordinating regional and river-basin ecological protection and pollution prevention/control; assessing environmental impacts of major national decisions; and providing incentives for, or assessing punishments on ministries under the State Council and local governments based on their environmental performance.
- (iii) In the State Council's next round of government reforms, pollution prevention responsibilities should be integrated bringing together the functions of water pollution control and conservation and biodiversity protection. Environmental protection functions should be separated from resource development management functions. Nature reserve management and other cross-cutting functions should be unified under an independent regulatory and enforcement power.

4.4.2 Establish Incentive Mechanisms to Encourage Environmental Protection

China has developed many laws, regulations, polices and standards on environmental protection; however, there are enforcement gaps. Considering the externalities caused by pollution to public property and the environment, it is necessary to maintain pressure on polluters. It is also very important to consider how to motivate companies,

industries and local governments to protect the environment. A sound balance between regulation and punishment and guidance and incentives shall be achieved; that is, both carrots and sticks will be needed. In terms of institutional reform, special attention should be paid to the following:

- (i) Various fiscal and taxation measures and pricing and financial policies that encourage environmental protection should be promoted. Fiscal investments for environmental protection at various levels of governments have long been relatively low. The central government should take the leading role in ensuring that the growth rate of the central fiscal budget for environmental protection is no lower than the growth rate in revenue. Under the ‘polluter pays’ principle, special environmental pollution funds should be set up (e.g., a soil contamination remediation fund) to raise funds for pollution control. For the construction and operation of environmental infrastructure, models of public-private partnerships (PPP) should be used more often to leverage social capital and technology, make full use of market mechanisms, reduce the cost of investment and improve operational performance.
- (ii) An enterprise environmental credit system according to the principle of ‘incentivize credit and penalize dishonesty’ should be established. This can be jointly implemented by the Ministry of Environmental Protection in cooperation with the People’s Bank of China and the China Banking Regulatory Commission (CBRC). Third-party social non-profit agencies and organizations are encouraged to participate in the evaluation. Enterprises should be categorized by their performance. Those enterprises that comply with environmental protection laws should be encouraged; those that deliberately discharge pollution illegally should be cracked down on and publicly disclosed. For small and medium sized enterprises (SMEs), a pollution treatment service platform should be provided.
- (iii) Voluntary action by industries and enterprises — examples being the Green Supply Chain Program and the Top Runner Program, environmental labeling of products, and green procurement — should be promoted. The best performers can be rewarded with incentives provided by the government.
- (iv) Following the principle of ‘he who pollutes pays, he who damages compensates, he who protects benefits,’ speed up the promotion and improvement of an ecological compensation system and mobilize the enthusiasm of local governments for protecting the environment, especially in areas experiencing fiscal difficulties. In the short-term, great efforts should be made to disseminate Shandong and Hebei provinces’ experiences with river-basin ecological compensation pilots.

4.4.3 Strengthen Social Governance of Environmental Protection by Engaging Multiple Stakeholders

Social governance is the weak link in the environmental governance triangle connecting the government, enterprises and society, and should be strengthened in order to modernize the environmental governance system. Currently, environmental demonstrations in reaction to environmental problems are on the rise. The government is losing credibility, and the public has limited ability to control polluting enterprises. All of these points indicate that social environmental governance is a weak link in environmental protection. In order to solve China’s environmental problems, a governance structure led by the government but with the active participation of multiple stakeholders should be developed. To this end, special attention should be paid to the following:

- (i) Public participation, information disclosure and environmental litigation should be promoted as stipulated by the new Environmental Protection Law. In terms of environmental information reporting and disclosure, a key focus should be enterprises’ self-reporting of their pollution discharges, pollution treatment and the environmental risks of the pollutants being used. Enterprises should report to the government and release

information to society as prescribed by regulations. Social organizations and the public should have the right under the law to require environmental protection departments and enterprises to provide environmental information. Punishments should be developed for those enterprises that fail to provide information in a timely manner as required by law.

- (ii) Environmental protection social organizations should be encouraged to play a role in environmental governance. A supportive environment that facilitates their involvement should be developed. Laws and regulations that protect their legitimate rights and interests as well as regulate their behavior are needed. Mechanisms that encourage public and private funding of social organizations, including government procurement of their services and a tax exemption policy for public welfare projects, should be developed.
- (iii) Encourage grassroots organizations (including committees of villagers, urban neighborhood committees, property owner committees, etc.) to focus on environmental management issues and embrace the public's environmental demands. Develop community by-laws for environmental protection, advocate green lifestyles, solve the problems of noise pollution and garbage separation via self-governance, and cooperate with the government to collect sewage treatment fees and refuse disposal fees in accordance with established rules. The government should provide environmental information, give guidance and training, as well as establish a mechanism for regular communication and consultation.
- (iv) The CCICED or relevant departments should conduct special research on the Aarhus Convention, so as to draw lessons from international experiences related to public participation in environmental protection and multi-stakeholder governance.

4.4.4 Match the Environmental Protection Department's Authority, Capacity and Resources to its Supervision and Management Functions and Tasks

As a large developing country that has experienced rapid economic development, China is experiencing extremely complex environmental problems. China has formulated many laws, regulations, policies and standards, and has decided upon a grand vision of building a 'Beautiful China'. To achieve this goal there must be an organization with sufficient authority and a strong team to steer environmental protection work. The national environmental protection agency only became a department of the State Council in 2008. The environmental protection department has long been a weak division and as a result has struggled to fulfill its mandated tasks. Substantially strengthening the environmental protection department's supervision and management functions and enforcement ability should be top priorities. Special attention should be given to the following:

- (i) The provision in the Environmental Protection Law which specifies that the competent department of environmental protection 'conduct a unified supervision and management of the environmental protection work throughout the country' should be enforced. The State Council should formulate relevant administrative rules and regulations that clearly specify the responsibilities, authority and work procedures for environmental protection departments to be able to supervise the environmental protection work carried out by government departments at the same and lower levels. Such supervision is to be carried out by environmental protection departments in collaboration with supervisory departments, and the results should be publicly disclosed to effectively enhance the supervision and enforcement authority of environmental protection departments.
- (ii) Establish a unified environmental information platform to achieve timely and accurate data sharing. Develop relevant plans, standards and procedures to guide various departments and local governments to collect and disclose environmental information. Set up a national environmental quality monitoring network under the unified management of the Ministry of Environmental Protection. Reform the environment statistical

system. Gradually establish a statistical data collection system based on surveys made at sampling sites and use the material balance and pollution discharge coefficient method to improve data quality and reduce the potential for external manipulation of data. Improve the quality of the China Environment Bulletin providing more details on environmental protection activities, especially the evaluation results of local government environmental performance, so as to increase the transparency and influence of the Bulletin.

- (iii) Increase fiscal investments in environmental science research, monitoring and information capacity, and supervision and enforcement capacity, and improve the efficiency of the use of funds. Reform public institutions for environmental protection, adjust and optimize their organizational structure, and reduce the staff size that is supported by public funds. Encourage provision of environmental services through market mechanisms. Increase the number of civil servants in environmental protection departments to match their workload. Meanwhile, improve the management competency and public communication ability of environmental management staff, speed up the development of legal interpretations of the duties of environmental law enforcement staff, and require them to strictly adhere to implementation procedures prescribed by environmental protection laws and regulations.

4.4.5 Reform Environmental Management Institutions to Improve the Efficiency and Effectiveness of Implementation

Currently, there are multiple systems regulating emissions of industrial pollutants, including total emission controls, environmental impact assessments, the ‘Three Simultaneities’ system, pollution permits, pollution discharge fees, etc. In addition, there are emission standards for various pollutants and environmental quality standards which are used as quantitative requirements and pollution control targets. However, environmental pollution remains severe and quite a number of enterprises are not in compliance with emission standards. Institutional arrangements have contributed to enforcement problems. There is a need to review the scientific basis and rationality of these systems, increase enforcement efficiency by improving and integrating implementation mechanisms, and revise environmental protection laws and policies based on scientific research and environmental management needs. The following reforms should be pursued:

- (i) Based on scientific assessments, reform the total emission control system to improve environmental quality and bring regions into compliance with environmental quality standards. Develop a comprehensive total emission control system that covers primary pollutants, and CO₂ emissions from the consumption of fossil fuels. Put in place regional, river-basin and sectoral total emission control systems that are based on each region’s environmental carrying capacity. Incorporate total emission controls for enterprises and other institutions into pollution permit systems. Strengthen permitting standards for high energy consuming and emission producing as well as resource-intensive industries. Define specific requirements for resource and energy savings and pollution discharges. Finally, reform the requirements for environmental permits so as to take into consideration regional resource endowments, environmental capacity and ecological conditions.
- (ii) Speed up the formulation of relevant laws and regulations and implementation methods for an emission permit system at the national level. Provide a legal basis for the establishment of a nationwide emission permitting system which is unified, fair, feasible and embraces all kinds of pollutants. Total pollution discharge limits should be defined according to emission standards, cleaner production levels and the total emission control indicators for local environmental quality. All pollutant discharging entities should register their emissions with environmental protection departments which should be the issuing agents of pollution permits under a unified regulatory system.

- (iii) Reform the environmental impact assessment (EIA) system to achieve coordination with the pollution permitting system. A pilot can be tried that integrates EIA and pollution permit approval with the aim of developing less-environmentally impacting industrial projects, a more simplified and unified permit system, and a more efficient environmental approval process. The EIA system should be applied on strategies, plans and policies, as well as cross-regional and river basin projects that may have significant ecological impacts.
- (iv) Strengthen the link between environment and health institutions and the ecological environmental damage compensation and accountability system. Increase the cost for enterprises and individuals of violating the law causing ecological damage. Despite the efforts made by environmental protection departments, it is also important to strengthen the responsibility and capacity of the judicial system to investigate environmental violations. There should be proper and timely handling of disputes tied to environmental damage compensation and fair expectations regarding burden of proof requirements in environmental damage cases. Establish mechanisms for appraising the scope and costs and assessing the responsibilities for environmental damages. Improve the public interest litigation system, and accept public interest environmental cases filed by governmental and social organizations according to laws and regulations in a timely fashion. Strengthen the intensity of investigations into environmental criminal liability to ensure offenders are sanctioned accordingly.

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This report is submitted by the CCICED Task Force on Institutional Innovation for Environmental Protection in the Context of Ecological Civilization.

CHAPTER 5

GOOD CITY MODELS UNDER THE CONCEPT OF ECOLOGICAL CIVILIZATION

URBANIZATION DEVELOPMENT PATTERN AND INSTITUTIONAL RESEARCH IN THE CONTEXT OF ECOLOGICAL CIVILIZATION

CCICED Special Policy Study Report

CCICED 2014 Annual General Meeting

December 1-3, 2014

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REPORT SUMMARY

China's urbanization will continue to be at an enormous scale, characterized by quick changes and a short window to implement policies. The policy objectives include the permanent settling of 100 million migrant workers and their families; improved housing for another 100 million urban dwellers; rural-to-urban migration and new employment for yet another 100 million people. The target is to reach these goals before 2020, soon after which population aging will have shrunk the possibilities for undertakings at this scale. This development places a great burden on environmental and natural resources in and outside China. At the same time, it offers the opportunity to apply the best insights about how to reach an Ecological Civilization and a Beautiful China.

Key Findings

The key challenges China faces in working towards an Ecological Civilization are:

1. Due to **lack of coherence** among government bodies, the current planning system fails to sufficiently protect the environment and control the use of natural resources.
2. Urbanization is fast and expansive, leading to excessive resource consumption that **cannot be sustained**. Growth causes significant damage and risks when it intrudes into natural areas such as mountain areas and river flood beds.
3. Urban development does not take **climate change** into consideration. Chinese cities are therefore unprepared for an increase in extreme weather events such as heat waves and floods.
4. Large scale and fast construction of residential housing causes a **loss of environmental services to inhabitants**. This is exacerbated by liveability problems related to urban design and building typology.
5. In many rapidly expanding agglomerations, the **urban transportation system** is unbalanced and a major cause of air pollution. This self-perpetuating problem quickly escalates.
6. The natural and cultural heritage of cities is being lost at a large scale, eroding their **identities and attractiveness**. Liveability and the human scale are weak in current Chinese urban design and are under further pressure due to lack of coordination, imbalances in planning and increase in automobile traffic.

7. China lacks regulatory and fiscal mechanisms to incentivize efficient resource use and recovery. Efforts to promote judicious use of natural resources in urbanization are handicapped by the multitude of agencies to be coordinated and an absence of clear sustainable development guidelines from the central government to provincial and municipal governments.
8. Mechanisms for public participation in environmental aspects of urban development are in need of updating and improvement to encourage people-oriented urbanization.

This Special Policy Study analyzes these challenges, in the light of international experiences. From this analysis, the following was found.

Firstly, the findings support the need to **integrate sectoral and spatial policies** at the city level. Integrated diagnostics should become the basis for improving policy coherence, increasing public participation and measuring performance.

Secondly, this study underlines that around the globe, **cities lead** in their own development and on other issues. The national level in China should create a holistic framework to support urbanization at the provincial and local levels.

Thirdly, this report underlines that due to the multitude of dimensions to consider, there is no single best city model. Despite this, there are **key issues** that should be considered in every well-planned urban design.

Fourthly, it finds that urban spatial layout **endures for centuries**, and buildings are generally financed and endure for several decades. Therefore, sound planning must allow room for foreseeable future needs such as new infrastructure and new public facilities to care for an older population.

Finally, this study identifies the need for Chinese cities to base their development on stable **financial resources** more than is currently the case. This should reduce over-reliance on land development as a source of local public finance.

SUMMARY OF MAIN POLICY RECOMMENDATIONS

Know what is going on and set objectives and limits based on integrated spatial planning

- Establish and improve a spatial control system at the provincial and municipal level to promote efficient developments in the urbanization process and protect ecosystems. At the provincial level, establish ecological redlines.
- Prioritize an urban spatial layout favouring the health of the environment and its residents.
- Strictly implement of national standards for the per capita built-up area. Check unreasonable growth and random sprawl. Encourage re-use of existing buildable land and old building stock.
- Promote regional collaborative governance. At the city level, use a selection of existing pilot cities to test multi-sectoral collaboration for ecological civilization.

Plan for financially-sound and adaptive development

- Financing for local government operations and initiatives must become much more independent from selling and developing land. Alternatives should be explored such as rule-based transfers from the central government's budget. When land markets are set up in China, provision should be made to ensure that environmentally sensitive or high priority green space lands will remain in public control.

- Greater attention should be given to climate resilience and other urban environmental planning issues within an adaptive risk assessment framework.
- Cities should be permitted and even encouraged to engage in green bond markets as a means to invest in green urban infrastructure.

Adhere to people-oriented urbanization

- Provide administrative officials, especially mayors, with more in-depth training on implementing resource-saving, environment-friendly and low-carbon green development. Support public awareness campaigns and urban educational initiatives under the concept of ecological civilization.
- Let the human scale prevail in urban design. Promote and ensure cities' own identities through deliberate protection of natural and cultural heritage.
- Establish a system to monitor and assess urban developments in relation to environment, nature and resources. Establish a fuller set of environment and resource use targets for the performance evaluation of city officials. Regularly publish up-to-date projections and assessments of future health risks to urban populations. Provide a reliable legal basis for public participation in urban social governance.

5.1 THE FEATURES AND IMPACT OF URBANIZATION ON REGIONAL RESOURCES AND ENVIRONMENT

5.1.1 Trends in Urbanization in China

At the end of 2013, the urbanization rate in China was 53.7%, a growth of 4% since 2010. The average annual increase of 1.3% represents the migration of 18 million people per annum which is a speed and scale of growth rarely seen in the world. This massive migration from rural to urban China impacts the structure and spatial planning of cities and towns throughout the entire country.

5.1.1.1 Migration and Social Change

5.1.1.1.1 Gradual shift from large-scale cross-region to inter-regional migrations

China's long-distance, large-scale population movements associated with rapid urbanization have continued for almost 20 years. By the end of 2013, 62%¹¹³ of laborers were migrant workers. Mega-cities, such as Shanghai, Beijing, Shenzhen, Dongguan, attract over 43.5 million floating workers, which accounts for 51% of inter-provincial migrants. Rural populations, especially the young, are hoping to move to mega-cities.

China's aging population will result in a reduction of the total workforce and a narrowing of the wage gap. Future population movements will vary from region to region and will tend to move within the county. Inter and intra-regional movements will center on economically developed urban clusters, with an inflow of population from nearby provinces. For example 2013, 78% of the migrants from Anhui province entered the Jiangsu-Zhejiang-Shanghai region; 85% of the outflow from Guangxi and 64% of outflow from Hunan entered the Guangdong province; 66% of the migrants from Hebei entered the Beijing-Tianjin region. At the same time, there has been a significant increase of intra-regional migration within provinces, which increased from 47% in 2008 to 53% in 2012¹¹⁴.

¹¹³ Source: 2013 Annual Monitoring Report of Migrant Workers

¹¹⁴ Source: 2008 and 2012 Annual Monitoring Report of Migrant Workers

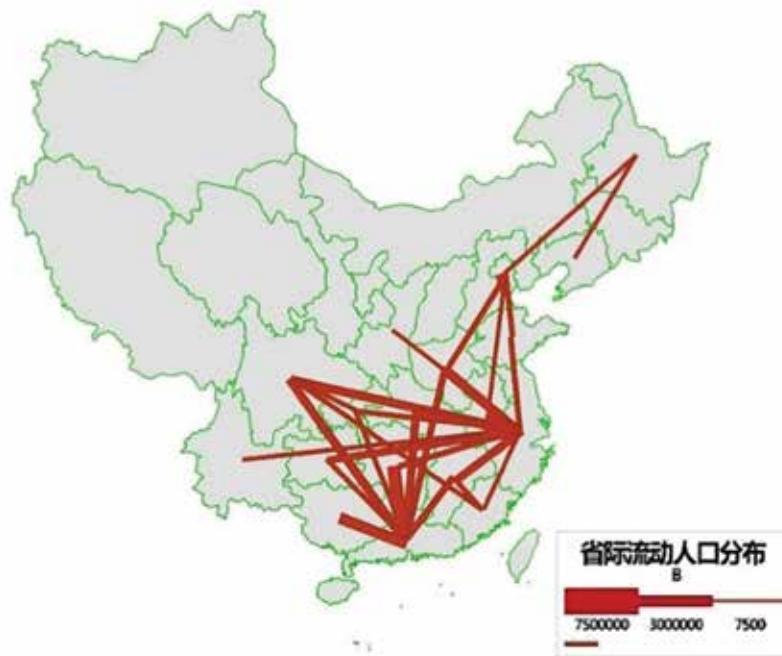


Figure 5-1-1. Direction and scale of inter-provincial population flow in 2010
Scale above 500,000 migrants per year.

Source: Drawn by author, according to statistics of the 6th demographic census

5.1.1.1.2 Living in both the city and the countryside, working in industries and in the fields

A large percentage of the rural population is employed in non-agricultural sectors in nearby counties or small towns¹¹⁵. These people live in rural areas and commute daily to their work. With the economic growth in counties and towns, non-farming employment opportunities have grown rapidly, prompting an increasing number of rural laborers who choose to work close to home and commute daily. According to a survey across 20 counties by the China Academy of Urban Planning and Design, 80% of people over 40 work near their residences, in farming and non-farming occupations. This statistic increases to over 90% for people above 60 years of age. At the same time, with increased savings and advancing age, more and more migrant workers chose to return home; and more rural households invest in homes near towns while still retaining their rural housing. Despite these movements, the continuous migration away from rural areas, and an aging population means that villages are likely to continue to be increasingly abandoned.

Table 5-1-1. Survey of employment sectors for rural workers in 2013

	Farming	Farming & manufacturing	Local manufacturing	Migrant worker	In school or army
16-19 years old	3%	2%	5%	15%	75%
20-29 years old	9%	9%	23%	46%	12%
30-39 years old	13%	25%	26%	34%	2%
40-49 years old	22%	37%	20%	20%	1%
50-59 years old	30%	43%	15%	9%	3%
60-64 years old	37%	46%	8%	4%	5%

Source: Research data collection of CAUPD in 2013 in 20 counties in China

115 For a detailed overview on rural-urban development in China, see China Small and Medium Towns Overview. International Bank for Reconstruction and Development / The World Bank, Washington, D.C., 2012.

5.1.1.1.3 Separation of families and aging population are becoming prominent social issues

China's urbanization has resulted in separation of families among migrant workers. High housing costs and living expenses in large cities make it difficult for migrant workers to move with their families. Only 0.6% of migrant workers are able to become home owners in the cities where they work. Migrants often suffer from prolonged separation from their families, especially between migrant worker parents and their children. A large number of elderly parents, women and children are stranded in rural areas, often without any able-bodied younger family members to take over farming responsibilities.

Issues associated with the aging population have become more pronounced. In 2011, the number of people over 60 was 178 million, or 13% of the total population. In rural areas the percentage was 15%, 2% higher than the national average. In the future, the proportion of the population over 60 will increase 0.35% per year. After 2030, the proportion of people over 60 will exceed 20%. China will reach a turning point for population dependency in 2015, when the elderly population will exceed that of the children. This will put considerable burden on Chinese society.

5.1.1.2 Characteristics of Population and Industry Clusters

5.1.1.2.1 Pattern of agglomeration in coastal and mid-western regions

At present, the Yangtze River Delta, Pearl River Delta, and Beijing-Tianjin-Hebei regions have the highest population density with the largest clusters of cities and towns. These urban regions are anchored on key cities with international influence (Beijing, Shanghai, Guangzhou, and Tianjin) with smaller cities in key supporting roles. This forms a pattern of "multi-centered and urban networked regions". In the future, urbanization will continue in these locations, which are key regions for China in terms of their global competitiveness. These regions will increase their pace of industrial upgrading by attracting technical professionals instead of manufacturing laborers. The national economic development strategy shift from export oriented development in coastal regions to balanced national development will create more opportunities for cities in the central and western regions of China. China is actively promoting the Yangtze River Economic Belt and the Silk Road Economic Belt. Border Region Opening-up and Development strategies are generating development opportunities in inland urban agglomerations, along regional transportation corridors and in border ports. New urban clusters will gradually form in the Yangtze River area, the Chengdu-Chongqing area and the Central China area.

5.1.1.2.2 Pattern of towns agglomerating around central cities

China has gradually formed a development pattern that focuses on towns clustering around cities. While the upgrading of the industrial structure in central cities allowed them to become service oriented economies; the processing and manufacturing industries have shifted to less expensive parts of Western and Central China.

5.1.1.2.3 Pattern of agglomeration in counties

In recent years, county towns have increased their population and industrial capacity. In 2010, the proportion of urban population growth in county towns in central and western regions was 70% and 60% of the region's total urban population growth. Rural migrants and investors for new businesses have been attracted by the rapid development of industrial park sites and the availability of key social services, especially education and medical services. Despite these gains, small towns have much poorer service levels compared to larger cities. For example, in 2011 in smaller towns there were only 2.8 hospital beds per thousand, far below the average in large cities of 6.2 beds per thousand.

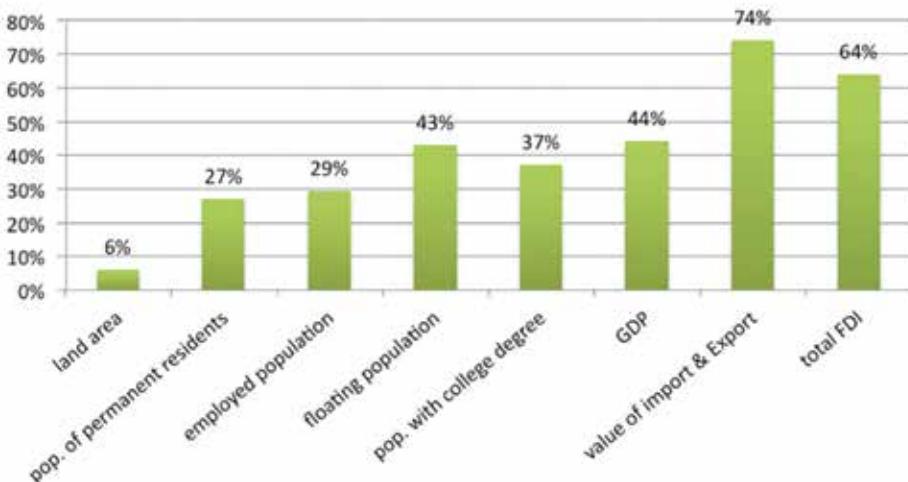


Figure 5-1-2. Share of the Three Major Urban Agglomerations, Yangtze River Delta, Pearl River Delta and Beijing-Tianjin-Hebei

Source: CAUPD Report 'Optimizing the Layout and Pattern of Regional Urban Agglomerations'

5.1.1.3 Development Trends and the New Demands of Urbanization

5.1.1.3.1 Projection for the scale and speed of urbanization in 2020 and 2030

Population projections indicate that overall China's speed of urbanization will slow down, but that the urbanization in Central and Western regions will speed up significantly. In the Central and Western regions the urbanization rate is expected to increase by 0.8 to 0.9 percent annually between 2013 and 2020, reaching 60% urbanization in 2020. The national annual increase is expected to be lower at between 0.4 to 0.5 percent after 2020, reaching 65% urbanization in 2030. Even though the speed of urbanization will slow down, the growth is still huge. The urbanization processes which took place in OECD counties over a period of 100 to 150 years are happening within 15 to 20 years in China, which is a compression of "space-time"¹¹⁶. China's urbanization will face enormous challenges for a long time in the future.

5.1.1.3.2 Employment and accommodation demands of rural migrants

Before 2020, 100 million additional migrant workers and their families will settle in cities and towns, the housing and living conditions for 100 million people residing in urban areas will have been improved, and employment will have been provided to 100 million people who will transfer from rural areas to cities and towns. To solve the "citizenization" of such massive migrant populations, the *National New Type Urbanization Plan* (2014-2020) proposes ways to diminish the gap between census registered urban populations and the permanent resident urban population, from 18% in 2013 to 15% in 2020.

¹¹⁶ Marcotullio, Peter. Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. Springer Open. 2013.

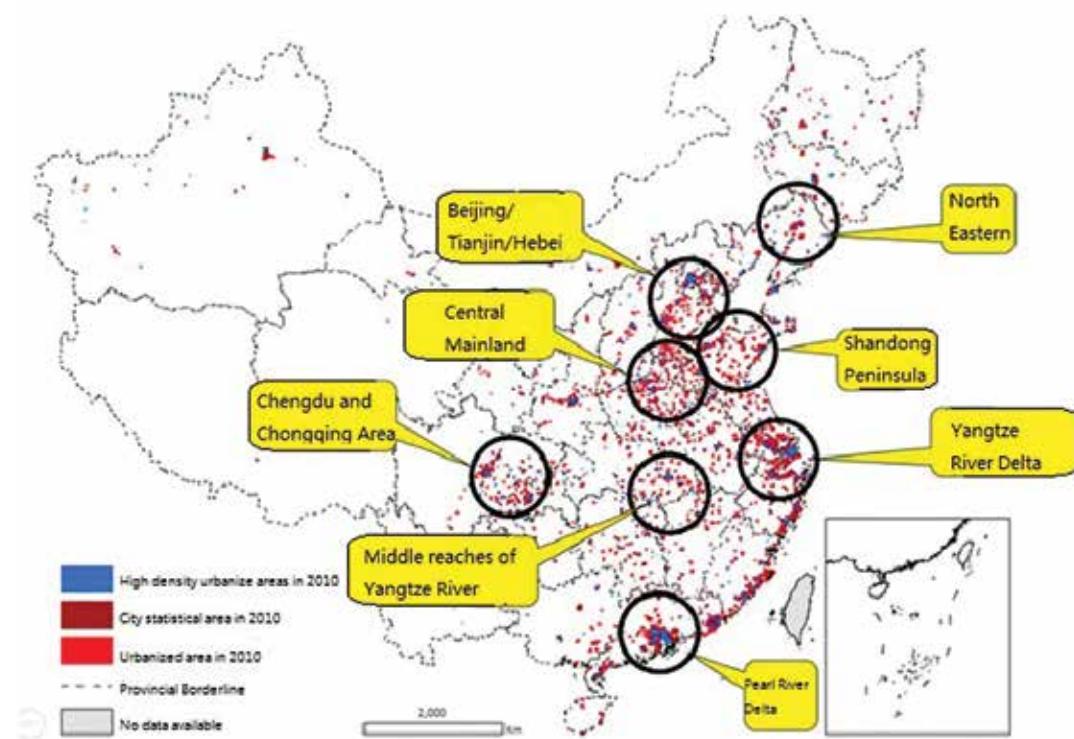


Figure 5-1-3. Distribution of Eight 100-Million-Population Urban Agglomeration Regions

Source: BCL data base of population density (county, town and street)

5.1.1.3.3 New demands of the existing urban population

The urban middle class is one China's fastest growing demographics. This group demands improved quality of life and more diversified consumer products. The growing demands include matters such as living space, living environment, expenditures on health care, education, culture, entertainment, fitness, recreation and spaces for social interactions. The consulting group Euromonitor forecasts the growth of the middle class¹¹⁷ in China, India, Brazil, Indonesia and other countries. China's middle class is expected to increase from 18 million in 2000 to 200 million in 2020.

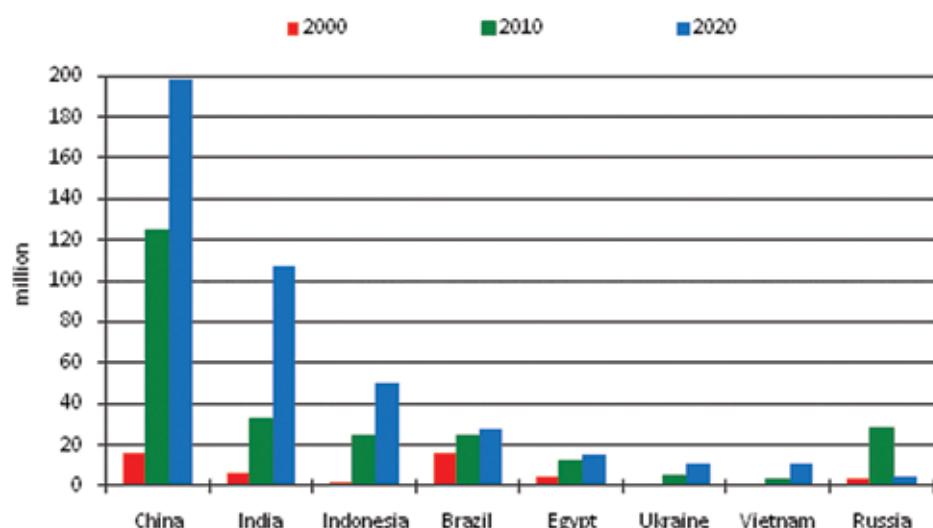


Figure 5-1-4. Development of the size of the middle class

Source: Euromonitor

¹¹⁷ According to purchasing power, with average annual household income between USD 5000-15000.

The chart by Euromonitor (2010) provides comparative figures about the size of the middle class for three decades starting in 2000.

Taking stock of vacant lands:

There is significant inefficiency in urban land use. According to the Ministry of Land and Resources, the amount of underutilized lands in China's cities and towns account for 5000 km², which is 11% of the total built up urban area. In 2012, vacant land accounted for only 5% of the total land approved for development.

Taking stock of vacant houses:

The Urban Housing Vacancy Rates and Housing Market Trends survey conducted by Southwest University, suggests that the overall vacancy rate of China's urban housing market reached 22% in 2013, up 1.8 percentage points from 2011. Even after accounting for renovations, sublets and special rural housing, the percentage is still 18%.

5.1.2 Urbanization will increase pressures on land resources, the environment and municipal finances

5.1.2.1 Steady Increase in Pressure on Ecological Resources

China's process of rapid urbanization, will produce an extra housing demand of 450 million square meters and a demand for 120 to 150 million cars. This will spur significant production of steel, cement, building materials and mineral resources.

Energy and water consumption is growing in cities and towns. At the present time, although China's GDP per capita is half of world's average, the consumption of energy per capita is the same as the world's average. Demand for water and the pollution caused by inadequate wastewater treatment in urban centres is putting pressure on the country's limited water resources, particularly in eastern China.

Urban expansion reduces space available for the regeneration of plants, animals and other biota, which has led to a substantial transformation of the natural environment. In addition, the increased demands of urban residents for leisure, exercise and sports will put a strain on the natural environments of the cities' surroundings.



Figure 5-1-5. Urban housing vacancy rates in six cities

5.1.2.2 Environmental pollutants will continue to increase and spread to surrounding regions

With the shift of China's industrial economy from the coast to inland along with accelerated development of inland towns and cities, China's pollution will gradually shift from the coastal to inland regions. As China's major rivers flow to the west, the transfer of industries upstream along rivers is bound to increase the pressure on these water resources. Pollution will gradually expand from cities to the countryside. In recent years, persistent atmospheric haze across regions means that health problems are becoming more prominent for urban and town residents. This will increase the burden on public finance and households for medical expenses. Over the past 30 years, the rate of malignant diseases caused by water, land and air pollution have skyrocketed. If environmental quality continues to deteriorate there will be alarming consequences.

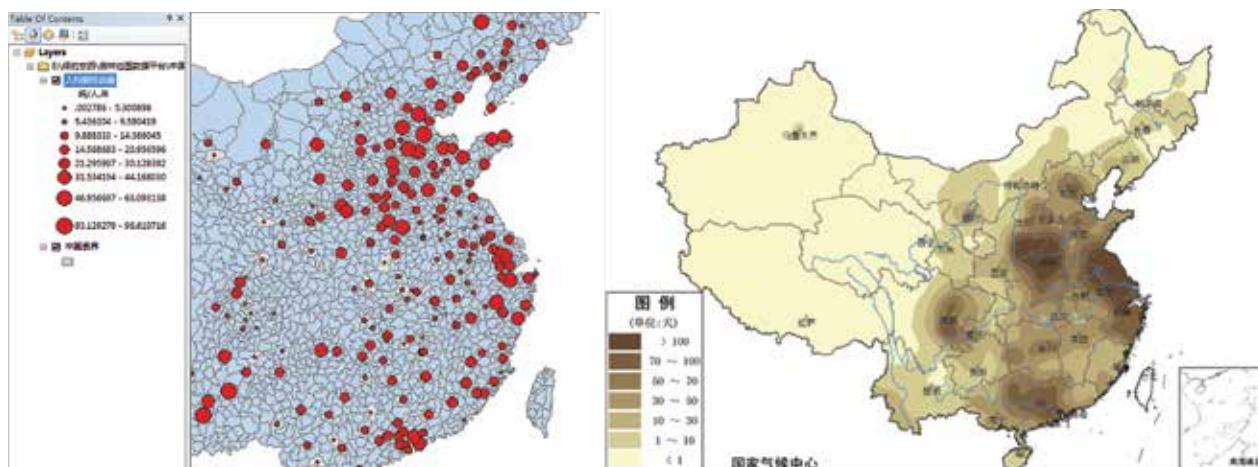


Figure 5-1-6. 2013 Per capita carbon emission (tons/year) and the number of days of heavy smog

Source: Left, drawn by author according to local statistic yearbooks. Right, National Climate Center

In 2013, the top ten cities with the worst air pollution were Xingtai, Shijiazhuang, Handan, Tangshan, Baoding, Jinan, Hengshui, Xi'an, Langfang and Zhengzhou. Seven of which are located within the Beijing-Tianjin-Hebei region. The average concentration of PM2.5 in Beijing is 89 micrograms / cubic meter, 1.6 times more than the safe standards set by the Chinese government.

Source: 'Air quality report for 74 Chinese cities' in 1st quarter of 2013 and '2013 Air quality report of urban agglomeration, direct-control municipality, and provincial capital'

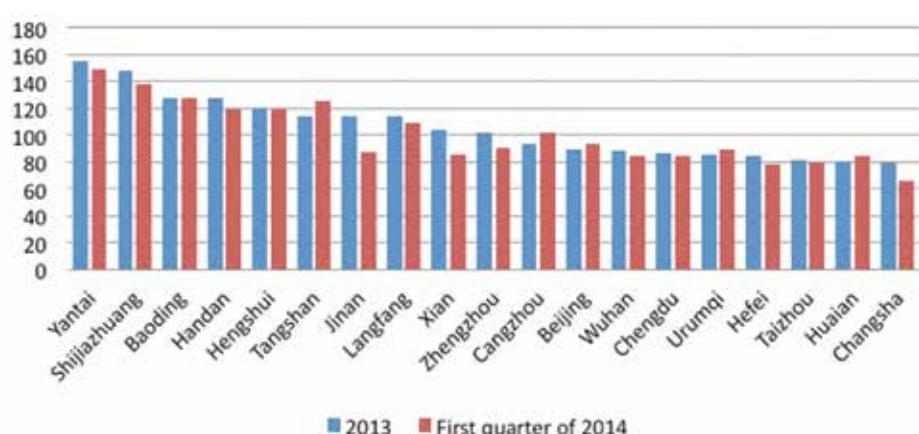


Figure 5-1-7. PM2.5 index for the main air monitored cities

Unit: microgram/cubic meter Source: Draw by author, according to National Environmental Monitoring Center

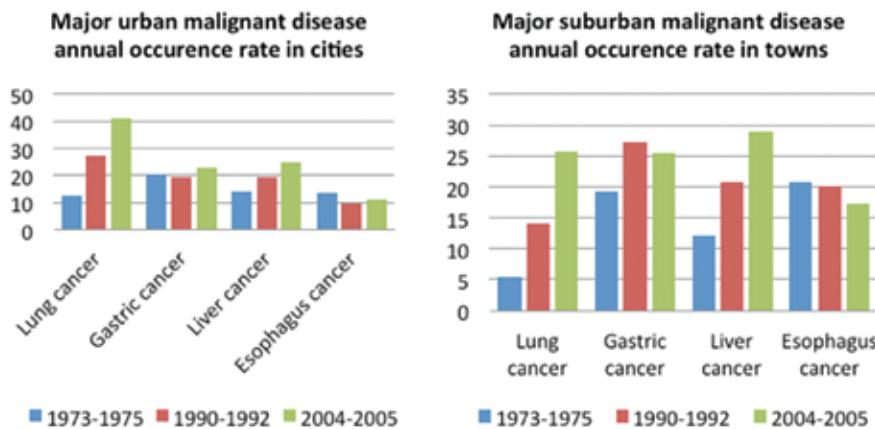


Figure 5-1-8. Major urban malignant disease occurrence rate in cities and towns

Unit in both charts: 1/100000 Source: 2012 China Health Statistic Yearbook

5.1.2.3 Increased Pressure on Urban Public Finances

There will be future pressures on the public finances of cities on two levels: i) investments from governments in environmental protection, ecological restoration, industrial upgrading will significantly increase; and ii) investments in public services by government will increase, with expected annual investments reaching USD 1,800-2,200 million. In this way it is expected that urban China can provide housing, employment and social security for 10 to 12 million rural migrants/ per year. Overall, this government expenditure will account for 16-20% of local public revenue.

Ratio of government debt in proportion to land: Data from the National Audit Office indicates that the four levels of governments are in debt by over RMB 14 trillion, the majority of which are new debts. A report called *The Debt Burden of Chinese Government Show Varying Degrees of Credit Risk* indicates that the provincial levels of government debt range from 69% to 156% of revenue. Due to government's financial dependence on land finance, land debt still accounts for a majority of the debt of local governments. Currently, the proportion of land debt in Zhejiang, Tianjin, Fujian, Hainan and Beijing are ranked in the top five and exceed 50% with Zhejiang at 66.3%.

5.2 NINE CHALLENGES OF URBANIZATION UNDER THE IDEOLOGY OF ECOLOGICAL CIVILIZATION

5.2.1 Environmental resources inadequately managed by current planning system

The three government agencies currently principally responsible for urban space, resource use and urban development are: the National Development and Reform Commission; the Ministry of Housing and Urban-Rural Development; and the Ministry of Land and Resources. Their respectively key plans are: social and economic development; urban master planning; and land use planning. Due to the breadth of these large portfolios and lack of coordination, contradictions frequently occur in spatial and resource utilization, guidance and control methods. The current urban planning framework has been unable to provide sufficient support for environmental protection and sustainable use of resources.

China has adopted the *Environment Impact Assessment* process (1980s), and the *Strategic Environmental Impact Assessment* plan (1990s) as evaluation mechanisms. The *Environmental Impact Assessment* process is now becoming legally binding. China has not yet established a statutory environmental planning process that engages all stakeholders from the central government to the cities and towns. For a new vision that promotes economic development and safeguards China's natural resources, new policies and regulatory structures are required.

5.2.2 Speed and scale of development creates excessive consumption of resources

From 1978 to 2013, China's urbanization rate increased by 1.02 percentage points each year. Between 2003 and 2013, China's GDP growth averaged 10.7% annually. Increase in investments led to the growth of cities which increased reliance on resource consumption rather than conservation. Resource-intensive industries account for a large portion of GDP and industries with high energy use account for 50% of total energy consumption. The land used in urbanization is unreasonable. For example, from 2001 to 2010, the annual growth of urban areas was 6.0%, while annual urban population growth was only 3.8%.

The transfer of state-owned construction land increased from 1787 km² in 2001 to 4326 km² in 2010¹¹⁸. Per-capita rural-urban construction land increased to 176 m² per capita in 2010 from 153 m² per capita in 2000. The fact that local governments gain significant income from the land market is the main motivation for cities to expand. Reliance on land for financing has favoured the development of the real estate market at the expense of more inclusive urbanization processes.

More Information:

Some resource-based Chinese cities have long relied on the low-cost of resources by using a low input-and-output efficiency model. They are less motivated to contribute to industrial transformation and improved efficiency of resource use. Once resources are depleted, cities will quickly fall into a recession. Currently, most Chinese cities are enjoying dividends brought by land and high property prices, which poses large risks.

5.2.3 Urbanization poses serious threats to the environment

During the past 30 years of China's rapid urbanization some towns and cities have severely affected the balance, quantity and quality of regional water supplies. Some towns and cities are located in river flood and flood retarding basins, which exposes them to flood risks. Other cities and towns have acquired land through large-scale demolition of mountains, thus damaging forests and causing soil erosion and flood risks. Other cities and towns have expanded into formerly highly productive farmlands, and in some cases forced farmers to relocate to less favorable places on mountain tops by implementing the policy of "occupy one and compensate one". Such actions damage eco-systems, while the waste generated by the cities damages the natural environment, disrupts eco-balance and degrades bio-diversity.

China has varied climate zones, topographic features and biodiversity. Thus, different cities face different natural disaster risks. China's fast urbanization ignores these unique features and follows a one-track model, which lacks planning and coordination at the regional level. This results in higher occurrence of floods, water logging, air pollution, poor water quality and damage to the eco-system. Recent reports about pollution incidents include those in the Han River, Wuhan stream of Yangtze River, and in Changzhi, Shaanxi.

118 China Land and Resources Statistical Yearbook 2011.

More information

China has tropical, subtropical and temperate areas and is classified into 21 climate zones. These zones have varied sunshine, wind, rainfall and other climate conditions which make them vulnerable to different natural disasters, like typhoons, rainstorms and drought. Cities in different climate zones must have different building types, energy consumption methods and levels, and disaster response systems and facilities.

The varied landscapes where cities are located, such as upstream of a river, on hills, in river plains or in an estuary, mean that they must protect the different species which live in these unique environments. Some cities introduce foreign species in order to attract public attention but this is harmful to local species and is wasteful. For example, Northern cities introduced species from Southern China, but their mortality rate was nearly 80%. Flooding, water logging and other natural disasters frequently occur due to the mono-development approach and poor urban development practices.

5.2.4 Climate change leaves cities unprepared for natural disasters

The expansion of cities has worsened the effects of climate change. An increase in extreme weather, as well as the intensity of precipitation, heat islands and winds has made environmental events more destructive.

Without effective actions, the urban heat island effect will worsen as urban areas increase in size and scale. Research indicates that the urban heat island effect is important in Northern China. Many coastal cities and regions of marine reclamation are not planning for the effects of climate change including rising sea levels and the impact on flood drainage plans. At the present time Chinese cities consider land demands only with respect to minimizing investment costs. The capacity to respond to disasters is poor in these cities.

Many Chinese cities suffer from oversaturation of the soil with water and poor drainage due to poor planning and inadequate urban spatial configuration. A Ministry of Housing and Urban-Rural Development survey in 351 cities found that between 2008 and 2010, water logging occurred in 62% of cities, occurring more than three times in 137 cities. Over saturation resulted in unwanted pooling of water in tunnels, interrupted roads, traffic jams and drowned garages and vehicles. Coastal cities frequently hit by typhoons, experience water logging due to strong rainfall and storm tide.

According to *the 5th Assessment Report* released by IPCC on June 7th, 2013, longer and hotter weather and more torrential rainfall will occur during the summer in China. The influence of extreme weather and natural disasters will intensify.

5.2.5 Blind urbanization neglects derelict land and vacant buildings

In areas of rapidly increasing population, public service facilities and infrastructure fail to meet the needs of people, especially for the large number of migrant workers who do not have equitable access to urban public services and affordable housing. New town housing and infrastructure construction, which is the aim of housing investors, results in a large number of vacant commercial housing and waste of resources. In 2012, there were 32.9 square meters per capita for urban housing, and 37.1 square meters per capita of housing area in rural areas, which is more than the average in developed countries. Local governments and developers still have the impulse to develop new towns and districts, without being fully aware of the huge demand for the transformation of old buildings and the urgency to improve the efficiency of existing industrial land.

5.2.6 Insufficient support for public and green transportation

As cities expand, mobility between residence and work becomes increasingly expensive, and many begin to rely on private motor vehicles. This leads to an unbalanced urban traffic structure which reduces walking and bicycle

travel and minimizes growth of public transport. Private cars worsen traffic jams in cities, leading to more energy consumption and higher emissions. People have not fully realized the advantages of electric bicycles due to factors including technology standards, disordered production and usage.

The development of low carbon Transit Oriented Development (TOD)¹¹⁹ such as public transport, bicycles and pedestrian lanes is not yet taken seriously. The efficiency of conventional public transportation is increasingly compromised due to traffic jams and Right of Way regulations. Pedestrian sidewalks and bicycle lanes have been squeezed and have insufficient multi-modal connections to public transport.

5.2.7 Urbanization neglects nature, cultural heritage and the human-scale

In the absence of a regulatory framework, profit driven investments in large-scale construction projects often damage urban and rural natural environments and cultural heritage. Many traditional districts and villages suffer from further loss of local culture through the disappearance of traditional neighborhoods. The memory of traditional cities and villages is diminishing. Newly built districts and buildings copy the model of “economically developed” cities without any local innovation, resulting in thousands of cities with the same appearance. Cities are full of zebra crossings, high-rise buildings and large-scale squares without human scale features or a sense of belonging. In these kinds of environment, residents can lose their identity and awareness of homeland, which can lead to urban crisis and serious social problems.

5.2.8 Lack of regulations and guidance for the sustainable development of cities

The following points illustrate why government measures and guidance to promote sustainable development continue to be insufficient:

First, China lacks a regulatory and fiscal mechanism to incentivize resource recovery. This has created perverse incentives for urban residents to adopt high-consumption life-styles which consume large amounts of energy and produce waste.

Second, there are insufficient effective eco-compensation mechanisms. Contradictions between protection of environment and economic development do not have a mechanism for resolution at the regional level through measures such as emissions and water trading and fair compensation.

Third, the multiplicity of implementing agencies makes coordination very challenging.

Fourth, in the absence of clear guidelines from the central government, the provincial and municipal governments do not have the incentives to adopt administrative measures to guide districts, towns and villages to implement sustainable development practices.

5.2.9 Lack of social governance in promoting eco-civilization

Between now and 2020, an additional 220 million migrant workers will have moved into Chinese cities. Migrants require a long period of social integration before becoming urban residents. In the past, Hukou obstacles have meant that migrants earned less income and had fewer residential and public services available, creating long-term vulnerability. The 2010 Central Document No. 1 used the term “new generation of migrant workers” for the first time to describe people who have secondary or higher education, are computer literate, have networks and other tools. Although the total number of migrant workers is increasing, the difficulties and demands they face are often ignored by cities.

¹¹⁹ TOD (Transit Oriented Development) is the development of mixed-use areas along public transport systems. TOD densities are highest around centrally located public transport stops.

In addition, environmental awareness among the public must improve. A public participation system with broad participation and supervision has not been established. The government has not done enough to publish environmental information, or allow public access to sufficient environmental information. The government is not yet fully aware of the important role of NGOs in environmental and social governance and has not established effective mechanisms to support the role of NGOs.

5.3 VISION

“Until recently nature performed benignly. It functioned as a wonderful ‘hinterland’ for cities that could be drawn upon for all those things needed to make urban society excel. It provided the input of building materials, fuels, water and food. On the ‘output’ side nature seemed to function as a sink, which cleared away whatever we produced in terms of waste or emissions. For some decades we were able to live in the illusion that nature was resilient. Nature supplied the cities with what they needed, in the way of food, abiotic resources and energy. And the rivers, soils and air cleared away the urban muck¹²⁰. ”

5.3.1 Value Proposition

At a World Economic Forum meeting hosted in Tianjin in 2014, Premier Li Keqiang stated that China will “promote a people centered, new type of urbanization (that) will itself be the biggest structural re-adjustment. This will leverage the role of cities in galvanizing hinterland development, promote rural-urban integration and a gradient development of different regions and bring about a synchronized progress of the new type of industrialization, IT application, urbanization and agricultural modernization.¹²¹”

This value proposition includes three objectives to be achieved simultaneously:

- A **People Centered** approach that puts citizens at the heart of the development agenda, providing quality public services, reducing risks from environmental pollution, equalizing social welfare and improving urban livability,
- A **Beautiful and Prosperous China**, with blue skies over its vast urban and rural areas, in which people benefit from economic prosperity, the convenience of modern life, and the natural beauty of the surrounding environment, and
- Sustaining an **Ecological Civilization** that prioritizes resource efficiency, environmental protection and ecosystem restoration, with a green, circular and low-carbon development trajectory.

Figure 5-3-1 represents Premier Li Keqiang’s words, “not only technology but more of institution, management and growth models” by describing the planning and policy formulation processes required.

The center of the circle describes two key areas that require city-focused processes. The first relates to giving citizens a voice in the governance and planning process through:

- (a) *Transparency* in institutional and regulatory processes so that equitable access is maintained to every member of the society.
- (b) *Accountability* of public officials, both externally to their clients and internally within the organizational structures. This suggests that the performance of public officials be judged in terms of achieving the triple bottom line of economic, social and ecological sustainability.
- (c) *Participation* by all stakeholders in the design, planning and implementation of urban programs.

¹²⁰ Maarten Hajer, Ton Dassen “On being smart about cities” nai010 publishers/PBL publishers Rotterdam 2014, p. 25

¹²¹ Speech from Opening Ceremony of the Annual Meeting of the New Champions 2014, in Tianjin, September 11 2014



Figure 5-3-1. Requirement of planning and policy formulation process

The second area relates to the management and planning aspects in terms of economic, social and ecological sustainability.

The outer circle in the chart describes key outcomes of good city models in promoting an ecological civilization.

- Economic: job creation and equitable access to urban services by the poor;
- Social: sustaining social cohesion and measures to support a city's unique cultural heritage; and
- Ecological: the city's regional impacts on bio-diversity, land use and forestry.

5.3.2 Install a System of 'Measuring to Manage Performance' to achieve Good City Models

Chinese eco-cities tend to focus on ecological parameters while ignoring the human scale. In Tianjin eco-city for instance, residential towers are repeated over 10 times, pedestrian routes are very lengthy and streets are difficult to cross. There is no direct connection from the residential areas to the sea and the lake, depriving residents of naturally symbiotic relationships with their surroundings.

The new vision highlights the importance of moving from an object-oriented to a human-oriented approach, in which the city's interface with its regional natural resource environment is a central part of the planning process. Central to this 'people first' approach, cities take the lead in: (i) articulating their specific vision, and defining and prioritizing the three components; (ii) developing measurements of sustainable outcomes that matter to the people; and (iii) creating opportunities for investment and finance at the appropriate scale.

This vision implies that while there is a planning process for "good city model for ecological civilization" which traces the impacts of urbanization on the economy, society, regional ecology and energy, water and land ecosystems. The proposed approach utilizes a spatial lens to integrate the way in which resource and investment flows are monitored and managed throughout the city's jurisdiction. Each track must create outcomes that are priorities for the community. For example:

- The energy ecosystem should include cost savings and GHG footprints of major energy users (buildings, transport, water and waste);
- The water ecosystem should suggest how to minimize water risks and manage the water footprint of household consumers, industries, other private consumers public sector consumers, and

- The urban form and regional ecosystem should assess how land is used, including green space, built infrastructure, housing, population density and land asset value differentials.

While sectoral interventions usually focus on inputs and outputs, the suggested approach measures outcomes, and how these meet the goals of the three ecosystems. There is considerable benefit in learning lessons from cities in OECD countries that have had several decades of experience in undertaking such processes and reporting the outcomes achieved.

5.4 AN AGENDA FOR ACTION

The preceding chapters presented the difficulties in China's urbanization. Chapter Two noted nine important challenges. Chapter Three connected these to the vision of ecological civilization and provided an overview of how to advance strategically. This chapter elaborates on opportunities represented by the nine challenges in Chapter Two by identifying for each a set of principles, criteria for action, and recommended approaches.

Introduction: Achieving a good city model under the concept of ecological civilization

Numerous concepts for urbanization have been developed in China over the past twenty years. Planners describe new cities with adjectives such as green, resilient, low-carbon, smart, healthy, vital and sustainable. These concepts tend to address single environmental issues, ignoring economic and social dimensions. A focus on "sustainable" development requires integrating economic and social factors into environmental and ecological development. Urban planning can act as a comprehensive horizontal layer which combines all vertical interests into one plan. Good urban design plays a significant role by revealing synergies between sectors and mitigating competing demands for land and ecological resources.

Good Cities

Many city rankings are published each year. Mercer, EIU and Monocle¹²² for instance, publish yearly Quality of Life and Liveability indices. Siemens publishes its green city index and the EU selects cities for the Green Capital Award¹²³ every year. Cities like Vienna, Zurich, Munich, Auckland, Copenhagen, Melbourne and Vancouver are often leaders in such lists. The qualities in these cities include leisure in the direct neighbourhood of the city (water, mountains), good public transport, a vibrant urban life, culture and a green urban policy, including strategies on water management, energy saving, use of renewable energies, waste reduction, and protecting bio-diversity. None of these qualities can be simply copied and reproduced somewhere else. They depend on their local, spatial and historical context and are therefore tailor made.

While all of these qualities have multiple dimensions which can sometimes all be optimized, urban design cannot always mediate between conflicting demands. Spatial demands such as diversity, orientation, density and mixed functions have external effects that can influence other demands in a positive or negative way. For example, if all buildings have the same orientation to the sun, all buildings are perfectly conditioned to use less energy, but the overall result might be monotonous because the orientation of the buildings is repetitive. Monotony can lead to liveability problems. Another example is high density, closed building blocks which enhance urbanity but are less compatible with the generation of renewable energies. Environmental requirements, people-oriented needs and economic demands sometimes strengthen each other and sometimes compete. **There are valuable processes for good city models.**

¹²² See more about the rankings: www.mercer.com/insights/view/2014/quality-of-living-rankings-spotlight-emerging-cities.html, www.eiu.com/public/topical_report.aspx?campaignid=liveability2014, <http://monocle.com/film/affairs/quality-of-life-survey-2014>

¹²³ See more about the award: <http://ec.europa.eu/environment/europeangreencapital>

Concepts and experience with ecological civilization in urban planning and design are found in other cities. Participating in national and international city networks should be encouraged to exchange ideas and experiences.

Time

Time is very important in urban planning: Buildings are generally written off in economic terms after 20 to 30 years, though they often last for a few more decades before being replaced by new structures. It is the location and urban design of the buildings which lasts for centuries¹²⁴. Once built, the layout of the streets lasts forever. Changes in street patterns are very expensive: all buildings have to be demolished and rebuilt, all proprietors should be compensated and the underground infrastructure (sewage, cables etc.) must be relaid. This high price means that changes in the urban design rarely occur and that the original urban design will structure the life of people for decades or even centuries.

Large-scale urban plans should be flexible so that they adapt to future demands. The introduction of new technologies from developments in agriculture, defence systems, transportation (the automobile), and communication (the internet) have all had serious spatial consequences for urbanization. In the future, new technologies might have significant but unknown impacts: 3D printing, new transportation systems, and life extension. In addition, the demands of people change over time. As soon as people become wealthier, they ask for more residential living space, better housing conditions, healthier surroundings and greater access to recreational facilities.

Urban design and architecture follow trends of new visions and lifestyles. Economic stagnation and political changes influence and can halt future developments.

Population ageing is a special consideration for new towns/ new districts as they are generally populated by young people in the beginning. Though schools are needed initially, eventually the generation gets old and there is less demand for schools and greater demand for housing for the elderly.

If changes of functions for specific buildings or urban areas are not foreseen, it becomes very expensive and resource-intensive to adapt them at a later phase. Therefore, room for the needs of the foreseeable future such as infrastructure and public facilities should be accounted for in urban plans. These community resources should remain in public hands.

A good city model is not necessarily a new town or a new city extension. A good city model can also be achieved by upgrading an existing city. Land previously used for industrial purposes offers possibilities to turn an area with a bad reputation into a newly developed urban district while upholding the concept of ecological civilization.

5.4.1 Comprehensive planning must guide sectoral policies

Principle

Policy coherence at an urban level is most easily depicted as collaboration between sectors such as housing, water, transportation, economic policy, energy, environment, and land and resources. When criticizing the lack of policy coherence, the term 'silos' is often used.

Spatial planning can be an important means of increasing policy coherence between these 'silos', in medium and long term planning, at large and small scales. In the urban context, we speak about urban planning. This is a comprehensive style of planning, combining the various spatial demands and contributions with the existing context (the substratum, the networks and the occupation). It is a horizontal layer which connects all of the 'silos' with a spatial impact. Urban planning is about weighing various interests and ideas, identifying potential synergies and developing these ideas not only into a plan with rules and regulations but also into a convincing story.

¹²⁴ Philibert and Pershing, Beyond Kyoto: energy dynamics and climate stabilization, OECD/IEA 2002

Criteria

The promotion of policy coherence through integrated urban planning should be based on a clear demand from the top leaders.

Integrated urban planning should provide a framework for the performance evaluation of local governments and any independent urban development agencies, as well as individual cadres such as mayors.

Choices considered, choices made, as well as the risks involved have to be transparent and actively communicated to the public.

Approach

Policy coherence should be promoted through:

- Improved integration using the idea and method of Strategic Environmental Assessment ('plan Environmental Impact Assessment') into urban planning. Optimizing the ability of such an assessment to inform and structure discussions to deliver different options to balance urban, industrial and ecological development and to create a framework for monitoring and performance evaluation of planning decisions. This method offers accountability to the government and informs the public.
- Integrated spatial planning for China's urban developments. Implications and choices should be fed back to sectoral plans, such as the planning of transportation infrastructure.
- Social impact assessment of urbanization strategies. This is an active and full-blown assessment that provides a fair view of the social impacts of the strategies and provides a framework to engage with stakeholders.

It is suggested that in the application of these planning/assessment systems to the various urban agglomerations, at least the following five topics will always be given proper consideration: the built environment; mobility and transport; demographic changes; availability of resources (such as energy and water); urban/rural economic policies. *Research by design*¹²⁵ is a good method to explore the possible consequences of the spatial claims in urbanization and to look for synergies.

In situations where existing cities and adjacent development areas are governed by separate bodies, the principles of policy coherence and integrated spatial planning mean that old and new should be considered in the same plan and assessment system.

Good City Model

Reserve space for future development. The Dutch new town Almere, founded in the 1970s, consists of a centre surrounded by several nuclei. Space was reserved in the master plan to allow the city to upgrade and expand the city centre.

Red and green lining can be used as a means for a more sustainable land use. It can help to prevent the uncontrolled use of green fields for urban development and to stop the development of urban sprawl. When combined with regulations to reuse existing urban areas, it could lead to a sustainable use of existing stock and protection of farmland. The concept of green lining has the same objectives but focuses more on the protection of certain green areas. In this way green areas are protected while at the time development in other areas is still possible. In this way policy makers are able to appoint which green areas are of explicit value for urbanized areas.

In the Netherlands the concept of green lining was used to maintain green areas in proximity to urban areas. Restriction of new housing and succeeding urbanisation concepts managed to prevent sprawl. The Green Heart of the Randstad area in the Netherlands can be a relevant case study.

¹²⁵ Research by design is a research method used in urban design and architecture research. It takes design as a part of the research: designing variants can explore the scope of the research and the research can limit or widen the number of design variants. It is an iterative method.

5.4.2 Make local public finance less dependent on land development

Principle

Development of land has always been a means to urbanization, but it now seems to have changed from a means to an end goal. Chinese municipalities use their land development as an ATM. Land revenues represent an enormous share of the income stream of local governments.

This cash cow creates a perverse incentive for city expansion. It has led to an enormous building boom – very likely a bubble – resulting in a high vacancy rate.

The demand for land might decrease in the future which will likely result in heavy public budget cuts and a decrease in the provision of public services.

Criteria

When derelict industrial or residential land is available for city developments it should be prioritized over green-fields. Targeted investments and legislative support for the redevelopment of derelict land are needed as well.

Approach

Local governments should refrain from selling and developing greenfields. Options for local governments to make their financial situation independent from land sales include:

- The provision of local public services which can alternatively be financed through cost recovery measures under the law or by (increased) local property taxes.
- Applications for green funding from international sources. If a local government can demonstrate that there is a global interest for their “good city” it will attract global funds.
- Make more use of Public Private Partnerships (PPP) in order to attract investments and share risks with private actors. PPPs do not fully remove the incentive for city expansion and still carry financial risks.

It must be ensured that all levels of government get appropriate financing to avoid unwanted negative effects on urban development.

5.4.3 Risks to population health, environment and ecoservices in China's urbanization

5.4.3.1 Decouple urbanization from the use of resources

Principle

Measures for energy conservation and efficient use of resources must be incorporated into urban planning, infrastructure and building design. “Urbanization, with its direct and indirect effects, is considered one of the principal causes of the threat to global biodiversity.”¹²⁶

It is essential for cities to develop financial mechanisms to pay for the ecological services they enjoy and bear the cost of damages to ecosystems through “Eco-Compensation.”¹²⁷

126 McKinney 2002, Olden et al. 2006, p. 56 <www.bfn.de/0502_siedlung.html?&no_cache=1>.

127 CCICED Task Force Report on “Eco-Compensation Mechanisms and Policies in China”, 2004.

Criteria

City and resources interact: The city consumes resources, and resources shape the city. The form, density, mixture and typology of a city has a big influence on its consumption of resources and its demand for eco-services from the outside. Densely populated cities use less energy than sprawled urbanization, because of shorter distances, more efficient use of buildings and a better business case for public transport. Location and orientation of the building mass in relation to water resources and sunlight reflect constraints as well as elementary choices for the conservation of energy, water and other natural resources.

Cities account for enormous flows of energy and material while they also embody innovative methods which are key to sustainable management of these resources. The body, or an ecosystem, can be used as a metaphor for the city. The concept of urban metabolism compares the flows of resources in and out of a city to the metabolism of a living creature. The metabolic approach of a city serves to improve the city's governance in relation to resources by identifying possibilities for improved efficiency, recycling and reducing resource use. Related indicators should be institutionalized in the performance evaluation scorecards of cadres. Since cities and streets remain for centuries, an urban layout that makes inefficient use of resources can do harm for centuries. The current wave of urbanization in China provides a unique opportunity to put in place resource-efficient designs.

“Ecosystem services” are the benefits that cities receive from the environment. Although urban planners have long been attentive to ensure harmony between nature and human activities in cities and the concept of ecosystem services has become popularized, it has not yet been incorporated into urban design and planning. Ecosystem services in a city are provided from both ecosystems within and outside the city boundaries, and they include products such as food, water, minerals, energy (hydropower, biomass fuels), raw materials and so forth, as well as benefits obtained from the regulation of ecosystem processes such as carbon sequestration and climate regulation, waste decomposition and detoxification, purification of water and air and pest and disease control. There are also nonmaterial benefits such as recreational and amenity values.

Approaches

- Use of resources (energy, water, building materials, land) and production of waste from a city should be minimized.
- Tracking throughputs enables city stakeholders to appreciate the harmful effects of untreated liquid and solid waste as well as air pollution. Resource use and waste production should be monitored and compared to historic performance, contemporary standards (best practices), and targets for the future attainment of ecological civilization. Assessments for these should be within public domain.
- Minimal resource use should be a prominent criterion in deciding the location for the expansion of urban agglomerations or the establishment of new towns. Resource use in the construction phase (energy, water, cement, land, ecosystems) should unequivocally be monitored and accounted for.
- A lifestyle of smart, modest resource use and livability in the framework of ‘Beautiful China’ should be promoted as part of a city’s identity and as a pull factor for a desirable place to live.
- Planning of urban mobility should be integral to urban design and be accounted for by the top local authorities in order to minimizing resource use.
- With a resource use framework, cities will be able to better monitor expansion of the built environment. High level and local authorities should actively discourage the – construction of buildings due to speculation as this risks having long-lasting vacancy and the need for resource-intensive conversion.

- The integration of ecosystem services into urban planning can consist of two pillars- the integration of energy and material flows into spatial planning and the enhancement of environmental capitals in cities.

Good City Model

Vancouver chose a really holistic approach to deal with the matter and it included the whole agglomeration together with Portland. They based their activities among others on the economic effect of becoming attractive for private and economic settlement. All involving county and/ or agglomeration are in efforts.

Singapore creates innovative means of communication and precise knowledge exchange to measure change and progress. Apart from the Biodiversity Index the Biodiversity Portal is outstanding, a blog with information, photography, conservation projects, books, news and events. (www.biodiversity.sg). And it installed a National Biodiversity Centre as a branch of the National Parks Board serving as Singapore's one-stop agency for biodiversity-related information and activities.

Sources: Greater Portland-Vancouver Region: www.theintertwine.org/biodiversityguide
http://en.wikipedia.org/wiki/National_Biodiversity_Centre_%28Singapore%2

5.4.3.2 Justify choices for size and shape of cities in terms of their influence on population health

Principle

The lay-out of a city can mitigate public health issues and support adaptation measures to promote greater well-being. The shape, size, structure, building typology and materials used in buildings all influence winds and the accumulation of heat. Winds can circulate fresh air to improve the air quality.

Criteria

Population health in an urban environment reflects key aspects of a good city:

- Lifestyle, behavior and work environment. This includes smoking and choices for modes of transportation.
- Ambient quality, such as outdoor air quality
- Climate change, particularly the expected increase in frequency and severity of heat waves in very large urban agglomerations
- Aging population. The older population is more vulnerable to environmental conditions. Within decades, levels of air pollution in Asian cities will cause more health problems and two or three times more mortality.

The guidelines for policies which promote health for the urban population in China should simultaneously address: (i) Risks due to environmental contamination and specific ways to reduce pollution (mitigation, see 4.3.1.). (ii) Rational size and layout of future agglomerations design which ensures population health, (adaptation).

Approaches

Boundaries for urban agglomerations can enhance wellbeing for vulnerable people by reducing the accumulation of air pollution and the severity of future heat waves. Key indicators concerning the health of the urban population, such as average life expectancy, should be disclosed to the public, even though not all of the factors are under the control of local authorities. Permits to erect large and extensive structures in cities should be given after considering effects on air circulation and air quality. The former Tempelhof airport in Berlin was intentionally left vacant after such deliberations. The orientation of main street canyons and green corridors in relation to wind directions

is an efficient and inexpensive way to ensure better air quality. This may require modifications in the regulatory framework so that spatial planning is based on integrated diagnostics, and strategic environment assessment.

Sunshine can be reflected by painting roof tops white or can be absorbed by creating green roofs. By doing so the heat stress can be reduced. Trees can also provide shadows to temper the heat.

5.4.4 Chinese cities must prepare for climate change

Principle

Evidence is mounting that climate change presents challenges for urban areas and their growing populations. UN Habitat published the *Global Report on Human Settlements on Cities and Climate Change* in 2011 and the IPCC specifically addressed urban areas in the *Fifth Assessment Report*.¹²⁸ Climate change will likely affect water supply, physical infrastructure, transport, ecosystem goods and services, energy provision, industrial production and human health.¹²⁹ Mitigation, through more efficient use of resources (see 5.4.3.1), and adaptation should be included in comprehensive planning.

Criterion

China's capacity to address climate change is weak, particularly in small and medium-sized cities with poor infrastructure and planning.¹³⁰ Climate adaptation and mitigation require long and systematic projects that require scientific and technological inputs, policies and sufficient supporting capabilities. China has strong scientific and policy input at the national level, but still lacks capacity at the local level.

Approach

China's national strategy for climate change adaptation (National Adaptation Strategy, NAS) was guided by the 12th FYP and will last from 2013 to 2020.

The New Strategy has identified a number of gaps in infrastructure that must be addressed. It divides its focus into three areas- urban, agricultural and ecological- with priorities as follows: infrastructure, agriculture, water resources, coastal zones and maritime waters, forests and ecological systems, tourism and other industries, human health.

In the coming years, an important agenda will be to mainstream climate resilience, and adaptation capacity in Chinese cities¹³¹. The NAS identifies guiding principles, priority areas and pilot provinces for adaptation in response to climate change. This provides an opportunity for the country – including cities – to address climate change in a more holistic manner, and to involve the concerned central/local authorities to align the existing policies and institutions with the Strategy.

Resilience of cities to extreme weather can be strengthened through investments and institutional measures that incorporate citizen participation.

128 UN-Habitat (2011), Global Report on Human Settlements 2011 Cities and Climate Change. IPCC Working Group II, 2013, Impacts adaption and Vulnerability. See especially Ch. 8, Urban Areas.

129 Nadin R., Lashford S., Street R., Liu Y., Cardenes Trujillo I. "Climate Resilient Low Carbon Frameworks", INTASAVE and WWF, 2014.

130 UNDP, "2013 Sustainable and Liveable cities: towards Ecological Civilization", China National Human Development Report, Beijing, 2013; China's National Adaptation Strategy, 2013.

131 "Shaping China's Climate Finance Policy", Climate Group and the Central University of Finance and Economics, 2013.

Good City Model

Shenzhen was the first mainland Chinese megacity to join the C40 Cities Climate Leadership Group.

Suzhou fosters urban liveability combined with cultural heritage and received the Lee Kuan Yew award for 2014.

The **Rotterdam Climate Change Adaptation Strategy** is relevant for climate impact and adaptation needed, and a **Connecting Delta Cities** network set up within C40 (2008) Development of mechanisms to co-ordinate adaptation efforts, including funding, encouraging neighboring regions and areas of the same basin or similar climatic conditions to set up communication and coordination mechanisms

Curitiba, Brazil, resilient city for sustainable urban revitalization. Introduced the world's first bus rapid transit system which is used by 70% of Curitiba's daily commuters. Curitiba is tied with Copenhagen for the lowest emissions per capita (2.1 Tons CO₂).

Several cases from both Europe, North America, Latin America and S & SE Asia at the Rockefeller 100 Resilient Cities.

Sources:

www.c40.org/cities/shenzhen/blog_posts

www.deltacities.com/cities/rotterdam/climate-change-adaptation

www.triplepundit.com/2011/06/top-10-globally-resilient-cities/

5.4.5 Build liveable cities

Principle

A balanced planning and implementation process that respects the needs of job creation and economic development while promoting social harmony and environmental sustainability.

Criteria

The Prime Minister's announcement of the 100+100+100 million strategy provides an opportunity to re-think the urban policy, spatial planning and resource management process so that Chinese cities can become good models of ecological civilization. Three principles implemented through spatially referenced actions:

- (1) Support economic prosperity for residents,
- (2) Conserve and recycle land, water and atmospheric resources, and
- (3) Compensate nature when necessary through strategic environmental policy and investment interventions.

Approaches

- *Re-develop urban lands with low value usage instead of using green fields*

Many Chinese cities provide opportunities to re-develop urban land and industries that have relocated to Western China. These lands are already well-serviced by infrastructure, and offer opportunities for mixed use re-development. Redevelopment could be more expensive than greenfield development in the short term, but much more sustainable in the long term because of land value capture potential.

- *Systematically incorporate risks in the planning process*

142 As cities generate wealth through their buildings and infrastructure assets, it is important to understand the various risks these assets face, from changes in the economic structure, weather and climate related events. This requires re-assessing spatial plans whenever there are changes in the economic structure of the city.

Industries grow and contract depending on their competitiveness. Valuable real estate in many European cities becomes low value derelict industrial sites once the related economic activities end. This was the case for steel making and coal production in the Ruhr valley in Germany.

- *Measure with integrated diagnostics:*

Integrated spatially referenced diagnostics can identify sustainability outcomes that need to be managed by public officials, and install an objective data gathering system which reports the performance of city agencies in achieving the desired outcomes. This requires developing legal, governance and economic instruments that create the planning, financing and implementation frameworks to deliver the outcomes. Equally important is to design participative governance arrangements, so that the opinions, preferences and feedback from city level stakeholders are continuously fed back to policy makers.¹³²

- *Demand, instead of supply driven real estate development*

Reckless behavior and blind investments leading to ghost cities can be prevented by a demand driven planning. Only start planning after an inventory of the real needs of the real estate market.

- *Provide new towns with a vital economic base.*

The British new town Milton Keynes, founded in the 1960's created favourable conditions so that it became home to several national and international companies. Due to local employment, Milton Keynes is more self-sustaining than other new towns.

5.4.6 Adopt Transit Oriented Development as a main concept for urban development

Principle

Transit-oriented development (TOD) should be emphasized. TOD is the development of mixed-use areas along public transport systems. TOD densities are highest around centrally located public transport stops. The strategy of waiting until the urban population grows to construct mass transit systems is dangerous. Creation and renovation of city centers must be accompanied by investment in mass transit systems. "Green corridors" should be developed as they improve connections between transit stations and neighborhoods. Thoughtful traffic control and effective spatial planning will control air pollution. New technologies decrease traffic and the use of fossil fuels: E-bikes reduce the air pollution, smart car-sharing systems reduce the number of parked cars in public spaces and broadband internet reduces travel by offering possibilities for working from home and teleconferencing.

Criteria

Sustainable models of urban transport differ depending upon the population size and financial abilities of cities. Cities with more than a few million people can use railways and subways, while small and medium cities can use compact systems such as light rails, monorails, BRT (Bus Rapid Transit), trams and buses and their combinations. These systems are popular in Europe. Transit and land-use should be integrated so that they can generate revenue, vitalize the local economy and enhance convenience. Mobility of people in rural and suburban areas can be improved by using electric motorbikes instead of cars.

¹³² The principle of subsidiarity says that decisions should be taken at the lowest appropriate level. In order to achieve the triple bottom line this is either the city level, or in the case of large cities at the neighborhood or district level.

Approaches

Cities can select sustainable models of urban transport depending upon their population sizes, financial and other conditions. Cities with successful transit and land-use integration can generate revenue and capture value through the development of property and air rights. High quality TOD generates higher profits and fiscal revenue which can go into creating additional high quality TODs. This cycle will provide an effective value capture tool and encourage private sector to participate in the investment and it will help ease the financial burden of the government.

Good City Model – London

The mayor's Transport Strategy in London includes transport planning, financing and pricing, travel demand management.

London has developed a multimodal public transport system containing national railway, subway (or tube), over ground rail, light rail, buses and trams. Most of the stations around the central area are integrated transfer terminals providing seamless connection with other modes. It also has an integrated fare system based on zonal fare with different types of tickets such as peak and non-peak ticket, long- and short-distance ticket and transfer discounts.

In February 2003, London began to charge vehicles entering the 21 km² downtown area with a congestion fee. In February 2007, the area was expanded to 40 km², which reduced traffic by approximately 30% and decreased concentrations of nitrogen oxide, suspended particulate matter (PM10) and carbon dioxide by approximately 15%. The Government built a lot of parking areas near the railway and metro stations around the city, and reduced parking fees.

Recommendations:

- Promote the integration of a variety of public transportation modes.
- Develop a flexible fare policy.
- Develop public transport in priority; promoting the other supporting policies at the same time, including district differentiated policy, congestion charging policy, emission control policy, park and ride policy, etc.
- Broaden the channels of investment funds, strengthen government guidance and encourage private sectors to participate.

5.4.7 Identity through human scale urban design, natural and cultural heritage

Principle

Identity is important in city planning. People may identify with a region, city, district, street or dwelling. When people identify with their surroundings, they feel proud, responsible and take better care of their surroundings. A city or a district with a strong identity has better chances of attracting investments and tourists.

The protection of natural and cultural heritage contributes to the identity of a city and region. A human, or small, scale of public space is crucial for people to feel comfortable in a city.¹³³ If the urban design of a street is pleasant, people will more readily go outside, feel safe and enjoy walking on the pavement.

Criterion

A city, region, district, street or building must differ from its neighbour in order to have its own identity. This means that cities and regions should celebrate their existing qualities such as landscape, nature, culture, human capital and building heritage and that districts, streets, universities/industries and buildings should be different from their neighbours.

¹³³ Reimagining China's cities towards sustainable urbanization, China Dialogue, p.55 "Chinese cities feel loss of streetlife and community", London.

If there is space available on derelict industrial sites there is no spatial need to develop greenfields. In many cases, vacant buildings can be transformed for new uses so that they maintain the identity of a district. Adjacent apartments can be merged in order to provide larger living spaces.

When reusing vacant buildings, retrofitting and changing floor plans require specific knowledge and craftsmen.

The pedestrian scale is critical to feel at home in a city. For the pedestrian, the public space should be lively, beautiful, safe and full of variety, especially at eye-level. These will promote slow modes of transport over taking the car.

Approaches

- Make an inventory of all vacant land in a city is the first step in redeveloping them.
- Make a small gridded road network to ensure pedestrian crossing and the safety of non-vehicular travel
- Make sidewalks and bicycle lanes safe
- Orient buildings with their entrances and windows towards the streets, in order to evoke mutual social security between the people in the streets and in the buildings
- Prevent fences along the streets
- Prevent large distances without entrances
- Make lively ‘urban plinths’ along the streets, for instance with shop-windows or public services. The plinths might cover only 10% of the building, but determine 90% of the experience.¹³⁴
- Vary buildings along the streets instead of repeating. Diversity can be reached by designing each building in a different style or typology, by mixing functions (housing, recreation, working, shopping) and adding buildings to existing monotonous urban fabric. This usually means less repetition, meaning less profit from the economy of scale, so more expensive.
- Plant trees and other vegetation.
- Organize participation, this leads to identity, raises awareness and develops ownership. Self-building or self-commissioning of buildings is method to let people directly identify with their surroundings through their responsibility.

Good City Models

IBA Emscherpark (Germany) was a project in 1990s that transformed the contaminated and derelict industrial landscape of the Ruhr area, into an ecologically restored landscape full of industrial icons that hosts cultural and leisure activities, attracts visitors and makes local people proud of their industrial heritage. Brownfields that had negative reputations in the past (industrial structures such as gas holders, blast furnaces and factories) were redeveloped and became regional icons. The IBA Emscherpark used marketing and branding opportunities to promote the region.

Port redevelopments in Amsterdam, Antwerp, Hamburg, London, Rotterdam

The scale of port activities has grown over the years. The recent large container ships are no longer able to enter the historic port areas in Western Europe. That's why the port areas expanded towards the sea and left the port areas in the city vacant. These vacant areas were redeveloped in cities such as London (*Isle of dogs*), Rotterdam (*Kop van Zuid*), Hamburg (*Hafen-city*), Amsterdam (*IJ oevers*) and Antwerp (*Eilandje*) with mixed use functions, all taking advantage of the waterfront and historic relicts.

134 For further reading: www.thecityateyel level.com

Recommendation of Institutions and Policies:

- Limit greenfield development in favour of brownfield development. Former port areas, especially have many spatial qualities.

Renovation and transformation offactories, churches and office buildings

All over the world vacant historic buildings have received a new function: industrial buildings and religious buildings have become shops, museums, libraries, schools or ateliers. Vacant office buildings are being transformed into residential buildings. The central location of these buildings, along with their characteristic structure and facades make these building very attractive for “a second life”.

Recommendation of Institutions and Policies:

- Make use of existing buildings that keep the memory of the place alive and diversify the area.

5.4.8 Develop a coherent national framework of tax incentives to significantly promote resource efficiency and test this for effectiveness in the context of urbanization

Principle

Because of the speed and visibility of the process and the related political commitments, China’s urbanization is a once-in-a-lifetime opportunity to align the essential actors to move towards sustainable development. China’s urbanization also touches on incentives for resource efficiency; the growing importance of the middle class in terms of consumption; and coordination among government bodies with different ambitions.

Criterion

Resource efficiency provides suitable, quantifiable targets in order to focus efforts for more effective policies towards sustainable urbanization.

Approach

Cultural education as well as economic incentives should be brought into play. Greater efforts are needed to strengthen integrated planning and monitoring (Section 5.4.1), urban initiatives and role models to promote decoupling (Section 5.4.3.1). It is therefore recommended that the central government develop a framework of tax incentives for key natural resources and compensation rules according to the principle of ‘the polluter pays’. In as far as such measures exist, it is recommended to unite them in a coherent framework. In addition to pollution, a focus is recommended on three categories of resources that are important in China’s urbanization, namely land; fresh water; and fossil energy. The effectiveness of this framework should be analyzed in the context of current urbanization.

5.4.9 People oriented urbanization: participation

Principle

Any form of citizen participation requires a great deal of time, communication, debate and cooperation. Citizens can make valuable contributions based on their professional and life experience. Irritation caused by globalization and the economic and social changes in the lives of many people can be counteracted by stabilizing the identity in the personal environment through meaningful activity, and by the “self-at-home-feeling”.

Criteria

Participation requires transparency, decision-making power, a clear mandate, defined tasks, and a firm time frame. Experience shows that external facilitation is needed to negotiate critical issues/topics and tasks. Sufficient organizational support and clear background information must be provided to citizens and other participating stakeholders in order to encourage their participation.¹³⁵ Local administration must be well prepared and professionally trained to fulfil this task.

Large cities have more problems with citizen participation than medium-sized cities, which generally are highly innovative¹³⁶. These findings support Chinese plans to encourage the urbanization of cities up to 500,000 inhabitants to absorb immigration into the cities.

Approaches

- *Red lining is considered as a means to a more sustainable land use.* It can help to prevent the uncontrolled use of green fields for urban development and to stop the development of urban sprawl.
- *Provide for clear responsibility of individuals by having dialogues with citizens.* Ireland is a strong model, it emphasizes the role of Government, “the key element in any form of participation is the willingness to hold a government-citizen dialogue¹³⁷”.
- *Define procedure to follow by law.* Finland’s “Building and Land Use Act” requires an approved “Public Participation Plan” prior to starting a planning process¹³⁸.
- *Make use of the knowledge and expertise of other cities by joining city networks worldwide to accompany the process over the years.* Examples for citizen participation described by the “International Council for Local Environmental Initiatives” (ICLEI) include Porto Allegre (small city known for its participatory budgeting), Sao Paulo and Tokyo (major participatory efforts regarding reduction of Green House Gas (GHG) emission), Durban (global leader in providing measures to protect ecosystem services).

Good City Model

Since the early 90s **Heidelberg** (Germany) has adopted a policy for citizen participation for all major development plans and projects involving the decision on the nature of participation by the City Council, depending on the subject matter. Thus the most important political strategies of the city for overall development or the one of single districts, on traffic, economic or touristic development, on cultural activities or social aims are prepared with broad participation of all stakeholders: academia, the private sector, social-, cultural-, and environmental non-profit organizations, women- and immigrant minority groups etc. A special example is the intensive participation by Industry and Academia within the city’s project “Sustainable Management” which encompasses crafts and small and medium enterprises. This enabled environmental management with more than 100 enterprises.

5.5 RECOMMENDATIONS

China’s cities can serve as engines for growth, as models for innovative development, as leaders in environmental protection, and as places that have a high quality of life, prosperity, and health. Cities that embody these aspects could be considered good city models in the context of ecological civilization. This study recognizes there is no single blueprint for a good city.

¹³⁵ P 85, how can city governance change? China Human Development Report, 2013: Sustainable and Liveable Cities: Towards Ecological Urbanization. Beijing, UNDP.

¹³⁶ ICLEI

¹³⁷ See: http://eprints.nuim.ie/272/2/Paper_Local_Government_Draft.pdf and http://ec.europa.eu/regional_policy/archive/innovation/innovating/terra/explan/sruna.pdf

¹³⁸ Communication with Kaarin Taipale, Architect, City Planner, Helsinki, 2014.

However, it identifies key characteristics of a good process for reaching good cities. These attributes to some degree already are present in many of China's cities but need to be strengthened so that cities can take more responsibility in steering China towards an ecological civilization.

For cities to assume this important leadership role, they must be supported to make the best possible use of their financial, human, social, natural and built capital. They should be helped to access tools and networks that can help them to make and implement informed decisions. Many of these tools are related to monitoring, of, for example, urban population and environmental health issues, status of brownfields, and energy conservation. Urban eco-indicators should be compared with historic performance as well as with national and international best practices.

Know what is going on and set objectives and limits based on integrated spatial planning:

China is still in the process of rapid industrialization and urbanization. Reasonable spatial layout and an increase in resource use efficiency are the main priorities for urbanization towards ecological civilization. Currently, there is a lack of communication and collaboration between departments with important decision-making ability. As a result, it is difficult to implement guidance and control in a process with rapidly changing space and fast resource consumption. The way to address this important issue should be: to strengthen spatial information systems and accurate data acquisition and integration of multiple departments; strengthen the comprehensive assessment and diagnosis; improve multi-sectoral policy and planning coordination, and ultimately environmental protection and sustainable resource as a common goal.

Recommendation 1. Set up or strengthen geographical information systems at **provincial level** to monitor and visualize urban changes in relation to the environment and adjacent ecosystems. Use these systems to timely identify potential problems in view of choices and priorities set in the urban plan, or potential compensation issues, as well as challenges that require new policy coordination initiatives. At the provincial level, establish ecological redlines for conservation areas of ecological importance and sensitivity. Further strengthen the permit licensing system in areas with construction limits, e.g. specify upper development limits for cities with ecological sensitive areas or important ecological functions. Create a list of offenders. Based on these provincial spatial control systems, institute integrated urban and rural plans for mega-city regions and town clusters; determine urban growth boundaries; and integrate the spatial plans for the ecological space, production space and living space.

Recommendation 2. Use all options to achieve an **urban layout** favouring the health of the environment and its residents. Control the size and shape of urban agglomerations. Instead of continuous sprawl, develop for example multi-centered urban and town clusters and, for example, protect their green cores. Use the development of public transport systems to guide these spatial developments. Promote the development of green transportation. Use current opportunities to develop cities with properly oriented main streets and open spaces that provide low-cost, effective urban ventilation corridors for fresh air. Set aside land of strategic importance, for example with a view to future important transport facilities.

Recommendation 3. Strictly implement national **standards for the per capita built-up area**. Encourage the use of the existing stock of urban land and utilization of brownfields, improve industrial land use efficiency and promote renovation of old town and existing buildings To cities whose urban built-up land is projected to exceed 130% of the national standard per capita, the central government should issue a policy to limit new construction sites. This should help to avoid "ghost cities," resulting from unreasonable investments and developments. In addition, make sure reliable information is collected on housing needs, real estate needs and vacant dwellings and other buildings in order to assist demand-oriented planning.

Recommendation 4. At the regional level, establish **collaborative mechanisms** for environmental governance and the sharing of core resources. In particular, introduce regional collaborative pilots in the Beijing-Tianjin-Hebei area (air pollution and industrial reconstructing), Yangtze River Delta region (regional water pollution and waste allocation), the Pearl River Delta region (soil pollution and comprehensive management). At the city level, use a selection of existing pilot cities to test and promote multi-sectoral collaboration. Strategic environmental assessment (SEA) is a tool that should be used more effectively in urban planning to: (1) involve all relevant government bodies and other stakeholders in decisions; (2) provide major design choices for discussion; and (3) provide a basis for measurement and performance evaluation follow-up.

Plan for financially-sound and adaptive development:

A good urban plan should set aside enough space and room to manoeuvre in order to accommodate future demands and new developments, such as demands to build climate resilience, new infrastructure and public facilities for elderly population. In order to enable cities to take higher levels of responsibility for their development, long term sustainable financing is needed. However, many cities in China are sinking into an over-reliance on finance from selling and actively developing land. Therefore, a restructuring of governmental finance and tax system is needed to lessen the reliance on land revenues and to cater to uncertain future demands.

Recommendation 5. Financing for local government operations and initiatives **must become much more independent from selling and developing land**. Alternatives should be explored such as transfers from the central budget according to objective allocation rules, local property taxation, and construction permit fees. When land markets are set up in China, provision should be made to ensure that environmentally sensitive or high priority green space lands **will remain in public control**. Only in exceptional cases should local governments be permitted to participate in the risks of selling and actively developing land.

Recommendation 6. Greater attention should be given to climate resilience and other urban environmental planning within an **adaptive risk assessment framework**. This framework should consider both potential hazards and the adaptive capacities and financing required to deal with increasingly extreme weather events and other aspects of climate change that can cause major damage to property and infrastructure, loss of life, and adverse economic consequences.

Recommendation 7. Cities should be permitted and even encouraged to engage in **green bond markets** as a means of financing investments in for example public transportation, waste management systems, and other long-term public services appropriately linked to green economy and development. Green bonds are suitable when they can be repaid through user fees, rent or taxation. Long-term incentives should be established in order to reduce the consumption of resource and energy. For example, appropriate financial subsidies and tax breaks to encourage energy-saving and insulation improvement for existing buildings.

Adhere to people-oriented urbanization:

To achieve people-oriented urbanization, changes are needed in governance, improvements in legislation, administration and monitoring systems, as well as support to relevant performance evaluation and accountability. Mechanisms of information dissemination and public participation need to be established. Awareness and concrete understanding of ecological civilization need to be improved in both government officials and general public. People-oriented urbanization should respect people's feeling for and attachment to places, such as cities and neighbourhoods and their specific identities.

Recommendation 8. Provide administrative officials, **especially mayors**, more in-depth training on implementing resource-saving, environment-friendly and low-carbon green development. Set out a greater array of specific environmental goals as a scorecard that can be used as binding obligations in assessment and promotion of officials. Create awards for mayors and city officials who are innovative in ensuring greener cities. Support **public awareness** campaigns under the concept of ecological civilization, advocating resource-saving and low-carbon lifestyle at community level, for example on green travel or waste sorting. Support **urban educational initiatives**. These should be tailored to the new and more diverse urban populations of China's cities, including the many newcomers and enable the skill sets required in an urban, environment-friendly economy.

Recommendation 9. Let the **human scale** prevail in urban design. Guide it to develop urban layouts and road networks at a reasonable scale, suitable for pedestrians and bicycles. Streets should be easy to cross by foot and slow-mode routes should be short. The plinths of buildings should relate to pedestrians. Promote and ensure **cities' own identities** through deliberate protection of natural and cultural heritage. By fully utilizing existing buildings and facilities, a city's history and culture diversity can be sustained; by building residential buildings with local materials, a city's characteristics can be reflected; by encouraging small-scale, incremental, multi-stakeholder involvement urban regeneration, living conditions for residents can be greatly improved, while giving benefits to property owners and preserving the historical context and collective memory.

Recommendation 10. Establish a **system to monitor and assess** urban developments in relation to environment, nature and resources. Based on a generic format, its contents for a specific agglomeration should mirror the strategic focus in the urban plan. Pollution, extreme weather and climate risks would be among the standard contents. This is a fundamental element in people-oriented urban planning. It should permit consistent reporting to officials from various agencies; information dissemination to the public; as well as support to performance evaluation and accountability of government officials. Projections of **future health risks** to the urban population by air pollution and climate change should be regularly updated and made available, including their underpinning, as part of performance evaluation. Individual citizen and social organization participation rights should be defined clearly in relevant laws and regulations at the provincial and municipal level. They should provide a reliable legal basis for **public participation** in social governance. The public 'right to know' and to be consulted needs to be spelled out in the regulation and laws for urban planning and in performance evaluation systems for local governments.

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This report is submitted by the CCICED Special Policy Study on Good City Models under the Concept of Ecological Civilization.

CHAPTER 6

INSTITUTIONAL INNOVATION OF ECO-ENVIRONMENTAL REDLINING

CCICED Special Policy Study Report

CCICED 2014 Annual General Meeting

December 1-3, 2014

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BACKGROUND AND SUMMARY OF THE STUDY

China's rich and varied ecosystems deliver a wealth of benefits in the form of ecosystem services and should form a sound pillar for the creation of an ecological civilization. However, the pace and nature of physical and economic growth are having alarming impacts on the health of those ecosystems and will limit national aspirations to achieve an ecological civilization unless addressed.

Admirable government efforts to protect and restore environmental health by establishing Protected Areas, restoring forests, controlling the use of grasslands, farmlands, wetlands, and strengthening the administrative and legal framework are proving inadequate to the task, especially in the context of an ecological civilization approach and in optimizing ecological goods and services.

In recognition of these problems the Government of China has issued the following direction. To strengthen ecological protection and establish ecological security pattern, in 2011, "State Council's Opinions on Priorities of Strengthening Environmental Protection" (GF [2011] No. 35) made it clear that in important ecological function areas, terrestrial and marine ecology sensitive areas, fragile areas, and other areas, ecological redlining shall be drawn. "Decisions on Several Major Issues of Comprehensively Deepening Reform" adopted on Third Plenary Session of 18th CPC Central Committee set the ecological protection redlining as key content to speed up the ecological civilization institutional construction. It explicitly requested "to delineate ecological protection redlining. Establish national spatial development and protection system", "establish spatial planning system, delineate production, life and ecology space development control limits, and implement use controls."

The Special Policy Study officially commenced in March 2014. Over the succeeding six months the SPS has met with a wide range of experts and studied the rationale for and current practice of redlining in China by examining many practical cases in Jiangsu, Shenzhen, Beijing, and the Bohai Sea. The SPS team has identified several reasons why current efforts have failed to reverse the trend of ecological degradation, including: (1) the lack of a coordinating institution with the primary role and responsibility for ecological well-being; (2) insufficient recognition of ecological conservation in spatial planning; (3) the reality that the Protected Area system was not specifically designed to protected ecosystem services; (4) problems with accountability and enforcement for all types of environmental protection; (5) lack of an integrated approach to managing land, water, and marine uses and insufficient coordination among different agencies; (6) the inadequacy of eco-compensation systems to pay for protection of ecological services, and to provide adequate incentive to ensure local agencies pay attention to these issues.

SUMMARY OF RECOMMENDATIONS AND IMPLEMENTATION PLAN

The SPS study team recommends several institutional reforms to address the pressing need for safeguarding and improving ecological and environmental goods and services. These suggested reforms are based on using the mechanism proposed by the central government of establishing ecological protection red lines (EPRL) in order to delineate additional lands and water areas for strict protection and restoration of ecological functions. The SPS team views this effort as essential for China's national and local ecological security and sustainable development. The specific recommendations are to:

1. Institute a major redlining effort starting immediately to identify adequate ecological lands and water areas to ensure sustained delivery of ecosystem services, at a level sufficient to guarantee protection of China's national needs; and strengthen the legal framework for ecological protection with introduction of a comprehensive

law and regulations covering existing and new Protected Areas, their use and management in relation to Ecological Civilization, and the new designations of ecological protection red lines.

2. Integrate these EPRLs into a reformed land-use planning process by introduction of a new land-use category for ecological protection and to pay specific attention to situations involving areas surrounding China's urban areas, coastal, marine and watershed areas, which otherwise will face environmental and ecosystem degradation.
3. Establish a new coordination agency to plan, supervise and monitor ecological conservation in China since redlining is just one tool in the battle to preserve a healthy and safe living environment; additional institutional changes and market reforms also need to be made.
4. Reform the mechanism of payment for ecological services, including a performance-based approach to improve the environmental benefits and cost-effectiveness of eco-compensation and environmentally based transfer payments for ecological construction and other ecosystem protection mechanisms.
5. Reform the existing Protected Areas system in China to allow more management categories and include protection of areas for primarily ecological function. Similarly, introduce into ocean and coastal zoning initiatives a category of zone important to protect sustainability of ecosystem services delivery and ecological functioning, and for the protection of sea life, migratory birds, fish and mammals, and other biodiversity components.

The recommended changes need to be institutionalised within recognized national plans and strategies by:

- 1) Approval of the SPS recommendations by the central Government Economic and Eco-civilization Reform Group;
- 2) Mainstream the Recommendations into the National and Provincial Five-Year Plan to be approved at the March 2016 National Peoples' Congress;
- 3) Refer all law and regulatory changes to the National Peoples' Congress for approval in 2016.

These steps will take some years and a number of tasks are required to be implemented in parallel. Immediate actions are required to:

- 1) Establish the national coordination function to oversee all implementation;
- 2) Set the EPRL definition and characteristics and targets;
- 3) Establish management rules and regulations by State Council;
- 4) Freeze all incompatible development in nationally significant approved Ecological Function Zones and existing nature reserves.

Within one year actions required to:

- 1) Commence full implementation of planning, management and enforcement of the ERPL system throughout China
- 2) Change the spatial and land use planning systems
- 3) Undertake the necessary steps to rationalise and improve the Protected Areas system.
- 4) Develop the payments for performance approach

National implementation at all levels will take five years. By that time the complete institutional system will be in place and technical functions will have become routine. At the end of a ten year period China will have in place a fully functional comprehensive and systematic approach to the conservation and restoration of ecologically important lands, services and environments that will be the underpinning of an Ecological Civilisation and will also lead the world in practice.

6.1 THE NEED TO STRENGTHEN ECOLOGICAL PROTECTION IN CHINA

6.1.1 The Importance of Healthy Ecosystems

Human welfare and development depend to a large extent upon the ecosystem services provided by our natural environment. For centuries we have taken the fertility of soils, the patterns of annual climate, rainfall, river flow of clean water, the bounty of the lakes and oceans for granted and treated the growth of timber and the pollination of our crops by insects as free gifts from nature. These services are not free and we can no longer take them for granted. They can and are being irreversibly damaged by the pace and scale of modern development and need careful protection^{139,140}.

Ecosystem services can be classed into four main categories:

- Provisioning – drinking water, timber, fuels, fish, game, medicinal plants, fibres, etc.
- Regulating – pollination, decomposition, water purification, erosion and flood control, carbon storage, and climate regulation
- Cultural – contributions to local practices, beliefs, inspiration, and recreation
- Supporting – photosynthesis, nutrient cycling, the creation of soils, and the water cycle

The total value of such ecosystem services is immense. Globally, these have been calculated to be in the order of \$125 trillion per annum¹⁴¹. With 6% of global land area and 20% of the human population, China is a primary beneficiary of this total but also a country with a high demand for such services. Further, due to its overall geographic setting, China contains a wide range of extremely rich and valuable ecosystems. National efforts to determine the value of ecosystem services in China suggest they must be at least worth several times national GDP¹⁴².

While few would doubt these values exist, many are somewhat intangible and difficult to fully capture or audit in national accounting. However, the scale of economic losses faced if ecosystem services start to fail becomes painfully evident when China faces floods, landslides, typhoons, droughts, or when valuable soils, coastline, houses and loved ones are being washed away¹⁴³.

The continued flow of these benefits is vital for human health, security and a foundation for sustained economic development, but is dependent on the health of functioning ecosystems such as forests, grasslands, farmlands, wetlands and oceans. However, the Government of China is alert to growing evidence that ecosystem health is degrading at an alarming pace. In large part this change is the undesirable consequence of the remarkable pace

¹³⁹ TEEB Reports

¹⁴⁰ CCICED 2010a

¹⁴¹ Costanza 2014

¹⁴² Ouyang Z Y, Zhu C Q, Yang G B, Xu W H, Zheng H, Zhang Y, Xiao Y. Gross ecosystem product: concept, accounting framework and case study. *Acta Ecologica Sinica*, 2013, 33(21):6747-6761

¹⁴³ Wang *et al.* 2010

of economic and physical development over the past few decades. Human-induced changes to climate are placing an additional and accelerating stress on already degrading ecosystems in China.

6.1.2 Growing Threats to China's Ecological Health

Deteriorating ecosystem functions in China slow the attainment of 'ecological civilization'. Recent reviews of the status of China's ecological environment are cause for alarm and urgent attention¹⁴⁴. Certainly economic development since the 1970s has raised hundreds of millions out of poverty, but these 'miracles' have not been without environmental costs. Land reclamation, deforestation, overgrazing, uncontrolled mining, unsustainable fishing, pollution and improper use of water resources have resulted in ecological degradation on almost all fronts.

- *Water resources* – The Ministry of Water Resources reported in 2012 that two thirds of Chinese cities were "water-needy", nearly 300 million rural residents lacked access to safe drinking water, and 40% of rivers were seriously polluted.¹⁴⁵
- *Forests* – China's original forest cover was reduced in area and quality by unsustainable logging, fuel collection, agriculture encroachment and forest fires. New forest plantings are now restoring forest area from a low of 8% cover to 22% cover, but new forests lack sufficient biomass and biodiversity levels and deliver reduced hydrological functions.
- *Grasslands* – These have been severely degraded as a result of over-grazing and losing biodiversity as a result of fencing and misguided pest control policies. The situation has worsened through reduced water tables, changing climate and desertification¹⁴⁶.
- *Wetlands* – Over 1.3 million ha of lake surface have been lost to reclamation and more than 1,000 lakes have disappeared forever¹⁴⁷. Large lakes have been reduced, e.g., Dongting was 430,000 ha in the 1940s but is only 240,000 ha today. Marshes have been drained. For instance, Sanjiang Plain had 2.44 million ha of marshland in 1975 but was reduced to only 1.13 by 1990. River flow has been altered by thousands of dams, and wetlands face increasing pollution, water diversions and reduced water tables. Wetland biodiversity is under severe pressure – 40% of all amphibians and 88% of all fish evaluated are categorized as 'threatened' in the China Red List¹⁴⁸.
- *Coasts* – 50% of the intertidal zones of Bohai and Yellow Sea have been lost to reclamation¹¹ and 80% of China's mangroves have been lost^{149,150}. Reduction in silt deposition rates caused by major dam projects plus rising sea levels are causing fast erosion of precious coastal lands¹⁵¹ along with nursery habitats needed by commercial fish populations. Sediment starvation and subsequent erosion also puts coastal lands, infrastructure, and cities at hazard risk.
- *Ocean and islands* – Onshore habitat destruction has increased sediment flow and pollution into marine waters, land reclamations¹⁵², destruction of sea-grass, mangroves and coral reefs, and destructive fishing methods all reduce fish catch and negatively impact coastal communities¹⁵³.

144 Ouyang Z Y et al. 2014 MEP & CAS Special Project: "National Wide Remote Sensing Survey and Assessment of the Ten Years Changes of Ecological Environment of China (2000-2010)

145 http://news.xinhuanet.com/english/china/2012-02/16/c_131414176.htm

146 Piao et al. 2010

147 An et al. 2007

148 China Red List of Endangered Species, 2002, IUCN 2011

149 IUCN 2012 Situation Analysis

150 Murray et al. 2014

151 Chen 1997

152 Barter 2006

153 CCICED 2010b

- *Fragile soils* – Loose dusty sands and fragile soils of the Loess Plateau continue to be lost and create spreading deserts and dust storms that reach Beijing and beyond.
- *Deserts* – Desert cover of China has increased throughout history and now covers 2.6 million ha or 27% of the entire country.
- *Air* – High-rise urban developments combined with increases in factory, household and car emissions have resulted in dangerous levels of air pollutants and subsequent acid rain.
- *Agro-biodiversity* – A shift from traditional crop varieties adapted to local conditions towards more mechanical cultivation of high-yield varieties is well underway. Much greater use of chemicals and water leads to the loss of soil fertility and hundreds of traditional varieties¹⁵⁴. Soils are becoming toxic; natural pest control and pollinating bees are endangered. High diversity provides resilience and adaptability to change and this capacity is being lost, at a time when China is facing climate changes.
- *Urban environments* are choked with pollution, and are affected by introduced alien species¹⁵⁵ and water-hungry grasses. Industrial brownfield zones are in need of environmental restoration and greening. Paving of vast areas for roads and parking lots leads to flooding and loss of plant and animal habitat. Interurban transportation and utility construction damages wildlife corridors and fragments key ecosystems.

6.1.3 Government Efforts to Strengthen Ecological Protection

China's government has given increasing policy attention to the state of the living environment, undertaken a wide range of related actions, and expended very large investments in programs to strengthen protection of the natural environment. The government has adopted a green development path to achieve harmony between man and environment and has recently clarified this policy in the goal of attaining an ecological civilization. Major elements of the government's actions pertinent to ecosystems and ecology include:

- *Protected Area* (PA) system – Built up gradually since 1956 originally of nature reserves for species or representative ecosystems, with accelerating increase in spatial cover following the logging ban of 1997. Recent additions to the PA system include a wide range of land-type titles such as national and provincial parks, scenic areas, forest parks, geoparks, wetland parks, marine reserves and agro-genetic resource reserves. Different PA types are administered by several agencies at different levels of government from national to local. The total PA system covers more than 15% of China's land area, much less of the marine and coastal area. According to China's National Main Ecological Function Zoning Plan issued by State Council in 2010, Development-prohibited Zones include all types and all levels of protected areas of nature, culture and resources and any other areas of key ecological functional zones, which are the first category of the Key Ecological Functional Zones, and not allowed to carry out industrialization and urbanization, and require special protection.
- Reforestation programs – Designed to restore diminished forest cover by protection of remaining natural forests, post-logging replanting, green shelter belts establishment, logging ban over most of the country, returning steep farmlands to tree and grass cover, and ecological restoration of mangroves and wetlands.
- Ministry of Environmental Protection (MEP) – Serves as focal point for Convention on Biological Diversity and administers Environmental Impact Assessments and Strategic Environmental Assessments. MEP has played a key role nationally and within the regions of China concerning pollution control and many important matters such as public participation.

¹⁵⁴ NEPA 1998

¹⁵⁵ Yu & Yan 2002

- National Biodiversity Conservation Strategy and Action Plan^{156, 157} issued by State Council and developed by MEP in collaboration with other relevant agencies outlining policy and strategy for biodiversity conservation and identification of key programmes and a system of key biodiversity priority areas, including marine areas.
- The Key Ecological Function Zones identify Development-restricted Zones which are defined as the areas where large scale and high intensity industrialization and urbanization is not allowed, which include water sources protection areas, soil and water erosion control areas, wind break and desertification control areas and biodiversity maintaining areas. Twenty-five areas of Development-restricted Zones had been identified based on integrated national wide assessment, with total areas of 3.86 million km², takes 40.2% of the total land territory of China.
- Revised Environmental Protection Law – Taking effect from January 2015, this major revision will be the overarching law to cover the use and protection of both physical and biotic environments. It provides much more severe penalties for infractions. However many new regulations will need to be put into place and other sectoral laws also will need to be made consistent, especially with respect to ecological civilization needs.

6.1.4 Why are these efforts failing?

The current approach to ecological health can be summarized still as ‘develop first and clean up after’, and sometimes responding *post facto* rather than taking a precautionary approach. There is a tendency to solve environmental problems with yet more development (dams, reservoirs, water diversions, plantations), rather than tackle root causes, or to take heed of early warnings of emerging environmental and ecological problems. Other specific reasons for failing efforts are noted in the following sections.

6.1.4.1 Inadequacy of the Existing PA System

The existing PA system protects some superb and important sites for biodiversity conservation and natural heritage (scenic, geological and cultural values). Although these sites also deliver other important ecosystem services, such as clean water supply, this was not the function for which most PAs were originally selected or established. Also, huge areas with important ecological functions exist outside of the PA system. The Protected Area system itself faces many problems, including patchy management effectiveness, designation overlap and poor coordination with uses in surrounding areas, and the lack of specific legislation or an overall strategic framework.

The core of the PA system consists of some 2,669 nature reserves, covering 14.9% of China’s total land area. Reserves are registered at the national level (363), provincial level (876) or city and county level (1,430). These nature reserves are established and managed by several different agencies, with the majority under the State Forestry Administration (SFA), the Ministry of Environmental Protection (MEP), the Ministry of Agriculture (MoA), the Ministry of Lands and Resources and the State Oceanography Administration (SOA).

The Nature Reserve system is augmented by scenic areas. The Temporary Regulation of Scenic Spots was issued by the State Council in 1985 and revised in 2006 and 2013. The State Council has approved eight batches of 225 national scenic spots, with an area of about 103,600 km². Provincial governments have approved 737 Scenic Spots, with an area of about 90,100 km². The total area accounts for 2% percent of China’s land area. Additional designations of protected areas include forest parks, wetland parks and geoparks.

International designations cut across the national system including World Heritage Sites, Man and Biosphere Reserves, Global Geoparks, and wetland sites of global significance (Ramsar Sites). There is a great deal of overlap

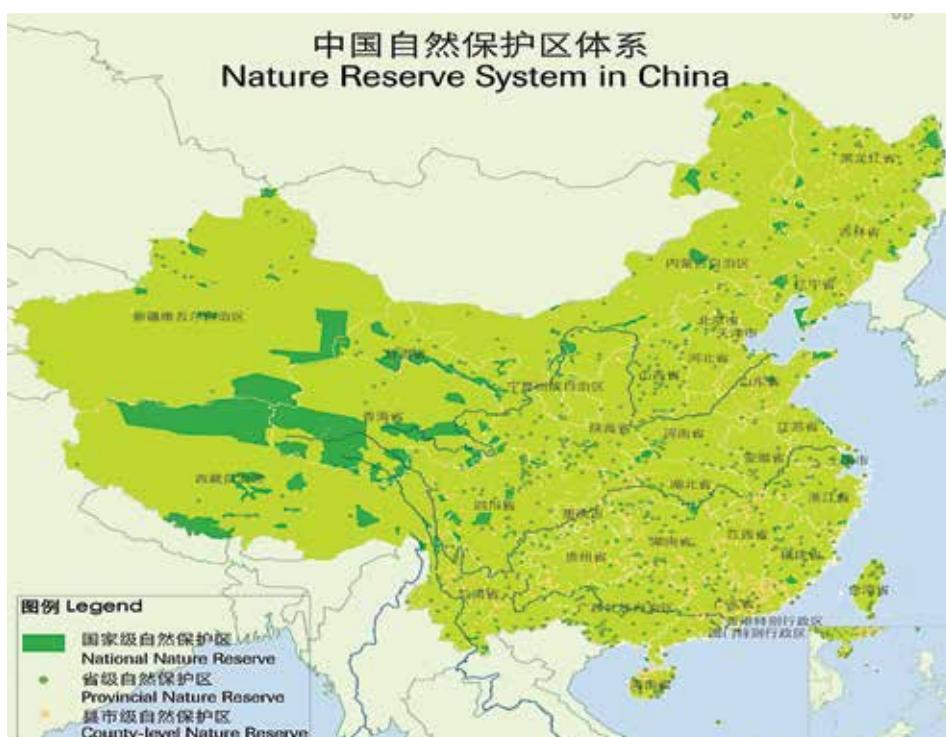
156 NEPA 1994

157 China National Biodiversity Conservation Strategy and Action Plan (CNBSAP), 2011, China Environmental Sciences Press



Map 6-1-1. Priority Biodiversity Areas

Source: "NBSAP Strategies and action plan for biodiversity conservation in China" (2011-2030)



Map 6-1-2. Distribution of China Nature Reserve System

Source: TNC

in designation. For instance Jiuzhaigou is listed as a national nature reserve, national level scenic spot, National Forest Park Global Geopark and World Natural Heritage Site. The following major issues have been highlighted by earlier studies and CCICED working groups and task forces^{158,159,160}:

158 Wang Sung & MacKinnon 1997

159 Yan *et al.* 2004

160 CCICED 2010c

(1) Apart from a few super-sized reserves in western China, which help boost the area of terrestrial PAs almost up to the Aichi target¹⁶¹, most of the country's nature reserves and other PAs are too small, suffer from encroachment, and lack sufficient connectivity to sustain high biodiversity. The system evolved on an ad hoc basis without systematic planning. Many PAs were established out of timber production areas following the logging ban of 1997. There are identified gaps in terms of representational coverage of species and habitat types. Thirty-two terrestrial biological diversity conservation priority areas have been proposed in the "China National Biodiversity Conservation Strategy and Action Plan" with an area of 2.32 million km², accounting for 24.2% of total land area (see Map 6-1-1)¹⁶². There is at the same time a paucity of well-managed marine Protected Areas. There is a need to do the systematic analysis of the ecological representativeness of PAs system in China.



Map 6-1-3. Key Ecological Function Zones

Source: http://www.gov.cn/zwgk/2011-06/08/content_1879180.htm

- (2) Management standards remain low for a variety of reasons. Staff lack specific training in Protected Area management (many are ex-loggers); there is no legal requirement to develop or follow management plans; management lacks supervision; Protected Area staff lack police status and have a weak law enforcement mandate; and the lack of operational funding drives many sites down a commercial-orientated path of chasing economic ventures (including excessive eco-tourism), which is in conflict with their protection mandate.
- (3) Although many national level Protected Areas enjoy high levels of financial support, most provincial level sites are severely under-funded and most county level sites have no operational funds at all. There is no specific law to define different types or categories of Protected Areas. Nature reserves are regulated through an outdated regulation issued by the State Council. It was drafted by the Ministry of Forestry (now SFA) and National Environmental Protection Agency (now MEP) in 1986. The regulation is weak, fails to protect nature reserves from mining and other impacting developments, uses confusing terms for zones, offers no opportunities for wildlife or habitat management or rehabilitation, and gives no consideration to new threats

¹⁶¹ The Aichi Biodiversity targets (5 goals and 20 targets) are part of the Strategic Plan of the Convention on Biological Diversity. They were adopted in an October 2010 decision at the Conference of the Parties in Nagoya, Aichi Prefecture, Japan

¹⁶² China National Biodiversity Conservation Strategy and Action Plan (CNBSAP), 2011, China Environmental Sciences Press

such as Alien Invasive Species (AIS) and climate change. The regulation also fails to provide for any forms of public participation or co-management. The legal status of all other types of PAs remains undefined and vague. Many sites enjoy multiple overlapping status and titles. One reason for the proliferation of many types of legally undefined ‘parks’ is a deliberate effort to avoid the strictures of the Nature Reserve regulation.

- (4) The weakness of PA status is revealed by GIS analysis of the rate of conversion of one key biodiversity habitat—intertidal estuarine in the Yellow Sea¹⁶³. This study reveals the frightening rate of habitat loss, matched by documentation of the rates of species losses. Both South Korea and China have been reclaiming coastal lands at a similar pace, but there is an alarming difference between the two countries: in those areas in which South Korea has declared nature reserves, the rate of habitat loss has been significantly reduced, whereas in China, the status of nature reserve has had no impact on the rate of coastal development and land reclamation.

6.1.4.2 Inadequacy of the Key Ecological Function Zones

National Ecological Function Zones have been identified and published at the national scale by the Ministry of Environment and the Chinese Academy of Sciences (CAS) in 2008 and the National Main Ecological Functional Zones Plan was issued by State Council in 2010. These maps (see Map 6-1-3 above) are useful as a strategic planning tool but the identified areas lack protective legal status and have little meaning for ground level management. The Ecological Function Zones are not approved by all ministries. The 50 Important Ecological Function Zones proposed in the “National Ecological Function Zoning” have a total area of 4,360,000 – accounting for 45.4% of total land km², and the 25 Key Ecological Function Zones¹⁶⁴ proposed in the “Nationwide Main Functional Zones Plan” have a total area of 3.86 million km², accounting for 40.2% of total land.¹⁶⁵

6.1.4.3 Weak Incentives for Ecological Protection

There are insufficient legislative mechanisms for the identification, management and protection of critical ecosystem services across the landscape outside the PA system. Ecosystem services are being assessed across the landscapes of China, but very little assessment or valuation has been done on marine and coastal ecosystem services, which are some of the most valuable and most threatened services. Where ecosystem services have been identified and attempts have been made to alleviate pressures that cause declines in services, fines and penalties for ecological damage are weak and poorly enforced, providing little disincentive for many destructive activities and developments.

Considerable financial support has been expended for ecological work in China through reforestation programs, ecological construction projects, protection of fragile soils and water catchment sources and post-disaster restoration projects. However, some of these activities are misdirected and payments for ecosystem services are inefficient and fail to reach the most critical targets.

6.1.4.4 Lack of Institutional Coordination Enforcement and Accountability

Responsibilities for ecological protection are scattered among many organizations including nine major governmental agencies. This in itself is not unworkable, but there is no agency for which ecological well-being forms the major mandate, and there is little coordination among the activities and programs of these nine agencies. Indeed, there are overlaps of responsibilities, jealous protection of mandates and land management allocations, gaps in

¹⁶³ Murray *et al.* 2014

¹⁶⁴ The Nationwide Main Functional Zones Plan is a strategic level plan released by the State Council and identifies the Four categories of i) Optimal Development ii) Key Development iii) Limited Development iv) Prohibited Development. It is intended as guidance to provincial and local governments.

¹⁶⁵ Ouyang ZY and Zheng H, 2014, Ecological Security Strategy.

attention, no overall plan or legal basis and no transparent reporting or effective enforcement. There is no agency with overall coordination or supervisory role and no comprehensive plan for ecological protection, or mainstreaming of ecological protection and biodiversity conservation into holistic government plans at different levels.

6.1.4.5 Poor Awareness

Senior government leaders clearly understand the value of ecosystem services, recognize the threat of degrading ecological health of the country, and have made ecological protection redlining a high priority for the government development program. Yet this level of awareness is not shared fully by many other government officials, especially at a local level. Nor is it shared by some members of the public and perhaps not by the majority of enterprises.

Such lack of awareness leads to half-hearted support of the program and regular ignoring or deliberate disregard for the government policies and regulations. These attitudes, combined with a lack of laws and weak penalties, explain why ecologically damaging developments and activities remain so widespread across the landscape.

6.1.5 New Approach to Be Followed

New approaches are clearly needed. Chinese leaders have identified the red line concept as a key mechanism. To strengthen ecological protection, the “State Council’s Opinions on Priorities of Strengthening Environmental Protection” (GF [2011] No. 35) made it clear that for important ecological function areas, terrestrial and marine ecology sensitive areas, fragile areas, and other areas, red lines for ecological protection shall be drawn. “Decisions on Several Major Issues of Comprehensively Deepening Reform” adopted by the Third Plenary Session of 18th CPC Central Committee set ecological protection redlining as a key action to speed up the ecological civilization institutional construction. It explicitly requested “to delineate ecological redlining. Establish national spatial development and protection system”, “establish spatial planning system, delineate production, life and ecology space development control limits, and implement use controls.”

6.2 ECOLOGICAL PROTECTION REDLINING (EPRL) NEEDS AND OPTIONS

Despite a relatively clear introduction of the term ‘ecological red line’ in national policy documents, it is apparent that there is a lack of clarity and uncertainty in the understanding of this term, how it relates to red lines for environment, and what it entails. Different agencies of the government have initiated quite separate efforts to describe and apply their own ideas. There is a great need for a clear, commonly accepted definition of the term, better understanding of what China expects from such red lines for ecological protection, and improved harmonization among the different approaches being launched.

6.2.1 Definition and Characteristics of EPRL

6.2.1.1 Definition

The term EPRL is proposed to best convey the primary focus and intent with regard to ecology and it is defined as the aggregate minimum space or area within which strict development controls can ensure the sustainable provision of ecosystem services that underpin regional and national development and support the attainment of China’s vision of an ‘ecological civilization’. EPRL includes natural and constructed ecosystems (terrestrial, freshwater and marine), and degraded areas with potential for ecological restoration to high ecosystem services value.

6.2.1.2 Characteristics of the Ecological Protection Red Line (EPRL)

6.2.1.2.1 What is contained within the EPRL?

There is already a plethora of red lines emerging in China for different purposes. As one senior official noted “there are enough red lines to knit a sweater”. We have agreed that there should be a single EPRL rather than several “ecological” red lines or lines of yet more colours. The line is simply the tool to delineate spatial land units that require various measures of special protection or strict limits on activities and developments. Moreover, it is not the only regulatory designation that may apply to a specific unit of land since these lands may be used for various purposes. Within the EPRL, different land units will be labelled as to what ecological functions need protection or enhancement. The responsible agencies and managers will be accountable to ensure that the correct designation and regulations are applied.

It should also be pointed out that the EPRL is only the final line that should not be breached. Lands falling outside of the EPRL also serve important ecological functions and require various levels of protective management and controlled use. And the viability of continued ecological function within redlined areas is also influenced by the context – islands of protection in a sea of degradation will have little ability to provide services or meet the needs of the China ecological civilization into the future. This is especially true in marine and coastal areas, where degradation from afar is often the driver of ecosystem services loss. So in many cases, the redlined lands will require establishment of an external buffer that allows some appropriate level of development that is compatible with the adjacent EPRL and provisions to protect functional connectivity to ensure, for example, migration routes for wildlife.

The EPRL can thus be seen as a category division in a land-use classification system that contains a review of the ecological protection needs of all land units, freshwater and marine areas of China, dividing those lands for which ecological protection is the primary function from lands where other uses – farming, forestry, mineral development, etc. – may be the primary function. However, attention will also be needed to protect some ecological functionality in these lands.

Some areas within the EPRL may be primarily for water catchment protection and require strict protection of vegetation cover but not necessarily native vegetation. Other areas may be important for biodiversity and the emphasis would be more on natural conditions or even conditions managed to favour a specific target species or species community. And even other areas may be primarily concerned with binding loose soils or creating wind or storm barriers to protect crops and property. Many land units will serve multiple ecological functions and may need attention from several different agencies to ensure their proper management. Marine redlining could underpin the country’s marine spatial planning and ocean zoning, in such a way that it improves the prospect for food security and assures that ecosystem services flow into the future, even as global change stresses ecosystems everywhere¹⁶⁶.

6.2.1.2.2 Relationship with other red lines

There are currently many “red lines” (or other coloured lines) being utilised by the various departments of government. Some, but not all, may apply to ecological protection in some way and will need to be rationalised during implementation.

Table 6-2-1. Various red lines under different ministries/agencies

	Name	Ministry	Feature
1	Red line of land	Ministry of Housing, Urban and Rural Development (MoHURD)	space bound area proportion
2	Red line of farmland	Ministry of Land and Resources (MLR) and Ministry of Agriculture (MoA)	quantity / total
3	Red line of water control	Ministry of Water Resources (MWR)	total \ limiting value
4	Law of water and soil conservation	Ministry of Water Resources (MWR)	spatial constraint
5	Red line of forest and wetland	State Forestry Administration (SFA)	quantity/quality

These different red lines vary according to their nature and purpose; some are spatially fixed, while others are quantile rather than spatial. For instance, the agricultural red line simply demands that an adequate extent of arable lands be protected from conversion so as to guarantee long-term food security (assuming *per capita* food consumption levels remain constant with growing wealth, China's population levels off, and soil fertility is maintained). Such lands can be identified and marked on a map.

Clearly, there will be overlaps among these red lines. For example, some of the lands reserved under the agricultural red line may serve important ecological functions, notably in steep terrain, important water catchment areas, and on fragile soils. Some agricultural lands may be important for biodiversity conservation – feeding areas for geese and cranes, breeding sites for endangered Crested Ibis, etc. Thus, the EPRL is likely to overlap the agricultural red line and identify some farmlands that require special protection measures or controlled use.

There will be more overlap with lands redlined to protect forest lands, wetlands and lands redlined to protect water sources. During implementation these overlaps can become harmonized through the land-use planning process, where overlay of all classifications are considered during the allocation of appropriate land or marine-use category.

6.2.1.2.3 Basic characteristics of the EPRL

Once an EPRL has been delineated it should satisfy the following properties and characteristics:

Nature remains unchanged. The main goals of EPRLs include ecosystem services protection, protection of ecologically sensitive areas and fragile areas, and biodiversity conservation. EPRL blocks shall be clearly fixed, and the natural environment and ecosystem types inside the red line area shall remain unchanged. These conditions may be difficult to guarantee, especially when climate change and other drivers come into full play.

Functions are not reduced. For important ecological function areas with good ecological conditions, ecosystem services delivered by the EPRL cannot be reduced. For ecologically sensitive areas, vulnerable areas, and areas within ecological protection red lines, measures of ecological restoration and management shall be taken to continuously improve the ecological function.

Area is not diminished. After the EPRL is delineated, it is not permanently unchanged. When the borders and thresholds of ecological protection redlining change due to external environment changes, the EPRL be adjusted so as to ensure timely supply of basic ecological functions. However, the EPRL area cannot be reduced, and shall be appropriately increased with the enhancement of ecological protection ability and optimization of land spaces.

6.2.1.2.4 Objectives of the EPRL

- 164 As implicit in the definition of the ecological protection red line, the objective is to safeguard or restore a minimum of ecological functions that underpin the safety and sustainability of human development.

The EPRL delivers three main categories of function. First, it protects the most critical lands for delivery of regulatory and supporting functions with protection of water resources, soil formation/protection and climate mitigation as the main objectives. Secondly, the EPRL protects and conserves areas vital for protection of high conservation values of biodiversity, important species, wild crop relatives, representative ecosystem types and genetic resources. These are valuable as provisioning services, and provide ecological resilience and adaptability as well as forming an important part of national natural heritage. Thirdly, the EPRL includes areas of sensitive/fragile ecological conditions that can be easily threatened or destroyed by erosion, flooding, landslides, flooding, coastal typhoons, etc. Again, there is considerable overlap between these functional types and many areas deliver services of all three.

6.2.1.2.5 What can establishing EPR deliver?

EPR alone cannot cure all that ails China's degrading ecosystem functionality. It is one important set of tools in an arsenal of measures needed. Table 6-2-2 lists the main ecological problems and failings being experienced in China and annotates the relevance of EPR in the remedial prescription.

Table 6-2-2. Ecological problems and relevance of EPR

Ecological problems faced	Causes and drivers	Remedial actions required	Contribution of EPR
Drying up of dry season river flows	Loss of forest, grassland and wetland sponges in upper catchments; excessive and wasteful upstream water use	Strengthen protection of natural vegetation in catchments; improve reforestation techniques and farm practices	Helps identify and protect critical water catchment areas
Drying up and reduced volume of freshwater lakes	Diversion of water supplies; excessive and wasteful upstream water use; reduced water tables from tapping underground sources; climate change	Better regulate diversion and extraction of water; improve efficiency of irrigation, strengthen water conservation	Minor and indirect
Loss of species connectivity through aquatic habitats	Construction of dams and weirs; disconnection and reduction of lakes; alien introductions	Create fish 'ladders' around dams; restore important lakes and re-open connections to major rivers	Used to protect or restore aquatic ecosystems
Excessive siltation of waterways	Poor soil conservation practices; cultivation of steep slopes; loss of forest cover; poor engineering	Improve forestry and agricultural practices; apply strict Environmental Impact Assessments (EIA) on all engineering projects; better siting of roads and other constructions	Identifies areas most prone to soil losses, but these are mostly in forest and farmlands outside of the EPRLs
Pollution of waterways and soils	Weak control of industrial and domestic waste; excessive use of fertilizers and pesticides	Apply better standards and enforcement; improve agricultural practices; promote use of green manures and integrated pest management	Significant – can help zone location of pollution sources to minimize effect on natural ecosystems
Air pollution and acid rain	Excessive use of coal as fuel	Reduce dependence on coal; raise energy use efficiency; apply carbon cap	Minor – as air pollution can travel long distances and impact ecosystems
Desertification	Destruction of original vegetation; climate change; overgrazing and reduced water tables	Protect and reestablish vegetation; reduce grazing and use of wood fuel; control water boring	Significant – can help prioritize areas for strengthened conservation and ecological restoration
Degradation of grasslands	Overgrazing; fencing of grasslands, climate change; and reduced water tables	Reduce grazing levels; halt misguided pest control (pika) program; protect key functional grasslands	Significant – can help prioritize which grassland areas most need protection from overgrazing
Dust storms	Poor vegetation cover in regions of loose soils and fine sand	Improve natural vegetation cover and strictly control farming practices	Indirectly through identifying sensitive areas where vegetation must be protected or restored

Ecological problems faced	Causes and drivers	Remedial actions required	Contribution of EPR
Extreme weather events	Consequence of man-induced climate change	Maintain shelter belts to limit desertification and protect coastline and river banks	Slight mitigation of impacts and identification of important shelter belts
Climate change	Excessive carbon emissions from fuels, land clearance and reduced carbon capture due to loss of green vegetation and biomass	Improve carbon fixation by intensifying vegetation cover and carbon storage of forests and wetlands	By helping protect vegetation, can improve carbon sequestration of degraded lands and mitigate some climate effects
Declining terrestrial biodiversity	Loss and fragmentation of original habitats; fencing of grasslands; over-hunting and collecting; pollution	Extend and strengthen protective management of PA system; control excessive eco-tourism; limit hunting and wildlife trade; promote connectivity and habitat cover	Major contribution through better protection of natural habitats and important reforms to and extension of PA system
Declining aquatic biodiversity	Loss of habitat; pollution, loss of connectivity and over-harvesting	Strengthen wetland protection; control harvest levels and restore waterway connectivity; halt pollution	Indirect through better protection of some wetlands and catchments
Declining agro-biodiversity	Shifting agricultural practices and economic changes	Provide incentives for promotion of traditional varieties; protect wild crop relatives	PA buffers offer opportunities to maintain traditional varieties; PAs can also help to conserve crop wild relatives
Declining marine biodiversity	Sedimentation; loss of habitat, pollution; overfishing and destructive fishing methods	Protect spawning source areas; control mariculture and fishing methods and catch; reduce land sourced pollution	Can help zone harvesting and better protect vital spawning areas
Collapse of migratory shorebird populations	Estuarine and intertidal land reclamation and pollution; bird nets	Restore and protect a flyway of adequate intertidal feeding sites and high tide roosting areas; halt pollution; ban bird netting	Can help identify critical habitats that should be spared from coastal reclamation
Forest fires	Conversion of mixed forests to fire-prone conifer or bamboo plantations; climate change; careless land clearance	Promote reforestation with wider mix of native species especially broad-leaf trees; ban shifting cultivation	Adds little to already sophisticated fire proneness models and early warning system
Alien Invasive Species (AIS)	Dynamic changes to landscape combined with uncontrolled imports and deliberate introductions	Strictly control release of exotic species; strengthen IAS monitoring and control measures and regulations	Minor and indirect

6.2.1.2.6 Beyond EPR – additional needs

However well-chosen, well-protected and well-managed, China's EPR system will fail to guarantee long-term ecosystem service and biodiversity conservation needs unless various other measures are also taken. These should include:

- *Environmental Hazard Line* – To designate additional areas unsuitable or unsafe for living or certain uses due to proximity to toxic wastes, radioactivity, seismic activity, dams, national security installations, etc.
- *Environmental buffering* – EPRL lands need buffering from various extraneous environmental impacts such as upstream water pollution sources, acid rain sources, noisy airports and roads, and other incompatible neighbouring land uses that could undermine the objectives of their protection. This is a two-way relationship as ecosystems serve also to mitigate and cure some environmental problems, e.g., cleansing functions.
- *Population red line* – All red lines will be inadequate if the Chinese population does not reach a stable zero growth.
- *Red line for carbon emissions* – If China and/or the rest of world continue to increase carbon emissions the pressures on ecosystems will prove too great.
- *Agriculture red line* – Even if enough land is reserved to meet long-term food production needs, this depends on stabilizing human population and maintaining fertility of those agricultural lands. Almost all soils are

created under natural forest or grasslands. It is a technological battle for farmers to maintain soil fertility after that original formation vegetation has gone. This is a battle China is still losing. Failure to preserve soil fertility would ultimately demand clearing more forests and grasslands.

- China needs red lines in territories beyond its boundaries to protect its long-term dependence on resources from those territories and to ensure that other countries do not suffer loss of ecological services.

6.2.2 Components, Procedures and Responsibilities for Identifying EPRLs

6.2.2.1 Components and Procedures for Identifying EPRLs

Terrestrial lands can be classed into EPRL areas by overlaying maps defining three component science-based lines: ecosystem service line, biodiversity conservation line and living security line. All constitute vital ecosystem services. All lines are based on sound scientifically gathered data but involve some choices based on socio-economic situations and choice preferences. Decisions should be open to public enquiry and challenge. Establishing marine EPRLs is similar but more specialized. There is a problem when inter-coastal lands are reclaimed and effectively shift from State Ocean Administration (SOA) administration to urban uses under the Ministry of Housing, Urban and Rural Development (MOHURD).

Table 6-2-3. The three component lines of the EPRL

1. Ecosystem Services Protection Line (approximately 30% of land surface with variations to reflect local character)	
Includes	<ul style="list-style-type: none"> • Water catchment and storage functions • Fringe protection (river banks, shoreline forests, etc.) • Climate amelioration (including CO₂ fixation) • Soil protection and formation • Desert control (sandy, stony, limestone, etc.) • Areas needing ecological rehabilitation • Sustainable supplies of wood, NIFFP, fish, etc.
Identification	<ul style="list-style-type: none"> • Broad key functional areas already identified by MEP and the Land Survey Department • Finer resolution of identification occurring at local BSAP level based on landform, slope, forest/vegetation cover, hydrology systems, location of important dams and reservoirs, climate, and soil type
2. Living Environment Security Protection Line (approximately 5% land surface with variations to reflect local character)	
Includes	<ul style="list-style-type: none"> • Flood prone lands • Regular earthquake and landslide areas • Eroding coastal areas • Fragile ecosystems/habitats • Fire hazard zones
Identification	<ul style="list-style-type: none"> • GIS analysis of soil fragility, slope, climate, sea level changes, seismic history, inflammable litter • Separate thematic threat maps to be produced
3. Biological Diversity Protection Line (approximately 15% land cover with variations to reflect local character)	
Includes	<ul style="list-style-type: none"> • Best viable representatives of major ecosystems of China • Unique or endangered habitats or ecosystems of China • Minimum survival areas of precious (including wild crop relatives, medicines, etc.) and endangered species of China • Vital habitat corridors needed for survival and climate adaptation • Internationally designated sites – Word Heritage, Ramsar, EEAfp, MAB, etc.
Identification	<ul style="list-style-type: none"> • Core areas and buffer zones of existing nature reserves • Additional reserves, extensions and corridors as identified by several gap analysis exercises • Broad priority areas already identified in National Biodiversity Strategy and Action Plans (NBSAPs), local Biodiversity Strategy and Action Plans (BSAPs), hotspot reviews, Key Biodiversity Areas, etc.

A scenario of the steps and components for identification of terrestrial and watershed Ecological Protection Red Lines has been developed to illustrate the approach that might be followed (see Figure 6-2-1 below).

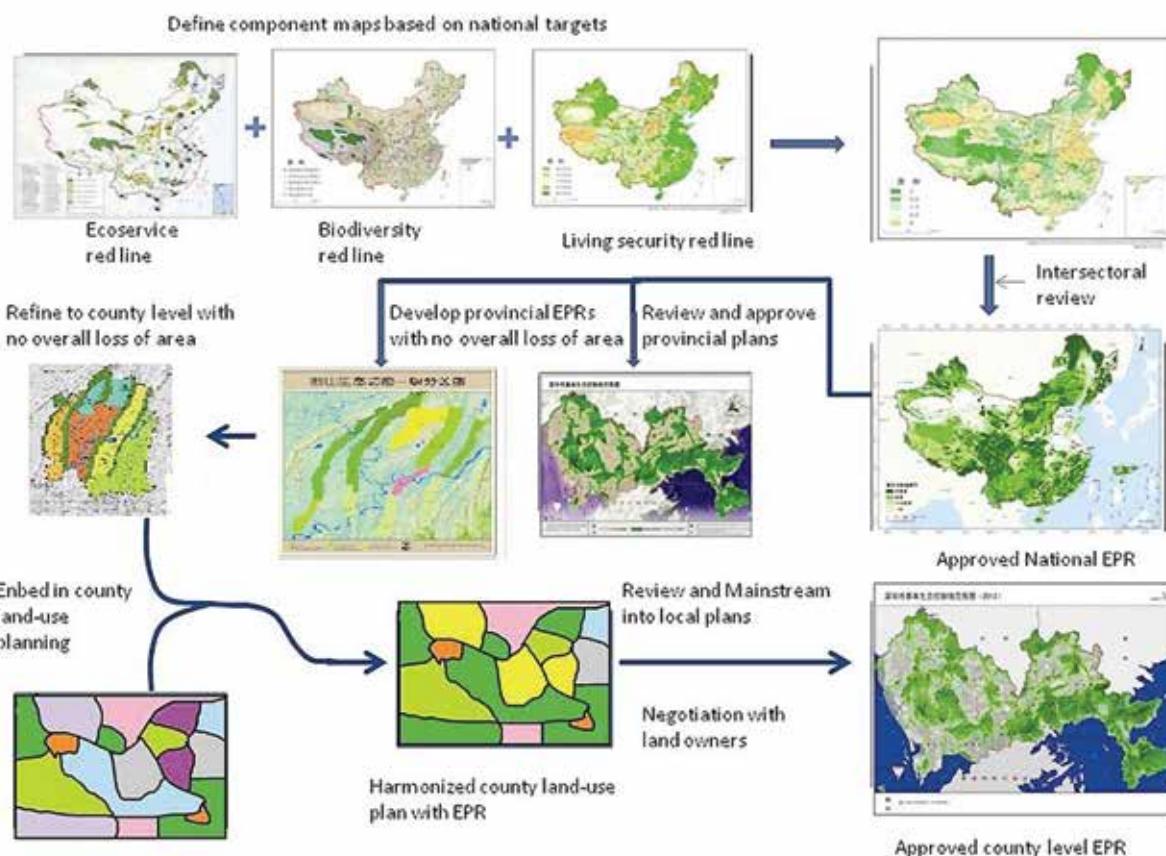


Figure 6-2-1. Delineation steps of EPRL maps

In practice, separate teams could prepare the three component lines with polygons (land units) shaded in two colours – those “essential” for inclusion and those “recommended” for inclusion.

When the three lines are combined there will be a lot of overlap between biodiversity conservation areas and ecological function areas. Areas identified as “essential” for any of the two categories would automatically qualify for including within the master EPRL system. Any area coloured as “recommended” for two or more categories would also be included within the EPRL system areas.

Regions shaded as “recommended” for only one category would be subjected to a secondary selection process by local planning agencies.

Final EPRL maps would, at each hierarchical level (national, provincial, county etc.), be reviewed by all relevant agencies prior to final ratification

Marine EPRL, a Special Case

In order to define red lines for protection of ecology and environment in marine and coastal areas in a way that maximizes benefits flowing from natural capital and reduces environmental threats and risks, the People's

- 168 Republic of China has several options. One option is to mirror what is already beginning on land – this is the identification of coastal / marine areas having high ecosystem services value, including provisioning and regulating services, priority areas delivering multiple services, and areas of economic value. Another approach would

be to do something more akin to systematic conservation planning, in which the focus is on the identification of coastal and marine areas having high conservation value, using criteria such as: species richness, endemism, and habitat diversity; vulnerable or sensitive species and habitats; and highly migratory or mobile species.

Regardless of which approach is used, China will have to deal with data gaps and inconsistent information, a situation in which heavily studied areas like the Bohai Sea provide a much greater amount of data and higher degree of analysis, while other areas lack this information. It will be important for national agencies to work closely with academic and epistemic communities. Since every effort should be made to apply criteria consistently and to systematically assess all marine areas in concert with coastal and watershed areas, the precautionary approach is likely warranted. International experience has shown that the most efficient way to identify areas in which ecosystem services and conservation are maximized is that which uses a hierarchical approach, beginning with the largest geographical scale.

The People's Republic of China has embarked on an effort to identify priority areas for protection in order to safeguard natural capital, keep the flow of natural goods and ecosystem services flowing, and reduce risks borne from natural catastrophe. While these benefits can also flow from protecting natural capital in the marine environment, there are special challenges inherent in attempting redlining in the marine environment, which include:

- The reality that the oceans are opaque, contain ecosystems with nebulous boundaries, and often have overlapping jurisdictions that make agency responsibilities and opportunities difficult to determine;
- The undeniable fact that much of ocean health and productivity is linked to terrestrial and wetland ecosystem condition, therefore marine redlining should be done systematically with redlining on land;
- The difficulties inherent in defining, mapping, quantifying and valuing marine ecosystem services, despite the fact that marine and coastal ecosystems may provide even more natural capital and services of value than terrestrial; and
- The limited options available for effective management of priority areas, given the need for inter-agency cooperation, surveillance and enforcement, and geographically large scale coordinated and collaborative action.

China also presents a particularly opportune case in marine priority area identification and protection since many redlining initiatives are already underway. A unique challenge, and opportunity, exists to strategically align all these ecological protection redlining initiatives, and systematically link them to other spatial planning processes underway, such as spatial and land-use planning, regional marine redlining, national ocean zoning, and both terrestrial and marine protected area designations.

In practice there should be three important steps in marine redlining:

Step 1. Identification of areas having high ecosystem services value:

- Provisioning and regulating services
- Priority areas delivering multiple services
- The role of economic valuation

Step 2. Identification of coastal and marine areas having high conservation value:

- Species richness, endemism, and habitat diversity
- Vulnerable or sensitive species and habitats
- Highly migratory or mobile species habitats

Step 3. Drawing boundaries around what is important.

This process is not totally scientific and objective. There is an important social dimension. There are three principles for application.

(1) Delimiting target areas in view of ecosystem complexities:

- Shorelines are dynamic systems
- Boundaries at sea are fluid and shifting
- Size and shape of area depends on scale
- Redlining requires periodic revision as ecosystems, conditions, and needs change (especially in the face of changing sea level, temperature and sea currents)

(2) No redlined area is ‘an island’; marine areas are intimately connected.

- Target areas need to be considered for their linkages to other areas, both marine and terrestrial
- Marine areas are often degraded due to poor land-use practices and poor watershed management, even when the area is strictly protected at sea
- Need to take an integrated approach, recognizing connections

(3) Ecological protection redlining of marine areas must be fitted into existing initiatives:

- Land-use planning
- Regional marine redlining
- National ocean zoning
- Marine protected area designations

6.2.2.2 Harmonizing the Land-Use Planning Process to Include Recognition of Ecological Functions

All land is useful and much of the currently defined wasteland or unused lands are in fact delivering valuable ecological services. Use of these negative terms should be ceased.

Strict division of marine, urban and rural area planning causes harmonization problems, as different agencies have differing land classification systems and control/planning procedures. The division in reality is not so clear-cut. Coastline changes rapidly, towns grow into country with urban sprawl, and new towns are constantly built. The very valuable intertidal zone is a case in point. Most marine areas are under control of SOA but this zone can also be classed as a forest or wetland, both under nominal control of SFA. However, plans to reclaim such areas as dry land ports or docks fall under MOHURD. Only a harmonized land-use planning system under Ministry of Lands and Resources can effectively control and harmonize such transitions.

Responsibilities

- **National government responsibilities are to:** set targets for the area and quality of lands to be established as EPRLs; identify national major ecological zones, including those which cross provincial boundaries or are critical watersheds; and set acceptable uses and performance standards for red line management. A national target should be put in place to establish 35% of the land and water area and coastline of China within the EPRLs¹⁶⁷.

167 Based on analysis undertaken by the CAS Eco-environmental Laboratory

- Define acceptable quality standards and establish the monitoring and enforcement regime. For Oceans a target is still required to be set.
- **Provincial government responsibilities are to:** translate national targets to local government; work in cooperation with surrounding provinces on cross-border EPRLs; and ensure no net loss of areas at a provincial scale resulting from the local land use planning
- **Local government responsibilities are to:** identify ecological lands, resolve conflicting objectives, and ensure achievement of targets for identification of ecological lands through land use planning that involves both local peoples and ministry representatives; and manage and report on Ecological Lands according to national standards.

6.2.2.3 Negotiation with Local Land Owners and Planners

There will be quite heated negotiations with landowners and local planners to achieve agreement for a mainstreamed and approved version of the draft EPRL map produced by the agencies. Much at this stage will depend on the confidence of local agencies and communities in the incentive system and methods of payment for ecosystem services that are bought into play.

6.2.3 Monitoring, Evaluation and Management of EPR

6.2.3.1 Guiding Principles and Practices for Compliance and Enforcement

Effective compliance and enforcement is vital for ecological protection and successful implementation of the redlining initiatives in China. It is a topic on which there is considerable international experience. This set of principles and practices has been derived from that experience and is intended to provide guidance in the next steps of implementation.

Table 6-2-4. Principles and practices for effective compliance and enforcement

<i>Defined</i>	clear authorities; separate those who are responsible for decision making from those responsible for compliance and enforcement at the local government levels
<i>Systematic</i>	well-coordinated approach between the various agencies and levels of government
<i>Focused</i>	on compliance as much as on enforcement.
<i>Rules</i>	that are clearly defined and can be enforced effectively
<i>Predictable</i>	transparent, rules and information driven actions
<i>Engaged</i>	citizens and society
<i>Informed</i>	monitoring, accurate and transparent
<i>Trusted</i>	integrity in delivery
<i>Fair</i>	dispute resolution mechanism

6.2.3.2 Management Responsibilities for EPRL

Identification of a red line will not in itself alter the designation of the land or authority of land managers. It is proposed that direct responsibilities for the day-to-day management of EPRL lands will remain in the hands of the current responsible agencies unless the lands are to become new Protected Areas. The EPR process will add protection to many new areas. These are already mostly under control of SFA if they are forests or wetlands, MOA if they are grasslands (including mountains), or SOA if marine. Newly added areas should be reviewed against available options of new protection status and, depending on specific protection demands, may be suitable for allocation under any of the existing PA categories to be systematically reformed. Many existing PAs are

inappropriately allocated and may need to have status revisions to more suitable use categories. In making such selections and reallocations, the needs for protecting identified ecological functions should be given priority over opportunities to maximize economic potential.

Table 6-2-5. Main Protected Area types and management agencies in China

Types	Agencies							
	SFA	MEP	MOA	SOA	MLR	MHURD	MWR	Other
Nature reserve	X	X	X	X	X	X	X	X
Protected Area for fish germplasm resources			X					
Forest park	X							
Wetland park	X							
National Scenic Spot (national park)						X		
World natural and Cultural Heritage						X		
National geopark					X			
National water park							X	
Water resource Protected Area							X	
Traditional cultural protected forest								X

6.2.3.3 Control of Activities and Developments inside EPRLs

Precise regulations need to be developed for different zones of the EPRL lands and categories of the reformed PA system; however a matrix similar to the one presented will be needed.

Table 6-2-6. Proposed acceptable uses in different zones

Protection needs/activities	Biodiversity	Scenic/ heritage	Ecological services	Forestry red line	Degraded or fragile
Logging	P	P	P	C	P
Hunting	P+buffer	P	C	C	P
Clearing vegetation	P	P	P	C	P
Housing/Urban expansion	P*	P	P	P	P
Rural buildings	P*	P	P	C	C
Industrial construction	P	P	P	P	P
Dams or water diversions	P+buffer	C	C	C	C
Water extraction	P	C	C	C	P
Pollution discharge	P+buffer	P	P	C	C
Road/rail construction	C	C	C	OK	C
Grazing	P	Z	P	Z	P
Plantations	P	C	OK	OK	OK
Farming	P	C	Z	C	Z
Tourism access	Z	Z	C	OK	Z
Habitat restoration	Z	C	C	OK	OK
Mining	P	P	P	Z	P

P = prohibited, P+buffer = prohibited in RL and within appropriate further buffer

C = controlled

Z = only within designated zones

OK = normally allowed

* Protected Areas may contain small zones where construction is allowed.

In the case of areas redlined for biodiversity conservation, there is sometimes a need to define a wider buffer zone in which certain activities will need to be controlled. Quite distant sources of pollution, water flow changes or adjacent hunting activities outside the protected site could completely undermine the objectives of the Protected Area and have negative impacts on the protected biodiversity. This type of external buffer zone is relatively common in other countries but very different from the currently designated ‘buffer zones’ inside Chinese nature reserves, which are strict protection zones with no exploitative human activities permitted.

6.2.3.4 Freeze on Major Developments and Approval of Plans in Nationally Identified Candidate EPRL Areas

In order to immediately prevent EPR planning from being undermined by a flood of other plans and claims in anticipation of delineation and introduction of this and other new reforms, regulations and zoning, it is necessary to put in place an immediate freeze on major developments inside the already identified Key Ecological Function Zones. When the final EPRLs are agreed, frozen developments that fall outside the EPRLs can be reactivated while those that fall within the EPRLs can be terminated without need of undue compensation. A freeze such as this will require urgent and decisive action by the State Council.

This freeze would also serve as a massive awareness measure. Everyone would quickly realize that the government means business, and consequently understand the importance of ecological protection in government policy objectives. The freeze would also accelerate the completion of the drawing and agreement of red line boundaries by local agencies if they wish to speed up the thaw on halted developments.

6.2.3.5 Paying for Redlining

The costs of the identification, legislation, demarcation, education and building awareness of EPRLs and EPRL monitoring, law enforcement and revision are all responsibilities of government and good governance. Their full costs must be borne by government at different levels, but these costs could be covered by new forms of taxation on areas of the economy that most benefit from good ecosystem services.

The costs of managing PAs, establishing protected forests or undertaking ecological restorations are also primarily government responsibilities and should be covered by the relevant establishing agencies. These costs may be offset by earnings from eco-tourism, public or private sector donations, or co-management partners. Costs involved in responsible protection of the environment are a fundamental part of government expenditure and should not be termed eco-compensation.

The term ‘eco-compensation’ should be reserved for payments to individuals, communal or private land-use owners whose loss of development options will be limited through the application of EPRLs. A variety of such eco-compensation mechanisms have been tried in China with varying degrees of success. A CCICED task force on Eco-compensation measures advised on how ecosystem services can be incorporated into Green Development (CCICED 2006). The task force report suggests a variety of payment mechanisms for different types of compensation. One important point of the report is the stress placed on involving local communities in the process. The following table summarizes several such mechanisms.

Table 6-2-7. Summary of payment mechanisms for eco-compensation

Date	Location	Type of mechanism	Brief description	Comments on suitability
2000 onwards	Western provinces	Grain for Green	Return of steep farmlands to forest or grass cover	Compensation not long enough and farmers usually opt for economic rather than ecological plantation
2008 onwards	Several poorer provinces, mostly western	Horizontal payments between provinces	Beneficiary provinces transfer funds to provinces providing water catchment functions	Only a small fraction of these funds really spent on ecological protection works
2008 onwards	Nationwide	Forest stewardships	Individuals or households paid to protect sectors of forest	SFA lose some control of forest estate, ok for economic forests but less interesting for pure protection work
2010 onwards	Qinghai	Community co-management of NRs	Local communities paid to protect and monitor protection of sections of nature reserve	Communities complain they have no police powers to evict illegal poachers and gold miners
2013 onwards	Hainan	Buy-back of fish ponds	To be converted into mangrove forests	Excessive payment leads to false claims and building fake ponds

6.2.3.6 Ensuring compliance with EPRLs

Monitoring, Reporting and Compliance Enforcement form critical elements of a program that must be independent and separated from any agency that has direct planning or management accountability for EPRLs. There are two functions:

(1) Monitoring and Reporting

- Monitor and report publicly on local, provincial and national government performance in planning and management according to the prescribed regulations.
- Develop a national information data base and mapping for ecosystem values and areas.

(2) Inspectorate and Enforcement Program

- Establish a national program for compliance and enforcement of ecological regulations.
- Undertake compliance and enforcement review and report publicly.

6.2.4 Requirements to Make EPRLs Operational

If the EPRL system is to be more than just a strategic planning tool, it requires operationalizing so as to have real meaning on the ground level in terms of protective management and land use. This requires bold and decisive action by the government, but can also form part of the deepening reforms that help guide towards the goal of building a ‘Beautiful China’. Establishing EPRLs requires the following components:

- *Processes* (principles, methodology, procedures, approval, application)
- *Institutional shifts* (clear agency lead and responsibilities for establishing, managing and monitoring red lines)
- *Legal instruments* (better framework for PA system with more categories, protection of other ecological lands, clarification of responsibilities) with real authority and enforcement
- *Capacity* (manpower, training, guidelines, technology, finance)
- *Public engagement monitoring* with open and transparent information, involvement in planning and management, etc.
- *Funding mechanisms* to incent individual and collective actions

The following table summarises the actions to be taken to establish red lines.

Table 6-2-8. Summary of actions needed to establish EPRLs

Actions	Involvement	Difficulty	Notes
Decide what red lines are needed	Technical experts	Easy	Largely done
Agree on standards	Technical experts	Easy	Largely done
Map red lines spatially on land and at sea	Technical experts	Easy on land, more difficult at sea	Some done
Harmonize zoning plans of different agencies and stakeholders	Experts, government and stakeholders	Very difficult and some compromises	Needs wide participation and consultation
Approval of integrated plans	Government at different levels	Difficult	Senior government must have ownership of plans
Adjust legal and regulatory framework	Experts and legislators	Easy but slow and complex	Priority needed to jump queue
Harmonize scales of planning	Owners of plans at different levels	Difficult	Top down and bottom up issues
Implementation	Inspectors, developers, funders	Very difficult	Big governance challenge
Revision as conditions change	Technical experts	Relatively easy	Constant process

6.2.4.1 Identification of Underlying Principles

Guiding Principles for EPRL Implementation

(1) **Ecological development is as important as social or economic development**

- Apply precautionary principle – err on the safe side of projections.
- EPR area shall not be diminished and areas not reduced.
- EPR ecosystem services shall not decline.
- Nature remains unchanged.

(2) **Use creative financial, market and regulatory measures**

- Employ incentives and market mechanisms to drive action as well as use of punishment systems.
- Polluter pays – apply heavy fines and disincentives to those developments that damage the ecosystem. Such fines to be proportional to damage caused.
- Developers should not benefit from any illegal development.
- Fair play – losers will be compensated (especially rural communities).
- Beneficiaries should be taxed to cover costs of redlining.

(3) **The land use system needs to adapt to the ecological imperatives of China**

- Environment and ecology are not separate but inextricably bound together.
- All land in China is valuable.
- No such thing as ‘waste’ land.
- “Ecological” land needs to be recognised.
- Both natural and damaged lands are essential components.

(4) **The Institutional regime must accommodate EPRL**

- Common objectives and standards but differentiated solutions and approaches.
- EPR includes terrestrial, freshwater and marine system.

- Not just about EPRL but the whole landscape.
- Separation of planning, management and monitoring/assessment functions.
- Professional Compliance and Enforcement is necessary.
- Full operational costs to be covered.

6.2.4.2 Reform of the Protected Area System

There is a strong case for comprehensive reform of the existing PA system to help solve the many problems alluded to in section 6.1.4.1. Reforms should include the imposition of an overall framework of approved PA categories to allow more appropriate management options for different situations in China. In particular, this should include clarification of standards and management objectives for such categories as national and provincial parks so that they can achieve a sound balance between the objectives of earning income from eco-tourism and protection of ecological, scenic, cultural and biodiversity values contained in such sites. There is also a need to include a managed reserve category to allow various forms of land management for specific biodiversity or ecological restoration, which are currently prohibited in nature reserves. An appropriate category needs to be defined for protection of extensive grasslands, where grazing needs to be integrated with the presence of valuable wildlife and ecological functions of catchment control. In addition, a new category of Protected Area should be added for designation of lands whose primary function is protection of ecosystem services.

A national PA system plan is required, one that identifies the overall objectives of the PA system and the roles of the individual units in it. The framework needs to clarify and expand the system of zoning on land and at sea and specify how much of each PA category can be zoned into different levels and types of use, ranging from strict protection to visitor zones, management zones, administrative areas, and sustainable use external buffer zones, consistent with international standards.

New regulations should be issued for the proper management procedures for each recognised category and level (national, provincial, county) of Protected Areas. Regulations should clarify objectives, management responsibilities, management procedures, law enforcement procedures, financing mechanisms, public engagement, and permitted co-management arrangements.

These regulations should be enshrined within an overall Law of Protected Areas. While it is anticipated that drafting and approval of such a law might take a matter of years, appropriate regulations could be brought into play very quickly.

Finally, PAs need proper budgets that are dedicated for expenditures on the planning and management of the system and the individual units in it.

6.2.4.3 Legal Framework for EPRLs

In addition to the need for a revised legal framework for Protected Areas, there is a broader need to review and strengthen the entire process of ecological protection redlining. The process can be launched by decisions of State Council but would require a legal context, approved plans, standards, targets, procedures and budgets^{168 169}.

168 Song 2007

169 There are several options for developing the legal instruments:

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- i) Develop and pass a completely new piece of legislation. While ultimately desirable, this will take some time to accomplish.
 - ii) Add specific rules and regulations into the Sections that have been deliberately designed under the recently amended Environmental Protection Act. While this is both expeditious and quickly achievable, it may well be that the Ministry of Environmental Protection is not deemed to be the most desirable host for this law, in which case,
 - ii) State Council can issue a “Regulation for Ecological Protection” in the short term. While this is expeditious and the recommended approach, it ought not to be seen as the best final solution.

The core existing framework is the current process of land-use planning and approval of development plans. This is controlled under the “The Law of Land Administration of the People’s Republic of China”, which specifies, “The State is to place a strict control on the usages of land. The people’s governments at all levels should manage to make an overall plan for the use of land to strictly administer, protect and develop land resources and stop any illegal occupation of land. Land should be used strictly in line with the purposes of land use defined in the general plan for the utilization of the land whether by units or individuals.”

The so-called “One proposal and three permits” is the core system for implementation of urban and rural planning, achieving the comprehensive objectives of relevant departments. The proposed development must acquire three different permits before construction can start (construction land-use permit, planning permit for construction project, and planning permit for rural construction). Procedures are similar for each permit and could be adjusted to allow evaluation against agreed red lines, or a fourth permit could be required. The proposal and three permits steps must be transparency and with public participations. (See Appendix 3 for detail on the Steps in Acquiring Development Permits.)

6.2.4.4 National Capacity Development and Engagement Program

China needs to encourage active participation in planning and managing all aspects of the system of EPRLs and the new PA system. It will be important to establish and implement a program to develop and engage all parts of society (government and non government) in planning and managing ecological values and areas, and in the monitoring and enforcement functions.

6.2.4.5 Incentives and Penalties “Sticks and Carrots”

Legislation will clarify the regulations relating to controlling developments within the EPRL areas, but judicious use of several other incentives is needed to help in enforcement and compliance.

Table 6-2-9. Examples of incentives, penalties and principles

Incentives	<ul style="list-style-type: none"> Civil service performance appraisal to include evaluation of ‘green’ performance Local administrators to be held responsible for ecological damages resulting from neglect or wrong decisions Tax incentives to encourage appropriate types of development in different EPRL zones Payments for ecosystem services (watershed, forest protection, carbon storage, guarding, reporting, fire fighting, reforestation, etc.)
Penalties	<ul style="list-style-type: none"> Fines/prison for polluters of EPRL ecosystems Fines/prison for damage to EPRL ecosystems or species Confiscation or demolition of inappropriate developments, structures or equipment within EPRL areas Confiscation of illegal traps, fences, structures, harvested materials or domestic animals within respective zones of EPRL Taxes on prime beneficiaries of ecosystem services – users of water, lands, minerals, extracted goods; costs of goods and products (including timber, water, coal, etc.) should include all environmental externalities
Compensation offered for	<ul style="list-style-type: none"> Loss of economic benefits or land/property values caused by establishment of EPRLs to individual households or enterprises Compensation for damage caused to private property by wildlife (system already in place) Compensation for voluntary abandoning of agriculture/grazing rights within EPRLs
Principles for determining levels of penalties and compensation	<ul style="list-style-type: none"> Polluter pays – apply heavy fines and disincentives to those developments that damage the ecosystem. Such fines to be proportional to damage caused Penalties high enough to ensure that developers should not benefit from any illegal development Fair play – losers will be compensated (especially rural communities) Beneficiaries should be taxed to cover costs of redlining Full operational costs (externalities) to be covered

This chapter has examined the definition, characteristics and the potential approaches to establishment of Ecological Protection Red Lines. It has identified applicable national and international experiences and identified a number of principles on which further progress might be based. By examining the possible technical approaches it is clear that significant work and change is required, but also that this important work can be brought to successful fruition. In the next chapter the conclusions of the team and recommendations for implementation are presented based upon the analysis presented here.

6.3 LESSONS LEARNED FROM INTERNATIONAL AND NATIONAL CHINESE EXPERIENCES

The term Ecological Red Line does not exist in international practice, however, there is international experience worth learning in the conservation and management of ecological values, the construction and management of natural ecological protected areas including building global natural protection area, and large-scale green corridor protection promoted by International Union of Conservation of Nature (IUCN) and many others.

6.3.1 Ecosystem Management and Protection

Global assessments of the status of biodiversity and the protection of ecosystem services generally observe that:

- In the developed world though there are very many reasons for concern and continuing vigilance, the situation (for terrestrial systems at least) is relatively stable and there are in fact places where the prospects and conditions are improving.
- In the developing world (where much of the globally critical biodiversity still exists) ecosystem services are under considerable pressure and subject to continuing loss of biodiversity and imminent threat of early collapse in some ecosystem services in particular locations and more extensively in the long term.

Many explanations have been offered:

- The Developed world; has less diversity, fewer pressures and a longer history of resource management and development as a result of which these countries have evolved a complex set of governance institutions and measures that are open, comprehensive, continuously evolving and well adapted to the particular needs of those jurisdictions.
- The Developing world is subject to significant drivers of change (poverty alleviation, agricultural development, settlement expansion, resource extraction and development) in the absence of stable governance regimes or the application of locally adapted and accountable modern management measures.

The counties of Brazil, Colombia and a very few African nations are often mentioned as the best examples of large countries in the developing world that are dealing most effectively with these pressures. Countries such as Australia and Canada are developed world countries that are often identified as most like the developing world with models of resource conservation that are seen as effective. Common characteristics and predictors of effective performance in these jurisdictions are identified as:

- Governance structures that are well grounded continuously evolving and that derive from and are well adapted to local and cultural roots as well as responding to larger national needs.
- A well integrated, open and comprehensive land use planning system that deals effectively with conservation as well as development needs by zoning all lands for those purposes including identification of areas that might be considered Redlines (though this terminology is exclusive to China).

- A history of good resource science and knowledge systems along with training and deployment of highly capable professionals into the field.
- A diversity of modern and traditional market and regulatory “carrots and sticks” that are adapted to local needs and are intended to ensure a mixture of conservation along with development.

6.3.2 Peri-Urban Conservation

In some ways the challenge of ecosystem service management and protection in urban areas is a very specific, intense and particularly local example of those challenges as encountered in the wider arena of rural resource management.

However, development and in particular the expansion or “sprawl”, of urban areas is the outcome of the complex interaction of many forces. It is reflective of cultural differences, and is driven by the interaction of infrastructure development (in particular but not only transportation) for residential, commercial and service centralization, market and taxation differentiation and variations in governance structures.

The challenge of “urban containment” and the “transition” between urban and rural areas has been one with which many developed and developing world countries have wrestled with varying degrees of success.

Some early examples of structural solutions to the development and containment challenge include the long history of “Green Belt” zonation in the UK and of Agricultural and Nature Reserve establishment in some Canadian jurisdictions. These might be considered as early “red lines” for development control and protection of various values including aesthetics, liveable communities and the quality of environment and ecosystem services.

Experience has demonstrated, however, that a purely structural approach has limited effectiveness. In practice the imperatives of residential and commercial development and service provision both within and around cities have to be considered. An intricate set of policy measures including taxation and market mechanisms along with zonation and accompanying development “codes” also have to evolve to deal with these and related pressures.

6.3.3 Nature Conservation Management

6.3.3.1 Established a system of legal protection for ecological values

Many countries have passed national legislation and set in place coordinated and cohesive policy and practice, that taken together are intended both to establish a “system or systems” of Protected Areas (Parks, Nature reserves, Areas of Outstanding Natural Beauty, Habitat and Wildlife Protection Areas, etc) and a systematic approach to management of those natural values and ecosystem services that are located in areas outside those protected entities.

For instance, basic laws of the United States involving natural protected areas include a number of special laws such as “National Parks Basic Law”, “Law of Natural Reserve”, “National Environmental Policy Act”, “Federal Endangered Species Act”, and “Federal Advisory Committee Act”; “Russian United Specially Protected Natural Areas Law” comprehensively regulates the construction and management of specially protected nature reserves in Russia. In addition, German “Law of Nature and Landscape Protection”, Japanese “Natural Environment Preservation Law”, “Natural Park Law” and “Forest Law”, and Canadian “National Parks Act” and “Canadian Wildlife Act” have all specified the management practices of their countries’ nature reserves, national parks, and other protection parks. EU Natura 2000 Conservation Network, based on “Habitats Directive” and “Birds Directive”, carries out constraints and management on the protection areas of the 27 member states. Management procedures, responsibilities and protection requirements of all countries’ natural protected area are governed by the above-mentioned laws.

6.3.3.2 Unified regulation achieved scientific planning

In most countries for example in North America, or Europe, Australia, and Asia, the management of their national Parks is placed within the jurisdiction of a single agency. This ensures clear accountability and consistent management according to a single set of legislation and policy.

In many of these nations this single “Parks” entity may also be responsible to manage many other types of Protected Areas. However, there are also many jurisdictions where multiple agencies are responsible for various different areas and laws; however, there are strong coordination or unification processes in such jurisdictions.

The unification or single agency approach is intended to facilitate unified supervision, assessment and unified planning, ensure the integrity of the ecosystems, and improve protective effect. Most countries have made detailed plans on their national nature reserve system, and divide and identify the different types and levels of protections according to the conservation goals, providing guidance reference for the scientific management of protected areas. For instance, the United States carried out national natural protected areas system development planning based on ecological zoning principle, European Union gave detailed development plan on network construction of European natural protected areas based on IUCN protected area classification system (i.e. Natura 2000); New Zealand authorities established two supreme statutory policies on management, that “Protection General Policies” and “National Parks Overall Policy” to provide guidance for all types of natural protected areas to develop protection management strategies and conservation management plans.

6.3.4 IUCN Protected Area System

International Union of Conservation of Nature (IUCN) has been committed to promoting global conservation construction, the protected area is defined as: geological space with clear range, recognizable and manageable, to achieve long-term protection of its naturally associated ecosystem services and cultural values through legal or other effective methods. IUCN, on the basis of summarizing the status quo, systematically classified global conservation systems. In 1994, IUCN issued “Protected Area Management Type Guidance”, according to the key management objectives of natural conservation, divided nature reserves into six types. IUCN system of protected areas are accepted and learned by more and more countries, some countries have also included this classification system into the relevant regulations on the construction and management of national nature reserves (e.g., Australia). United Nations List of Natural Ecological Protection Zones (UN List) also regards this system as the standard structural mode for statistical of data of world natural ecological protected areas See Appendix 2.

According to the conservation, management and utilization levels, IUCN protected area classification system can be divided into three categories, namely strict protection class (Ia, Ib, II), habitat/site management class (III, IV) and sustainable use class (V, VI), currently the world’s strict protection class accounts for 15.4% of the total natural protected areas, its coverage area accounts for 38.3% of the total area of all natural ecological protections.

With the exacerbated human activities and enhancement of conservation awareness, the number and size of protected areas worldwide have rapid growth rate and the scope of protection also expanded from land to sea. 104,791 protected areas included by World Commission on Protected Areas (WCPA) under IUCN cover an area of more than 200 million square kilometres of earth’s surface, most of which is land, and covers more than 12.2% of the land area of the earth’s surface, marine protection area is only 0.5% of the earth’s oceans.

180 6.3.5 Summary of International and Chinese Experiences

Lessons from international (derived from experience in UK, Australia, Canada, USA, Malaysia, Indonesia, Thailand and others) and national (Shenzhen, Beijing, Zhejiang, and Jiangsu) experience. See appendices for more detail.

- No countries reviewed specifically use the ecological protection red line concept, but all have taken measures to protect biodiversity and important ecological lands.
- Most countries have a broad range of PA categories, from strictly protected nature reserves to multiple-use management sites. IUCN categories provide a classification system of the main types.
- Most countries additionally have various designations of lands protected for ecosystem services, such as green belts (UK), protection forests (Indonesia), national forests (USA), Sites of Special Scientific Interest (SSSIs) (UK), etc.
- Most countries have multiple agency involvement and responsibilities. This is not a problem as long as they are harmonized, with clear differentiation of roles and responsibilities and high levels of information exchange and coordination.
- Most countries recognise the need to mainstream conservation of biodiversity and ecosystem services into broader planning processes. The use of municipal-level spatial plans in the Cape Floral Kingdom of South Africa is a good example. The ‘Working for Water’ program in South Africa is another success story, where the removal of invasive plants from wetlands saves water, reduces the need for reservoir capacity and provides employment.
- There is a growing recognition of the need to involve the public and local communities not just in awareness and education, but also in decision-making and co-management.
- There is a proven need for transparency, open decision making, independent oversight and public enquiry.
- There is growing recognition that biodiversity conservation needs a landscape approach with enough connectivity to allow migration, redistribution and adaptation to changing climate.
- Most countries have complex histories of different laws but these need to be compatible. Although laws need periodic updating, much can be done under high-level directives, subsidiary regulations and through development of plans and budgets. Good laws do not guarantee high performance. There needs to be effective compliance and enforcement.
- Most countries have land-cover, land-use and land-ownership database/cadastre systems that form the basis of land-use planning, zoning and approval of developments.
- Models of payments for ecosystem services are emerging, particularly with regard to agriculture and conservation (the EU and US) and tropical forest conservation (Brazil, Guyana and Costa Rica).
- Lessons about ecological protection redlining can be derived from marine protected area (MPA) establishment, marine spatial planning (MSP), and ocean zoning initiatives around the world. The premise here is that spatial planning requires the identification of priority areas, which can then be managed or protected in a spatial plan or MPA. The methods used to identify these priority areas mirror some of the methods used to do ecological protection redlining at sea. Intrinsic to MSP is the concept of ecosystem-based management (EBM), which reiterates the need to think about priority areas in the broader context (and necessitates the linking of marine redlining with terrestrial)
- A recent report¹⁷⁰ commissioned by the Global Environment Facility’s Scientific and Technical Advisory Panel, at the request of the Convention on Biological Diversity, presents lessons learned about MSP at all scales. The findings confirm that the theoretical basis for MSP is well established, but the practical execution of MSP is still in its infancy. The report reviews conventional planning processes, identifies innovative new tools, and discusses the potential MSP has – as yet not fully realized – in aligning conservation and

¹⁷⁰ Agardy, P. Christie, and E. Nixon. 2012. Marine Spatial Planning in the Context of the Convention on Biological Diversity: A study carried out in response to CBD COP 10 Decision X/29. CBD Tech. Series 68, Montreal

development interests while protecting vital ecosystems, the services they deliver, and the biodiversity they support. A review of MSP at all scales across the world suggests that one of the important keys to success includes using planning approaches appropriate to the particular circumstances of the place (this includes using scientific information as well as traditional ecological knowledge to support management plans and regulations). Another essential element is having a supportive legislative framework in place, with a means to determine priorities (based on the best available science), and a hierarchical system to clearly establish goals, objectives, and strategies for MSP. Governance of management that flows from marine spatial plans is at least as important as effective planning of MSP, so the current undue emphasis on planning as opposed to implementation needs to be overcome (Agardy *et al.*, 2012). China is in a leadership position in this regard, as it already has an ocean zoning initiative underway, and has developed plans for the Bohai Sea, among other areas.

- A number of Chinese municipalities, cities and provinces and the State Oceans Administration have made considerable progress in delineating “ecological” red lines of various types in spite of the previously identified (above) challenges (see Appendix 1) These provide valuable case examples on which to build.

6.4 KEY CONCLUSIONS

6.4.1 Imminent Challenge of Eco-Environmental Protection in China

Experts agree that despite significant government initiatives to improve environmental conditions, China’s continued prosperity and social advancement are now threatened by the lack of sufficient attention to protection and management of ecological values. Continuing deterioration of natural ecology now poses a significant risk of natural disaster and constitutes a very real threat to achievement of an Ecological Civilization¹⁷¹.

At risk annually are trillions of dollars in calculated ecosystem service values¹⁷². Coastal areas are particularly at risk, as demographic trends indicate further mass migration of people to coastal cities and suburban areas or into downstream areas of watersheds draining to the coasts. The resulting degradation and loss of services can be countered by effective protection of natural infrastructure and restoration of key areas providing multiple ecosystem services.

For the marine environment, it is vital to ensure that critical areas (in particular the intertidal zone) and regions providing ecosystem services are identified and protected, whether through existing planning processes such as the marine spatial planning undertaken under China’s ocean zoning, or by dedicated initiatives such as those related to the Bohai Sea and other areas. Considerations related to connectivity between land, freshwater, and coastal systems are paramount. Thus redlining protection and future restoration should be designed in a comprehensive and integrated manner—from mountain to sea.

6.4.2 Opportunity Presented by the Reform Process for the Establishment of Ecological Protection Red Lines

The wide-ranging Reform agenda now underway via the Economic and Eco-civilization Reform sub-group under the direction of the President-led Deepening Reform Central Party leading group¹⁷³ is timely and highly appropriate in light of the severity of the risks and the interrelated and complex nature of the issues.

171 ADB 2012 Toward an Environmentally Sustainable Future

172 Costanza *et al* 2014

The SPS supports the conclusions of previous CCICED task force studies on the importance of ecosystem services.

173 Naughton 2014

Arresting the current decline in ecological conditions will require significant new action to put in place initiatives such as the low carbon economy and solutions that will deal with the fundamental economic, financial, social and institutional drivers that are causing these problems.

Establishment and proper management of Ecological Protection Red Lines (EPRLs) is one key part of the solution. These lines will identify the important functional features and locations of the terrestrial, freshwater and marine ecosystems of China that must not be impaired or must be restored, in order to provide ecological and environmental services essential for social and economic development. However they are not the only part of the necessary solution to maintaining ecological services. In fact, they will only succeed if part of specific reforms to the institutional approach to and the management of these services on *all* lands and resources in China, including those exploited by resource and development sectors of China's economy.

While most attention by government so far has focused on land-based ecological protection, establishing red lines at sea presents a unique opportunity. Critical areas can be demarcated within existing marine spatial planning processes, such as China's ocean zoning initiatives, to maximize and even enhance marine and coastal ecosystem services delivery. Demographic and economic trends in China suggest coastal pressures will only rise in the future, through direct pressure caused by coastal industrialization, and, importantly, indirect pressures caused by land and water use in watersheds, and coastal land reclamation. However, establishing and maintaining redlined areas may be easier at sea than doing so on land, since displacement and eco-compensation needs are more limited. The time is right to insert red line considerations into all coastal and marine planning processes in China, to ensure growth of the blue economy will be as sustainable as possible.

6.4.3 Clarifying Responsibility to Protect Ecosystem Services and Ecological Conditions

Within the current institutions of the government of China there is no fully comprehensive understanding of eco-environmental issues and no vision or systematic, cohesive and well-integrated, strategic and operational approach to confronting the loss of ecosystem services. A responsible authority with the mandate to identify areas of high ecosystem services value is needed to ensure these areas get protected through the planning and management undertaken by all agencies.

Responsibility and accountability to address, identify and manage ecological values is scattered among many government organizations; none is fully responsible for analyzing the issues, developing a fully integrated national policy or implementing and enforcing management solutions, and there is limited coordination and accountability in the governance system.

Responsibility should no longer be seen as only a government task. All of society needs to be welcomed as part of the solution by playing a more significant part in planning, active management, oversight and rules enforcement.

6.4.4 Critical Components to Successful Implementation of the Ecological Protection Red Lines (EPRL)

The current legislation, policy and institutions available are insufficient to protect terrestrial and especially marine areas that provide high ecosystem service values. Experience within China and internationally indicates that reform of the following components of the governance system is required:

- *Lack of legally enforceable rules that protect ecological services is a problem.* There is need to clearly define, identify and strictly (but flexibly) manage EPRLs by setting and enforcing limits to development and use.

- *There is a lack of a systematic set of designations.* These need to be designed to identify, “zone” and manage ecological values inside and outside the red lines in a manner that is sensitive to the differing ecological situations across the nation.
- *The planning and management tools at the ground level are not effective enough.* Ecological Function Zones are identified at the national level but this is primarily for strategic planning and not for ground-based management.
- *The current Protected Areas System (PAS) should be a key component of the solution.* It is inadequate in terms of its size, types of designation, the lack of systematic planning, the lack of marine and coastal representation, and problems of jurisdictional overlap and conflicts. PAs should be expanded in the coastal and marine areas as well, and designed as networks that allow for true ecosystem-based management.
- *The current spatial and land-use planning systems in China are well established and have great potential.* However, they lack any identification of ecological lands¹⁷⁴ (The current system includes instead “Waste Land” which is at best misleading). Additionally a process is required to resolve conflicting land uses at the local level.
- *China’s spatial land-use planning systems could benefit from a more ecosystem-based approach,* in which case marine planning, coastal planning, and watershed planning will be done in a complementary way that maximizes the ecosystem services flowing from all its biomes. Currently, marine spatial planning is done to accommodate existing and emerging maritime industries, with insufficient attention to identification of ecologically critical areas, and impacts of degradation from afar.
- *Clarity of intent is required.* Experience with EPRLs for agricultural lands indicates that use of targets is effective in the process to resolve conflict over the EPRLs at provincial and local government levels of implementation. To be effective the approach needs both top down and bottom up approaches for harmonization.
- *Local governments and peoples are key to success.* They sometimes lack knowledge and motivation. Enforcement actions on their own are unlikely to succeed. They need in addition capacity development and positive incentives such as principled, properly financed and centrally controlled eco-compensation or performance payment schemes. These will help resolve impacts on local peoples as well.
- *The current institutional problems are well documented. Resolution requires a new institution.* This would be responsible for: improved coordination and accountability for ecology and greater coordination of all initiatives; more public involvement and transparent monitoring, reporting and accountability; professional compliance and enforcement mechanisms that are separate from the actual decision makers at a local level; development and management of a payment for performance approach; and capacity development for ecological protection.
- *Key nationally important “candidate” EPRL areas can be identified quickly given current information,* although full implementation will take time. Without a freeze development within these candidate areas, essential ecological values will be lost and government could face significant unnecessary extra compensation costs to establish the EPRLs.

A reformed institutional framework and systematic approach to identification and protection of critical ecological values is necessary for China. It is possible to complete implementation within a reasonable timeframe if undertaken in a coordinated and urgent manner. This is necessary to avoid future costly losses of eco-environmental services and to restore those already compromised. The identification and full implementation of Ecological Protection

¹⁷⁴ Ecological Lands would be those lands that are primarily and essential to ensure retention of ecological and environmental service functions but this does not mean that these functions are ONLY supported on those lands.

Red Lines, the identification of Ecological lands and improvements to the national protected areas system are key components of that work. High priority must be placed on urban and peri-urban areas, coastal and marine areas and critical watersheds. In this way it will be possible to properly balance the various competing imperatives necessary to achieve an Ecological Civilization.

6.5 POLICY RECOMMENDATIONS

The Special Policy Study has identified five recommendations and an implementation plan to guide the work that is necessary to respond to the task force conclusions.

6.5.1 Set into law the definition and characteristics of ecological protection red lines

Successful implementation requires a single clear definition that identifies acceptable uses for ecological and environmentally redlined areas and that is legally enforceable. It is also critical that national targets are set to guide the identification of candidates for EPRL designation.

- An ecological protection red line (EPRL) defines the minimum spatial area within which strict development controls ensure sustainable provision of ecosystem services vital for national and regional development. EPRL includes natural and constructed ecosystems, terrestrial, freshwater and marine, and degraded areas with potential for ecological restoration to valuable health. The ecosystems may be located in rural or urban settings.
- Ecological protection redlines include three components: Ecosystem Services Protection line, Living Environment Security Protection line and Biological Diversity Protection line¹⁷⁵.
- Establish a national target of 35% of China's land area to be within an EPRL on the basis of ecological problems, ecological sensitivity and important spatial characteristics of ecosystem services in China this will include some but not all existing Protected Areas.
- New Law is required but in the interim State Council should be authorized to issue as regulations "Management Measures for Ecological Protection Red Lines" that establish this definition and intent of EPRLs, along with rules and regulations to describe intended uses and restrictions on such activity in order to guide implementation and ensure enforcement of the intended uses and clear identification of a responsible agency.

6.5.2 Reform the spatial, land-use planning and marine-use planning systems to include EPRLs

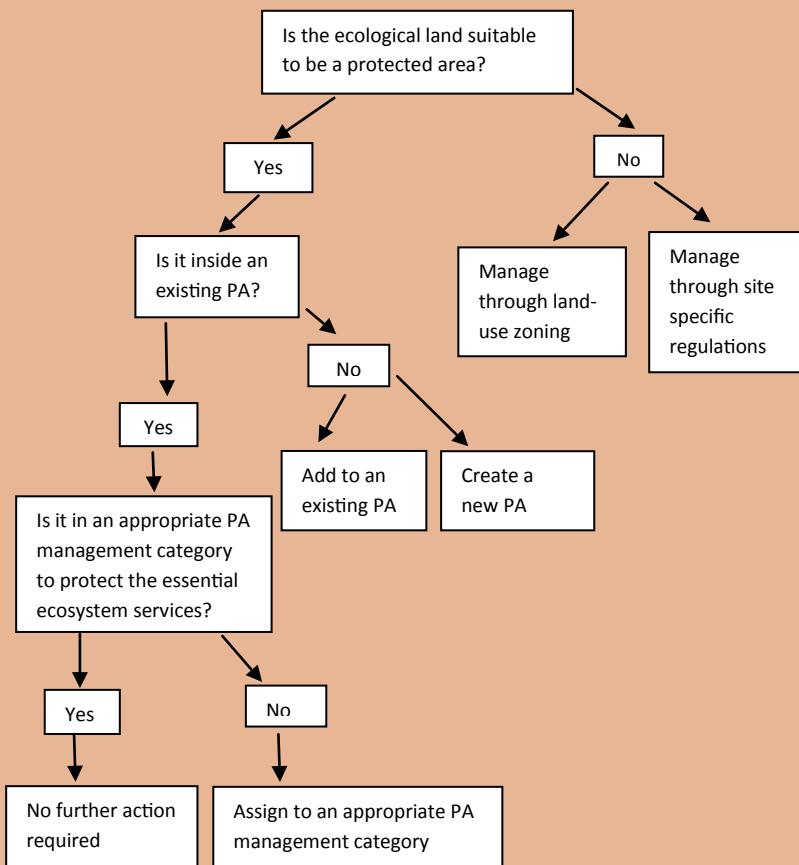
Change in the national spatial and land- and marine-use planning processes is required in order to resolve jurisdictional overlaps, and identify and describe a new set of designations and processes associated with EPRLs and Ecological Lands and to remove the designation of Waste Land:

- Establish a new terrestrial land-use category to protect as "Ecological Lands" those lands that have the dominant function of providing ecosystem services.
- Form a new integrated land use planning and spatial planning system and new categories of land designations
- Establish a similar approach to national marine spatial planning undertaken through China's ocean zoning, or by dedicated EPRL initiatives.

¹⁷⁵ See Chapter 2.2.1 Table 2-3 for a full documentation of these three components.

The Relationship Between Ecological Lands and Protected Areas

Once ecological lands have been identified, it will be important to ensure that they are appropriately managed. In many, but not all, instances, it may be appropriate to incorporate these ecological lands into China's protected area system. The flow diagram below outlines a possible decision-making process for integrating some ecological lands into the PA system.



6.5.3 Establish new national coordinating mechanisms for ecological conservation and for monitoring and compliance

The current institutional framework requires a major change focused on establishing a single coordinating and accountability centre for ecological conservation, EPRL designation and management, setting targets, assessing performance, and monitoring and reporting functions. This is a highly significant issue that requires focus on a new operating mechanism. It is not within the remit of the study to advise government on where such a mechanism or agency should be established. Major functions and responsibilities of this mechanism or agency should include:

- State ecological conservation policy: develop a single integrated national ecology strategy and policies;
- EPRL oversight, coordination and facilitation;
- Oversee and coordinate the work to develop a single integrated national Protected Areas system plan and management approach;
- Plan and Implement the new payment for performance and eco-compensation approach (see 5.5 below);
- Plan and organise regional major ecological construction and restoration projects to protect and restore ecosystem services in EPRL lands;
- Implement unified EPRL monitoring, reporting and enforcement;

- Plan and implement a national capacity development and engagement program.

6.5.4 Renew and expand a national Protected Areas system

A national PA system plan, new legislation and strengthened management are required to strengthen the status and functionality of existing protected areas. This is consistent with earlier CCICED task force and working group recommendations. Protected Areas form an essential part of the backbone of China's ecological security and have a key role to play in delivering EPR. Therefore it is necessary to:

- Develop a single integrated national PA system plan that includes consolidation of PA categories and management approach and ensure integration with the EPRL system.
- Further examine the need and requirement for a National Park Agency and administration.
- Develop a Protected Areas law to strengthen Protected Area management by improving public engagement, management plans and dedicated financing.

6.5.5 Design and implement a national program of payment for performance in EPRL

A new eco-compensation program is recommended that would provide incentives to local governments and to those impacted by the designation of Ecological Protection Red Lines. This would be a payment for performance directly to the impacted individuals, cooperatives or local governments, rather than the more traditional simple transfers of moneys to provincial or local government bodies. It will require careful monitoring to ensure that work undertaken does provide desired improvement and protection of ecological services, or other ecological and environmental benefits.

6.5.6 Implement the Institutional and Operational Priority Actions

6.5.6.1 Institutionalise the recommended changes

It is important that these changes become a full part of recognized national plans and strategies. For this reason the following actions need to be undertaken.

- Approval of the SPS recommendations by the central Government Economic and Eco-civilization Reform Group.
- Mainstream the Recommendations into the National and Provincial 13th Five-Year Plan to be approved at the March 2016 National Peoples' Congress.
- Refer all law and regulatory changes to the National Peoples' Congress for approval by 2016.

These steps will require some time to implement and must necessarily be undertaken in parallel with a number of immediate actions that are identified below.

6.5.6.2 Operationalise the EPRLs

6.5.6.2.1 Critical immediate tasks

In order to meet government leaders stated objective to have the EPRLs identified as quickly as possible, the following tasks need to be underway immediately.

- Define a time-limited national coordination office for EPRLs; this would involve all key agencies and would report to a committee of vice-ministers. The coordination office would provide direction, oversight and

coordination of the development and implementation of the EPRL system for China. The coordination office would be responsible to ensure the various policy initiatives, program changes, and actions are well coordinated and initiated by 2015. If a conservation agency were established later, its function would be part of that mandate.

- Refine the EPRL system by:
 - i. Finalizing the definitions and characteristics of a simplified and harmonized system that covers all lands, resources and environment regulatory functions;
 - ii. Identifying nationally significant ecological land as Candidate EPRLs based on the existing analyses undertaken by MEP and CAS;
 - iii. Confirm the national 35% target; and
 - iv. Create a set of technical guidelines for local governments to assist their work in identifying local level EPRLs.
- Develop the rules and regulations that will immediately be set in regulation as “Management Measures” by state council (or, under Section 3 Article 30 of the new Environmental Protection Law) to govern the development and management of the EPRL system. This includes:
 - i. Defining the roles and responsibilities of all agencies and levels of government;
 - ii. Defining guiding principles that will govern the EPRL system;
 - iii. Defining acceptable uses inside EPRLs;
 - iv. Defining the provisions for differentiation and situational flexibility both spatial and temporal;
 - v. Developing separate and specific provisions for rural-urban, coastal-marine, resource development areas, rehabilitation lands, etc.; and
 - vi. Ordering an immediate development freeze in approved Ecological Function Zones and existing nature reserves. This follows the precautionary principle and avoids a rush to start developments in anticipation of future prohibition or stricter controls. The freeze should remain in place until the EPRL planning of the zone concerned has been completed. At that time it will be clear whether such development is to be permitted, controlled or prohibited.

6.5.6.2.2 Tasks to be completed within one year

To oversee practical implementation on the ground, the coordination agency should:

- Develop a strategy for establishment and review of an expanded system of pilots for fast implementation of the system approach to land -use planning;
- Fully incorporate new categories into spatial planning; define how to consult on resolving issues and making decisions to establish “National Priority” EPRL areas within the main functional zones as a priority for first phase of planning;
- Define the rules to rationalize the national PA system and categories and set priorities for work to review all existing “designated areas” to place them in the correct category;
- Oversee implementation of the new EPRL regulations;
- Develop and implement a national approach to compliance and enforcement and public monitoring and reporting;

- Develop and implement a strategy for capacity development and stakeholder engagement, targeted at the local level;
- Develop a “decision support and analytic tool” to enable choices between competing land designations during land-use planning; and
- Determine development, approval and funding of the new performance based payments system for local peoples and governments.

The individual ministries, provincial and local governments should:

- Undertake their own EPRL plan (SFA, MOHURD, MOA, MEP, SOA, etc);
- Strengthen protective management of the nature reserve system following self assessment of needs using IUCN assessment toolkit, management effectiveness tracking tool (METT) and adoption of competence standards already proposed by CCICED Protected Areas Task Force (2004); and
- Complete a PA systems review including proposals for completing ecosystem type coverage, species coverage needs and distribution corridors. Priorities include potential Ramsar sites already identified by Birdlife International, key coastal sites identified by the East Asia Australasian Flyway Program and key trans-frontier sites already identified by IUCN WCPA.

6.5.6.2.3 Tasks to be completed within five to ten years.

- EPRL monitoring and reporting procedures routine; first report complete and publicly available by 2016;
- Full legislation and institutional reform completed by 2020;
- PA system reconfigured, expanded and integrated with EPRLs;
- 10-year EPRL review and revisions;
- Eco-compensation payment and payment for performance system fully institutionalized;
- PA competence standards form basis for in-service training programs, career promotions and professional hiring;
- Evaluation study of EPRL success and economic contribution;
- China assists supply countries to put in place their own EPRL systems.

At the end of this ten year period China will have in place a fully functional comprehensive and systematic approach to the conservation and restoration of ecologically important lands, services and environments that will be the underpinning of an Ecological Civilisation and will also lead the world in practice.

This report is submitted by the CCICED Special Policy Study on Institutional Innovation of Eco-Environmental Redlining.

APPENDICES

Appendix 1: Case Examples

Irrevocable losses - Daxing'anling (Greater Hsingan Mountains)

When naturalist Sowerby visited the Daxing'anling in 1913 he found forests that “rolled on and on, seemingly without end” (Sowerby 1922-23). The conifer forests of NE China at that time compared favourably with those of Canada and the US. As Russian forester Ivashkevich (1916) described, “The Manchurian forest [...] has a tremendous percentage of big trees that I have not only never seen, but have not even heard of before.” Sadly without proper planning or protection, those great forests have become shrunk, fragmented and degraded with huge loss of ecosystem service values. But with redlining and wise restoration, much could still be recovered.

The Daxing'anling Region is located in the most northern part of China, straddling northwest Heilongjiang Province and northeast Inner Mongolia Autonomous Region ($47^{\circ}03'40''$ - $53^{\circ}33'25''$ N and $119^{\circ}36'20''$ - $127^{\circ}01'17''$ E), bordering the Heilongjiang (Amur) river and Russia. This region comprises a large mountainous wilderness of 189,775 km² (106,275 km² in Inner Mongolia and 83,500 km² in Heilongjiang) containing mixed deciduous and coniferous forest with marshes, peatlands and a small amount of agriculture. The region is underlain by discontinuous permafrost at 0.8 – 1.5 m. Annual rainfall is approximately 400-500mm with temperatures ranging from 35 °C to – 50 °C. Drainage is to the Heilongjiang directly or via the Songhua River and represents the principal source of water for the rest of Heilongjiang Province and many important wetlands downstream.

The region is still critically important both for its ecosystem services and for biodiversity conservation. The annual carbon sequestration is likely to be very substantial due to both the annual primary (forest) productivity of 25.2 million m³ and the large proportion of larch and deciduous species that shed needles/leaves in winter, which accumulate in the forest and wetlands soils and bogs and are converted to organic carbon. The entire region is also listed as one of the 50 National Ecological Function Zones jointly issued by the Ministry of Environment Protection and the Chinese Academy of Sciences in 2008, identifying the most important zones for ecological function of ecosystem conservation and water retention in China.

Daxing'anling represents a unique forest and wetland wilderness habitat and is home to cold temperate and polar species (moose, reindeer, wolverine, sable, arctic hare, etc.) that are found nowhere else in China. It is one of the 35 priority areas identified in the NBSAP for biodiversity conservation, and supports 11 Important Bird Areas (IBAs).

Nature reserves in danger – A Hainan case study

The mangrove forests of Qinmeigang near Sanya in Hainan were declared a nature reserve in 1989, with a total area of 200 ha. The site was investigated by a team of 20 PA managers in March 2014.

The boundary of the site is mostly fenced and well marked. The zoning scheme is hypothetical and not meaningful on the ground. However, the team noticed several spatial incursions. Hotel developments around the site have excised small portions of the original nature reserve to construct water treatment facilities. Hotels have blocked and diverted flow from some lateral streams that formerly fed into the mangroves. Hotels discharge waste water into the nature reserve and considerable pollution emanates from ongoing construction of additional hotel complexes upstream of the reserve, including direct discharge of excess concrete and untreated sewage. One section of about 2 ha of the nature reserve has been opened up and is used to store rocks and other construction materials for the surrounding hotel developments. A pipe remains that was used for sucking dredged sand out of the reserves main river bed to be used in neighbouring construction.

Perhaps the most disturbing development is the construction of a marina at the mouth of the main river. This construction greatly reduces the tidal flow in and out of the nature reserve causing significant changes to the salinity and diurnal water levels that in turn create the floral and faunal zonations within the nature reserve.

Other problems include the fact that developments around the nature reserve create a barrier between the mangrove reserve and an adjacent forest nature reserve that formerly acted as a connection for forest birds and squirrels to access the mangrove forests. Jet ski boats are parked inside the nature reserve and cause considerable noise disturbance and oil leak sources. Bright lights and loud noise around the site are a disturbance to insects and nocturnal birds and mammals.

In the absence of native ungulates such as deer and pigs (formerly present at the site) the grazing of some water buffalo may be a positive factor maintaining some open swampy habitat and an attractive population of cattle egrets. Management intentions to remove the buffalo may be misguided, as is the plan to quantitatively increase the area of mangrove through planting (sometimes improper species) on all open habitat in the reserve – mud-flats, sand bars and some long abandoned grassy fields. Certainly many birds and crabs (plus apparently absent mudskipper fish) depend on the open mud and sand flats. It is probably better to allow nature to sort out what species should grow where for a balanced ecosystem.

The nature reserve management is politically weak in the face of pressures from hugely lucrative tourism developments that surround the site. A strict redlining policy could certainly be useful in strengthening protection of this important area. However, it is clear a single line around either the core area or total boundary of the site would not be enough to prevent threats from well outside the nature reserve boundary, especially upstream pollution and downstream changes to the river mouth. The red line would need to be supported by a well-zoned buffer.

Ningbo Designated 10 Categories EPRL Areas to Protect the Eco-system

In order to strengthen the space control and optimize the pattern of urban and rural ecology, the Ningbo government is modifying the Ningbo Master Planning. The key tasks are: delineation of EPRLs; and preventing urban construction near the mountains and waters, specifically: Ningbo nature reserves, scenic areas, forest parks, geological relic protection areas, drinking water source protection areas, flood regulation and storage areas, important water conservation areas, important wetlands, ecological forest, and Protected Areas of special species, which are 10 types in total. In addition, the Ningbo City area delineated prohibited construction areas, limited construction areas, fitness areas, etc., which in turn promoted the zoning classification management and the regional ecosystem services protection.

EPRL Region Protection Planning of Jiangsu Province released

In order to protect the important areas for ecosystem services and eco-security of Jiangsu Province, in May 2012, Jiangsu Province started the program of *Eco-red Line Region Protection Planning of Jiangsu Province*, and it was released in August 30, 2013. The total land area within EPRLs is 22,839.58 square kilometers, accounting for 22.23% of Jiangsu Province, where the first-level control area accounts 3.03%, the secondary control area accounts 19.2%. For marine EPRL areas, the total area reaches 1263.91 km². The main experience of this was:

- (1) **Taking the protection of the regional biodiversity and ecosystem services as the leading factors in EPRL delineation.** There are 15 kinds of important protection types, including: nature reserves, scenic areas, forest parks, geological relic protection areas, wetland, drinking water source protection areas, special marine Protected Areas, flood regulation and storage areas, important water conservation areas, important fishing areas, important wetlands, water channel maintenance areas, eco-public forest, Taihu important Protected Areas, and Protected Areas of special species.

- (2) **Classified guidance, hierarchical management.** The control measures for the 15 kinds of important protection areas are divided into two levels: the first control areas and the secondary control areas. The first control areas are the core of the EPRLs, with the most stringent protection and all forms of development and construction activities are prohibited. While the secondary control areas focus on ecological protection, with differentiated control measures, although the activities detrimental to the ecosystem are also prohibited.
- (3) **Combined the eco-red line assessment and supervision with the eco-transfer payments.** Jiangsu Province issued the *Interim Measures for Assessment and Supervision of Eco-red Line Protection* and *Interim Measures for Eco-transfer Payments*. The eco-transfer payments include subsidies and incentive funds. The subsidies should be calculated comprehensively according to the EPRL areas' level, type, size, local financial security, and other factors, while the allocation of incentive funds are based on the assessment results that related to the task completion on a year around.

Beijing designated ecological land to strengthen regional ecological protection

The Law of Land Administration indicates that the state shall compile general plans to control usages of land including those of farm or construction use or unused. The *Guide on compiling general plans at prefecture level* subdivided three categories of land use, namely farmland, construction land, and unused land, into 10 second classes and 23 third classes. The traditional classification reflects economic and social values; however, biological value is neglected. Ecological land is added into the existing categories to intensify regional ecological protection in Beijing practices.

Ecological land provides fundamental security for regional ecological security and habitable urban construction, with important ecologically sensitive areas and ecologically functional zones included. Based on evaluation of ecological sensitivity and ecological services, the designated ecological land covers 5722.05 km², accounting for approximately 34.87% of the prefecture area, which is comprised of water conservation land, water and soil conservation land, eco-diversity conservation land, ecological protective land, urban green, and others. It is of great importance to protect the regional ecological security by land-use planning. In order to strengthen the delineation and management of ecological land, further researches are needed: the improvement of the existing land use planning system; the coordination of ecological land and other land types; and specific management measures of ecological land.

Marine Ecological Protection Red Line (MEPRL) Identification in Bohai Sea

In 2012, State Administration of Oceanic Administration issued “*Opinions on establishing marine ecological redline institutions in Bohai Sea*”, which require to draw marine ecological red lines and identify management measures of marine ecological red line areas.

MEPRL means the areas are identified and strictly protected to maintain the marine ecological health and ecological security. MEPRLs include important estuaries, important coastal wetlands, sea islands under special protection, marine conservation areas, natural landscape and historical cultural relics and remains, sandy coastlines and sand-source marine protection areas, important fisheries waters and important coastal tourism areas. The marine ecological red line areas are divided into forbidden development zones and restricted development zones.

“*Opinions on establishing marine ecological redline institutions in Bohai Sea*” also identified 4 management goals to strengthen the management of MEPRL in Bohai Sea: (1) The area of marine ecological red line area in the Bohai Sea accounts for at least 1/3 of total of the offshore area of the Bohai Sea; (2) The retention rate of natural coastline of the Bohai Sea should be not less than 30% of the total coastline of the Bohai Sea; maintain the length of the existing sandy coastline; (3) By 2020, the overall standard-reaching rate of water quality should be not less

than 80%; (4) The standard-reaching rate of pollutant discharge at the land-based direct outlets in the marine ecological red line areas of the Bohai Sea reaches 100%; by 2020, the total amount of land-based river pollutants discharged to the sea in the marine ecological red line areas should decrease by 10% - 15%.

Designation and Implementation of “Basic Ecological Control Line” — Experiences from Shenzhen

The “basic ecological control line” (BECL) was designated on the basis of urban green system planning in Shenzhen, 2005, which covered an area of 974.5 km², approximately 50% of the prefecture land. The designation of BECL consistently plays an important role in ecological protection, which prevents disorderly urban sprawl and promotes sustainability of urban development.

Experiences:

- **Systematic management.** Led by the Shenzhen Municipal Government, the planning department is responsible for delineation and adjustment of BECL. Enforcement is stringently carried out by the joint effort of district governments and departments in charge of the following fields: planning, land management, environmental protection, development and reform, agriculture, urban management, and others.
- **Detailed regulation.** In 2005, *Regulation of Shenzhen Municipality for management of basic ecological control line* was promulgated. Then in 2007, the government issued *Opinions on implementation of Regulation of Shenzhen Municipality for management of basic ecological control line*, to clarify the responsibilities of various departments and policies on legal mercantile activities and buildings previously located inside the line. In 2013, the government issued *Opinion on further regulation of basic ecological control line management*, which proposed specific practices to combine the BECL management and ecological civilization construction. N.b. It takes several years to undertake.
- **Integrated system of ecological protection areas.** The main protection areas include: major river and wetland, green and ecological corridors, important seafront land, water source PAs, scenic spots, natural reserves, basic farmland, forest park, and ecological fragile zones where the slope is greater than 25%.

Problems:

- **Contradictions between protection and development within BECL is still intense.** Since some residents have not sufficient awareness of BECL, they may have antagonism against it; therefore the contradiction could go on for a long period.
- **Construction before planning remains a big problem.** Some buildings within BECL are illegal, while some are legal with property certificates or construction permissions, which makes management complex.
- **Regulation of Shenzhen Municipality for management of basic ecological control line** is at a low position in the legal hierarchy, which limits the accountability for violations and punishments.
- **Public engagement is not enough.** There is a lack of mechanisms for stakeholders to participate, which adversely affects the practicality of BECL.

APPENDIX 2

IUCN PA Category System and Best Practices

The International Union for Conservation of Nature (IUCN) defines a Protected Area as follows:

A Protected Area is a clearly defined geographical space recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. (Dudley, 2008).

Protected Areas have proven to be one of the most successful and widely adopted land-use approaches in history. Virtually every country in the world has established Protected Areas. However, a very wide range of Protected Area types, approaches, names and terms have been used, sometimes leading to confusion and misunderstanding and making it difficult to compare information between countries. For example, “national parks” in the UK are very different from “national parks” in Canada and the US.

To help address these concerns, IUCN issued its *Guidelines for Protected Area Management Categories* in 1994. The original objective of the guidelines was to provide a single, international classification system for Protected Areas, to enable information about Protected Areas to be effectively shared and compared both within and among countries. Increasingly, however, the guidelines are being used as a tool for the planning, establishment and management of Protected Areas. The guidelines are recognized by international bodies such as the United Nations and have been endorsed by the Convention on Biological Diversity’s Program of Work on Protected Areas. The guidelines are also used by many national governments across the world for defining and recording Protected Areas, and are increasingly being incorporated into national legislation.

The guidelines were subsequently revised in 2008 and further elaborated in 2013, based on the feedback and lessons learned from a very wide range of stakeholders. Today, the guidelines recognize six management categories, as summarised in Table 6-1a below.

Table 6-1a. IUCN Protected Area categories (taken from Dudley, 2013)

Category	Name	Description	Primary Management Objective
Ia	Strict Nature Reserve	Strictly Protected Area set aside to protect biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such Protected Areas can serve as indispensable reference areas for scientific research and monitoring.	To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.
Ib	Wilderness Area	Large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.	To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.
II	National Park	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.	To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.

Category	Name	Description	Primary Management Objective
III	Natural Monument or Feature	Areas set aside to protect a specific natural monument, which can be a landform, seamount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small Protected Areas and often have high visitor value.	To protect specific outstanding natural features and their associated biodiversity and habitats.
IV	Habitat/ Species Management Area	Areas aimed to protect particular species or habitats and management reflects this priority. They will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.	To maintain, conserve and restore species and habitats.
V	Protected Landscape/ Seascape	A PA where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value; and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.	To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.
VI	Protected Area with Sustainable Use of Natural Resources	PAs conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level, non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.	To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

In addition to these six management categories, IUCN defines four Protected Area governance types, as summarized in Table 6-1b below:

Table 6-1b. IUCN Protected Area Categories (taken from Dudley, 2013)

Governance Type	Description
Governance by government	Federal or national ministry/agency in charge; sub-national ministry/agency in charge; government-delegated management (e.g. to NGO)
Shared governance	Collaborative management (various degrees of influence); joint management (pluralist management board; transboundary management (various levels across international borders)
Private governance	By individual owner; by non-profit organizations (NGOs, universities, cooperatives); by for-profit organizations (individuals or corporate)
Governance by indigenous peoples and local communities	Indigenous peoples' conserved areas and territories; community conserved areas – declared and run by local communities

International Best Practice

International best practice is to establish an integrated Protected Area system, comprised of Protected Areas of many different management and governance types, supported by enabling legislation. IUCN (Davey, 1998) has recommended that Protected Area systems should be:

- **Representative:** The system should contain high quality examples of all the major ecosystem types in the country.
- **Adequate:** The system needs to be sufficiently large, ecologically connected and well managed to sustain viable processes, populations and communities that make up the biodiversity of a country.
- **Coherent and Complementary:** Each PA should make a positive contribution to the overall conservation and sustainable development goals of the PA system.

- **Consistent:** Management objectives, policies and classifications should be applied in a standardized and consistent fashion across all Protected Areas in the system.
- **Cost-effective, Efficient and Equitable:** There should be an appropriate balance between the costs and benefits of Protected Areas and equity in their distribution.

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APPENDIX 3

Steps in Acquiring Development Permits

Proposal of location	
Issuing department	Urban and rural planning departments
Applicant	A construction project that is subject to the approval or verification of the related department as required by the state provisions, whose right to use state-owned land is appropriated
Audit stage	Before filing the project with the related department for approval
File nature	Location agreement
Management content	Define location, land-use planning and development intensity and other design requirements
Construction land use permit	
Issuing department	Urban and rural planning departments
Applicant	A construction project that needs to apply for state-owned land use right
Audit stage	Before obtaining the land
File nature	Legal evidence for construction unit to apply for land acquisition, allocation and compensation
Management content	Verify whether location, size, development intensity, etc. meet the requirements of planning conditions
Planning permit on construction project	
Issuing department	Urban and rural planning departments
Applicant	Any construction, expansion and renovation of buildings, structures, roads, pipelines and other engineering facilities within a city or town planning area
Audit stage	Before construction
File nature	Legal credentials for the building projects meeting the requirements of urban planning
Management content	Audit the detailed planning; verify function, position, size, development intensity, detailed design, etc. to meet the planning requirements
Planning permit for rural construction*	
Issuing department	Urban and rural planning departments
Applicant	Construction of facilities needed by township and village enterprises, village public utilities or public welfare establishments within a township or village planning area
Audit stage	Before construction
File nature	Legal credentials for the building projects meeting the requirements of urban planning, legal land credential for building units and individuals
Management content	Verify whether location, size, development intensity, etc., meet the requirements of planning conditions; whether construction activities are in line with transportation, environmental protection, disaster prevention and control, heritage protection, and other planning requirements

* Standing Committee of the National People's Congress. [2008] No.74. Urban and Rural Planning Law of the People's Republic of China. State Council. No.116. Village and town planning construction management regulations.

GLOSSARY

Ecological Protection Redlining Terms	
Eco-environmental red line	Component of the environmental red line relating to safeguarding the ecological environment
Ecological protection red line (EPRL)	A red line that defines those lands that deliver critical ecosystem services and require protection from threatening developments and activities
Ecological protection redlining (EPR)	The act of establishing ecological protection red lines
Environmental red line	A red line that defines danger limits to a variety of environmental hazards, including ecological, chemical, radioactivity, climate, seismic, etc.
Red line	A line or limit that cannot be breached without severe danger, consequences, and/or penalties
Redlining	The process of defining and establishing a red line
Environment and Ecology Terms	
Biodiversity	The diversity of living organisms in a given area, including genetic, species and ecosystem diversity; usually refers to nature but also includes domesticated species and varieties (agro-biodiversity)
Ecological restoration	Recovery of ecosystems damaged by natural disaster or human abuse, either by natural processes or human inputs (rehabilitation)
Ecology/ecological	Study of relationships between living organisms and their physical environment/relating to ecology and its processes
Ecosystem	The complex community of organisms and their environment functioning as an ecological unit, e.g. forest, lake, grassland
Ecosystem services	Beneficial services delivered through the functions and processes of ecosystems
Environment	Physical and biotic living context of humans and other life-forms; can be natural, man-modified or artificial
Habitat	Specific living environment (physical and biotic) of a given species or species assemblage
Protected Area (PA)	A clearly defined geographical space that is recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (IUCN 2013).
Financial Mechanism Terms	
Eco-compensation	A form of payment mechanism used to reward work undertaken to protect ecological health, or compensate for losses and damages caused by measures taken to protect the natural environment
Ecological transfers	Budgetary transfers paid from primary benefitting regions to regions or agencies that generate or protect valuable ecosystem services
Green taxes	Taxes imposed on goods or services (water, timber, etc.) needed to internalize external environmental damage or recover environmental protection inputs from beneficiaries of ecosystem services
Green incentives	Fiscal measures applied to encourage 'greener' development options including grants, tax breaks, eco-compensation, etc.

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CHAPTER 7

PERFORMANCE EVALUATION ON THE ACTION PLAN OF AIR POLLUTION PREVENTION AND CONTROL AND REGIONAL COORDINATION MECHANISM

CCICED Special Policy Study Report

CCICED 2014 Annual General Meeting

December 1-3, 2014

SPECIAL POLICY STUDY MEMBERS

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SUMMARY OF KEY FINDINGS

A Thorough Appraisal System is Needed for Air Pollution Plans

China is confronted with severe air pollution, especially regional atmospheric problems, including PM_{2.5}, which is becoming increasingly prominent. Among the 74 cities that first launched PM_{2.5} monitoring networks in the year 2013, 71 cannot reach the secondary air quality standard. The annual average concentration of PM_{2.5} of the 74 cities is 2.1 times the secondary standard. The average annual concentrations of the Beijing-Tianjin-Hebei Region, Yangtze River Delta and Pearl River Delta were 3.0, 1.9 and 1.3 times the secondary standard, respectively.

In order to improve air quality and protect the public health, the new government has adopted the *Action Plan of Air Pollution Prevention and Control* (hereinafter referred as “*action plan*”), the strictest air pollution control measures ever adopted in China. It is imperative to also establish a thorough performance appraisal system for scientific evaluation of the environmental, social and economic benefits generated by the pollution prevention and control measures. An integrated performance appraisal system should include pre-implementation analyses of implementation plans and follow-up appraisals of program implementation and results. An index system, including air quality improvement and program performance indicators, etc. needs to be established.

According to the pre-implementation analysis of the Beijing-Tianjin-Hebei Region action plan, PM_{2.5} concentrations are expected to drop significantly after implementation of the *action plan*. However, Tianjin municipality and Hebei province may not reach the 25% PM_{2.5} concentration reduction target by the year 2017. Resources and capacity for comprehensive implementation of the policy measures must be enhanced. We suggest that different regions should further refine the *action plan* and clearly quantify the various control measures and the expected emission reductions. Meanwhile, China should enhance control of NO_x, VOC and NH₃ – key components of PM_{2.5} – in order to realize synergistic air quality improvements.

China Faces Great Challenges to Reduce Emissions and Meet the Air Quality Standard

Air quality in key cities should achieve the ambient air quality standard for PM_{2.5} (i.e., annual limit of 35 µg/m³) by 2030. Keeping this target in mind, we calculated the pollutant emission reduction targets nationwide and in

all provinces. On the basis of 2012 emissions, SO₂, NO_x, PM_{2.5} and VOC emissions nationwide should be reduced by at least 52%, 65%, 57%, and 39%, respectively, by 2030, and NH₃ should decrease slightly. We should intensify emission control in heavily polluted areas. For example, SO₂, NO_x, PM_{2.5}, VOC and NH₃ emissions in the Beijing-Tianjin-Hebei Region in 2030 should be reduced by at least 59%, 72%, 70%, 44%, and 21% respectively.

In order to reach the above emission reduction targets, China should carry out coordinated control efforts for multiple pollutants and emission sources in different regions, adopting control measures that can complement the process of adjusting the energy structure, improving energy efficiency and enhancing end-of-pipe pollution control, etc. In terms of energy structure and energy efficiency, China should cap its coal consumption; promote new energy and clean power generation, including clean fuels for commercial and residential sectors; promote advanced production techniques to accelerate the elimination of backward industrial capacity; increase fuel efficiency of motor vehicles and promote the application of the energy saving and new energy vehicles. With regard to end-of-pipe controls, power plants should adopt desulfurization, particulate controls and nitrogen oxides controls technologies; industrial sectors should gradually adopt efficient pollution control technologies, especially the most advanced particulate controls technology; residential and commercial sectors should gradually adopt efficient particulate controls technologies, advanced thermal coal and biomass combustion technologies; the vehicle population in cities should be properly controlled, and the new vehicle emission standards should be accelerated and strictly implemented and enforced, along with much stronger pollution prevention and control of non-road mobile sources, and unified fuel quality standards for road vehicles and non-road machines; and apply the EU VOCs emission standard in manufacturing and solvent use.

China's air pollution problem will require years to solve

China's air pollution problem is quite severe and it has evolved over several years of rapid industrialization. Therefore it is unrealistic to expect that it can be reversed overnight even with the best of intentions. High pollution episodes are inevitable in the short term when unfavorable weather conditions and stagnant air occur. International experience indicates that it usually takes decades to initially reverse the increasing pollution trends and then to bring about substantial air quality improvements. In order to achieve the short term 2017 targets laid out by the State Council, China needs to reduce the national SO₂, NO_x, PM_{2.5} and VOC emissions by at least 24%, 15%, 16%, and 2%, respectively, and limit the increase of NH₃ emissions to less than 10%, compared with that in 2012. The SO₂, NO_x, PM_{2.5} and VOC emissions in Beijing-Tianjin-Hebei Region must be reduced by at least 32%, 25%, 30%, and 11%, respectively, by 2017 on the basis of 2012 levels, and NH₃ emissions can only increase slightly.

In September 2013, the Action Plan was officially issued by the State Council, which included ten air pollution prevention and control measures. The Action Plan includes the strictest air pollution control measures ever adopted in China. However, the Action Plan has only been in effect for one year and will require several years to begin to show significant benefits. Cleaner and more efficient new cars and trucks take several years before they dominate the vehicle fleet. Reducing the increases in coal consumption and shutting down or relocating high polluting industrial facilities requires some time to develop alternatives. Designing and installing end of pipe controls on major power plants and industrial sources will also take several years. In the meantime, when poor meteorological conditions occur, high pollution episodes are inevitable. But with each passing year, international experience suggests that effective implementation of the Action Plan complemented by local air pollution control measures should result in gradual improvements in air quality and fewer and fewer high pollution episodes. By 2030, the SO₂, NO_x, PM_{2.5}, VOC and NH₃ emissions in Beijing-Tianjin-Hebei Region shall be reduced by at least 59%, 72%, 70%, 44%, and 21%, respectively and high air pollution episodes should be greatly diminished if not eliminated.

International Experience is an Important Reference for Regional Air Pollution Control and Coordination

Europe and the US demand that the relevant local and state/national authorities achieve air quality standards within specified time frames. In order to realize the targets, the European Air Quality Plans (AQPs) and the American State Implementation Plans (SIPs) outline comprehensive strategies for emission reductions and air quality improvements. The strategies consist of (1) pollution prevention and control policies; (2) policy implementation timetables; (3) scientific and economic evaluation of emission reduction policies; (4) emergency programs for serious episodes of atmospheric pollution; and (5) resource adequacy demonstrations¹⁷⁶ for implementation and enforcement. Comprehensive air quality monitoring networks are used to evaluate progress toward meeting ambient air quality standards, and ensure transparency of relevant environment monitoring information.

Both Europe and the US have established integrated management mechanisms for regional air quality to coordinate regional air pollution prevention across states/nations. For example, the Convention on Long Range Transboundary Air Pollution (CLRTAP) aims to establish common strategies and policies, and monitoring systems for air quality under the United Nations Economic Commission for Europe (UN-ECE). All parties agree to restrict and gradually reduce air pollution as much as possible, including long-distance and cross border air pollution; the American Regional Planning Organizations (RPOs), set up through the concerted efforts of USEPA, the state governments and other stakeholders, enhances regional coordination and cooperation on air pollution planning and control.

China Lacks Strong Regional Coordination Institutions and Unified Plans, Objectives and Management

Conventional air pollution control and management in China lacks consideration of air pollution transport and a systematic analysis of air pollution. For example, the air pollution problems in the Beijing-Tianjin-Hebei Region, the Yangtze River Delta, Shandong and Henan are greatly impacted by pollutants that are transported from surrounding areas. Therefore, integrated regional control must be adopted in these areas. In the future, regions should be scientifically grouped based on quantitative research based on satellites, ambient monitors and air quality models to enhance air quality management.

Because the government performance appraisal focuses on total emission control of SO₂ and NO_X pollution, local governments have, to some extent, not focused on air quality improvements. A lack of unified air quality objectives and lack of coordination among cities and provinces in terms of reducing PM and VOC emissions have hindered regional air quality improvements. Unless this is corrected by adoption of unified air quality objectives and coordinated control measures and strategies, air quality objectives will not be achieved.

An initial mechanism has been established to support regional decision making and consultations in the three key regions. However, the regional coordination mechanism is limited, focused primarily on heavy pollution weather alerts and joint emergency responses. The regions lack unified plans, objectives, control requirements, supervision and administration. As to environmental information sharing, significant progress is needed to meet the requirements for regional air pollution prevention and control.

¹⁷⁶ Including financial commitments as well as staffing.

SUMMARY OF MAIN POLICY RECOMMENDATIONS

Recommendation 1: Build an Air Quality-Oriented Air Pollution Management System

Improve the Legal Status of Standard Air Quality

The *Atmospheric Pollution Prevention Law* should explicitly state that provincial and local governments must implement and enforce atmospheric protection programs based on air quality objectives. Government at all levels should improve air quality in substandard areas and prevent deterioration of air quality in compliant areas. These objectives should be binding requirements in performance evaluations of officials. Accountability provisions should levy economic punishments for areas that cannot achieve air quality goals on time, and include administrative accountability for persons in charge of the regional and/or local government.

Atmospheric Management Regions should be Based on Science

The atmospheric management regions should not be based purely on political boundaries, but should be based on scientific assessments that consider spatial and temporal distribution of emissions, meteorology, terrain and pollution transport. The eastern provinces with heavy air pollution should be grouped into one region. Atmospheric management regions should have regional coordination organizations and mechanisms, unified laws and regulations, and united management and enforcement on air quality to enhance overall regional efforts to meet air quality objectives.

Recommendation 2: Deepen Joint Prevention and Control for Regional Air Pollution

Establish a Unified Standard Program for Regional Air Quality

Based on the target of regional air quality compliance in key regions, such as eastern provinces, the schedule for achieving air quality standards in different cities should be considered at the national level, aiming to improve air quality while providing a reasonable and feasible pathway. Policies should promote coordinated control of regional air pollution, rigorously control the total emission amount and reduce pollution transport. The population, industry, energy and motor vehicle patterns in the region should be established or adjusted based on the distribution of regional atmospheric carrying capacity. Integrated and unified monitoring of air quality should be designed and conducted in the regions to support scientific assessment on the plans.

Establish a Clear-cut, Unified and Integrated Regional Air Pollution Control and Management Mechanism

To enhance regional coordination, an environmental decision-making and consultation mechanism is needed along with enhanced information sharing about air quality management. Regional coordination can also be enhanced with consultation mechanisms for environment impact assessments (EIAs), including EIAs for major pollution sources, and for industrial planning; regional environmental law enforcement mechanisms for unified supervision and enforcement, as well as strict inspection and accountability; joint emergency response for episodes of heavy pollution with coordinated temporary emission reduction measures; and unified supervision.

Establish Regional Decision Support and Planning Agency

Establish regional planning organizations funded by various ministries and commissions like the Ministry of Environmental Protection to provide national and local scientific and technological resources, and facilitate coordination among local and regional governments. To enhance our understanding of pollution transport, conduct research on emission tracking, transport, atmospheric pollutant transformation, and source identification of regional air pollution. To address air pollution cost effectively, recommend air pollution control techniques that can be effectively applied to all cities in the region.

Recommendation 3: Enhance Air Pollution Control Based on the Existing Measures

Clean, efficient and sustainable use of coal

It is preferable to use coal in large-scale facilities with high-efficiency end-of-pipe control technologies; small-scale boilers and stoves should be phased out gradually, and district heating should be strongly promoted. China should make great effort to improve the energy efficiency of major coal-consuming sectors, such as power plants and industry. For example, the average energy efficiency of coal-fired power plants should be increased from 36% in 2010 to 42% in 2030 and the energy consumption per unit of production of industrial coal-fired boilers, cement production and coke ovens should be 24%, 16%, and 44% lower, respectively, in 2030 compared with 2010. China should increase the proportion of coal washing and promote clean coal technologies.

Accelerate Adjustment of the Energy Structure and Increase Clean Energy

It is essential to commit to energy structure adjustments and cap the coal consumption. Coal's share of total energy consumption should be less than 50% by 2030. This will require increased clean energy utilization, including natural gas, nuclear energy and renewable energy (biomass not included), up to 25% by 2030, and the clean utilization of biomass.

Enhance Coordinated Control over Various Sources of Pollution and Contaminants

In order to meet the atmospheric quality and air pollutant emission control goals, China should stick to the strategic concept of "coordination", "integration" and "joint action". That is, China should carry out coordinated control over pollutants including SO₂, NO_x, primary PM_{2.5}, VOCs and NH₃. Regarding control of various pollution sources, China should launch comprehensive pollutant control of industrial sources, domestic and rural non-point sources and mobile sources. These policies should require joint prevention and control between regions and cities, and consider the key emitting sectors, the feasibility of control technologies, the challenges for different regions to reach the standard and the multiple environmental implications of pollutant emission reductions. Region-specific air pollution prevention and control strategies are likely necessary to address regional characteristics.

Recommendation 4: Establish Scientific Appraisal System

Establish Pre-implementation and Annual Appraisal System

Pre-implementation and annual appraisal systems should be established so that local governments can assess progress and adjust measures as necessary to meet the goals. The pre-implementation indicators include projected reductions of PM_{2.5} concentrations and frequency of heavy pollution days. The annual appraisal indicators should include the actual monitored PM_{2.5} concentration (multi-year moving average), pollutant emission reductions and progress on control measures such as improving energy efficiency and adjusting the energy structure.

Establish Final Appraisal System

A final appraisal system should be established to provide a technological basis for the sustained improvement of air quality. The appraisal indicators should include PM_{2.5} concentrations (multi-year moving average); number of heavy pollution days; economic, industrial and energy structures; and benefits to human health attributable to improved air quality.

BACKGROUND AND IMPLEMENTATION OF THE PROJECT

With the rapid economic development and urbanization in China, especially the industrial development pattern featuring the chemical industry, coal-oriented energy structure and the rapid increase of motor vehicles, China's emissions of key pollutants ranks first in the world. This has generated serious atmospheric contamination with marked features like the superposition of various pollution sources and contaminants, the dual and overlapping challenges of urban and regional pollution, the connection between pollution and climate changes, etc. Thus the governance of China's air quality management is far more difficult than that in developed countries. Since 2011, the frequent and extensive dust-haze with heavy pollution has troubled the central and eastern region of China in winter and spring, seriously influencing industrial production as well as the lives and health of the people. The new government adopted air pollution control measures that are the strictest in the history of China so as to improve the air quality and protect the public health. The government also released the first *Action Plan of Air Pollution Prevention and Control* (hereinafter referred to as *Action Plan*) in August, 2013.

The Action Plan explicitly states the objective to improve air quality nationwide and in key areas, and provides ten measures, including 35 specific actions, to help achieve these objectives. In order to evaluate the progress in the implementation of the various measures and the relevant environmental, social and economic benefits which serve as the basis for future policy adjustment, this project focuses on exploring and establishing performance appraisal indicators and an appraisal system for the *Action Plan*. At the same time, this project also conducts pre-appraisal and follow-up appraisal on the implementation progress and the impact of the plan, for the purpose of recognizing the key factors that hinder the realization of the *Action Plan* goals, and raises the relevant policies and measures; the research incorporates the medium term objective of the 13th Five-Year Plan and the long term objective of 2030 in terms of air pollution prevention and control. The research has presented the medium and long-term air pollution prevention and control strategy and has projected the roadmap for air pollution prevention and control; meanwhile, it studies the solution for building a regional coordination mechanism and provides policy suggestions for improving regional air quality.

Since its proposal in February 2014, the project group held four working meetings in six months. The first meeting after the project launch adopted the implementation program through deliberation, and finalized topics, division of labor and schedule for the project research. At the second meeting held on May 26th, the individuals in charge of each subject reported the research progress and the initial conclusions. The project group conducted in-depth discussions and listened to the ideas of other research organizations, government sectors, non-government organizations and the industrial sectors. The group also identified the modifications and improvements to the research, and reached consensus on future work. The third meeting was held on July 30th to August 1st in Washington. The Chinese members and the foreign experts of the research group conducted intensive communications on several important subjects. For example, the regulation on regional air quality management under the Clean Air Act in the US, the function and mode of operation of regional planning organizations, the formulation and implementation of cross-state air pollution rules, and the traffic pollution control, etc. The communication on these subjects enabled the researchers to better draw on the international experiences and summarize the policy suggestions. The fourth meeting was held on August 29th where researchers in charge of various subjects reported final research results.

The project group and the experts who participated in the meeting carried out extensive discussions on the major research results and the policy suggestions, and put forward advice and direction for further modification of the first draft of the research report. The project group had full knowledge of further modification and promised to submit the revised draft on schedule.

In addition, on the 2014 ICDF round-table conference in May and the Third Joint Work Meeting between Chief Advisor and Secretariat of 2014 ICDF in July, Professor Kebin He, the core expert of the subject group, and the Chinese group leader Academician Jiming Hao reported the research progress and the future work plan respectively, which gained helpful suggestions from foreign and domestic experts at the meeting. Internal meetings were repeatedly held inside the project group. In short, the project group had absorbed the combined wisdom of experts from home and abroad by means of European and American experience case study, national analysis of conditions and assessment of the current policies in China, exchange of views and brainstorming, investigation, survey and discussion of special project policies, etc. The project group defined the ultimate policy suggestions after research and comparison of domestic and foreign systems, providing important scientific and technological support for the establishment of the performance appraisal method system of *the Action Plan* and the regional coordination mechanism.

Key Words: air pollution, air quality standard, regional coordination mechanism, energy conservation and emission reduction, policy, PM_{2.5}

7.1 RESEARCH ON PERFORMANCE EVALUATION INDICATORS AND METHODOLOGY OF THE ACTION PLAN

At present, the atmospheric pollution situation in China is grim and regional atmospheric environmental problems, such as fine particle (PM_{2.5}) and inhalable particle (PM₁₀) concentrations, are increasingly prominent. According to the air quality monitoring data of 2013 issued by the China National Environmental Monitoring Centre (“CNEMC”), among the 74 cities that first launched the PM_{2.5} monitoring,⁷¹ failed to reach the prescribed standard; the annual average concentration of PM_{2.5} in the 74 cities was 2.1 times the class II standard; the annual average concentrations of PM_{2.5} in the Beijing-Tianjin-Hebei Region, the Yangtze River Delta, and the Pearl River Delta were 3.0, 1.9, and 1.3 times the class II standard, respectively.¹⁷⁷

In September 2013, *the Action Plan of Air Pollution Prevention and Control* was officially issued by the State Council, which included ten air pollution prevention and control measures (hereinafter referred to as “Ten Measures”). The Ten Measures include air quality improvement targets for 31 provinces in 2017 based on each province’s current situations of social and economic development and air quality of localities and agreed to through the signing of commitment letters about targets. The whole country is divided into key regions and non-key regions, and graded improvement targets are set for each region. Under this approach, to promote the implementation of provinces’ and municipalities’ responsibilities, it is necessary to establish an effective system of performance evaluation indicators and a methodology for the implementation of the *Action Plan* so as to evaluate and assist in offering guidance on the implementation of the *Action Plan* by all localities across the country.

7.1.1 Establishment of Performance Evaluation Indicators and Methodology

7.1.1.1 Performance Evaluation Methodology

The performance evaluation methodology involved in this research includes two evaluation methods, namely, pre-evaluation (ex-ante) of the implementation performance and follow-up evaluation (ex-post) of the implementation performance, as shown in Figure 7-1-1.

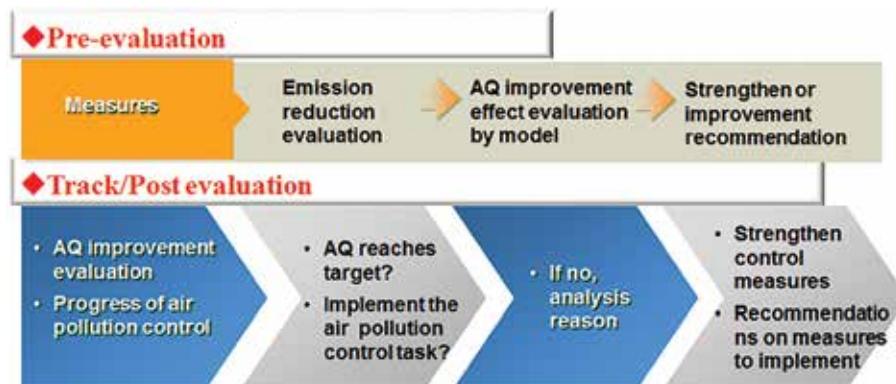


Figure 7-1-1. Performance evaluation methodology of the Action Plan

The term “pre-evaluation of the implementation performance” refers to a pre-evaluation of the effects of the current control measures on emission reductions and air quality improvements using emission inventories and an air quality model, with the aim to predict the atmospheric improvements after implementation of current policies and identify weaknesses in the current policies and the direction of further efforts. The term “follow-up evaluation of the implementation performance” refers to an evaluation of progress of control measure implementation and the actual impacts on air quality, with the aim to promote the gradual development of various tasks and the actual effects of the evaluation work.

7.1.1.2 Methods for Pre-evaluation of the Implementation Performance

In the pre-evaluation of the implementation performance, the implementation effects of the current control measures are evaluated using emission inventories and an air quality model. The specific pre-evaluation methods are illustrated by Figure 7-1-2.

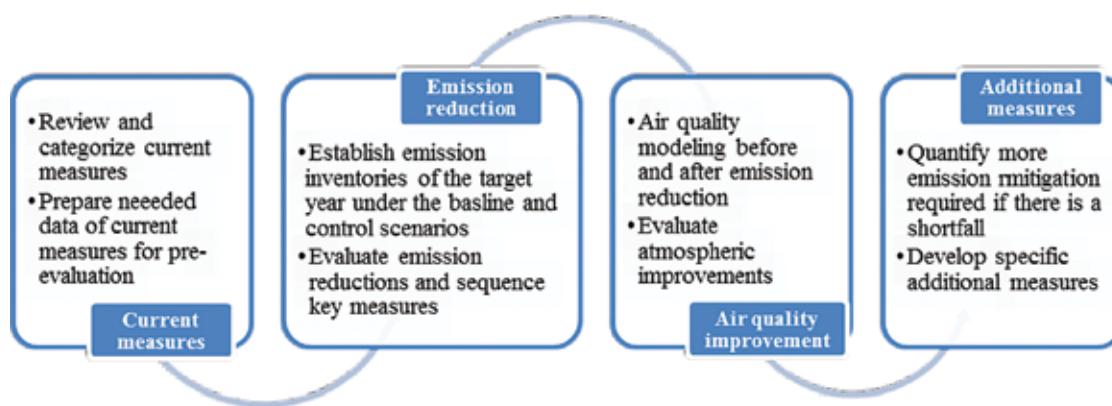


Figure 7-1-2. Methods for pre-evaluation of the implementation performance

7.1.1.3 Indicator System for Follow-up Evaluation of the Implementation Performance

In the follow-up evaluation of the implementation performance, two parts are examined: one is the ambient air quality, for assessing the impact of the control measures already implemented; and the other is the progress in implementing the planned control measures by all localities. Thus, two indicators are created, namely, a performance indicator of air quality improvement and an indicator of control strategy implementation. In particular, the performance indicator of air quality improvement shall serve as the key evaluation indicator for nationwide evaluation; and the indicator of control strategy implementation serves as the auxiliary secondary evaluation indicator for the annual evaluation in key regions.

7.1.1.3.1 Performance indicator of air quality improvement

The decrease, expressed as a percentage of the annual average concentration of PM₁₀ or PM_{2.5} is the key evaluation indicator of air quality improvement. Reductions in the number of days with heavy pollution and the percentage decrease of annual average concentrations of other pollutants (NO₂, SO₂, CO, O₃) serve as secondary evaluation indicators of air quality improvement. Table 7-1-1 summarizes the annual average concentration improvement targets of PM₁₀ or PM_{2.5} of all provinces and provincial-level municipalities in 2017 in the *Commitment Letter on Targets*. The Beijing-Tianjin-Hebei region and surrounding areas, the Yangtze River Delta, the Pearl River Delta, and Chongqing City have PM_{2.5} targets, and other regions have PM₁₀ targets.

Table 7-1-1. Air quality improvement targets of all localities in the *Commitment Letter on Targets*

Province	Decrease in the Annual Average Concentration of PM _{2.5}	Province	Decrease in the Annual Average Concentration of PM ₁₀	Province	Decrease in the Annual Average Concentration of PM ₁₀
Beijing	-25% (60 ug/m ³)	Henan	-15%	Sichuan	-10%
Tianjin	-25%	Shaanxi	-15%	Ningxia	-10%
Hebei	-25%	Qinghai	-15%	Heilongjiang	-5%
Shanxi	-20%	Xinjiang	-15%	Fujian	-5%
Shanghai	-20%	Hubei	-12%	Jiangxi	-5%
Jiangsu	-20%	Gansu	-12%	Guangxi	-5%
Zhejiang	-20%	Liaoning	-10%	Guizhou	-5%
Shandong	-20%	Jilin	-10%	Hainan	Continuous improvement
Guangdong	Pearl River Delta -15%	Anhui	-10%	Yunnan	Continuous improvement
Chongqing	-15%	Hunan	-10%	Tibet	Continuous improvement
Inner Mongolia	-10%	Guangdong	Other cities -10%		

Since the nationwide routine monitoring of PM_{2.5} was not initiated until 2013 and by taking the availability of monitoring data into account, 2012 was set as the base year for PM₁₀ and 2013 was set as the base year for PM_{2.5}. To avoid any inaction by local governments in the early years, an annual progress assessment should be established. For the annual assessment targets of PM_{2.5}, the annual average PM_{2.5} concentration declines from 2014 to 2017 could be set at 10%, 40%, 70%, and 100% of the targets in the *Commitment Letter on Targets*. It is proposed that the moving annual average (for example, the moving average values over three years) should be adopted for purposes of evaluation so as to remove the interference of meteorological factors and emphasize the role of human-influenced emission reductions.

7.1.1.3.2 Indicators of control strategy implementation

Indicators of control strategy implementation and indicators of emission reductions of air pollutants are used for investigating the completion of key tasks. Key work tasks in the Ten Measures are shown in Table 7-1-2, including industrial restructuring, energy structure optimization, industrial atmospheric pollution control, dust pollution control, motor vehicle pollution prevention and control, and heavy-pollution weather warning and so on. Meanwhile, a rating mechanism should be established for assessment of adequacy of measures and evaluation of progress toward air quality goals. Air pollutants closely related to particulate pollution (e.g., SO₂, NO_x, PM_{2.5}, VOC, NH₃) are considered for evaluating progress on the emission reduction measures. Task scores are determined on the basis of the importance of such tasks in the effects on air quality improvement and the operability and costs of the tasks. Indicators of assessment tasks shall be quantitative in principle.

Table 7-1-2. Indicators of control strategy implementation

Indicator	Sub-indicator	Indicator	Sub-indicator
Industrial restructuring	<ul style="list-style-type: none"> Reduction of surplus production capacity Elimination of outdated production capacity Relocation of enterprises with heavy pollution 	Dust pollution control	<ul style="list-style-type: none"> Control of dust pollution in construction sites Control of dust pollution on roads
Energy structure optimization	<ul style="list-style-type: none"> Control of total coal consumption Optimization of coal consumption structure Improvement of coal quality Improvement of energy efficiency 	Motor vehicle pollution prevention and control	<ul style="list-style-type: none"> Elimination of yellow-label (high-polluting) vehicles Improvement of fuel quality (diesel & gasoline) Strict standards for emissions of new motor vehicles Vehicle population and use restrictions Sales of New Energy Vehicles
Industrial atmospheric pollution control	<ul style="list-style-type: none"> Elimination of small and inefficient coal-fired boilers Desulfurization, nitrogen oxides controls, and particulate controls control of key sectors Control of volatile organic compounds Vapor recovery 	Heavy-pollution weather warning	<ul style="list-style-type: none"> Real-time warning issuance Building of emergency response plan system

7.1.2 Pre-Evaluation Case Analysis-Based on the Beijing-Tianjin-Hebei Region

7.1.2.1 Summary of Measures in the Action Plan

The measures for the Beijing-Tianjin-Hebei Region in the *Action Plan* were mainly from the following several documents: the *Air Pollution Prevention and Control Action Plan*, the *Detailed Rules for the Implementation of the Air Pollution Prevention and Control Action Plan in the Beijing-Tianjin-Hebei Region and Surrounding Areas*, the *Action Plan of Beijing for Clean Air from 2013 to 2017*, the *Action Plan of Tianjin for Clean Air*, and the *Plan of Hebei for the Implementation of the Air Pollution Prevention and Control Action Plan*. These measures could be classified into two categories: structural adjustment measures and end-of-pipe control measures. Structural adjustment measures aim to reduce emissions from the front-end; and end-of-pipe control measures refer to the application and upgrading of end-of-pipe control technologies.

Energy structural adjustment is a prominent policy in the Ten Measures. Figure 7-1-2 shows projections of energy consumption in the Beijing-Tianjin-Hebei Region in 2017. By 2017, coal consumption in Beijing-Tianjin-Hebei shall be reduced by 63 million tons compared to 2012 according to the Ten Measures, specifically, 13, 10 and

40 million tons for Beijing, Tianjin and Hebei, respectively. In 2017, the proportion of coal in total energy consumption will be reduced to 65% or below and coal will be replaced by taking such measures as gradual increase in the percentage of electricity from other regions, increase in natural gas supply, and increased use of non-fossil energy. Industrial restructuring is another important measure. By 2017, the Beijing-Tianjin-Hebei Region plans to eliminate outdated production capacity of cement of 70 million tons and steel production capacity in Hebei is to be reduced by 60 million tons compared to 2012.

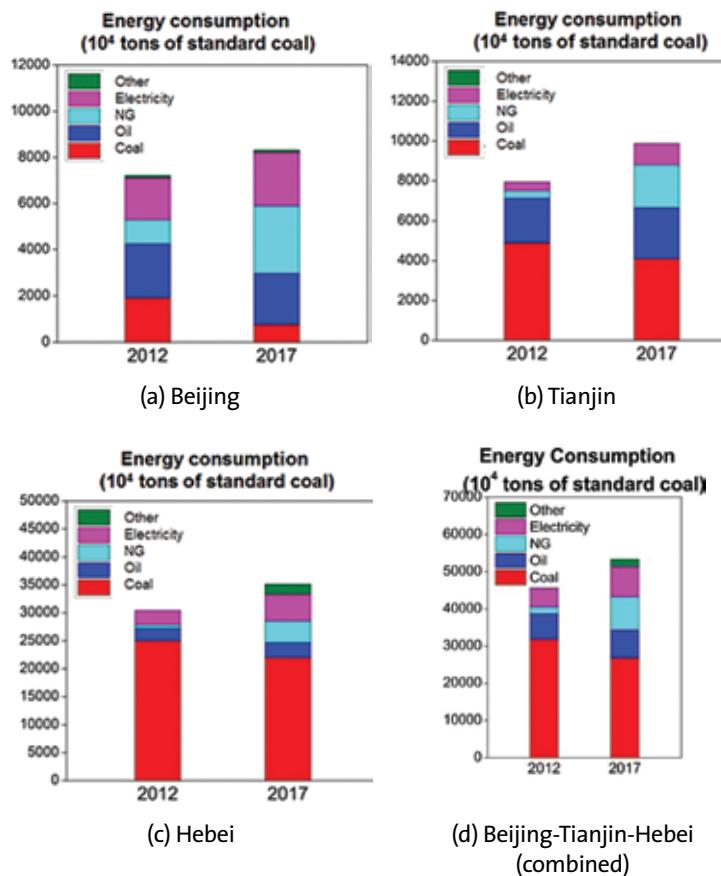


Figure 7-1-3. Projections of energy consumption in the Beijing-Tianjin-Hebei Region

The Ten Measures put forward a series of end-of-pipe control measures for accelerating the projects of desulfurization, nitrogen oxides controls, and particulate controls. All iron and steel mills shall install desulfurization technologies on sintering operations. Coal-fired boilers with capacity of 20 t/h (1 t/h=0.73 MW) or above shall use desulfurization technologies or techniques. Coal-fired units except circulating fluidized bed boilers shall install nitrogen oxides controls technologies. Precalcer cement kilns shall implement the technical transformation to low NOx burners and install end-of-pipe nitrogen oxides controls technologies. Existing de-dusting facilities of coal-fired boilers and industrial kilns shall be upgraded. Control over vehicle emissions shall be continuously tightened. In 2015, the Beijing-Tianjin-Hebei Region will implement the China 5/V vehicle emission standard; Beijing plans to implement a stricter China 6/VI vehicle emission standard in 2016. It is further recommended that China's three developed regions including the Beijing-Tianjin-Hebei Region implement China 6/VI in 2018 as fuels with a maximum sulfur content of 10 ppm will be mandatory across the entire country by the end of 2017.¹⁷⁸

¹⁷⁸ As China's vehicle population continues to grow rapidly and as it increasingly dominates the new vehicle market, China should consider also taking a leadership role in the development of clean and efficient vehicle requirements. For example, California and the US EPA recently adopted standards for new cars that are 70% cleaner than Euro 6/VI requirements in addition to mandating longer in-use vehicle durability performance. In the future, China should consider not only adopting similar limits but also becoming the leader in pushing the clean vehicle technology envelope.

7.1.2.2 Evaluation of Emission Reduction Effects of Air Pollutants

The emission inventory of the base year (2012) is based on the Multi-resolution Emission Inventory for China (MEIC)¹⁷⁹ developed by Tsinghua University and the emission inventory of the target year (2017) is quantified on the basis of the emission inventory of the base year and in accordance with the Ten Measures and the projection of energy consumption and penetrations of control technologies. The emissions of SO₂, NO_x, PM_{2.5} and VOCs of the Beijing-Tianjin-Hebei Region in 2017 are estimated to be 1.395 million, 2.212 million, 0.902 million, and 1.999 million tons, which are projected to decline by 32%, 21%, 24%, and 6%, respectively, compared with 2012 levels (see Figure 7-1-4). Hebei contributes the most in the emission reduction of pollutants of the Beijing-Tianjin-Hebei Region and it accounts for 71%, 71%, 74%, and 45% of emission reduction of SO₂, NO_x, PM_{2.5}, and VOC in the Beijing-Tianjin-Hebei Region; and the emission reduction rate of Beijing is the largest because it implements relatively stricter control measures.

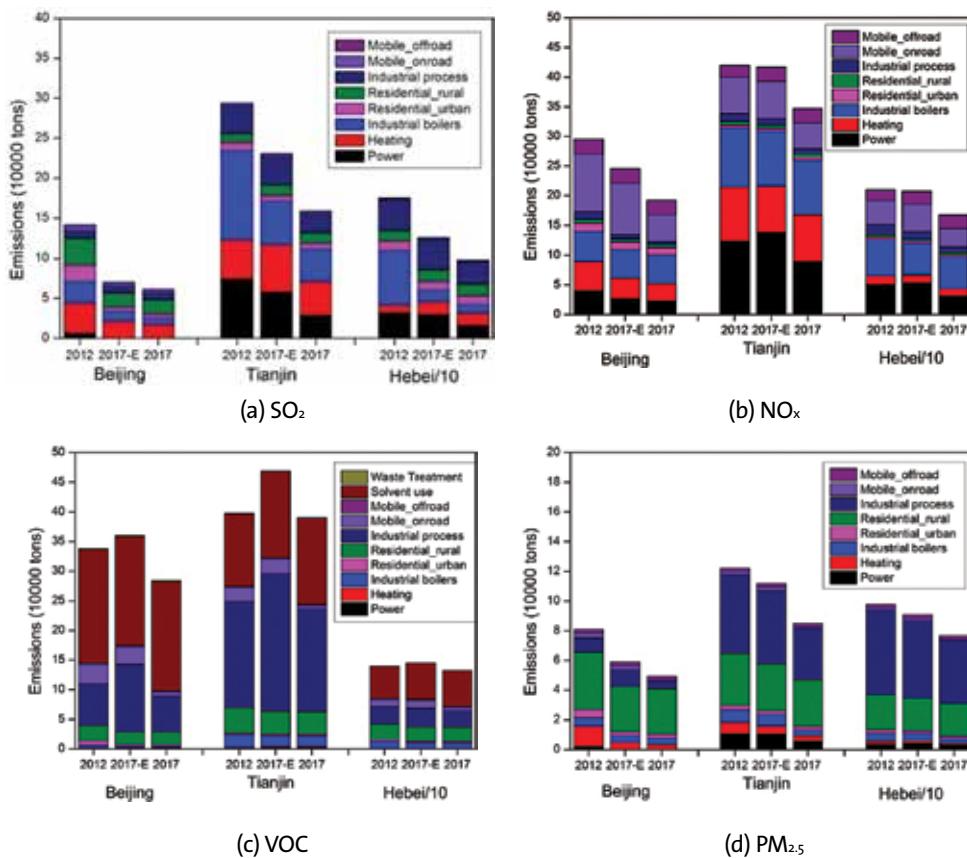


Figure 7-1-4. Emissions of key pollutants in the Beijing-Tianjin-Hebei Region in 2012 and 2017

The most effective control measures for SO₂ emission reductions are energy structure adjustment measures (contributes 41% of reductions) followed by desulfurization in the power sector (24%); the most effective control measures for NO_x emission reductions are nitrogen oxides controls in the power sector (46%) followed by reductions from vehicles (20%) and energy structure adjustment measures (19%); the most effective control measures for primary PM_{2.5} emission reductions are upgrading of dust collectors in the steel industry (29%) followed by energy structure adjustment measures (20%).

7.1.2.3 Evaluation of Air Quality Improvement Effects

To assess air quality improvement effects in the Beijing-Tianjin-Hebei Region under the Ten Measures, two air quality simulations was conducted based on the base year (2012) emission inventory and the target year (2017)

179 <http://www.meicmodel.org>

emission scenario under the Ten Measures by using the Community Multiscale Air Quality (CMAQ)¹⁸⁰ model. According to the simulated results (Figure 7-1-5), after the implementation of the Ten Measures, the annual average concentration of PM_{2.5} in Beijing, Tianjin and Hebei will be reduced to 65.8 µg/m³, 91.6 µg/m³, and 96.3 µg/m³ in 2017 from 88.3 µg/m³, 112.7 µg/m³, and 112.9 µg/m³ in 2012, declines of 25.6%, 18.7%, and 14.7%, respectively. The declines of the PM_{2.5} concentration in the Beijing-Tianjin-Hebei Region is remarkable, but there are still risks of failing to reach the target concentration reduction of 25% in 2017 in some areas in Tianjin and Hebei. In the decrease of the concentration of PM_{2.5}, sulfate, elemental carbon, organic components and other components make the largest contributions; nitrate makes relatively smaller contributions and its concentration even slightly increases, which is related to the nonlinear chemical reaction. The emission reduction measures of SO₂ and primary PM_{2.5} play great roles in the decline of the PM_{2.5} concentration. These effective measures include significant reductions in the use of coal in the Beijing-Tianjin-Hebei Region, installing of desulfurization systems and controls of primary PM_{2.5} in steel and cement industry in Tianjin and Hebei. Great efforts shall be made to control emissions of NO_x, VOC, and NH₃ and collaborative emission reduction of PM_{2.5} by multiple components shall be implemented. Not only will these measures improve both PM_{2.5} and ozone air quality, they will also reduce short lived climate forcers such as black carbon and tropospheric background ozone as well as carbon dioxide, the most important greenhouse pollutant.

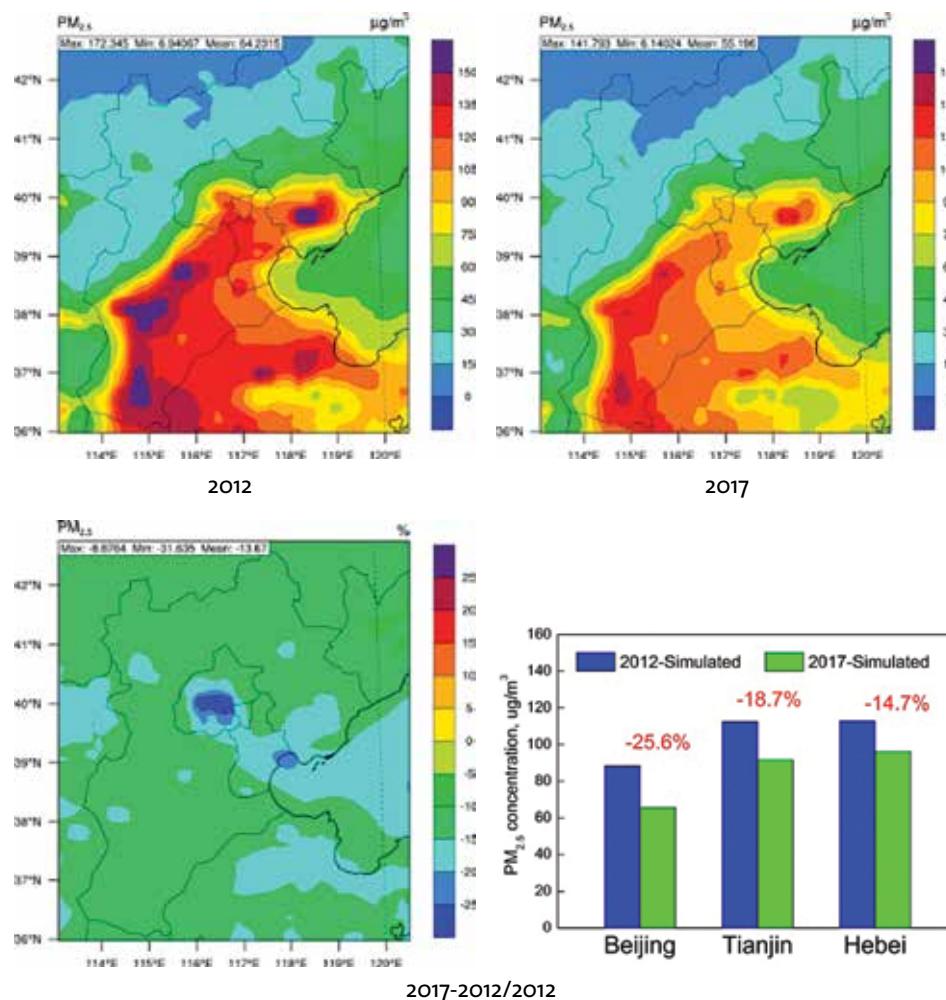


Figure 7-1-5. Simulations of spatial distribution of the annual average concentration of PM_{2.5} in the Beijing-Tianjin-Hebei Region

7.1.2.4 Strengthened Control Measures and Proposals for Improvement

The current policies have obvious effects on the control of SO₂, but have limited effects on the emission reduction of NO_x and primary PM_{2.5} and weak control over VOC and NH₃. The measures for emission reduction of SO₂ and PM_{2.5} have obvious effects on the decline of the PM_{2.5} concentration in the Beijing-Tianjin-Hebei Region, and Tianjin and Hebei shall pay special attention to control emissions of primary PM_{2.5} so as to ensure that the environmental objectives as made in the Ten Measures are reached. At the same time, great efforts must be made to the control over NO_x, VOC, and NH₃ and the collaborative emission reduction of PM_{2.5} by multiple components must be implemented.

The residential sector and industrial processes (steel, cement, and coking) make the greatest contributions to the emission of primary PM_{2.5}. Industrial processes and solvent use are primary sources of VOCs and fertilizer use and livestock are important sources of NH₃ emissions. In the Ten Measures, it is difficult to quantify measures for the residential sector as well as VOC and NH₃, and such measures must be subject to further elaboration and exploration.

7.1.3 Follow-up Evaluation Case Analysis-based on the Beijing-Tianjin-Hebei Region

7.1.3.1 Performance Indicator of Air Quality Improvement

Figure 7-1-6 shows changes in the air quality of the Beijing-Tianjin-Hebei Region in the first quarter of 2014 compared with that in the same period of 2013. The average quarterly concentration of PM_{2.5} and the days with serious or above pollution in most heavily-polluted cities in 2014 dropped significantly compared with those in 2013, which showed that the Action Plan has achieved some control effects; however, in such regions with relatively clean air as Zhangjiakou City and Chengde City, the concentration of PM_{2.5} rebounded to some extent, which was possibly related to changes in the meteorological conditions. The interference of meteorological factors shall be removed during evaluation. Therefore, it is proposed that the moving average method (for example, the moving average values in three years) should be adopted during evaluation so as to emphasize the role of man-made emission reduction.

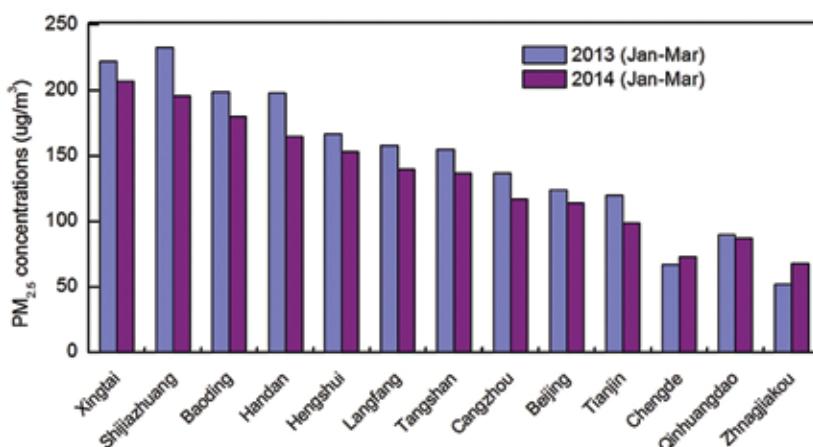


Figure 7-1-6. Changes in the concentration of PM_{2.5} in the Beijing-Tianjin-Hebei Region in the first quarter of 2014 compared to that in the same period of 2013¹⁸¹

181 Data source: National Ambient Air Quality Monitoring Network

7.1.3.2 Indicators of Control Strategy Implementation

Ranking of the various control measures must be based on their importance in terms of their effects on air quality improvements. Indicators of assessment tasks shall be quantitative. For example, 54% of primary PM_{2.5} emissions in the Beijing-Tianjin-Hebei Region come from the industrial sectors, in which 46%, 23% and 18% of industrial emissions are from the steel, building materials and coke industry. Considering that these industries greatly contribute to the emission of PM_{2.5} in the Beijing-Tianjin-Hebei Region, the ranking of control measures in these industries are correspondingly high.

7.1.4 Policy Proposals

7.1.4.1 Establishment of Pre-evaluation and Annual Evaluation Systems and Adjustment of Measures on the Basis of the Evaluation

Through the establishment of pre-evaluation and annual evaluation systems, annual measures can be adjusted on the basis of the evaluation so as to ensure that expected control targets are achieved. It is proposed that pre-evaluation indicators shall include: decreased concentration percentage of PM_{2.5} and decreased days with heavy pollution; and annual evaluation indicators shall include: annual reduction of the PM_{2.5} concentration (multi-years moving average), pollutant emission reduction, energy efficiency improvement, energy structure adjustment, and other completion progress of measures.

7.1.4.2 Establishment of Final Evaluation System

The final evaluation system provides a technological base for the continuous improvement of air quality. Indicators incorporated into the final evaluation shall include: decrease percentage of the concentration of PM_{2.5}, decreased days with heavy pollution, changes in economic and industrial structure, and human health benefits. Improvements in air quality should result in such health indicators as reduced asthma attacks in school children, and reduced hospital admissions due to a variety of respiratory and cardiovascular diseases.

7.1.4.3 Further Intensifying and Improving the Implementation Plans of Key Regions for the Action Plan

Pre-evaluation case results show that the concentration of PM_{2.5} in the Beijing-Tianjin-Hebei Region after the implementation of the Ten Measures has fallen remarkably; however, Tianjin and Hebei still have risks of failing to reach the target concentration reduction of 25% in 2017. All localities are advised to refine the Ten Measures, specify and quantify various control measures one by one, and implement the Ten Measures to reduce actual emissions. At the same time, more efforts shall be made to control NO_x, VOCs, and NH₃, each of which contributes to ambient levels of PM_{2.5}.

7.2 THE THIRTEENTH FIVE-YEAR PLAN AND THE GOAL AND ROADMAP OF AIR POLLUTION PREVENTION IN 2030

7.2.1 Prediction of Social and Economic Development From the Thirteenth Five-Year Plan Period to the Year 2030

Researchers used appropriate mathematical models to make prediction on the development trends of population, economy, energy, industry and transportation. In this study, the BAU (Business as usual) scenario stuck to the existing policies, with enforcement of them staying as usual, and no new policies of energy conservation and

emission reduction are adopted. Representative policies include: firstly, gross domestic production (GDP) will reach the level of moderately developed countries by 2050, which means the per capita GDP is 20,000 dollars; secondly, CO₂ emissions per-unit GDP will be reduced by 40%-45% compared with the year of 2005; thirdly, emission standards issued for power plant, cement, industrial furnace and motor vehicles before 2010 will continue to be put into force. Based on the above assumptions, under the BAU scenario, the researchers forecast the economic development trends, industrial and energy structures, urbanization rates and transportation modes and trends during the 13th Five-Year plan period and continuing up to 2030. Predictions are summarized in Table 7-2-1:

Table 7-2-1. Predictions for economic and social development from the 13th Five-Year to 2030 (BAU scenario)

Item	2010	2020	2030
GDP (2005 price)/billion yuan	31165	65741	117718
Population /billion	1.340	1.440	1.474
Urbanization rate /%	49.7	58.0	63.0
Electricity production/TWh	4205	6690	8506
Percentage of coal-fired power /%	75	74	73
Crude steel output /Mt	627	770	770
Cement output /Mt	1880	2400	2450
Vehicle held per thousand people	58.2	191.2	380.2
Share of new and renewable energy /% ^a	7.5	8.3	8.9
CO ₂ emission per GDP/(t/ten thousand yuan)	2.67	1.82	1.20

^a Includes hydropower, solar energy, wind electricity, ocean energy and nuclear power, etc. No utilization of biomass.

7.2.2 Medium-term Goal of Air Pollution Prevention in the Thirteenth Five-year Plan and the Long-term Goal up to 2030

Setting the medium and long term goal to prevent air pollution is based primarily on relevant plans and reports like the *Clean Air Action Plan* by the State Council, *Air Quality Guidelines* (update version in 2005) by WHO, and the *Macro Strategy Research on China's Environment* by Chinese Academy of Engineering and Ministry of Environmental Protection. Therefore, goals for controlling and preventing air pollution adapted to China's situation have been put forward, as given in Table 7-2-2:

Table 7-2-2. Medium and long term goals for control and prevention of air pollution in China

Year	National goal	Goals in key regions
2017	Reducing PM ₁₀ of cities at prefecture level and above by over 10% compared with the year of 2012	Reducing PM _{2.5} in Beijing-Tianjin-Hebei Region, Yangtze River Delta and Pearl River Delta PM _{2.5} by 25%, 20% and 15% respectively, and annual concentration of PM _{2.5} in Beijing should be reduced to 60 µg/m ³
2020	Concentration of PM _{2.5} in cities at prefecture level and above should be reduced by over 15% compared with that in 2012.	Concentration of PM _{2.5} in Beijing-Tianjin-Hebei Region and Yangtze River Delta should be reduced by over 35% and 30% respectively, and annual concentration of PM _{2.5} in Pearl River Delta should reach the standards, annual concentration of PM _{2.5} in Beijing should be reduced to 50 µg/m ³
2030	Annual concentration of ambient PM _{2.5} in most cities at prefecture level and above should meet the standard (GB3095-2012)	

7.2.3 The Roadmap for Controlling and Preventing Air Pollution in Medium and Long Term

7.2.3.1 Scenario Design

The researchers have developed different scenarios to prevent pollution in the medium and long term using an energy technology and pollution control model framework developed by Tsinghua University¹⁸². This research, based on the BAU, firstly designed a scenario for the sustainable energy policy (PC). Then, we set up three pollution-controlling strategies, namely the baseline strategy ([0] strategy), the progressive strategy ([1] strategy), and the maximum feasible reduction strategy ([2] strategy). After combining these two energy scenarios with three pollution-controlling strategies, six different pollution-controlling scenarios come into being, namely BAU [0], BAU [1], BAU [2], PC [0], PC [1], and PC [2]. Definitions of these scenarios are given in Table 7-2-3:

Table 7-2-3. Names and definitions of these six scenarios

Energy Scenario	Energy Scenario Definition	Pollution Control Strategy	Pollution Control Strategy Definition	Emission Scenario
Business as Usual (BAU)	Current policies and compliance (till the end of 2010) are assumed, especially that CO ₂ intensity will be 40%-45% lower in 2020 than that of 2005.	Reference ([0])	Current policies and current implementation status (till the end of 2010).	BAU[0]
		Progressive ([1])	New pollution control policies are implemented from 2011 to 2015, representing progressive approach towards future environmental policies after 2016.	BAU[1]
		Maximum Feasible Reduction ([2])	Technically feasible control technologies are fully applied and regarded as the maximum feasible reduction strategy	BAU[2]
Alternative Policy Scenario (PC)	New energy-saving policies are introduced and enforced more stringently, including life style changes, structural adjustment and energy efficiency improvement.	Reference ([0])	Current policies and current implementation status (till the end of 2010).	PC[0]
		Progressive ([1])	New pollution control policies are implemented from 2011 to 2015, representing progressive approach towards future environmental policies after 2016.	PC[1]
		Maximum Feasible Reduction ([2])	Technically feasible control technologies are fully applied and regarded as the maximum feasible reduction strategy	PC[2]

7.2.3.2 Results of the Energy Scenarios

Under the circumstances of BAU and PC scenarios, total energy consumed in China will increase from 4,159 Mtce in 2010 to 6,817 Mtce and 5,295 Mtce respectively in 2030. Coal has dominated the energy consumption, but its proportion will be reduced from 68.1% in 2010 to 59.5% and 51.8% in BAU and PC scenarios, respectively, in 2030. However, the proportion of crude oil will increase; this is mainly resulting from the continuous increase in the vehicle population. In terms of the PC scenario, due to the implementation of the sustainable energy strategy, the proportions of natural gas, clean utilization of biomass, nuclear power and other renewable energy resources are higher than that in the BAU scenario. Energy consumption of different resources is given in Figure 7-2-1.

¹⁸² Zhao, B., et al. NO_x emissions in China: historical trends and future perspectives. *Atmospheric Chemistry and Physics*, 2013, 13: 9869-9897.

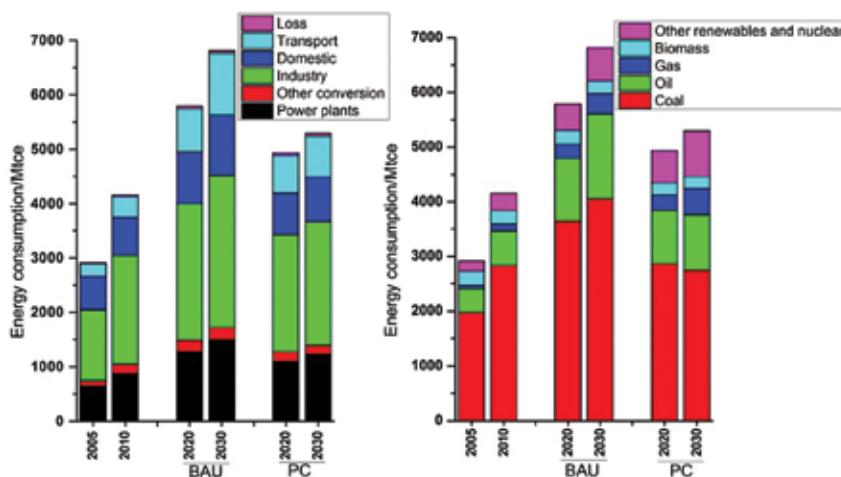


Figure 7-2-1. Prediction on China's total energy consumption

^a Biomass includes traditional burning material, methane, bio-fuel and biomass power^b Other renewable energy resources include hydropower, solar energy, wind and ocean energy

7.2.3.3 Emission Control Scenarios

7.2.3.3.1 Design of emission control scenarios

BAU [0]/ PC [0] is mainly based on the current policy and standard.

For the BAU [1]/ PC [1] scenario:

- For the power sector implementation of the *National 12th Five-Year Plan for Environmental Protection and Emission Standard of Air Pollutants for Thermal Power Plants (2011)* is assumed.
- For the industrial sector, it is assumed that the *National 12th Five-Year Plan for Environmental Protection* and relevant emission standards are put into practice from 2011 to 2015, and new policies come into being gradually after 2015.
- For the residential sector, it is assumed that high-efficiency particulate controls and low-sulfur coal will be adopted gradually; the total proportion of them will reach 20% in 2020 and 40% in 2030. In addition, this research has taken the application of advanced stoves and advanced biomass stoves into consideration.
- For the transportation sector, it is assumed that the vehicle ownership per thousand people will decrease from 380 to 325, to properly control the total vehicle population in cities. This scenario also assumes that the existing standards in Europe will be carried out in China step by step, and the interval of carrying out these two different standards should stay the same as or slightly shorter than in Europe.
- For the solvent use sector, we assume that the new emission standards of NMVOC (equivalent to the European standards of 1999/13/EC and 2004/42/EC) will be issued and carried out in key provinces during the 12th Five-Year Plan period, and they will be issued and carried out in the rest of the provinces during the 13th Five-Year Plan period. Later, the emission standards of NMVOC will become even stricter.

BAU [2]/ PC [2] assumes that China takes full advantage of the most advanced emission reduction technology available. Flue gas desulfurization (FGD) technology, low-nitrogen combustion (LNB) + selective catalytic reduction (SCR) technology, and particulate control will be fully applied for the power and industrial sectors. Apart from these control technologies, we will also promote advanced coal/biomass stoves in the residential sector and prohibit open burning with stronger enforcement. We will also accelerate our efforts to eliminate high-emission vehicles, and make sure all vehicles in use meet the most stringent emission standards of Europe by 2030.

7.2.3.4 Prediction of Atmospheric Pollutants Emissions

Emission of atmospheric pollutants from 2005 to 2030 is given in Figure 7-2-2. In 2010, the anthropogenic emissions of SO₂, NO_x, PM₁₀, PM_{2.5} and NMVOC in China were estimated to be 24.4 Mt, 26.1 Mt, 15.8 Mt, 11.8 Mt, and 22.9 Mt, respectively. Under current legislation and current implementation status (BAU[0] scenario), NO_x,

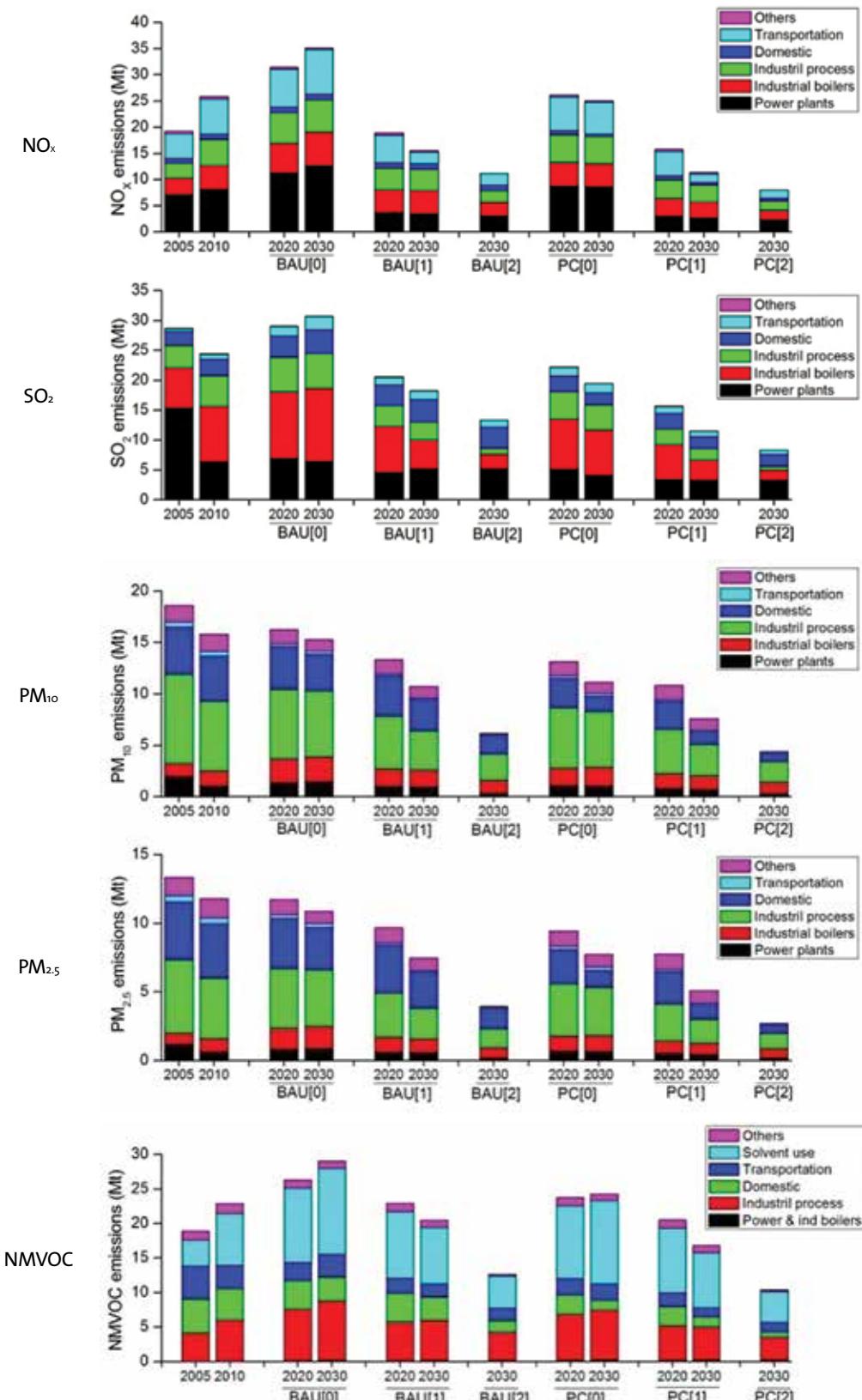


Figure 7-2-2. Air pollutant emissions from 2005 to 2030

SO_2 , $\text{PM}_{2.5}$, and NMVOC emissions in China are estimated to change by 36%, 26%, -8%, and 27% respectively by 2030 from 2010 levels. Assuming enforcement of new energy-saving policies (PC [0] scenario), emissions of NO_x , SO_2 , and $\text{PM}_{2.5}$ in China are expected to decrease by about a third while NMVOC by 16% by 2030 compared with the BAU [0] scenario. The implementation of the “progressive” end-of-pipe control measures (reflected by the difference between PC [1] and PC [0]) is expected to lead to about 55%, 41%, 31%, and 29% reductions of the baseline emissions of NO_x , SO_2 , $\text{PM}_{2.5}$, and NMVOC, respectively. With the full implementation of maximum feasible reduction measures (PC [2] scenario), China’s emissions of NO_x , SO_2 , and $\text{PM}_{2.5}$ would account in 2030 for only a quarter and NMVOC for a third of the baseline case (BAU [0] scenario).

7.2.3.5 Air Pollution Simulation and Emission Reduction to Achieve the Air Quality Target

In this study, the scientists used the CMAQ4.7.1 model developed by US EPA to simulate China’s atmospheric conditions and assess air quality impacts of different emission levels. Based on simulation and experiment results, the scientists conducted a statistical analysis and developed a response surface methodology (RSM) for emissions and pollutant concentrations. This allows them to rapidly estimate the impact different emission levels from different source categories can have on atmospheric pollutant concentrations. In addition, the RSM makes it possible to quickly assess different control measures for different regions to ensure that pollutant concentrations in target provinces and cities can reach the standards. Results of the analysis show that in 2017 China needs to reduce the national SO_2 , NO_x , $\text{PM}_{2.5}$ and VOC emissions by at least 24%, 15%, 16%, and 2%, respectively, and the increase of NH_3 emissions shall be limited to less than 10%, compared with that in 2012. By 2030, China needs to reduce national SO_2 , NO_x , $\text{PM}_{2.5}$ and VOC emissions by at least 52%, 65%, 57%, and 36%, respectively, and NH_3 emissions shall also decrease gradually. China needs to intensify the emission control in heavily polluted areas. For example, the SO_2 , NO_x , $\text{PM}_{2.5}$, and VOC emissions in Beijing-Tianjin-Hebei Region shall be reduced by at least 32%, 25%, 30%, and 11%, respectively, by 2017 on the basis of 2012 levels, and NH_3 emissions can only increase slightly. By 2030, the SO_2 , NO_x , $\text{PM}_{2.5}$, VOC and NH_3 emissions in Beijing-Tianjin-Hebei Region shall be reduced by at least 59%, 72%, 70%, 44%, and 21%, respectively. The emission targets for major pollutants in all provinces are given in Table 7-2-4.

Table 7-2-4. Target emission ratio for major pollutants in all provinces, taking 2012 as the benchmark (namely 1.0)

Pollutants	Primary PM2.5		SO2		NOX		NH3	
Year	2017	2030	2017	2030	2017	2030	2017	2030
The country	0.85	0.39	0.85	0.56	0.86	0.37	1.10	1.00
Beijing	0.65	0.43	0.62	0.48	0.66	0.26	1.10	0.65
Tianjin	0.70	0.33	0.70	0.45	0.69	0.28	1.10	1.00
Hebei	0.71	0.37	0.72	0.63	0.71	0.39	1.10	1.00
Shanxi	0.80	0.31	0.79	0.56	0.88	0.36	1.10	1.00
Inner Mongolia	0.82	0.35	0.85	0.67	0.89	0.36	1.10	1.00
Liaoning	0.92	0.33	0.99	0.62	0.93	0.36	1.10	1.00
Jilin	0.86	0.36	0.81	0.58	0.75	0.36	1.10	1.00
Heilongjiang	0.78	0.29	0.77	0.55	0.85	0.35	1.10	1.00
Shanghai	0.75	0.43	0.82	0.58	0.89	0.34	1.10	1.00
Jiangsu	0.77	0.38	0.88	0.58	0.86	0.34	1.10	1.00
Zhejiang	0.71	0.34	0.85	0.56	0.85	0.31	1.10	1.00
Anhui	0.90	0.42	0.88	0.66	0.87	0.42	1.10	1.00
Fujian	0.93	0.39	0.85	0.48	1.06	0.44	1.10	1.00
Jiangxi	0.92	0.33	0.80	0.50	0.91	0.42	1.10	1.00
Shandong	0.74	0.33	0.79	0.45	0.89	0.34	1.10	1.00

Pollutants	Primary PM2.5		SO2		NOX		NH3	
Year	2017	2030	2017	2030	2017	2030	2017	2030
Henan	1.00	0.35	0.92	0.56	0.92	0.40	1.10	1.00
Hubei	0.84	0.40	0.65	0.45	0.76	0.35	1.10	1.00
Hunan	0.89	0.45	0.86	0.54	0.88	0.42	1.10	1.00
Guangdong	0.81	0.43	0.93	0.52	0.93	0.36	1.10	1.00
Guangxi	1.02	0.58	1.08	0.54	0.87	0.41	1.10	1.00
Hainan	0.86	0.52	1.09	0.49	0.87	0.36	1.10	1.00
Chongqing	0.92	0.45	0.86	0.54	0.83	0.41	1.10	1.00
Sichuan	0.89	0.36	0.84	0.51	0.85	0.37	1.10	1.00
Guizhou	1.06	0.71	1.05	0.94	0.89	0.46	1.10	1.00
Yunnan	0.83	0.46	0.95	0.54	0.83	0.39	1.10	1.00
Tibet	0.77	0.35	0.85	0.62	0.78	0.33	1.10	1.00
Shaanxi	0.86	0.29	0.86	0.61	0.83	0.36	1.10	1.00
Gansu	0.88	0.34	0.95	0.64	0.89	0.40	1.10	1.00
Qinghai	0.75	0.27	0.70	0.49	0.72	0.32	1.10	1.00
Ningxia	0.85	0.32	0.83	0.49	0.84	0.33	1.10	1.00
Xinjiang	0.87	0.38	0.81	0.43	0.81	0.34	1.10	

7.2.4 Medium and Long Term Strategies For Controlling and Preventing Air Pollution

After determining the goals of emission reductions for different regions, sectors and pollutants, we use the technical model of energy and pollutant emission to further analyze the possible technical measures to achieve the above goals.

In terms of industrial restructuring and energy consumption, the percentage of coal accounting for the total energy consumption must be no more than 65% in 2017. Beijing-Tianjin-Hebei Region, Yangtze River Delta and Pearl River Delta will endeavor to achieve negative growth in coal consumption by means of increasing power transmission from other regions and natural gas supply, and using non-fossil energy to replace coal. Apart from keeping what is necessary, urban areas should eliminate coal-fired boilers with capacity of 10t/h or less, and forbid the building of coal-fired boilers with capacity of no more than 20 t/h. In industrial cluster districts like the chemical industry, paper making, tanning and pharmacy, must focus on constructing co-generation units to eliminate scattered coal-fired boilers. In Beijing-Tianjin-Hebei Region, Yangtze River Delta and Pearl River Delta, China must closely restrict vehicle ownership and use, and speed up upgrading and transforming the petroleum processing companies.

In 2030, besides the above measures, China must close down more facilities with outdated capacity, compress facilities with excess capacity and strive to develop energy-saving and environment-friendly industries. China must promote cleaner production in agriculture, industry, construction and the business service sector; to reduce the energy consumption and emissions of air pollutants. China should promote the cascaded utilization of energy and construction circular economy.

As for end-of-pipe emissions, China must implement the following technical measures in order to achieve the air quality targets.

220 7.2.4.1 Power Sector

Newly-built power plant must be equipped with low NOx burners (LNB) and selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), or hybrid SCR/SNCR devices. The existing generator sets with capacity

of more than 300 MW should install and operate SCR before 2015, and generator sets with capacity less than 300 MW should be gradually equipped with SCR after 2015. High-efficiency particulate controls, such as fabric filters, should be promoted gradually and should be used universally in key regions before 2030.

7.2.4.2 Industrial Enterprises

As to SO₂, flue gas desulfurization (FGD) will be put into use on a large scale. As to NO_x, newly-built industrial furnaces will be equipped with LNB and the existing boilers shall have the transformation to LNB from 2012 to 2017, and most of the boilers will be equipped with LNB by 2020. As to PM, electrostatic precipitators (ESP) and high efficiency particulate controls will gradually replace the inefficient wet PM scrubbers (WET).

7.2.4.3 Residential Sector and Open-Burning of Biomass

Adjustments of energy structure will play a key role in reducing emission in residential sector. In terms of end-of-pipe control, high efficiency particulate controls and coal with low sulfur will be utilized gradually in residential sector. In addition, China shall consider the use of advanced boilers and biomass stoves (such as restructuring combustion mode and using catalytic stoves), and take measures to forbid open burning.

7.2.4.4 Transport Sector

By the end of 2017, gasoline and diesel fuel for vehicle use that meet China 5/V standards will be provided nationwide; in the three key regions China 5/V fuels will be introduced even earlier, by the end of 2015. China must control the emissions from new vehicles; east China must implement the China 5/V emission standards ahead of the national schedule; China must eliminate the production of low speed agricultural trucks and substitute modern light-duty diesel vehicles meeting national emissions standards instead. Compliance with vehicle emissions standards must be greatly improved by strengthening the conformity of production enforcement and enhancing the oversight on in-use compliance. In addition, China must deal with high-emission vehicles by scrapping all the light vehicles produced before the implementation of the first-stage (China 1) national standards, and launch a pilot project to either scrap heavy-duty diesel vehicles with high emissions (i.e. produced before China III was implemented) or retrofit them with high performing diesel particulate filters (DPFs). China must vigorously develop energy-saving and new energy vehicles (like hybrid vehicles, plug-in hybrid vehicles, battery electric vehicles and natural gas vehicles) for public transportation vehicles with high annual mileage (like taxis and buses). China must implement the China III emission standards for non-road machines in the year 2015.

From 2018 to 2030, except for the three key regions which will proceed on a quicker schedule, China shall establish a sound regulatory system along with a good enforcement capability for the rest of China. By the end of 2019, the gasoline and diesel fuel for vehicle use that meet China 6/VI standards will be provided nationwide, and the three key regions should achieve this goal in advance, to cut the evaporation of gasoline significantly. China must properly control the total vehicle population in cities by various means including a lottery system such as used in Beijing or an auction system as used in Shanghai. China must also implement the China 5/V emission standards for new vehicles nationwide in 2018, and phase in the China 6/VI emission standards for new vehicles nationwide in 2020. China 6/VI emission standards for new cars, trucks and buses must be introduced in 2018 in the three key regions; Beijing will introduce China 6/VI standards even earlier. China must actively develop the energy-conserving and new energy vehicles in the private vehicles; China must introduce the China IV emission standards for non-road machines in the year 2020, and unify the fuel standards for road vehicles and non-road machines step by step, to ensure that the emissions from non-road machines are at the same level as that from on-road motor vehicles. When it comes to formulating national emission standards for inland vessels and domestic flights, China should base requirements on air quality levels near the airports, ports and waterways in China,

transport of pollutants from these localities, and the health and environmental damages which result, and also promote the use of cleaner fuel for ocean-going vessels.

7.2.4.5 The Utilization of Solvent

During the 12th Five-Year Plan, the new emission standards of NMVOC shall be issued and implemented in key provinces. While during the 13th Five-Year, the rest of the provinces shall follow the example of those key provinces. Later, emission standards of NMVOC will become stricter.

7.2.4.6 Agricultural Sector

Fertilizer utilization and livestock farming are important sources of NH₃ emissions. Improving fertilizer application structure and reducing the emission factor of urea are important in reducing emission in fertilizer utilization. For livestock emission reduction, the application of low-nitrogen feed, breeding house renovation, quick waste collection and mulch compost will be effective.

Conclusions Regarding Medium and Long Term Strategies

In short, to improve the ambient air quality and achieve the goals of controlling emissions of major air pollutants in stages, China should adhere to the coordinated, integrated and joint strategy. In controlling pollutants, China should exercise coordinated control over SO₂, NO_x, PM, NH₃ and NMVOC; in controlling pollution sources, China should attach importance to industrial pollution sources, area pollution sources and mobile pollution sources; and in making control strategies, China should make joint measures to connect regions and cities.

7.2.5 Policy Suggestion

7.2.5.1 Identify Medium and Long Term Targets for Control and Prevention of Air Pollution

China should identify the medium and long term targets to control and prevent air pollution: in 2020, concentration of PM_{2.5} in cities at prefecture level and above should be reduced by over 15% compared with that in 2012. Concentration of PM_{2.5} in Beijing-Tianjin-Hebei Region and Yangtze River Delta should be reduced by over 35% and 30% respectively, and annual concentration of PM_{2.5} in Pearl River Delta should reach the Chinese air quality standard; annual concentration of PM_{2.5} in Beijing should be reduced to 50 µg/m³. Annual concentration of ambient PM_{2.5} in most cities at prefecture level and above should meet the Chinese air quality standard (GB3095-2012).

7.2.5.2 Clean, Efficient and Sustainable Use of Coal

It is preferable to use coal in large-scale facilities with high-efficiency end-of-pipe control technologies; small-scale boilers and stoves should be phased out gradually, and district heating should be greatly promoted but with fully metered use.

China must make great effort to improve the energy efficiency of coal utilization. The average energy efficiency of coal-fired power plants should be increased from 36% in 2010 to 42% in 2030. The energy consumption per unit product of industrial coal-fired boilers, blast furnaces, cement production, coke ovens, and brick kilns is assumed to be 24%, 13%, 16%, 44%, and 27% lower, respectively, in 2030 compared with 2010.

Clean coal technologies should be encouraged. China should increase the proportion of coal washing. The import of high-ash and high-sulfur coal should be banned.

7.2.5.3 Speed up the Adjustment of Energy Structure; Increase the Use of Clean Energy

The total consumption of coal should be stringently restricted. By 2017, the share of coal in total energy consumption should be reduced to 65% or less, and Beijing, Tianjin, the Yangtze River Delta, Pearl River Delta region should strive to achieve a negative growth of total coal consumption. By 2030, the proportion of the national coal consumption should account for no more than 50% of the total energy use.

China will speed up developing and exploiting clean energy to ensure that the total proportion of natural gas, nuclear and renewable resources (biomass not included) amounts to 25% of energy consumption. The supply of natural gas should be increased, and natural gas should satisfy the need of residential sector in priority. Hydro power, nuclear power, wind power, and solar power should be greatly promoted.

7.2.5.4 Strengthen the Coordinated Control on Multi-Sources and Multi-Pollutants

To improve the ambient air quality targets, China should adhere to the coordinated, integrated and joint strategies. That is to say: in controlling pollutants, China should exercise coordinated control over SO₂, NO_x, PM, VOCs and NH₃; in controlling pollution sources, China should attach importance to industrial pollution sources, area pollution sources and mobile pollution sources; and in making control strategies, China should make joint measures to connect regions and cities.

The recommended future emission reductions are as follows: On the basis of 2012 emissions, the national SO₂, NO_x, PM_{2.5} and VOC emissions should be reduced by at least 52%, 65%, 57%, and 39%, respectively, by 2030, and NH₃ should have a little decline. China should intensify the emission control in heavily polluted areas. For example, the SO₂, NO_x, PM_{2.5}, VOC and NH₃ emissions in Beijing-Tianjin-Hebei Region should be reduced by at least 59%, 72%, 70%, 44%, and 21%, respectively, by 2030 from the 2012 levels.

7.3 INTERNATIONAL EXPERIENCES OF COORDINATION MECHANISM FOR REGIONAL AIR POLLUTION MANAGEMENT

7.3.1 International Experience

7.3.1.1 Ambient Air Quality Standards, Action Plans, and Monitoring

Europe and the US establish science-based ambient air quality standards to adequately protect human health and the environment from excessive levels of pollution. Attainment of the standards is also required at hot spots where the public is exposed to pollution. Local and state/national authorities are given a timeframe to meet the ambient air quality standards. If an area fails to meet the ambient air quality standards, the relevant air quality authority is legally required to take actions to reduce pollution concentrations in an effort to bring the area into compliance with the standards. If an area fails to take sufficient action to meet ambient air quality standards, authorities can withdraw subsidies (e.g., highway construction funds in the US) provided by national authorities.

Air Quality Plans (AQP) [Europe] and State Implementation Plans (SIP) [US] provide a comprehensive strategy for reducing emissions and pollution concentrations; AQP and SIP include among other items: (i) Analysis of source contributions, (ii) Pollution prevention and control policies, (iii) Schedules for implementing policies, (iv) Scientific and economic assessments to illustrate the potential emission reductions and their costs, (v) Emergency plans for severe air pollution episodes, and (vi) Implementation and enforcement resource adequacy demonstrations.

Europe and the US require comprehensive air quality monitoring networks to track progress toward attaining the ambient air quality standards.

In the US, EPA designates “nonattainment” areas – an area that includes one or more ambient monitors that are not attaining the standard, and nearby areas with emissions that contribute to the air quality problem. Europe has a similar procedure. Monitors are sited in different locations based on their measurement objectives – “background” stations, whether in urban or regional/rural areas, are placed in areas that are not affected by nearby sources (e.g., industrial areas or roadways); “traffic” and “industrial” stations are sited in hot spot areas (e.g., roadways) that represent the highest likely concentrations to which the general population may be exposed. Rigorous procedures to assure high data quality are set down.

Monitoring data are published and easily accessed by the public and interest groups; the public and interest groups can use the data to challenge air quality authorities in court if they believe the government is not adequately addressing the air pollution challenges.

In Europe, SO₂ and NO_x emissions have been reduced at roughly equal shares through (i) energy efficiency improvements (decoupling between GDP and energy consumption), (ii) changes in fuel input, i.e., substitution of coal by cleaner fuels, and (iii) dedicated end-of-pipe emission control measures, with strict enforcement mechanisms. Economic incentives have proven to be a very effective tool to encourage clean technologies. As a co-benefit, this triple approach has also led to a decline in CO₂ emissions.

7.3.1.2 Regional Air Quality Management

Europe and the US have spatially distributed emission reduction targets based on extensive measurements and modelling in an effort to determine the least cost approach to reducing emissions that cause or contribute to the ozone or PM_{2.5} problems.

European PM_{2.5} levels are significantly affected by NH₃ emissions, increasing the prominence of NH₃ reductions in efforts to improve air quality.

European Member States must meet treaty obligations to limit pollution that contributes to downwind areas and adhere to national emission ceilings (i.e., total emission caps). European national emission ceilings are based on cost-effectiveness and distributional impacts. In addition, joint air quality planning cooperation is encouraged in the event of non-compliance with air quality standards due to transboundary pollution transport.

The US Clean Air Act requires upwind areas to prevent or control emissions that cause a downwind area to exceed the National Ambient Air Quality Standards. EPA worked with state governments and other stakeholders to create regional planning organizations (RPOs) to foster regional coordination and cooperation; RPOs were tasked to: (i) compile regional emission inventories, (ii) improve regional modeling capabilities, (iii) bolster monitoring programs, and (iv) build capacity for air quality management.

The US RPOs are independent organizations that facilitate regional coordination, but the legal forcing mechanisms within the US Clean Air Act (e.g., “Good Neighbor” provision, State Implementation Plan requirements) encourage participation and require action.

The US focused many of the regional control programs on the power sector because the sector was responsible for a significant portion of total emissions and provided the most cost-effective emission prevention and control opportunities; other sectors (e.g., transportation) were also subject to stricter pollution prevention and control requirements.

The Convention on Long-range Transboundary Air Pollution (CLRTAP)

CLRTAP is an international agreement for the establishment of common policies on strategies, monitoring systems and measurements in relation to air quality under the United Nations Economic Commission for Europe' (UN-ECE), Parties as fully-sovereign states agreed to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Parties to the Convention have agreed to specific obligations in 10 protocols, which among other things established common air quality monitoring and atmospheric dispersion modelling activities, and specific quantitative obligations to reduce emissions of single pollutants, such as SO₂, NO_x, VOC, heavy metals and POPs. Most recently, Parties agreed to an amendment of the Gothenburg protocol that also addresses health impacts from PM_{2.5} and includes country-specific emission reduction obligations to limit their national emissions of SO₂, NO_x, NH₃, VOCs and PM_{2.5} below specified ceilings and to recognize the close linkages between regional air pollution and global climate change.

7.3.1.3 National Emission Standards for Major Stationary Sources

The Industrial Emissions Directive (IED) [Europe] and New Source Performance Standards (NSPS) [US] establish emission limits for large stationary sources. The IED requires Member States to develop a plan outlining the strategy for implementing and enforcing the limits and to apply “best available emission control technology” defined EU-wide by institutionalized expert groups. The US and the EU requires that large stationary sources obtain a pre-construction permit (similar to an EIA) and an operating permit from the state environmental agency; the operating permit consolidates into a single document all the various air pollution and monitoring and reporting requirements that apply to the facility or enterprise.

US experience in regional air quality management

The amendments to the Clean Air Act (CAA) in 1977 and 1990 include a “good neighbor” provision, which requires each state to have provisions in its overall air quality management plan that prohibit activities that lead to interstate transport of pollution that can “interfere” with the attainment and maintenance of the ambient air quality standards by another state. The CAA also includes a “bad neighbor” provision. This provision allows a downwind state to petition EPA to require emission reductions in a neighboring state, and gives EPA the authority to directly regulate a specific source (or group of sources) in the upwind state.

In the 1990 CAA amendments, Congress established the Ozone Transport Commission (OTC), charged with evaluating the interstate transport of ozone and its precursors, and designing regional pollution prevention and control policies. The 1990 CAA amendments also called for the establishment of the Grand Canyon Visibility Transport Commission (GCVTC). The GCVTC was a regional organization established in 1991 (comprised of 9 western states and 4 Tribal nations) charged with developing recommendations for measures to reduce visibility impairment (caused by emissions of fine particles and precursors such as SO₂ and NO_x) in 16 national parks and wilderness areas. The Commission’s report in 1996 provided important technical and policy foundation for the EPA to establish the Regional Haze program in 1999. In addition, the CAA also gives EPA the general authority to establish other interstate transport commissions.

In 2000 EPA provided initial funding for five Regional Planning Organizations (RPOs) across the US to assist with the coordination and cooperation needed to provide the technical, scientific foundation necessary to assist state agencies with developing regional air quality SIPs. EPA also developed guidelines for improving coordination among states and organized biannual meetings of all RPOs to share information and lessons. Among other activities, the RPOs were tasked with compiling emissions inventories, establishing emissions tracking systems, improving regional modeling capabilities, bolstering monitoring programs, and providing capacity building to state air quality agencies.

In the past, when states have been unable to agree on a final policy option for all states to adopt, EPA has then taken a lead role in developing a regulatory program applicable to a large group of states to reduce SO₂ and/or NO_x to address regional PM_{2.5} and ozone problems. The 2005 Clean Air Interstate Rule (CAIR) and the 2011 Cross-State Air Pollution Rule (CSAPR), both regional cap-and-trade programs designed to reduce emissions of SO₂ and NO_x from the power sector, were developed to address this type of situation. CSAPR established emission caps for each upwind state based on the state's significant contribution to nonattainment in downwind states, including emission levels, sources to be controlled, and schedules for CSAPR, and under the CSAPR, states were required to develop a SIP describing how they would achieve state-level emission limits (i.e., emission caps). States also had the option of developing state-specific policies.

7.3.1.4 National Emission Standards for Mobile Sources

Europe and the US have stringent emission standards for on road vehicles and are expanding the standards to include more off road sources (e.g., construction and agricultural equipment and in some areas marine vessels and fuels).

The US has an effective recall program that requires vehicle manufacturers and importers to recall and correct engines or pollution controls that are unable to meet emission or durability requirements. It has also added a wide range of test conditions to type approval and in use compliance regimes.

Euro 6/VI substantially improves the type approval testing and in use compliance requirements compared to previous mandates.

As the above summary indicates, both Europe and the United States have strong and mature strategies to address air pollution. While they differ significantly in details, they have many important common elements. Based on the long term experience in both Europe and the United States, the following measures are recommended.

7.3.2 Recommendations for China's Air Quality Management based on the International Experience

7.3.2.1 China should adopt a strong regional program to assure close coordination by all parties whose emissions contribute to the air quality in a given air shed

Effective reductions of ambient PM_{2.5} and ozone in China require a coordinated regional approach taking into account that PM_{2.5}, ozone and their precursors are transported in the atmosphere over hundreds of kilometers. Therefore regional planning centers (RPCs) should be established to: (i) facilitate coordination and cooperation among provincial and municipal air and energy officials, (ii) build capacity through training, and sharing experiences and lessons, (iii) bring consistency to emission data, monitoring networks and methods, and modeling analysis, and (iv) leverage resources.

RPCs will likely require Central government financial and logistical support, oversight, and authority to compel provincial and municipal governments to participate in the RPC.

Definitions of air sheds should be based on meteorological, topographical and other conditions that define appropriate boundaries for effective emissions control to assure that air quality standards can be met. Consideration should be given to combining the three key regions – JJJ, YRD and PRD - and other associated provinces in Eastern China's industrialized, highly populated and highly polluted area into a single region. Such an approach would still likely require multiple sub regional planning centers to maximize the overall effectiveness.

7.3.2.2 Effective pollution prevention and control policies and planning are critical; therefore, China should carefully analyze experience with control measures and implement those found to be both environmentally and cost effective

Cost-effective reductions of ambient PM_{2.5} require significant cuts of SO₂, NO_x and VOC emissions from industrial sources and transportation are needed. Without additional and appropriate measures to control NH₃ emissions from agricultural sources, it is unlikely that the benefits from the reductions of SO₂ and NO_x will be realized, especially during peak pollution episodes. Emission reductions and the spatial and sectoral distributions of those reductions should be based on integrated modelling of all precursor emissions and regional discrepancies.

Integrated multi-sectorial policy approaches have been used to cost-effectively reduce emissions in Europe and the US and should be used in China – SO₂, NO_x, PM and VOCs emissions can be reduced through: (i) energy efficiency improvements (decoupling between GDP and energy consumption), (ii) changes in fuel input, i.e., substitution of coal by cleaner fuels, (iii) dedicated end-of-pipe emission control measures, with strict enforcement mechanisms. These policy approaches can take the form of regulatory measures or economic incentives and disincentives. Integrated multi-sectorial approaches should be used to maximize co-benefits of air pollution control, energy conservation, greenhouse gas emissions, oil imports, water resources and others.

Stationary sources: Minimum performance standards, which relate to what is achievable with advanced emission control technologies while not entailing excessive costs, should be required for all new major sources and any major sources undergoing significant modification or relocation from high-density urban areas. An institutional framework should be established to define “minimum performance standards” for different types of industries. In pollution control areas, local authorities should be authorized to impose stricter standards.

Mobile sources: Because motor vehicles travel across political boundaries, vehicle emission controls should be nationally consistent to the degree of stringency necessary to address the most serious air pollution problems. Local controls can supplement but not replace national controls. Once fuel of sufficient quality can be made available, the most stringent feasible vehicle standards have been found to be very cost effective in Europe and the US and should be adopted in China. Economic incentives, such as emission-dependent vehicle taxes and motorway charging schemes, should be used to promote faster modernization of the vehicle fleet or retrofit with exhaust gas treatment systems, like diesel particulate filters.

In parallel with tighter vehicle and fuel standards, Europe and the US have found it critical to substantially increase the focus on in-use compliance throughout the wide range of real in-use driving conditions; an upgraded compliance program is critical to the success of China’s vehicle pollution control efforts.

Air quality planning: Air quality action plans are a critical tool to help provincial and municipal air, energy, economic, and health officials develop strategies for enhancing air quality and reducing energy consumption; plans should include: (i) emission inventories to identify, assess, and rank pollution sources and sectors, and to evaluate progress in reducing emissions, (ii) pollution prevention and control strategies to achieve air quality targets, (iii) air quality modeling to assess the impact of economic trends and the expected effects of pollution prevention and control strategies, (iv) ambient monitoring and assessment strategies to measure progress toward air quality targets (v) implementation strategies to identify the required resources to implement and enforce the pollution prevention and control strategies, (vi) program evaluation procedures to assess progress and identify gaps, and (vii) contingency plans that can be implemented if the region fails to make reasonable progress toward the air quality targets. Air quality attainment and emission prevention and control timelines in the plan should be realistic; repeated failure of compliance despite reasonable efforts might compromise the policy approach.

In areas exceeding the air quality standards, economic growth should be conditioned on measures to offset any additional emissions; the amount of offset should be dependent on the degree the air quality standard is exceeded.

Assessments of the plan should be based on the air quality assessment, compliance assessment, and the pollution prevention and control measure impact analysis and implementation assessment.

7.3.2.3 China should focus on building a strong and effective compliance program

The effectiveness of the policies and control measures adopted by China is ultimately dependent on a well-funded and staffed compliance program. Forecasts of successful emission control efforts are dependent on the assumption that control measures are fully effective. Based on international experience, strong compliance programs must be included in all administrative levels of the clean air program to assure this effectiveness.

7.3.2.4 Setting appropriate air quality standards that will adequately protect public health and implementing a monitoring network that accurately assesses compliance with those standards should be the backbone of China's Clean Air Program

Air quality standards, that need to be attained, should be defined for and monitored in all areas, including in areas with high concentrations (e.g., hot spots), like road side locations or industrial centers, where the population is exposed to air pollution.

Ambient air pollution data quality should be ensured through carefully designed and operated data quality assurance and quality control (QA/QC) procedures, including: (i) specifying the differing objectives of the various monitors (e.g., hot spots, background levels) and the appropriate siting conditions for each type, (ii) specifying the needed accuracy of the monitoring data specifically for the Beijing or other Action Plans work (data quality objectives), especially with a view to the need for accurately assessing annual improvements in the PM_{2.5} concentration, (iii) ensuring that the QA/QC procedures are adequate to provide the needed accuracy, (iv) ensuring the monitoring stations on which the PM_{2.5} reduction assessment is based are properly located, subjected to QA/QC, and stable, especially in terms of changes in nearby area use and activities. This requires regular cross-comparisons among the monitoring networks and calibration with the national standard to ensure data consistency across all networks. Finally, a successful air monitoring program will require an infusion of resources dedicated to this effort along with training and capacity building.

Ambient monitoring networks should be designed to enable the apportioning of the contributions from local sources, urban conurbations, and regional pollution sources based upon the data from the network, as an additional source of apportionment to that given by modelling.

7.3.2.5 A process for measuring the effectiveness of control measures and determining progress in improving air quality should be a priority for China

Meteorological and other conditions can significantly affect ambient pollution concentrations. The evaluation of annual air quality changes should be adjusted for inter-annual differences in these conditions in order to assess the progress towards the air quality goals as a result of the control measures, which is a main indicator for the success of the air quality action plans in JJJ, YRD and PRD. No specific method can be recommended, because it needs to be tailored to the meteorological conditions in China. Given the strong relevance the adjustment method should as far as possible be applicable everywhere to ensure a consistent and transparent way of measuring and comparing the achieved progress. However, it is important to recognize that air quality, regardless of meteorological conditions, has human health implications. Therefore, achieving the air quality standards in absolute terms under all meteorological conditions should be the goal for every region.

Measuring annual improvement in air quality is strongly linked with quality/accuracy of the monitored data, and the needed capacity for QAQC procedures. Air quality modeling can supplement air pollution monitoring to assess the annual pollution reduction rate, based upon the assessment of the annual reductions in the emissions.

7.3.2.6 China should highlight the climate change co-benefits of the air pollution control effort

China's air pollution control effort will reduce coal consumption, facilitate industrial modernization, increase the use of renewable fuels, improve vehicle efficiency, and stimulate the increased production and sale of new energy vehicles beyond business as usual; each of these air pollution control steps will reduce CO₂ emissions as a co-benefit. Other clean air control strategies will also reduce CO₂ emissions. Further, actions to reduce PM emissions from diesel vehicles and other sources will also lower black carbon emission, a very important short lived climate forcing pollutant which recent evidence indicates may be second in importance only to CO₂ in terms of its climate impact. Finally, the reduction in NOx and VOC emissions from all sources as a result of the clean air control measures should contribute to lowering of global tropospheric background ozone levels, also a potent greenhouse pollutant.

In light of the increasing urgency in addressing global climate change as well as China's recent emergence as the largest contributor to the problem along with the United States, it is extremely important to highlight the climate benefits of the clean air strategy and the win-win nature of the effort.

7.4 COORDINATION MECHANISM AND POLICY RESEARCH FOR THE REGIONAL AIR POLLUTION CONTROL

7.4.1 Current Situation of the Coordination Mechanism and Policies

7.4.1.1 The Zones Designated for Regional Air Pollution Control

7.4.1.1.1 Traditional management zones of regional air pollution control

Prior to year 2010, the scope of air pollution control was defined by administrative regions. Different administrative regions respectively make their own pollution control policies to achieve their own goals. However, air pollution does not abide by the administrative boundaries, so the “Twelfth Five-Year” Plan for the Key Regional Air Pollution Control (hereinafter referred to as the *Key Regional Planning*) breaks the administrative boundary constraints for the first time, marking out 13 areas (3 regions and 10 city clusters) for air pollution control, as shown in Figure 7-4-1. Defining of these zones is based on the fact that air pollution in China is highly dependent on economic development level and population density.



Figure 7-4-1. Regions set out in “Twelfth Five-Year” Plan for the Key Regional Air Pollution Control

7.4.1.1.2 Defining the zones based on the satellite remote sensing

According to the satellite remote sensing data, areas with high PM_{2.5} concentration include the following regions: Beijing-Tianjin-Hebei region, Yangtze River Delta region, Shandong, Chengdu-Chongqing, Wuhan, Chang-Zhu-Tan, Henan province and Anhui province. Northern China, Central China and Eastern China have formed into a large area of heavy PM_{2.5} pollution.

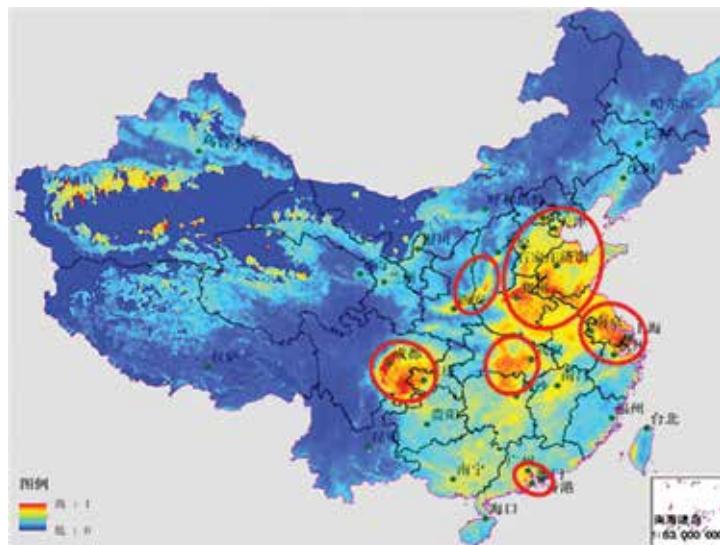


Figure 7-4-2. Spatial distribution of aerosol optical depth during 2011-2012¹⁸³

7.4.1.1.3 Defining the zones based on the ground measurement

The neighboring cities always present similar trend and characteristics of air pollution due to similar surface and meteorology condition. Wang (2008)¹⁸⁴ grouped 86 Chinese cities into 14 areas based on statistical analysis of API data, which is derived from ground measurement of air pollution concentrations (Figure 7-4-3).

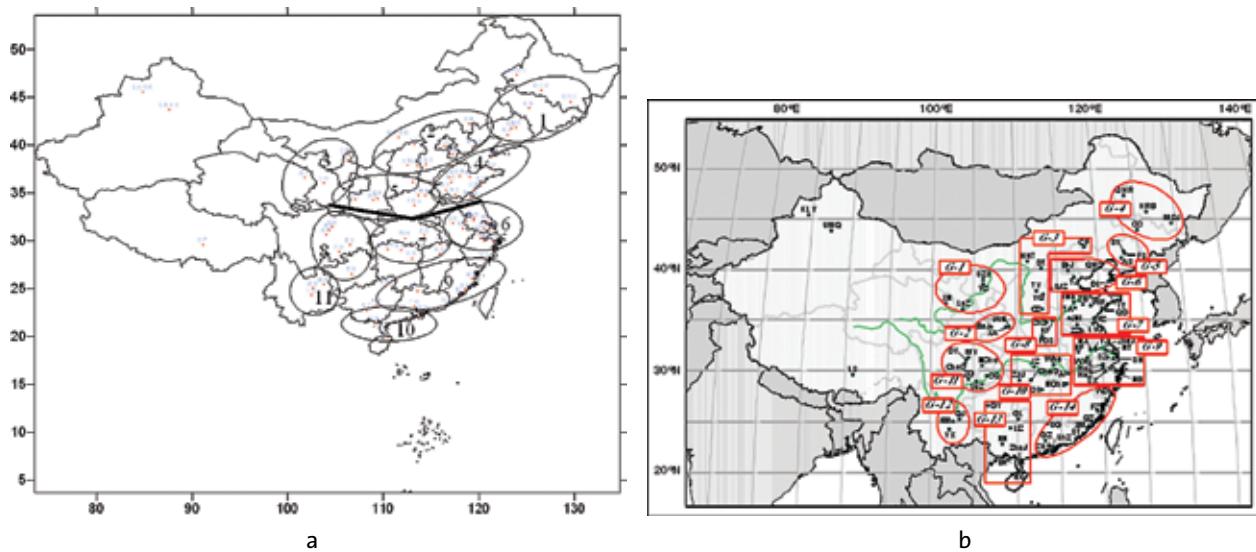


Figure 7-4-3. Partitioning of air pollution control

¹⁸³ Based on the data retrieved from MODIS, NASA.

¹⁸⁴ Wang, B. Analyzing spatial and temporal characteristics of regional air pollution of China Based on Air Pollution Index (API), Dissertation of Ocean University of China, Qingdao, China. 2008.

7.4.1.1.4 Indication from simulation of air pollution transport

Based on simulations of PM_{2.5} transport with Particulate matter sources tracking technology (PSAT) of CAMx air quality model, a PM_{2.5} transport matrix between 31 provinces (sources) to 333 prefecture cities (receptors) was developed.¹⁸⁵ The analysis results show that more than 50% of PM_{2.5} in the Beijing-Tianjin-Hebei region comes from Hebei province, followed by Beijing and Tianjin, with the contribution rate of 12% and 10% respectively; there are about 20% from regional transmission, such as Shandong, Henan and Shanxi, with the contribution rate of 6%, 5% and 5% respectively. The key zones for regional air pollution control should be adjusted according to the result.

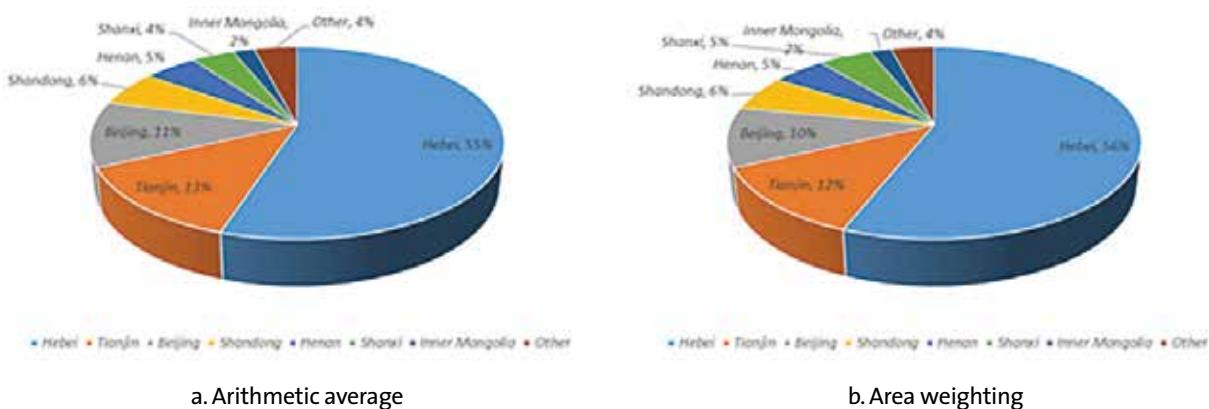


Figure 7-4-4. Source apportionment of PM_{2.5} in Beijing-Tianjin-Hebei region

7.4.1.1.5 A brief summary

The Key Regional Planning defines “three regions and ten city clusters” based on the regional characteristics of social and economic development. As more and more facts indicate a significant contribution from transport of air pollutants among provinces/regions, there should be adjustments to the definition of zones, based on facts from satellite observation, ground monitoring and modelling. The eastern part of China should be considered as a whole for regional management.

7.4.1.2 How Atmospheric Environmental Management Organized

7.4.1.2.1 From total emission control to air quality improvement

Since early 1970s, atmospheric environmental management in China has experienced a significant evolution. The management metric changed from emission standards during 1970-1995 to total emission control during 1995-2010, then to air quality after 2010.

During the “11th Five-Year Plan” period, total emission control was set as a national strategic target. Achieving the target led to a significant reduction of SO₂ emissions. However, the feelings of the public regarding bad air quality stimulated the government to change the goal of air pollution management from total emission control to air quality improvement.

In September 2013, the *Action Plan on Air Pollution Prevention and Control* (hereinafter referred to as the *Action Plan*) was issued. The binding targets of PM_{2.5} concentration reduction were agreed between central and provincial government. Annual average PM_{2.5} concentration should decline by 25%, 20% and 15% in the Beijing-Tianjin-Hebei region, Yangtze River Delta region and the Pearl River Delta region, respectively. Annual average PM₁₀ concentration should decline by 10% for other part of China.

¹⁸⁵ Xue, W, et al. Numerical study on the characteristics of regional transport of PM_{2.5} in China. *China Environmental Science*, 34(6):1361-1368, 2014.

7.4.1.2.2 Top-down approach

The top-down approach is applied in China's atmospheric environment management. Namely the central government determines the overall target and puts the target into detail from the top down. Then the target is decomposed to each province, taking into account the local environment quality as well as the economic and social development status. Then the target is further decomposed to even lower level such as cities.

7.4.1.2.3 A brief summary

To date, atmospheric environmental management in China has focused more on total emission control of SO₂ and NO_x. It contributed significantly to air quality improvement; however, improving air quality needs more integrated approaches. In one hand, the local governments should take air quality, instead of emission reduction of SO₂ and NO_x, as their soul target, in the other hand, approaches to reduce PM and VOCs emission should be more considered as well.

7.4.1.3 Coordination Mechanism of the Regional Air Pollution Control

7.4.1.3.1 Working mechanism

The state council has developed the MEP leading inter-ministerial coordination mechanism of the air pollution control to strengthen information communication between departments. The coordination mechanism for air pollution control in Beijing-Tianjin-Hebei region and its surrounding, Yangtze River Delta region and the Pearl River Delta region, is also developed, respectively led by Beijing, Shanghai and Guangdong provinces. Working rules were made to claim the explicit responsibility and focuses, and working conferences were held routinely to discuss the key issues of the cooperation.

The coordination mechanism for air pollution control in Beijing-Tianjin-Hebei region and its surrounding areas

The team members of air pollution control in Beijing-Tianjin-Hebei region and its surrounding areas include Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Shandong and seven ministries and commissions. The main duties and responsibilities of the team are to coordinate and address the major regional environmental problems, and to coordinate with related ministries to formulate and implement the policies (such as energy, industry, transportation, construction, funds safeguard and so on) in favor of the improvement of regional air quality.

In October 2013, the collaborative team held the first working conference. The conference determined the working principles of "responsibility sharing, information sharing, consultation, mutual defense and joint control" and established working schemes.

In May 2014, the collaborative team held the second working conference. The conference examined and approved the prior work in 2014 and the working plan to promote new energy vehicles in public service; the conference also solicited opinions in terms of motor vehicle pollution control, atmospheric pollution control of the power, steel, cement and flat glass industries, clean control of the bulk coal as well as the comprehensive utilization of straw and the prohibition of straw burning. National energy administration signed the "coal to gas" agreement and the agreement on clean control of the bulk coal with CNPC, Sinopec and Shenhua group respectively; and signed the assignment book for the building project of the electricity transmission channel with State Grid Corporation of China and China Southern Power Grid.

7.4.1.3.2 Regional EIA consultation mechanism

Regional EIA consultation mechanism refers to the regional consultation and interactive mechanism to prevent potential regional atmospheric environmental problems caused by the plan or new installations. Requirements

are put forward that the plans for national industrial parks involving coal-fired power generation, petrochemical industry, chemical industry, nonferrous metal, steel, and building materials in specific regions needs regional EIA consultation.

7.4.1.3.3 Regional joint enforcement mechanism

This mechanism refers to the joint law enforcement mechanism established within neighboring cities and related departments. By conducting joint investigations and peer review actions, it can unify the enforcement standards and achieve better performance to combat illegal environmental behaviors and handle environmental events reasonably and in a coordinated manner.

After the publication of *Action Plan*, MEP launched monthly inspections in the Beijing-Tianjin-Hebei region. The results are reported to the government and published for the public. In addition, MEP and the MPS (Ministry of Public Security) jointly issued opinions on strengthening the cooperation with public security departments in law enforcement of environmental protection so as to improve the deterrent power of law enforcement.

7.4.1.3.4 Emergency response mechanism for heavy regional pollution

A 4-levels (country-key areas-province-city) air quality forecast framework has been preliminarily established. Among them, the national forecast and early-warning center and the center for Beijing-Tianjin-Hebei region have been operational, providing supportive information for regional emergency response.

Followed the *Guide for Emergency Plans of Cities' Heavy Atmospheric Pollution*, the local governments have made their specific emergency response plans for heavy air pollution. Emergency response will go into force followed the instruction from forecast and early-warning centers.

7.4.1.3.5 Information sharing mechanism

Regional environmental information sharing refers to sharing and exchanging information about air pollution control among different districts, departments and levels. It is clearly required in *Environmental Disclosure rules (trial implementation)* that environmental protection departments should offer 17 kinds of environmental information to the public with their extent of competence. To date, sharing of air quality information has been realized through real-time publication of air quality monitoring data; sharing of emissions information has been realized through annual report of the environmental status; and sharing of environmental performance information of key enterprises has been realized through the annual reports disclosure system for the 16 kinds of heavy pollution industries in stock markets.

MEP and MPC have established a trans-department information sharing system. Within this system, MEP transfers the legal cases to MPC, and MPC shares the status information of case processing with MEP, as well as the environmental pollution cases investigated and discovered by MPC.

MEP and Meteorological Administration have established a cooperation framework, including information sharing of chemical composition of air pollutants, monitoring data of ambient air quality, meteorological observation and forecasting, and data from the satellite.

7.4.1.3.6 A brief summary

China has developed a unified environmental decision-making and consultation working mechanism in three key areas. However, cooperation on pollution control and supervision still need to be strengthened. In addition, improving the air quality of the whole region rather than some key cities should be more focused.

In regard to regional EIA and Consultation, some specific aspects like confirming the scope and content of consultation and handling of the opinions from Consultation need further research and exploration. In regard to regional joint enforcement, there is a demand to further improve the regime of regional joint enforcement, explore diversified forms of regional joint enforcement, establish multi-sector joint law enforcement mechanisms, and perfect the linkage mechanism of law-enforcing and judicial departments. In regard to early weather warning of regional heavy pollution, grading standards of early warning in some areas still fails to achieve complete unification, and the emergency response plans need cost-effectiveness analysis. In regard to environmental information sharing, sharing of some key information such as EIA information of new installations, emission of air pollutants in some enterprises is still lacking, and the communication between local governments and relevant departments also needs to be enhanced.

7.4.1.4 Policies for regional air pollution control

In order to promote regional air pollution control, MEP together with other relevant departments has put forward 22 supporting policies and measures, which include 3 aspects like energy restructuring, economic incentives and responsibility. 11 of these 22 supporting policies and measures have been issued, and the rest will be put into effect before the end of this year.

Among these policies, an environmental electricity tariff, a tariff for better vehicle-used fuels, and cascading electricity prices for electrolytic aluminum were formulated by NDRC. MOF issued policies to promote new energy vehicles, and set up special funds for the control of air pollution. MEP issued the guidelines to appraise the performance of local governments to implement the Action Plan, as well as the requirement on information publication and the guidance on promoting public participation.

However, some aspects have not been covered yet. For example, some policies are needed to promote elimination of “yellow label” and old vehicles, and to expand the depth and breadth of information disclosure and public participation.

7.4.2 Policy Recommendations

7.4.2.1 Targeting Air Pollution Management to Better Air Quality

7.4.2.1.1 Set air quality compliance as a legally-binding target

An accountability and evaluation system with air quality compliance as the soul should be explicitly provided for in the *Law on the Prevention and Control of Atmospheric Pollution*. Compliance with ambient PM_{2.5} concentration standards should be set as a binding target for all cities.

7.4.2.1.2 Redefine the zones based on scientific evidence

The key zones for regional air quality control should be redefined taking into account the spatial and temporal distribution of air pollution, meteorology and topography, as well as pollution dispersion and transport. A wider region including Beijing-Tianjin-Hebei, the Yangtze-River Delta, and provinces between them should be considered as a whole for more effective regional air pollution control.

7.4.2.2 Developing the Coordination Mechanism for Joint Prevention and Control of Air Pollution

7.4.2.2.1 Developing a unified planning toward regional air quality compliance

A regional compliance plan should be formulated for the eastern part of China, clarifying the compliance time-table and roadmap, as well as reasonable and feasible control schemes for different parts of this region. An integrated approach in terms of economic and energy restructuring, urbanization and mobility, should be considered accordingly.

7.4.2.2.2 Perfecting the unified and coordinated working mechanism for regional air pollution control

Based on the established coordination mechanism and inter-ministerial coordination mechanism, more formal rules and procedures for coordination and policy making should be developed, and in-depth regional coordination on economy and energy issues that impact the regional air quality should be conducted.

7.4.2.2.3 Establishing regional EIA consultation mechanism

The major planning and the list of projects with significant impact on regional air quality should be asked for regional EIA consultation. The superior environmental protection administrative departments should organize the consultation, and the advice should be collected from those relevant administrative regions whose air quality could possibly be affected by the planning or project.

7.4.2.2.4 Improving the regional joint enforcement mechanism

The regional enforcement capacity should be enhanced by developing a regional environmental supervision network and exploring cross investigations. The multi-sector joint enforcement system should be developed involving MEP, MIIT, and other administrations. A joint working system of the environmental administrative enforcing departments and judicial organs shall be perfected and the force against environmental crime will be intensified.

7.4.2.2.5 Integrating national science and technology power to offer regional decision support and scientific planning

Taking the full use of the national and provincial science and technology resources, there is a need to establish a regional planning organization, funded by MEP and other ministries, to carry out basic researches on causes, transport and changes of the regional atmospheric pollution. This organization could provide basic information to support regional PM_{2.5} pollution control, including emission inventory, source apportionment, emission abatement technologies, and cost-effect analysis. This organization could also develop regional air quality control planning and evaluations for central and provincial government.

7.4.2.2.6 Further deepening information sharing

The scope and content of environmental information sharing should be expanded, including early-warning and emergency response to heavy pollution, consultation mechanism of environmental impact assessment, joint environmental enforcement, and joint pollution control. There is a special demand in promoting the environmental impact assessment involved in the regional air quality monitoring, polluting source emission, key pollution sources, meteorological data and new projects, as well as key environmental information sharing such as supporting data, achievements of management technology, management experience and so on.

7.4.2.3 Improving the Policies for the Regional Air Pollution Control

7.4.2.3.1 Increasing the policy and financial support for the industrial structure adjustment in the key areas

The directories and standards of industrial restructuring should be strictly created in the key areas. Their special funds and fiscal transfer payments should be increased to boost the structure adjustment. Meanwhile, the number of the pilot cities substituting subsidies with rewards should be increased and more incentives are needed to reduce the outdated capacity and curb new projects in industries with overcapacity.

7.4.2.3.2 Setting economic incentive policies for the technical innovation of enterprises' environmental protection

The related state departments and local governments should explore the economic guiding policy of air pollution control to lead existing enterprises to the technical innovation of air pollution control and the sharp reduction in pollutant discharge, with the help of many approaches such as setting up special funds, issuing bonds, and offering discount, subsidies, and incentives.

7.4.2.3.3 Improving economic incentive policies for motor vehicle pollution control

It is proposed that motor vehicle fuel surcharge should be collected timely to lower the vehicle operation intensity. An atmospheric pollution control fund could be established with the surcharge to support infrastructure construction such as local public transportation and the control of air pollution. The policies should be made for the scrapping of the old motor vehicles, and the financial subsidies strength should be improved to eliminate yellow label and old vehicles, with the fiscal funds playing a guiding role. The “cash-for-clunkers” policy should be implemented under the coordination of related departments to promote the elimination of yellow label vehicles.

This Report was submitted by the Special Policy Study on Performance Evaluation on the Action Plan of Air Pollution Prevention and Control and Regional Coordination Mechanism

CHAPTER 8

CHINESE ENVIRONMENTAL AUDIT SYSTEM

FOR THE GOVERNMENT

CCICED Special Policy Study Report

CCICED 2014 Annual General Meeting

December 1-3, 2014

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SUMMARY OF KEY FINDINGS

Serious environmental problems and the need for environmental performance audits of government officials require the improvement of China's environmental audit systems

With rapid industrialization and urbanization, the “resources and environment for growth” model in China has led to increasing inconsistencies between economic and social development and environmental protection. As an issue of national concern, environmental protection has become a policy focus for the Communist Party of China (CPC) and the national government. In spite of this, the country continues to face serious environmental challenges; excessive pollution, high levels of smog in many cities, contamination of surface and groundwater and soil degradation are just some of the challenges faced.

Strengthening the government’s environmental audit systems must be part of the solution to China’s increasingly serious environmental problems. The government and its senior officials play crucial roles in the implementation of environmental and economic policies. Improved environmental audit systems are required to review the environmental performance of senior officials and hold them accountable for performing their environmental protection duties responsibly and fully.

China already has an established economic accountability audit system for senior officials and has been actively making efforts in standardizing its systems for natural resource and environment audits. In July 2014, the *Implementation Guidelines for Regulation of Economic Accountability Audit on Leading Officials of Party, Government and State-owned Enterprises* was jointly issued by several key agencies of the Chinese government.¹⁸⁶ According to these guidelines, the economic accountability auditing of China’s senior officials should include, in addition to the quality and sustainability of economic and social development, auditing of officials’ performance with respect to environmental protection, natural resource management and improvement of people’s livelihood.

There is a significant gap in the scope and methods of environmental auditing methods between China and other countries

Canada, the Netherlands, the United States, India, Brazil, Japan and South Korea, among others, have made important progress in supporting the effective implementation of national environmental policies through independent national and sub-national environmental audit systems of various forms.

The experience of these countries demonstrates that audit institutions at each level of the Chinese government should conduct audits of environmental funding, policy design and implementation, and policy and project management through their audit systems. Moreover, these systems must more fully reflect the characteristics of proper environmental audits as laid out by the International Organization of Supreme Audit Institutions (INTOSAI).¹⁸⁷ These characteristics include standards and methods for collecting evidence and ensuring objectivity and independence.

With the recently issued guidelines on economic accountability audit (see above), the system of economic accountability audits that is widely applied in China now highlights the need for protection of natural resources and

¹⁸⁶ The Chinese National Audit Office, the Central Commission for Discipline Inspection of the CPC, the CPC Official Management Department, the CPC Organization Staffing Management Office, the Ministry of Administrative Supervision, the Ministry of Human Resources and Social Security, and State-owned Assets Management Commission.

¹⁸⁷ These guidelines can be found at <http://www.intosai.org/issai-executive-summaries/view/article/issai-3000-implementation-guidelines-for-performance-auditingstandards-and-guidelines-for-perf.html>.

environment. In spite of this positive development, there remain problems in the practice of environmental auditing in China. Challenges include inadequate training and knowledge of audit team members; narrow audit scopes; the absence of appropriate audit standards and procedures; weak audit institutions and others.

There are therefore large gaps in environmental audit systems between China and other countries, both in terms of the content of audits and the methods they employ. In the future, China must attach greater importance to its environmental audit systems. Improvements required include a greater emphasis on auditing the implementation of environmental policies (with the aim of improving the policies over time); the adoption of international standards for performance audits as the basis for environmental audit; improved documentation of environmental audit methods and procedures; and increased cooperation between the agencies involved in the environmental audit systems.

The need to improve Chinese environmental auditing is recognized but better cooperation is required to achieve this

There is widespread consensus in Chinese society that there is greater need to focus on environmental performance in the evaluation of senior officials of government. Though the government has carried out pilot environmental performance audits of officials at various levels, there remains much to be learned; for example, the environmental knowledge of audit professionals is uneven. Additionally, a set of implementation guidelines for environmental auditing that is flexible enough to be adapted to different needs does not yet exist.

Cooperation between the agencies involved in China's audit systems is weak at the moment. Better cooperation is required both to enhance the independence of audit institutions and also to deal with the practical difficulties faced by the current audit systems. The various government agencies responsible for natural resource management and environmental protection could do much to increase their efforts to support the activities of audit institutions, while respecting the need for full independence of these institutions.

The Chinese government does not have a plan for strengthening its audit systems

Though there is recognition that the Chinese government, through its audit institutions, must be more active in carrying out environmental audits, there is no national plan at the moment to accomplish this. Such a plan is needed to demonstrate how the government will establish both a solid theoretical foundation for environmental auditing as well as the strong technical support necessary to carry out effective audits.

In any plan that might be established, environmental audit activities should be expanded on a step-by-step basis, starting with pilot audits. The experience gained from the pilot audits could then be used to improve audit methods and procedures on a nation-wide basis.

It is also essential that environmental audit systems be brought into alignment with the new guidelines on economic accountability audit. This would require establishing and improving the legal basis, frameworks and technical guidelines for environmental auditing.

The scope of environmental auditing, which is uncertain at the moment, requires clarifying as part of any plan. In addition to compliance and financial auditing, environmental auditing in China should also include environmental

performance auditing if the country is to align with international best practices as set out by INTOSAI.¹⁸⁸ Looked at from the perspective of environmental issues, audits typically cover issues related to water, the atmosphere, solid waste, soil, natural resources and sustainable development. This is not the case currently in China, where the scope of environmental audit is limited to financial audits of funds used for environmental protection and some aspects of compliance with environmental laws, policies and regulations. The following existing national action plans could provide a path toward strengthening China's environmental audit systems: the *National Action Plan for Atmospheric Pollution Prevention*; the *National Action Plan for Water Pollution Prevention* and the *National Action Plan for Soil Pollution Prevention*.

A plan for strengthening environmental audit systems should also help direct efforts to improve audit methods and processes and the independence of China's audit institutions, both which are in need of enhancement. The key CPC and government leaders at different levels who will be the objects of environmental audits are not clearly identified today. Nor is it clear that audit reporting is adequate or that the necessary measures are in place to ensure that audit results are acted upon. It would be appropriate that all this be carried out under the guidance of the CNAO, which would be responsible for implementing any enhancements to the audit systems.

Once the above improvements are implemented, it would be sensible as a final step to place the CNAO and related audit institutions under the responsibility of the National People's Congress. Such a move could do much to ensure the independence of China's audit institutions and, therefore, to ensure that environmental protection and natural resource management audits lead to real improvements in the quality of China's environment.

SUMMARY OF MAIN POLICY RECOMMENDATIONS

In the 30 years since reform and opening up, China has achieved remarkable economic progress. However, some governments and officials, including local officials, have narrowly pursued the growth of GDP and overlooked the protection of resources and the environment, which has resulted in a significant conflict between economic development and environmental protection. Improvement of government environmental audit systems is a key institutional innovation that will advance China's creation of an "ecological civilization"¹⁸⁹ and will be of great importance in implementing scientific development and the decisions of the 3rd Plenum of 18th CPC aimed at guaranteeing the health of national economy, society and environment.

As understood for the purposes of this report, environment auditing in China includes both environmental audit of government programs as well as environmental accountability audit of senior officials after leaving their posts.

Based on China's current situation and a review of international best practices, the Special Policy Study team proposes the following five priority policy recommendations.

Recommendation 1: Establish and improve the legal basis for government environmental audit

- Revise China's existing *Audit Law* and other relevant auditing guidelines with new provisions that will strengthen existing government environmental audit systems and clarify the subjects, targets and scopes of these systems and ensure their outputs are shared with the public to the fullest extent possible.

¹⁸⁸ The INTOSAI financial audit guidelines can be found at <http://www.intosai.org/issai-executive-summaries/view/article/issai-1000-general-introduction-to-the-intosai-financial-audit-guidelines.html> and the compliance audit guidelines can be found at <http://www.intosai.org/issai-executive-summaries/view/article/issai-4000-compliance-audit-guidelines-general-introduction.html>.

¹⁸⁹ The notion of an "ecological civilization" is one in which further development of China's economy and society is pursued simultaneously with efforts to protect the ecological systems that are the basis of economic and social activities.

- Revise existing environmental protection laws and regulations with new provisions that will strengthen existing environmental audit laws and improve the basis for integrating the findings of environmental audits to improve the implementation of environmental law and decision making.
- Strengthen communication and cooperation between Chinese National Audit Office (CNAO) and State Ministry of Environmental Protection, to jointly issue Guidance on Government Environmental Audit to clarify their approach to mutual cooperation and to strengthening of government environmental audit systems.

Recommendation 2: Strengthen government environmental audit capacity

- Undertake institutional reform of national and local audit institutions to strengthen their capacities to undertake environmental audit and enhance their responsibilities in this regard. Expand and improve the institutional support for environmental audit systems and their application in decision-making through, for example, the establishment of an Environmental Audit Research Centre.
- Establish an environmental audit professional qualification system to standardize and strengthen the process of managing the professional qualification of auditors. Use this system to expand and strengthen human resource capacity for environmental auditing and establish an expert pool of professional auditors.
- Strengthen and expand environmental audit training and education. Develop and publish relevant training materials and technical guidelines.
- Strengthen capacity in terms of database and information technology. Improve and expand environmental statistics and accounting systems to improve data quality.
- Strengthen understanding of international audit standards and practices and increase international collaboration in audit design and implementation.
- Increase investment in government environmental audit capacity.
- Recognizing the urgent need for reform, in near-term (2 years), undertake strengthening of environmental audit systems with auditing institutions as the lead authority working in cooperation with environmental authorities; in mid-term (3-5 years), consolidate strengthening, with auditing institutions assuming full and independent control of the environmental audit systems; in long-term (beyond 5 years), reform current audit institutions; *i.e.*, establish the CNAO as a body of the National People's Congress in order to assure the full independence of its auditing. Do all that is necessary to ensure that this schedule is met or, ideally, accelerated; for example, begin immediately to educate senior officials about the environmental accountability audit system and its implications for their roles.
- Test other methods of environmental performance assessment to complement formal environmental audits.¹⁹⁰ These methods can be particularly useful in the evaluation of performance related to environmental issues with long time delays; environmental degradation caused by past economic activities; and where inter-regional pollutant flows are responsible for environmental degradation. They are also valuable in assessing the complex situations in which positive and negative influences have to be disentangled in order to present a realistic and fair assessment of performance.

¹⁹⁰ It is common for western countries to employ a variety of non-audit methods of assessing environmental performance of governments; for example, state-of-the-environment reporting, periodic environmental conferences of senior government leaders, strategic environmental assessments, corporate environmental sustainability reporting and public assessments by outgoing politicians of their terms in office (see Section 8.2.1 for further details).

Recommendation 3: Improve technical guidelines and standards for government environmental audit systems

- Develop technical guidelines for different types of government environmental audit systems, in particular audits of government programs and accountability audits of senior officials, drawing wherever possible on international experiences while also considering practices in China.
- Develop:
 - *Government Environmental Audit Standards System*
 - *Technical Guidelines on Environmental Audit of Government Programs (Operational Manual)*
 - *Technical Guidelines on Environmental Accountability Audit of Senior Officials after Leaving their Posts (Operational Manual)*
- Develop:
 - *Environmental Indicator System and Application Methods for Audit of Government Programs*
 - *Environmental Audit Indicator System and Application Methods for Environmental Accountability Audit of Senior Officials after Leaving their Posts*

Recommendation 4: Strengthen coordination between government environmental audit systems and other environmental evaluation systems

- Strengthen coordination with other government environmental evaluation systems, including systems designed to provide future outlooks; e.g., environmental performance evaluation; pollution emission reduction targets evaluation; systems as stipulated in new *Environmental Protection Law* such as the environmental status reporting system;¹⁹¹ accountability systems; environmental information disclosure system; and public consultation system.

Recommendation 5: Initiate a series of pilot audits to gain experience with strengthened audit systems and gradually promote government environmental audit

- Implement pilot environmental audits at levels of province, municipality and county governments.
- Conduct special environmental audit pilots for key environmental protection tasks such as air, water and soil pollution control and key natural capital conservation tasks such as forest and fisheries management.
- Develop an agenda of issues related to strengthening of government audit systems requiring additional research and discussion.
- Continue work with CCICED to support gradual strengthening of Chinese environmental audit systems by pursuing this research agenda and by participating in pilot environmental audits.

¹⁹¹ Article 27 of the new *Environmental Protection Law* requires governments at or above county level to report annually to the relevant people's congress or standing committee on the state of the local environment and on fulfilment of environmental protection targets.

BACKGROUND AND IMPLEMENTATION OF THE PROJECT

a. Background

Rapid industrialization and urbanization combined with high rates of economic growth dependant upon massive investment and consumption and an economic performance evaluation system for government officials and political leaders focused on GDP-based targets have led to serious environmental damage due to pollution and natural resource exhaustion in China. Without improvements to the performance evaluation system through a strengthened system of environmental audits, China's environment and natural resources will continue to suffer declines, which will hinder future development.

To address this situation, the 18th National Congress of the Communist Party of China (CPC) made the strategic decision to promote the concept of ecological civilization and called for the incorporation of resource consumption, environmental damage and ecological protection into the performance evaluation system of those responsible for China's economic and social development. Further, the 3rd Plenary Session of the 18th CPC Central Committee drew attention to the need for a better institutional system to promote the concept of an ecological civilization and for strengthened institutional guarantees for environmental protection. It further set out requirement for the preparation of natural resource and environmental asset (natural capital) balance sheets to serve as information sources in conducting environmental performance audits of senior government officials when they leave their posts (either to assume a new post or upon retirement).

Environmental auditing is conducted in all countries by independent audit institutions (national audit offices, internal audit departments and certified public accountants). It is based on the principle of sustainable social and economic development and its goal is to verify the effectiveness and legality of governmental activities as they relate to the environment and natural resources. The use of environmental audit helps ensure effective management of the environmental and natural resources by audited entities according to the principles of sustainable development.

In principle, environmental audit in China includes audits of government programs related to the environment as well as the performance evaluation (audit) of senior government and political officials when they are leaving their posts. Today, China's environmental audit systems mainly focus on financial audits of the use of government funds for environmental purposes. Though they make significant contribution to the conservation and effective utilization of natural resources; environment protection; industrial restructuring; efficient allocation of the factors of production and sustainable economic development, these systems nonetheless face challenges. In particular, the following can be mentioned: an inadequate legal basis to support environmental audit objectives; inconsistent criteria for measuring environmental performance; narrow audit scope; limited awareness of environmental audit goals among the government and public; inadequately trained audit personnel and a lack of international cooperation. At the same time, carrying out government environmental audits sends an important signal that oversight function of audit is being used to promote sustainable development. Such oversight is an unavoidable requirement given the current situation with respect to environmental quality in China.

In line with China's overall scientific approach to development and the spirit of 18th CPC National Congress and the 3rd Plenary Session of the 18th CPC Central Committee to improve China's environmental performance evaluation system and promote effective environmental audit systems, the China Council for International Cooperation on Environment and Development (CCICED) organized a Special Policy Study (SPS) to consider these issues. The SPS team comprised both Chinese and international experts, with the Chinese Academy for Environmental Planning (CAEP) providing Chinese leadership with support from the Chinese National Audit Office and Renmin University of China.

b. Implementation of the policy research project

With expert input from the members of the CCICED SPS team, the objectives of the project were as follows.

- Compare Chinese and international foreign environmental audit system to draw lessons from both China and abroad, bearing in mind the conditions of China and its goals with respect to the creation of an ecological civilization.
- Identify the essential elements and framework needed for China's environmental audit systems, establish the indicator system and methodology for environmental audits and prepare a roadmap for implementing improved environmental audit methods and procedures.
- Provide policy suggestions regarding environmental audit systems for inclusion in the 13th Chinese Five-year Plan and major environmental protection planning shall be made so as to promote the development of ecological civilization.

To accomplish these objectives, the study covered four separate sets of outputs.

Firstly, international theories, methods and practices in environmental auditing were studied and drawn upon, focusing on those in the United States, the Netherlands, Canada, Sweden, India, Brazil and Japan. In addition, the guidelines of the Working Group on Environmental Accounting of the International Organization of Supreme Audit Institutes (INTOSAI WGEA) were reviewed. Chinese methods and practice were also summarized in order to compare them with international practice related to the scope, content, methods, standards and processes of environmental auditing.

Secondly, drawing upon the lessons learned from international practice, a proposed framework for environmental auditing in China has been developed. The framework covers the following.

- The definition, classification, scope, object and features of environmental auditing.
- Essential elements of environmental audit systems, such as their legal basis, goals, principles and methods.
- Scope of environmental audits, including environmental regulations and standards; project planning and implementation; environmental performance; use of funds for environmental protection; pollution emissions; environmental quality; ecological preservation and natural resource management.
- The basic methods and processes used in environmental auditing.
- The results and application of environmental audits.
- The organization and implementation of audit systems, including the roles and responsibility of officials.

Thirdly, an indicator system for the environmental audit systems has been considered,¹⁹² including the following.

- The principles for selecting and developing environmental audit indicators.
- The development of the environmental audit indicator system with consideration given to the measurement of environmental policies, performance, funding, emissions, quality, etc.
- The application of the environmental audit indicator system, including interpretation of the indicators, calculation methods, documentation of quality issues, data sources, evaluation methods, evaluation standards and methods for collection of evidence.

Finally, on the basis of the above activities, a roadmap for the Chinese government to improve its environmental audit systems in the future has been put forward. It covers the guidelines, basic principles and concepts, goals,

¹⁹² The work of the SPS team on environmental audit indicators was inconclusive and, therefore, is not covered in detail in this Executive Summary Report. Both sides agreed that further work is required on this topic.

implementation schedule (including pilot audits) and policy recommendations required to realize the goal of improved audit systems.

Overall, the study's goal has been to promote improved environmental audit systems in China as part of the country's efforts to create an ecological civilization and to increase accountability of government and political officials in the field of environmental protection.

Over the course of the study (March to October 2014), two seminars dealing with Chinese environmental audit systems were held with attendees from the Chinese government departments of environment protection and national audit, research institutes, non-profit organizations and all members of the SPS team. Recommendations for the improvement of environmental audit systems were raised from different angles and at different levels. The team also held several internal working meetings and teleconferences. Through the lessons learned from the review of international experience, the analysis of China's national conditions and the discussion of key policies in China, the final study recommendations reflect the knowledge and experience of both Chinese and international experts.

Key words: Government environmental audit; environmental audit of senior officials leaving posts; environmental performance; system; policy

8.1 BACKGROUND AND PURPOSE

8.1.1 Significance

8.1.1.1 Serious Deterioration of Environmental Quality in China

During the 35 years since China's economic reform and opening up policy was initiated, China has experienced very high levels of economic growth, on the order of 10% per year. This continuous growth has moved the country to second place in the global ranking of economies. However, this rapid industrialization and urbanization, combined with high rates of economic growth dependant upon massive investment and consumption and an economic performance evaluation system for government officials and political leaders focused on GDP-based targets, has led to serious environmental damage due to pollution and natural resource exhaustion in China.

High levels of urban smog, contamination of surface and groundwater, soil contamination and other issues have aroused significant public concern and criticism, leading to an increasing number of mass demonstrations. China's record on environmental protection has also become a target of criticism from the international community.

8.1.1.2 Management Difficulties of the Chinese Government

As an issue of national concern, environmental protection has been become a policy focus for the Communist Party of China (CPC) and the national government. In the past, principles such as sustainable development and the scientific outlook on development were proposed as means to deal with the issues. These have been more recently superseded by the "five in one" strategy for the building of ecological civilization put forth during the 18th CPC National Congress. A relatively complete system of environmental policies and regulations has been established and the former State Environmental Protection Agency has been elevated to the Ministry of Environmental Protection to enhance overall planning and coordination for environmental protection. In spite of this progress, the policies, regulations and laws formulated by central government are not well enforced and the country is left with a serious environmental situation.

One important reasons for this is that regional development led by local governments is not easily regulated, controlled or redirected by the central government on a comprehensive, scientific, timely and objective basis.

Quite a number of local governments, especially those at the city and county levels, retain a narrow focus on economic development while ignoring the need for environmental protection. Some governments even intervene in normal environmental management efforts and provide undue protection to polluting industries or enterprises. Serious problems can be found in local departments of environmental protection, including false information and statements and weak law enforcement.

This situation can be explained by the following factors. First, GDP growth is still the main indicator used in the performance evaluation systems used by local governments. Secondly, local governments benefit in terms of income if their economies are growing. Thirdly, environmental damages are often externalized (that is, those who bear the costs of the damages are different than those responsible for them) and exhibit path dependence (that is, cannot necessarily be undone by removing the cause of the damage).

Redirecting local governments' pursuit of economic development at the cost of environmental protection requires strong, top-down administrative regulation, control and correction. In the absence of such redirection, China will not have sufficient resources and environmental capacity to support its development in the future. Needed are changes to the incomplete national economic accounting and performance evaluation systems; to environmental auditing and accountability of government departments and patterns of economic growth that can be achieved without high resource consumption and pollution.

8.1.1.3 The Chinese government needs and wants to promote ecological civilization and institutional innovation

Establishing an appropriate system and mechanism for environmental performance evaluation of government and political leaders is essential. The current GDP-centred performance evaluation system in China has inspired great initiative and innovation on the part of governments and enterprises at all levels and it plays an important role in stimulating and promoting the acceleration of industrialization and development of the economy. At the same time, China has witnessed serious and astonishingly negative consequences by pursuing rapid economic growth while failing to care sufficiently about environmental and ecological capacity, loss of natural resources and damage of the environment.

As part of the solution to these grave environmental issues, a key goal is to establish an environmental management system administered outside local governments to change the incentives created by the current GDP-centred performance evaluation and restrain local governments' pursuit of development without environmental regard. Instead, local governments must be encouraged to seek local development through management and institutional innovation rather than simple growth.

Since the Eleventh Five-Year-Plan period, the Ministry of Environmental Protection has established and improved a performance evaluation system centring on the reduction of total pollutant emissions. The system assigns environmental targets for governments at all levels and for various sources and types of pollutants. However, the achievement of environmental targets of different governments cannot be promoted on a consistent basis since different assessment methods (such as auditing and accounting of total pollutant emissions and quantitative assessments of improvements in urban environmental quality) are used in different cases and the frequencies of the assessments vary. Besides that, improvement measures carried out after the assessments cannot be effectively monitored and supervised, making sustainable improvement difficult. As a result, the impact and efficiency of environmental protection efforts are diminished.

Since the opening of the 18th CPC National Congress, the implementation of improved environmental audit systems has gained a high level of attention as a key means for 1) independent and objective measurement and enforcement

of the government's responsibility for environmental quality and 2) establishing a lifetime accountability system for officials who have control over environmental and ecological protection. Introducing natural resource consumption, environmental damage, ecological benefits and other indicators into the current evaluation system for economic and social development is therefore needed. Establishing a system of targets, assessment methods, incentives and sanction mechanisms according to the requirements of creating an ecological civilization. All these concepts have been proposed during the 18th CPC National Congress.

In addition, the 3rd Plenary Session of the 18th CPC Central Committee has proposed establishing a complete ecological civilization system; implementing environmental audits of senior officials when leaving their posts (either for promotion or on retirement); and establishing a lifetime accountability system concerning environmental and ecological damage.

From this, it is evident that establishing and improving China's environmental audit systems and making it a key environmental protection and management tool of the country has become one of the major tasks for environmental protection today.

8.1.1.4 Major Issues for Environmental Audit in China

Looking at practices in other countries, environmental auditing is commonly adopted as a means of reviewing and improving government environmental performance. Comprehensive systems of methods and processes have been established and operating for many years to support environmental audits.

In China, environmental audit was introduced into conventional financial audit systems starting in the 1980s. Since then, the statutory authorities and duties of government audit institutions for implementing environmental audits have been clearly formulated and the corresponding departments of central, provincial and regional level audit institutions have been established. Environmental audit is today carried out with an increasingly wide scope and rigorous methods and processes.

Good results are being achieved. To promote environmental quality protection and improvement and to help reduce environmental pollution, audit institutions at all levels have launched different environmental audits. Financial audits of forest resource conservation and reforestation projects, audits of sewage discharges and projects to prevent and control water contamination in key river basins, and special audits of energy conservation and emission reduction projects have all been carried out.

However, compared with environmental auditing in other countries, China finds itself still at an exploration stage in terms of both theory and practice, even after more than 20 years of effort. China's environmental auditing today mainly focuses on legal and financial compliance audits and is carried out mainly by the National Audit Office. Environmental performance audits of governments at all levels have not yet been completely carried out. Environmental accountability audits of senior officials after leaving their posts is an area of almost no experience in China, either in theory or practice.

More specifically, the following issues can be mentioned as standing in the way of more effective environmental audit systems in China: an inadequate legal basis to support environmental audit objectives; inconsistent criteria for measuring environmental performance; narrow focus on single issues; limited awareness of environmental audit goals among the government and public; inadequately trained audit personnel and a lack of international cooperation.

8.1.2 Purpose and Objectives

Environmental auditing is conducted in all developed countries and a growing number of developing countries (including Brazil, India, South Africa and China) by independent audit institutions (national audit offices, internal audit departments and certified public accountants). China's environmental audit systems are based on the principle of sustainable social and economic development; their goal is to verify the effectiveness and legality of governmental activities as they relate to the environment and natural resources. The use of environmental audit helps ensure effective management of the environmental and natural resources by audited entities according to the principles of sustainable development.

In principle, environmental auditing in China includes audits of government programs related to the environment as well as the performance evaluation (audit) of senior government and political officials when they are leaving their posts. It is legally conducted by the country's formal audit institutions on relevant government departments and their officials to evaluate and assess their compliance with laws and regulations; to monitor their use of public funds; to assess their environmental performance with respect to environmental pollution control, ecological protection, etc. The organization, authentication and reporting of results, and supervision of recommendation implementation of environmental audits shall be carried out by government so as to ensure the legality and scientific basis of audit procedures as well as objective and authoritative audit results. Audit institutions implement environmental audits by employing their full legal prerogatives and special functions. They therefore play a significant and irreplaceable role in promoting and ensuring environmental management.

Environmental auditing in China makes a significant contribution to the conservation and effective utilization of natural resources; environment protection; industrial restructuring; efficient allocation of the factors of production and sustainable economic development. Carrying out government environmental audits sends an important signal that the oversight function of audit is being used to promote sustainable development. Such oversight is an unavoidable requirement given the current situation with respect to environmental quality in China.

Environmental auditing should also play an important role in strengthening the ecological protection responsibilities of senior officials through its proposed role in performance evaluation system for officials who are leaving office. This should help to fundamentally change the GDP-centred development focus that currently dominates in China.

Taking into account national realities and the requirements to create an ecological civilization – and focusing on the 13th Five-Year Plan and longer-term development – this report is intended to contribute key recommendations for the development of an institutional framework for environmental auditing in China (both for environmental audit of government programs and for performance evaluation of senior officials when leaving their posts). The report also presents an implementation roadmap for the proposed systems and makes policy recommendations on how environmental auditing might be incorporated into the 13th Five-Year Plan, thereby promoting institutional capacity building for an ecological civilization.

8.2 OVERVIEW OF ENVIRONMENTAL AUDITS AT HOME AND ABROAD

8.2.1 International Experience

Environmental auditing began in the late 1960s and 1970s, when national audit offices in some Western countries began to examine the effectiveness of government policies related to natural resources such as forests, water,

agriculture and fisheries. For example, the United States Government Accountability Office conducted an audit for a water pollution abatement project in 1969. Other western countries, such as Canada, also began to implement environmental auditing.

Around this time, some private businesses in the West also embarked on environmental audits out of need to address concerns arising from rapidly growing economies and the emerging understanding of the need for environmental sustainability. They made use of environmental consultants to conduct the audits and the results were used by senior managers to improve environmental performance and reduce raw material consumption.

It was during the 1980s that environmental auditing truly emerged as its own discipline and gained a significant role as a macro management tool. It expanded to address a broader series of government actions related to pollution abatement, freshwater management, biodiversity, regulatory design and enforcement, and adherence to international environmental agreements.

Environmental audit has since become an important tool in formulating and implementing environmental policies. During the last two decades, there has been particularly rapid development of the discipline. The United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992 was a collective global response to environment and development problems. Agenda 21, the outcome document adopted during the conference, pointed out that environmental problems would become the main challenge faced by human beings in the 21st century and called for focused attention of all countries on environmental issues.

During the 14th congress of the INTOSAI, held in the United States in 1992, the membership expressed a strong interest in assisting national audit institutions to deal more effectively with the issues related to environmental auditing. The formation of a Working Group on Environmental Auditing (WGEA) was therefore initiated and approved at the Washington congress. The WGEA aims to improve the use of national audit mandates and instruments to promote effective environmental protection policies.

The 15th congress of the INTOSAI, held in Egypt in 1995, again considered environmental auditing in depth and resulted in the *Cairo Declaration*:

“international auditing organizations [should] advocate that all supreme auditing institutions take environmental problems into consideration while exercising their auditing responsibilities in view of the importance of protecting and improving environment”.

It was further decided during the 16th congress of the INTOSAI (held in Uruguay in 1998) to establish regional working groups of the WGEA. The support thus given to environmental auditing greatly promoted its development.

At present, national environmental auditing is carried out in most countries. According to the INTOSAI, national audit institutions have undertaken more than 2,000 environmental audits since the late 1990s. Canada, the Netherlands, the United States, Norway, India, Brazil, Japan and South Korea, in particular, have carried out a wide range environmental, conservation and sustainable development audits focusing on the use of fiscal instruments, procurement, environmental quality monitoring, sustainable fisheries and other topics. These efforts have been effective in helping promote the implementation of national environmental policies.

For example, audits conducted in Canada by the Office of the Commissioner of the Environment and Sustainable Development discovered, among others, the following shortcomings.

- The Canadian Coast Guard had weak command and control coordination to respond to major oil spills from tankers, which led to a two-year program to improve the central command structure.
- Canada's liability limits for offshore oil platforms were significantly below world levels, which led to the federal government introducing legislation to increase the limit to \$1 billion.

- Inspections of energy pipelines by the National Energy Board were inadequate to understand risks, which led to \$14 million budget increase.

In addition to the work of national audit institutions, other methods of assessing governments' environmental performance are commonly used in western countries; for example:

- policy assessment through state of the environment reporting (e.g., 2012 PBL Assessment of the Netherlands);
- periodic meetings of senior government officials (e.g., the indicator-based *European Semester*);
- strategic environmental assessments;
- corporate social responsibility reporting (e.g., the *Global Reporting Initiative*).

All of these methods are annual or biennial and all require substantial but not enormous quantities of human and financial resources. All synthesize many types of information and make use of indicators along with other forms of evidence to assess performance. None addresses the performance of individual leaders; rather, they focus on institutional performance. Experience with them suggests that they work best when a separate scoping phase is conducted by an independent agency to formally determine the scope and targets of the assessment. The use of "traffic lights" (red, yellow, green icons) to summarize and compare the state of complex situations in a visually appealing and simple manner has been shown to be effective (e.g., by the OECD).

In the Netherlands, for example, the state-of-the-environment (SOE) reporting conducted by the national environmental assessment agency (PBL) is used as a tool to assess the effectiveness of Dutch environmental policy. PBL's independent SOE reports are used as a basis for parliamentary debate and a chance for government to explain its performance record. The reports address questions of ambient environmental quality, natural resources, policies and trends. They are based on statistics, models and political science and are complemented by statistical data compendia and future outlooks.

Another example is the so-called *European Semester*, which is an annual spring meeting of European heads of state. There is extensive preparation for these events, which make use of indicators as the basis of assessment. There is sectoral/country-oriented coordination of opinions. Formal milestones are set and regulations put in place. A wide range of issues is discussed and countries set self-imposed performance targets. The event is essentially a type of peer review that fits well in the specific style of governance unique to the European Union. The process is carefully structured in terms of governance mix, with distinctions made between hierarchical/centralist, market-driven and network-based approaches. The semester is currently one of the few ways the European Commission can "take the measure" of national governments in the EU.

Both of these approaches (SOE reporting and the *European Semester*) actually have more influence on policy than do formal audits in Europe, except in the case where audits expose actual wrongdoing.

8.2.2 History and Current Status of Environmental Auditing in China

Since its foundation in 1983, the Chinese National Audit Office (CNAO) has used environmental audit as an important measure for promoting environmental protection and sustainable development in China. This is consistent with the *Cairo Declaration* (see above).

Today, the statutory authorities and duties of Chinese government audit institutions regarding environmental audit have been clearly formulated and the corresponding departments of the central, provincial and regional audit institutions have largely been established. Environmental audit is now being carried out with an increasingly broad scope and refined processes and good results have been achieved. During the restructuring of the government administration of 1998, the State Council strengthened the basis for environmental audit by approving the

restructuring plan of CNAO. This included the establishment of the CNAO's Department of Agriculture, Resources and Environmental Protection Audit and clarified its environmental auditing functions. The 18 regional offices of CNAO along with the audit institutions of China's 31 provinces, autonomous regions and municipalities have all set up departments specializing in environmental audit. CNAO has reinforced its environmental audit functions, increased the number of relevant institutions and departments and carried out a series of audits of natural resources and environment.

In 2013, after a number of years of auditing experience, CNAO's Department of Agriculture, Resources and Environmental Protection Audit clarified its definitions of environmental auditing. It proposed that environmental auditing refer to the auditing of the legitimacy, legality and effectiveness of revenues and expenditures and management activities related to natural resources and environment carried out by governments, relevant authorities and enterprises and institutions engaged in creating an ecological civilization and promoting sustainable development.

8.2.2.1 Content of Environmental Auditing

Natural resource audits carried out by audit institutions in China include audits of the development, utilization, and protection of natural resources and of the management of related revenues and expenses. Areas of focus include land resources, mineral resources, energy conservation, water resources and forestry resources.

Environmental auditing mainly includes audits of pollution prevention and control, supervision, protection and improvement of the environment and management of related revenues and expenses. Areas of focus include auditing of water pollution control, air pollution control, solid waste management, heavy metal pollution and pollution reduction.

In general, natural resource and environmental auditing focuses on four issues: 1) management of funds; 2) policy implementation; 3) program management; and 4) project management.

- (1) Audits of the management of funds include those focused on the collection, management, and use of funds, including government financial funds and special funds for natural resources and environment. Their primary focus is the legitimacy, compliance and effectiveness of the management of the funds.
- (2) Audits of the implementation of environmental policies include those focused on the fulfillment of national policies, laws, plans and measures for natural resource management and environmental protection, the achievement of the policy's objectives and the implementation of recommendations resulting from policies.
- (3) Audits of the fulfillment of environmental program responsibilities by government departments include fulfillment of the responsibilities and objectives related to the delivery of public services and management activities related to natural resources and environmental protection as specified in China's laws.
- (4) Project management audits include those focused on the management and operating conditions of major natural resource and environmental projects, as well as the impacts of other major projects on natural resources and the environment.

8.2.2.2 The Organization of Government Environmental Auditing

Environmental auditing in China has evolved a specialized organizational approach in which environmental audits are integrated into audits of other sectors/disciplines. Audit institutions began to consider coordination of resource and environmental auditing with other audits following the establishment of the *Environmental Audit Coordination Leading Group* by the CNAO in 2003. Since then, the responsibility for environmental auditing has

shifted from a single audit department within CNAO to all audit departments. Under this integrated approach, all departments are expected to pay attention to natural resource management and environmental protection issues when conducting audits in their specific domains. They must incorporate environmental considerations into their audit plans in accordance with national policies and laws for natural resources and the environment. Such an integrated approach reflects the characteristics of economic and social development in China and the country's special needs for natural resource management and environmental protection.

8.2.2.3 Environmental Audits of Senior Officials

In China, a unique audit system focused on the economic accountability of senior officials of the government and the CPC has evolved during the expansion of economic and political reform in the last decades. It is recognized as an innovation of the modern audit system in China. Article 25 of China's *Audit Law* (as revised in February 2006) clarifies the legal basis of such "economic accountability" audits. The CNAO published its opinions on strengthening natural resource and environment auditing in 2009, which specified that "in auditing fiscal, investment, financial, enterprise, foreign investment and economic accountability, audit bodies at each level should incorporate resource and environment into audit plan for implementation" and "economic accountability audits should keep a watchful eye on officials' performance of resource management and eco-environmental protection responsibilities, especially on the accomplishment of goals with respect to energy conservation and emission reduction as well as agricultural land (particularly basic farmland protection), while disclosing resource and environment problems resulting from poor decision-making, improper performance of duties and poor management".

In line with the spirit of these statements and to strengthen the laws, regulations, methods and scientific development of economic accountability audit, the General Office of the CPC Central Committee and the General Office of the State Council issued *Regulations on Economic Accountability Audit for Leading Cadres of the Party and Government and Leaders of State-owned Enterprises* in October 2010. These regulations specify that economic accountability audit is to be used to encourage senior officials to contribute to the scientific development of China's regions, departments and units and to pay close attention to the scientific outlook on the development of the economy. In the organization and execution of economic accountability audits, special attention should be paid to the economic, social and ecological benefits generated by major decisions made by senior officials.

The CNAO has clarified how economic accountability auditing is to be used in natural resource and environmental auditing in its audit documentation and institutional standards. In 2012, it proposed *Guidance for Economic Accountability Audit* that stated, "for senior officials of the government, economic accountability audits should be focused mainly on the implementation and effects of policies with respect to...energy conservation, environmental protection...based on an overall review of financial balance scale, structure and performance".

According to the *Implementation Guidelines for Regulation of Economic Accountability Audit on Leading Officials of Party, Government and State-owned Enterprises* jointly issued in July 2014 by several key government agencies¹⁹³, the economic accountability audit of Chinese senior officials should focus on:

"quality, benefits and *sustainability* of economic and social development; economic, social and *environmental benefits* of management and decisions related to senior officials' economic responsibility; debt borrowing, *natural resource assets management, environmental protection*, improvement of people's livelihood, technology innovation; and issues for which senior officials shall assume direct responsibilities." (Italics added)

¹⁹³ The CNAO, the Central Commission for Discipline Inspection of the CPC, the CPC Official Management Department, the CPC Organization Staffing Management Office, the Ministry of Administrative Supervision, the Ministry of Human Resources and Social Security and the State-owned Assets Management Commission.

As the italicized phrases suggest, these guidelines are highly relevant to the management of natural resources and environment in China.

8.2.2.4 Difficulties in Environmental Auditing Faced by the Government

Progress has been made in natural resource and environmental auditing in China. However, difficulties remain:

- the concepts underlying resource and environmental audits must be further refined
- audit quality and efficiency must be further improved
- audit breadth, depth and effort must be further expanded, and
- the capabilities and knowledge of audit personnel must be further improved

These issues are taken up further below.

(1) Weak theory and incomplete standards

Though progress has been made in establishing the theory and standards for natural resource and environmental auditing in recent years, some basic questions remain unsolved. For instance, the fundamental definitions of resource and environmental auditing remain uncertain and the relationship between natural resource auditing and environmental auditing is not fully clear. These and other issues require further study.

Secondly, complete regulations, standards and evaluation measures have not been established for resource and environmental auditing. This not only leads to inconsistent audit measures and a questionable audit basis but also affects the legitimacy and credibility of audit outcomes and, therefore, their acceptance by audited institutions and individuals.

(2) The Breadth and Depth of Natural Resource and Environmental Auditing Must Be Improved

Currently, the breadth of natural resource and environmental auditing in China is not sufficient. Audits are largely concentrated on land-transfer fees, water pollution prevention and control projects and investment in forest management. Many other important domains remain uncovered. Few audits have been conducted in relation to mineral resources, air pollution, nuclear waste, non-point source pollution from agriculture, ecological protection or biological diversity.

Similarly, the depth of resource and environmental auditing is not sufficient. The majority of audits are focused on the legitimacy and legality of the collection, management and use of funds related to natural resource management and environmental protection projects. Few audits are focused on the performance of such projects.

(3) Natural Resource and Environmental Audit Teams Must Be Strengthened

Generally, the availability of audit professionals trained in natural resource and environmental auditing does not correspond to the importance of natural resources and the environment in economic and social development. Natural resource and environmental auditing not only requires audit personnel to have solid training in financial auditing but also to have professional knowledge of natural resource management and environmental protection and to be familiar with environmental policies, laws and technical/operational standards. These special requirements related to natural resource and environmental knowledge mean that qualified personnel for resource and environmental auditing are urgently required in China.

8.3 DESIGNING AND IMPLEMENTING STRENGTHENED ENVIRONMENTAL AUDITING SYSTEMS IN CHINA

This chapter discusses the design and implementation of strengthened government environmental auditing systems in China. The purpose is to lay out the basis necessary for China to create systems that:

- are focused on the appropriate measures (financial management; compliance and performance) and targets (government programs and senior officials)
- have a strong legal basis, and
- are implemented by objective and independent auditing institutes.

8.3.1 Objective and Basis of Environmental Auditing

8.3.1.1 Objective of Environmental Auditing

Governments at all levels have the responsibility to protect the quality of the environment and to comply with environmental policies and laws. The purpose of environmental auditing is to provide objective and independent information on the performance of government's and their officials in meeting these responsibilities. The objective is improved government actions and environmental decision-making and, ultimately, improved environmental quality and sustainability.

8.3.1.2 The Basis for Environmental Auditing

Environmental auditing rests on three pillars: laws and regulations, institutions and processes.

- Clear, sound and comprehensive laws and regulations are essential for ensuring that environmental audits are legitimate and that their results have credibility.
- Auditing institutions must be (and be seen to be) independent of the institutions and individuals that are the targets of their audits; must be staffed by properly trained professional audit staff; and must be mandated to undertake audits across the full scope of relevant issues.
- Finally, audits must be based on clear, sound and comprehensive processes, including principals, ethics, guidelines, procedures, methods and indicators.

Currently, there is insufficient basis for implementing environmental auditing in China. Laws and regulations are not adequate. Auditing institutions require further strengthening to ensure their independence, equip them with strong audit teams and permit them to broaden their audit scopes. Audit processes are not clear enough to ensure high quality audit results.

8.3.2 Audit Institutions and Their Targets

8.3.2.1 Audit Institutions

Audit institutions are responsible for the quality and effectiveness of environmental audits. Their success depends in the first instance on their independence from the targets of their audits. In the case of government environmental audit, this means audit institutions must be independent of the government departments and the officials they are charged with auditing. Only such independence can ensure the objectivity and credibility of audit outcomes and, therefore, the effectiveness of the audit outcomes.

In China, there is need to strengthen the independence of audit institutions. Four possibilities for doing so are given below. Table 8-3-1 discusses the advantages and disadvantages of each.

- **Option 1 (status quo)** – Environmental auditing falls under the responsibility of audit institutions at the central, provincial and regional levels. These institutes are agencies within their respective governments.
- **Option 2** – Environmental auditing falls under the responsibility of the People's Congress. Under this option, audit institutes at the central, provincial and regional levels are mandated by and accountable to their respective People's Congress, which provides supervision for the audit systems.
- **Option 3** – Environmental auditing falls under the responsibility of environmental protection agencies at the central, regional and local levels.
- **Option 4** – Environmental auditing is a joint responsibility of environmental protection agencies and auditing institutions at the central, provincial and regional levels. Auditing institutions are specifically responsible for audit management, planning, implementation and publication. Environmental protection agencies are responsible for technical matters, drafting of auditing reports and implementing auditing recommendations.

Table 8-3-1. Comparison of Institutional Options

Responsible body	Independence	Feasibility and Cost
Audit institutions	Independence of audit processes and outcomes is, in principle, assured but, as agencies of the government, the institutions are possibly subject to government influence.	Audit institutions suffer from a number of shortcomings that limit their ability to effectively carry out environmental audits; in particular, lack of professional audit staff with environmental knowledge. The cost of institutional transition is high.
People's Congress	Since audit institutions are accountable to the People's Congress, full independence of the audit systems from government agencies and officials is assured, greatly reducing the possibility of government interference in audit processes and outcomes.	Lack of environmental auditing expertise within the People's Congress would limit its ability to hold audit institutions accountable for their work. The cost of the institutional transition from the current situation is high.
Environmental protection agencies	The independence of audit processes and outcomes is not assured because the same agencies that will be the targets of the audits will also be responsible for them. High likelihood of influence of the outcomes by government.	Audit teams will benefit from the environmental knowledge of staff in the environmental protection agencies. The cost of institutional transition is low.
Audit institutions and environmental protection authorities jointly	Independence of audit processes and outcomes is, in principle, assured by the independence of the audit institutions, though the involvement of the environmental protection agencies greatly increases the likelihood of government influence.	Audit teams will benefit from the environmental knowledge of staff in the environmental protection agencies. The cost of institutional transition is low.

Each of the four options has advantages and disadvantages. From the point of view of audit processes, the joint responsibility option (#4) scenario is attractive because it offers the opportunity to limit government interference and also secure the expertise of staff knowledgeable in environmental issues to take part in audit teams. It also offers low transition costs. It brings an increased risk of government influence, however, due to the direct involvement of environmental protection agencies in audit processes.

From the perspective of China's long-term socio-economic development, the option of making audit institutions accountable to the People's Congress is particularly attractive, as it offers the surest protection of audit processes and outcomes from government influence. The relatively high transition costs of this option mean that it cannot be adopted in the short term however. For now, the status quo, in which audit institutions accountable to the government are – with appropriate strengthening – responsible for environmental auditing is the best option to mitigate the distrust between the government and public on environmental matters and reduce the possibilities

of social crises. Thus, we recommend strengthening of the status quo in the short term followed by reform of the institutional arrangements in the longer term to make audit institutions accountable to the Peoples' Congress.

Environmental auditing not only requires knowledge and experience in finance and accounting but, equally importantly, knowledge of environmental issues and the science underlying them. This includes knowledge of ecology, biology, engineering, physics and chemistry in relation to air, water and soil. A set of systems to cultivate and identify professionals with this knowledge to work as environmental auditors is needed in China, since audit institutions currently have few such staff. Consideration should be given to establishing a qualification examination system that could be used to certify the knowledge of environmental auditors

8.3.2.2 Target of Environmental Auditing

A core principle underlying environmental auditing is the notion that governments, businesses and individuals have responsibilities to protect the environment and that they can be held publicly accountable for the fulfilment of those responsibilities when they have been entrusted with them by the nation. Article 6 of China's newly revised *Environmental Protection Law* clearly defines these responsibilities:

- Governments at all levels are to assume responsibility for the environmental quality of their administrative regions;
- Enterprises, institutions and other producers should prevent and reduce environmental pollution and environmental damage and bear responsibility (in accordance with the law) for any damage they are unable to prevent;
- Citizens should be aware of the need to protect the environment and live in accordance with this need by, for example, adopting low-carbon, sustainable lifestyles.

According to the new *Environmental Protection Law* (Article 26), governments and their officials at all levels may be targets of environmental auditing. Enterprises also may be audit targets (Article 42).

8.3.3 Audit Types

Environmental auditing includes, in principle, the same three audit types as does government auditing in general: financial auditing, compliance auditing and performance auditing. In terms of its environmental scope, it includes audits focused on water, atmosphere, pollution, natural resources and ecosystems.

Again in principle, there are no significant differences between the conduct of environmental audits and audits in general. Environmental financial audits focus, like all financial audits, on the legality and legitimacy of the management of state funds devoted to natural resource management and environmental protection.

Environmental compliance auditing focuses on whether the audited organizations and officials are acting in accordance with the environmental programs, plans, policies and standards stipulated by the state.

Environmental performance auditing considers whether government organizations and officials have fulfilled their natural resource management and environmental protection responsibilities; in particular:

- whether their activities achieve their intended objectives;
- whether their use of financial resources is cost-effective;
- whether their efforts result in permanent changes, and, ultimately
- whether environmental quality has actually improved.

8.3.4 Audit Process

The audit process can be broken into four phases:

Preparation: Environmental auditing objectives and implementation and guarantee mechanisms. Establish the requirements and basis for environmental auditing in accordance with the major environmental objectives and programs of the state. Establish annual audit schedules and work plans, define clear working responsibilities and tasks and set up corresponding systems to ensure that audit recommendations are acted upon.

Implementation: Establish systems and processes in accordance with the objectives of environmental auditing and define the responsibilities of different audit professionals. Establish qualification certification systems for audit team professionals. Prepare technical guides and specifications for different types of environmental audits.

Reporting: The legal status and authority of environmental audit reports must be made clear and reporting guidelines introduced. Data sources used in audits must be clearly documented to ensure the objectivity of results. Audit reports should include both audit conclusions and recommendations to correct deficiencies found.

Post-audit monitoring: Systems must be established to publicize environmental audit results to increase their transparency and credibility. The management of environmental audit information, materials and files must be improved to improve audit efficiency.

8.3.5 Audit Evidence

8.3.5.1 Requirements of Audit Evidence

To ensure the legitimacy and fairness of environmental audit and to reduce risks of errors in audit processes, the collection and analysis of audit evidence is of fundamental importance. The adequacy of evidence must be taken into account during its acquisition and auditors must exercise good professional judgment in determining this. There are several principles that must be kept in mind.

Completeness of evidence: Evidence must be collected to cover the full range of issues relevant to the target of the audit and the type of audit being conducted. The overall audit should be broken down into individual elements and evidence should be collected and classified according to these elements. The classification should be established from the bottom up and the evidence should be collected to form a complete system adequate to underpin the audit results and recommendations.

Coherence of evidence: The collection and evaluation of audit evidence must be linked with audit objectives and the relationships among individual pieces of evidence must be made clear; merely collecting and presenting a mass of evidence is not sufficient. Relationships among pieces of evidence are determined by relationships among auditing items themselves.

Objectivity of evidence: During the collection and evaluation of audit evidence, auditors should never replace objective evidence with their own subjective opinions. Audits must be based on facts collected through, for example, field observation and monitoring, as explained next.

8.3.5.2 Acquisition of Audit Evidence

Several methods are available for the collection of appropriate audit evidence.

Examination of laws and related databases: In the process of collecting evidence for environmental audits, examination of existing laws, policies and regulations and the associated databases should be the first approach.

Relevant databases include the financial accounts, administrative records and other standard reporting systems maintained by government departments and agencies. Other relevant databases include official statistics, environmental monitoring data and reports, and performance assessment reports.

Statistical sampling: Audit institutions must investigate thousands of separate issues during the course of their work. The burden of evidence collection associated with this can be substantial. In case of insufficient resources to collect comprehensive data, statistical sampling can be considered as a valid means of reducing the burden and cost of data collection while maintaining the overall quality of the data collected.

Field surveys: When auditors require a deep understanding of a natural resource management or environmental protection activity, they should carry out direct field surveys of the relevant organizations.

Standardized questionnaires: The use of standardized questionnaires (e.g., self-assessment reports) is an effective means of collected audit evidence in some cases. Audited organizations may be requested to fill in a questionnaire aimed at collecting, for example, general information on environmental management activities or environmental performance. Questionnaires can also be used to collect information related to the public's satisfaction with the management of environmental quality.

8.4 POST-TERM ENVIRONMENTAL AUDIT SYSTEM FOR SENIOR OFFICIALS

Generally, post-term audits of senior officials refer to review, verification and overall evaluation of the fulfillment of the *economic* accountability responsibilities of the officials during their entire tenure. As the senior officials of the government form a special group in China, such economic accountability audits are already regularly carried out when senior officials leave their posts (either to assume a new role or to enter retirement). In contrast, *environmental* accountability audits are not yet implemented. Since senior officials decide upon the allocation of substantial economic and social resources in China and, therefore, have great influence on economic and social development and environmental protection in the regions where they hold office, senior officials should be the subject of post-term environmental accountability audits.

Compared with general government environmental auditing (discussed in the preceding chapter), post-term environmental accountability audits have several unique features. First, environmental accountability audits are specific only to the special group of senior officials with significant powers to allocate resources. Second, environmental accountability audits are implemented only when senior officials are leaving their posts rather than during their tenure. Thirdly, environmental accountability audits focus on a given senior official's specific responsibilities, which makes them much narrower in scope than government environmental audits are typically. Fourthly, only the Human Resources Department of the government or institutions authorized by this department can undertake such audits and act upon their results.

8.4.1 Audit Institutions and Targets

8.4.1.1 Audit Institutions

Generally, environmental auditing institutions in China include the state auditing institution (CNAO), internal auditing departments of government departments and agencies and social auditing agencies. As senior officials are a special subject in China, in practice it is not possible for environmental accountability audits to be undertaken by social auditing agencies, as they will face obstacles in evidence collection and application of results. Therefore, environmental accountability audits must be the responsibility of the CNAO and internal auditing departments.

8.4.1.2 Auditing Target

The target of environmental accountability audits follows the definition of senior officials in China. Generally, this group refers to the senior officials of the Communist Party of China, the People's Congress and state-owned enterprises, as defined in relevant national laws and regulations.

According to the leadership system that is in place in China, the local head of the Communist Party have primary responsibility for environmental protection in their administrative region. Therefore, these officials are subject to environmental accountability audit first, followed by senior officials and, as relevant, other personnel of government departments and state-owned enterprises.

8.4.2 Audit Types

As with general government environmental audit, environmental accountability audits include three types of audits.

First, there are **financial** audits of senior officials' management of funds allocated for environmental protection purposes. These audits focus on the legality and legitimacy of senior officials' collection and use funds under their direct administration and their efforts to guarantee compliance with laws in the investment and use of funds by departments and agencies under their control.

Second, there are audits of **compliance** with responsibilities to enforce laws, policies and regulations designed to ensure environmental protection. Senior officials are expected to take action to enforce these by, for example, supervising and encouraging relevant departments and lower-level authorities to carry out legally required environmental protection responsibilities and ensure that national environmental protection objectives are achieved.

Finally, there are audits of the **performance** of senior officials in carrying out their responsibilities for environmental protection, which are aimed at the actual protection and enhancement of environment quality. These audits focus on, for example, performance in meeting targets for environmental quality and pollutant control.

8.4.3 Audit Implementation

There are two possibilities for the implementation of environmental accountability audits of senior officials. One is to add such environmental audits to the current process for economic accountability audits, making environmental performance an important - or even key – basis of evaluation of the overall performance of officials. The second possibility is to implement environmental accountability audits as separate category of audit for senior officials that are leaving their posts.

8.4.3.1 Legal Basis

A legal basis for environmental accountability audits is potentially offered by in the *Measures for Comprehensive Evaluation of the Local CPC and Government Leading Group and Leading Officials as Required by the Scientific Outlook on Development* (trial) promulgated by the Central Committee of the Communist Party in 2006. These measures include three evaluation criteria that are related the environmental performance:

- environmental protection,
- resource consumption and workplace safety, and
- natural resource (e.g., arable land) management.

These criteria have not yet been broken down into indicators that could be suitable for evaluation purposes at the national level however.

At the end of 2013, a circular entitled *Improving Performance Appraisal of Local Communist Party and Government Leading Group and Leading Cadres* was promulgated by the Central Committee of the Communist Party. It outlined requirements for improvements to the performance appraisal of local party officials and other senior officials, noting that efforts to promote ecological protection should be a consideration in performance evaluation. In parallel with China's strategy of classifying land into development areas considering, *inter alia*, ecological carrying and population density (main functional area strategy), many local governments have already put forward requirements that accountability audits of senior officials leaving their posts should focus on environmental protection in order to motivate them to take their responsibilities seriously. However, as there are many problems still to be resolved in the implementation of environmental accountability auditing, no actual audits have yet been conducted.

8.5 ROADMAP AND POLICY RECOMMENDATIONS ON IMPLEMENTATING IMPROVED CHINESE ENVIRONMENTAL AUDIT SYSTEMS

8.5.1 Roadmap for the Environmental Audit Systems

8.5.1.1 Objective

The objective of this roadmap is:

- To set up unified, scientific and practical government environmental audit systems nationwide. The audit systems are to cover auditing of government programs and accountability auditing of officials leaving their posts (either because of promotion or retirement). The ultimate goal is to standardize and institutionalize activities of environmental auditing.
- To promote the implementation of environmental audit systems nationwide (beginning with a series of pilot audits) in order to support the improvement of environmental performance for officials at all levels of the government and, in particular, environmental accountability of senior officials.
- To provide policy recommendations for the improvement of environment audit for inclusion in China's 13th Five-Year Plan and other important environmental initiatives, thus promoting the creation of an ecological civilization.

8.5.1.2 Focus

Currently, Chinese environmental auditing is mainly centred on financial and legal compliance audits of the use of public funds for environmental purposes and not on the government's environmental policies and regulations or environmental planning and performance. As a result of this relatively narrow audit scope, China's existing audit systems are failing to reveal the country's deeply rooted environmental problems.

To correct this, the focus of future improvements to environmental audit systems should be:

- To increase the scope of the auditing of government environmental programs in alignment with priorities for environmental protection to include, for example, energy saving and emission reduction audits, rural development program audits, air pollution prevention and control action plan audits, water pollution prevention and control action plan audits and soil protection action plan audits.
- To establish cooperation mechanisms between audit institutions and all other departments, while fully ensuring the independence of the audit institutions.

- To carry out environmental accountability audits of senior officials when they leave their posts (either for promotion or upon retirement).
- To establish and improve frameworks and criteria for environmental auditing.
- To explore new processes, operating modes and technical methods of environmental auditing.

8.5.1.3 Proposed Schedule

Stage 1 – Development stage (2015): During this stage, the basic methods and processes of government environmental audits and environmental accountability audits of senior officials when leaving their posts will be designed. The theoretical foundation for future work will be laid down. Technical guidelines will be developed and a program of pilot audits will be designed to provide practical experience for the expanded scope of environmental auditing.

Stage 2 – Pilot audit stage (2015-2020): During this stage, pilot environmental accountability audits of senior officials leaving their offices in selected regions and cities will be undertaken in order to gain experience, explore methods and processes, demonstrate the feasibility of national implementation and provide improvement suggestions.

Stage 3 - Post 13th Five-year Plan period (Beyond 2020): During this stage the improved environmental audit systems for government programs and environmental accountability of senior officials will be implemented on a nationwide scale on the basis of the experience gained during the pilot stage. Periodic reviews of the audit systems (every three years) will be carried out so as to adjust and guarantee the sustainability of the system and ensure on-going, standardized national environmental audit systems remain in place.

8.5.1.4 Institutional Reform and Coordination

Every effort will be made to fully understand the importance, urgency and difficulty of developing and implementing the new environmental audit systems and to strengthen organizational leadership for implementation and adoption of necessary policies. Building upon the opportunity offered by the decision of the CPC Central Committee related to comprehensively deepening China's reforms, special reform groups should be established for environmental auditing, beginning with a reform group for the environmental audit of officials who are leaving their posts.

To ensure the success of the new systems, China's audit institutions should strengthen their cooperation with the Ministry of Environmental Protection, the Ministry of Water Resources, the Ministry of Land and Resources, the State Forestry Administration and the State Oceanic Administration to work out the development of the systems together and define clear responsibilities, while ensuring the full independence of the audit institutions. Efforts shall be made to strengthen coordination to ensure the necessary reforms and unify efforts relating to the environmental audit systems. Regular meetings will be held to study and solve the major problems encountered in the process of promoting reform of the systems.

8.5.2 Policy Suggestions for Improved Environmental Audit Systems

8.5.2.1 Improving the Legal Basis and Capacity Building

8.5.2.1.1 Improving the Legal Basis

It is urgent to put forward suggestions for the revision of existing audit rules and environmental and natural resource regulations so as to provide a sound legal basis for environmental audit.

- Revisions are required to China's existing *Audit Law* and other relevant auditing guidelines to introduce new provisions that will strengthen environmental audit systems by clarifying their subjects, targets and scopes and ensuring their outputs are shared with the public to the fullest extent possible.

- Revisions are required to existing environmental protection laws and regulations to introduce new provisions that will strengthen environmental audit laws and improve the basis for employing the findings of environmental audits to improve environmental decision making.

8.5.2.1.2 Developing Technical Guidelines and Standards

The development of technical guidelines and the formulation of standards for environmental auditing must be the focus of a major effort. A standard system for environmental auditing should be established along with clear operating rules to ensure the institutionalization and standardization of the scope, contents, procedures and methods of environmental auditing and to ensure their legal and evidence bases.

- Technical guidelines for the different environmental audit systems must be developed, drawing wherever possible on international experiences while also considering practices in China. In particular, the following guidelines should be developed:
 - *Government Environmental Audit System Standards*
 - *Technical Guidelines on Environmental Audit of Government Programs (Operational Manual)*
 - *Technical Guidelines on Environmental Accountability Audits of Senior Officials when Leaving their Posts (Operational Manual)*
 - *Environmental Indicator Systems and Application Methods for Audit of Government Programs*
 - *Environmental Audit Indicator System and Application Methods for Environmental Accountability Audits of Senior Officials when Leaving their Posts.*

8.5.2.1.3 Strengthening Capacity Building

(1) Improving auditor training

Given the shortcomings in the knowledge, skills and capacity of existing environmental auditors in China, efforts should be made to strengthen training for auditors, broaden their expertise and increase their knowledge. The goal should be to create high-quality environmental audit professionals and strengthen audit teams. Auditors should be encouraged to master environmental audit knowledge and improve their audit skills, so as to build professional audit teams that can meet the requirements of the new environmental audit systems.

- An environmental audit professional qualification system should be established to standardize and strengthen the process of managing the professional qualification of auditors. This system should be used to expand and strengthen human resource capacity for auditing and establish an expert pool of professional environmental auditors.
- Environmental audit training and education should be strengthened and expanded. Relevant training materials and technical guidelines should be developed and published.

(2) Encouraging innovation and improving audit methods and processes

In order to meet the China's socioeconomic development requirements, the country's audit systems must keep up with best practice and ensure constant innovation to improve and strengthen audit efforts. China's current information base for environmental management is weak and its environment statistics programs started later than those in other statistical domains; thus, environmental statistics are not as complete and standardized as economic and social statistics.

For these reasons, efforts should be made to increase innovation in auditing methods and processes, strengthen environmental statistics and accounts (along with other databases) and increase the country's overall capacity to compile environmental data. China should more actively collect basic environmental data and ensure their accuracy and authenticity. The country must have a reliable and transparent system of environmental statistics and accounts to provide a comprehensive, timely and credible information basis for environmental management, decision making and evaluation.

(3) Improving coordination

Environmental audits involve various departments, so China must improve inter-departmental coordination to strengthen its audit systems. There is a need to define clear working arrangements between CNAO, Ministry of Environmental Protection and Ministry of Finance in order to do this. In the near-term (2 years), strengthening of environmental audit systems should be undertaken with auditing institutions as the lead authority in collaboration with environmental authorities. In the mid-term (3-5 years), auditing institutions should assume independent control of the strengthened environmental audit systems. In the long-term (beyond 5 years), the current audit institutions should be reformed such that the CNAO becomes a body of the National People's Congress. Such a change in the oversight of the CNAO would best assure the full independence of its auditing methods, processes and results.

8.5.2.1.4 Strengthening Institutional Capacity

Efforts should be made to strengthen national and local audit institutions and improve institutional capacity-building efforts. Consideration should be given to the creation of an Environmental Audit Research Center.

To move beyond the current situation in which audit teams are made up primarily of auditors with traditional accounting expertise, it will be necessary to build interdisciplinary audit teams. These must include experts from the fields of natural resource management, environmental protection, ecology and economics selected from institutes of forestry, agriculture, mining, geology, water resources, marine resources and environmental engineering. Joint training programs building upon the strengths of academic institutions focused on finance and economics with those focused on natural resources and the environment should be created. Consideration must also be given to strengthening international cooperation in developing environmental audit skills and expertise.

8.5.2.2 Improving the Impact of Audit Results

8.5.2.2.1 Strengthening Coordination between Environmental Audit Systems and Other Environmental Evaluation Systems

To strengthen China's environmental audit systems, they must be coordinated with the other evaluation systems used by the government. Due attention should be given to this need when considering improvements to the legal basis for environmental auditing, since China has entered a period when a single measure can influence many processes.

Coordination with the following systems is required: systems designed to provide future outlooks; pollution emission reduction targets evaluation systems; environmental status reporting systems¹⁹⁴; accountability systems; environmental information disclosure systems; and public consultation systems.

¹⁹⁴ Article 27 of the new *Environmental Protection Law* require governments at or above the county level to report annually to the relevant people's congress or standing committee on the state of the local environment and on fulfillment of environmental protection targets.

8.5.2.2.2 Increasing the Use of Audit Results

(1) Using Audit Results to Tighten Environmental Accountability

China should ensure that environmental audit results are actively used to evaluate the environmental performance of senior officials. This should include examination of performance in the context of promotion, retirement and dismissal of officials and the giving of rewards and punishments. The agencies of the Chinese government with the responsibility for human resource management (discipline inspection and supervision departments, departments of finance and state-owned assets supervision and administration departments) should make use of audit results to exercise their full authority in accordance with the law and handle cases of violations of environmental laws in a timely fashion. Accountability systems should be implemented using audit results.

(2) Strengthening Disclosure of Audit Results

China is undergoing rapid economic and social transition and the disclosure of audit results is of great importance in respecting citizens' environmental "right-to-know" (that is, their right to be informed about the quality of the environment and how it might affect their personal well-being). Public disclosure of audit results will help promote participation in the political management of the country, democracy and law making. Disclosing audit results ensures that the performance of the officials who are responsible for ensuring environmental quality is known by the general public and not just by a minority. This supports broad public engagement in the process of holding officials accountable for their performance in ensuring a healthy environment for all citizens. Institutionalized and legally required disclosure of audit results and widespread public participation in their use is an effective means of preventing pollution and corruption, thereby contributing to the promotion of sustainable development in China.

8.5.2.3 Initiating Audit Pilots

The theory and practice of environmental audit in China remain at the exploratory stage. As a means of ensuring accountability for environmental performance, environmental auditing is a huge and complex task. Pilot audits in representative regions of the country on typical projects are, therefore, a sound means of laying the foundations for long-term improvement in audit systems, particularly given the need for these systems to reflect Chinese characteristics. By studying new situations, solving new problems and summarizing new experiences gained during pilot audits, the path toward improved systems can be fully explored. This will permit the required deep reforms of the environmental audit systems to be achieved in a sound and sustainable fashion.

Pilot audits should be undertaken first at the level of provinces, municipalities and counties. Following this, pilot national audits for key environmental protection activities such as air, water and soil pollution control and key natural resource management activities such as forest and fisheries management should be undertaken. Based on the results of these pilots, an agenda of issues related to strengthening of audit systems that requires additional research and discussion should be developed. Further work with CCICED to support the strengthening of Chinese environmental audit systems should be undertaken to pursue this research agenda. It would also be beneficial to pursue the pilot audits with the involvement of CCICED.

ACKNOWLEDGMENTS

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- Ministry of Environmental Protection,
- the Chinese National Audit Office,
- the Lanzhou Environmental Protection Department,
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- Professor Zhang Hongliang, Business School of Beijing Technology and Business University for their support and cooperation in the study.

This report was submitted by the Special Policy Study on Chinese Environmental Audit System for the Government.

CHAPTER 9

CCICED 2014 WORK REPORT

CCICED 2014 Annual General Meeting

December 1-3, 2014

CCICED 2014 WORK REPORT

In the 23rd year since its inception, the China Council for International Cooperation on Environment and Development (CCICED), as a high-level policy advisory body in the field of environment and development, has continued to promote sustainable development and has received the recognition and support of the Chinese Government. At the CCICED Annual General Meeting (AGM) 2013, Mr. Zhang Gaoli, Vice Premier of the State Council of China and Chairperson of CCICED, pointed out that *CCICED has played a positive role in promoting China's economic development and environmental protection over more than 20 years by conducting in-depth study of environment and development issues and formulating important policy recommendations.* In an informal discussion with the CCICED members, Mr. Li Keqiang, Premier of the State Council of China, expressed the hope that *CCICED will continue to make recommendations for China's development, environmental protection, and ecological progress.*

Under the strong leadership of the Bureau and with the support of domestic and international partners, CCICED has successfully completed the tasks set for the year and satisfactorily met planned objectives over the year. Below is an overview of the progress achieved during the year.

9.1 SMOOTH PROGRESS IN POLICY RESEARCH

In 2014, CCICED carried out policy research under the theme, "Management and Institutional Innovation for Green Development". The policy research work focused largely on identifying the challenges in the existing management system in the context of green transformation and green development of the Chinese economy and the community and exploring institutional innovation suited to green transformation and green development. The policy research teams formulated workable policy recommendations for institutional improvement that would contribute effectively to ecological civilization.

9.1.1 Completing the policy research as planned

In 2014, CCICED completed two task force projects and four special policy studies and reported the findings to the AGM 2014. The topics are listed below:

1. Evaluation and Prospects for a Green Transition Process in China (2013-2014)
2. Institutional Innovation for Environmental Protection in the Context of Ecological Civilization (2014)
3. Good City Models under the Concept of Ecological Civilization (2014)
4. Institutional Innovation of Eco-Environmental Redlining (2014)

5. Chinese Environmental Audit System for the Government (2014)
6. Performance Evaluation on the *Action Plan of Air Pollution Prevention and Control* and Regional Coordination Mechanism (2014).

Also, as authorized by the Bureau and approved by the Secretary-General, the Task Force on National Governance Capacity for Green Transformation and the Task Force on Environmental Finance Reform and Green Transformation were established during the year. Their findings will be reported to the 2015 Annual General Meeting.

The Task Force and Special Policy Study teams put forward policy recommendations to the Chinese Government that integrated best practices in international and Chinese experience in the context of the realities of China. This way of working reflected the unique role and value of CCICED as a bridge for achieving international cooperation on environment and development.

9.1.2 Holding seminars of experts in different fields

In accordance with the 2014 work plan, CCICED successfully hosted seminars in January, June, August and October on the themes “Comprehensive Deepening Reform, Promoting the Modernization of Environmental Governance”, “Promoting the Institutional Innovation for Ecological Progress”, “New City Models and Environmental Protection”, and “Modernization of National Governance Capability under the Framework of Environment and Development”. Experts and scholars in related fields were invited to discuss difficulties, priorities, and pressing issues related to environment and development in these various areas and to draw on research findings and practical experience at home and abroad to provide useful input for CCICED’s policy research.

9.1.3 CCICED members, donors, and partners playing an active role in policy research

CCICED members, donors and partners played an important role in policy studies. A total of 9 Council members served as Co-Chairs or core specialists with direct involvement in the policy research work. Moreover, 11 donors and partners contributed 15 senior experts and scholars in social, economic, environmental, management, urban planning, ecological protection, and atmospheric fields. These experts made significant contributions to the high quality of the policy research.

9.1.4 Research by CCICED members as individuals and small groups

CCICED encourages its Council members to conduct research as individuals or small groups relevant to Annual General Meetings’ annual theme and to submit reports containing the results of their research. Earlier this year, 11 members submitted outlines of the research that they proposed to conduct. Coordinated by the Secretariat and the Chief Advisors, a working group composed of 6 Chinese and international Council Members was established, led by Mr. Daniel J. Dudek, to conduct a joint study and prepare a report on “Emissions Trading and Institutional Innovation: Lessons Learned From China’s Carbon Trading Pilots”. Eight other members, namely Peter Kent, Achim Steiner, Kandeh K. Yumkella, Roger Beale, James Leape, Nicholas Stern, He Jiankun, and Li Yong, also submitted their reports to the AGM this year. These reports cover South-South environmental cooperation, global green supply chain, ban of the illegal wildlife trade, China’s sustainable growth reform and cooperation, and carbon reduction and sustainable development. All of these reports will be submitted to the AGM for the reference of members and participants.

9.1.5 Further clarifying the direction and focus of work over the next two years

In line with the policy research framework of Phase V, CCICED developed a proposal on the research focus for the next two years, based on analysis of the new international situation in environment and development and China's priorities and needs. This proposal, which focused on the theme of the 2015 AGM, research directions in 2015-2016, and policy research project topics, will be submitted to the Bureau for consideration in the context of the 2015 Work Plan.

9.2 MAKING GREATER EFFORTS TO ENHANCE THE IMPACT OF POLICY RECOMMENDATIONS

A major target in Phase V is to continue to promote the adoption and application of CCICED's recommendations, share policy research findings with the international community, especially with developing countries, and expand CCICED's influence at home and abroad. More specifically, the work carried out in 2014 in this respect is as follows.

9.2.1 Hosting successfully CCICED 2014 Roundtable Meeting to share research findings with Asia Pacific Economic Cooperation (APEC) countries.

The CCICED Roundtable Meeting 2014 was held on May 9-10 in Tianjin with the theme of "Green Transformation and Institutional Innovation for Investment, Trade and Consumption". CCICED shared policy research findings in the fields of investment, trade and environment, sustainable consumption, and corporate social responsibility, and experience gained through the Tianjin Green Supply Chain Demonstration Project. Exchanges and discussions also took place on green transformation and institutional innovation for environmental protection. Coinciding with and closely reflecting the objectives of the APEC High-level Roundtable on Green Development, CCICED's 2014 Roundtable Meeting served to promote achievement-sharing and regional cooperation on environment and development between China and its Asia-Pacific neighbors. More than 160 people attended the event, including the CCICED Secretary General, Vice Minister of Environmental Protection Mr. Li Ganjie, and other five Council members, Tianjin Vice Mayor Mr. Cui Jindu, as well as representatives from central and local government departments, policy research projects, research institutions, APEC Member States, CCICED donors and partners, domestic and international enterprises, and news media.

9.2.2 Deepening dialogue and exchanges with Africa and ASEAN

To strengthen its role as a platform for sharing information, perspectives, and experience in environment and development, CCICED hosted, together with the World Wildlife Fund for Nature (WWF), the China-Africa Cooperation Symposium on Building Partnership for Sustainable Development in April this year. Representatives from African diplomatic institutions, Chinese central and local governments, research institutes, and non-governmental organizations (NGOs) were invited to discuss and exchange ideas and experience on seizing opportunities through China-Africa cooperation to promote sustainable development in China and in African countries.

On September 17, CCICED successfully hosted the Conference on *Ecological Civilization and Institutional Innovation for Green Transformation* as a side event of the China-ASEAN Environmental Cooperation Forum during the 11th China-ASEAN Expo in Nanning, Guangxi Province. The Conference reviewed China's achievements in ecological civilization and green transformation and CCICED's policy research findings, and shared experience with ASEAN countries in promoting sustainable development. The event facilitated dialogue and exchange on environment and development between China and ASEAN and laid a solid foundation for further communication and cooperation.

9.2.3 Promoting the adoption and implementation of recommendations through policy demonstrations.

Policy demonstration is a proactive initiative to enhance CCICED's impact at the central and local government levels and as an effective way of piloting implementation of CCICED's policy recommendations at the local level.

9.2.3.1 Significant results of the demonstration project on green supply chain

The Green supply chain demonstration project, the first demonstration project in Phase V, was carried out simultaneously in Shanghai and Tianjin. Since its inception in March 2013, the project has trialed a range of operational policies, systems, standards, and measures in terms of green production, green supply, green procurement, and green consumption chain, and played a significant role in extending green supply chain management concepts nationwide. In particular, the proposal to establish an APEC Cooperation Network on Green Supply Chain, which was put forward on the basis of CCICED demonstration projects on green supply chain, was endorsed by the 22nd APEC Economic Leaders' Declaration. This demonstrates that the concept of green supply chain and CCICED's related policy recommendations have been widely recognized and green supply chain will become a new focus in Asia-Pacific regional cooperation.

9.2.3.2 Substantial progress in the demonstration project on media and public participation

In response to policy recommendations in 2013, a demonstration project on media and public participation was carried out. *Regulations of Hebei Province on Public Participation in Environmental Protection* were formulated to establish legal protection for public participation in environmental protection. With the support of CCICED, and though the positive efforts of local government departments, the draft was revised repeatedly and submitted to the Standing Committee of Hebei Province.

9.2.3.3 Launch of the demonstration project on sustainable consumption

In October this year, CCICED launched a demonstration project on Sustainable Consumption. It will explore institutional development models and evaluation systems for sustainable consumption through a pilot project in one province or one city, and will provide experience and examples for promoting sustainable consumption nationwide.

9.2.4 Disseminating CCICED's achievements through publications and websites

The Proceedings of the 2013 Annual General Meeting (in English and Chinese), *CCICED Annual Policy Report 2013* (in English and Chinese), and *CCICED Annual Report 2013* (in English and Chinese) were published and distributed. A special issue on the 2013 AGM of the magazine *Environment and Sustainable Development* was published. CCICED's official websites in English and Chinese were improved on a continuing basis and were enriched in order to share information in a more timely and "user-friendly" fashion. Annual site visits rose by 24%.

9.2.5 Strengthening the top-level communications design

To implement the requirement of "strengthening top-level design for communications", with the support and assistance of the Secretariat International Support Office (SISO), CCICED developed terms of reference to engage international experts to develop a communications strategy. The strategy will further clarify the objectives and functions of a CCICED communications strategy, and will develop a strategy implementation plan, so that the CCICED communications can proceed effectively in a progressively improved manner.

9.3 FURTHER STRENGTHENING AND IMPROVING OPERATION AND MANAGEMENT

9.3.1 Expanding and deepening partnerships through mutually beneficial cooperation

In 2014, CCICED established strategic partnerships with the Chinese Academy of Governance (CAG), and the China Executive Leadership Academy Pudong (CELAP) following pro-active communication and consultation. CCICED's collaboration with CAG and CELAP, covering teaching materials, distance learning, and seminars, will have a direct impact on the perspectives of medium- and high-level government decision-makers and will promote transformation of local government green development practices.

At the same time, CCICED implemented the strategic cooperation memorandums signed in 2013 with the United Nations Environment Programme (UNEP), World Wide Fund for Nature (WWF), World Resources Institute (WRI), International Institute for Sustainable Development (IISD), and Stockholm Environment Institute (SEI), and carried out effective cooperation in policy research and communications, and personnel exchange and training. CCICED and its partners have benefited mutually through these joint efforts to strengthen CCICED's capacity building, improve the quality of policy research, and expand CCICED's international reach.

In addition, with the support and assistance of donors and partners from Canada, Germany and WRI, 4 overseas training programs were carried out to draw on international experience in such fields as the formulation, implementation, and supervision of environmental policy; renewable energy; sustainable cities; environmental impact assessment; and stakeholder engagement in decision-making on environment and development. These programs encompass exchanges with international think tanks and research institutes on environment and development and the exploration of advanced practices in organizational structures, strategic planning, project management, and performance evaluation. By implementing these programs, CCICED has strengthened capacity in operations and management; this creates conditions for a durable and stable CCICED and its further development. More than 20 people attended the training and exchange activities, including staff from the Secretariat, the Chief Advisor Support Team, and supporting partner institutions.

9.3.2 Chief Advisors and the Chief Advisors Support Team playing a more prominent role

Chief Advisors and the Chief Advisor Support Team play an important advisory role in the policy research process. To strengthen the capacity of the Support Team, CCICED invited Mr. Liu Jian, Director of UNEP International Ecosystem Management Partnership Programme (UNEP-IEMP), to join the Support Team to provide assistance to the Chief Advisors.

The Chief Advisors and the Support Team have provided the following services over the past year:

1. Providing advice to the Secretary General on the formation of task forces and policy research projects; providing academic guidance on the research based on effective communication with the research team; drafting concept papers, terms of reference, and outlines for new policy research projects; convening start-up seminars; monitoring and reviewing implementation programs, strengthening progress tracking and guidance activities; and appraising project achievements;
2. Proposing the themes of AGMs and policy research projects in 2015 and 2016 to support the Bureau and the Secretary General in their consideration of policy research agendas;

3. Holding 5 Chief Advisors and Secretariat Joint Working Meetings and the monthly meetings of Chinese Chief Advisor and the Support Team, to facilitate close coordination between the Chief Advisors and the Secretariat and to ensure the orderly conduct of all activities;
4. Drafting the 2014 Report of Recommendations to the Government of China, the Issues Paper, and the Report on Progress of China's Major Policies Pertaining to Environment and Development and the Impacts of CCICED Policy Recommendations (2013-2014).

The Chief Advisors and the Support Team thereby expedite policy research and ensure the quality of the policy research and policy recommendations.

9.3.3 Strengthening internal management and improving on-going operations.

In 2014, the Secretariat and SISO sought to introduce innovations to ensure effective implementation of the work plan and made necessary improvements to on-going operations. Continued capacity building programs were designed to improve the effectiveness of operation and over-all management.

9.3.3.1 Enhancing policy research quality control and internal management systems

Rules for Implementing the Measures for the Management of Policy Research Projects were drawn up and will be implemented to strengthen and improve policy research project management. With the support and cooperation of the Chief Advisors, policy research projects will be subject to more stringent process-wide management. In the meantime, improvements have been made to the *Procedures for Organizing the Annual General Meeting, Interim Measures for the Management of Economic Issues, Measures for the Office Management of the CCICED Secretariat, and Measures for the Use of the Office Seal of the CCICED Secretariat*. Policy Research Management and Implementation Guidelines for International Co-Chairs and International Members and Guidelines on the Preparation of Task Force and Special Policy Study Reports were up-dated.

9.3.3.2 Highlighting communication and increasing information transparency

To strengthen communication and exchanges with donors and partners, donor consultations during the Chief Advisors and Secretariat Joint Working Meetings and meetings with donors and partners under the auspices of the Secretariat and major partners were held to inform donors and partners in a timely fashion about the work of the Council and future plans. These meetings provided opportunities for donors and partners to comment on and offer advice on major activities, progress and achievements of on-going policy research projects, and future policy research plans.

9.3.3.3 SISO playing an important role

SISO has played an active and important role in such areas as financial and program management, communication and coordination with international Council members and international policy research experts, capacity development, expanding partnerships, and external communications.

APPENDIX

PHASE V (2012-2016)

REPORT ON FUNDING: 2013-2014

INTRODUCTION

Phase V of the China Council for International Cooperation on Environment and Development (CCICED) was inaugurated at the 2012 Annual General Meeting. The 2014 Annual General Meeting marks the third AGM of this Phase. Due to the timing of the AGM and the availability of financial data, this report on funding covers the period from 1 October 2013 to 30 September 2014. For consistency and to facilitate comparison with past years, where multiple currencies are involved they have been converted to US dollars at 30 September 2014 exchange rates. The real US\$ value of a contribution will vary depending on when it was made available and when it was used over time to meet Council expenses.

PHASE V CONTRIBUTIONS

The Council's operation and activities for Phase V are supported financially by the Government of China and a wide range of international donors. Details of donors' contributions or commitments in US\$ equivalent amounts as of September 30, 2014, appear in Table A-1; they total US\$ 22,909,113. The data reflects a sizeable increase in China's contribution to CCICED during Phase V. Table A-1 shows China's actual contribution for 2012-2014. Discussions are underway on additional contributions on the part of existing or new donors/partners.

CORE FUNDING AND DEDICATED FUNDING

As in earlier Phases of the Council's work, funding can be categorized as Core Funding and Dedicated Funding. Generally, Core Funding can be deployed flexibly to finance the full range of the Council's operations, including the Annual General Meetings, Task Forces/Special Policy Studies, Roundtable Meetings, Chief Advisor Group, and the Secretariat, and thus helps ensure that the Council can respond in an unrestricted and prompt manner to changing priorities and circumstances. Dedicated Funds are funds that are provided to the Council for a specific purpose, usually to support the work of a particular Task Force, Special Policy Study, or pilot project. These Dedicated Funds are concentrated on policy studies and help ensure that high-priority policy research activities have access to sufficient resources.

MANAGEMENT OF FUNDS

Most funds are administered by the Council Secretariat (SERI) in Beijing or by the Secretariat International Support Office (SISO) situated at Simon Fraser University in Canada. During the October 2013-September 2014 period, SISO managed the contributions to the Council on the part of Environment Canada and AusAID and may be asked to manage other donors' funds during the remainder of the 2014-2015 fiscal year. In a few instances, donors manage their contributions through their own offices.

During 2013/14, the Secretariat and SISO have continued to apply standard Guidelines on the use and management of funds used to meet international costs related to task forces. These Guidelines establish standards and limits

for reimbursable costs, which were based in turn on the regulations and other conditions set by major donors on the use of their funds, and are designed to ensure consistency across all task forces. In addition, a number of procedures and contract and other templates have been developed to facilitate task force financial management.

EXPENDITURES 1 OCTOBER 2013 – 30 SEPTEMBER 2014

Table A-2 displays expenditures from 1 October 2013 to 30 September 2014 by donor. A number of other costs related to this period were processed through donor financial systems either before or after the October 2013 – September 2014 period and were included in last year's data or will appear in figures reported to the next AGM.

Table A-1. CCICED Phase V – Donor Contributions / Commitments as of September 30 2014

	Donor	Amount in original currency	Amount in USD (See Note 1)	Details
1	China	22,900,000 RMB	3,732,700	Contribution for 2012 - 2014. See Note 2.
2	Canada	7,290,000 CDN	6,504,587	
3	Norway	25,000,000 NOK	3,888,634	
4	Sweden	11,500,000 SEK	1,592,850	Contribution for 2012 - 2015.
5	Germany	2,000,000 EURO	2,524,729	
6	Australia	1,500,000 AUD	1,309,774	
7	Italy	500,000 EURO	631,182	
8	The Netherlands	500,000 EURO	631,182	
9	US EDF	650,000 USD	650,000	
10	Shell (China Limited)	600,000 USD	600,000	
11	Energy Foundation	200,000 USD	200,000	Contribution for 2012.
12	Hong Kong University	1,500,000 HKD	193,172	Contribution for 2012.
13	EU	165,214 EURO	208,560	Contribution for 2013.
14	World Resource Institute	23,717 USD	23,717	Contribution for 2014.
15	UNDP	40,000 USD	40,000	
16	UNEP	20,000USD	20,000	Contribution for 2014.
17	WWF	900,000RMB	146,700	Contribution for 2014.
18	IISD	11,326USD	11,326	Contribution for 2014.
Total in USD			22,909,113	

Note 1: the value in US\$ of a contribution will vary depending on when it was made available and when it was used over time to meet Council expenses. To provide notional amounts based on a consistent exchange rate, exchange rates valid on 30 September 2014 were used.

Note 2: China's contribution data for Phase V will be updated according to actual financial inputs in 2015 and 2016.

Table A-2. Expenditures: CCICED Phase V October 2013 – September 2014
US dollars (1RMB = 0.163US dollar)

Category	China	Canada	Australia	Norway	Sweden	Germany	Italy	Netherlands	EDF	WRI	IISD	UNEP	WWF	Total
1. Task Forces / Special Studies														
TF on Environment and Society (2012-2013)	78,588	42,903		406,581										528,072
TF on Sustainable Consumption (2012-2013)	46,656	11,413		73,408										131,477
TF on Green Transition Process (2013-2014)	65,400	18,577		34,949	68,135									187,061
TF on Institutional Innovation for Environmental Protection (2014)	32,700	53,216	11,478		108,933	139,250								345,577
SPS on Media and Public Participation (2013)		80,855	28,966		29,377									139,198
SPS on Corporate Social Responsibility (2013)		30,021			16,379									46,400
SPS on Good City Models (2014)	65,400	35,211	4,271		33,265	144,980								283,127
SPS on Eco-Environmental Redlining (2014)	65,400	84,259	20,750		33,998									204,407
SPS on Chinese Government Environmental Audit (2014)	65,400	35,517	13,464		14,051									128,432
SPS on Performance Evaluation for Action Plan on Air (2014)	65,400	11,063	2,226		33,265	115,300								227,254
CCICED Project Performance Evaluation	32,700													32,700
Pilot Project : Green Supply Chain														
Subtotal	392,400	473,963	135,471	34,949	817,391	399,530	—	—	100,000	—	—	—	—	100,000
2. Council AGM 2013	78,140	109,088	91,598	189,741		3,270	34,103							505,939
3. Roundtable 2014	39,325	14,534		30,354										84,213
4. Chief Advisor Group	65,400	303,334		114,450										503,184
5. Publicity and Promotion	23,054		5,798	16,530		24,525								11,326
6. CCICED Secretariat (SERI)	424,025		7,240	17,993		103,902	29,927							583,088
7. SISO Administration		473,185												473,185
8. Training	18,642	88,179		146,830										277,368
Total expenditures	1,040,985	1,462,283	227,069	47,987	1,186,459	546,360	131,697	64,030	100,000	23,717	11,326	20,000	146,700	5,008,614

2014

Management and Institutional Innovation in Green Development



CHINA COUNCIL FOR INTERNATIONAL COOPERATION
ON ENVIRONMENT AND DEVELOPMENT

The China Council for International Cooperation on Environment and Development (CCICED) was established in 1992 with the approval of the Chinese government as a high-level advisory body consisting of senior Chinese and international experts. Its mandate is to share international successful experience on environment and development, to conduct research and to provide forward-looking, strategic and early-warning policy recommendations to the Chinese government to support and facilitate China's implementation of sustainable development strategy and to enhance the building of a resource-saving and environmentally friendly society.

CCICED has operated on the basis of five-year phases. Phase 1 (1992–1996) concentrated on exchange and dissemination of international experience and successful policies, and raising the environmental awareness of policy-makers. Phase 2 (1997–2001) focused on environmental pollution, the relationship between environment and economic development, and strengthening environmental legal and regulation systems. Phase 3 (2002–2006) addressed the integration of environmental protection into the holistic planning of China's development. Phase 4 (2007–2011) promoted the establishment of a new relationship between China's economic development and environmental protection and explored a new path for optimizing environmental protection in economic development.

Phase 5 (2012–2016) will seek to promote China's sustainable development and ecological civilization; shift policy research priorities from the relationship between environment and economy to environment and social development, with more emphasis given to regional and global environment as well as the interaction and influence between China and the world; share research findings with the international community; and play a greater role in building a beautiful China and global sustainable development.

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