



**CHINA COUNCIL FOR INTERNATIONAL
COOPERATION ON ENVIRONMENT
AND DEVELOPMENT**

**Policy Research Report on Environment
and Development**

REGIONAL BALANCE AND
GREEN DEVELOPMENT

2012

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

Policy Research Report on Environment and Development

Regional Balance and Green Development 2012

CCICED Policy Research Report on Environment and Development

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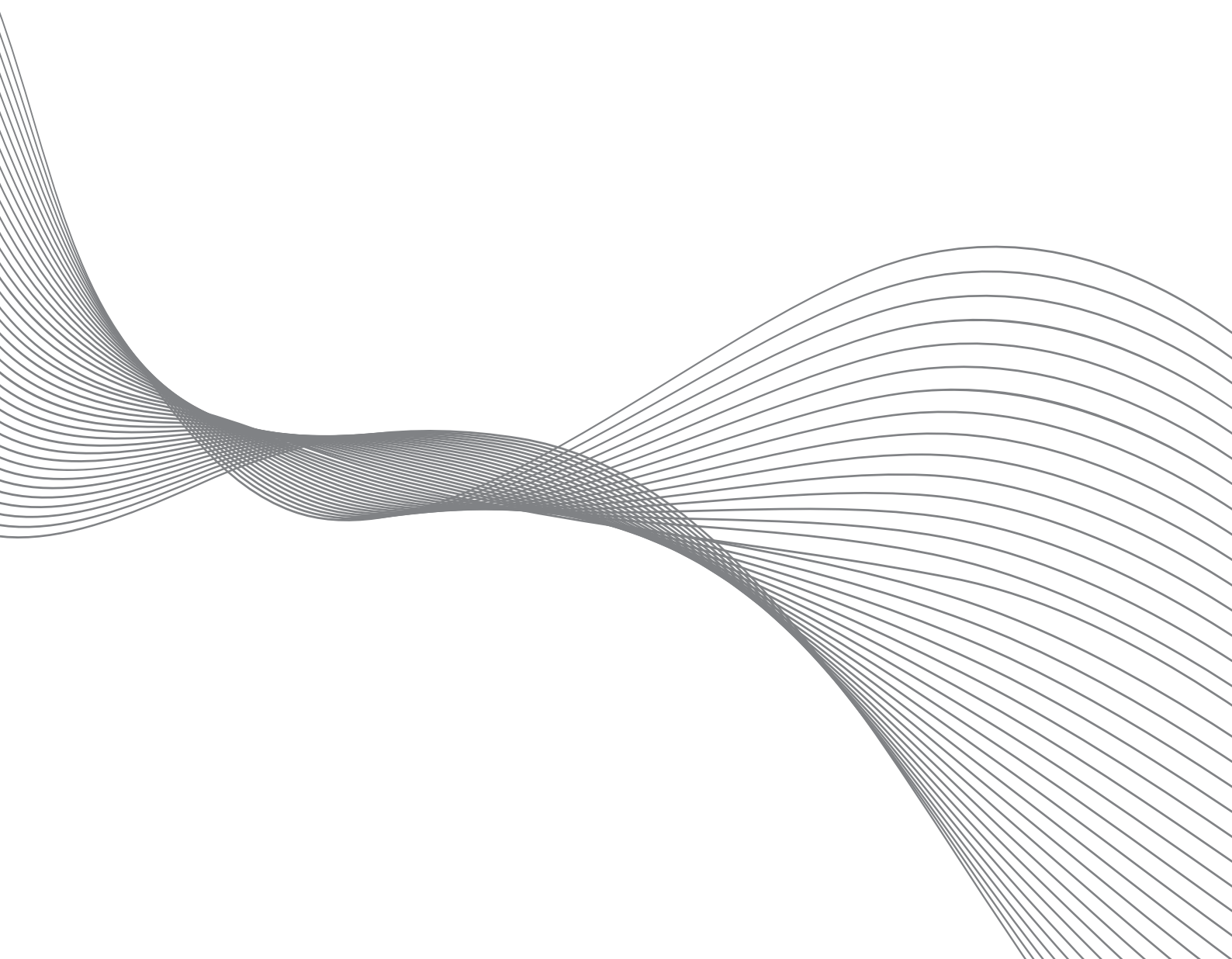
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China Council for International Cooperation on Environment and Development (CCICED)

CCICED Secretariat

No. 5 Houyingfang Hutong

Xicheng District, Beijing, China 100035

Tel: +86-10-82268656, 82268659

Fax: + 86-10-82200535

Website: www.cciced.net

iisd International Institute for Sustainable Development
Institut international du développement durable

International Institute for Sustainable Development (IISD)

Head Office

161 Portage Avenue East, 6th Floor

Winnipeg, Manitoba, Canada R3B 0Y4

Tel: +1 (204) 958-7700

Fax: +1 (204) 958-7710

Website: www.iisd.org

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NOTE ON THIS VOLUME

The year 2012 was significant in China's historic evolution. The 18th National Congress of the Communist Party of China was held and a new central leadership was established; the concept of scientifically based development was identified as a long-term guide, integrating ecological civilization with economic, political, cultural and social aspects as components for modernization; and the nation was presented with a blueprint for green prosperity and a Beautiful China.

Against this backdrop, the China Council for International Cooperation on Environment and Development (CCICED) held its 2012 Annual General Meeting (AGM), on the theme of "Regional Balance and Green Development". The AGM explored an optimized development mode for the Eastern regions; a coordinated path of environment and development for the Western regions, leapfrogging the old development mode of treatment after pollution; reviewed and analyzed China's environment and development for the past 15 years; deliberated on mid- to long-term strategies for pollution mitigation; conducted debates on major oil spill incidents and regional air quality improvement issues; and submitted recommendations on China's scientific, balanced and green development.

Li Keqiang, Vice-premier of the State Council and Chairman for CCICED, delivered a speech at the AGM. He pointed out that China will promote an ecological civilization concept of respecting nature, conforming to nature and protecting nature, and incorporate ecological civilization into China's overall modernization process to realize simultaneously economic development, improved people's livelihood and ecological protection. He emphasized five aspects of future work for China, including transformation of development mode, enhanced benefits for people, expansion of markets, deepening reform, and strengthening cooperation, with ecological protection as a key area for going-out activities. China will continue to strengthen cooperation with other countries and international organizations, and introduce and absorb their advanced thinking, treatment technology, management model and successful experiences.

CCICED Members believe that the direction for China's strategic transformation is green transformation, which is affirmed by the formulation and implementation of China's green "12th Five-Year Plan". The green transformation is not only significant to China; it is also significant to global green development. China's green transformation has reached a crucial stage. In order to reach the strategic green development targets set for 2020, China is still faced with huge pressures and challenges on such issues as unbalanced, uncoordinated and unsustainable development, and increasingly constrained resources.

Members pointed out that China has made progress in reaching consensus on scientifically based development and ecological civilization and trial implementation, but the overall situation is far from satisfactory. One of the major

barriers is system and policy coherence, which is also a barrier to reaching regional balance and coordinated as well as sustainable development. Therefore, the Chinese government must give this high priority.

This policy research report of environment and development has incorporated CCICED 2012 policy research findings, CCICED 2012 recommendations to the Chinese government, and a study of major policy progress (2011-2012) on China's environment and development and the impact of CCICED policy recommendations, for the reference of decision-makers at all levels, experts, scholars and the general public.

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The Chinese and international experts and other individuals who prepared each document are listed below:

Chapter 3

Wang Jirong, Dan Dudek, Wang Jinnan, Wu Shunze, Feng Fei, Zhang Qingjie, Brendan Gillispie, Laurence Tubiana, Mary Gade, Martin Janicke, Norm Brandson, Wan Jun, Ge Chazhong, Jia Jielin, Zhang Feifei, Li Xin, Yu Lei, Zhou Jinsong, Wu Yueying, Zhang Wenjing, Ye Weili, Wen Yuli, Sun Juan, Yan Gang, Jiang Chunlai, ZhongYuezhi, Jin Ling, Dong Zhanfeng, Li Hongxiang, Cao Ying, Li Na, Xu Jiayu, Zeng Siyu, Dong Xin, Zhao Bin, Liu Tonghao, Sun Shuo, Huang Yunqing, Dong Wen, Cheng Shaojie, Liu Linyan, and Bai Hua, Shi Yaodong, Liang Yangchun, Wang Jinzhao, Song Zifeng, Song Jianjun, Li Zhong, Liu Yang, Lu Wei, Yang Hanling, Wang Xin, Zhang Feifei, Liu Jia, Wang Lei and Zhao Xiaolu

Chapter 4

Ding Zhongli, Robyn Kruk, Liu Jiuyuan, Ouyang Zhiyun, Liu Weidong, Zhang Huiyuan, Zhou Hongchun, Deng Xiangzheng, Xuemei Bai, Stein Hansen, Derek Thompson, Su Ming, Han Fengqing, Shen Lei, Zhen Lin, Liu Hui, Shao Quanqing, Zhuang Xuliang, Zheng Hua, Liu Guihuan, Hao Haiguang, Jiang Qun'ou, Zhong Haiyue, Cai Suihua, Deng Xiangzheng and Wang Peishen.

Chapter 5

Sarah Liao, Peter Hills, Tang Xiaoyan, Andrew Gouldson, Zhang Shiqiu, Luan Shengji, Lu Shuyu, Wu Chengjian, Yu Xiaoxuan, Zhang Zhentian, Ren Hongyan, Darwin Leung, Dorcas Yeung, Patrick Yan, Joyce Chow, Regina Lo, Sianna Yiu, Zhang Hui, Song Yingwei, Winnie Law and Wei Yongjie.

Chapter 6

Lim Haw Kuang, Shi Peijun, Olof Soren Linden, Yu Junbao, Liu Shuguang, Du Qun, Peter K. Velez, Per W. Schive, Gu Wei, Xu Yingjun, Guo Jie, Zhang Yuqing and Xu Yingjun.

Chapter 7

Hao Jiming, Michael Walsh, Yang Jintian, He Kebin, Tang Dagang, Meinolf Drüeke, Catherine Witherspoon, Markus Amann, Liu Huan, Li Pei, Fu Qingyan, Wang Shuxiao, Lei Yu, Ning Miao, Liu Huan, Lu Xuyang, Yan Gang.

CHAPTER 1

POLICY RECOMMENDATIONS FROM THE 2012 AGM

The first Annual General Meeting of CCICED Phase V was held in Beijing during December 12-14, 2012, with the theme of *Regional Balance and Green Development*.

The CCICED members observed that the 18th CPC Congress Meeting provided a clear roadmap towards green prosperity and a 'Beautiful China'. At the 18th CPC Congress Meeting, it was accepted that the Government of China put Scientific Development strategy as a highest guiding principle for the modernization of China, and listed Ecological Civilization, economic, political, social development and cultural construction as the five components of modernization. The government aims at major progress in resource saving and in constructing an environmental-friendly society by 2020 when an overall well-off society target is to be achieved. CCICED welcomes this coherent approach, which promises a more rapid and substantive shift towards a new era in the relationship between people and the environment.

CCICED members believe that balanced and green development is essential for China's scientific development and for construction of an ecological civilization. Members believe that China's green transformation is currently at a critical stage. There remain unprecedented challenges and pressures for achieving the objectives of green development. There are still prominent problems of "unbalanced, uncoordinated and unsustainable" development, with intensifying resource and environmental constraints. These issues are reflected sectorally, regionally, and even within regions.

Although China has made great efforts in the past decade to promote regional development and has achieved impressive progress, some problems and conflicts continue to intensify: large regional development gaps, especially in providing basic public services; imbalances of regional environment and economic benefit distribution, and a lack of coordination among policies related to population, economy, resources and environment. Effective coordination and cooperation mechanisms for integrated ecological system management, air and water shed pollution control are missing among regions, provinces and cities. And there is evidence of new types of environmental issues emerging, such as those related to PM_{2.5}, and concerns about potentially unsustainable patterns of domestic consumption especially in richer parts of the country.

CCICED members have stressed the importance of addressing poverty alleviation while preserving fragile ecosystems, as a significant proportion of poor people live in these areas. There is a reliance on an extensive development mode in ecologically-fragile and lesser-developed regions, leading to potential conflicts between future environmental and development trends.

The members have concluded that, with further economic development, upgrading of industries and technologies as well as enhanced environmental protection efforts, the conflicts and constraints between resource use, economic development, and environmental protection could lessen. However, impacts from a "catching up" and "leap-frog" development mode in central and western regions with fragile ecological environments, together with a gradual transfer of polluting industries and other factors, may make the environment and development relationship more difficult.

Overall, the double pressure of environmental pollution and ecological degradation may threaten the foundation of green development in China. A key constraint is the institutional and policy-enabling environment, which today is a bottleneck for achieving balanced, and sustainable regional development. This is a key issue that the new central government must resolve.

Based on the discussions during AGM and findings of relevant studies, CCICED proposes the following five major policy recommendations to the Government of China:

1.1 RECOMMENDATION 1: Enhance Institutional and Policy Innovation as Well as Enforcement in order To Promote Practical Implementation of Ecological Civilization

China's government has recognized and committed to deepen reforms in key sectors, eliminate ideological constraints and institutional/policy flaws for scientific development, and clearly has set out some of the tasks of institutional innovation for creating an ecological civilization. It is necessary to speed up the establishment of strategies, policies, institutions and mechanisms that are compatible with an ecological civilization, and to conduct comprehensive pilot demonstrations for practical implementation. Our four detailed recommendations are to:

1.1.1 Define and develop mid- and long-term plans for an ecological civilization at the macro level.

Based on the reform and opening-up policies of the past 30 years and the practice of scientific development in the recent decade, there should be little doubt that China can and will achieve the target of developing an overall moderately well-off society by 2020, with significant progress in resource efficiency and environmental protection. However, according to China's target to become a wealthy, democratic, civilized, harmonious and modernized country by the mid of this century, the next 30 years beyond 2020 is of particular importance. Therefore, China's government should prepare for the future by initiating study of environment and development trends and characteristics beyond 2020, and systematically designing a mid- and long-term plan identifying priority sectors and key tasks ahead. China needs long-term targets to guide near-term policies.

1.1.2 Reform and establish institutional systems capable of creating and supporting an ecological civilization with great political commitment and drawing upon the views of the Chinese people.

Ecological civilization construction and green development are new tasks. Reform is also a complex system issue that involves various government agencies, social sectors and regions, and requires coordination of interests of various stakeholders. Ecological civilization construction must not only focus on ecosystem and environmental protection, but also put forward ecologically friendly development principles for other social sectors. Therefore:

First, a Commission for Ecological Civilization to oversee the strategy, planning and institutional setup at the top level as well as to coordinate implementation details, should be established at the central level. The Commission should ensure that ecological civilization is indeed incorporated into economic, political, cultural and social development.

Secondly, environmental protection should be the underpinning for an ecological civilization, and environmental authorities should be the leader, supporter and key practitioner in a national ecological civilization coordination mechanism. Establishment of an integrated and comprehensive environmental authority for ecological and environmental protection with integrated functions and high efficiency could be considered.

Thirdly, the relationship between central and local government should be coordinated in terms of ecological civilization construction within the framework of overall social and economic development, with authorities, administrative responsibilities and financial accountabilities clearly defined.

1.1.3 Promote integrated institutional innovation towards the direction of green and ecological transformation.

To ensure that the concept of ecological civilization is incorporated into various aspects—and the whole process—of economic, political, cultural and social development, integrated institutional and policy innovation at various levels and within sectors is required, with greater attention to the levels of risk present in various development initiatives. The specific directions of ecological transformation of institutions and policies are:

- Politically, establish ecological civilization-oriented government performance assessments and other evaluation and accountability systems as a lever to ensure proper motivation and governance structure.
- Economically, put forward requirements on economic spatial layouts and structures. Require resource/energy efficiency and environmental performance in line with ecological and environmental principles to promote the transformation of production modes.
- Culturally, promote values and norms supporting ecological civilization and enhance awareness and action on the part of the public.
- Socially, advocate for green consumption patterns and direct social activities and promote a change of life styles compatible with an ecological civilization.
- Ecologically, put ecosystem and environmental protection as the main body of ecological civilization construction with provision of sound eco-services and products, and improve protection of biodiversity through greater attention to conservation and management of natural habitats on land, in fresh waters, and in marine areas and sensitive coastal habitats.

1.1.4 Establish ecological civilization indicators, and encourage wider public participation

Ecological civilization development targets, indicators and approaches should be established, taking into account the differences between main function zones and regions. In addition, a government official examination and evaluation system supported by appropriate indicators should be established and an accountability system should be implemented, taking into account differences between regions and levels.

It is also important to clearly define the respective roles and responsibilities of government, enterprises and civil societies in ecological civilization. Government should play a leading role in designing, guiding and exemplifying ecological civilization. Enterprises should assume higher levels of environmental and social responsibilities and improve their environmental performance. It is also important to strengthen ecological civilization related information disclosure, promote effective and orderly public and media participation, and achieve a collective force in ecological civilization.

1.1.5 Promote comprehensive pilot demonstrations of ecological civilization

Given the complexity and difficulty of ecological civilization construction and the regional differences, it is necessary to carry out comprehensive pilot demonstrations of elements of ecological civilization to form an overall framework for a national promotion of ecological civilization construction. Ecological civilization pilot projects should take into account regional differences.

Large numbers of pilot activities have been conducted at provincial, municipal, county, village and industrial park levels by various sectors and departments in China. It is necessary to draw on and consolidate these pilot activities, and to develop uniform standards and a specific indicator system supporting the construction of an ecological civilization.

1.2 RECOMMENDATION 2: Establish a Balanced and Green Regional Development Strategy

Balanced regional development is a difficult topic for all countries. Closing the socio-economic development gaps is one key side of the challenge, while securing sustainable development is the other. China should grasp the historical opportunities of scientific development and ecological civilization construction to meet these challenges mainly through implementation of green development.

Our detailed recommendations are to:

1.2.1 Establish general national principles and strategy for regional development to form a broader framework of regional green development.

- 1) From the perspectives of its industrialization stage, urbanization level, economic capacity, and public demand for a better environment, eastern China has the basic conditions to be the first region to achieve a green transformation. In the central and western regions, conflicts between environmental and socio-economic development are still likely to be present for some time to come. Therefore, these regions must be treated as a priority for enhanced support, but in differentiated ways, in order to avoid continuation of the old path of economic development at the cost of a fragile environment. Furthermore, the effort should lead to new approaches of national, and, ultimately, international significance for sustainable development.
- 2) To improve the speed and quality of such a transformation, develop and implement a green strategy or blueprint for the western region, covering infrastructure construction, human capital investment, urbanization, industrialization, pollution control and eco-services provision. Increase investment for projects that can improve the human capital in western region, enhance regional infrastructure construction and eco-services provision, and reduce poverty.
- 3) Based on the current Main Function Zoning Plan, various development objectives, industrial development directions and spatial layout should be more clearly aligned to specific and detailed functional zoning administrative areas in order to improve operability of this zoning. At present there is confusion since the zoning is done at a coarse-grained level. For instance, develop differentiated industrial policies based on fine-grained function zones and resource carrying capacities; and develop land and population policies according to different function zones and development objectives. Then formulate investment policies according to sectoral arrangements within the detailed functional zones, and improve the fiscal system for providing public services and protecting public goods according to local ecological and social conditions. To enforce mandatory protection, define ecological red lines for important function zones, nature reserves, sensitive land and marine areas, and other ecologically fragile areas.
- 4) The development of eastern China heavily relies on the energy and resources supply from the western part of the country. The payment for ecological services from the east at present is far from sufficient to cover the ecological deterioration suffered by the west. For central and western regions, establish and improve a fiscal transfer system to guide and support green transformation, and implement a payment system for ecosystem service payments from eastern areas to central and western regions.

- 5) Adopt the principle of “priority for resource- and energy-saving and environmental protection” in the eastern region. Develop and follow very strict environmental quality standards and related emission targets, such as imposing strict pollutant discharge standards for power intensive and high pollution industries. Enhance technological innovation and management capacities that will increase the competitiveness of green economy components and their products. Fully implement a green tax system covering environmental and resource taxes or other market-based approaches to promote behavioral change of enterprises and consumers. Increase corporate social responsibility awareness, promote green corporate governance mechanisms, and establish green enterprise alliance systems and implement green supply chain management strategies for improved voluntary measures involving business, government and end users of products and services. Seek sustainable consumption through activities such as environmental awareness raising, labeling and information sharing; strengthen public monitoring, with much improved government information disclosure and public participation concerning development decisions, and insist on more adequate public environmental information disclosure by enterprises, financial institutions and other bodies, especially those operating at municipal and provincial levels.

1.2.2 Develop sustainable urbanization plans, and establish urbanization modes adaptive to differentiated regional characteristics.

Exploring sustainable urbanization modes is one of the major challenges for eastern, central and western regions in their process of sustainable development. Differentiated sustainable urbanization plans should be developed for each of the regions.

The eastern region should aim to develop city clusters with international competitiveness, refine the service functions of super-large and large cities, improve the urban habitat environment, promote green transformation of super-large and large cities and create green development patterns within the small and medium-sized cities, and pay much greater attention to the construction of integrated and sustainable urban infrastructure.

Central and western regions should foster eco-cities, strengthen industrial functions of small and medium cities, enhance public service and functioning of small towns, prioritize the development of medium and small cities with advantageous locations and strong resource/environment carrying capacities, and actively tap the green development potential of current cities.

1.2.3 Strengthen policy enforcement and establish an improved coordination and cooperation mechanism for regional green development and attainment of ecological civilization objectives.

- 1) China should establish a regional coordination mechanism and improve the capacity of central and western region governments, particularly county governments, to secure ecological civilization and green development. Together with direct investments from the government, a green development fund should be established to encourage green industries, improve the stability of ecosystems of regional concern, and support ecological construction projects. In the relatively developed eastern region, a regional environmental pollution control fund can be established to conduct environmental health risk assessment, provide compensation and resettlement of affected people, remediate the brown fields, and provide funding for pollution control.
- 2) Implement ecological compensation measures. A compensation fund should be determined according to the ecological function zoning in the eastern, central and western China. Eco-compensation standards need to be established based upon specific ecosystem service requirements. Fair compensation should be paid to rural

residents that commit to long-term ecosystem protection. Meanwhile, extend the “polluter pay” principle to the resources and mineral development fields on a much more extensive and well-enforced basis.

- 3) Tighten the environmental access permission system to prevent pollution transfer on the part of industry migration or other development initiatives such as those related to tourism or new settlements. Implement a strict environmental access permission mechanism, adopt stricter emission standards and pollution control technology requirement to prevent new pollution sources and migration of pollution industries towards central and western regions. Develop regional environmental performance evaluation and assessment methods with enhanced public participation, define indicators, and determine the green development indicators according to main function zoning and regional characteristics. Monitor and evaluate the implementation by enterprises and local governments and enhance the enforcement. Regularly disclose the enterprise and government authorities that are not in compliance with EIA requirements.

1.3 RECOMMENDATION 3: Strengthen Joint Control of Air Pollution to Improve Regional Air Quality

Pollution by PM_{2.5} and ozone is becoming a prominent problem that poses serious threats to public health. In recent years, the PM_{2.5} concentration in Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta remains at a high level. The haze days occur for 30-50% of a year, and there are ever widening gaps between the officially announced air quality and public perception. Regional air pollution has become an environmental problem that needs to be dealt with urgently, since no one city or even province can adequately address the issue on its own. Improving regional environmental quality requires regional joint prevention and control, coordinated control of multi-pollutants and multi-sources, institutional innovation of regional environmental management and strengthening of management capacity. Our four detailed recommendations are to:

1.3.1 Integrate regional environmental capacity, optimize economic structure and layout, and establish new regional joint control mechanism.

- 1) Based on factors such as inter-city pollution transmission pattern and air quality status of cities with different environmental carrying capacities, key control areas that have significant contributions to regional air quality should be identified, especially Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta areas. These are areas where there are serious problems of regional and compound air pollution. In these areas air quality monitoring should be strengthened, and regional environmental information sharing platform, joint review/approval system for major projects, and regional emergency response mechanisms should be established. There should be strict controls on new construction projects that are likely to introduce additional air pollutants into areas where planned targets are not being achieved at present, and where air quality is seriously deteriorating. Mechanisms that can help improve regional air quality, such as emissions trading systems, should actively be promoted.
- 2) Deepen industrial pollution control, advance SO₂ emission reduction, establish industrial NO_x control system focusing on power and cement sectors, deepen industrial smog pollution control, and enhance VOCs pollution control from typical sectors and sources. Multiple pollution control is essential if good air quality is to be secured.
- 3) A systematic environmental and resource review of domestic automobile development plan should be conducted. Comprehensively strengthen mobile sources control, implement new vehicle emission standards at proper time to reduce the vehicle emission intensity, and adopt total vehicle quantity control in cities with serious vehicle emission pollution. Develop new sustainable urban transport system. It is necessary to further define

low-emission zones and zero-emission zones in the major cities under a regional air pollution control system, and develop management measures accordingly. A total vehicle volume control policy should be explored in mega cities with population of more than 10 million. Better air quality modeling and better emission inventories are required.

- 4) Promote multiple high quality energy sources such as natural gas, low-sulfur diesel, LPG and electricity to replace coal. Regional coal consumption growth should be strictly controlled. There should be a continuous increase in the percentage of high-pollution fuel forbidden zones in urban built-up areas.

1.3.2 Revise relevant laws and regulations to provide legitimate guarantees for regional air pollution control.

The existing Air Pollution Control Law cannot adequately address air pollution control under the current situation. It needs to be revised to provide legitimate support to relevant policy measures for new types of pollutants. First, $PM_{2.5}$ and ozone should be treated as the new core need of air pollution control. Besides the further deepening of industrial pollution control, focus should also be put on pollution control of non-point sources of smog such as small and medium boilers, dust, restaurant emissions, decoration painting, small engines, as well as mobile sources such as vehicles. Also pay attention to non-vehicle mobile sources, and include emissions from ship, plane, train and off-road equipment into the coverage of air pollution control laws. Second, keep ambient air quality improvement as the key objective of air environmental management, and clarify the responsibilities and obligations of local government for the compliance of air quality. Third, strengthen the punishment of violators with a view to make non-compliance more expensive than compliance.

1.3.3 Strengthen pollution control and implement multiple-pollutant synergic control

Establish total amount control method with improvement of air quality as core objective, implement synergic emission reduction of multiple pollutants such as SO_2 , CO_2 , NO_x , particulate matter and VOCs, etc., and coordinate emission reduction and energy conservation policies. Deepen industrial pollution control, advance SO_2 emission reduction, establish industrial NO_x control systems focusing on power and cement sectors, deepen industrial smog pollution control, and enhance VOCs pollution from typical sectors.

1.3.4 Increase investment and strengthen science and technology development, and implement a strong national clean air action plan as soon as possible.

It is urgent to establish a special fund at the central government level for air pollution control, enhance the support of science and technology, and implement a national clean air action plan. Establish investment mechanism with diversified investors and modes to direct and encourage active investment from local governments and enterprises on air pollution control. Carry out special studies on generation mechanisms, source analysis and control approaches for air pollution in different regions.

1.4 RECOMMENDATION 4: Strengthen Marine Environmental Protection and Construct a More Balanced Approach to Becoming a Marine Power

While China's marine economic development is accelerating, there has been intensive pressure on the marine environment, with the most critical example being the Bohai Sea. Specifically, with increasing large-scale offshore oil exploitations, the risk of marine oil spill is rising and marine oil spill incidents occur frequently. This problem is exacerbated since there are serious problems of contaminants entering the ocean from the rivers, and also across-the-board, large-scale, rapid-paced land reclamation activities. Also other sectors are expanding, for example aquaculture and tourism, leading to conflicts in use of the marine environment. There is an urgent need to reform the current marine environmental management mechanism, coordinate marine resource development and environment protection, and achieve integrated marine-land economic development and environmental protection. In order to improve marine resource development capability, and to more effectively protect the marine ecological environment, and to approach the strategic goal of China becoming a sustainable marine economy and power, our four detailed recommendations are to:

1.4.1 Speed up the formulation of a robust national marine development and environmental protection plan.

This plan should be based on existing land and marine function zoning plans and national-level development strategies of coastal governments, cover all the coastal zones, and identify fundamental policies and strategies for handling the relations between the marine development and marine environment protection. The plan should integrate the overall planning of offshore areas with plans for coastal provinces, and establish marine economy and environmental protection areas in the Yellow Sea and the Bohai Sea, the East China Sea and the South China Sea.

Based on the integration of industrial distribution planning in existing land and marine functional areas, one should formulate and revise the coast layout planning of key marine industries and major sea-related industries (especially, offshore oil and natural gas, coastal nuclear power, coastal or port chemical industry, coastal or port irons and steels, coastal real estates), pay special attention to marine ecosystems that preserve high ecological value, but are highly vulnerable to human activities, and incorporate such planning into overall coastal and marine spatial plans. China should also focus on international relationships within marine development and protection, and participate and take the lead in cross-border international and regional cooperation.

1.4.2 Strengthen legislation, law enforcement and governance mechanisms of marine environment management.

The institutional and regulation system for offshore oil field development approval and supervision should be improved with emphasis on environmental assessment as articulated in the *Environmental Impact Assessment Law* and *Regulation on Environmental Impact Assessment of Planning*. There is a need to improve the information disclosure system, establish a unified mechanism of receiving and publishing information, strengthen enforcement of the *Regulations on Open Government Information*, and ensure the public's right to know. It is important to establish and improve the cost bearing system for emergency responses, explicitly identifying the party/parties responsible for the accident and the costs of emergency responses.

The following actions should be taken. Clearly define the liability of enterprises for preparing emergency response plans. Revise relevant laws based on lessons learned from international experience—require the operator and oil company to take the primary responsibility to meet any emergency. The government's reaction to emergency

should be supplemental. Develop a more complete set of applicable specifications to enterprises for access permission, operation, and for disaster response. Strengthen corporate environment awareness and responsibilities. Corporate environmental protection capacity will be considered as an essential condition for approval of enterprises' involvement in any activity by marine development. Local maritime courts and procuratorates should be instructed to clearly address enterprises' legal responsibilities regarding pollution and damages of marine environment arising from their operation. This should discourage enterprises taking any chances. Enhance the prevention of environmental risk from marine-related enterprises, clearly regulate enterprises or other beneficiaries from overdevelopment and illegal development activities, and set in place other sector-specific mechanisms to avoid marine accidents.

Furthermore, there is a need to strengthen the enforcement and supervision capacity of the marine administration authorities, form a unified offshore law enforcement team, establish China's marine environment administrative supervision and law enforcement system, and strengthen the supervision and enforcement of the environment impact assessment system for marine development activities.

1.4.3 Establish national marine emergency response planning system for major environmental incidents.

Based on *National Marine Functional Zoning (2011-2020)*, existing *Emergency Response Plan for Oil Spill in Offshore Oil Exploration and Development* and *Emergency Response Plan for Accidents and Disasters in Offshore Oil and Natural Gas Activities* should be consolidated, and a National Emergency Response Plan for Major Marine Environmental Incidents should be established by joint effort of relevant departments. The system should formulate special emergency response plans and on-site emergency handling plans for various levels and types of potential marine environmental accidents from all risk sources, and define the responsibilities of relevant departments and personnel for various stages of accidents (i.e., before, at the beginning of, during, and after, accidents).

1.4.4 Strengthen the capacity building of science and technology in marine environmental management.

China should require oil and gas operators to invest in regional and national funds for marine environmental research with the aim of strengthening science and technology research on marine environmental management. This will support overall strategic planning of coastal zones and marine spaces, increase capacity for ocean and coastal emergency responses, help improve marine environmental management laws and regulations, developing marine environmental monitoring and early-warning systems, and improve marine ecological loss evaluations and remediation efforts.

1.5 RECOMMENDATION 5: Establish Long-Term Mechanisms With Environmental Quality Improvement and Risk Prevention as Objectives to Promote Strategic Transformation of Environmental Management and Human Health Protection

It should be clearly articulated in all environmental laws, regulations, and any documents that comprise China's National Environmental Management System that the ultimate goal of the environmental system is to protect public health and the ecosystem. To achieve this goal, ambient environmental quality standards should be designed based on the scientific understanding of the pollutants' effects on human health and ecosystems and in cooperation with implementing agencies. These ambient environmental quality standards should be assessed, revised, and updated so

that they are in line with the latest scientific findings. Environmental monitoring standards and regulations should be developed to accurately measure ambient conditions against the quality standards.

Our nine detailed recommendations are to:

1.5.1 Link emissions control targets directly with achieving specific environmental goals.

A clear distinction must be made between ambient standards designed to maintain pollutant concentrations at environmentally protective levels, and national or regional pollution caps designed to limit total pollutant loadings and control trans-boundary flows. The two policies must be integrated to avoid antagonistic effects especially if market-based implementation policies are applied. Implementation policies should be established that link the interim targets and the improvement of air and water quality.

It is recommended that MEP organize comprehensive research on the environmental carrying capacity of key national development zones and preferred development zones and on the assimilative capacity of river basins. In addition, efforts should be spent in developing sectoral caps for the major industrial source sectors such as electricity, cement, iron and steel and automobile industries.

1.5.2 Develop, maintain and update scientifically sound pollution inventories.

Inventories should be established for air and water pollution sources as well as contaminated sites and sites where chemicals and hazardous substances are located as feed stocks or products. A science-based inventory will enable China to establish criteria for prioritizing and cleaning up the worst sites.

1.5.3 Strengthen institutional capacity at all levels.

At the central level, it is important to integrate water management authorities which are currently scattered among over 10 ministries. MEP should be designated as the lead coordinating agency, with support from the other ministries.

At the regional level, it is recommended to expand the six MEP's Regional Environmental Supervision Centers into Regional Environmental Quality Management Centers.

At the local level, governments should develop and publish mid- and long-term strategies on environmental quality and emissions reduction control, as well as a detailed implementation plan to achieve the ambient environmental standards. Sanctions should be applied in case local governments fail to meet established requirements. Meeting these targets should become the key components of the environmental performance contracts signed by the local government officials.

1.5.4 Improve coordination between ambient air quality standards, vehicle emissions standards and fuel standards.

Continuous efforts should be made to increase incentives for low emitting vehicles and disincentives for high emitting vehicles. The air quality impacts of transportation infrastructure need to be evaluated as part of the planning and permitting process. Authority should be conferred to MEP for fuel quality standards development.

1.5.5 Strictly enforce Environmental Impact Assessment and “Three-Simultaneous” requirements.

Environmental impact assessments (EIA) should be conducted on major government policies, and social and economic development plans. Independent analysis and verification must be carried out to ensure their scientific validity. The public should be given full access to the complete text of EIA reports and be allowed ample time for comments. The construction of projects should not begin until all EIA requirements have been satisfied and a permit issued. In addition, it is necessary to revise the existing legal requirements.

1.5.6 Improve permitting system.

Connections must be established between permit issuance and total emissions control targets to ensure attainment of environmental quality standards. New sources discharging pollutants covered by total emission control requirements must offset their added incremental discharges.

Enterprises should not be allowed to start up or continue to operate without pollutant discharge permits, and be supported by monitoring, reporting and inspection requirements as established by the government.

1.5.7 Increase penalties for non-compliance and enhance monitoring and inspections.

The responsible party should pay the costs of environmental damage to people or property, or economic losses. Compensation should also cover the costs of reasonable measures taken to prevent or limit environmental damage and for clean-up and restoration of the environment to its previous state.

China must first establish stringent requirements for monitoring (including electronic monitoring), reporting and certification. This should include specific regulations governing quality control and quality assurance.

1.5.8 Improve environmental information disclosure and public participation.

Environmental information should be made available to the public in a timely and accurate manner. Data on air quality in key cities will be disclosed in form of forecast and daily report. Online monitoring data on the quality of surface water should be disclosed every four hours. Data on section water quality in key river basins will be disclosed weekly. Lists of key projects subject to national pollution reduction mandates should be disclosed. Sensitive information such as heavy metal and landfill pollution should be published and followed up in a timely manner. Information on large environmental incidents, as well as the treatment and follow-up measures, should be released in a timely manner. Name lists of key emitters and emitters who violate laws should be disclosed.

1.5.9 Promote the use of market mechanisms.

China needs to increase the use of market-based economic incentive tools such as taxes, emissions trading, and natural resource pricing and establish supporting policies, institutions, and guidance for each of the market-based policy alternatives under consideration. Complimentary laws and regulations and public participation must also be in place. Furthermore, setting up a Clean Production Fund will help provide incentives for existing and new enterprises to adopt clean production methods.

CHAPTER 2 REGIONALLY BALANCED AND GREEN DEVELOPMENT¹

2.1 INTRODUCTION

China seeks to build a society where all citizens will be moderately well-off by 2020. A society in which people and nature can live in harmony. And a nation that will proudly take its place as a key player on the world stage—through its overseas direct investment, its success as a trading and manufacturing nation, and through its contributions to solving global problems including climate change, poverty elimination and sustainable ocean use.

As Premier Wen Jiabao has noted, China still faces a situation of “unbalanced, uncoordinated and unsustainable development.”² Recent analyses have tried to identify how China might turn the situation around by 2030, a time frame of only 17 years from now.³ The economic development results achieved over the past three decades, show that positive changes can be made in remarkably quick order within China. However it is inconceivable that further transformative changes can be accomplished without greater attention to and investment in a new relationship between environment and development. This new relationship will be one that is unprecedented among the world’s nations.

The long-term aspiration has been for China to become an *Ecological Civilization*, a view strengthened at the 18th CPC Congress in November 2012 where this concept, renamed *Ecological Progress*, was elevated to the same level as Politics, Economy, Society and Culture, as one of the main drivers of the whole society.

The congress called for making great efforts to promote ecological progress. We should raise our ecological awareness of the need to respect, accommodate to and protect nature, incorporate ecological progress into all aspects and the whole process of advancing economic, political, cultural, and social progress, intensify protection of the ecosystem and the environment, work hard to build a beautiful country, and achieve lasting and sustainable development of the Chinese nation.⁴

At Rio+20 Premier Wen called for “a green & prosperous world” in his address.

2.1.1 Seeking “Balanced, Coordinated and Sustainable Development”

CCICED understands the urgency of today’s environment and development situation in China and Asia, in other regions and globally. Thus, as CCICED enters Phase V of its work (2012-2016), the Council will need to consider topics on balanced regional development, coordination needs, and improved policies for sustainable development

1 This report is the 11th in a series of CCICED Issues Papers produced since 2002. The report has been prepared by the CCICED Chief Advisors, Dr. Arthur J. Hanson and Prof. Shen Guofang with inputs from members of the Chief Advisors Group and especially from Dr. Zhang Shiqiu, who prepared a major analytical report on China’s Regional Development as the basis for sections of this Issues Paper. The views in this Issues Paper are those of the authors. This draft paper may be modified to take into account additional material and comments arising from the CCICED AGM.

2 Speech by Premier Wen Jiabao at Stockholm +40 Meeting, Stockholm, Sweden. April 2012.

3 See for example World Bank and Development Research Center of the State Council. 2012. *China 2030. Building a Modern, Harmonious, and Creative High-Income Society*. 448 pp., including Chapter 5. *Seizing the Opportunity of Green Development*; Asian Development Bank. 2012. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. ADB, Manila. 199 pp.

4 Xinhua. 14 November 2012. *Full Text of Resolution on CPC Central Committee Report*. http://news.xinhuanet.com/english/special/18cpcnc/2012-11/14/c_131973742.htm

implementation within China. Furthermore, CCICED also needs to take into account China's international situation on environment and development. The latter point was underscored at Rio+20 in June 2012, where it was very apparent that China efforts will help to determine the success of future international efforts on green growth, green economy and green development.⁵ Domestically, it is the right time for strengthened policies and action for broadening the scope and quality of development, given that the decadal renewal of government is underway.

Fortunately much of the necessary groundwork is in place. Especially with the 12th Five Year Plan (12th FYP), which takes a more sustainable scientific development approach aimed at reducing alarming development gaps among the regions; addresses difficult and worsening pollution issues such as NO_x, and soil pollution; and places greater emphasis on quality of life in both cities and countryside. But the fundamental issue of uncoordinated development remains at the heart of many difficulties faced in China.

The economic juggernaut model of development in Eastern China is gradually shifting to other regions and in particular to the very large Western China Region, raising the spectre of repeating past patterns of high pollution and profligate energy use in new development locations, or even repeating past bad domestic practices in some locations abroad where China private sector investors are active. Now instead of major provinces in Eastern China leading GDP growth, it is provinces in the west. It is not certain that these western provinces and autonomous regions will be able to meet energy and pollution targets.

All parts of China require a new model of development that will be “greener”, will place greater emphasis on domestic consumption, and will set priorities that “put people first.” Of course there can be no “one size fits all” approach. These are dilemmas of balancing regional development, and in designing differentiated regulatory and incentive systems that are also fair and workable.

2.1.2 CCICED Theme – 2012 AGM and Phase V

At this year's AGM, CCICED examines Regional Balance and Green Development. The choice of wording is very deliberate. One can consider a range of unbalanced development situations in regions of China at the present time, but ultimately all must be transformed into environmentally, socially and economically sustainable forms of development. This will involve many different kinds of actions in both rich and poorer provinces and regions, in the interactions among regions, for example in transfer payments such as eco-compensation, and in new regulatory frameworks to take into account integrated management needs such as for China's marine and coastal regions.

Green Development has taken on greater significance globally since Rio+20 where there was extensive discussions on Green Growth, a concept that gained political traction after the 2008 financial crisis and through efforts particularly on the part of OECD, and on Green Economy, which has been explored in great detail by UNEP, and well-embraced by countries during Rio+20. Green Development is a term favored in China. Indeed, China is as advanced as any other leading nation in its understanding the value of this concept and related approaches such as Low Carbon Economy and Circular Economy. However, serious implementation gaps exist for all countries, including China, for mainstreaming these good ideas into decision-making nationally and locally.

It has been proposed that Green Development be taken as an overall theme for CCICED's Phase V. Thus it is appropriate for CCICED to explore how Green Development can be more effectively implemented in the various regions of China—in the immediate future and over the longer-term, certainly for the critical decade of 2020-2030. The 12th FYP is a first big step towards Green Development in China.

⁵ China's overall sustainable progress and its vision for the future have been summarized in its report to Rio+20. *The People's Republic of China National Report on Sustainable Development*. Beijing 2012. 100 pp.

2.1.3 2012 CCICED studies

Five CCICED study teams related to regional and green development will report their recommendations during the 2012 AGM. Their efforts are outlined below:

12th Five Year Plan Task Force (12th FYP TF) examined how to achieve mandatory pollution targets of the Plan, with regionally differentiated regulatory needs. The TF also proposed possible environmental protection needs for future Five Year Plan periods, especially for the 13th, 14th and 15th FYPs. This longer-term view underscores the time required to bring complex pollution issues under full control. This TF provides an overarching perspective for the other studies, examining specific pollution control needs for regionally balanced and green development needs in China. The diagram below, from the TF report, illustrates how, nationally, there must be a very major decoupling of resource consumption in order for economic growth to rise and environmental quality to be restored; otherwise environmental conditions will decline from today's levels.

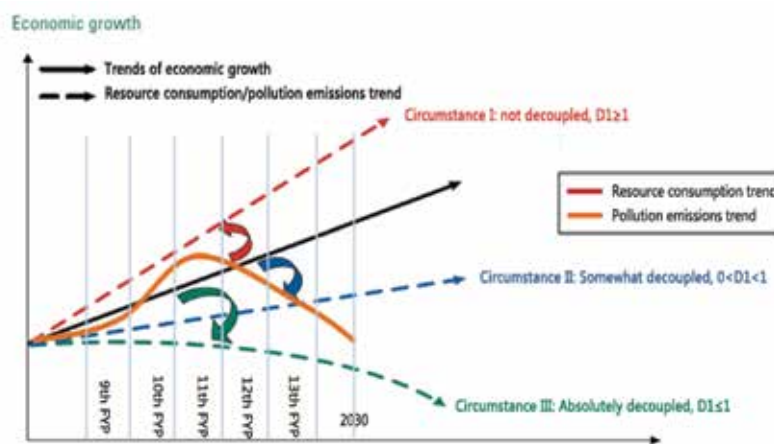


Figure 2-1 Economic Growth

Western China Green Development TF (Western TF) proposed a roadmap for green development in this ecologically and ethnically complex region of China which is home to most of China's remaining citizens still experiencing extreme poverty, has most of China's desertified areas, is the headwaters of the major rivers of China, and holds most of China's biodiversity in its fragile ecosystems. As a consequence of the Western Development Strategy in place since 1999, expanded investments especially for mining and urban development, and migration of industrial operations from other regions of China is taking place. Ecological protection, green industrialization, sustainable natural resource development for both agriculture and mining, energy use, sustainable urbanization and rural development are key Green Development needs. It also is necessary to have a robust approach to climate change mitigation in this vast region. There are fears that local emphasis on GDP growth could destabilize both ecology and social harmony. This vast region is the most significant in terms of *Main Functional Zoning*, where land and water use zones delineate areas for various levels of protection or multiple use. This promising zoning effort is still at an elementary stage but the initiative highlights the difficult path ahead, since there are major social and economic impacts of any restriction on uses.

Eastern China Development Special Policy Study (Eastern China SPS) was established to consider how the rich eastern coastal region might put in place advanced approaches for Green Development. Some of the sub-regions such as the Yangtze Delta, Pearl Delta, and Beijing are building post-industrial economies in which the service economy will account for more than 50% of GDP. Advanced energy and environmental protection mechanisms; achieving better quality of urban lifestyle; sustainable consumption; green jobs; and greater use of market instruments for

achieving Green Development are some of the matters considered by this SPS. Also, how to avoid dismantling and migration of dirty factories to new locations away from richer cities; and how to share environment and development experience from these regions, for example, from major events such as the Beijing Olympics and the Shanghai Expo. The graph below from this SPS report shows the rise in household consumption in Beijing between 1996 and 2010 as illustrated by 7 major items. Clearly some are essential such as refrigerators; others likely could make a positive contribution to sustainable development, for example, mobile phones, and some, including private automobiles and air conditioners, contribute to environmental problems. Multiply the problems of unsustainable consumption within 600 cities throughout China, and the issues of rapid urbanization become very important, especially of the expanding middle class with higher disposable income levels.

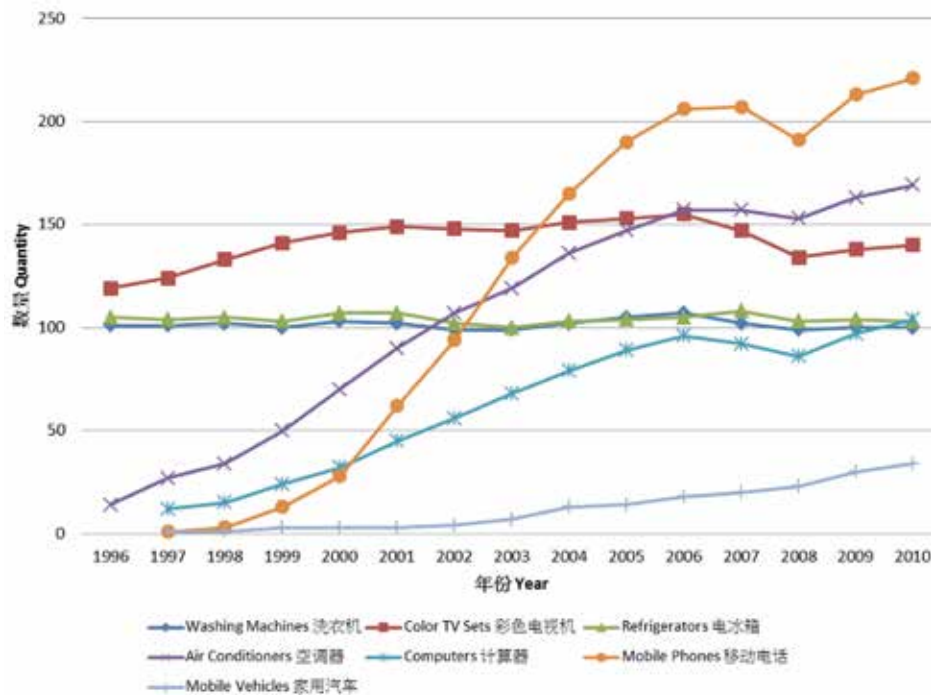


Figure 2-2

Regional Air Pollution SPS ($PM_{2.5}$ SPS) addressed emerging air pollution problems such as photochemical smog and ozone that have become serious threats even as problems such as SO_2 have been reduced in intensity during the 11th FYP. These new problems are complex since they involve chemical transformation and formation of new compounds, often turning into small particles suspended in the atmosphere (particulate matter, PM). Over the past year there has been considerable public debate over $PM_{2.5}$, the smallest particles which are particularly dangerous to the respiratory system. These are responsible for turning officially reported “blue sky days” into citizen observed gray days in many cities. Most importantly, no single city can adequately control smog, since airsheds cover large regions. China’s serious air quality problems therefore require regional strategy and policies for complex issues such as $PM_{2.5}$ and ground level ozone pollution control. These emerging problems are still on the rise and likely will require decades to control. This point is illustrated below in a graph from the SPS report, where it is seen that many cities today exceed ambient air quality standard, even for the more controllable pollutants such as PM_{10} . While targets are important, they need to be linked to good regional monitoring information that can demonstrate whether the actual environment conditions (ambient) are getting better.

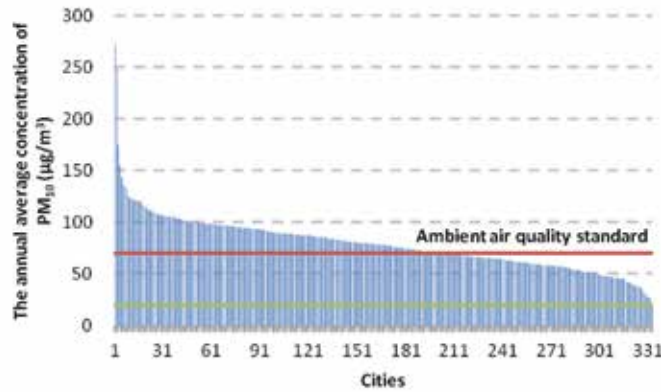


Figure 2-3

Marine Oil Spill Prevention & Response SPS (Bohai Oil Spill SPS) examined a 2011 Bohai Bay oil spill associated with offshore oil development. The incident provoked severe reactions on the part of many resource users such as aquaculturalists, with the result that very substantial cleanup costs and compensation payments were required. There is recognition that the Bohai Sea is facing a dismal future unless good environmental planning, management and monitoring is in place, with full cooperation from industries and resource users. In particular, disaster response strategy has been called into question. This study is to give specific guidance on these points and is a very operational follow-up to CCICED warnings provided in 2010 concerning the declining health of this very economically and ecologically important ocean region. The diagram below from a presentation of the Bohai Oil Spill SPS team illustrates a key issue—how to deal with integrated planning, management and emergency response. The actual number of governmental organizations, enterprises and other stakeholders involved is actually much larger than indicated in this summary diagram.

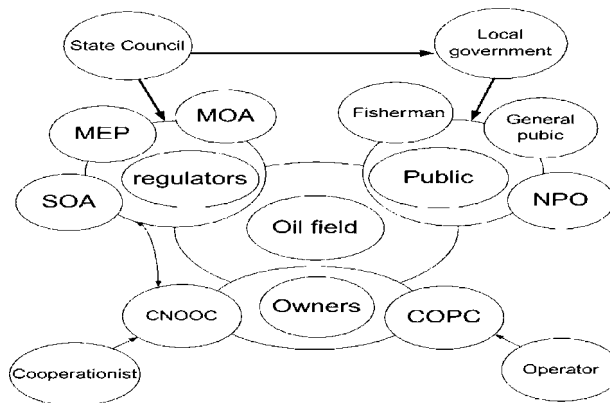


Figure 2-4

The five studies provide a rich set of examples and recommendations on how to shift towards more balanced and coordinated approaches. In 2011 CCICED examined Green Development in a more sectorally-defined way and at a national level. The 2012 work has drawn upon this earlier work, and takes advantage of other work carried out since that time.

This Issues Paper provides a short review of some current factors influencing economy and environment globally during this past year; gives an overview of the evolution of regional development strategy in China, a complex subject in its own right, plus analysis of how today’s four regions in China can be linked to green development strategy; and concludes with several key issues that are challenges to be overcome.

2.2 THE INTERNATIONAL ECONOMIC CRISIS AND GREEN DEVELOPMENT

As the financial crisis that began in 2008 continues to ricochet around the world—even threatening the European Union, and slowing anticipated recovery in the USA and certain other countries. The implications for China have been serious. GDP growth has slowed to about 7.5% year-on-year, manufacturing jobs lost, and international trade reduced. There is hope that China might be a kind of savior for the economies of other countries, or as a source of new investment capital. While this hope may be somewhat misplaced, it is clear that China will continue to expand its investment abroad via its now well-established *Going Out* Strategy.⁶ Furthermore, China has expanded the number of bilateral and multilateral arrangements for investment and trade in Asia, the Asia-Pacific Region and elsewhere.⁷ This expansion is helping to rewrite old relationships, and open new opportunities. However, these agreements are not directly tuned into green development or, for that matter, environmental concerns in any systematic fashion.

China's growth continues at a time when much of the rest of the world continues to operate in the shadow of recession. There is widespread worry abroad that sooner or later China could experience much lower growth rates, leading to a downward economic spiral worldwide. This is a simplified view of a complex situation, not completely taking into account all aspects. Notably, China is fostering its domestic consumption, although not with the full-blown approach of the stimulus applied in 2009 and 2010. Also, it does not take into account the major investments made to enhance value-added in China's export products, and the country's innovation efforts designed to open new sectors that could help meet national priorities such as clean energy, while contributing to international sustainable development. Examples are solar and wind energy, and in battery technology.

But it is also apparent that the downturn of economy in other countries and the rise of Chinese share in some of the new technology markets is leading to challenges that threaten some of the new industries. This is particularly the case with complaints recently brought forward to the European Commission, the US International Trade Commission, and the World Trade Organization (WTO) concerning subsidy and trade practices for solar and wind energy products manufactured in China for sale abroad.⁸ China has responded with complaints concerning EU subsidies on solar panels and complaints regarding US practices. In addition, there are pressure points on other topics such as the requirement for airplanes flying into EU region airports from other parts of the world to participate in the EU emissions trading system. This action has been suspended temporarily following complaints of a number of large countries including the USA, China, India, and Russia.⁹

The escalation of trade disputes on matters related to important new technologies for green growth and development is unfortunate. Certainly it is not in anyone's best interest to see impediments to the rapid commercialization of environmental goods such as those now being disputed. Price reduction to make these energy sources more competitive against high carbon energy sources is essential. And market size is a primary consideration to make that happen. It is also unfortunate that in the slow movement on Doha Round the issue of exemptions for

6 This topic is well covered in the Report of the CCICED Task Force on Investment, Trade and Environment. 2011. *Going Global Going Green*. <http://www.iisd.org/publications/pub.aspx?pno=1615>; also, see http://www.ecfr.eu/page/-/China_Analysis_Facing_the_Risks_of_the_Going_Out_Strategy_January2012.pdf

7 See for example, China FTA Network <http://fta.mofcom.gov.cn/topic/enpacific.shtml>, and the China-ASEAN Investment Agreement (2009) <http://www.aseansec.org/Fact%20Sheet/AEC/2009-AEC-031.pdf>

8 *US will place tariffs on Chinese Solar Panels*. 11 October 2012 New York http://www.nytimes.com/2012/10/11/business/global/us-sets-tariffs-on-chinese-solar-panels.html?_r=0&pagewanted=print, http://ictsd.org/i/news/bridgesweekly/134029/China-US_sparring_over_renewable_energy_intensifies

9 http://ictsd.org/i/news/biores/150032/European_Commission_announces_temporary_suspension_of_aviation_emissions_law

environmentally beneficial goods is not fully resolved.¹⁰ Therefore there are gray areas that likely will become contentious as seen over the past year.

Despite the disputes centred on renewable energy technologies and other green trade problems described above, progress has been made in recent months by agreeing within APEC (Asia-Pacific Economic Cooperation) to a planned reduction of tariffs to 5% or less for a long list of environmental goods.¹¹ This is seen as a “commitment to pursuing green growth objectives, addressing climate change and securing sustainable economic development”.

In the 12th FYP China set out lower targets for annual GDP growth nationally, even though actual performance for some provinces remain in the double-digit level. Growth reductions are a realistic appraisal in the face of international economic downturn, but within China they also are interpreted by government as a focus on quality of development, including pollution reduction, greater energy efficiency and protection of ecological services. However, it is a fine line that must be observed—if growth rates fall too much, job creation worries emerge; and if revenues are diminished, funds needed for environmental protection may be difficult to find, or enterprises may be uncooperative.

Chinese leaders have repeatedly noted that they will not ignore the need for environmental protection, and green development. This is an important statement and there is evidence of its implementation, including the commitments made in the 12th FYP. However, this does not necessarily mean that if a more serious global recession were to occur, there would be a repeat of the massive stimulus spending on environment, such as water and sewage infrastructure, at the level seen in 2009-2010. Indeed, as Vice Premier Li Keqiang has said: “*We should insist on protecting the environment while developing, and developing while protecting the environment, actively exploring China’s ‘new environmental protection way’ characterized as ‘small cost, good returns, low emission, sustainable’.* Create a new situation for environmental protection.”¹² This pragmatic approach should be kept in mind while considering issues and policies related to Green Development. In particular, greater attention to outcomes is needed, since meeting pollution targets or other environment targets does not automatically lead to improved ambient environmental conditions, or lower risks to health of people and ecosystems—the desired outcomes.

Concern is expressed that prolonged conditions of global or national recession will lead to a gradual relaxation of environmental regulations and standards. This view was expressed at Rio+20, including the observation that the meeting outcome might otherwise have been much stronger in terms of commitment to Green Economy. In addition, there is a concern that enthusiasm on the part of investors for renewable energy sources and for bringing new sustainable development technologies to commercialization will slow as a consequence of greater exploitation of non-conventional fossil fuel sources such as natural gas obtained by “fracking” of shale gas,¹³ or for other reasons, as biotechnology companies seeking advanced biofuels have found.

China may have advantages in these circumstances. It can invest more in S&T development than most others, and it has potentially large domestic markets. China is improving its capacity to innovate, as measured by patents registered. It is reasonable to believe that China could have significant advantages in moving ahead on sustainable green technologies, even if others fall behind during these lean, recessionary times. This point is a matter of concern for regional development in all parts of the country including Western China—there are many elements of green development such as agriculture and water conservation where there are major innovation opportunities.

10 G. Balineau and J. de Melo. 2011. *Stalemate at the negotiations on goods and services at the Doha Round*. Working Paper/P28. FERDI. 29 pp. <http://www.ferdi.fr/uploads/sfCmsContent/html/112/P28.pdf>

11 http://www.apec.org/Meeting-Papers/Leaders-Declarations/2012/2012_aelm/2012_aelm_annexC.aspx

12 Government Net. 20 December 2011. *Speech by Vice Premier Li Keqiang at 7th Environmental Management Conference*. http://www.gov.cn/ldhd/2011-12/20/content_2025219.htm

13 <http://news.nationalgeographic.com/news/energy/2012/08/120808-china-shale-gas/>

The bottom line for many countries, including China is job creation and poverty elimination. There are differing views about the extent to which new green growth strategies and green economy initiatives will produce net employment benefits. Certainly UNEP's view is the most optimistic view.¹⁴ OECD does not see green growth as being primarily about job creation, but instead focuses on environmental benefits, and transformative change of industry, energy, etc., leading to fundamental industrial ecology shifts.¹⁵ It is quite possible that the situation will be quite variable, according to national, local or sectoral circumstances. The Rio+20 outcome document¹⁶ is backed by solid analysis that suggests positive employment gains are possible. China could turn out to be one of the best cases in terms of turning green development into net employment gains and for poverty reduction. Certainly green development will be an important driver for creating structural adjustment between secondary and tertiary sectors, with the latter producing the largest share of jobs in the future. This shift will require a very disciplined approach to investment strategy, especially for heavy industry, a point made in current strategic analyses of China's economy.

2.3 CHINA'S REGIONAL DEVELOPMENT¹⁷

The great regional differences in China's geography and environment, resources, and culture, have been important in its historical pattern of development. As well, over the past sixty years, China has experienced several economic reforms as well as major changes in development policy, especially *Opening Up* in Eastern China. In recent years, various social contradictions, and conflicts created by unbalanced and uncoordinated development have affected social stability, economic growth, environmental and ecological protection, social justice and fairness. To resolve problems both nationally and regionally matters, programs for revitalization and for intensive development have been initiated, for example, in Northeastern China and the Western Development Strategy Still, these efforts have been ineffective in producing a genuinely sustainable pattern of development, and for some areas income gaps continue to widen, especially between urban and rural populations.

2.3.1 Evolution of today's regional structure

The modern-day evolution of thought on uneven regional development in China started in 1935 with the famous "**Hu Line**", a diagonal line drawn from China's Northeast to the Southwest, which more or less divides China into western and eastern areas. This line is still relevant today in terms of population density (low in west and high in east), and also in relation to ecological transitions and vulnerabilities.

The line is also relevant to ecological vulnerability and transitions. Landslides, mudslides, and other landform disasters are concentrated along parts of it. The middle part of the line crosses the Loess Plateau, with its erosion and dust storms and main source of Yellow River sediment. The Hu Line is a boundary transiting from waterlogged areas in the northwest region to the flood zone in the southeast, with floods and drought on the east side of the line. This dichotomous pattern was used for planning till the 1980s.

During the 7th FYP (1986-1990), the central government divided the huge inland regions into central and western regions, and producing a clear gradient structure—eastern coastal region, the central inland region, and the western region. This was the period of rapid development of the eastern coastal areas each having their own characteristics:

14 See UNEP. June 2012. *Building an Inclusive Green Economy for All*. <http://www.unep.org/newscentre/default.aspx?DocumentID=2688&ArticleID=9169>

15 See *Green Growth and Sustainable Development OECD and Rio+20* <http://www.oecd.org/greengrowth/oecdandrio20.htm>

16 United Nations. June 2012. *The Future We Want*. Rio+20 outcome document.

17 This section is a summary of a longer background document included as an Annex to this Issues Paper. They provide an introduction to the complexities of regional development in China. It is written in a narrative style without full referencing. Further information and a longer document in Chinese prepared by Dr. Zhang Shiqui is available upon request. We wish to acknowledge the valuable efforts of Zhang Shenghao and Wang Peishen in translations from the original document.

Liaoning Province relies on heavy industry to promote regional economic development; Jiangsu and Zhejiang provinces, on the rapid development of the private economy; Guangdong relied on the open-door-driven policies.

With the implementation of the Western Development Strategy in 1999–2000, coverage of the geographical scope within the three regions changed. Guangxi and Inner Mongolia were reassigned to the western zone, but the three zones pattern did not change. With the first-mover advantage, the Eastern Region continued to maintain rapid development, and, until recently, the growth rate has been generally higher than in the Central and Western regions. Inter-regional development disparities continue to expand. The resource mobilization capacity of the developed areas comes from the market, whereas within the underdeveloped areas, funds from the market mechanism are relatively small.

The Western Development Strategy is the first regional development strategy formally implemented by the central government. Subsequently, in order to resolve the issue of economic structural changes in resource-based cities and to improve efficiency of state-owned enterprises, the government proposed the strategy of revitalizing the old industrial base in the Northeast Region of China. After that, to balance the regional development and to avoid the collapse of the central region, attention was given to improvements in the Central Region and efforts to accelerate the development of the Eastern Region. Therefore, during the 10th FYP, the pattern of four plates gradually formed.

The 11th FYP proposed an overall regional development strategy, which is *promote the development of the western region, revitalize the old industrial bases in northeast China and other regions, promote the rise of the central region, and to encourage the eastern region to lead the development* as the regional pattern of four plates. The **Eastern Region** refers to 10 provinces and municipalities including Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan; the **Central Region** consists of Shanxi, Anhui, Jiangxi, Henan, Hubei, and Hunan provinces; the **Western Region** includes 12 units—provinces, autonomous regions, and municipalities—Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang; and the **Northeastern Region** refers to 3 provinces—Liaoning, Jilin, and Heilongjiang Province.

The 12th FYP has placed greatest emphasis on the Western Region and also the Northeast, as noted below the China Daily¹⁸ in a report of a State Council meeting in January 2012:

China will continue to boost the development of the country's less-developed western and northeastern regions, according to a statement released after an executive meeting of the State Council... The meeting, presided over by Premier Wen Jiabao, has approved guidelines for the development program of China's west and the revitalization of the northeast old industrial bases in the country's 12th Five-Year Plan period (2011-2015)... The vast western region is still a "short plate" in the country's regional development, and achieving its prosperity is an important but difficult task in the building of an all-round well-off society.

Priority should be given to the implementation of the strategy of large-scale development of the western region in the country's overall regional development scheme, to maintain its continued stable and rapid economic and social development... Efforts should be undertaken to keep the growth of the regional GDP and the residents' income higher than the national average in the five-year period... More emphasis should be put on the construction of "development priority zones" with their own development focus and priority according to their environmental features, natural resources, current development stage and development potential.

18 http://www.chinadaily.com.cn/china/2012-01/10/content_14410199.htm

The State Council also underscored the importance of infrastructure construction, environment protection, promotion of advanced industries and agriculture, and the development of small towns and villages, education and opening-up.

The statement said that there were still unsolved systematic and structural problems that have restricted the development of China's northeastern region, and that local governments should continue to deepen reform and accelerate transformation of development pattern in the 12th Five-Year Plan period. The State Council urged those involved to make vigorous efforts to promote agricultural development, further perfect modern industries, and optimize regional development strategy in the northeastern provinces. Local governments should also work to ensure sustainable development of resource-rich cities, improve infrastructures, enhance environmental protection, boost employment and affordable housing construction, and deepen reforms of state-owned enterprises while accelerating the growth of the private sector.

The more developed eastern and central provinces should offer better assistance to the development of these regions, the statement said.

2.3.2 Building a Well-off Society and unbalanced regional realities

Over the past 30 years, China has achieved a “high-speed” average annual growth rate of 9.6%. Although the national economy is moving towards the desired comprehensive well-off stage, among the various regions economic gains are very uneven. In fact the disparities among regions are multi-dimensional, including level of economic development accessibility towards basic public services and state of ecological wealth. Regional development strategy is intended to confront the challenge of *strong ones getting stronger, and weak ones getting weaker constantly*.¹⁹

The following sections will discuss similarities and differences among the four regions based on eight aspects: degree of accomplishing a Well-off Society, level of economic development, urbanization, living standards, regional self-development capacity, basic public services, pollutant emissions, and environmental resources pressure. Despite its relevance, we have not examined environmental resources pressure as a separate point since it is not a subject that permits a brief overview and use of numbers like the other measures.

There are six indicators for measuring the efforts towards accomplishing a Well-off Society: economic development, social harmony, quality of life, democracy and rule of law, culture and education, resources and environment. How these are actually measured will not be discussed here, only some results as perceived by the government of China.

Figure 2-5 shows steady progress in attainment of the Well-off Society goal, but the reality is that only in the Eastern Region is it nearly achieved. The levels of full achievement in 2010 were Eastern Region 88.0%, Northeastern Region, 82.3%, Central Region 77.7%, Western Region was 71.4%. From 2000 to 2010, the highest levels were in the Eastern Region, and the Western Region was the lowest. As cities move towards a 90% level of achievement research indicates a slow-down in meeting the goal. And the indicators do not cover all aspects of what a Well-off Society might be expected to encompass.

¹⁹ An Shuwei, Yu Peng, 2009.

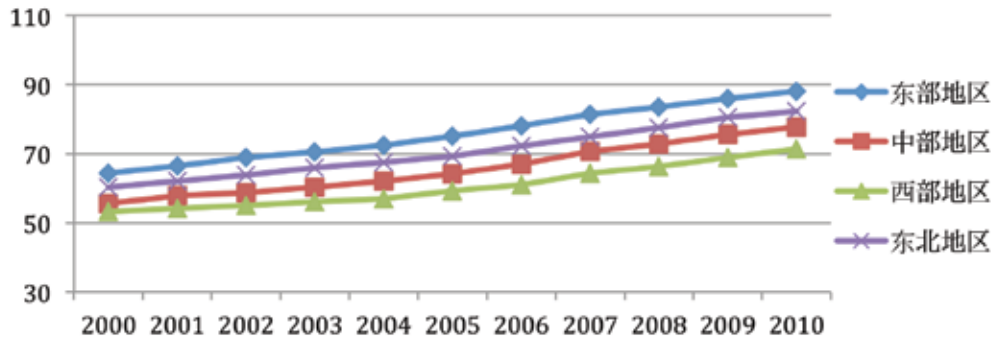


Figure 2-5 Regional accomplishment in building up a Well-off Society (blue diamond-eastern region; red square-central region; green triangle-western region; purple cross-northeastern region)

2.3.3 Level of economic development and industrial structure

Based on the aggregate GDP, from 1992 to 2010, the Eastern Region ranked first. The GDP of the Eastern Region in 2010 accounted for 57.8% of the national GDP, the Central Region 21.5%, the Western Region 20.3%, and the Northeastern 9.3% of the national GDP. The year 2007 was a turning point in terms of growth rate. Before then, the fastest growing economy was in the Eastern Region; and the Northeast Region had the smallest economic growth in most years. After 2007, the situation reversed; the Northeast Region had the fastest economic growth, and the Eastern Region became the slowest. In 2010, the Central Region experienced the fastest economic growth with a 14.1% GDP growth rate; the Eastern Region had a rate of 12.9%, the slowest. The Western (13.7%) and Northeastern (13.6%) Regions ranked in second and third place. From 1992 to 2010 the Eastern Region achieved much higher GDP per capita than the national average. In 2010, the GDP per capita reached RMB 45,798.2 a level 1.53 times the national GDP per capita. By contrast the proportion of the Western Region's GDP per capita rose from 67% in 1992 to 75.4% of the national average in 2010.

There also are important difference in the industrial structure of the four regions, meaning a range in 2009 from the Eastern Region stepping into the late stage; the Central and Western Regions just entering to the middle stage; while the Northeastern Region was in the late phase of the middle stage of industrialization. Taken together, the national industrialization level was at the middle stage. These points are important since criticism exists that China has overinvested in heavy industry in recent years. This leads to overcapacity and a search for markets to sell surplus products in China and abroad. And, as the most developed region seeks pollution reduction and energy efficiency, the dirty industries are likely to be moved out, certainly the case in Beijing and Shanghai.

In general there is a major effort to further optimize industrial structure in all four regions. The proportion of the primary industry has declined although the decline in the Northeast has been very small. Among the four regions, the proportion of secondary industry in the Eastern region is steady, and the proportion of tertiary industry (service sector) has increased steadily to the point where some cities such as Beijing now have more than 50% of the economy vested in the tertiary sector, a "post-industrial" situation.

2.3.4 Urbanization

The dramatic shift of China from an agrarian society to one where soon most people will live in cities is unprecedented in scale and vision for the future. Clearly sustainable urbanization must be a priority, and that is a great challenge. With over 600 cities, China faces planning and administrative challenges at an unprecedented scale. It is believed that China's urbanization process involves migration numbers greater than any other country at any time in history. Cities are the crucible for industrial innovation, and the hub of manufacturing success, but regrettably also the source of much pollution and problems related to land allocation, transportation and many other development issues.

China is on a pathway of urbanization that will see at least 70% of its citizens housed and working in cities. In 2009 the levels of urbanizations in the four regions were: Eastern Region 56.7%, Central Region 42.3%, Western Region 39.4%, and Northeastern Region 56.9%. Increasingly, there are initiatives aimed at improving the models of urban development, for example, through development of Eco-cities, and through designation of some urban areas as Low Carbon cities.²⁰ A substantial number of Chinese cities are rated as highly polluted on WHO lists and by other international agencies. But there has been progress on both environmental planning and specific issues like water pollution.

2.3.5 Living standard – income gaps

Corresponding to the level of economic development, disposable income of urban residents in the Eastern Region is significantly higher than other regions (Figure 2-6). In 2010, the disposable income per capita of urban residents in the Eastern Region was RMB 23,272; the differences among the Central, Northeastern, and Western regions are very small, RMB 15,962, RMB 15,941, and RMB 15,806, respectively. From 2000 to 2010, the net income per capita for Eastern Region rural residents was much higher than the other three regions, increasing from RMB 3,588 to RMB 8,143. In 2010, the ratio of urban to rural income was 2.48 in the northeastern region, 2.86:1 for the Eastern Region, and 2.90:1 for the central region. The urban-rural income gap in the western region is relatively high, a ratio as high as 3.58:1 (Figure 2.7).

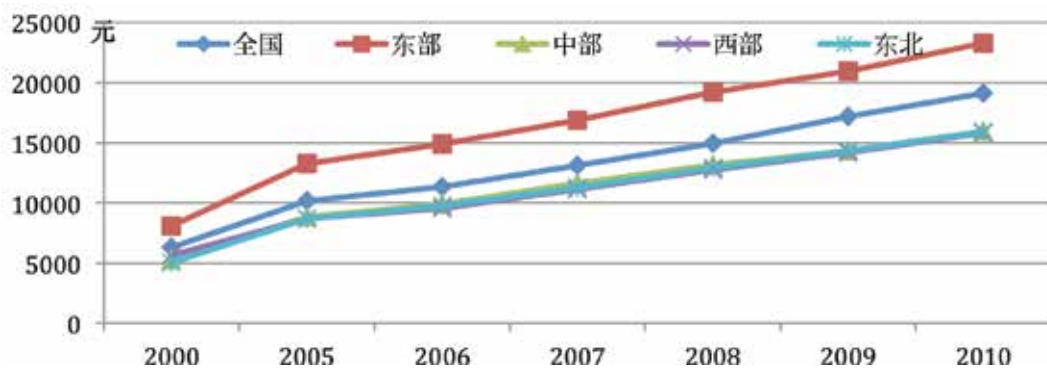


Figure 2-6 Disposable incomes per capita of urban residents 2000-2010 (blue diamond-national; red square-eastern region; green triangle-central region; purple cross-western region; turquoise cross-northeastern)

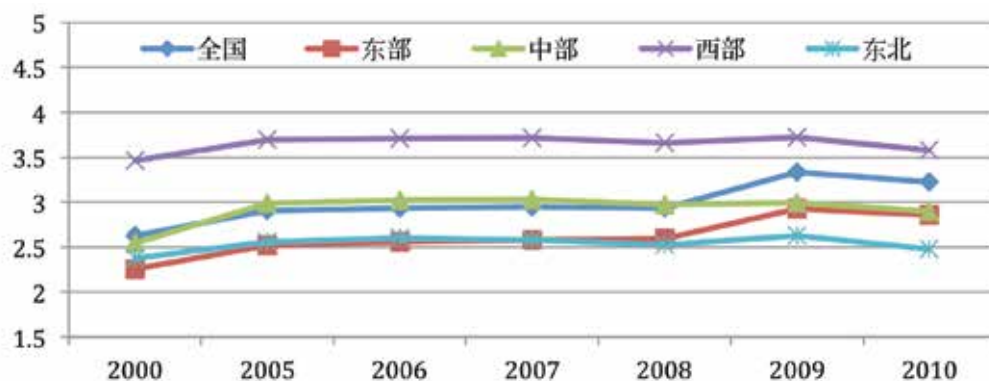


Figure 2-7 The income gap between urban and rural inhabitants in China's regions (blue diamond-national; red square-eastern region; green triangle-central region; purple cross-western region; turquoise cross-northeastern)

20 <http://usatoday30.usatoday.com/news/world/story/2012-07-15/china-building-green-cities/56219286/1> ; see also *Eco-cities A Global Survey. 2011*. This survey, conducted by the University of Westminster International Eco-cities Initiative, indicates that China likely has the largest number of eco-cities found in any country. <http://www.westminster.ac.uk/?a=119909>

2.3.6 Regional self-development capacity

Capacity to undertake regional development includes the ability to raise revenues locally. Certainly the Eastern Region is best placed to do so (see Figure 2-8, describing total locally-raised fiscal income levels). The Western Region has shown considerable increase in capacity since about 2007.

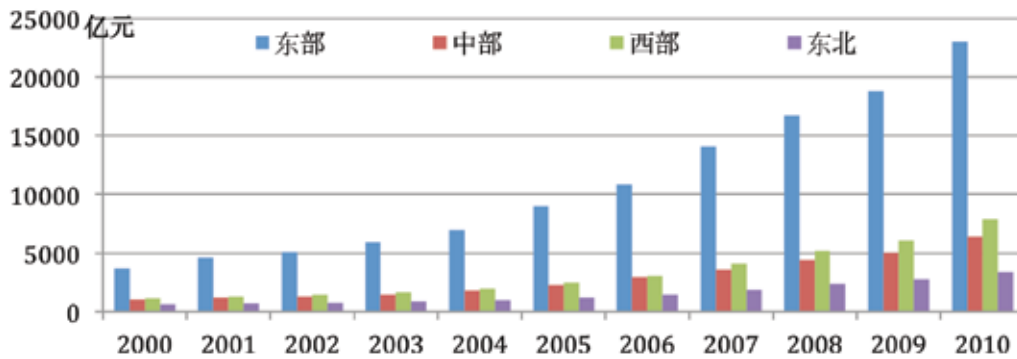


Figure 2-8 Fiscal income level in billion yuan
(based on prices of the years) (blue-Eastern, Red-central, Green-western, Purple-northeastern)

Another useful measure of self-development capacity is the proportion of local fiscal revenue in local fiscal expenditure. This figure is relatively stable over the decade for each region but dramatically different between regions (see Figure 2-9). In 2010, the percentage ranged from 76.2% in the Eastern Region to 36.8% for the Western region.

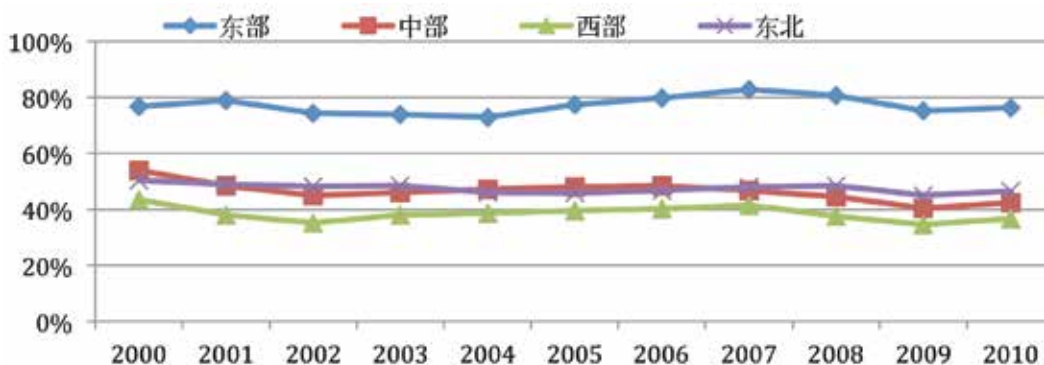


Figure 2-9 Proportion of local fiscal revenue in local fiscal expenditure
(blue diamond-eastern region; red square-central region;
green triangle-western region; purple cross-northeast)

2.3.7 Public services

Public services have advanced considerably in all regions over the past two decades, in both urban and rural areas. The rise has been particularly significant in the last decade, including the efforts brought about through post-2008 stimulus expenditure. Here only a few examples are profiled. For example, there are significant difference in the proportion of people with a college degree or higher: in 2009 the figures were 9.02 % for the Eastern Region, 6.1 % for Central Region, 5.6% for Western Region, and 9.07% for the Northeastern Region. In fact, the regional disparities have grown over the period 2005-2009.

For water conservancy, environment and public facilities management industry, from 2003 to 2010, there were significant differences among the four regions in fixed asset investment in such services. After 2007, the Eastern Region's fixed asset investment in water conservancy, environment and public facilities management industry grew significantly faster than the other three regions (as shown in Figure 2-10).

Both road and railroad mileage increased very dramatically in the past decade, with much of the development in the Western Region (see Figure 2-11 for road expansion between 2005 and 2010 according to region).

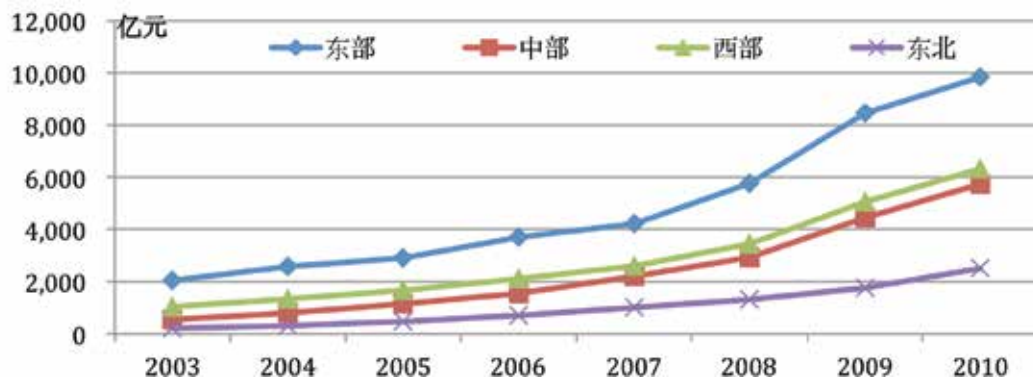


Figure 2-10 Fixed asset investment in water conservancy, environment and public facilities management industry (blue diamond-eastern region; red square-central region; green triangle-western region; purple cross-northeastern region)

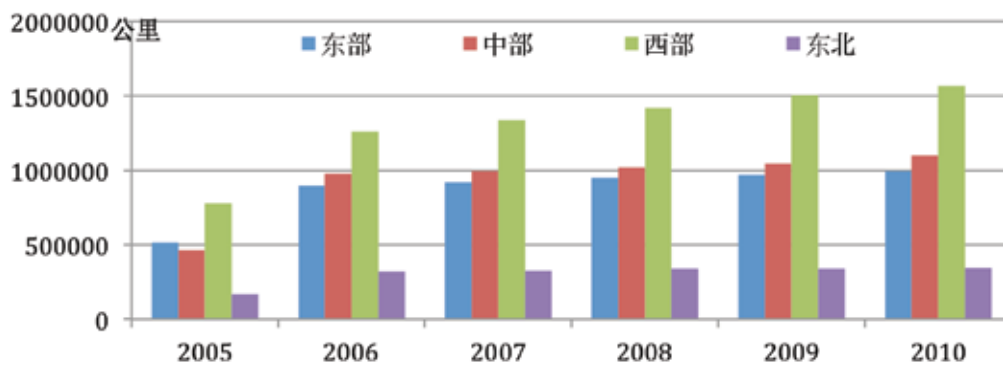


Figure 2-11 Operating mileage (km) of roads by region (blue-eastern; red-central; green-western; purple-northeastern)

2.3.8 Emissions and Environmental Emergencies

In 2002-2010, for water pollution the Chemical Oxygen Demand (COD) emissions in tonnes per unit of GDP (billion RMB) showed a declining trend in the four regions. This is, of course, an intensity measure rather than an absolute decline in pollution. The convergence of figures is of interest. Western China started at a much higher level of intensity, and yet was relatively close to the intensity of other regions by the end of the decade (Figure 2-12).

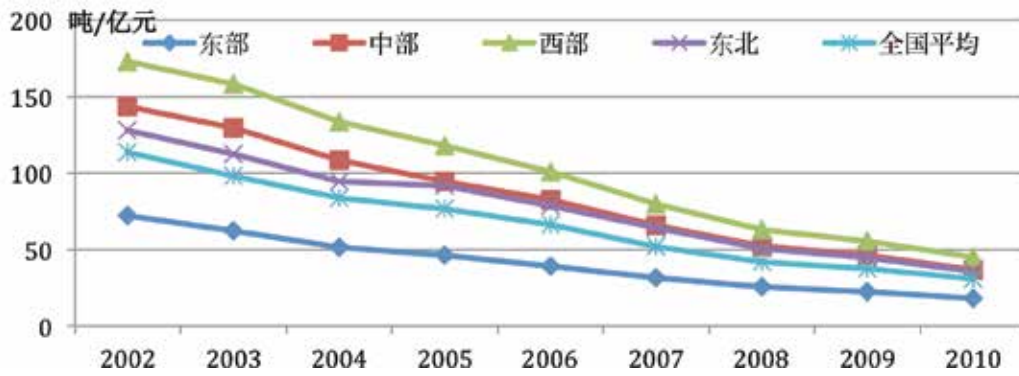


Figure 2-12 Chemical oxygen demand (COD) mission per unit of GDP (tonnes per billion RMB (blue diamond-eastern region; red square-central region; green triangle-western region; purple cross-northeastern region; turquoise cross-national))

Between 2002 and 2010, the sulphur dioxide emissions per unit of GDP also displayed a declining trend in the four regions (Figure 2-13).

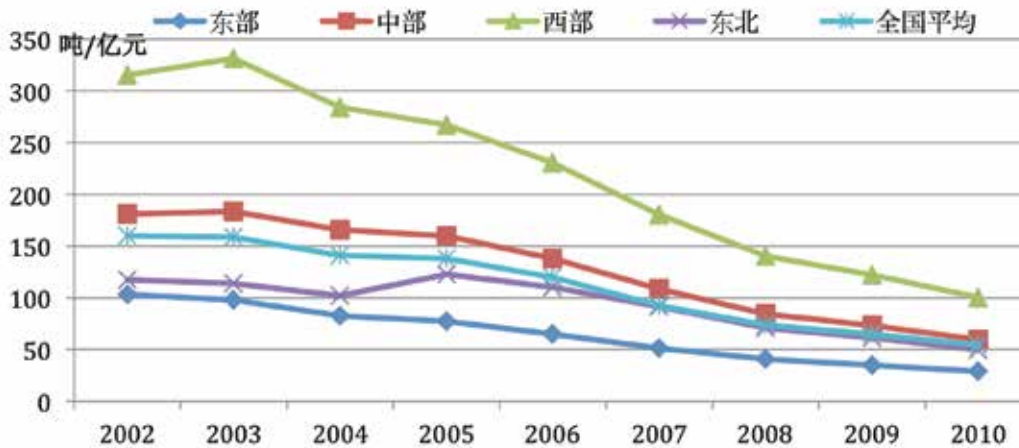


Figure 2-13 Sulphur dioxide emissions (tonnes) per unit of GDP (RMB) (blue diamond-eastern region; red square-central region; green triangle-western region; purple cross-northeastern region; turquoise cross-national)

From 2002 to 2010, within the four regions, the number of environmental accident emergencies has generally reached a lower level (Figure 2-14). In the Northeastern Region the numbers have generally been at a lower level, although with some serious incidents. In the Western Region, the number of environmental accidents dropped from 893 in 2002 to 67 in 2010; in the Central Region, the number decreased from 621 in 2002 to 53 in 2009. The situation in the eastern region is very different. Starting in 2008, the number of environmental accidents has again been increasing, from 172 in 2006 to 255 in 2009.

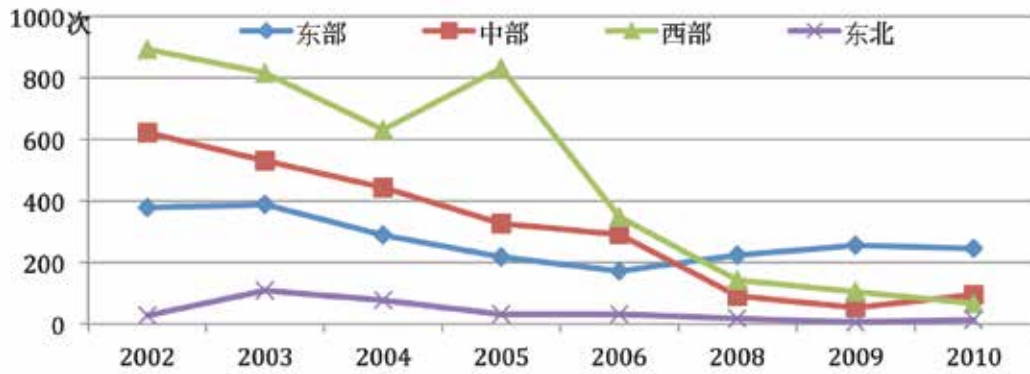


Figure 2-14 Emergency environmental accidents 2002-2010
(blue diamond-eastern region; red square-central region; green triangle-western region;
purple cross-northeastern region; turquoise cross-national)

2.3.9 Summary observations on unbalanced regional development

There are many hypotheses and conclusions about regional development. However there is not really a consensus on which conclusions are the most important, or even the most credible. Furthermore, the most relevant and appropriate metrics for green and sustainable development still need to be identified. Nevertheless there are some points that cannot be ignored including those noted below.

2.3.9.1 Regional performance characteristics

- 1) *The Eastern Region is at the highest level of economic and perhaps social development, but certainly this has been achieved at a very high environmental cost.*

Yet there is no full picture of the costs, especially in terms of cumulative impacts, and costs related to health and well-being of ecological services, human health, plus economic productivity reductions.

The economic strength of the Eastern Region continues to lead the country with the aggregate GDP and GDP per capita significantly ahead of other regions; the tertiary service sector is developing rapidly, and drives further optimization of the industrial structure. But in recent years, economic development has slowed down, and the high dependence on foreign trade has led to development influenced strongly by the international situation including global economic volatility. People's living standards in the Eastern Region are in the leading position—the disposable income per capita of urban residents and net income per capita of rural residents rank first among the four regions. In addition, the infrastructure of the Eastern Region is the most complete. However, the level of urbanization lags behind the level of industrialization, and the income gap between urban and rural residents is growing. Migrant workers from other regions, or even from rural areas in the Eastern Region do not have access to full social benefits accorded urban residents.

- 2) *The Central Region shows many signs of advanced development, but with bottlenecks.*

The aggregate economy of the Central Region has continued to increase, and its national proportion shows a rising trend. Living standards improve very fast; the growth rate of net income per capita for rural residents is the highest among the four regions. The construction and development of infrastructure is good. However, the level of urbanization improves slowly, and still lacks coordination with industrialization.

3) *The Western Region has made substantial progress, but still has the lowest level of comprehensive development.*

There are still major concerns related to the human dimensions, including poverty reduction, income gaps and education; and to ecological fragility, especially at a time of more rapid infrastructure and mineral development, and with pressures from agriculture and grazing on landscapes. Furthermore impacts of climate change and other factors affecting water and ecological services are being experienced. Entry conditions for enterprises are not well worked out. More adequate monitoring and standards are needed.

The economic development of the Western Region has been significantly accelerated, and the overall economic strength has continuously improved, but its overall economic development is still lagging—GDP per capita is at the bottom of the four regions; there is rapid increase in the level of industrialization, but the industrial operational level is low, and the structure is unreasonable. The growth rate of disposable income per capita of urban residents ranks first in the four regions; the income gap between urban and rural residents is the highest, but the net income per capita of rural residents is lowest.

Infrastructure development needs, low level of basic social services, strong dependence on the central support policies, and weak self-development capacity have seriously restricted the economic and social development of the western region. In addition, COD and sulphur dioxide emission levels of the Western Region ranks highest among the four regions, and ecological damage is very severe. The change of economic development mode is urgent. Furthermore, sustainable development in Western China is a prerequisite for environmentally sustainable development of all China, as downstream impacts from degraded watersheds, polluted airsheds and soils will affect the other regions.

4) *The Northeast Region has a good development foundation, but relatively low growth.*

Economic development of the Northeastern Region overall has a relatively strong capability—GDP per capita, and the level of industrialization is right after the Eastern Region. But economic structural changes are difficult; the development of high-end industry and modern service industry is not good enough; upgrading the industrial structure is proving to be a hard task. However the net income per capita of rural residents is only lower than the Eastern Region; the income gap between urban and rural residents is the lowest, and presents a continuously shrinking trend. In addition, the development of education in the Northeastern Region is excellent; the level of urbanization ranks first in the four regions, and human resources are well positioned for economic restructuring, perhaps better than other regions. In recent years, infrastructure development, for example highways, has been slow; urbanization is lagging behind industrialization to a certain extent.

2.3.9.2 Environmental performance

The environmental performance of the Eastern Region is better than that of the Central and Western regions, especially during the 11th FYP. Whether the total discharge of pollutants, emissions per unit of output value, or the quality of the urban environment, the Eastern Region appears better than the Northeastern, Central and Western regions. Yet, the advent of serious emerging problems in Eastern China, mostly related to development of the last decade may yet change this observation. Marine and coastal concerns such as oil spills and other contaminants, soil pollution and the major air pollution problems such as smog and ozone are pressing matters, with very significant health impacts in some of the richest cities, and with a spread across regional airsheds. Furthermore, the ecological footprint arising from development in the Eastern Region extends far beyond its boundaries as a result of rapidly increasing material demands.

2.3.9.3 Poverty reduction and income disparities

Although China has made very major gains in dealing with the Millennium Development Goals, the job is not yet complete, and income gaps are growing both within and between regions. Peng Tengyun and Xu Yong respectively utilized the Gini and GE (generalized entropy index) methods²¹ and concluded that uneven development in China is expanding according to the data from 1995 to 2003. However, this expansion of income has been relatively slow since there has been a general uplifting of economic conditions. Referring to data from 1993 to 2003, Li Qian and other scholars (2006) found that the tendency of uneven regional development expanded after 1993 as measured by per capita GDP, in which the contribution of Central and Eastern Regions exceeds 50%. The research of Jin Xiangyu and Hao Shouyi (2006) shows that after the start of Chinese Economic Reform, especially since 1990, among the 31 provinces and municipalities as well as the Eastern, Central and Western regions in China, uneven regional development is expanding.

The data analysis of the per capita GDP gap coefficient in China shows that this gap coefficient has gone through shrinking (1978-1990), expanding (1990-2004), and then shrinking again (2004-2010) phases, forming a reverse U shape. The analysis of the data in the years of 1978 to 2010, after the Chinese Economic Reform, shows that the Gini coefficient started to fall from 1978 to 1991, and then rose in the years 1991-2003, then fell again in the years of 2004-2010.

2.3.9.4 Causes of regional development imbalances

Regional economics as well as national economic development provide explanations for the uneven regional/area development in China. But various other factors significantly affect regional development. These factors include government policies, macroeconomic factors, regional resource endowments, liquidity of elements, and interactions among these factors. No single theory can fully explain unbalanced regional development in China. In pragmatic terms, there are a number of factors that in the past have been important and will continue to be significant as China attempts to narrow development gaps. These include natural endowments and the cumulative effects of six decades of planned development. There are historical origins of the imbalance in regional development mainly manifested in two aspects: available infrastructure, and social capital. Regional social capital will influence the economic efficiency, including efficiency, sense of competition, cultural traditions, and education structure. These points are discussed in more detail below.

2.3.9.5 Differences in geography and natural resource endowments

Access and transport lead to important transaction cost differences. The improvement of water transportation (especially marine transportation) and land transportation cost-savings, have been advantageous for coastal areas especially for expanding international trade. Inland western regions have significant disadvantages due to inconvenient transportation linkages resulting in high transaction costs.

Resource development costs tend to be higher in the Western Region by comparison to Eastern Region in particular. Although mineral resources are abundant, those located in distant high mountain areas are difficult to access, extract and process. Costs are therefore high. The natural resources buried in the mountains are difficult to extract, and costs also higher.

Quality of agricultural development varies considerably, with the Eastern Region and parts of some other regions being favorably endowed, and close to high population markets. By contrast, for much of the Western Region's vast lands the quality and potential are lower and subject to environmental risks including climate change impacts, erosion, etc.

21 For explanation of these terms see Fernando G De Maio. 2007. *Income inequality measures*. J. Epidemiol Community Health. 61(10): 849–852. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2652960/>

2.3.9.6 Strong correlation between ecologically-fragile and poverty-stricken counties in the Central-Western Region

Within Central and Western regions, of the counties recognized as ecologically sensitive areas, about 76% are also poverty-stricken. For ecologically-sensitive areas, about 43% of such lands lie within poverty-stricken counties. For arable lands classified as ecologically sensitive areas, 68% is located within the poverty-stricken counties, accounting for 74% of the total arable land of the poverty-stricken counties. And, for populations living in areas classified as ecologically sensitive areas, about 74% of such populations live in poverty-stricken counties, accounting for 81% of the total population of these poverty-stricken counties. These figures suggest that the relationship of ecology and poverty in at least some of the poorer areas of China is significant, likely complex, and certainly a significant matter to be considered for sustainable development.

2.3.9.7 Cumulative effects of development history over 60 years

China's development policy has undergone three stages, including: the stage of focusing on the development of basic agriculture and industry; the stage of implementing the regional gradient development strategies and eventually prioritizing regional development of the Eastern Coastal Region with an emphasis on *Opening Up*, accompanied by economic and some financial and political reforms; and the stage of implementing balanced development strategy, including the Western Region Strategy.

The economically well-developed regions obviously have benefitted greatly from preferential policies of the national government.. The disparities of the *Opening Up* period led to a more open economic environment in some cities while others remained closed to outside investment. Prioritizing the coastal economic system reform created crucial differences in regional development. From a practical point of view, areas with the *Opening Up* pilot project experience got rid of the rigid planning system first, stimulated their economic vitality, and realized the rapid development of the private economy. In addition, geographic advantages could be optimized, such as access to cheap shipping from coastal ports.

2.3.9.8 National development strategies and plans during different periods

From 1949 to 1972, the government's strategy was even development; during this period of time, the priority was given to the development of the backward inland areas. By setting up heavy and chemical industries in the inland areas, this strategy was trying to change the previous eastern-oriented layout for heavy and chemical industries. The Central and Western regions invested in low value-added mining and energy industry, whereas the East Sea coastal area was focusing on processing industry. Therefore, with regard to industrial structure, the Central and Western regions were in a disadvantaged position. From 1973 to 1978, China's development strategy gave priority to the development of coastal areas. During the 6th FYP (1981 to 1985), the government emphasized setting up regional development strategies based on regional comparative advantages. At this stage, the development strategy was gradient development from coastal to inland. The coastal areas had the priority to optimize the industrial structure, build up infrastructure, and participate in international trade and investment. Inland areas needed to develop energy, transportation and raw materials industries to support coastal areas. The special economic zones and opening-up policies were implemented, mainly along the south coast, especially the Pearl River Delta, and including Zhuhai, Shantou, Xiamen, and Hainan special economic zones plus 14 opening cities. Overall, the eastern coastal areas gained greater autonomy in finance, taxation, prices, investment, credit policy, and the eastern coastal areas have relatively greater institutional innovation space.

30 From 1991 to 2000 (8th and 9th FYPs) the development strategy aimed to coordinate development of regional economies and reduce regional disparities. It adopted a series of policies to stimulate the development of inland areas, including increasing the funds for the infrastructure construction of the inland areas, attracting foreign investment

for the inland areas, and guiding the collaboration between inland and coastal areas. The Special Economic Zones began to expand from the southern coast (southern section) to the central coast and the northern coast, forming the Yangtze River Delta-centred “middle section” and the Bohai Bay-centred “northern section”. Meanwhile, the regional development focus moved from the eastern coast to the central and western regions, especially from the east to the west along the Yangtze River Valley.

Starting with the 1999 Western Development Strategy, the government tried to implement balanced and coordinated development. The Western Development Strategy focused on attracting foreign investment through improving the basic infrastructure and business environment, with the hope that the Western Region could catch up with the development in the Eastern Region. However, based on actual results, the regional disparities between the eastern and western region were not significantly lessened. In addition, the government promoted the “Revitalization of the Northeast Industrial and Other Old Industrial Bases” strategy (2004), “the Rise of Central Region” Strategy (2006) and other policies, such as to increase transfer payments. Now, in the 12th FYP, the government aims to reduce regional disparities and seek coordinated regional development.

2.3.9.9 Regional industrial structure

The industrial technical content, added value, and economic scale of different regions are different, leading to differences in how fast industries can change and advance. In the Western Region, the main industry has been primary industrial raw materials processing. In the development of a heavy industry strategy in the Central and Western regions, many large and medium-sized state-owned enterprises have been established; most belong to low value-added extractive industry and energy industry, and raw material industry with low processing depth and level. These industries are hard to integrate into local rural industrial structure and further promote the development and growth of the rural township enterprises. After the Chinese Economic Reform, the Eastern Region gave priority to the development of high value-added industry including finance, trade, information, and communication. The Western Region became a periphery zone of agricultural and other primary products, resulting in the expansion of inter-regional disparities for more than 20 years. Qin Chenglin’s (2011) analysis shows that primary industry has made a great contribution to resolving the issue of regional development imbalances in China. Contributions of other industries including service industry, the wholesale and retail industry, hospitality industry, and the financial industry to the uneven regional development in China ranked at the second, third, and fourth place respectively.

2.3.9.10 Regional marketization and ownership

At the moment, the marketization level of the Eastern Coastal Region is relatively high; collective, private, foreign and other non-state-owned economy have all made relatively large contributions. The situation in the Western Region is the opposite. Wang Feng (2007) found that regional differences in human capital, the development of a non-state-owned economy, and the extent of opening to the outside world are important causes of the imbalance of regional economic development in the present stage. Wang Xiaolu and Fan Gang (2004) pointed out that the economic growth gap between the Central-Western regions and the Eastern region is mainly due to the low productivity. This issue depends mainly on the regional difference of technological progress and marketization. In terms of marketization, the disparity between the eastern and western regions is very significant, particularly, the regional disparities on the non-state economic development and factor market development (capital, labour, land).

Regional restrictions have existed for a long time in the capital market and the labor market in China. Specifically, the inter-regional free flow of labor cannot be achieved; imbalance exists in regional investment. These factors are an important cause of the differences between the coastal and inland areas. In addition, technical workers prefer to find higher-paying job in the coastal areas. Also, there are differences between the coastal and inland areas on the growth of investment, financing structure, and the efficiency of funds allocation. These factors can amplify regional

differences. Furthermore, the imbalances in regional development cause labour migration to the well-developed regions, and therefore intensify the regional differences.

2.3.9.11 Central fiscal policy

At present, the central government promotes regional coordinated development through fiscal transfer payments and by improving public services. To accomplish fiscal transfers payment, the government changed the previous decentralized fiscal tax system to the current tax sharing fiscal tax system. As a result of the reform, the central fiscal income has accounted for a big proportion of total fiscal revenue and changed the former situation of local fiscal domination for some areas. As the central government has gained more revenue, it can provide more subsidies for the less developed regions. The design of central government's fiscal policy design is not based on local economic development and sources of revenue growth, but on the average of recent years' fiscal revenue and expenditure. Regions like Eastern China with larger fiscal expenditures and higher potential for economic growth benefit by gaining more income.

2.3.9.12 Chinese Economic Reform policy (globalization and economic liberalization)

Globalization and economic liberalization amplify the regional disparities. Through export and foreign investment, globalization promotes economic growth; adopting advanced technology promotes economic growth and competition among enterprises. The Economic liberalization promotes economic growth by optimizing the resources allocation. However, at the same time, owing to the regional difference in resource endowments, economic structure, and policy, globalization and liberalization may broaden regional disparities.

Chinese Economic Reform policy implemented policies preferential to the eastern coastal regions, including low tax rate, high financial return, and permission to use land for high-tech industrial development. This situation benefits the eastern region in many ways, for example, through better utilization of foreign capital for economic development, accumulating capital from international trade, introducing advanced technology, and adopting good management experience. Over the past 20 years of economic reform, market-oriented foreign direct investment and private investment drove the large amount of capital flows to the Eastern Region with accelerated economic growth results, but also expanding regional disparities. Commercialization of scientific and technical achievements in the Central and Western Regions is still very low. The resulting disparities in human capital between the Eastern and the Central-Western regions have become an important factor in regional differences.

2.3.9.13 Role of policy interventions

In the 8th FYP, China began to focus on more even regional development, and proposed coordinated regional development strategy: *to handle and perform regional advantages and the national coordination of planning, and the relationship between the coastal and inland areas, the economically developed regions and less developed regions, motivating the regional economy to move towards reasonable division of labor, performing advantages, advantages of complementarity, and coordinated development direction.* This strategic thinking was further explained and specific measures identified during the 3rd Plenary Session of the 16th Central Committee of the CPC as the *Five Overall Arrangements*. Strategies like the development of the Western Region, the rise of the Central Region, and the revitalization of the old industrial bases in the Northeastern Region aim to narrow the regional development gap and to promote more even regional development and targeted measures.

32 The specific contents of the *Five Overall Arrangements* are to:

actively promote the development of the Western Region, revitalize of the old industrial bases in the Northeastern Region and other regions, promote the rise of the Central Region, and encouraged

prioritization in Eastern Region development; continue to highlight advantages of the various regions and enthusiasm, improve the market mechanism, cooperation mechanism, mutual aid mechanisms, support mechanisms, and gradually reverse the trend of the regional development gap, forming the new pattern of the western and central regions to promote each other, to take advantage of complementarities, and to promote common development goals.

The 16th Plenary Session of the Fifth CPC Central Committee passed *the suggestion of the 11th FYP from CPC on the national economy development and social development*. This *suggestion* promotes the healthy development of urbanization, adherence to coordinated development of medium and small cities and small towns, improvement of the overall carrying capacity of cities and towns; continue to upgrade the driver and radiation effects of the Pearl River Delta, Yangtze River Delta, and the Bohai Sea region on the mainland's economic development; and continue the role of special economic zones and the Pudong New District of Shanghai, while stimulating the economic development of Tianjin Binhai New Area, and other areas with advantageous conditions.

The Decision of the Central Committee of the Communist Party of China on Several Important Issues on Building up the Socialist Harmonious Society passed by the 6th Plenum of the 16th CPC Central Committee, mentioned:

implementing the overall strategy for regional development and promoting coordinated regional development to form a regional industrial structure with reasonable division of labor, obvious characteristics, and complementary advantages, and to promote the common development of all regions; increase support to less developed areas and difficult areas, improve the infrastructure and the education, health, cultural and other public service facilities of the central and western regions, and gradually narrow down the gap among the regional basic public services; improve the support for the old revolutionary base areas, ethnic minority areas, border areas and poverty-stricken areas as well as major grain producing areas, mineral resources development areas, areas with ecological protection challenges, and ethnic groups with small population; support the economically developed areas to accelerate industrial structure optimization and industrial transfer, support the advantageous industrial projects in the Central and Western regions to speed up the transformation from resource advantages into economic advantages, encourage the Eastern region to help the development of the Central and Western regions, expand the developed areas to provide related assistance to the less developed areas and ethnic minority areas, form the mutual benefit mechanism with government as the leader, market as the channel, enterprises as the mainstay, the project as the carrier, establish a system for resource exploration with the pay to use and compensation mechanisms, put up measures to support the implementation of regional economic transformation in areas confronting resources recession and depletion.

Corresponding to the above policies, the government controls and regulates the developmental spaces through planning, policy, investment, and other measures.

Measures aiming to balance and correct regional development disparities include:

- *Improving management of land resources*. This is the measure that most governments try to implement. China has strengthened the planning and management of land, including 18 million acres of arable land with red line protection.
- *Developing better regional policy*. For example, when implementing the development of the Western Region, carrying out the Northeastern Region revitalization, and promoting the development of poverty-stricken areas the government carries out a series of preferential policies to support the region to accelerate development.

- *Improving overall planning.* The central government already has prepared some 86 regional planning or guidance documents. The major contribution of those efforts is to provide functional orientation for regional development, and clarify the role for each area in the national socio-economic development. Better coordination of plan implementation, attention to overlaps that create clashes between objectives, and other efforts towards integrated planning and management must become key priorities.
- *Promote infrastructure construction and implement of major land improvement projects.* Construction of the Qinghai-Tibet Railway and much other highway length and other infrastructure is intended to improve the conditions for regional development.

In 2006, the national 11th FYP put forward promotion of the regional main functional areas. Regional main functional area planning is based on: the region's resources and environmental carrying capacity, existing development density and development potential, consideration of the future of China's population distribution, economic layout, land use, and urbanization patterns, and division of the land space into classes based on development potential and protection needs. Areas suitable for future large-scale accumulation of population and industries would become the development class areas, and ecologically sensitive areas would be the protected class area. Within these general categories, according to the degree of capacity and sensitivity, areas will be further divided into four main functional areas: optimized development, key development, limited development, and prohibited development areas. Different regions have different functional orientation and assessment index systems (Zhang Xiaorui and Zong Yaoguang, 2010). The regional main functional area planning helps to go beyond ecologically insensitive administrative divisions, with the hope that better coordinated allocation of resources can achieve balanced social, economic and environmental development. However, the planning of the regional main functional areas is still at the elementary stage operating at a scale sometimes too coarse for use in local planning.

2.3.9.14 Multiple factors at play

Uneven regional development in China is the outcome of many factors. First, the economic geography, history, and a variety of factors lead to the situation that the level of economic development of coastal areas is higher than the inland areas. This is an early gap effect, that is, during the early stage of development, the gap of income per capita or starting points has a major role in enlarging the disparity at a certain stage. There can be cumulative effects. Second, the national gradient development strategy and tilt policy accelerate the trend of enlarging the economic disparity between coastal area and inland area due to the benefit gained from participating in the globalization and liberalization of the economy. Third, among different regions in China, the investment model is very different. The investment in human capital in developed coastal area is significantly higher than the central and western inland regions. The return on investment in human capital, social capital, and intangible capital is higher than the return on investment in the development of natural resources, physical capital, and tangible capital.

2.4 SOME KEY ISSUES

2.4.1 China's environmental still faces serious challenges despite vigorous mitigation efforts.

The pressures on environment continue to rise as a consequence of China's rapid development even though there have been important advances in pollution control and other environmental planning and management efforts especially in the 11th and 12th FYPs. Current efforts will help, especially transformative changes in the economy related to industrial restructuring and improved regulation and market-based incentives. There have been enhanced efforts to address the most difficult pollution problems such as non-point agricultural pollution sources, and

photochemical smog. However, there remain institutional cooperation and coordination issues, implementation inefficiencies, and great difficulties in the conduct of integrated environmental planning and management. These systemic issues will continue to hold back progress unless they can be tackled effectively.

Overall there is a need for accelerated efforts to tackle significant challenges in the environment and economy relationship of China, especially in the implementation of Circular Economy, Low Carbon Economy, and Green Economy. The continuing decline of ambient conditions needs to be stopped during the 12th and 13th FYP periods, so that environmental protection guarantees can be well implemented during the decade after. Then China can truly meet its expectations for an Ecological Civilization and Ecological Progress. By 2030 to 2035, the main environment and development problems of today should be solved, or well on the way to solution. The tasks are massive for this to happen well.

The sobering thought is that new issues will continue to emerge, especially as China's domestic consumption expands, and as Climate Change impacts are expressed throughout the country. China is already encountering various limits and scarcities created by a variety of factors, including push-back from citizens concerned about development, from high food, energy and many other demands on natural resources, and, internationally from matters related to trade and investment and from the increasing demands linked to regional and global environment matters. Expectations are high on the part of China's citizens and from the global community that China will play a growing role on green development internationally, including transfer of its best experiences into other developing countries.

There are also emerging opportunities associated with the transformative changes required in environment, economy and development relationships. Green development and sustainable development will produce new streams of revenue as well as jobs and better quality of life. Turning these hopes into reality will require that the current efforts to mainstream environment into economic and social decision-making must be considerably strengthened—at the national level, and within all regions of China.

As CCICED's 2012 study reports indicate, whether a region in China is economically advanced, even becoming post-industrial; or whether at an earlier stage, such as Western China, there are both significant challenges and opportunities for environment and development. Another reality check is that it will take insight and effort on the part of those cooperating with China internationally to keep a steady and productive relationship that optimizes outcomes for all sides. Otherwise, it is possible that the shift to green economy and development could stall. That would be most unfortunate whether the impacts are in China or in other countries.

2.4.2 Today's regional development strategy does not guarantee sustainable development within or among regions.

Certainly over the past 15 to 20 years there has been a shift towards a more comprehensive approach to regional development policy and planning. The four main regions have benefitted differentially, yet all have experienced trade-offs between environmental quality and economic growth, and with different levels of natural, human and social capital as a result. The richer areas of Eastern China have experienced significant declines in air and water quality, but now have the management capacity, including well-trained people, technical and financial resources, to deal with these and even the most difficult environmental protection problems in the coming years. Other areas, especially in Central and Western Regions, are not as well equipped to deal with the environmental stresses associated with high growth rates. Some areas are experiencing the double-digit economic growth rates common until recently in Eastern China provinces. However these other regions face the possibility of pollution spreading and intensifying from inward migration of heavy industry; impacts of mineral resource development; and the effects of rising market demand for animal protein on grasslands and water quality.

Regional growth places emphasis on transportation and infrastructure development. Some decisions are on track in relation to efficiency of energy use as well as opening opportunities for implementing renewable energy, for addressing poverty, and for ensuring that basic environmental infrastructure (water and sewage, solid waste disposal, protection against natural hazards) is in place throughout China. All these investments often have major environmental impacts, for example, from dams, and water diversion projects, and the effects of highways and pipelines on ecosystems and biodiversity. Indeed, new corridors transform landscapes on a massive scale. The cumulative environmental impacts of transportation and infrastructure are only beginning to be well understood in some of the larger parts of the country, especially in Western, and inter-regional effects.

Although China has experimented extensively with water basin planning and management, marine and coastal planning, and, more recently, with regional strategies for air pollution, these efforts have not met with necessary levels of success. Often there are collisions of objectives among sub-regions, or between regions. Mechanisms such as eco-compensation for protection of ecological services have taken hold. However no national system is in place. Some problems such as smog have become regional issues where no single city or industrial area can control the problem, since airsheds are polluted from multiple sources over extensive areas. This same problem exists for non-point agricultural pollution, and of course, marine areas.

Unless regional development strategy places greater emphasis on green development throughout all parts of China, and on inter-regional issues, it will be difficult to achieve sustainable development either regionally or nationally. The regions are so interlocked that even if there are improvements in part of the country, these achievements will be endangered if conditions decline elsewhere. This has already occurred in relation to air and water quality, and possibly in soil pollution problems. The difficulty to be faced is how to fairly and effectively address needs for differentiated approaches while still ensuring that the nation as a whole benefits.

2.4.3 Mechanisms for differentiated regional green development are still at an elementary stage.

It is appropriate for the goals of green development to vary between regions; and, within each of the four major regions to vary among the different provinces, autonomous regions and municipalities. This point is often explicitly recognized, for example by setting out differences in the environmental targets to be reached, and in relation to actions such as outmigration from areas that need strict ecological protection, or in the funding allocated to reforestation or grassland programs for protecting ecological services. The best efforts deserve considerable praise as successful efforts to accomplish both environmental and social economic development objectives. However, there is considerable confusion, sometimes with objectives working at cross-purposes and lack of capacity and understanding for newly introduced management concepts.

Confusion exists over national vs. regional pollution standards and practices. Although it is not surprising that differing levels of pollution control are a reality in China today, there must be some agreement about the future. The issue is whether major pollution emitting centres should be treated more or less alike, and cleaned up to similar standards and over similar time periods. Or should there be more lax standards in areas of lower population, or at an earlier stage of development?

Western China development is being based in part on policies related to Eastern China's past experience and primarily based on stimulating economic growth through increased investment. This strategy, which can rapidly raise growth rates to levels above 10 to 12%, led to high energy and high pollution outcomes and the same could happen in Western China and perhaps in other areas: 'pollute first, clean-up later'. Certainly there is some hope that the worst will be prevented, but the capacity to deal with rapid development is limited, and there is limited control in dealing with the large number of industrial shifts taking place.

Incentives for environmental improvement are inadequate in the taxation system and in regulatory measures such as fines for pollution control. Enterprises have limited incentive to spend on environmental controls as long as there are limited financial sanctions, or if they are not encouraged through sharing of costs for improvements. Competition between regions and provinces to secure industrial development is severe and cutting environmental corners by accepting less than best practices in order to secure industry growth is an issue. Green tax reform has been slow.

R&D investment in green technologies and capacity building of innovation skills is limited in some areas. If the right combination of human resources and access to green technology cannot be put in place, there is limited potential for green development. This places some sub-regions at a severe disadvantage, as cities and resource-dependent communities in rural China have discovered.

Main functional zoning is not developed well enough to be a reliable tool for sustainable and green development. China's laudable effort to define zones according to sustainable land and water use based on ecological conditions, existing uses and special conditions has been underway for a half decade. Yet main functional zoning is by no means a success at this point. The scale is too coarse (i.e., not operative at very local levels), and the designations are poorly understood locally. The functional zones and their boundaries are defined without full participation of affected people and resource users. They may become locally contentious. Thus what could be a most useful means to resolve land and water user conflicts and marine resource overlaps must be considerably upgraded to achieve optimal results. This will take a decade or more based on experience in other countries, and it is urgent to accelerate progress.

There is no comprehensive, unified eco-compensation system in China, although substantial financial support is expended each year on such compensation. China has a well-established and quite extensive set of initiatives to provide longer-term protection for watersheds, wetlands, and other areas that provide ecological services. Most of the payments originate from central government, or upstream subnational jurisdictions. Those benefitting most from the services (e.g., cities on rivers downstream) generally pay little. Furthermore, at this point, there is limited assessment of how to achieve best value for expenditure. Eco-compensation is a vital part of both national and regional green development strategies and likely could produce much greater benefits at lower cost, with more consideration of having beneficiary regions directly share in the costs. Better outcomes might then occur more quickly.

2.4.4 Industrializing and post-industrialization processes require separate but linked green development approaches.

China is currently paying much attention to structural adjustment of its heavy industry in order to reduce the extent of overinvestment and environmental damage, and to provide a quicker path to more balanced growth, including expansion of the service sector. As the service sector's contribution rises to levels of 50% or greater, there should be positive effects on environmental conditions in the Eastern Region. The assumption would seem reasonable, but the balance is precarious since there is redistribution of heavy industry especially to Central and Western Regions.

Green development for industry must be multi-pronged, taking into account cleaner production based on lower pollution intensity, ultra-energy efficient and non-polluting new production processes, and substitution of processes and products. Such industrial ecology is becoming well tested in China, but still not widely enough applied. Consolidation into large, modern operations combined with forced closure of inefficient producers occurs frequently and this trend will continue.

Soon industrialization will see quite separate types of situations. One is in the newly industrializing locations such as Western China and parts of Central China, where there may be good intentions but limited capacities to move directly to a desired high level of clean production and advanced technologies. The second is the post-industrialization

situation in areas such as the Northeast and East, but also in the other regions, where dirty industries have moved out, leaving a legacy of brownfields that require expensive remediation. The post-industrialization areas also face the emergence of new service-oriented facilities and activities that have their own new types of environmental problems such as the high energy use of major computer data storage facilities, the demands on the financial sector for improved environmental monitoring of their loans and other activities, and the tourism sector with its impacts on biodiversity and fragile ecosystems. Thus separate but linked pathways of green development are needed to make regional green development supportive of national needs.

For greening of older industrialized areas that remain in place, entrance requirements need to be high so that best practices are favored. It will be necessary to have high standards put in place throughout China—so that simply dismantling old high polluting, high energy use industrial plants and re-assembling them in new locations is not an option. Mechanisms are needed for sharing experience based on success stories where production facilities have been environmentally upgraded cost-effectively. Much of this successful experience can be gleaned from locations in the Eastern Region.

For some of the service industries that increasingly will be found throughout China, there are challenges that include green building design, design and operation of new business campuses, and light industry or high-tech green industrial parks, and the development of green relationships, whether for investments, market supply chains, or customer/client oriented certification or other programs that demonstrate commitment to green development and green products.

At the heart of all these approaches is corporate social responsibility, covering the industry's license to operate in a community and its profitability based on meeting—in a transparent way—specific environment and green development goals.

2.4.5 Green development coordination and integrated management is limited in effectiveness.

Coordination mechanisms are insufficient at local-provincial, regional and within central government levels. This is a general problem concerning development within China, but it is perhaps more severe in the case of environment and green development concerns. The reason why is that many such concerns are “spill-over” problems, or externalities. In addition, most of China's rich resource bases are now being exploited in a single-minded way to meet very specific objectives that demand a more or less constant increase in production. The Bohai Sea is an example in the marine environment, where more is being demanded from fisheries, aquaculture, offshore oil and gas, tourism, and from shoreline development that includes extensive infill and loss of wetlands. There is no effective integrated planning and management; nor is there a robust emergency response system. Thus when an oil spill occurs, the economic cost is high and ecological damage excessive. Similarly, the pollution over China's cities now requires an integrated management approach since the primary pollutants from various sources and locations form into secondary pollutants such as PM_{2.5} small particles that spread widely and form a costly regional problem that is hard to solve.

The success of past efforts for environmental protection has been based largely on meeting defined single targets, whether for reforestation (% of forest cover) or pollution reduction and energy efficiency (reduction of SO₂, energy intensity reduction). The problem is that these targets do not necessarily translate directly into improvements in ambient environmental conditions, or to more healthy ecosystems, or even to reduced environmental risks. This a dilemma that will be repeatedly encountered in the complex situation of regional green development in China, where there already exists a high level of demand on the part of citizens for actual environmental improvements. The argument for effective integrated assessment and management includes improved capacity for monitoring for improvements in environmental quality progress, plus human and ecosystem health. The recently-created MEP

regional offices have demonstrated the value of independent monitoring, and should be strengthened in order to carry out their mission even more effectively.

Given that existing regulation and institutional arrangements are not working to solve these and other such problems such as integrated water basin management, there clearly must be a move to new ones. There are numerous models to draw on from international experience, for example Los Angeles on air pollution, Murray Darling river basin management in Australia, the Barents Sea integrated management and the Black Sea Commission in Europe. China may learn from these and other approaches, but it will need to define approaches unique for its own complex situation. Two great problems need to be addressed: (1) overlapping institutional responsibilities without clear lines of authority; and (2) limited monitoring and enforcement abilities, with many dispute resolution needs.

More broadly, there is no clearly defined green development authority at any level of government in China; nor is there a full understanding of how far-reaching an integrated planning and management approach to green development might have to become. Green development certainly requires new investment strategies, new indicators of progress, improved sharing of information, regulatory streamlining, clearer lines of accountability, and capacity development. It may be valuable to consider consolidation of implementation authority so that resource and environmental management may be dealt with on a more holistic basis, and in the context of regional green development.

2.4.6 Lack of a clear long-term vision and strategy to guide national and regional action for green development in China.

The 1994 China Agenda 21 document provided a comprehensive sustainable development outline appropriate for China's needs at that time. It was to a considerable extent outstripped by the high economic growth rates of the past 15 years, leading to the situation of today's "unbalanced, uncoordinated and unsustainable development." While many of China's existing policies are suitable for a national green development strategy, they are still pieces that do not add up to a whole, and there is no nationally-adopted strategy. A vision and strategy at least to 2030 are needed, and for some important elements such as Low Carbon Economy, the need extends well beyond that time frame. A strategy for Green Development needs to consider the optimal balance and utilization of natural, economic, social and human capitals to bring about and sustain green regional development and prosperity. In addition there must be political leadership and good governance at a national level without which any strategy is likely to fail. The timing for defining and adopting a Green Development Strategy is excellent, given that, at the 18th CPC Congress in November 2012, Ecological Civilization/Progress was elevated to the same level as Politics, Economy, Society and Culture—all main drivers of change for the whole Chinese society.

Citizens should play a responsible & helpful role in green development planning and implementation, yet the opportunities to do so are largely beyond their reach at present. Four examples of how this situation could be improved include:

- Expanding opportunities for more substantive direct citizen input to environmental assessments and other planning processes; with government providing full disclosure on green development concerns including topics such as toxic waste inventory and disclosure, and regular monitoring of environmental problems.
- Fostering green job opportunities within regions, e.g., to support low carbon economy, circular economy, etc. This may require financial inputs through mechanisms such as eco-compensation.
- Putting in place co-management arrangements with local community groups in Western China & elsewhere for ecological construction and nature protection including ecosystem and biodiversity conservation.

- Placing greater emphasis on environmental education, community improvement initiatives and other means to promote an understanding and capacity for green development.

Green consumption should be part of the Green Development vision and strategy. This element should be tied to both consumers and producers. If green choices are unavailable, poorly understood, not offered at a reasonable price point, or uncompetitive for other reasons they will not be purchased. Both goods and services are of concern, especially regarding personal transportation, government procurement, and in market supply chains. It is observed that a significant number of urban dwellers in China are moving towards western consumption levels either at home or in their office workplaces, often in western-styled high energy consuming buildings. While a small number of office buildings in China are built to LEED standards, most are not.

China's cities are essential partners for Green Development and yet in the rush to build quickly and cheaply this potential is not being fully exploited. There is no overall Green Development Strategy for China's urban development, although there are many interesting initiatives unfolding. The concept of eco-cities, pioneered in other countries but also found in China is one starting point. Another is the enthusiastic reception of many Chinese cities to Low Carbon Economy, as highlighted at the Shanghai Expo.

China's urban development allows for a variety of approaches to take into account the uniqueness of setting, cultural, stage of development, and other characteristics. Also, there is the opportunity to build specific innovations centred around sustainable technologies, for example related to green automobile development and production, and a focus on high quality of urban living through outstanding urban planning and design. Gateway cities to areas of outstanding natural beauty can develop a tourist based service economy. It is quite likely that within the various regions of China, it is the cities that will take the lead in defining green development opportunities and pathways.

2.4.7 Alignment of China's Green Development with International Green Economy Trends.

Rio+20 emphasized Green Economy directions at the national level, but was not particularly strong on sub-national regional development needs. Generally, China is ahead of many other countries in terms of exploring the implications of green growth, economy and development. However it is essential for China to draw upon the relatively rich experience in other parts of the world that could hasten China's own transformative changes. Secondly, China already is in a position to market both goods and services for green development to other countries and thus turn its efforts into substantial economic gains. Third, there are important implications for China's future international cooperation, especially with transferring experience and technologies to developing countries, and in cooperation with countries to solve problems of mutual interest such as clean energy technologies. There is a need to green China's Outward Direct Investment (ODI) and perhaps include this process in the overall Green Development Vision and Strategy.

Finally, given that Green Economy and Green Growth will be an important component of discussions in future international negotiations and dialogue, China can seek workable partnerships and other cooperation that will benefit its own regional and national development, and will contribute to better development elsewhere and globally.

2.5 CONCLUSIONS

Consolidation of environmental protection and management, low carbon economy, circular economy and sustainable development strategies with green growth and green economy is needed in order to provide a strategic direction for green development. In a few words: mainstreaming green development into national and regional decision-making. China's most recent elevation of *Ecological Progress* places the subject at the highest level of societal drivers. This

should permit accelerated consideration of green development in future regional development efforts well into the future, especially in the critical period between now and 2030. While the CCICED studies this year provide insight into green development roadmaps for specific regions and types of problems, it is very evident that a national green development strategy strongly focused on regional development and also on China's external environment and development relationships is needed for guidance. Such a strategy would be very helpful in providing substance and practical guidance for implementing a comprehensive approach for *Ecological Progress*.

2.5.1 Mainstreaming regional Green Development

China has made substantial commitment in the 12th FYP to addressing regional economic imbalances and to enhancing environmental quality throughout China. These commitments will provide a substantially altered baseline condition by the start of the 13th FYP. The richer provinces will focus on pollution reduction, but it is very important that new sources of environmental degradation not be allowed to gain a foothold anywhere, as happened with nitrogen pollutants during the 11th FYP. Migration of heavy industry is already taking place on a considerable scale, but should not be at expense of the environment, for example in Western China. Significant issues of inter-regional cooperation & competition, transfer payments, eco-compensation. Urbanization is a key matter for regionally balanced development, including regional clusters of very advanced infrastructure development and with great possibilities for mainstreaming green development. As well, rural-urban migration is one of the most significant subjects with regard to inter-regional development management, and will play an on-role on green development.

The following conclusions are useful considerations for the mainstreaming of green development:

- All regions are interdependent with regard to environmental changes and impacts, but the actual issues and the capacity of regions to deal with them are quite different and depend on many factors. Thus, while high quality of environment should be maintained throughout the nation, and the necessary standards put in place to ensure this happens, differentiated strategies are needed at regional and sub-regional levels.
- Continuous attention and guidance is needed from senior leaders at all levels to ensure that better coordination produces optimal outcomes. This coordination should be both vertical and horizontal, and between sectors. Green development requires institutional changes and considerable attention to capacity development. There is a need to improve accountability and to monitor outcomes through improved ecological knowledge and environmental quality. Green development requires good governance in order to achieve cost-effective, high quality outcomes.
- Green development has to be a longer-term planning effort with an agenda that extends until at least 2030, and increasingly demanding objectives including those of the current 12th FYP and the 13th FYP. Over time it should be possible to build more integrated green development approaches for topics such as poverty elimination and protection of ecologically fragile areas, green urban development, and rural ecological progress.
- Major investment decisions are required on the part of both government and enterprises to ensure effective and efficient use of funds for environmental protection and for the emerging low carbon economy. Many of these decisions involve SOEs, and also municipal levels of government. There has been much concern on how the concept of scientific development can best be applied for these decisions and in the follow-up management actions. Further improvements of environmental impact assessment, new efforts such as social risk management, and environmental audits are being discussed at present. These are promising mechanisms, but require careful consideration of how they can produce better results without further administrative confusion and coordination complexity. They also require a high level of transparency in their application.

- Laws and regulations pertaining to greening of regional development, and necessary incentive systems require further attention. Some environmental laws are outdated, and perhaps are not sufficiently robust to address emerging problems such as regional air pollution, adequate fines or other punishment for major incidents, or health and environment risks. Promotion of the rule of law includes the need for improved disclosure of environment and development information. It also means full access to courts for citizen complaints and other mechanisms that improve the capacity of citizens to monitor, comment upon, and take action for the safeguarding of their local environment, and participating in the improvement of the country's Ecological Progress.
- China's efforts for mainstreaming green development may be helped by improved linkages to green growth & green economy efforts elsewhere in the world, including both developing & industrialized countries

2.5.2 Practical priorities for Green Development

Among the many practical priorities that have been identified in the discussion on regional green development, seven stand out for special attention in all regions:

Improved human capital in all regions through robust employment strategies, with a focus on poverty reduction, education, health, and advanced skills for value-added employment especially in the service sector.

- Improvement of the integrity of urban and rural environments and ecosystems and biodiversity management, improvement of ecological services, high quality of the built environment, regional pollution control, sustainable resource use.
- Transition to a Low Carbon Economy including sustainable energy transportation & infrastructure, application of green technologies throughout energy production and utilization in key sectors, and major shifts away from today's approach to coal use.
- Green industrialization in primary, secondary and tertiary levels of industry.
- Optimized land and water use, including river basins, marine & coastal areas, waterbasins, in urbanization and rural sustainable development.
- Sustainable consumption and a relatively small ecological footprint are essential elements of a moderately well-off society.
- Livable cities and rural communities with low levels of environmental risks.

2.5.3 Innovative tools for regional Green Development

A number of tools now in use within China are specifically designed for application at the regional level in addition to those of general application for environment and development these include:

- Ecologically-based Main Functional Zoning can be used for ensuring green development based on local attributes, ecological services value and fragility of ecosystems. But zoning information and the actual use of such zoning for local decisions still require considerable refinement.
- Eco-cities and eco-provinces are terms used in China, with interesting local experiments, However, the expansion of today's experimentation into full practice in every part of the country could be accelerated. The benefits and costs also require careful assessment, since showcasing can be an expensive approach of limited value.

- Eco-compensation experience in China has expanded greatly over the past decade, but is not yet a comprehensive national system. It must be considered a national system since it meets needs of both richer and poorer regions. The sources and levels of funding and the use of incentives in expenditures will be important considerations in future design and long-term application.
- Ecological construction is of great value to China, with use in restoration of damaged areas. In general this approach has seen its most significant application in rural areas of Western and Central China. However as the country addresses soil pollution and brownfield sites in the industrialized areas, and ecologically damaged marine and coastal areas in Eastern China, the experience gained in operating the forest and grassland rehabilitation efforts may be put to get use. These existing programs also require improvements, especially for grassland-dominated regions.
- Innovation clusters for green technology development & application have become important in many cities and it should be possible to harvest the results of investment in such clusters during the coming decade. The possibilities for expansion into areas and development matters of sub-regions within Western China and elsewhere will open new opportunities for innovation.
- Investment models in green development will continue to evolve. This is a matter not fully resolved by any means. The potential roles of smaller start-ups and the much larger SOEs is one area of concern. Both are important. Another is the potential of FDI into areas beyond the Eastern Region to introduce new technologies and management approaches for green development. Investment in heavy industry will likely fall off somewhat after 2020, opening new possibilities for more balanced and green development. This will accompany the interest in stimulating domestic consumption levels. However, there is no guarantee that the trend will be towards sustainable consumption. Investment can help to shape the directions taken.

2.5.4 New Political Opportunities

CCICED's 2012 Annual General Meeting is taking place at a time of political transition in China. It is therefore appropriate to leave the final word on development to a new political leader. In his speech at the conclusion of the 18th CPC Congress, China's Vice-President, Mr. Xi Jinping noted that:

Our people have an ardent love for life. They wish to have better education, more stable jobs, more income, greater social security, better medical and health care, improved housing conditions, and a better environment. They want their children to have sound growth, have good jobs and lead a more enjoyable life. To meet their desire for a happy life is our mission.

These wishes hopefully will be turned into reality during the coming years, and in the process, green development achieved for all parts of China. Such an outcome will be an immense contribution for the whole world's environmental state as well.

CHAPTER 3

POLICY MECHANISM TOWARD ENVIRONMENTAL TARGETS FOR THE 12TH FIVE-YEAR PLAN: STRATEGIES AND POLICY STUDIES ON MID-TO-LONG-TERM POLLUTION REDUCTION

Executive Summary

From the “one control, two standards”²² in the 9th Five-Year Plan (FYP) to the binding pollution reduction indicators in the 11th FYP, China has pursued efforts to reduce pollution—through total emissions control, pollution prevention, risk prevention, and quality improvement—for 15 years. Pollution reduction will continue to be an important measure as the nation promotes green development and improves environmental quality over the long-run.

Based on the success of the “policies and mechanism to achieve the 11th FYP environmental targets” project, CCICED has launched a sequel project for the 12th FYP. This project analyzes the situation today and new problems, and builds a medium-to-long-term roadmap for China’s efforts to further reduce pollution during the 13th FYP and beyond. Policies put forward to achieve the 12th FYP targets include coordinated multi-pollutant emissions reduction, sector-specific and region-specific efforts to protect the environment, and economic restructuring through total emissions control.

3.1 REVIEW: Assessment of Pollution Reduction Under the 11th FYP

The CCICED Task Force have used methods such as logical framework analysis, traffic light analysis, regression analysis, and decomposition of factors to objectively assess work toward pollution reduction goals, the resulting benefits, and the challenges that lie ahead. The Task Force found that, generally speaking, pollution reduction efforts under the 11th FYP have been a great success, meeting and even surpassing targets. Against a backdrop of faster-than-expected economic growth, industrialization, and urbanization, this is a remarkable achievement—and a sharp contrast with results under the 10th FYP.

Thanks to the joint implementation of a responsibility system for local governments, pollution control projects, structural adjustment, and environmentally friendly economic incentives, China has avoided higher pollution levels. However, despite these significant accomplishments, the nation will need to ramp up its efforts to achieve the environmental goals in the coming years.

²² “One control” refers to the control of 12 main industrial pollutants, including SO₂, industrial dust, chemical oxygen demand, mercury, and cadmium. “Two standards” means that industrial polluters must meet national or local emissions standards, while specific zones must meet national standards for air and water quality.

I. China made great efforts to pursue arduous pollution reduction tasks under the 11th FYP, and the resulting achievements are remarkable.

Adhering to caps on pollution when economic growth was greater than expected is a great accomplishment.

Under the 11th FYP, some measures of economic and social development related to the environment deviated from the planned scenario. GDP growth exceeded the target by 13.7 trillion Yuan. Urban population increased by 11 million. China consumed an extra 550 million tons of coal-equivalent energy. The service industry's share of GDP was 0.5 percentage point less than expected. Reductions in energy intensity fell 0.9 percentage point short of the goal.

Because of the higher than expected economic growth, the nation needed to reduce its chemical oxygen demand (COD—a measure of organic pollutants in wastewater and surface water) by 2.08 million tons, and sulfur dioxide (SO₂) by 4.93 million tons, to meet the 10 percent pollution reduction goal in the 11th FYP.

Table 3-1 Performance on environment-related targets in economic and social development under the 11th FYP

Economic growth exceeded the planned scenario under the 11th FYP, putting extra pressure on efforts to reduce overall pollution, and preventing China from reaching some resource- and energy-saving targets.

Item	Target	2005	Set Targets		Actual Performance		Difference in growth rates (percentage points)	Impact on environment
			2010	Average annual growth (%)	2010	Average annual growth (%)		
Economic growth	GDP (trillion Yuan)	18.5	26.1	7.50	39.8	11.2	+3.7	Negative
	Per capita GDP (Yuan)	14,185	19,270	6.6	29,748	10.6	+4.0	Negative
Economic structure	Proportion of service industry (%)	40.5	43.3	[3]	43	[2.5]	[-0.5]	Positive
	Proportion of R&D expenses in GDP (%)	1.3	2	[0.7]	1.75	[0.45]	[-0.25]	Positive
	Urbanization level (%)	43	47	[4]	47.5	[4.5]	[+0.5]	Negative
Population, energy and resources	Total national population (10,000)	130,756	136,000	<8	137,053	9.6 % ²³	[+1.6] %	Negative
	Reduction in energy consumption per unit GDP (%)		[20]		[19.1]		[-0.9]	Positive
	Reduction in water consumption per unit of industrial value-added (%)			[30]		[36.7]	[+6.7]	Positive
	Utilization efficiency of agricultural irrigation water	0.45	0.5	[0.05]	0.5	[0.05]	0	Positive

Source: Outline of the 12th Five Year Plan for National Economic and Social Development; 2010 6th National Population Census (No.1). Data in [] are five-year totals.

By 2010, China had surpassed the emissions reduction goals in the 11th FYP, with COD discharges and SO₂ emissions declining by 12.45 percent and 14.29 percent, respectively, from 2005 levels. COD discharges dropped by 6.94 million tons and SO₂ emissions dropped by 10.44 million tons. Specifically, China reduced extra COD discharges by 5.18 million tons and SO₂ emissions by 6.80 million tons²⁴ to offset faster-than-expected economic growth (Figure 3-1).

Controlling a rapid pollution increase given economic growth, and maintaining caps on key pollutants, will be China's most important and difficult challenges in the new era.

²³ The GDP numbers are original prices of the year (not comparative prices), but the growth rate are calculated by comparative prices (discounted and considered inflation), therefore, they are not consistent.

²⁴ These numbers are the sums of the numbers for new emissions due to unexpected new development (pink-key) and the numbers for anticipated new emissions (brown-key).

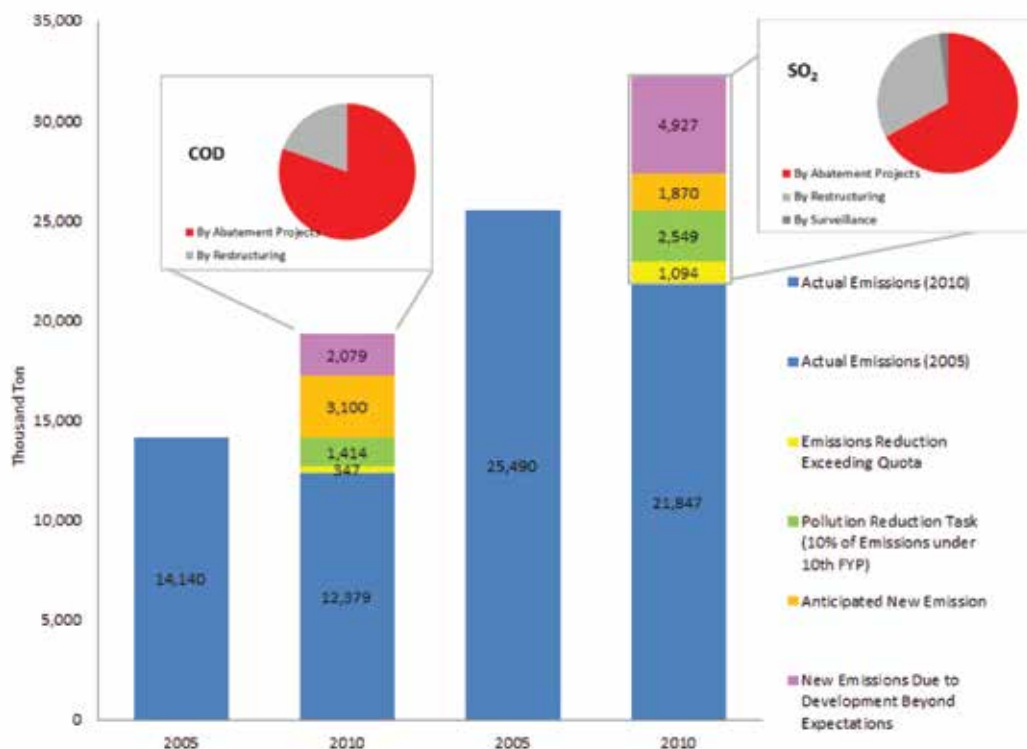


Figure 3-1 Reductions in total COD discharges and SO₂ emissions under the 11th FYP

Source: Social and economic development scenarios developed at the beginning of the 11th Five-Year Plan; MEP monitoring and appraisal data, 2007 to 2010.

Pollution abatement projects contributed to most reductions, and laid a solid foundation for success.

Investment in pollution reduction projects under the 11th FYP totaled around 816 billion Yuan, with construction and operational costs costing 455 billion Yuan and 361 billion Yuan, respectively. With environmental investment from all sources programmed at 2 trillion Yuan in the 11th FYP, including 166.7 billion Yuan from the central government budget—an almost threefold increase compared with the 10th FYP, the construction of key projects was guaranteed.

Construction of sewage treatment plants in cities, and desulphurization facilities for coal-fired power plants, far exceeded the original targets under the 11th FYP. By 2010, all counties in 16 provinces and municipalities, including Hebei, Henan, Hunan, and Guizhou, had set up their own sewage treatment plants. By the end of 2010, China had built a total of 2,832 urban sewage treatment facilities—an increase of around 2,000 under the 11th FYP. Daily treatment capacity reached 125 million tons—an increase of 65.35 million tons per day from 2005.

The capacity of completed and functioning sewage treatment plants exceeded the target by 20 million tons, or 144 percent. The capacity to treat COD discharges exceeded the target by more than 1.3 million tons. Statistical analysis shows that increased investment in urban environmental infrastructure construction has played the largest role in reducing COD emissions. Sewage treatment in cities rose from 52 percent in 2005 to 77 percent in 2010.

By 2010, 578 GW of coal-fired power plants had been equipped with desulphurization facilities—an increase of 532 million kW under the 11th FYP. The share of thermal power generating units with desulphurization equipment rose from 12 percent in 2005 to 82.6 percent in 2010. The installed capacity of thermal power plants with desulphurization equipment has exceeded the planned target by 177 GW. This represents an increase of 50 percent over the original goal, or the capacity to reduce 2.9 million tons of SO₂ (Figure 3-2, Table 3-2, and Figure 3-3).

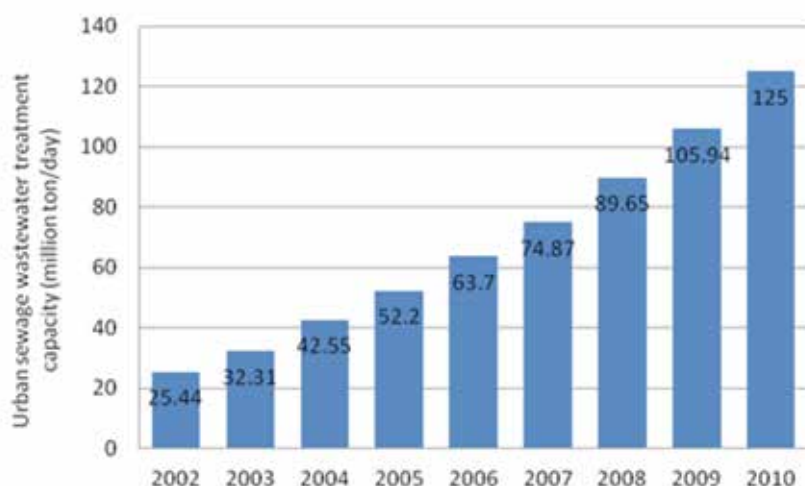


Figure 3-2 City sewage wastewater treatment capacity, 2002–2010

Source: Environmental Statistics Communique, Ministry of Environmental Protection.

 Table 3-2 Construction of wastewater treatment facilities under the 11th FYP

Major Items	Targets for 11th FYP	Actual performance under 11th FYP
Wastewater treatment capacity	105 million m ³ /day, including new capacity of 45 million m ³ /day (with 30.00 million tons of capacity formed)	125.35 million m ³ /day, including new capacity of 65.35 million m ³ /day
Wastewater treatment volume	29.6 billion m ³ /year	34.33 billion m ³ /year
COD reduction	3.00 million tons	4.00 million tons
Wastewater treatment rate	Average city/town wastewater treatment rate of 52%, with cities ≥70% and county towns ≥30%	Average city/town wastewater treatment rate exceeded 75%, with cities reaching 76.9% and county towns reaching 44.2%
Load factor of urban wastewater treatment facilities	≥70%	78.9%

Source: Environmental statistics communique, MEP.

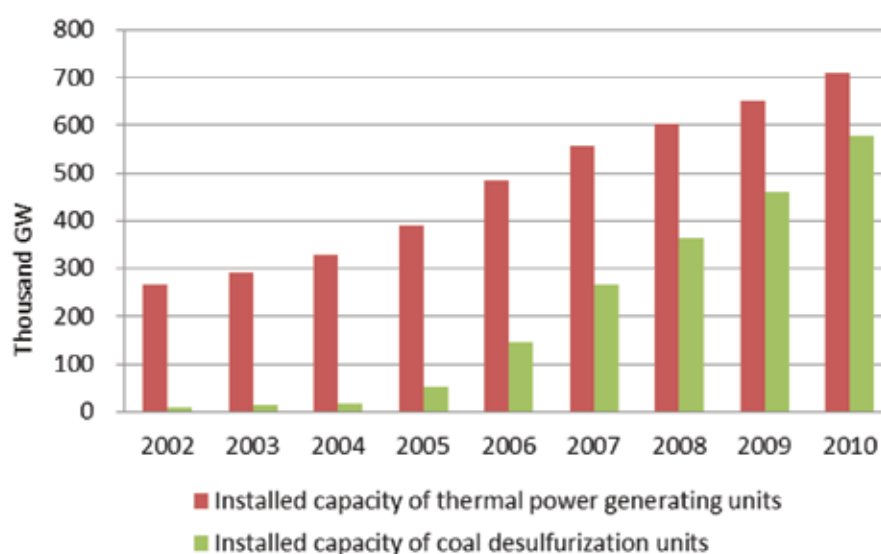


Figure 3-3 Growth in installed capacity of coal desulfurization units

Source: Power industry statistics; Environmental Statistics Communique, MEP.

The construction of pollution-treatment and emission-reduction facilities contributed most to the attainment of emissions goals under the 11th FYP. To be specific, COD reduction achieved through project construction accounted for 80.5 percent of the total COD reduction. Sewage treatment plants accounted for 58.5 percent of that share, with plants in 20 provinces and municipalities, including Beijing, Tianjin, Shanghai, Guangdong, and Chongqing, accounting for more than 50 percent of their local reduction. SO₂ reduction achieved through project construction accounted for 67.2 percent of the SO₂ reduction, with desulphurization projects for coal-fired power plants contributing 59.5 percent of that share.

Analysis of the impact of different efforts to reduce COD discharges (using a binary regression model) suggests that sewage treatment facilities in urban areas and cleaner production were more important than other efforts in achieving this goal. However, industrial COD discharges may contain more environmentally toxic elements, and are likely to be more critical in keeping specific bodies of water clean. Determining whether to adopt centralized municipal treatment or decentralized treatment at industrial sources—or a combination of both—will be key in coming years.

Under the 11th FYP, provinces and municipalities also established 343 pollution monitoring centers, with automatic surveillance of 15,000 enterprises now under way. Supervision of pollution treatment facilities has also improved. However, given the 1.9 million industrial enterprises and tens of thousands pieces of pollution-treatment and emission-reduction equipment now operating in China, the share under surveillance is quite limited. Weak capacity in environmental management and surveillance remain acute barriers to further environmental progress.²⁵

Synergy between efforts to restructure industry, reduce pollution, and improve efficiency is occurring.

Reductions have decreased the COD and SO₂ pollution intensities of most industries—and the gap between industries—under the 11th FYP. In 2010, industrial COD and SO₂ pollution intensity declined by 55 percent and 50 percent, respectively, compared with 2005 levels.

Industrial restructuring has become one of the main drivers of pollution reduction. The share of thermal power generating units with installed capacity of 300 GW and above rose from 47 percent in 2005 to 71 percent in 2010. The cement industry has eliminated 370 million tons of outdated production capacity, while the steel manufacturing industry has eliminated 72 million tons. The share of new-type dry-process cement clinker rose from 39 percent to 81 percent, while the share of blast furnaces larger than 1,000 cubic meters in the iron and steel industry rose from 21 percent to 52 percent. Under the 11th FYP, small power plants with a total capacity of 0.77 GW were closed.

All this industrial restructuring reduced SO₂ emissions by 3.6 million tons, accounting for 31 percent of total SO₂ reductions. Closure of small plants reduced SO₂ emissions by 2.07 million tons, or 17.8 percent of the total.

However, despite the declining intensity of emissions, it is still higher in China than in developed countries. Generally speaking, China's development pattern—featuring high input levels, high energy consumption, and high pollution levels—has not been reversed. If the service industry's share of GDP rises by 1 percentage point, and industry's share falls by 1 percentage point, energy consumption per 10,000Yuan of GDP could decline by 1 percent. When the high-tech sector's share of GDP increases by 1 percent and the share of high-energy-intensity sectors declines by 1 percent, energy intensity per 10,000Yuan of GDP could also fall by 1.3 percent.

Industrial restructuring is progressing slowly. From 2005 to 2010, the share of heavy industry in total industrial output increased from 68.1 percent to 70.9 percent. The share of tertiary industry increased only by 2.5 percentage points—less than expected.

²⁵ For example, SO₂ reductions achieved through stronger supervision account for less than 2 percent of the total reduction. COD reductions achieved through stronger supervision are normally counted as project emissions reduction.

The challenge is that economic policies intended to spur growth also stimulate “dual highs”—high-energy-consuming and high-pollution sectors. Industrial restructuring in China has also mainly relied on administrative measures, which may only have short-term, periodic, and reversible effects. Some industrial policies lack a long-term framework, with measures that can be implemented progressively. The randomness of some policies, the *cost of economic restructuring, and sunk costs are impediments to further structural adjustment.*

China has put in place a package of policies to reduce discharges and emissions of pollutants, including economic incentives such as a desulphurization electricity price.

Under the 11th FYP, China established a series of economic incentives that promote energy conservation and emissions reduction, including pricing and fiscal and tax measures. It is fair to say that a policy framework for environmental improvement is emerging.

In the power sector, a subsidy of 1.5 cents per kWh was applied to electricity generated by coal-fired power plants that operate desulphurization equipment. A “green” electricity dispatching system was adopted. A cap on total emissions was introduced to the entire sector. Those sectoral policies and measures meant that the nation reached its target for reducing SO₂ emissions one year ahead of schedule. In fact, the power industry accounted for 79 percent of the total reduction in SO₂ emissions.

However, to attain the reductions required in future years, efforts to control SO₂ and other pollutants will have to move beyond focusing exclusively on large-scale sources such as power plants. The nation needs to develop and support comprehensive, long-term, forward-looking policies for conserving energy and reducing emissions. China also needs to pay much more attention to designing and implementing policies that promote the most cost-effective reductions.

A strengthening of the accountability and performance of local governments was the most significant advance in environmental protection under the 11th FYP.

Under the 11th FYP, all provinces assigned environmental goals and tasks to local governments and enterprises with clearly defined responsibilities, and gave them enough time to respond. The central and provincial governments complemented that effort with measures such as check and verification, regional restrictions on approval for projects that did not meet environmental standards, and the use of environmental and energy targets in evaluating local officials. This was the first time that local governments had fully shouldered responsibility for environment quality, and that shift will exert a profound influence on environment protection in the future.

The Ministry of Environmental Protection (MEP) suspended the approval of construction projects in six cities²⁶ and four corporate groups because they did not comply with environmental regulations. MEP also ordered 50 power plants and 44 urban sewage treatment plants to meet pollution targets within specific timeframes. Meanwhile the State Council commended Shandong, Jiangsu, and six other provinces and municipalities for their efforts to reduce discharges and emissions.

Some localities established positions such as “River Chief” system and “River Section Chief” system,²⁷ and “double 30”²⁸ to broaden accountability beyond local officials and target specific environmental problem areas. City

26 Yingtian in Jiangxi, Sanya in Hainan, Hechi in Guangxi, Yuxi in Yunnan, Shuangyashan in Heilongjiang, and Wenzhou in Zhejiang.

27 “River Chief” and “River Section Chief” are accountability mechanisms under which the local government chief is held responsible for the river water quality within his administrative area. The system helps facilitate the coordination among different departments in water management.

28 Under this plan, participating provinces evaluate 30 key counties (cities or districts) and 30 key enterprises on energy and pollution reduction goals, implementation measures, improvements in environmental quality, and public satisfaction.

and county leaders in charge of environment protection in Shandong, Hebei, and other provinces had their poor performance recorded in their personnel dossiers, or were dismissed from office for not attaining annual targets for reducing emissions.

A dozen provinces created cross-municipality mechanisms for assessing water body section performance and determining compensation for environmental incidents. On the other hand, emissions reductions under the 11th FYP stemmed mainly from government action and compulsory measures. China still lacks a framework for concerted action by government, enterprises, and society.

The State Council implemented most of a work plan identifying practical steps for achieving pollution reduction targets.

The Comprehensive Work Plan for Energy Conservation and Emissions Reduction issued by the State Council under the 11th FYP made the goal of curbing the release of major pollutants by 10 percent more practical. The Work Plan called for reducing emissions through restructuring, major projects, and better management. It also included 12 major measures, such as curbing the rapid growth of energy-intensive and heavy-polluting industries. Finally, the plan included 62 policy requirements, such as adding progress in energy conservation and emissions reduction to approaches to evaluating local economic and social development.

The Task Force used a qualitative approach (the traffic light method²⁹) to analyze progress on these fronts. We concluded that overall implementation of the policy requirements was satisfactory, and helped China achieve the goals of the Work Plan.

Specifically, the nation strictly implemented 38 requirements—recorded as a green light. The nation roughly implemented several other requirements, such as surveillance and management of equipment, budget guarantees, improvements in operating capability, and shifts in credit, insurance, and taxes to promote environmental goals—recorded as a yellow light. Finally, the nation did not fulfill 8 requirements in the Work Plan, such as curbing excessive growth of pollutants in energy-intensive and heavy-polluted industries—recorded as a red light.

Achieving targets for reducing emissions under the 11th FYP produced other environmental and economic benefits.

The reductions in emissions and discharges of pollutants achieved under the 11th FYP improved China's overall environmental quality. In 2010, the average Permanganate Index—a measure of organic pollution of surface water—at 759 state-controlled monitoring stations was 31.9 percent lower than in 2005 (Figure 3-4). Environmental quality in some key river basins has improved remarkably.

Because of declines in SO₂ emissions, the share of total land area affected by acid rain dropped by 1.3 percentage points. Average SO₂ intensity in key cities targeted for environmental protection declined by 26.3 percentage points in 2010 compared with 2005 (Figure 3-5). Using satellite surveillance data, the U.S. Environmental Protection Agency confirmed that atmospheric SO₂ in China has been dropping since 2007.

However, determining whether the nation has made enough progress to protect sensitive ecosystems and human health in acid rain hot spots will require further study. Nitrogen oxides have also become a more important factor in acid rain, and China needs to evaluate and reduce those emissions.

²⁹ This qualitative method assigns red to projects that failed or have not been implemented, yellow to those that have shown some success but need more work, and green to those that have achieved what was intended.

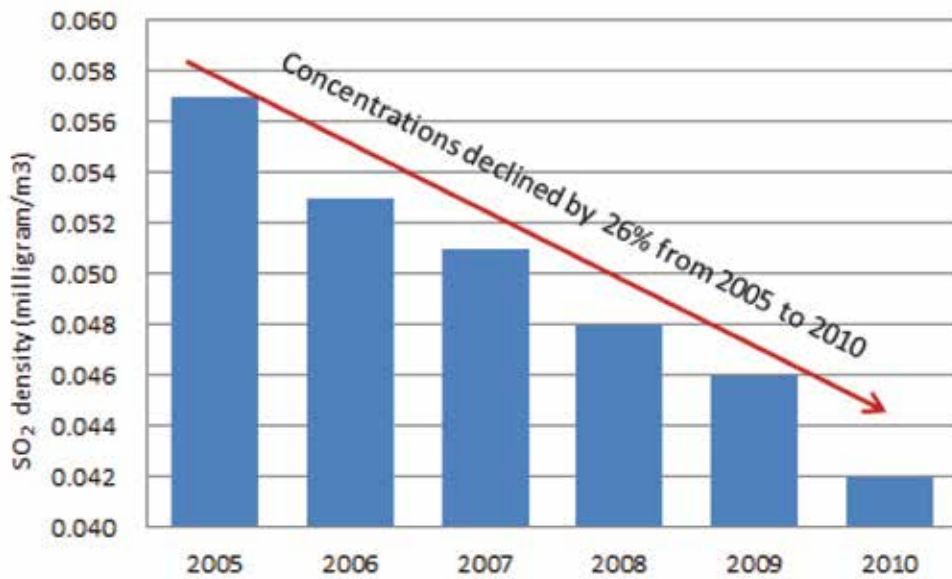


Figure 3-4. Changes in COD discharges and the Permanganate Index for surface water under the 11th FYP
 Source: Environmental Statistics Communique, MEP; National Water Environmental Monitoring

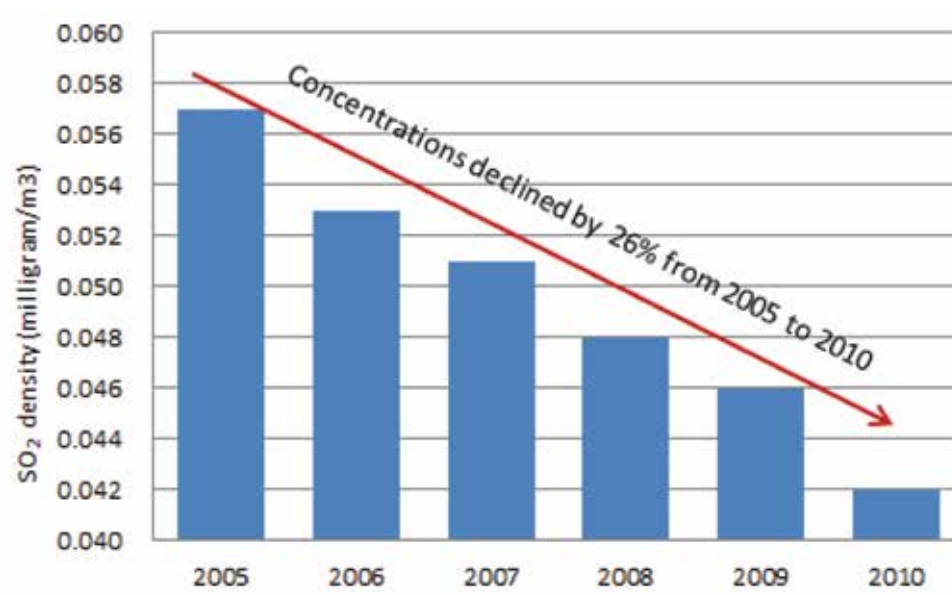


Figure 3-5. SO₂ concentrations in key cities targeted for environmental protection under the 11th FYP
 Source: Environmental Statistics Communique, MEP.

Cost-benefit analysis by the Task Force shows that efforts to reduce pollution under the 11th FYP were productive. That analysis included investments in urban infrastructure such as sewerage, gas, and centralized heating; investments in systems for treating industrial pollutants, such as wastewater and air treatment systems, and in environmental facilities for “three simultaneous”³⁰ construction projects; the costs of operating industrial and municipal wastewater treatment facilities; and the costs of running industrial air treatment facilities.

30 This refers to projects that must incorporate pollution control into design, construction, and operation.

We estimated the benefits of reducing pollution by calculating the costs of environmental degradation, including the impact on the health of urban and rural residents, the cost of treating industrial wastewater and water for human use, and agricultural losses. Specifically, the cost-benefit ratio of efforts to reduce COD discharges was 1:6.60, and that of efforts to reduce SO₂ emissions was 1:2.00 (excluding health damages caused by air pollution to urban dwellers). The overall cost-benefit ratio for pollution reduction was 1:4.94.

China greatly expanded the capacity of environmental protection institutions, and the scope and depth of supporting work, under the 11th FYP. For example, the nation upgraded the State Environmental Protection Administration into the Ministry of Environmental Protection, and made comprehensive decision making on environmental protection a high priority in the context of economic and social development.

MEP's decision-making capacity has been substantially strengthened. The Chinese society has become much more aware of the importance of environmental protection, and fundamental changes have taken place in both understanding and practice. However, the role of local offices in comprehensive environmental decision making still needs strengthening.

The Bottom Line

Under the 11th FYP, China achieved emission reductions that normally occur during a later stage of industrialization. The efforts used to reach this goal helped the nation begin to restructure its economy and transform its growth pattern.

Yet some work that occurred under the 11th FYP deserves further study and action. For example, overreliance on construction of pollution abatement projects is a very limited approach to reducing emissions. Efforts to control a single pollutant increase the cost and lower the efficiency of these projects. Project quality, investment performance, and operational efficiency urgently need to be improved.

The role of economic restructuring and technological change in achieving emissions reduction needs to be strengthened. Synergies between energy and environmental targets need to be clearly articulated. The by-products of pollution abatement—gypsum from desulphurization equipment, and sewage sludge—need systematic treatment.

China has not fully implemented market-based policies essential for spurring innovation. Trade policies in some industries conflict with policies designed to reduce emissions. And long-term environmental protection mechanisms still need to be established.

3.2. PROSPECTS: Transitional Changes Facing China's Economy, Society, and Environment

Most of the environmental problems China faces stem from the acceleration of industrialization and urbanization. A comprehensive analysis indicates that China would complete its industrialization around 2020. By then, the service sector's share of the economy will exceed that of the industrial sector. Increases in the rate of resource and energy use will slow down. All these phenomena will give China new opportunities to control pollution.

The nation will be able to tackle conventional environmental problems more effectively, even as the public demands more environmental protection. New environmental problems will intertwine with old ones. All these challenges will require in-depth study and response.

3.2.1 China's economic development will remain in transition for an extended period of time.

China has entered the middle and later stages of industrialization.

China entered the middle stage of industrialization in the mid-1990s. By 2011, per capita GDP had reached 36,774 Yuan (USD 5,432), and 51.3 percent of the population lived in urban areas. Agriculture, industry, and services accounted for 10 percent, 47 percent, 43 percent of economic output, respectively, and heavy industry accounted for about 70 percent of industrial value-added.

In general, China has developed into an upper-middle-income country in the middle and later stages of industrialization. Although not a fully modernized industrial country, China's economic growth has stabilized.

China's economic development has new features.

In the past 30 years, China's economy enjoyed continuous and rapid development. China has become the world's second-largest economy, its largest exporter, and its largest manufacturer.

China is about to transition into medium-speed development—as Japan, South Korea, France, Italy, Sweden, Switzerland, Spain, Portugal and other countries did during industrialization and economic recovery. The Chinese economy has slowed for six continuous quarters since the fourth quarter of 2010, and the annual growth rate has fallen below 8%.

So far, China has relied heavily on investment and export to spur economic growth. However, this development mode is changing. Domestic consumption has seen continuous high growth (Figure 3-6), which may jump-start consumption-driven economic growth. These market demands have already begun to compensate for the withdrawal of stimulus policies.

China is also gradually losing its demographic dividend. The cost of market factors is rising. Technological advance is making a greater contribution to economic growth: the share of R&D in GDP grew from 1.32 percent in 2005 to 1.76 percent in 2010.

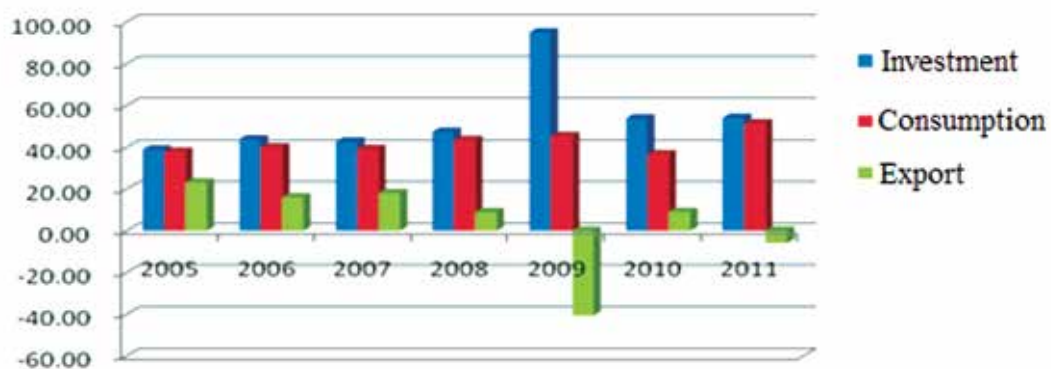


Figure 3-6 Contribution of investment, consumption, and export to GDP (%)

Source: Development and Research Center, State Council

The nation's economic structure is adjusting gradually. Industry's share of GDP fell from 47.4 percent in 2005 to 46.8 percent in 2010, while the service industry share rose from 40.5 percent to 43 percent. Although the nation did not meet its target under the 11th FYP, these shifts reflected China's economic restructuring. Still, as noted, heavy industry's share of industrial value-added remains stable at about 70 percent (Figure 3-7), posing a steep challenge to efforts to strengthen environmental protection.

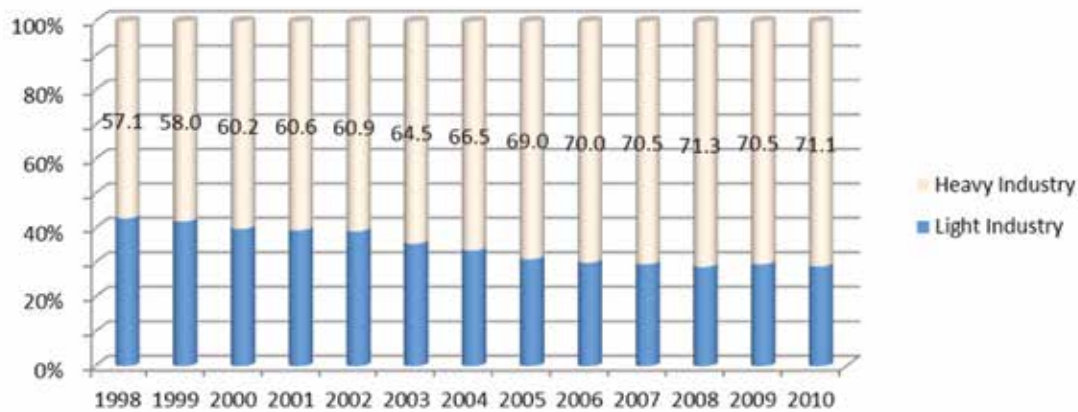


Fig. 3-7 The contribution of light and heavy industry to industrial value-added, 1998–2010

Source: calculated based on China Statistics Yearbook (1999-2011)

Given industrial and employment structures and urbanization, eastern China has entered the final stage of industrialization, with economic development slowing down. The central and western parts regions, in contrast, are still in the middle stage of industrialization.

Huge development gaps among various regions remain. In 2010, Shanghai had the highest per capita GDP, reaching USD 11,000, or RMB 74,500. Guizhou, in contrast, had the lowest per capita GDP: slightly more than USD 2,000, or RMB 13,200.

However, in general, development in central and western regions has outpaced that in the east since 2008. Continuous high growth in central and western China offset the economic slowdown in the east to some degree. Multi-regional development is occurring in China, and the focus is moving from east to west. This trend will continue.

China will complete industrialization and enter the post-industrialization stage around 2020.

China may join the world’s high-income countries around 2020. If China maintains an economic growth rate of 7–8 percent, per capita GDP is expected to reach about USD 11,000 by 2020 (taking into account factors such as the appreciation of the RMB). That would make it a high-income country by World Bank standards (Figure 3-8).



Figure 3-8 Projections for China’s per capita GDP

Source: National statistics, Development and Research Center, State Council

Agricultural employment accounted for 36.7 percent of all jobs in 2010—a relatively high share. However, rural labor will continue to migrate to cities for at least 10 years.

China will also enter the post-industrialization stage around 2020, when the industrial structure (agriculture, industry, and services) is expected to have shifted to 7:43:51 from 10:47:43 in 2010 (Table 3-3). The Chinese government set a goal of building an innovative country by 2020. The World Bank predicts that China is likely to become a country that uses creativity and ideas to promote economic growth by 2030.³¹

Table 3-3 Forecasts for China's economic structure

Year		2010	2020	2030
Economic structure	Agriculture	10	7	5
	Services	43	51	59
	Industry	47	43	36

Source: Development and Research Center, State Council.

China will complete urbanization around 2030. Countries such as the United States, France, Japan, South Korea all experienced several decades of growing urbanization, before it slowed or stabilized after reaching 70 percent. Historical experience and modeling suggest that China's urbanization will reach 60 percent in 2020 and 67 percent³² in 2030.

Trends in China's use of energy and other resources suggest slight changes in the near future.

Consumption of iron, steel, and cement dropped significantly in the United States after 1955, and in Germany and France in the mid-1970s, after those countries completed industrialization. China shows similar signs that production capacity of those commodities will peak within the next 10 years.

In 2011, China's output of crude iron and steel reached 683 million tons,³³ accounting for 50 percent of global output. However, demand has slowed significantly, and steel production has entered a stage of slow growth. Low-development scenarios show that China's iron and steel production will peak at 870 million tons in 2015, while normal-development scenarios predict 1.07 billion tons in 2018.

China produced 2.06 billion tons of cement in 2011, accounting for 60 percent of the world's total. The nation's cement output is expected to peak at 2.2 billion tons in 2015, and then remain stable.

In 2011, China's primary energy consumption accounted for 21.3 percent of the world's total, while the country's GDP accounted for 10 percent of the world's total. Increases in energy consumption will gradually slow after China's industrialization and urbanization are complete, and consumption of other resources per unit of economic output will fall dramatically. Energy consumption in the UK, France, and South Korea slowed after per capita GDP reached USD 12,000. Specifically, China's per capita electricity demand will increase by 6 percent annually from 2010 to 2020, and by 3 percent annually from 2020 to 2030. At that point, it will stabilize at about 7,500 kWh/year.

31 See World Bank report "China 2030 building a modern, harmonious, and creative high-income society." <http://www.worldbank.org/content/dam/Worldbank/document/China-2030-complete.pdf>

32 This forecast is based on data from the Development and Research Center of the State Council.

33 Research by the China Metallurgical Industry Planning and Research Institute indicate that crude steel production capacity has reached 800 million tons.

3.2.2 The public will demand more environmental protection.

Public understanding is shifting from environmental awareness to environmental rights, and environmental protection is becoming a basic demand of society in the new era.

As China's economic and social development has reached a higher level, public awareness of environmental issues has grown. Portable instruments for environmental monitoring and rapid information dissemination have also focused public attention on the environment.

More people have started to pay attention to environmental rights as well as the benefits of a clean environment. GDP, the consumer price index, and PM_{2.5} have become the new "3 Ps" of public concern. In many areas, especially in eastern China, public demand has become a major force driving environmental protection. The result has been greater demand for improvements in environmental quality. Demands for environmental protection have even led to some incidents and emergencies.

China's goal of building a moderately prosperous society by 2020 requires the harmonious development of the economy, society, and the environment. However, the demands for a better ecological environment will become the main bottleneck in progress toward a well-off society.

Public expectations for a high-quality environment may be beyond existing environmental capacity building.

Public demand for environmental protection has exceeded that in developed countries when they were at the same stage of economic and social development. China's GDP now equals that of developed countries in the early 1970s. Yet China's ambient air-quality standards have reached Category III standards of the World Health Organization, while standards for PM_{2.5} are equivalent to those of the United States in 1996.

Once data on air quality are published, the public will demand that China quickly catch up to the high standards for environmental quality in other countries. The existing environmental capacity building may not be able to fulfill those public expectations for environmental protection.

3.2.3 China's environmental problems—now in a transitional stage—are not completely synchronized with the nation's stage of economic development.

Environmental problems that usually occur during several stages of economic and social development coexist in China right now.

Although roughly following trends in environmental protection in developed countries, China's environmental problems do not fully match its stage of economic development. Pollution of Chinese rivers started in the late 1990s and became very serious under the 10th FYP, which was also when the heavy chemical industry enjoyed accelerated development.

Germany and the UK experienced similar challenges at similar stages. For example, pollution of the Rhine River intensified from the 1950s to the 1970s, during the massive postwar reconstruction. The oxygen content of the Thames was almost zero at the end of the 1950s, when industrialization sped up.

However, global warming emerged as a problem only in post-industrial countries such as United States, while China is facing the need to curb its greenhouse gas emissions right now. Meanwhile heavy metal and soil pollution, which should have been resolved at early and middle stages of industrialization, remains a core challenge. Problems with sewage and waste disposal, which should have been resolved at the middle stage of urbanization, also remain.

When China completes its industrialization and urbanization, environmental protection will become more complex and face new challenges. Under the combined effects of technological progress, transformation of the economic structure, and changes in consumption patterns, the nation may well avoid significant new pollution from 2020 to 2030. However, the huge amount of cumulative pollution and long-term lack of treatment will exert huge pressure for restoring air quality and the overall environment, and the climate change challenge remains.

If China does not apply stricter policy measures, mismatches between industries, resources, and ecosystems will last a long time. Complicated and novel environmental problems will intertwine even as the public demands better environmental quality. These challenges will make it more difficult for China to achieve the level of environmental quality that post-industrial and well-off society demands.

As environmental problems change, strategies for addressing them also need to change.

The growing prominence of regional pollution problems requires strategies for tackling them. Atmospheric haze and smog surrounding urban areas is intensifying. Some 30–50 percent of all days each year are oppressively hazy in the Yangtze River and Pearl River deltas, as well as provinces such as Beijing, Tianjin, and Hebei.

There have been many efforts over the years to reduce water and air pollution, while not enough attention has been placed on soil and groundwater contamination. Environmental risk at the watershed level remains a serious concern. The accumulation of heavy metals and other pollutants in soil is becoming more apparent, and that means environmental risk will persist for a long time. Acute instances of heavy metal pollution, hazardous chemicals, and hazardous waste are occurring more often. The nation needs to study and address these incidents.

With the advance of pollution abatement technology, fragmented local strategies for preventing pollution have become less effective in improving regional environmental quality. Strategies for regional, integrated urban and rural prevention and control—including efforts to control all pollutants—are essential. The system for permitting industrial projects needs reform to cover a wide variety of pollutants, including greenhouse gases, solid waste, heavy metals, chemicals, and other high-toxicity and non-biodegradable pollutants in air, water, soil, and ecosystems. That approach will require a long period of multi-media control.

Approaches to controlling secondary pollutants such as $PM_{2.5}$ differ from those used to tackle traditional pollutants. $PM_{2.5}$ stems from complex chemical reactions in the atmosphere among a variety of pollutants. Curbing $PM_{2.5}$ therefore requires synchronized and precise management of chemical precursors and the reaction process. The formation of secondary pollutants in different regions requires careful study, as well as tailored strategies that consider links between production and ecology, and the use of control systems targeting multiple pollutants. Models for urban planning, construction, and management also need to consider secondary pollution.

The Bottom Line

Remarkable progress in reducing emissions and other pollutants has occurred under the 11th FYP. However, these unprecedented pollution control efforts have not led to environmental quality that satisfies the public. Doing so will require measures targeting pollution control, climate change mitigation, and improvements in environmental quality. Problems not governed by a strong emissions reduction strategy, such as lead in people's blood, “poisonous land,” and non-point source pollution, require special attention so the public can recognize the nation's considerable efforts to protect the environment.

A focus on public welfare and environmental justice—with human health as a core concern—is becoming more apparent in China. As the nation enters a critical period in building a moderately prosperous society, the environment has become a central issue. China can no longer ignore inequities between the urban and rural environment. The nation needs a new human-oriented system for local pollution management, a diversified action plan targeting environmental quality, and a publicly acceptable monitoring and verification system.

3.3 STRATEGY: DESIGNING A MID-TERM AND LONG-TERM ROADMAP

The Task Force recommends that dual controls over total emissions and quality improvement be imposed during the 13th FYP. In particular, China should coordinate programs focusing on total emissions control with caps on motor vehicle ownership, land development, and the use of energy and other resources such as water. Priority should then shift to improving environmental quality to protect human health and the ecological system under the 14th FYP (Figure 3-9 and Figure 3-10).

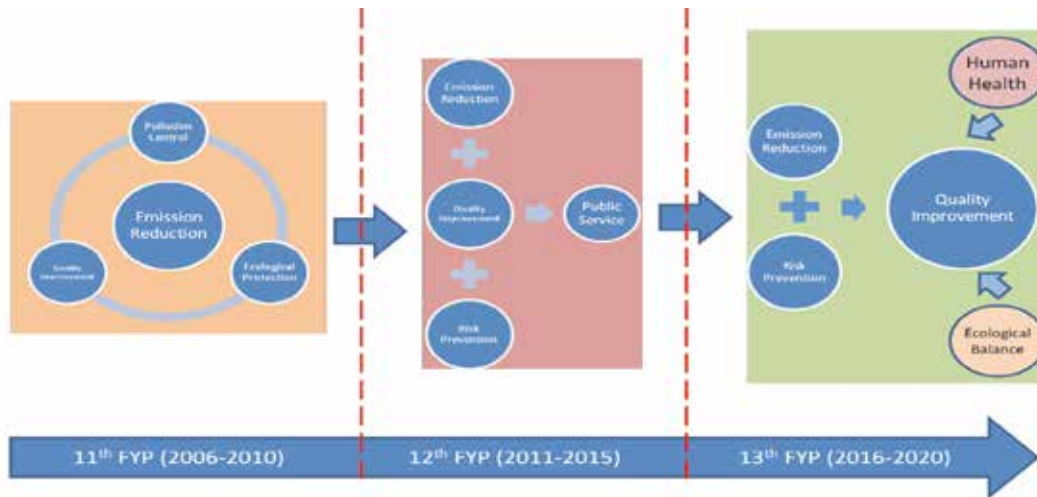


Figure 3-9 The focus of environmental protection during different stages of economic development
 Note: “Public service” refers to environmental services that the government provides to society.

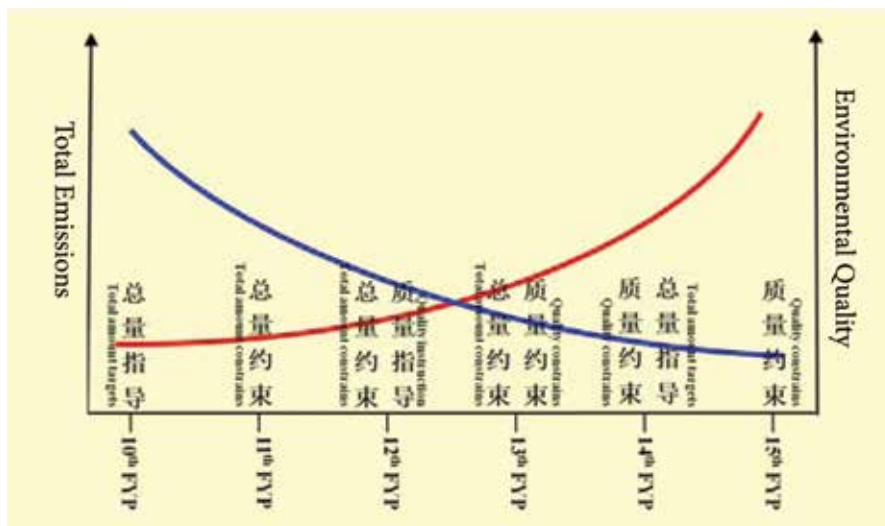


Figure 3-10 Trajectory of total emissions and environmental quality during different stages of development

I. Elevate the importance of improving environmental quality.

Strategies for managing the environment should also improve its quality. China needs to develop a mechanism driving total emissions reduction through quality control, and using the latter to force economic restructuring. Local governments should prioritize and implement efforts to improve environmental quality while fulfilling targets for reducing total emissions. Indicators for the performance of local governments should include environmental quality standards under the 13th FYP.

II. Establish a mechanism for preventing environmental risk.

China needs to establish a holistic environmental risk management system at the national level. Controlling and preventing environmental risk should then become a key goal at all levels of government.

China should strengthen its efforts to control industrial pollution, focusing on construction and operation of facilities, and waste disposal. The nation should also assess risks to human health and environmental damage, and establish a liability and compensation mechanism and codify it into law. Protection of the ecological system should guide environmental impact assessment, total emissions control, environmental treatment and restoration, and environmental quality standards.

China should clarify enterprises' responsibilities concerning environmental risk prevention, and safeguard environmental rights by using legal measures such as public interest or stakeholder litigation to compel enterprises to fulfill their duties.

China's stage of development until 2020 will be similar to that in Germany, when environmental policy moved from strict control of industrial pollution at high cost to ecological modernization at lower cost, thanks to innovations and more efficient use of resources. During this stage, China should focus on controlling growth in emissions of major pollutants and greenhouse gases, to prevent threats to food safety and drinking water, avoid health problems caused by large-scale environmental damage, reduce the risk of environmental accidents, and decouple economic development from pollution and more intensive use of energy and other resources (Figure 3-11).

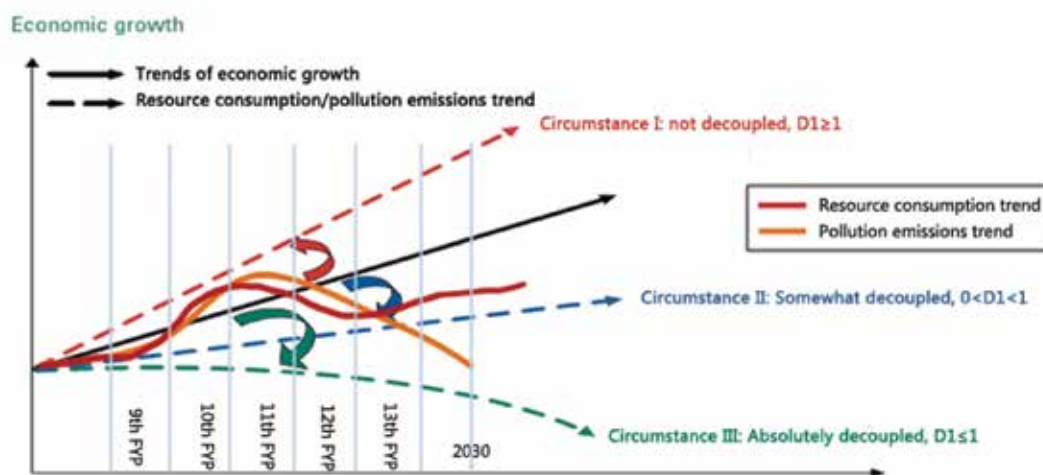


Figure 3-11 Decoupling economic development from more pollution and more intensive use of energy and other resources

Source: Prepared by the Task Force based on "Decoupling Natural Resource Use and Environmental Impacts from Economic Growth" report, page 111, OECD

Under the 13th FYP, the same 12 pollutants should be subject to total emissions control. However, the nation should strengthen efforts to control regional and industrial toxic and hazardous substances (such as heavy metals and persistent organic pollutants), volatile organic compounds (VOCs), and substances that consume oxygen in water (total nitrogen and phosphorus). China should also launch pilot projects to control non-point sources of agricultural pollutants (Figures 3-12 and 3-13; Table 3-4).

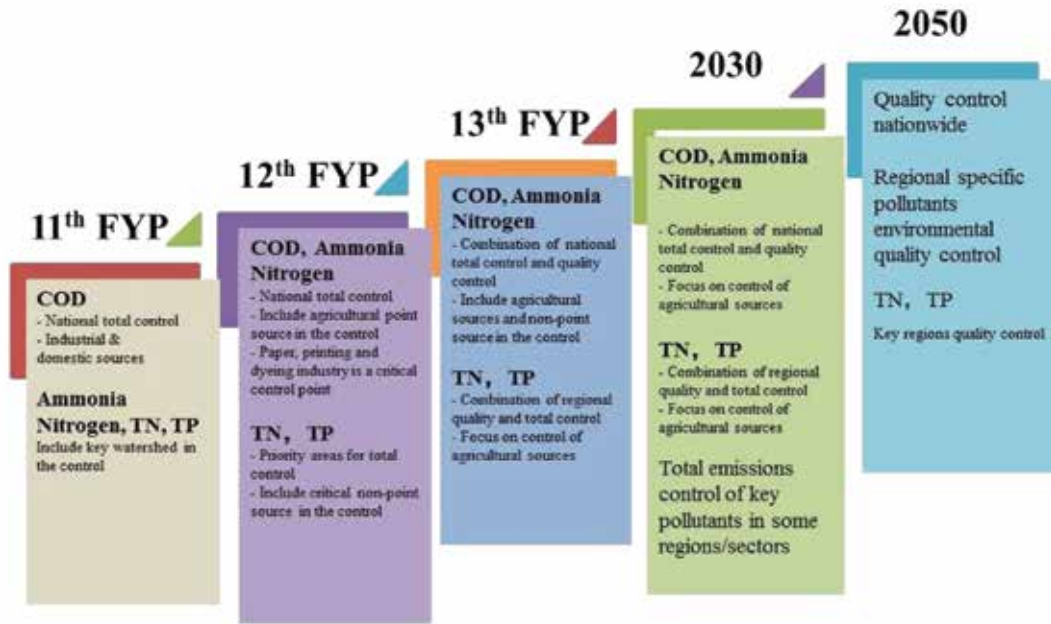


Figure 3-12 Roadmap for controlling water pollution

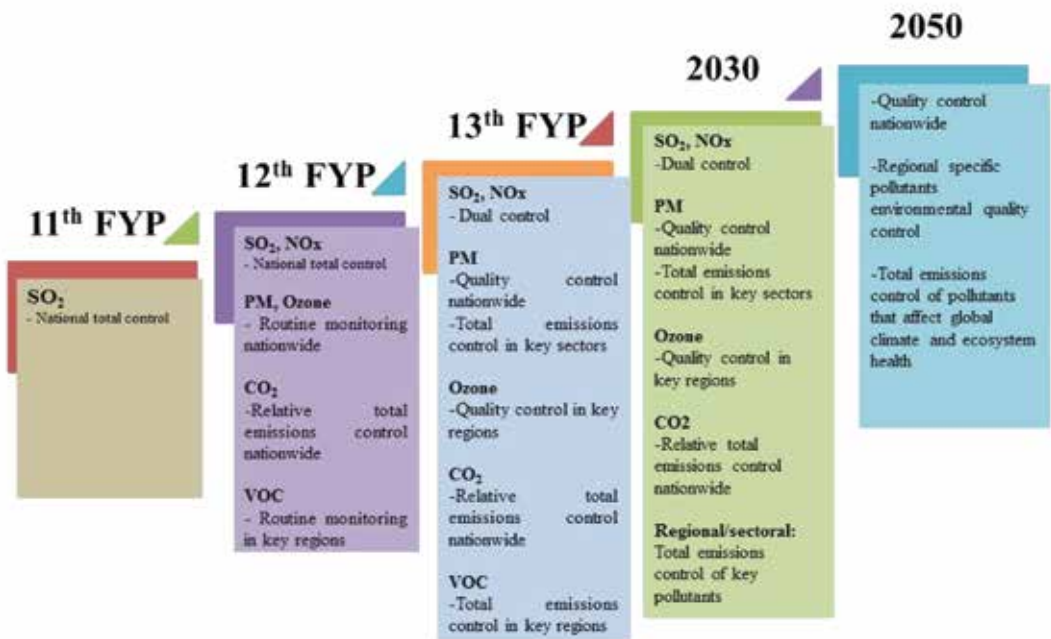


Figure 3-13 Roadmap for controlling air pollution

Table 3-4 Roadmap for mid-term and long-term pollution control and emissions reduction

	11 th Five-Year Plan	12 th Five-Year Plan	13 th Five-Year Plan	2020–2030	2030–2050
Key points	Control of total amount as the core goal	Three major aspects & basic environmental public service	Attach equal importance to pollution control and emissions reduction, as well as quality improvement; pollution reduction and risk prevention with more consideration of the quality factor; human health, and ecosystem	Focus on quality improvement, continue to prevent and control pollution, vigorously guard against environmental risk, protect human health, and consider the balance of the ecosystem	Focus on human health, ecosystem, and environmental quality
Evaluation mechanism	Control of total amount of emissions	Total amount of emissions and quality instruction	Pay equal attention to controlling total emissions and quality control, and emphasize quality control in some areas	Quality control, total amount instruction, continue to strengthen total amount control in nonattainment areas	Quality control in different areas
Binding control factors	Control of national amounts of SO ₂ and COD; total nitrogen and phosphorus control in key areas	Control of national amounts of SO ₂ , nitrogen oxides, COD, and ammonia; control of carbon intensity; control of total amounts of heavy metals, nitrogen, and phosphorus in key areas	Total amount control of national sulfur dioxide, nitrogen oxides, COD, and ammonia; CO ₂ relative amount control; total amount control and emissions standards of heavy metals, nitrogen, and phosphorus, toxic and hazardous substances, and VOC in key areas; quality control of fine particulate matter, ozone, nitrogen, and phosphorus in key areas	National quality control as the main task, taking into account the total amount of major pollutants in some areas in some industries	Environmental quality control of pollutants with regional characteristics
Controlling fields	Industrial and city life	Industry, living, agriculture (large-scale livestock farming), and motor vehicles	Industry, living, livestock, and agricultural non-point source pollution	Agricultural non-point source pollution, industry, and living	Agricultural non-point source pollution, industry, and living
Major industries	Key industries: electricity and pulp and paper	Key industries extended to general industrial (electricity, iron and steel, pulp and paper, printing and dyeing, building materials)	Expand coverage from key industries to all industrial sectors: the expansion of electric power, iron and steel, non-ferrous smelting, building materials, chemical industry, and pulp and paper industry to the petrochemical industry, ammonia, chlor-alkali industry, phosphorus chemicals, sulfur chemical, coking industry, dye industry, non-ferrous smelting, thermoelectric industry (oil, coal), special industry (gold potassium cyanide), and mining. Oil exploitation industry is a major source of emissions of toxic and hazardous pollutants	The major emitters of trace, poisonous and harmful pollutants	
Techniques for reducing emissions	Based on project emissions reduction, supplemented by structural emissions reduction	Both project emissions reduction and structural emissions reduction are important	Structural reduction and front-end control as the focus, supplemented by project emissions reduction	Middle-front control and modification of production process as the focus, supplemented by structural reduction and project emissions reduction	Middle-front control and modification of production process
Management mechanism	Government plays the main role	Government as the main player, supplemented by technological progress and market orientation	Attach equal importance to social constraints, administrative measures, standards, and market orientation	Standard policies, social participation, market orientation as the main methods, supplemented by government administrative measures	More dependence on standards, policies, and social participation

3.4 OPERATIONAL ADJUSTMENTS: MECHANISMS AND POLICIES FOR FULFILLING ENVIRONMENTAL TARGETS

I. Develop action plans for improving environmental quality.

China will be under growing environmental pressure until 2020. The nation needs to formulate an action plan for improving environmental quality for the next 20 to 30 years, to ensure that progress at different stages helps achieve mid- and long-term goals. Control of major air pollutants and a cap on coal consumption will remain the core policies for China's mid- and long-term emissions reductions. Together these control policies should have a significant impact on China's greenhouse gas emissions trajectory. China currently has energy and carbon intensity targets along with a suite of regulatory programs focused on carbon reductions. Experiments with more comprehensive approaches such as carbon cap and trade are occurring throughout the country. When these results are in, the opportunity exists for a deeper integration of environmental and energy policy.

Optimize the environmental management system.

- *Shift the focus from pollution control to quality improvement.* China may take 10 to 15 years to complete this transition. After 2025, the nation will expend more effort to prevent environmental risk and protect human health and the ecological system.
- *Establish a direct link between emissions control goals and environmental quality goals.* For example, China can establish clear quality goals for watersheds, regions, and cities; set up specific criteria for allocating pollution targets; select baseline years for measuring progress; and adjust objectives on a regular basis to reflect greater understanding of the impact of pollutants on human health and ecological sustainability.
- *Identify the ecological function and environmental quality requirements for different regions, and establish regional control units.* This entails implementing watershed-control systems to focus on trans-boundary pollution; promote air quality modeling to track the transfer of pollutants transfer and their interaction, define boundary conditions, establish section and point monitoring, and define accountability.
- *Establish a system for assessing regional consumption of energy and other resources, and new pollutant emissions including the improvement of data collection and reporting of statistics at the regional level.*
- *Establish a system for verifying the quality of environmental data.* MEP should oversee the monitoring of major rivers and cities, establish air monitoring over key watersheds and regions, conduct cross-province monitoring, and promote public oversight of environmental quality.
- *Rely on indicators of environmental quality that are tangible and publicly acceptable, and take into account human health and the ecological system.* Strengthen the indicator system to control toxic and hazardous substances with significant impact on human health and the ecosystem. Ensure that indicators include human health and ecological protection, by using designations such as "swimmable," "fishable," "visibility," and "blue sky days."
- *Implement different pollution offset policies for different regions.* As in the U.S. Clean Air Act, the ratio of new source emissions reduction versus existing emissions reduction must reach 1:1.5 for areas with extremely poor air quality. The ratio must be 1:1.1 for areas with severely poor air quality. By establishing the requirement for new sources to offset their new incremental emissions and linking the offset ratio to local ambient air quality conditions, the offset program can be used to make deeper reductions in airsheds most needing them.
- *Integrate economic and environmental policies decision making, by assessing the environmental impact of plans, development strategies, and policies; enforcing restrictions on regional approval, and moving total emissions control earlier in the production process.*

- *Develop a template for environmental planning to serve as a framework for urban and economic development.*

Improve policy and technological readiness.

Under the 13th FYP, China should:

- *Add environmental quality indicators and standards, including the number of people with access to clean air and a clean environment, and the length of clean rivers.*
- *Base environmental impact assessment on environmental quality rather than emissions standards.*
- *Improve the capacity of local governments to monitor environmental quality.*
- *Develop and maintain a scientific inventory of pollutants.*
- *Conduct a cost-benefit analysis of pollution reduction measures, taking into account the impact of pollution on human health, the environment, and the ecological system.*
- *Establish mechanisms for market-based environmental policies, promote eco-compensation and emissions trading, accelerate the use of environmental taxes, and internalize the costs of resource use.*

Strengthen public supervision.

- *Create an open government system, by publicly releasing environmental impact assessments, permits to discharge pollutants, the results of enterprise environmental monitoring, and information on environmental quality.*
- *Establish phased quality objectives and standards for different regions, and cite cities and regions that are not in compliance.* The U.S. government has given some severely polluted areas 18 years to comply with ozone limits. The key is to ensure quality improvement under feasible technological and economic conditions.
- *Report regularly on environmental quality. Governments at all levels should conduct regular regional environmental quality assessments, report the results to people's congresses at the same levels, and publicize the findings.*
- *Hold enterprises accountable by improving the permitting system, increasing penalties for violations, conducting environmental education, establishing a system for evaluating enterprise environmental credit, and promoting public-interest litigation.*
- *Include an environment audit in performance evaluations of government officials before they leave a post.*
- *Strengthen regional eco-compensation systems.*
- *Rely on people's congresses to hold the executive branch accountable for non-compliance with drinking water standards and other important indicators of environmental quality.* Findings from monitoring and assessment should be consistent with public observations.

II. Implement total emissions control at the sectoral and regional levels.

Although emissions reduction targets under the 12th FYP consider the potential of different provinces to reduce emissions and the need for industrial restructuring, links between target allocation and quality improvement are weak. Efforts to prevent pollution must shift from national control to national-regional-industrial control.

Implement top-down total emissions control in industrial sectors, and curb new emissions.

China needs to:

- *Coordinate efforts to control total emissions and production capacity in each sector*—such as iron and steel, cement, paper making, printing and dyeing, motor vehicles, and agriculture—to avoid increasing industrial emissions while decreasing regional emissions. Condition approval of new projects on pollution reduction and phase-out of old facilities.
- *Evaluate production intensity*—the use of energy and other resources per unit of output—and impose stricter standards on typical industries. For example, instead of requiring industries to meet a minimum passing standard (MPS) or average standard (such as corporate average fuel economy), impose Top Runner energy efficiency and emissions standards for certain product categories. A “Top Runner” program would periodically identify the most efficient producers by product category and set their efficiency levels as the standard for other producers to reach.
- *Cap the national use of energy (especially coal) and other resources to reduce emissions at the source.* Hold economic sectors responsible when new pollutant emissions deviate from planned scenarios and permits, or exceed the cap.

Implement bottom-up regional total emissions control, and curb pollutants by regions and categories.

- *Ensure that regions implement total emissions control policies to improve people’s lives and environmental quality.* Regions should establish maximum emissions and discharge loads, to bring discharges within the capacity of the environment to handle them. Regions that find it difficult to do so can phase in a system for achieving the targets over time. Regions with extra environmental capacity and good environmental quality can allow total pollutant discharges to increase moderately, but should ensure that pollution intensity continues to decline.
- *Ensure that regions develop implementation plans, with regular assessments and revisions, to achieve phased quality improvement.*
- *Allow different regions to pursue different approaches to environmental management.* In the eastern region, the focus should shift from total emissions control to quality improvement. In the central region, the focus should be to curb new pollution, strengthen total emissions control, and gradually improve environmental quality. In the western region, total emissions control should occur in key resource development areas. Efforts should be made to improve environmental quality in populated areas and ecological functional areas.
- In major cities such as Beijing and Shanghai, industrial pollution has dropped significantly while pollution from transportation and the activities of daily living are rising. These cities need to reduce the impact of transportation on air quality, cap vehicle ownership, adjust the urban energy infrastructure, continue incentives for low-emission vehicles coupled with restrictions on high-emission vehicles, and promote public transit and the use of clean fuel. The Yangtze River Delta, Beijing, Tianjin, Hebei, and Shandong should reduce the use of electricity and coal.
- *Ensure that urban and regional planning prioritize environmental considerations, and require protection for important ecological areas.* For grasslands, rivers, lakes, and other wetlands where pollution has already exceeded environmental capacity, regions should develop policies for evacuating residents and industry. Areas where development is forbidden or restricted should implement policies for fiscal transfer, ecological compensation, and clean development.

Improve co-control of multiple pollutants.

At the regional level, pollutants such as SO₂, NO_x, PM, and VOCs should be controlled together to resolve secondary pollution as well as problems caused by traditional pollutants, PM_{2.5}, and ozone. At the industrial and technological level, economic incentives should be used to promote pollution control at the source and during production. Standards and regulations should be established to control end products.

China also needs to:

- *Consider water, air, soil, and the overall ecosystem in managing environmental quality.*
- *Integrate management of surface water, groundwater, drinking water, wastewater treatment, and seawater.*
- *Coordinate efforts to control water use with total discharge control of major water pollutants.* Under the 12th FYP, China is studying the relationship between discharge of water pollutants and water quality throughout a watershed control area.
- *Promote coordinated reduction of water pollutants through denitrification and sludge treatment. Regulators should promote technological innovation, require that sludge be stable and non-hazardous, and conduct combined levy, supervision, and evaluation of both sewage and sludge treatment.*
- *Promote co-control of major air pollutants and CO₂.* Multiple pollution control, demand side management, expanded use of natural gas, increased generation from renewables, all will act to reduce conventional and greenhouse emission loadings especially from the electric generating sector.
- *Promote energy efficiency and clean energy to reduce emissions from the energy sector.* Technologies such as coal washing and separation, low-nitrogen combustion, supercritical cogeneration, flue gas desulfurization (wet process), selective catalytic reduction, and cottrell and bag filter dust removal have coordinated effects on emissions reduction.
- *Use recycling to control and treat pollutants in a coordinated way.*
- *Expand pollution control in livestock and poultry farming to reduce both water pollutants and greenhouse gas emissions.*
- *Ensure that the permitting system considers a broad variety of potential pollutants.*

3.5 SUMMARY AND CONCLUSIONS

This Task Force has had a wide remit and an awesome responsibility. We have had to review performance under the 11th Five Year Plan, make policy recommendations for attaining the 12th Five Year goals, and look beyond to China's environmental future. As a consequence of this relatively vast policy terrain, recommendations have been sprinkled throughout this report. In an effort to provide a further distillation of proposals, this concluding section of the report attempts a sharpened focus. The emphasis is on capacity building and institutional infrastructure as key foundation elements for the future of China's environmental management system.

I. The 11th Five Year Plan Outcomes

Meeting the 11th FYP environmental targets on SO₂ and COD is a remarkable achievement in the history of China's environmental management. Coming on the heels of the very poor performance of the 10th Five Year Plan, these results stand in even sharper relief. This report has carefully documented these achievements and the factors involved.

From the perspective of the 10th five-year plan (2001-05), this achievement is even more remarkable. The chart below shows national SO₂ emissions data. The 10th five-year plan set a goal of reducing SO₂ emissions by 10% from

2000 levels by 2005. The actual outcome was very different: rather than decreasing by 10%, emissions increased by 30%. The 11th FYP also aimed for a 10% SO₂ reduction, but this time from the much higher 2005 baseline. Actual SO₂ reductions came in 14% below the 2005 base. What accounts for this dramatic difference in environmental performance?

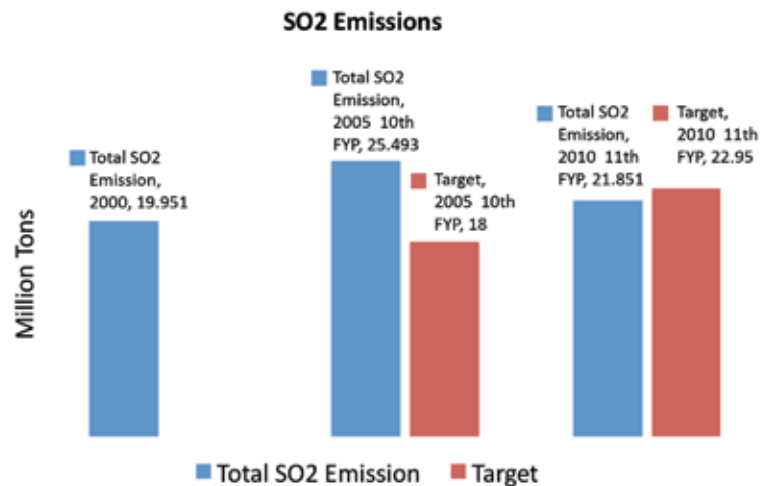


Figure 3-14 SO₂ emissions and targets

Source: emissions data are from “China’s Environmental Statistic Yearbook” 2000-2010, target data are from the 10th and 11th FYPs for Environmental protection.

The main reason for the change in performance was that the government adopted a series of coordinated programs explicitly designed to hit the mark. These included:

- The responsibility system in which both government and business leaders were held personally accountable for environmental performance.
- The requirement to compensate for emissions increase prior to issuing a permit under the Environmental Impact Assessment program and the State Council’s regional SO₂ control regulations gave expanding power companies the clear signal to shut down smaller less efficient generation units and reduce power generation at others.
- Technology subsidies for electricity generated from units with operating pollution controls.

This is a key lesson for environmental policy going forward: integrated policies with coordinated incentives are effective in reaching environmental goals. Integrated policy tools will be even more important for the 12th FYP. The combination of strengthened penalties and flexibility will help to establish a culture of compliance which can support even more aggressive environmental targets in the future.

Missed opportunities during the 11th FYP include the failure to further strengthen incentives by adopting stricter noncompliance penalties. The artificially low financial penalty cap was removed for the water pollution control law in 2008, but similar provisions have not yet been adopted for air pollution. Energy planning and management have not been integrated. Rather, as has been noted, the extraordinary growth in thermal generating capacity from 392 GW to 700 GW made achieving the 11th FYP SO₂ reduction target even more dramatic. The missed opportunity is that energy efficiency, especially demand side management strategies, was not considered as a pollution control tool.

II. Recommendations for achieving the 12th FYP targets and beyond

The 12th Five Year Plan represents an inflection point for China in terms of environmental management. Will the protection of human health be the prime directive for Chinese environmental management? Will China maintain and build upon the success of the 11th FYP? Will energy and environment be fully integrated to correspond to the reality of the duality of their nature? These are critical questions whose answers will determine China's national and global environmental trajectory for years to come. In this concluding section of the report, we highlight some specific areas of priority attention

During 2011, the first year of the 12th FYP, SO₂, COD, and ammonia releases declined by 2.2 percentage points, 2 percentage points, and 1.52 percentage points, exceeding the annualized reduction targets by 0.7 percentage point, 0.5 percentage point, and 0.02 percentage point, respectively. However, NOx emissions rose by 5.73 percentage points. The 12th FYP has added binding targets for ammonia and NOx releases, and extends coverage to livestock farming and vehicles. Nevertheless, the need to further curb new pollution growth and sources is still urgent, for several reasons.

- First, projects with high energy consumption and high emissions are still growing fast, despite a drop in industrial investment. Urbanization will be accelerating with the new macroeconomic stimulus package focused on domestic consumption and infrastructure. The lack of integration between energy management and pollution control continues to exacerbate the pollution control problem.
- Second, structural adjustment—and therefore pollution reduction—has not yet come into full force. Individual industrial sectors have significantly improved efficiency, but the economic transformation to a service based economy and rebalancing away from export-led growth is still underway.
- Third, one-third of emissions reduction projects have not made substantial progress.
- Fourth, pollution control facilities have not been operating steadily.
- Fifth, a mechanism for coordinating environmental protection is not in place. Despite the fact that MEP (formerly SEPA) was elevated to be a full ministry in 2008 and was charged with the responsibilities for the formation and enforcement of national environmental policy as well as the coordination and supervision of major environmental projects, it has not yet been given adequate policy tools, capacity or political strength to fulfill this expectation. As many environmental responsibilities are shared across agencies, different government bodies tend to compete with each other for limited resources and influence (the scattered water governance structure provides a good example; or fuel standards vs. emissions standards). MEP often finds itself in conflict with the priorities of other institutions, but lacks adequate capacity to address this problem as evidenced by the challenge of integrating energy saving and pollution reductions.

To help China to achieve its mid- and long-term environmental targets and improve its environmental quality, the Task Force proposes the following 10 specific policy recommendations:

Set protection of human health and ecosystems as the sole and ultimate goals of the environmental management system

It should be clearly articulated in all environmental laws, regulations, and any documents that comprise China's National Environmental Management System that the sole and ultimate goals of the environmental system are to protect public health and the ecosystems. It is critical that the goals should not be tied with the stage of China's economic development e.g., level of GDP or industrial stage.

To achieve these goals, ambient environmental quality standards should be designed based on the scientific understanding of the pollutants' effects on human health and ecosystems, regardless of economic and technological

feasibilities and costs. The goals may not be readily achievable. The point to the ambient standard setting process is to define the pollution threshold beyond which significant health damage occurs. Discharge standards on the other hand are transitional requirements that take costs and feasibility into consideration in the process of setting technology-based discharge standards for industrial sectors. However, these ambient environmental quality standards should be assessed, revised, and updated regularly (e.g., at least once every five years) so that they are in line with the latest scientific findings. Environmental monitoring standards and regulations should be developed to accurately measure ambient conditions against the quality standards.

Risk-based pollutant priority assessment is needed. A standing institutional mechanism to regularly review and evaluate the scientific understanding of the relationship between pollutant discharges and health is needed to advise MEP on the scientific understanding of risks and recommended control levels.

Link emissions control targets directly with achieving specific environmental goals

A clear distinction must be made between ambient standards designed to maintain pollutant concentrations at environmentally protective levels and national or regional pollution caps designed to limit total pollutant loadings and control transboundary flows. The two policies must be integrated to avoid antagonistic effects especially if market-based implementation policies are applied. For example, policies to control transboundary pollution problems such as acid rain focus on reductions over broad geographic regions. Policies such as cap and trade have been successfully applied to significantly cut SO₂ emissions, the chief precursor of acid rain. However, at the local level, SO₂ can have significant health effects. Therefore, a failure to coordinate regional and local control strategies could result in local concentration exceedances at the same time that regional caps are met. Neither ambient standards nor pollution caps linked to protecting human health and the environment may be readily achievable, but stepwise implementation policies should be established that link the interim targets and the improvement of air and water quality. It also needs to be clear that ambient standards and targets may change over time in relation to changing economic, demographic, and atmospheric conditions. Targets must be reviewed on a specified, recurring timeframe to determine what policy action is needed to meet the goals of protecting human health and the environment. It is recommended MEP organize comprehensive research on the environmental carrying capacity of key national development zones and preferred development zones and on the assimilative capacity of river basins. The findings should inform the formation of subnational target allocation criteria. The selection of a fixed baseline year is also critical to measure the progress made in improving water and air quality. In addition, efforts should be spent in developing sectoral caps (eg. a cap for total NO_x emissions) for the major industrial source sectors such as electricity, cement, iron and steel and automobile industries.

Develop, maintain and update scientifically sound pollution inventories

Scientifically sound pollution inventories should be developed, maintained and updated as a foundation for understanding the scope and source of environmental problems and for determining and applying appropriate permit or regulatory controls and market mechanisms to pollution sources. One of the most powerful modern environmental management aphorisms is “you manage what you measure”.

Inventories should be established for air and water pollution sources as well as contaminated sites and sites where chemicals and hazardous substances are located as feed stocks or products. In particular, addressing hazardous and solid waste issues earlier rather than later will reduce the extremely high economic costs and serious health consequences of remediating improper disposal later. A science-based inventory will enable China to establish criteria for prioritizing and cleaning up the worst sites. Additionally, there are water and air quality consequences from failure to appropriately deal with these wastes that will impede progress on air and water total emission control.

As China expands its environmental targets to include energy intensity, carbon intensity, limits on total coal combustion, limits on the total proportion of energy use that can be derived from fossil sources, a limit on the minimum amount of electricity that must be generated from renewable energy, the statistics gathered to measure performance against these goals are also helpful in cross-checking against the reporting of more conventional pollutants such as SO₂ and NO_x. These databases should be coordinated for consistency.

Strengthen institutional capacity at all levels

At the central level, it is important to integrate water management authorities which are currently scattered among over 10 ministries. Since only MEP has legal enforcement authority and resources, MEP should be designated as the lead coordinating agency for water quality for all waters including surface water, ground water, drinking water, waste water treatment and sea water etc., with support from the other ministries. MEP should be responsible for making recommendation for the harmonization of conflicting laws and regulations pertaining to water management so as to provide consistent and clear guidance to regulated industries and consumers.

At the regional level, it is recommended to expand the six MEP's Regional Environmental Supervision Centers into Regional Environmental Quality Management Centers. With more resources and expertise, these offices can focus on improving environmental quality. In addition, more effort should be spent on improving trans-boundary coordination among local governments, with a particular focus on air and river basins management.

AIR BASINS

Air quality basins should be delineated. A special study should be launched for regional air quality management with a special focus on institutional and policy design and implementation. The lessons from the priority regional air quality management regions established by the State Council should be harvested and implemented. Air quality modeling capabilities and needs should be assessed and recommendations supporting regional air quality management made.

Alternative institutional arrangements to promote effective regional coordination on air pollution prevention and control should be tested and evaluated. For example, air quality commissions could be established for each regional air shed with representation from all local governments in the region. Local governments in the region would be required to sign a binding agreement for regional air quality assurance as has been done with major sources. The commissions would be given a separate budget and take full charge of the implementation of the agreement. Regional air quality databases and monitoring networks would have to be developed to support management and decision-making. Cities that fail to meet the Grade II national ambient air quality standard would have to formulate plans for MEP's approval to meet the air quality standards, and ensure air quality improvements on a negotiated schedule. For cities in non-compliance, MEP could withhold permit approval over new construction projects that discharge air pollutants.

RIVER BASINS

Water management authorities involving water supply and water quality need to be integrated and interagency coordination needs to be established. River basin management should be put under the authority of river basin committees. The committees should consist of government heads from all the local governments in the river basin and representatives of the national ministries with regulatory authority over water supplies and quality. Management plans and decisions should be jointly made by all the members. Each local government and its representative should be held responsible for discharges in their jurisdiction. The river basin committees should have the power to levy discharge and user fees so as to raise revenues to help finance investments based on priorities for that river basin.

At the local level, local governments should develop mid- and long-term strategies on environmental quality and emissions reduction control as well as a detailed implementation plan to achieve the ambient environmental standards. The strategies and implementation plan should be published. In case local governments fail to make a required submittal or make a submittal that is determined to be incomplete, sanctions such as restriction over project approval and an MEP-developed implementation plan should be triggered. Additionally, meeting the ambient environmental quality standards (or their associated interim targets) and total emissions control targets should become the key components of the environmental performance contracts signed by the local government officials.

Improve coordination between ambient air quality standards, vehicle emissions standards and fuel standards

IMPROVE CHINA'S VEHICLE EMISSIONS STANDARDS SYSTEM

Develop National V emissions standards for light vehicles, durability requirements for the emissions control system for heavy-duty vehicles, and National IV emissions standards for motorcycles. National IV standards will be implemented nation-wide in the 12th FYP. Key regions and cities such as Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta should start using National V standards. Revise emissions standards for low-speed cargo vehicle. Improve the emissions standards for off-road engines, boats, ships and planes. Prohibit the production, sale and registry of vehicles that do not meet national standards. Strictly enforce the Inspection Maintenance Program. In addition, continuous efforts should be made to increase incentives for low emitting vehicles and disincentives for high emitting vehicles in order to speed up the replacement or elimination of “high-emitting” vehicles (such as yellow labeled vehicles). The air quality impacts of transportation infrastructure need to be evaluated as part of the planning and permitting process. Encourage residents to choose green commuting measures through fuel tax, congestion fees or administrative orders that help keep vehicles off the road. Enhance the attractiveness of public transit system through subsidies and system upgrade.

INCREASE FUEL STANDARDS

Authority should be conferred to MEP for fuel quality standards development since vehicle emissions systems are designed for specific fuel quality tolerances. MEP should also be given more authority to oversee the fuel's toxic constituents. Efforts should be strengthened to speed up the development and implementation of fuel quality standards for National IV and V vehicle emissions standards and the emissions standards on hazardous substances from fuels; improve the management on gasoline detergent additives; promote low sulfur fuels for vehicles; and establish a clean fuel development strategy.

Strictly enforce Environmental Impact Assessment and “Three-Simultaneous” requirements

Environmental impact assessments (EIA) should be conducted not only on comprehensive planning, functional planning and development projects, but also on major government policies, social and economic development plans. Independent analysis and verification must be carried out to ensure the information presented in the reports is scientifically valid and adequate. Instead of offering only one option for comment and approval, the EIA document should contain a comparison of alternative options to the proposal. Furthermore, qualification licenses for EIA consulting firms should be issued by independent authorities to avoid conflict of interest. The public should be given full access to the complete text of EIA reports and be allowed ample time for comments. The construction of projects should not begin until all EIA requirements have been satisfied and a permit issued.

- 70 In addition, it is necessary to revise the existing legal requirements on “Three-Simultaneous” (the design, construction and operation of environmental pollution prevention facilities should accompany the design, construction and operation of the projects) to clarify that pollution prevention measures must be functioning and stay in operation

after project construction is completed and operations commence. Any violation will lead to denial, suspension or revocation of permits.

Improve permitting system

Connections must be established between permit issuance and total emissions control targets to ensure attainment of environmental quality standards. Allocated total control targets must be strictly enforced and the regional monitoring centers should supervise the permit issuance process unless directly allocated to sources by MEP. Approval of new projects in non-attainment regions should be suspended. New sources discharging pollutants covered by total emission control requirements must offset their added incremental discharges.

Temporary permits during correction period should be eliminated. Enterprises should not be allowed to start up or continue to operate without pollutant discharge permits. Comprehensive requirements for information that must be in the permit should be delineated. Permit applicants should bear the responsibility of providing all necessary information. The permit document also should list and publish detailed information such as types and concentration of pollutants, pollution prevention controls and any emission/effluent or operating limitations and required monitoring, reporting and inspection requirements as established by the government. Transparency in the environmental permitting process will help the general public defend their environmental rights and enforce environmental laws and regulations against pollution violators.

Increase penalties for non-compliance and enhance monitoring and inspections

The responsible party should pay the costs of environmental damage to people or property, or economic losses. Compensation should also cover the costs of reasonable measures taken to prevent or limit environmental damage and for clean-up and restoration of the environment to its previous state. Existing caps on non-compliance penalties must be removed. The amount of penalties imposed on polluters must be increased significantly in order to make the cost of non-compliance higher than compliance. Adoption of a cumulative “Per Day, Per Violation Penalty” from date of non-compliance to date of compliance will help to achieve this goal. Additional penalties could be levied based on the severity of the damage caused. Furthermore, China should establish a penalty to capture the economic benefit of non-compliance that has accrued to violators by avoiding the costs of installation and maintenance of required control equipment and failure to meet other environmental requirements.

To better identify and document violations, China must first establish stringent requirements for monitoring, reporting and (where appropriate) certification by industry owners as well as allocate sufficient resources for inspections by appropriate government officials. China should establish requirements for electronic monitoring of pollution through continuous emissions monitoring systems (CEMs), including specific regulations governing quality control and quality assurance associated with the operation of these automated monitoring systems.

Improve environmental information disclosure and public participation

Environmental information should be made available to the public in a timely and accurate manner. For example, monitoring results under the newly revised Ambient Air Quality Standards should be published for 113 key environmental protection cities in 2013 and for all cities in 2015. Data on air quality in key cities will be disclosed in form of forecast and daily report. Online monitoring data on the quality of surface water should be disclosed every four hours. Data on section water quality in key river basins will be disclosed weekly. Lists of key projects subject to national pollution reduction mandates should be disclosed. Sensitive information such as heavy metal and landfill pollution should be published and followed up in a timely manner. Information on large environmental incidents, as well as the treatment and follow-up measures, should be released in a timely manner. Name lists of key emitters and emitters who violate laws should be disclosed.

In addition to guaranteeing meaningful public participation in the EIA process, public hearings should be held prior to the government's adoption of environmental laws, regulations, policies and approval of projects with significant environmental impacts. Notices for public hearings should be published on line, in a newspaper, posting on and/or near real property that may be affected by the matter being addressed in the hearing, and mailing notice to specific parties. The notice should be provided a number of days (7-10 days) before the hearing. Furthermore, revisions should be made to the current environmental laws to empower environmental public interest litigation.

Promote the use of market mechanisms

China has been experimenting with market instruments such as Eco-Compensation Mechanisms (ECMs), SO₂ emissions trading, carbon emissions trading, and water rights trading to supplement the command-and-control system. However, the government has been the major driving force behind these mechanisms, and the use of market measures needs significant improvement. For example, the development of eastern China heavily relies on the energy and resources supply from the western part of the country. But the payment for ecological services from the east is far from sufficient to cover the ecological deterioration suffered by the west.

China needs to increase the use of market-based economic incentive tools such as taxes, emissions trading, and natural resource pricing and establish supporting policies, institutions, and guidance for each of the market-based policy alternatives under consideration. At a minimum, control levels (caps) need to be set, procedures for the allocation of resources and control responsibilities, for monitoring and reporting performance (linked to emissions and performance reporting), for tracking emissions, for registering transactions, for establishing compliance, all need to be developed, tested, and deployed. Furthermore, setting up a Clean Production Fund will help provide incentives for existing enterprises to transition to clean production methods, and for new enterprises to design for clean production at startup.

A Final Word

The list of recommendations highlighted in this concluding section is formidable. Implementing them will not be an easy task and will strain the existing capacities at MEP. However, as the public's demand for environmental quality increases, the government must respond by serving the people with an efficient and effective environmental management system. It is our hope that the work of this Task Force is a small contribution to this need.

The report was submitted by 12th FYP Task Force.

CHAPTER 4

STRATEGY AND POLICIES ON ENVIRONMENT AND DEVELOPMENT IN WESTERN CHINA

ABSTRACT

China is at a Cross Roads where it must choose a path to Green Development or suffer the consequences of irrevocably damaged environmental conditions, continued regional disparities and generally poor social and economic outcomes for a substantial number of its citizens. Successive Five-year Plans and considerable fiscal expenditures have resulted in substantial but incremental improvements to some social, health and environment indicators. Chinese leadership has been apparent in tackling what is probably the greatest sustainability challenge in the world. However, the overall situation continues to be grave and deterioration has not been arrested.

If the nation is to achieve the sustainable development outcomes that it seeks it must find a way to integrate and translate national goals in order to achieve green development at the regional level. This one year Task Force studied the existing conditions and international experience in order to develop advice on a Roadmap for green development in Western China.

This is a distinct and highly diverse region that has significant national heritage values and current strategic importance for the entire nation. With 55 minority groups, many of the nation's international inland borders, significant mineral and energy resources and the source of much of the freshwater on which the nation depends, achievement of a green development model in this region is vital to the entire nation. Considerable potential exists for green development and urban expansion based on the distinct regional attributes and characteristics. It is, however, a region where environmental fragility and poverty co-exist in locations that are highly vulnerable to the impacts of climate change and loss of biodiversity. Moreover, investment and industry have been largely confined to government infrastructure programs and primary resource extraction and processing. Much past environmental damage needs to be addressed as well as prevention of future problems due to potential relocation of "black" industry from the eastern region.

The analysis focused on six policy areas that together inform many of the critical issues and define the pathway to the future. They are: (1) managing and restoring fragile ecosystems; (2) managing energy and mineral resources and pollution control; (3) improving labour quality and diversity for poverty alleviation; (4) promoting sustainable urbanization; (5) promoting green and inclusive industrial development; and (6) institutional and policy settings as facilitator and driver.

A Conceptual Framework for Green Development in western China has been produced. This is focused around the Four Capitals, i.e. Natural, Economic, Social and Human Capitals. The Framework identifies the critical interplay between Socioeconomic Development and, Environment and Resources Carrying Capacity. This interplay is described through the Challenges and Opportunities characteristic of the region and their resolution is seen in the various Policies and Interventions based on achieving the objective of an Eco-friendly, Socially Inclusive development that effectively utilises and enhances Indigenous Capacity.

A strategic overview analysis of the various challenges and opportunities associated with each of the six policy areas found considerable potential for green development as well as many issues which need to be addressed in a Roadmap for green development.

The Roadmap is a simple structure intended to demonstrate the coalescence of the wide-ranging initiatives and to give them focus and direction. It will place the government-announced goals, the Five-year Plan and the green development Framework in a single cohesive green development strategy.

The Roadmap includes four component parts:

- A set of goals which set out the overall direction for green development in Western China.
- A set of principles through which government leaders can guide work to achieve the goals.
- An integrated set of mechanisms that deliver green development outcomes for all of the policy areas.
- A monitoring and evaluation approach that enables informed adjustment to new information.

The Roadmap is not a set of prescriptive policy directions. Rather, like any map it is a guide or framework by which to assess and review existing policies, governance and planning structures and to assist in the development of further policy initiatives.

The analysis of challenges and opportunities also identified a set of seven key findings:

Key Finding 1: *Green development will not be fully achieved until government adopts a national roadmap that integrates green development with other long-term strategic and operational mechanisms.*

Key Finding 2: *Western China requires particular attention and priority by taking a roadmap approach to green development in China.*

Key Finding 3: *Specific green development goals are required for Western China.*

Key Finding 4: *Further guidance and engagement at all levels is required from senior leadership to achieve green development goals; a set of eight “principles” is presented as the basis for that guidance.*

Key Finding 5: *Integrated solutions are required to protect ecosystems, reduce poverty and expand economic opportunities to deliver green development in Western China.*

Key Finding 6: *Innovation is needed in institutional structures and approaches.*

Key Finding 7: *A new monitoring framework and evaluation approach is required for green development.*

Green development is not a goal that will be achieved in a short term. It will require long-term commitment and dedication. The Task Force identifies a limited set of eight recommended priorities on which to focus in the short term.

Recommendations

- 1) The Government of China should prepare and implement as soon as possible a green development Strategy for Western China.
- 2) Programs to deliver eco-construction and other means of protection of Western China’s ecological services, ecosystems and biodiversity should be better integrated and coordinated with those for poverty reduction in provinces and at local levels as a long-term seamless set of programs with a more unified basis of delivery.
- 3) Invest substantially more in programs specifically designed to increase and improve human capital in Western China to reduce poverty, and to enable the pace and quality of green development to accelerate, especially through green infrastructure construction and servicing.

- 4) Reform financial programs and mechanisms at all levels of government to more effectively target and drive green development via sustained funding.
- 5) Make Main Functional Zoning work effectively to support decisions and actions which lead to regional balance and green development.
- 6) Develop and adopt a sustainable urbanization model, including an eco-city approach tailored specifically to the needs and interests of provinces in Western China.
- 7) Encourage new green industries that reflect the character of Western China in the key and limited development zones, especially in areas of high poverty and areas of the greatest potential.
- 8) Strengthen institutional innovation to drive long-term green development.

Key words

Western China; Green Development; Environment & Protection; Poverty Alleviation; Urbanization; Industry Transformation; Ecosystem Restoration; Pollution Control; Institutional Arrangement

Task Force Report on Strategy and Policies on Environment and Development in Western China

Summary Report

4.1 INTRODUCTION

Western China (W. China) comprises 6.87 million square kilometres, accounting for 71.54 per cent of China and a population of more than 360 million. The region includes 12 provinces, municipalities and autonomous regions, and is home to 55 ethnic minorities (see Figure 4-1 and Table 4-1).



Figure 4-1 The Scope of Western China

This region's economic, environmental and human capital or assets and challenges make it critical to China as a whole (see Table 4-1). It holds the country's most vital mineral and energy sources, its most significant ecological and natural resources, including water, and is home to its most culturally diverse and poorest populations. The National Development and Reform Commission has identified targets for regional growth and socio-economic income levels higher than the national average rate³⁴ on the basis that this is necessary to reduce regional inequity and narrow the gap between Eastern and Western China. But the gaps are not just about regional economies and the income of residents in the western region. Arguably the more difficult inequities and barriers relate to social and human capital and the unequal access to public services and social harmony.

³⁴ NDRC. *Twelfth-Five Year Plan for Western Development*, February 2012.

Table 4-1 The Strategic Importance of Western China – Overview

Social cohesion and national security	Accounting for 71.54% of the terrestrial land area of China All of 55 ethnic minority groups With a population of 360.38 million, 27.04% of the national total ³⁵
Resource and energy security	Accounting for 81.1% of exploitable water resources ³⁶ All of 171 types of mineral resources 132 types of mineral reserves has been proven Accounting for 67% of China's fossil energy Accounting for 65% of China's renewable energy sources ³⁷
Ecological security	Having 85% of China's national nature reserve areas ³⁸ Having 70% of the state-level protected ecosystem and species Accounting for more than 65% of ecological service value of China ³⁹
Poverty alleviation	Accounting for 66% of China's poverty population ⁴⁰ Poverty rate is almost 17 times that of the eastern area 95% of absolute poverty population of China are in minority nationality areas, remote areas, border areas and ecologically fragile area, and these areas are mainly in western region The illiteracy rate among adults (above the age of 15) is 5.41%, 1.33 per cent higher than the national average ⁴¹
Urbanization	The western region urbanization rate is 28.70%, which is 7.52 per cent lower than the national average in 2000; after 10 years development, the urbanization rate had increased to 40.48%, which is still 9.20 per cent lower than the national average.
Industry development	The per capita GDP is 25% lower than the national average The output of energy and mining industry account for 63.41% of the regional output of industry. Emissions of the 'three wastes' per 10,000 <i>yuan</i> industrial value-added is 1.1 times more than national level
Transformation of economic structure Domestic demand playing larger role	W. China is a vast area, with an economy below other parts of China. There is huge potential for expanding regional domestic demand.

The CCICED Western China Task Force is focusing on developing a roadmap and policy recommendations for the green development of W. China at a time when there is significant national and international financial uncertainty and slowing growth on the global stage. China has a strong record and commitment to growth. Its growth rate has no international peer, tracking 10.7 per cent over the last decade.⁴² China has also made strong commitments to share the proceeds of this growth equitably across the country and to reduce disparity at both the regional and individual level and has recognized the need to do so in a manner that is more environmentally sustainable.

The western provinces are growing rapidly. Over the last decade, the region has achieved an average growth rate of 17.20%, which is faster than the national average. Of the five regions with the highest growth rates last year – Chongqing, Tianjin, Guizhou, Sichuan and Inner Mongolia – four are located in western China.⁴³ By contrast, the five regions with the lowest growth rates – Beijing, Shanghai, Zhejiang, Guangdong and Shandong – are all on the east coast. These regional growth variations will help to narrow the income gap between east and west in China. Per capita income in Shanghai (the highest in the country) was 9.2 times as high as that in Guizhou (the lowest) in 2005. This had fallen to five times in 2011, according to the National Bureau of Statistics (NBSC).

35 NBSC (National Bureau of Statistics of China). *China Statistical Yearbook*, 2011, Beijing

36 Xiangzhi Kong, Yingchun Hu. Superiorities, *Emphases and Countermeasures on Development of Energy Industry in China's Western Region, Ecology and Environmental Sciences*, 2012, 21(1): 94-100

37 NBSC and Ministry of Environmental Protection. *China Statistical Yearbook on Environment*, 2009, Beijing

38 Zhiyun Ouyang, Hua Zheng. *Ecological mechanisms of ecosystem services*, *Acta Ecologica Sinica*, 2009, (11):6183-6188

39 Ecological Environment Protection Research Center, Tsinghua University. *Current status and adaptive strategy of ecological environment in the western region* (in Chinese). *China Development Observation*, 2009 (05):29-33

40 NBSC. *China Statistical Yearbook*, 2010, Beijing

41 NBSC. *China Statistical Yearbook*, 2011, Beijing

42 China Daily, 12 September 2012, *Toward a brighter future for the Chinese economy*

43 NBSC. *China Statistical Yearbook*, 2011, Beijing

Several factors have contributed to better growth performance in W. China. Massive resources have been diverted to the western region, and capital accumulation in W. China has accelerated in recent years (resource-driven economic growth; see the trend of proportion of fixed investment to GDP and proportion of financial expenditure to GDP in Figure 4-2). Manufacturing has also relocated from the coastal areas to the inland and western regions. NBSC data show that W. China accounted for 18.8 per cent of national industrial output last year, compared with 13.9 per cent in 2000. During the same period, the six central provinces have also gained in terms of industrial-output share (from 19.1 per cent to 21.3 per cent). But the high proportion of fixed investment in GDP means the economy of W. China is highly dependent on government. It has also been suggested that manufacturing activities are shifting westward as a result of rising wages and the subsequent shortage of labour in coastal areas and relative weakness of environmental oversight mechanisms in W. China.

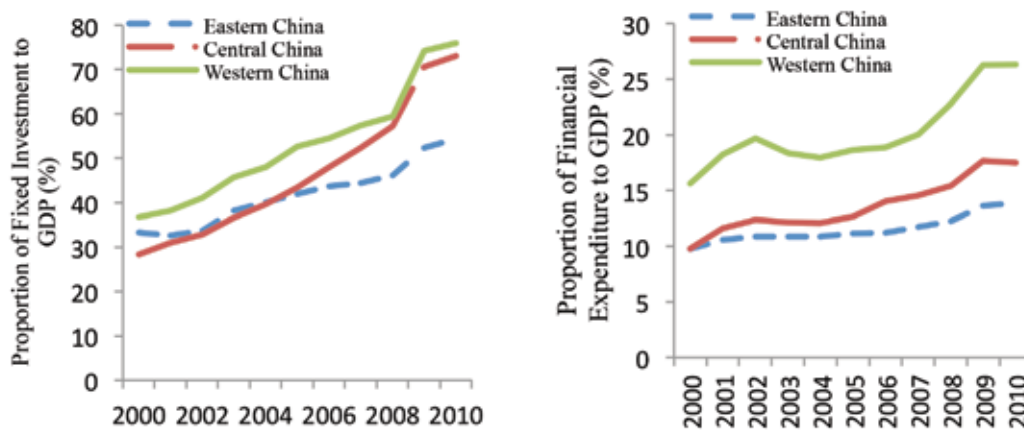


Figure 4-2 Proportion of Fixed Investment and Financial Expenditure to GDP

Source: China Statistical Yearbook (2001-2011).

Past growth has been achieved in “an environmentally profligate way” and “the overall situation (in China) continues to deteriorate”, and has relied on the primary and secondary sector while the development of the tertiary sector is too slow.⁴⁴ Energy consumption per unit of output (energy intensity expressed as kg/100 *yuan*) in the western region is on average much higher than that in the coastal provinces. Beijing and Guangdong recorded the lowest energy intensity (about 80 kg/100 *yuan*) in 2011 while the highest energy intensity was observed in Ningxia (five times as high as the best performer) and Qinghai (four times). Furthermore, growth in W. China has not been sufficiently translated into an increased overall standard of living for its residents. In addition, human capital has been and still is flowing to the eastern region.

The challenge for the CCICED Western China Task Force is not to limit growth but rather to provide a roadmap to help direct that growth: to build on increasingly strong political commitments contained in successive Five-Year Plans, and to bring environment and people (society) to the centre of economic decision making. And to ensure that future growth is not at the cost of the environment and with wealth shared unequally. This is an *environmentally sustainable development challenge* [that] is *arguably the most complex and difficult that any country has ever tried to confront*.⁴⁵

44 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012, p.6

45 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012, p.xviii

Nearly 80 per cent of territories in W. China are identified in the Main Functional Zoning Plan of China as either “restricted” or “prohibited development” zones (see Chapter 3, discussion of Main Functional Zoning). This acknowledges the fragility and ecosystem values of Western China, with the intention of retaining ecosystem functions during economic and social development processes. As a result of strong political focus, there have been significant investments of capital and increasingly stringent targets intended to incentivize improvements in per capita income, natural resource management, pollution reduction and GDP growth.

However, many key health, environment and social metrics for W. China have not demonstrated a rate of positive or sustainable change commensurate with the expectations of the Chinese government, key central or provincial officials, or of communities. According to 2009 estimates by the Chinese Academy of Sciences, for environmental quality to be maintained in W. China at a level similar to that in 2000, resource efficiency would need to increase by a factor of 4 to 5, and the environmental footprint per unit of GDP to decrease by 75 per cent.⁴⁶

The case for change is clear. W. China is the custodian of the nation’s greatest prospective natural resource wealth, so is at the heart of China’s long-term growth plans. Deterioration or poorly executed use of its natural resources, including water, or well-intentioned but poorly coordinated or implemented wealth creation and social welfare interventions, could have profound negative impacts on China’s future wealth, environmental and societal health and wellbeing.

There are also clear opportunities for China as a whole in the way it determines the future nature of growth in W. China. The central government clearly holds the major levers for change through the manner in which it invests its capital, targets its support for industry and innovation, sets its rules for natural resource planning and land use, and through the priorities and means by which it delivers programs to address social and human capital inequities. Diversity within W. China also requires a rethink of relationships between the national and provincial governments in order to make growth more sustainable. There is a need to better align and leverage the shared aspirations of the central and provincial governments as they relate to economic, social or environmental considerations, rather than have these goals independently pursued in an uncoordinated, or agency/project based focus.

China needs W. China to have a green growth trajectory built on the strong policy commitments in the Five-Year Plans and applied to the next steps. The Task Force recognizes that if Western China fails to achieve such a green growth trajectory, all of China will pay the costs in the economic, environmental and societal spheres.

4.1.1 Scope of the Task Force

The Task Force has been established to identify major issues in the process of ecological and social economic development faced by W. China, especially for improvement in the relationship between environment protection and economic development; to propose a green development strategy adapted for western conditions of economy, population, resources and environment in the next 20 to 40 years, and to make some policy recommendations for accelerating progress towards green development in W. China.

The Task Force identified specific work objectives from its Terms of Reference as follows:

- Understand past and current Five-Year Plans, the China Western Development Strategy and applicable policy measures in order to identify potential improvements.
- Analyze development and structural needs that require immediate policy actions and/or long-term transformational institutional development and policy setting.

⁴⁶ China Academy of Science. *China sustainable development strategy report 2009 – China’s approach towards a low carbon future*, Beijing: Science Press, May, 2009

- Identify key drivers for regional green development opportunities in W. China.
- Set out a roadmap and provide concrete policy recommendations, which expand on existing policy directions and initiatives and translate them into practical priorities and measures for a green development strategy in Western China.

This Task Force was officially launched on August 4, 2011 and has translated these objectives into the following five tasks that are the subject of the following chapters.

Task 1: Analyze environmental features and carrying capacity.

Task 2: Assess socio-economic realities, development strategies and models.

Task 3: Review international experience on integrated regional development of environment, economy and society.

Task 4: Develop a roadmap for green development for the western region.

Task 5: Produce green development policy recommendations for W. China.

4.1.2 Approach

The Task Force undertook a limited desk top analysis and worked on understanding and finding solutions for six policy areas: (a) managing and restoring fragile ecosystems; (b) managing energy and mineral resources and pollution control; (c) improving labour quality and diversity for poverty alleviation; (d) promoting sustainable urbanization; (e) promoting green and inclusive industrial development; and (f) Institutional and policy settings as facilitator and driver. In so doing the Task Force chose not to pursue specific issues such as climate change, energy development, biodiversity protection and many others.

Time constraints limited the scope and extent of the work and the number of regional consultations. The Task Force briefly visited a limited number of sites and talked with industry leaders and officials in two provinces to help its understanding of the larger issues. Two provinces with very different features and challenges were selected: *Sichuan Province* has experienced rapid industrialization and urbanization, and strong industrial transformation; while *Qinghai Province* is characterised by fragile ecology, which requires careful management to meet both regional and national ecological service needs. Both provinces have areas of high poverty and resource pressures.

The Chinese and international members met with officials from central government and the two provinces during both the research phase and during the drafting of recommendations focused on the major issues. More than 50 stakeholders from industry and different levels of government have contributed their thoughts and feedback, fundamentally influencing final recommendations of the Task Force. The Task Force also undertook a brief visit to Australia where considerable insight was gained on a number of relevant technical and governance innovations.

4.1.3 China's green development – an inevitable strategic choice

The core development challenge facing every jurisdiction today is how to achieve human development while maintaining essential ecosystems. China has achieved significant economic development and progress toward a truly prosperous society, but at the expense of the environment, and a widening gap between the rich and the poor. Consequently there are shifts: from “black” to “green”, from “ecological development” to “ecological construction”, and from “ecological deficit to ecological surplus”.

Box 4-1 China's Choice on Future Development

Premier Wen Jiabao has said: “China is determined to take a path of civilized development which ensures that production increases, people's living standards rise, and we live in a sound ecological environment.”⁴⁷

“A political awareness and consensus has thus emerged that China can no longer afford a continuous ‘black’ economic growth in the face of these serious resource bottlenecks. Environmental issues and social concerns are no longer merely the negative ‘side-effects’ of China's economic growth. China now finds itself in a loop, in which resource bottlenecks, environmental degradation and social discrepancy are causing serious economic problems and preventing a continuous and sustainable economic growth. A green transformation of the Chinese economy is therefore an inevitable strategic choice that aims to curb resource utilization and ecological degradation, and at the same time improve economic efficiency as well as social inclusion and stability.”⁴⁸

However, while there has been considerable investment in and some progress to improve essential environmental outcomes such as clean air, water and overall ecosystem services, many environmental and health conditions are being negatively affected, including in W. China. The challenge now is how to most effectively translate the new direction into effective action at a regional level.

4.1.4 China is at a crossroads of transformation

Chinese leaders have recognized that the country is now at a crossroads of transformation. Entering the 21st century, China is pursuing economic and social development under the guidance of the “Scientific Outlook on Development”, accompanied by a fundamental principle that calls for putting people first and promoting balanced and sustainable development in all areas. Making economic and social development compatible with the preservation of the natural environment has become a significant issue for China. Seeking a green, low-carbon economy, an emerging global policy agenda, has also become China's strategic choice. This political aspiration and concrete initiatives are manifested in China's 12th FYP.⁴⁹

China faces significant transformational challenges and necessary shifts:

- **Balance:** Moving from a narrow economic model to one protecting and enhancing natural, human and economic capital.
- **Structural:** Changing from an investment-driven primary and secondary industrial model to one giving greater prominence to services and domestic consumption, while also modernizing specific employment sectors.
- **Technology:** Taking advantage of new technologies and innovations requiring human capacity building and R&D investment to enable a green industry model. “In 2011, the coastal region spent, on average, more than 2 % of their income on R&D; in the western region the figure was about 0.5 %.”⁵⁰
- **Institutional:** Shifting from government-driven financial and regulatory models to a better-functioning market economy; with governmental institutions more focused on complex interrelationships of green development.

47 Xinhua Net. 25 April 2012. Speech by Premier Jiabao Wen at Stockholm+40 – Partnership Forum for Sustainable Development. http://news.xinhuanet.com/world/2012-04/25/c_123036994.htm

48 CCICED Annual General Meeting 2011. *Development Mechanism and Policy Innovation of China's Green Economy*. Beijing, 15-17 November 2011, p. 208

49 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People's Republic of China*. Philippines, 2012, p.144

50 China Daily, 24 August 2012, *Balance of economic power shifts*.

To support and realise green transformation at the national level, the regional dimension will be key for making fundamental and real changes on the ground. This is of particular importance for China given the sheer size of the country as well as the large diversity across regions. Alongside strong leadership at the top level, a multiple-level coordination as well as a genuine commitment and clear mandates at the regional level are necessary conditions for enhanced institutional capacity, for improved quality of implementation as well as for broad engagement and inclusiveness in China's green transformation. We believe it is advisable for China to take a regional approach when preparing a national green development strategy.

In W. China the broad national challenges are further exacerbated by:

Regionally uneven development Economic development is rapid in the eastern coastal areas of China while the western region is relatively backward. It accounts for 63.34 per cent of the total poverty-stricken counties⁵¹ in China and more than half of the ecologically vulnerable counties.⁵² It is necessary to explore new development strategies to solve the problem of regionally unbalanced or uneven development. There is a major trend in China to promote industry transfer to the western region and accelerate its development. Without scientific guidelines and rational planning, development acceleration in the western region would put more and more pressure on its vulnerable eco-environment and increase pollution there.

Close attention to environment and development to implement the China Western Development Strategy and promote sustainable development W. China supplies significant environmental services but is an ecologically fragile area with complex climatic conditions. Ecosystem degradation trends have not been halted. The challenge is to arrest the decline in *regulatory services* while simultaneously increasing the *provisioning functions* of environment services.

Distinct environment and development strategy and policies are needed for W. China

W. China plays a key role for the whole of the nation. This has been recognised in China's Main Functional Zoning, in particular by designating large areas of restricted development along with a large number of national nature reserves in the region.

Significant financial expenditure on eco-compensation and ecological construction to protect and enhance provisioning and regulating services recognise this reality but "*much environmental investment is made through special campaigns that are hastily conceived and implemented to respond to environmental incidents or emergencies. This approach is inefficient, too top down and extremely unpredictable.*"⁵³

At the heart of a green regional development agenda is a differentiated approach, taking into account region-specific development needs and constraints, and more importantly, identifying and creating context-specific green development enablers and opportunities, which bring a transformation of both mind set and practice, including:

- Indigenous capacity building and self-sustaining development.
- Refining and strengthening top-down, subsidy-based national support .
- Viewing environmental protection and ecosystem conservation as wealth generation and job creation from natural capital and environmental assets.
- Departing from concentrated and investment-driven industrial development towards a diversification of economic and employment structure.

51 <http://www.cpad.gov.cn/publicfiles/business/htmlfiles/FPB/fpyw/201203/175445.html>

52 Ministry of Environmental Protection of Republic of China. *The National Plan on the Ecological Fragile Zone Protection* (huan fa [2008] no.92), 2008

53 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People's Republic of China*. Philippines, 2012, p.xxi

The Task Force identified that China, and W. China in particular, needs a new conceptual framework setting the idea and practice of green development in the context of China's sustainable development, with specific goals for W. China.

4.2 CONCEPTUAL FRAMEWORK FOR GREEN DEVELOPMENT

4.2.1 International context

The 2008 global financial crisis accelerated concerns over development models that have relied heavily on resource depletion, leading to serious environmental pollution and ecological crisis. Green Economy (GE) was seen as a new vehicle for creating economic, social and environmental benefits, including the idea of “green growth”, a notion launched at Group of 8 and Group of 20 meetings⁵⁴ and via the OECD.⁵⁵ The United Nations Environment Programme (UNEP) launched the “Green Development Initiative” together with a “Global Green New Deal” to mobilise and re-focus the global economy towards investments in clean technologies and “natural” infrastructure. National green growth initiatives were established by several OECD countries. The theme of the green economy was the key focal point of the June 2012 Rio+20 global meeting on environment and development. Nations including China endorsed the meeting outcome, a document entitled *The Future We Want*. Green transformation has garnered the attention of decision-makers in both rich and poorer nations. Much of the attention has been directed to regions suffering from poverty.

4.2.2 Green development in China

Harmony between human and environment is a concept embodied in China's traditional values. Over 2000 years ago, Chinese philosophers called for maintaining “unity between nature and man” and following “the law of nature” to achieve harmony between mankind and nature. This harmony can be considered the ultimate goal in pursuing green development. And the philosophy was echoed in the sustainable development concept upon its introduction into China. Since 1996, sustainable development has been one of China's basic national strategies.

The 2002 UNDP China Human Development Report, *Making Green Development a Choice*, provided valuable insights into the definition of Chinese green development. The report suggested that: “*Green development stresses unified and harmonious development of the economy and environment, a positive path of people-centred sustainable development.*”⁵⁶

Since then, China has adopted a number of concepts important for sustainable development, including the “people-centred” approach, scientific development concept, harmonious society, environmental-friendly and resource-saving society, and ecological civilization. More recently green economy and green development concepts have been embraced by academics and the government of China. In recent years, the CCICED has formed several task forces to conduct studies along these lines, including the 2011 Task Force on Research on the Development Mechanism and Policy Innovation of China's Green Economy.

The 12th Five-Year Plan on Economic and Social Development is considered to be the first national green development plan for China. It formally adopted green development for building a resource-conserving, environment-friendly society, developing a circular economy, actively responding to climate change, and building a national disaster prevention system. One of the highlights of this plan is the concept of *net economic and social welfare maximization*, which not only means maximizing social welfare but also the minimization of the cost of economic development.⁵⁷

54 The Group of Twenty Annual Meeting's Summit. *Inclusive, Green and Sustainable Recovery*. London, 2 April, 2009

55 OECD (The Organisation for Economic Cooperation and Development). *Green Growth Strategy*, November, 2010

56 UNDP (United Nations Development Programme). China Human Development Report 2002: *Making Green Development a Choice*, Oxford University Press, 29 August, 2002

57 Wenhui Daily, The speech made by Professor Hu Angang at Expo Forum, 17 October 2010. *Environmental Changes and Urban Responsibilities*, <http://2010.eastday.com/G/20101017/u1a812903.html>

The net economic and social welfare benefit might be calculated as “Green GDP”, a metric for quantifying economic, social, human and natural capitals, and for environment pollution. However, Green GDP has not yet been fully adopted in China.

4.2.3 The conceptual framework

4.2.3.1 Core of green development in Western China

The Task Force has developed a conceptual framework for the green development of W. China, which guides the analysis and development of policy recommendations of this Task Force (see Figure 4-3).

The Task Force defines the core of green development as integrated development of four “capitals”: natural, economic, social and human capital. Only when these four capitals are built up and enhanced in a well-balanced way can green development in W. China be meaningfully achieved. Only pursuing growth of economic capital while massively depleting natural capital is a mind-set that is obviously unsustainable. On the other hand, purely emphasizing protection of natural capital without developing economic capital will not achieve the ultimate objective of welfare and human development.

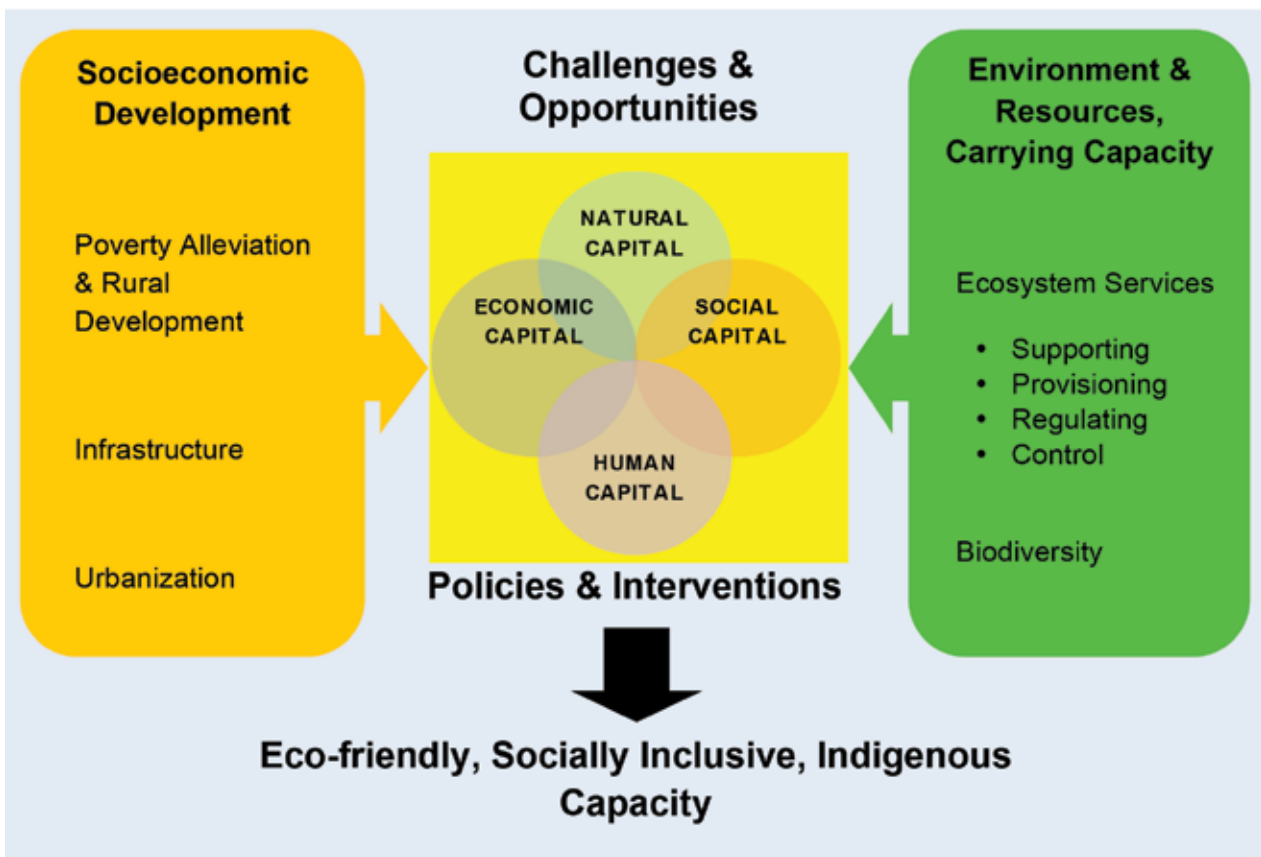


Figure 4-3 Conceptual Framework for Green Development in Western China

In addition, the green development of Western China must be balanced and coordinated with other regions; that is, it must not hinder the green development of other regions, and the cooperation of other regions will promote the process of green development in Western China.

Natural capital, the fundamental or supporting basis of social and economic activities, includes every natural element playing a role in any economically productive process. It includes stocks of clean water and air, animals,

plants, minerals, energy sources, forests, fisheries, all elements of biodiversity and ecosystems that support them. Compared to Eastern China, W. China has rich and diverse natural resources, forming a solid physical foundation for economic and social development not only for the region itself, but also for the rest of China.

Therefore, the most important issue for green development in W. China is to reduce over-dependence on natural resources as much as possible, and to make sure that the overall quality and quantity of natural capital is maintained at a level that can generate sustained service to support long-term economic growth and human wellbeing not only for W. China, but also throughout the country and the rest of Asia.

Economic capital, in the green development context, mainly refers to the regional economic capital stock, including infrastructure, fixed assets, technology progress and production capacity, and funds available to invest in economic, social and human development and environmental protection. It is the foundation of well-being plus social and human development. Being supported by natural capital, it can also provide necessary resources to strengthen natural capital, or to facilitate “growth of limits”.

Human capital can be interpreted as a stock of capabilities, which can yield a flow of services; that is, productive capabilities of human beings. Not only human knowledge, education, training and skills, but also useful behavioural habits as well as people’s levels of energy, and physical and mental health. It is important for the green development of W. China because these capabilities drive the development process. But comparatively weak human capital in W. China, in terms of overall education, labour skills and health, will be an obstacle for achieving high development expectations in the region. Unless human capital is further enhanced, there will be a lack of indigenous capacity to drive long-term green development.

Social capital often refers to characteristics of a society that encourage cooperation among groups of people (for example, workers and managers) whose interdependent efforts are needed to achieve a common goal such as efficient production. Trust among people, mutual understanding, shared values, and socially held knowledge for social coordination of economic activity are social capital elements. Western China has a far more complex social structure than the rest of China, given the region’s diverse cultural and ethnic composition. Unless the process of regional development is inclusive, it will be impossible for W. China to achieve economically strong, environmentally sound and socially equitable development. Social exclusion in Western China would add further burdens to vulnerable/disadvantaged social groups, while exacerbating poverty and severe social stability issues, with the risk of undermining the overall development of China.

The Task Force believes that green development in W. China can achieve the overall development and balance of these four capitals. A traditional development mode of pursuing maximum economic growth at the cost of the ecological environment will destroy the long-term sustainability of W. China. Under the current “Two Higher” target⁵⁸ for Western China (that is both the economic and the income growth rate for urban and rural residents in the western region must be higher than the national average from 2011-2015), there are significant risks that GDP-driven economic growth would be the single most important driving force for development in the region during the 12th FYP period – which inevitably would be at the cost of the ecological environment. In such a situation it is reasonable to expect that natural resources would be extracted to the greatest extent possible, industries would be fully promoted for GDP growth, and natural capital would be extensively cashed in for GDP and income generation, because meeting the “Two Higher” target is the true incentive for career development of government officials.

58 NDRC. *Twelfth-Five Year Plan for Western Development*, February, 2012.

4.2.3.2 Three special features of green development in Western China

For W. China, the path towards green development requires a roadmap that can identify and address various special regional features. Green development in W. China has three core features, which must be highlighted as desired outcomes.

Eco-friendly growth pursues socio-economic growth while maintaining or improving the ecological environment. It promotes a new economy featuring low carbon and high resource efficiency practices, while developing environmentally sustainable “products”. It respects finite carrying capacity of natural environment and enhances ecosystem service functions that can sustain genuine wealth and prosperity. Eco-friendly growth is particularly important for W. China due to its important ecological function and fragile ecosystems.⁵⁹

Indigenous capacity is one of the most urgent needs in order to generate economic growth without other forces brought in from outside. The China Western Development Strategy, implemented in 1999, obviously promoted economic growth in the western region. According to statistics, the total GDP of 12 western provinces increased from 4.54 trillion *yuan* in 1999 to 23.20 trillion *yuan* in 2011, an increase of 4.3 times.⁶⁰ However, the increase was mainly supported by capital inputs, not indigenous economic driving forces, such as technical advancement and regional human capital accumulation. Without large transfer payments and preferential policies of central government, economic growth of Western China can barely be maintained.

Without strong indigenous development and wealth creation capacity, such a high dependence on funding and outside investment is unlikely to achieve long-term prosperity in Western China. To stimulate and sustain its green development, W. China must enhance its own economic, social, human and natural capital.

Social inclusiveness is a core features that can be realized by creating buoyant local economies, improving degraded built and natural environments, by promoting community involvement and educational opportunities, and by improving living conditions and quality of life. The most prominent and recurring challenge across all areas of social inclusiveness is to join up and balance environmental, social and economic objectives. Even with recent rapid economic development in W. China there is a growing gap of per capita income between Western and Eastern China. Poor rural communities and ethnic minorities are not adequately mainstreamed into, or proportionally benefiting from the massive economic development of the nation. About 100 million people, mostly W. China, still live below the official poverty line.⁶¹ Continuing social exclusion in W. China would pose a significant risk for the nation in terms of the quality of overall green development and social stability.

4.3 CHALLENGES AND OPPORTUNITIES

The region presents distinct challenges and opportunities for green development, which are summarized in this chapter. We consider the issues from the perspective of six policy areas that, considered collectively, describe the green development “map” of Western China. The following discussion presents highlights from the detailed analysis contained in the *Strategy and Policies on Environment and Development in Western China – Technical Report*.

59 Zhiyun Ouyang, Hua Zheng. *Ecological mechanisms of ecosystem services*, Acta Ecologica Sinica, 2009, (11):6183-6188

60 NBSC, *China Statistical Yearbook*, 2000 and 2011, Beijing

61 Chinese Academy of Science. *China Sustainable Development Report 2012 – China's Sustainable Development in Shifting Global Context* (in Chinese), Beijing: Science Press, 2012

4.3.1 Managing and restoring fragile ecosystems

Current status

Much of the western region is ecologically important for biodiversity (for example, grasslands and wetlands), is naturally fragile (for example, the Loess Plateau) or prone to hazards (desertification, mass movements and earthquakes). Human activity over the millennia has diminished some of the values and exacerbated some of the problems. Vast areas have experienced deforestation, reduced biodiversity, soil loss and desertification. Recent human-induced phenomena like climate change are increasing the pressures and rapidly changing the nature and characteristics of critical values and resources in the region.

- **Grassland ecosystem** is the main ecosystem in W. China, with an area of about 287.44 million ha, accounting for about 42.77 per cent of the total land area of the western region. In the “Three-River” source region, grassland has been affected by human factors such as over-grazing, excessive reclamation and digging and the poor management of grassland and stockbreeding development, leading to degeneration and desertification of the natural grasslands on a large scale. Grassland degradation, especially black-soil grassland degradation, has caused serious ecological environment deterioration problems.⁶²
- **Wetland ecosystem** represents a total area of 21.47 million hectares, which accounts for about 3.2 per cent of the total land area of the western region. A large amount of wetland has disappeared as the result of negligent exploitation of land resources or has been replaced by man-made wetlands, while remaining wetland has atrophied heavily.⁶³
- **Water resource imbalance.** Abundant in the south and west (the “water tower” of China) but very scarce in the north and east of the region, this “lifeblood” of Chinese civilization is now extensively polluted in quality and restricted in quantity. The west is the essential source of water for hydroelectric power, coal washing, industry and agriculture, for residential consumption and for waste removal throughout the region and the rest of China. Climate change is an increasing threat to this vital resource since it is altering the hydrography of the glacier-fed rivers of the west and increasing the variability and intensity of both droughts and floods throughout.⁶⁴ Lake levels have fallen, and some lakes have dried up completely. For example, Bosten Lake, in Xinjiang, the water level has decreased by 3.45 meters over the last 30 years. Moreover, this lake transformed from freshwater to saltwater in just 10 years.⁶⁵ Its management is now a national challenge.
- Western China, especially in the Loess Plateau, is the main area of **soil and water loss**, in 2009 totalling 3.86 million ha⁶⁶ of the 12 western region provinces.
- **Land degradation**, including desertification, rocky desertification and soil salinization, is becoming the uppermost ecological problem in W. China. For example, by the end of 2005, the rocky desertification area of Guizhou had reached 3.32 million ha, 25.6 per cent of the national total.
- **The loss of biodiversity** is another significant issue in Western China, where there are abundant wildlife species. Some species are unique to Western China, and south-western China is recognized as one of the

62 Zhiyun Ouyang; Xiaoke Wang; Hong Miao. *A primary study on Chinese terrestrial ecosystem services and their ecological-economic values*, Acta Ecologica Sinica, 1999, (05):607-613

63 Xiaoke Wang, Zhiyun Ouyang, Hong Miao. *Formation, evolution and protection of wetland ecosystems in arid region, North-western China*, Territory & Natural Resources Study, 2003, (04):52-54

64 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012, p.75

65 Zhiyun Ouyang, Tongqian Zhao, Xiaoke Wang, etc. *Ecosystem services analyses and valuation of China terrestrial surface water system*, Acta Ecologica Sinica, 2004, (10):2091-1099

66 Xiaoke Wang, Zhiyun Ouyang, Han Xiao, et al.. *Distribution and division of sensitivity to water-caused soil loss in China*, Acta Ecologica Sinica, 2001, (01):14-19

25 global biodiversity hotspot areas. However, many rare and endangered species in the region are losing their habitat and facing extinction. In response, China's central government has committed significant financial resources and established nature reserves (1100 in the region, comprising 85% of the national total). Main Functional Zoning identifies restricted development areas and has imposed ecological migration on many small communities. Strategic biodiversity plans have been prepared for major communities such as Chongqing.

- **Geological hazards.** A combination of natural conditions and negligent human activities has increased the occurrence and economic consequences of natural disasters in China over the past 50 years due to a combination of factors including climate change.⁶⁷ For example, in Xinjiang Autonomous Region, in which 15 of 22 types of geological hazards exist, relatively large-scale geological disasters occurred 50 times in 2003, but sharply increased to 321 in 2010.⁶⁸

The central government has, through successive FYPs, undertaken many initiatives intended to address these issues. Many of these initiatives have achieved significant progress, such as the success of the “Grain for Green” and the “Sloping Land Conversion” programs in the reforestation of 21.77 million hectares.⁶⁹

Challenges

Lack of integration and consistency among various initiatives is a big problem. Main Functional Zoning was proposed in the 11th FYP⁷⁰ as a tool of planned regional sustainable development designed to zone lands at national and provincial scales: for economic development and urbanization, and for protection of land with high ecological and food production capabilities (see Table 4-2). Zones are identified based on nine quantitative indicators (for example, cultivable land, ecosystem fragility and importance, economic development, natural disaster risk, etc.) and strategic choice, a qualitative consideration. Western China is predominately zoned as Restricted Development with limited Key Development areas (see Figure 4-4). The very large scale of the zones, lack of local government capacity and the limited policy guidance and enforcement over the application of Restricted Development, constrains the practical utility of the current system as a tool for green development. The system has considerable practical potential for application at the sub-provincial scale. However, to be meaningful it must explicitly link with the EIA process and urban planning and provide the necessary direction in land and natural resource use decision making.

67 Asian Development Bank. *Toward an Environmentally Sustainable Future—Country Environmental Analysis of People's Republic of China*. Philippines, 2012, p.xvii

68 NBSC. *China Statistical Yearbook*, 2004 and 2011, Beijing

69 NDRC. *The People's Republic of China National Report on Sustainable Development*, 2012

70 NDRC. *Outline of the Eleventh Five-year Plan for National Economic and Social Development of PRC*, People's Publishing House, 2006

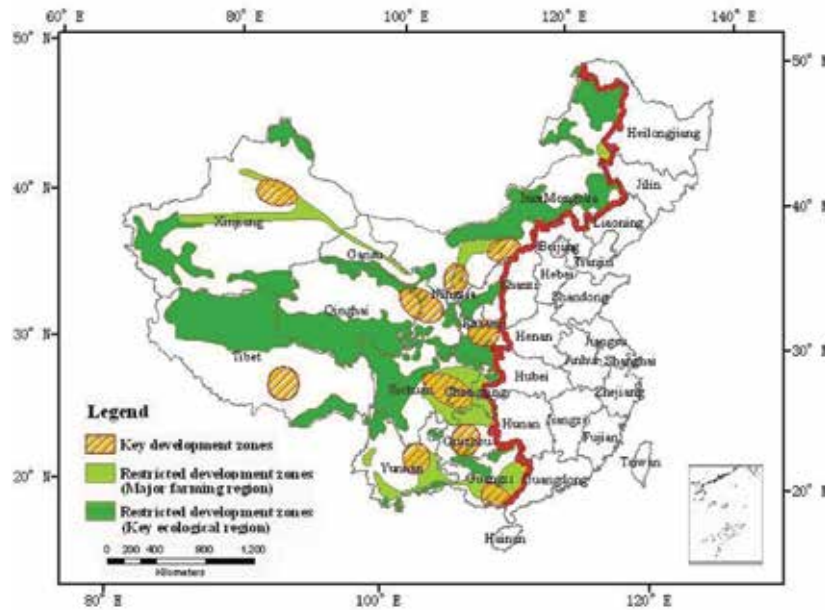


Figure 4-4. Distribution of National Key Development Zones and Restricted Development Zones in Western China

Main Functional Zoning needs to be used effectively to inform and constrain all major new development decisions, and be well aligned with EIA and other planning.

Table 4-2 Four Main Functional Zones in China

Zones	Features	Development Direction
Optimized Development Zone	Land exploitation intensity is already high and resource and environment bearing capacity starts to decline.	Prioritize improvement of quality and benefit of economic growth, enhance the level of participation in global distribution and competition, and maintain its role as the leader of national economic and social development
Key Development Zone	Resource and environment bearing capacity is relatively strong and economic and population concentration condition is relatively good.	Substantial infrastructure construction, improve investment and business establishment, promote development of industrial clusters, enlarge economic scale, accelerate industrialization and urbanization, undertake the industrial transfer from optimized development zone and the population transfer from restricted development zone and prohibited development zone, and gradually become the important carrier to support national economic development and high population density.
Restricted Development Zone	Resource and environment bearing capacity is relatively weak and large-scale concentrated economic and population condition is not good enough. The zone is related to ecological safety in the country or greater region.	Adhere to protection priority, moderate development, point development, rely on local conditions to develop characteristic industry supported by resource and environment, strengthen ecological restoration and environmental protection, guide over-concentrated population to orderly transfer and gradually become a national or regional important ecological functional zone.
Prohibited Development Zone	Various natural reserve areas	Carry out compulsory protection, prevent interference of human factors with natural ecology and prohibit exploitation activities not conforming to the principal function of the zone.

Underlying all this is the need to understand the importance of ecosystem services for meeting both provisioning and regulating functions (see Figure 4-5). In effect more economic goods will be demanded of ecosystems (*provisioning*) while ecological goods such as natural cleansing of water and flood control (*regulating*) also must be enhanced from these same ecosystems, a major dilemma in decision-making.

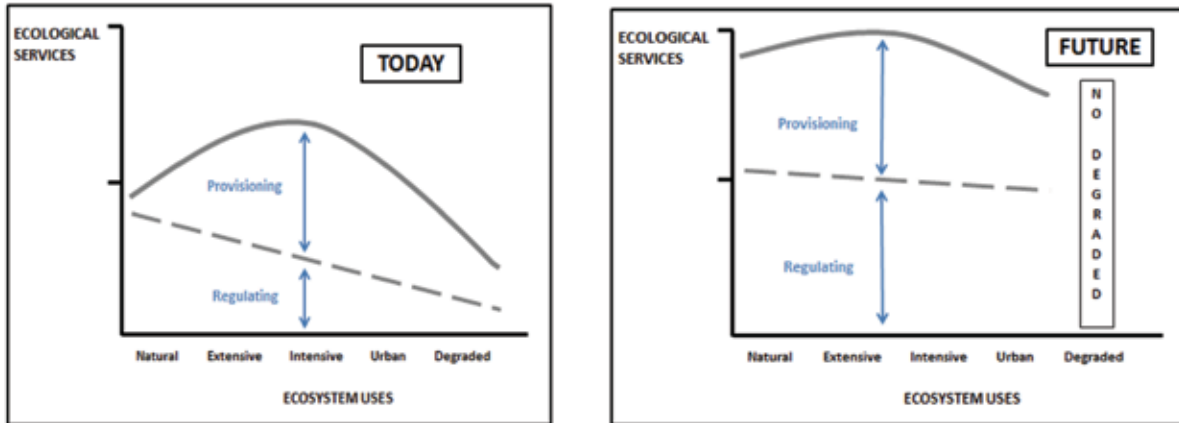


Figure 4-5 Ecological Provisioning and Regulating Services for China.

Source: Modified and further interpreted from CCICED Ecosystem Task Force scenario modeling.

Opportunities

Nature-based and cultural tourism such as in and around Chengdu and Central Yunnan is a fast-growing business that employs many local people and helps develop capacity. It depends on protection and planning of natural (and cultural) features and areas in a collaborative way to engage and empower local peoples. Elsewhere, businesses in urban areas are using natural products, such as in Xining, where wool and plants from grasslands are turned into carpets and medicines in factories employing “migrants” from rural communities. However, in both examples there is the potential for “green pollution” from resource overuse and from factory wastes.

Future development in the western region depends on improved governance and efficiency in water use and pollution control in urban areas, agriculture, industry and in power production (especially for new shale gas resources). Overcoming the challenge does present opportunities for green industrial development and human development (for example, innovation and investment in environmental technologies in Chengdu and surrounding areas). Experience in similar conditions elsewhere (in Australia, western United States and Canada) demonstrates a pathway from a situation of constraint and crisis towards one of expansion and potential (see Box 4-2), but with considerable adjustments in institutional mechanisms.

Box 4-2 Adjusting water management and allocation decisions involving national and state/territory governments – an Australian case example⁷¹

Challenge

- Managing supply and demand for a scarce resource which crosses state boundaries in an efficient, equitable and sustainable way.

Context

- Water has been a major factor in determining mining, agricultural and urban growth
- Responsibility vested in state/territory governments that are responsible for managing water resources to yield public and private benefits.
- History of conflicts between governments about planning and allocation (conflict between upstream and downstream) and about data objectivity and transparency.

Change in practice

- National government's role progressively increased. Council of Australian Governments developed a national water reform framework with national goals and actions for water to support resilient and viable communities, healthy ecosystems and economic development.
- All governments agreed to be independently assessed on progress of water planning.
- National Water Act 2007 introduced with a key reform—having an independent authority set sustainable diversion limits across the Murray Darling Basin, replacing consensus.
- Collection of reliable and transparently reported water data by a trusted, independent statutory agency, the Bureau of Meteorology, rather than on a jurisdictional basis.
- Robust planning applied within a broader management system incorporating appropriate regulation and effective market structures, including the establishment of property rights and a national water market. Statutory water plans used as the vehicle to provide security to all water users through clearly defined entitlements to a share of water.
- Responsibility for “environmental water” vested in environmental portfolios in many jurisdictions rather than natural resource or agricultural agencies.
- Water planning based on a participatory/advisory process that allows for community input to government decision-making in water management.

Lessons Learned

- Invest in establishing objective data sources and identify an independent data custodian.
- Data and modeling are critical and needs to be accepted by all concerned.
- Jurisdictions must be able to develop planning frameworks that reflect jurisdictional diversities to drive innovation and jurisdictional engagement.
- Use a suite of tools to achieve efficient and sustainable water management.
- Engage communities in both the assessment and decision-making processes relating to changes in water management regimes and the potential need for government assistance to affected communities in addition to direct water users.
- Cooperative arrangements between the governments that manage an interconnected system break down with economic growth pressures (e.g. as water demand exceeds supply) and start to undermine the key sustainability of all uses of the rivers in the long term. A central authority is required, although one that can work with the states. A coalition of the willing is the best way to implement a central water plan.

The critical work for the central authority is to define the objectives in water planning and to assist in identifying trade-offs for governments based on reliable and objective information.

4.3.2 Improving labor force quality and diversity for poverty alleviation

Current status

Poverty in Western China is especially dominant among poorly educated people, many of whom have an ethnic minority background, living marginally above subsistence level in rural areas characterized by poor soils, vulnerable ecosystems, unpredictable climatic conditions, and poor access to markets, schools, health and agricultural extension services. As a consequence, their educational levels are low and their physical capacity to engage in the “new green economy” is limited. Many such people, labeled as floating urban populations, migrate to urban areas and remain poor.

Challenges

The Government of China has undertaken many initiatives to address these problems, e.g. significant progress towards Millennium Development Goals,⁷² and many of which continue today. However, there are many social, economic and environmental challenges that reduce the effectiveness of existing measures. Some western regions have a fragile ecological environment with development banned or restricted under the Main Functional Zoning system. Extensive cultivation by farmers and expansion of grazing areas by herdsmen was interrupted by introduction of development limits on arable land and pastures. Environmental factors to a certain extent limit some economic benefits of local industrial development. Thus in ecological protection zones, residents with no other source of livelihood become the “green poor”.⁷³

Opportunities

Opportunities exist to reduce poverty in Western China by combining a set of actions addressing the above-mentioned constraints and creating jobs associated with environmental services, tourism and other green industry based on local characteristics, while also explicitly respecting endangered ethnic minority cultural values, and facilitating the smooth integration of these vulnerable minority groups into a rapidly changing modern society.

Towns and villages characterized by poverty need broad-based education opportunities at elementary and secondary schools, and specialized vocational and academic education at a cost and in locations that local people can afford to take advantage of. Due to language and cultural barriers, training and educational programs must be planned with sufficient duration and patience so that drop-out rates are reduced to the national average. This challenge must be explicitly expressed in curricula that maintain local language proficiency along with fluency in Mandarin, which is a necessary condition for being able to compete for better-paid jobs.

Efforts to enhance human capital should focus on how to cope with natural (soil, water, climate, etc.) constraints and opportunities, and strive to improve basic sanitation in these vulnerable areas. To facilitate this human capital enhancement program to a sustainable level, key physical infrastructure upgrading must accompany the human and institutional capital upgrading. There needs to be all-year road access to markets, credit institutions, insurance and public amenities. Teachers, extension workers and public health personnel must be able to reach towns and villages, so adequate roads must be built, with a program for their maintenance. The relevant authorities must commit to an accompanying budget. Such infrastructure provision needs to be coordinated with these other initiatives for human capital development.

72 Ministry of Foreign Affairs of the People's Republic of China, 2010. *China's Progress towards the Millennium Development Goals 2010 Report*

73 http://www.gmw.cn/sixiang/2012-03/25/content_3832145.htm

4.3.3 Managing energy and mineral resources and pollution control

Western China is rich in coal, oil, natural gas and other energy resources and is the most crucial source of strategic energy and raw materials for China's industrialization and modernization. All 171 minerals discovered in China have been found in the western region; they display the full range of mineral resources; and the symbiotic and associated minerals are rich. The potential value of 45 major mineral reserves is up to 44.9 trillion yuan, accounting for 50.85 per cent of the total metal reserves in China. The reserves of some rare metals in Western China rank top in China, if not the world. The abundance in natural resources and reserves provides the region with significant advantages for development.⁷⁴

Table 4-3 National Proportion of Main Energy Reserves in Western China

Minerals	Proportion of the national total reserves (%)	Minerals	Proportion of the national total reserves (%)
Pyrite	40.5	Kaolin	29.9
Coal	46.8	Trona	96.0
Bauxite	54.6	Magnesite	0.1
Oil	14.1	Asbestos	96.9
Manganese	60.9	Primary ilmenite	97.5
Natural Gas	61.5	Phosphorus	52.1
Copper	29.3	Vanadium	75.5
Water	54.1	Iodine	92.5
Chromium	48.8	Iron	27.8
Titanium	96.7	Mirabilite	83.8
Mica	85.2	Lead	65.2
Zinc	76.1	Nickel	88.0
Mercury	91.0	Fluorspar	63.3
Rock Salt	77.1	Potassium	99.3

Source: China Statistical Yearbook 2010.

Current status

During the past few decades, exploitation of mineral resources and energy sources have played an important role in promoting the economic development of the whole country, especially Eastern China. Current problems in resources exploitation in the western region include large numbers of small-scale mines, dislocated resource production and consumption, and environmental pollution from mining.

At the same time, currently there is insufficient exploration of resources in Western China due to the low per-capita value of various resources, quality disparities, spatial distribution, poor mining condition and insufficient investment in exploration. Physical access is difficult in many areas, compounded by restricted availability of water and energy resources, due to competition with the dominant hydropower industry. Distance from markets, harsh natural conditions and inadequate supporting infrastructure have collectively meant that despite W. China's natural mineral advantages, these have failed to translate into economic or community gains. Overall development and utilization levels are not high, many mineral resource reserves have yet to be accessed due to insufficient investment in exploration, and mining enterprises face serious problems relating to poor facilities, poor management, destruction and waste of resources and environmental pollution.

74 Xiuping Zhang, Lingqun Ma, Manqi Ke. *Status of Mineral Resources in China's Western Region – Problems and Countermeasures* (in Chinese). Northern Economy, 2010 (2): 37-39

Existing challenges

The challenges are linked to both accessing these resources and constraints related to natural resource scarcity, financial, infrastructure and technology matters, but also to the potentially negative impact of their extraction on ecosystems and the health and wellbeing of communities if managed poorly. The recovery rate of major minerals is generally only 30 to 50 per cent, and is 10 to 20 per cent lower in W. China than the national average. There has been a history of small mine development in the region. Due to the lack of environmental awareness and appropriate constraints, serious ecological and environmental problems have arisen due to unfettered exploitation of mineral resources causing significant community unrest and damaging the reputation of the industry both nationally and internationally. The western region has an average altitude of over 1000 meters, a fragile ecological environment, large areas of desertification, and is more vulnerable to predictable and unpredictable disasters and loss of human life associated with excessive resource exploitation. More than 70 per cent of sudden geological disasters occur in the western region. Many mining areas are in multi-ethnic districts and are subject to cross-border environmental problems and social issues relating to national unity, safety, stability and sometimes lack of benefits accruing to local communities.

Opportunities

Opportunities for Western China can be summarized as follows: (a) Through the implementation of the China Western Development Strategy and other relevant policies, special advantages have been offered to mining enterprises in Western China and deliberate action taken to reduce the number of small polluting mines. Significant benefits can flow with the further consolidation of small-scale mines to increase efficiency and reduce environmental damage, noting that they produce over half of China's mineral production. (b) A number of potentially beneficial policy and taxation initiatives are being developed but these need to be implemented more quickly to ensure that resource rents reflect environmental and other costs and stimulate local investment and innovation and promote investment in green technology and community development. (c) There is a need to more explicitly take into account broader health and socio-economic benefits and risks to communities in land use planning and decision-making and provide opportunities for public input. The government has recently announced yet to be implemented changes in this regard. (d) Current policies relating to resources tax require further adjustment. The mechanism for assessing resource development and use is imperfect and the income distribution policy of resources revenues is unclear and is currently not meeting its intended outcomes. Resource taxes are low, while in a resource-rich region, the income of local residents have not proportionally benefited. Decree of the State Council of the People's Republic of China No. 605⁷⁵ supports a policy to steadily promote reform in resource taxes and fees, mainly to increase the rates on standard coal, oil and natural gas, with price-based approach applied for oil and gas. However, the actual implementation of this policy has not yet been evaluated. (e) Natural resource use and decision-making frameworks and information bases should be strengthened. There needs to be site-specific and regionally focused EIAs which have the capacity to address cross-border issues. (f) There needs to be more appropriate cost recovery mechanisms to address mine remediation issues and a comparatively low number of mine sites are currently being remediated. This could include expansion of initiatives such as the guarantee fund to create a more comprehensive green development fund to provide a sustainable source of funds for provincial and local governments to remediate dirty mine sites.

⁷⁵ Decree of the State Council of the People's Republic of China No. 605, *The decision of the State Council on revising "the Provisional Regulations on Resource Tax of People's Republic of China"*, 2011.

Box 4-3 Sustainable mining in Australia⁷⁶

As in Western China, the mining sector is a key contributor to the Australian economy. However, mining companies are acutely aware that the old models of corporate responsibility, which were based on the aim of generating the greatest possible profit for shareholders, are now changing and the broader issues of wealth distribution, community development, environmental protection, health and education and human rights are no longer able to be viewed as just the business of governments. Sustainable development is directly linked to commercial sense, and it is fundamental to the mining sector attaining and maintaining integrity and credibility, in order to obtain permission from the community and government to continue to mine. In other words, the concept of sustainable development should underpin the nature of the interaction between the government, the community and industry as partners in the development of mining and other resources.

In Australia, the shift has seen the adoption of sustainable development programs. The Australian mining industry is well aligned to the global pursuit of sustainable development. Under the umbrella of “Enduring Value” and the former Ministerial Council on Mineral and Petroleum Resources’ strategic vision, the mining sector has been collaborating with government and community representatives to produce the Leading Practice Sustainable Development Program for the Mining Industry.

The Leading Practice Program provides practical guidance on sustainable development issues relevant to the mining industry through handbooks and workshops to assist implementation of leading practice and the shift towards sustainable development. Workshops based on sustainable development themes were conducted and handbooks used to promote leading practice sustainable development in regional and international forums; for example, a workshop on “Stewardship – Life Cycle Partnerships” was held in Beijing in November 2007.

Traditionally, environmental impact assessment is applied at project (site) level, with little or no consideration of cumulative effects over the long term and at a regional scale. This would result in the situation where an individual project is always justified, while the overall cumulative impacts often lead to environmental pollution and degradation at the regional level. Strategic Environment Assessment (SEA) is, on the other hand, a tool to identify and prepare for the potential cumulative effects upfront, so that large-scale irreversible adverse impacts can be avoided and minimized effectively. It is an analytical and participatory approach to strategic decision-making that aims to integrate environmental considerations into policies, plans and programs and evaluate their linkages to economic and social considerations. A growing number of countries, including Australia, have legislation or regulations prescribing the application of SEA. This is also of particular importance for W. China, where large-scale industrialization, urbanization and resource development are emerging.

In summary, the opportunities for green development in the mining industry require the coordinated application of a range of financial, policy and regulatory and market measures to support and provided incentives for a more acceptable type of mining development and offer direct benefits to the community, province and the nation as a whole. This approach seeks to shift the emphasis away from using government funds to fix environmental problems to supporting an industry that is demonstrably committed to broad sustainability principles. Government needs to be more prescriptive in what type of development it is prepared to encourage in this area and place greater onus on developers to behave in accordance with these standards.

4.3.4 Promoting green and inclusive industrial development

Although major inequities persist, some progress has occurred on narrowing the gap between eastern and western China through industrial development.

⁷⁶ The Department of Resources, Energy and Tourism, Australian Government, *Social Responsibility in the Mining and Metal Sector in Developing Countries*
<http://www.ret.gov.au/resources/Documents/LPSDP/DEPRES.pdf>

Current status

From 2000 to 2010, the industrial value of W. China increased by 20.12 per cent each year, which is 2.90 per cent higher than the national average, 3.82 per cent higher than Eastern China, and 2.19 per cent higher than Central China. In addition, the ratio of industrial added value to regional GDP in W. China had increased from 33.94 per cent to 42.19 per cent, with industry playing a more important role in the economic development of W. China.⁷⁷

While State Council policies and targeted infrastructure programs have promoted the shift of industries from east to west, there are significant concerns regarding the need to ensure effective policies and management instruments are in place to avoid the region becoming an unquestioning recipient of polluting industries from other regions.

Existing challenges

Challenges relate to: (a) dominance of capital rather than labour-intensive enterprises, providing very few employment opportunities; (b) high proportion of state-owned enterprises and low proportion of small and medium sized private enterprises resulting in a shortage of dynamic markets and high barriers to entry for local enterprises; (c) high proportion of resource exploiting heavy industries and low proportion of processing and manufacturing industries, resulting in high pollution emissions and significant environmental costs. In 2009, the proportion of energy/chemical industry and mineral development industry in the region's total industrial output was 63.41 per cent, 17.18 per cent higher than the national average. The proportion of the equipment manufacturing industry in the region's total output was 16.91 per cent, 7.69 per cent lower than the national average. Industry is in a highly resource-dependent stage, mainly relying on launching new projects and enlarging the production scale, which leads to low socio-economic benefits and high environmental resource consumption. For example, the industrial energy consumption per unit of value added is 1.09 times of the national average and industrial waste water discharged per unit of value added is 1.08 times the national average.⁷⁸

Opportunities

The opportunity lies in the promotion of rapid green industrial development. Western China represents an important potential domestic market and may potentially assist in minimizing China's reliance on its export industry during globally difficult times. Due to the low level of existing industrial development, fewer employment opportunities and many low- and middle-income residents, the region currently has relatively sluggish consumer demand. Green development provides opportunities to address disparities and optimize potential for economic, human and environmental "capitals".

This can be achieved by the expansion of a number of existing and new initiatives. For example: (a) introducing and fostering leading enterprises and industries and actively supporting small and medium enterprises including the more sustainable use of natural resources; (b) developing specialized and competitive agriculture, including improving agricultural efficiency, rural incomes and addressing concerns of food and ecological security; (c) developing the equipment manufacturing industry, acknowledging its potential to speed up and transform industrialization; and (d) supporting the development of people-enriching industries through the use of tax policies, supporting small and growing industries, agriculture and tourism in order to take full advantage of the area's natural characteristics and strong green brand power.

To deal with these issues, some solutions have been proposed in the guidelines for western development in the new decade, issued in 2010. This includes giving full play to the region's advantages while giving priority to the energy industry, agriculture, mineral resources, deep processing industries, and modern manufacturing industry.

⁷⁷ NBSC. *China Statistical Yearbook*, 2001 and 2011, Beijing

⁷⁸ NBSC. *China Statistical Yearbook*, 2011, Beijing

Most significant, however, is the need to fully utilise the human capital of Western China and improve the quality of the labour force and the overall access and quality of education and vocational training. The ageing of the population will affect workforce supply and officials and industry leaders have predicted emerging workforce shortages. Greater emphasis is required on strengthening professional training, especially secondary vocational training of practical use for local people.

A transformational change is required in the nature of industry being supported by government to operate in or relocate to Western China. A combination of market mechanisms, including appropriate pricing of natural resources; fiscal programs; and stricter regulatory and compliance mechanisms will be required. Green development funds have been effectively used internationally to assist industrial transformation, especially in towns and cities that are highly resource dependent. There are also opportunities to further promote potential industrial advantages of the western region by strengthening key areas of technological innovation, promoting environmental technology applications and by accelerating the development of a low carbon economy. These efforts will lead to transformational benefits for industry and a greater degree of environmental control and ecological protection.

Industry must be provided with efficient and outcome-oriented regulatory and compliance structures to underpin green entry criteria for development in Western China (see Box 4-4). Opportunities may also be explored to enable local communities to be reimbursed for participating in environmental monitoring programs.

Box 4-4 Potential Green Entry Standards & Criteria

- Green entry standards or criteria should align with national and provincial green development targets. They must reflect the unique characteristics of the province.
- They can include any or all of the following:
 - Requirements to evaluate site specific and broader regional impacts and ensure appropriate mitigation strategies
 - Strengthen the cost accounting and environmental threat recognition
 - Stipulate acceptable emission levels
 - Stipulate energy and natural resource use efficiency requirements including effective demand and supply analysis
 - Stipulate recycling requirements
 - Outline monitoring, auditing and public transparency requirements
 - Identify biodiversity or habitat protection measures
 - Require social impact appraisals and identify necessary social responsibility requirements relating to health, education, employment and infrastructure
 - Stipulate workplace safety requirements

4.3.5 Promoting sustainable urbanization

Western China has played a critical supporting role for economic advancement in China over previous decades, by providing cheap labor and abundant natural resources, but it is now time to reap some returns.⁷⁹ The level of urbanization can be an indicator of social economic development of a region or nation, and a relative high urbanization level are quite often linked with higher levels of income, education, and job opportunities. Research shows a strong correlation between urbanization and economic growth and between urbanization level and per capita income.⁸⁰ In Western China, a historical trend shows a very strong correlation between the urbanization level and

79 Liu, G., Y. Chen, et al.. *China's environmental challenges going rural and west*, *Environment and Planning*, 2012, A 44 (7): 1657-1660

80 Bloom, D. E., D. Canning, et al.. *Urbanization and the Wealth of Nations*, *Science*, 2008, 319(5864): 772-775

per capita GDP (Figure 4-6). Recent research shows there are positive correlations between urban growth and economic development in cities, with spillover effects in surrounding regions.⁸¹ Thus, urbanization and associated changes can become a powerful driving force for socio-economic development, and provide an opportunity for poverty alleviation and human development.

In addition, urbanization has the potential to relieve eco-environmental pressures of population in Western China, both directly and indirectly. Population pressure on sensitive ecosystems through inappropriate and excessive use has been cited as the most powerful agent of ecosystem degradation in Western China,^{82,83,84} and reducing such pressure often becomes the most important task for the many ecological protection programs.⁸⁵ Cities can provide alternative forms of settlement, education and job opportunities, which can reduce direct pressure on sensitive ecosystems. Indirectly, cities can be more environmentally friendly than rural living. Given the same income level, cities show higher per capita environmental efficiency than their rural counterparts,⁸⁶ often due to their much higher density and efficiency of scale. Urbanization will inevitably increase the living standards of people and the resource and environmental impacts associated with income growth in Western China, in the long run, can be a more sustainable habitat form.

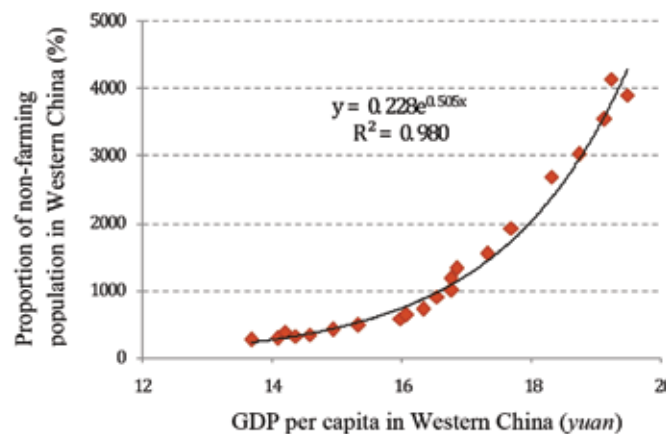


Figure 4-6 Urban Population Share and GDP per capita in Western China

Data Source: China Statistical Yearbook

Therefore, urbanization done well can improve all of the four “capitals”. It can serve as a powerful agent of change, as the urbanization process requires infrastructure development such as transportation systems and urban environmental infrastructure, accompanies industrial development, and brings about changing lifestyles and consumption behavior of local people. But it is not without risk, and careful attention needs to be paid to the special features in W. China. It is important to note that promoting urbanization in Western China should not aim to attract large-scale migration from outside the region, which was the case in eastern coastal regions, and probably in most other developed countries. Neither should it be about simply enhancing the urbanization level in the region. Rather, it

81 Bai, X., J. Chen, et al. *Landscape urbanization and economic growth in China: Positive feedbacks and sustainability dilemmas*, Environmental Science and Technology, 2012, 46(1): 132-139

82 Jun, W. Land degradation and ecological rehabilitation in karst areas of Guizhou province, South Western China, *Advances in Earth Science*, 2003, 18(3): 447-453

83 Liu, J. and J. Diamond. China's environment in a globalizing world, *Nature*, 2005, 435 (7046): 1179-1186

84 An, S., H. Li, et al. China's natural wetlands: past problems, current status, and future challenges, *AMBIO: A Journal of the Human Environment*, 2007, 36 (4): 335-342

85 Liu, J., S. Li, et al. *Ecological and socio-economic effects of China's policies for ecosystem services*, Proceedings of the National Academy of Sciences, 2008, 105 (28): 9477

86 Brown, M. A., A. Sarzynski and F. Southworth. *Shrinking the carbon footprint of metropolitan America*. Washington DC, Brook- ing Institute, 2008

should be promoted as an agent to provide an environmental and socially sustainable habitat form, that: (a) provides support for western development via attracting and retaining a high-quality labor force; (b) reduces population pressures on the ecosystem and environment; and (c) provides a platform for economic development and poverty alleviation. In other words, urbanization in Western China needs to be viewed and utilized as an agent for real, positive change to support the overall green development goal in the region.

Current status

In relation to urbanization, Western China can be characterized as having:

An overall low urbanization level, but increasing rapidly, and with a strong spatial variety. By the end of 2010, the level of urbanization in Western China was 40.48 per cent, 7.02 percentage points lower than the national average, 7.2 percentage points lower than Central China, and 17.32 percentage points lower than Eastern China. Among Western provinces, the urbanization level varies greatly. At the end of 2010, the urbanization level of Inner Mongolia was 53.4 per cent, the highest among the western provinces, while the level of Tibet was just 23.8 per cent, which was the lowest among western provinces. The urbanization level gap between Inner Mongolia and Tibet was as wide as 29.6 per cent.

Few urbanized areas, with small size and low density. As of 2010, Western China had a total urban area of 36,719.3 km², 0.53 per cent of the total regional area, compared with 2.67 per cent and 6.63 per cent in Central and Eastern China respectively. Within the urban area in Western China, there are 85 cities at prefecture level and above. The average size of cities at prefecture level in the western region, 431.99 km², is almost half the average in eastern cities of 946.97 km².

A relatively weak growth engine function of cities. Many cities in Western China have a similar industrial make-up, with energy, metallurgy and chemical industries occupying the top five major industries. This often leads to over-competition among cities in the region. In 2009, the ratio of GDP in central city areas in the total GDP of the whole city was 55.3 per cent on average among western cities, while the same ratio among eastern cities was 62.5 per cent, which illustrates the lower economic growth of cities in Western China.⁸⁷

Few cities have fully fledged urban function and enough attraction to retain high-end human capital. In Guizhou Province, for example, there 111 graduates with masters or doctorate degrees and 604 skilled workers moved into the region from 1995 to 2000, while the number of well-educated people with masters or doctorate degrees and skilled workers moving out of the region was 147 and 1738 respectively.

Key constraints/challenges

Five key constraints and/or contextual issues need to be kept in mind when promoting urbanization in the western region: (a) The region has a **fragile ecosystem** that provides vital ecosystem services to the rest of the country. Under the Main Functional Zoning, designated protected or limited development areas will limit the type and pathway of urbanization. (b) The **shortage of some key resources**, such as water already is a strong constraint in some W. China cities. In 2010, the per capita water supply in western cities at prefecture level and above was 24.11 tons, less than half of eastern cities, at 49.33 tons. (c) **The geographical location** of the region, which is land locked and far away from the coastlines that play a central role in terms of economic development and urbanization. (d) The region has a **relatively low starting point**, in terms of relatively weak industrial basis, and insufficient hard and soft urban infrastructure. Although there are some exceptions such as Chongqing and Chengdu, local industries in western cities are relatively weak and underdeveloped. and (5) The region has a **rich and diverse cultural background**, with

⁸⁷ NBSC. Research Report on the balanced development and the overall strength among cities in China, Beijing, 2011

55 ethnic minority groups. Given that urbanization often entails changes in habitat form and associated lifestyle, such cultural diversity can be a constraint in one-size-fits-all kind of urbanization, but at the same time can be a wonderful opportunity to develop vibrant, culturally harmonious cities. Urbanization should be promoted with due respect to this unique natural, economic, and social situation of the region.

Box 4-5 Eco-city Development in Western China⁸⁸

The concept of Eco-city means a city designed with consideration of environmental impact, inhabited by people dedicated to minimization of required inputs of energy, water and food, and waste output of heat, air pollution, and water pollution, also “low-carbon”. Eco-city construction in China started in 1986 with the goal of building an eco-city in Yichun, Jiangxi province. By February 2011, among 287 prefectural-level cities in China, 259 cities declared their goal of building eco-city (or low-carbon city). Tianjin Eco-city is a fascinating 30 km² development designed to showcase the best new green technologies and to serve as a model for future developing Chinese cities.⁸⁹

Influenced by the national trend on building Eco-city, governments in Western China also are active in promoting the construction of eco-cities. A number of eco-city efforts have been advocated in the western region recently, such as Beichuan County, characterized by low-carbon and post-disaster reconstruction; Turpan, characterized by an eco-city appraisal index system, saving water and energy, ecological protection and historical culture reserve; Chenggong County, characterized by effective urban land use, low-carbon urban planning and urban ecosystems.

Unique opportunities

Western China has unique opportunities in terms of promoting urbanization. First, the central government’s determination to develop the region can be the “wind under the wing” for the region, as high-level political attention and well-designed and coordinated government policy can provide a favorable environment and window of opportunity for sustainable urban development. Second, the relatively low current level of urbanization means there is little “minus” or historical legacy and associated need to retrofit, which can be costly. It also means there is an opportunity to embrace state-of-the-art sustainable development concepts, technologies and practices, including building codes, infrastructure, planning approaches, public transportation systems, low-carbon and eco-city building, taking the construction of the eco-city in Western China as an example (see Box 4-6). Third, some important strengths and advantages are under-explored: for example, the area’s natural beauty, for building tourist-industry based cities; border regions, for developing small but vibrant trade towns and cities; cities and towns linked with resource and mining industries. Fourth, as urban air and water pollution in eastern cities generates increasing concerns, relatively clean air and water in some secondary cities in the western region can be attractive to well-educated “human capital”.

88 Annual Report of the project of the *Construction of the Eco-city Appraisal Index System and the Evaluation on Typical Eco-city*, Chinese Society for Urban Studies

89 http://www.huffingtonpost.com/2011/01/13/tianjin-eco-city_n_806972.html#s221860

Box 4-6 “Five Golden Flowers”, a rural-urban integrative development in Sansheng County, Jingjiang District, Chengdu⁹⁰

To break up the dual structures of urban and rural areas and improve the rural environment, the government of Chengdu has invested in five villages in Sansheng county since 2003 to build five tailored eco-tourism areas. These projects not only make full use of geographical location advantages but also fit well with current urban residents’ desire to experience rural life. Initiatives have been undertaken through joint investment by the local government and farmers, land transaction, industrial support and institutional guarantees. The Huaxiangnongju project features bonsai, cut flower and tourism industries; Xinfumeilin has plum flower culture and industry; Jiangjiacaidi transformed traditional planting into a new venture; Donglijuyua focused on cultivating chrysanthemum and its relative industries; and Hetangyuese built an art village. In 2006, these eco-tourism areas, labeled the “Five Golden Flowers”, were included among the national AAAA grade scenic spots.



Xinfumeilin



Huaxiangnongju



Jiangjiacaidi



Hetangyuese



Donglijuyuan

Before 2003, Sansheng was among the poorest suburban counties of Chengdu, but because of the construction of the “Five Golden Flowers”, the socio-economic situation of these five villages has improved significantly. From 2002-2006, the total tax revenue increased from 0.5 million yuan in 2002 to 12 million yuan in 2006, rural net income increased from 3500 yuan in 2002 to 8015 yuan in 2006, while the average land price of surrounding areas increased from 0.5 million yuan per mu to 3.5 million yuan per mu.⁹¹ This successful experience shows how citizens’ lives can be transformed without land grabs, demolitions and moving people’s houses.

4.3.6 Institutional and policy settings as facilitator and driver

Effective policy guidance and institutional arrangements are essential to make the urgent changes required to achieve a green development outcome.

Current status

The current situation with regard to green development policy has been described as chaotic. Although many well-intentioned and effective initiatives exist, others interact to produce unexpected, counter-active, sub-optimal or even unproductive results.

⁹⁰ http://www.sdpc.gov.cn/tzgg/zhptggsd/t20070619_142124.htm

⁹¹ Chengdu Municipal Government. *The Report on the urban- rural integrative development in Jingjiang District, Wenjiang District and Shuangliu County* (in Chinese), 2007

Key constraints/challenges

In order to achieve a cohesive green development approach and outcomes in Western China it is necessary to transform the development model, to make integrated changes in national and provincial policy and practices, and to ensure real enforcement of regulatory frameworks. For example this requires a shift to increased coordination. Central government ministries and programs now interact sporadically. Financial support is significant (estimated to exceed \$US90 billion nationally in 2009),⁹² but funding is often short-term, project and issue-driven, with complex and specific eligibility rules that present formidable hurdles for poor, remote communities lacking human resource capacity. It also requires market mechanisms to incentivize investment in, for example, pollution prevention and ecosystem restoration and appropriate pricing of natural resources

Cautiously gearing towards the development target “Two Higher”. This target, set in the 12th FYP for Western Development, creates contradictions. However, 77 per cent of the western region is in zones that are “development restricted” or “forbidden” under the National Main Functional Zoning Large-scale, high-intensity industrialization and urbanization activities are limited in “restricted” areas, and any kind of industrialization and urbanization development is prohibited in “forbidden” areas. The pressure to achieve socio-economic development objectives requiring higher than average economic and income growth rates places great pressure on local officials to enable development that may conflict with the Main Functional Zoning intent. Guidance is required on how to reconcile the incompatible targets, and improvements to the Main Functional Zoning approach.

Weak policy monitoring mechanism. The current western development system is still a “top-down” management system, reflecting traditional Chinese practice. The China Western Development Strategy was established by the State Council in January 2000, with Premier Zhu Rongji as team leader of the leading group and Vice-Premier Wen Jiabao as deputy head. Local government departments set up specialized agencies within the National Development and Reform Commission (NDRC) system; relevant departments added units to support the West Development Strategy; and the National Natural Science Foundation Committee also directed talent and funds to support the program. This “top-down” management system probably led to regulation failures since not all departments involved are effectively connected with each other.

Added to these issues are the challenges of: inadequate, inaccurate or misleading information to enable adequate policy analysis;⁹³ a lack of mechanisms to effectively engage citizens in the involved communities; and a revenue-and-rewards system for local government officials that drive them to make short-term decisions that will improve GDP results.

Imperfect financial and fiscal mechanisms. Since the implementation of the Western Development Strategy, central government funding for Western China was directed by a series of state policies. A large amount of this financial assistance was provided through direct investment, transfer payments, ecological protection and construction projects, and tax preferences. These financial priorities played an active role in promoting growth, increasing tax revenues at the regional level, creating and offering job opportunities, and accelerating industrial restructuring. However, problems in current financial arrangements hinder potential green development:

- The amount of financial support is not matched to the level of responsibility for environment protection, meaning regions taking more responsibility for environmental protection did not get correspondingly larger amounts of funding from central government. This problem is undoubtedly the main cause of the difficulty identifying responsibilities for ecological system protection.

⁹² Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012, p.81

⁹³ Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012

- The transfer payment system aimed at balancing regional financial levels has not been fully established.
- Preferential tax policies need to be further perfected, in particular concerning: (a) Current preferential tax policy only covers a small range of industries. In addition, the tax exemption threshold is too high, which does not benefit many enterprises. (b) Preferential tax policy does not really support the industries currently encouraged by government (there is a list of industries to be encouraged in China). (c) Preferential tax, as a double-edged sword, can also lead to revenue loss for local government, causing fiscal difficulties. (d) The tax revenue division between central and local government adopts a universal tax revenue ratio, which results in a situation where poor regions have less tax revenue, and thus get less money back from central government.
- A long-term and stable funding channel for western ecological protection and social development has not yet been set up, resulting in an important bottleneck restricting on-going development in Western China.
- Current policies relating to eco-compensation are poorly articulated and need to progress from concept to implementation.
- Access to natural resources needs to be based on appropriate pricing policies and encourage efficient resource use by both government and private operators.

Opportunities

The distinctive characteristics of the western region need to be reflected in its institutions. The human and natural capacity limits that are not well recognized in national programs should be addressed. Poverty eradication can be achieved by expanding the focus away from short-term solutions that mainly favor GDP enhancement, which not only may not resolve many of the underlying cultural and environmental issues and drivers, but may actually further worsen the situation. Programs to improve accessibility and healthcare can be better coordinated with those aimed at loss of biodiversity and increased water supply and waste disposal issues (to avoid the experience such as in Qinghai Province, where the Task Force visited a new hospital that had no water and few services). There is a need to adapt to the cultural, language and other needs of distinct minorities living in poor communities.

The impact of significant financial transfer payments on the opportunities to secure progress in environmental management and development of green business made under the 11th and 12th FYPs could be greatly enhanced by an effective eco-compensation program transferring benefits directly to rural residents in a predictable way. The NDRC “has been made responsible for developing a national ‘eco-compensation’ policy framework, and it is expected that the 12th Five-Year Plan will incorporate this and possibly also a draft law”, however, “much work remains to be done... and leadership is required in working with lower level governments to develop pilots and eventually scale this up to landscape and regional levels”.⁹⁴ The very critical Main Functional Zoning approach is not yet fully integrated either with the eco-compensation approach or with decisions by all levels of government.

The opportunities are significant. China has a long history of focusing on the west and there is a sophisticated and effective planning infrastructure with great potential to change. All officials the Task Force met are dedicated and focused. They need a well-articulated, integrated, consistent and strategic framework within which to work.

⁹⁴ Asian Development Bank. *Toward an Environmentally Sustainable Future---Country Environmental Analysis of People's Republic of China*. Philippines, 2012, p.121-122

Box 4-7 International case: Zoning and land use planning to improve decision making for prosperity and environmental services, British Columbia, Canada⁹⁵

Challenge

To make timely decisions while improving the outcomes, consistency, predictability and public acceptability of the resulting resource management and development actions.

Context

1. An economy dependent on resources (energy, mines, forests, agriculture) and high-quality environmental services (water, biodiversity) for enabling societal wealth and prosperity.
2. Great geographical diversity and very high-quality natural resources facing increasing capacity pressures.
3. A history of conflict over decisions.
4. Increasing societal pressure for timely decisions which enable resource development but protect environment.
5. An increasingly complex and unpredictable decision context due to competing demands, the effects of globalization and the uncertain consequences of shifts like climate change.
6. Change in practice
7. Integrated and improved science-based information systems and increased transparency.
8. Extensive engagement of diverse interests (stakeholders) in decision-making and management.
9. Development of comprehensive and intricate land use zoning system through public consultation.
10. Environmental assessment involves full public disclosure and is a separate agency.
11. Establishment of neutral and legal bodies to review and report on implementation activity.
12. Full engagement of minority peoples as equal partners.

Lessons Learned

1. Zoning systems have limitations in highly complex and diverse environments especially when faced with requirement for constant adjustment and adaptation to changing contexts.
2. New decision-making tools and approaches evolved from the first stage of planning.
3. Development of well-coordinated and integrated accountabilities among management agencies and officials is essential to delivering effective and responsive decisions.
4. Improved, integrated and transparent information systems are essential.
5. Sustaining social license approaches becomes equally important as formal legislation and policy structures.
6. Cumulative effects tools and risk assessment approaches are required to inform most effective decision-making in public interest.
7. The approach must be enabled to evolve and adjust to change.

Applicability to W. China:

This region faces many of the same challenges but at far greater level of complexity. China can learn from this provincial experience and avoid many years of false starts.

⁹⁵ External Briefing Advice to British Columbia Government, Derek Thompson & Associates, 2012

4.4 SUMMARY

This is a highly complex region of inter-connected values and issues that require sophisticated management approaches. Despite significant investments and changes already undertaken, severe impacts on the natural environment are already being experienced and some environmental services are at or near a point of severe ecological and health-related disruptions. Nonetheless, there are also significant opportunities in this region of enormous natural resource wealth and cultural diversity. What is required is a well-articulated, integrated, consistent and strategic framework and approach involving all levels of government.

4.5 KEY FINDINGS AND ROADMAP FOR WESTERN CHINA

The Task Force has concluded that for China to advance its green development agenda in order to achieve the Five-Year Plan goals and objectives, a roadmap is required to help, guide, structure and demonstrate the overall directions over the next 20 years. We presents a case that such a roadmap is most urgently required first in Western China because of the risks incurred if green development is not achieved there, and because of the potential benefits if this approach is successful. Finally the Task Force has outlined a very initial set of ideas to demonstrate the possibilities of the approach and to enable further discussion.

4.5.1 What is a Roadmap for Green Development and why China needs one

The roadmap for green development is a simple structure intended to demonstrate the coalescence of wide-ranging initiatives, and to give them focus and direction. It will place the government-announced goals, the FYPs and the Green Development Framework outlined in Chapter 2 into a single cohesive green development strategy. The roadmap includes four components:

- A set of goals that set out the direction for green development.
- A set of principles that can guide work to achieve the goals.
- An integrated set of mechanisms that can deliver green development outcomes for all of the six policy areas.
- A monitoring and evaluation approach that enables informed adjustment to new information.

It is not a set of prescriptive policy directions. Rather, like any map it is a guide or framework by which to assess and review existing policies, governance and planning structures and to assist in the development of further policy initiatives.

Key finding 1: Green development will not be fully achieved until government adopts a national approach that integrates green development into a roadmap with the other long-term strategic and operational mechanisms.

Despite very significant commitments of financial and other resources and many substantial and positive changes, the rate of change toward improved environmental outcomes is too slow: “While some improvements in several indicators are made each year, the situation in general is not yet under control, and it is unlikely that truly comprehensive improvements in ambient environmental quality will be achieved until 2030.”⁹⁶ The Task Force agrees with the ADB’s assessment that a “strategic shift in the approach to environmental management will be required”.⁹⁷

96 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012, p.125

97 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People’s Republic of China*. Philippines, 2012, p.126

The Task Force considers this essential for the following reasons:

- (a) *The Five-Year Plans lack a comprehensive and integrated articulation of a green development approach.* The Five-Year Plans clearly provide a major building block to a green development trajectory in Western China. However, they are not sufficient to fully achieve green development in Western China or China as a whole. Effective planning for green development requires guidance, as well as better tools to help officials resolve the fundamental contradictions between the current strategies and the new green approach in an integrated, practical and business-like manner. China needs a national green development strategy supported by a sustainable and appropriately coordinated investment plan at central and provincial levels (including Western China) that will deliver the goal of “balanced, coordinated and sustainable development”. Green development under existing policy settings and delivery mechanisms will be very difficult to implement, or at worst unachievable.
- (b) *The scope of the targets needs to be more comprehensive to equally encompass all development goals and provide clarity on contrasting priorities.* The Task Force has concluded that the goals and targets in the 12th Five-Year Plan (see Box 4-8) are essential components of a green development approach for the nation and that those identified for Western China are also key components. As Box 4-9 demonstrates, these existing directions have been complemented over the past two years by further policy announcements and commitments of significant national funding and initiatives explicitly for Western China. But all such initiatives do not appear well integrated into a comprehensive framework that addresses the four fundamental goals of enhancing capital for green development.

Box 4-8 Goals set in the 12th Five-Year Plan for Western Regions⁹⁸

Ecological environment: Forest coverage 19%, forest stock increase by 330 million m³, grassland ecological deterioration trend halted, soil erosion.

Eco-compensation: Establish eco-compensation fiscal transfer system from province to lower levels; study the establishment of deposit system for resource extraction industries; gradually establish inter-regional eco-compensation system; speed up research for eco-compensation regulation.

Energy saving and emission reduction: Strictly enforce the total emission control for main pollutants – energy consumption per unit of GDP in provinces of Western China other than Tibet to decrease by 15%, COD emission reduction by 4.5%, SO₂ by 3.5%, NH₃-N by 6.8%, NO_x by 3.4% compared with 2010; pilot circular economy and low-carbon areas/sectors; control the repeated construction of high-energy consumption and high-emission enterprises; phase out production capacity of resource-wasting, environmental-polluting and non-compliance with safety codes.

Disaster prevention and reduction: Establish direction system of monitoring, warning and emergency system in province-city-county-country level.

Economic development: Economic growth rate higher than national average; system of characteristic industry preliminary formed; inclusive development capacity improved significantly.

Standard of living improvement: Income growth rate for urban and rural residents higher than national average; urban economic house coverage over 20%; registered urban unemployment rate controlled lower than 5%; poverty population significantly reduced.

Public service enhanced: Gaps with national level gradually reduced in terms of compulsory education, medical care, cultural and social security; nine-year compulsory education sustained above 90%; urban and rural basic medical insurance participation increase by 3%; new rural pension and urban resident pension scheme achieve full coverage.

Infrastructure improvement: Comprehensive transport network preliminary formed; two-hour transit zones formed for key city clusters; paved roads access to townships and road access to villages basically achieved; additional 15,000km railway constructed; road transport and information communication facilities further improved; water conservation facilities enhanced; additional 120,000t/d municipal waste treatment capacity achieved.

Industrial structural optimization: Population for primary industry decreased, and comprehensive agricultural production capacity increased; secondary industry competitiveness greatly enhanced; tertiary industry greatly developed with increased employment opportunities; promote renewable and new energy sources.

Urbanization: Urbanization rate over 45%; enhance management to improve quality of urbanization.

Integrated urbanization and rural development: Enhance the leading and powerhouse function of central cities; nurture medium and small cities; speed up urban infrastructure construction; integrate urban and rural development.

The Task Force noted that the 12th FYP presents a number of contradictory directions, which officials have difficulty in resolving in the absence of effective mechanisms and processes to guide, monitor, assess and adapt decision-making. Thus progress will continue to be erratic and the goals for green development may not be achieved.

- (c) Greatly improved coordination and innovation is needed. Transformational institutional innovation will be required to drive green development. It is widely acknowledged that the lack of (horizontal and vertical) coordination between ministries and programs in China requires significant reforms.⁹⁹ Internationally major governments have adopted greater coordination to more effectively tackle the challenge of complexity and uncertainty. While approaches differ in jurisdictions, underpinning rationales normally relate to reducing waste, increasing efficiency and improving outcomes. This must include a redefinition of the relationship between all levels of government. The Premier's articulation of a need for greater coordination is strongly endorsed by the Task Force, which recognizes that mechanisms to be adopted in China must fit China's needs. Government also needs more experimentation with performance-based, market-driven approaches while continuing to modernize and enhance traditional regulatory compliance and enforcement actions.

Box 4-9 Recent Policy Announcements and Commitments

The Technical Guide Rule of Environmental Impact Assessment (EIA) was delivered, which provided general principles, working guidelines, approaches and requirements of EIA on construction programs. In addition, the standards for coal selecting program was delivered, which provides references for evaluation of coal selecting programs and the EIA on coal resources exploration activities.

The Regional Biodiversity Evaluation Criterion was published. Applicable to regional biodiversity evaluation at county level, the criterion was set up to regulate biodiversity evaluation, taking account of national and regional biodiversity status, spatial distribution and variation trends, while identifying national and regional key biodiversity protection areas, and improving general biodiversity protection management.

The Coding Rule for Pollution Sources was introduced to process information and interchanges on national environmental pollution sources management, to promote environmental pollution prevention and control, improve environmental quality, and realize the standardization of pollution source identification.

Environmental Monitoring Measures were established to oversight the environmental monitoring system managed by the Ministry of Environmental Protection and carried by local environmental protection authorities at county level, and environmental supervisory agencies at all levels. The measures aim to establish a sound coordinated working mechanism providing necessary guidelines for environmental supervisory agencies.

99 Asian Development Bank. *Toward an Environmentally Sustainable Future – Country Environmental Analysis of People's Republic of China*. Philippines, 2012, p.123

The State Council recently issued ‘**Several Opinions on Further Promoting the West Development Strategy**’, which included: (1) promote ecological construction and environmental protection to realize the improvement of the ecosystem and increase farmers’ income; (2) continue to speed up key construction projects in infrastructure; (3) further enhance rural infrastructure construction to improve the rural living conditions; (4) take forceful measures to adjust the industrial structure and actively develop and advantage industries that are characteristic of the region; (5) actively promote the development of key development zones and accelerate the growth of regional economic hubs; (6) strengthen the development of science, education, culture, health and other social undertakings to promote the harmonious development of economy and society; (7) deepen economic institutional innovation; (8) expand the funding channel; (9) strengthen the building of talent team; and (10) speed up the process of legal construction.

(d) *Improved information and continuous transparent monitoring and evaluation must drive further adaptation.*

Decision-makers at the central and regional level and in communities lack reliable, relevant and accessible data on the quantity, quality and use of key aspects of all four “capitals”. These data are critical to ensuring that any changes to the stocks of capital are reflected and used to inform decisions on the quantity, quality and use of any particular stock at all levels of program delivery. There are many reasons why data are not available, such as cost, accessibility and scale issues associated with the large size and diversity of China. However, the result is that decision-makers and communities lack an accurate and balanced picture of whether “quality growth” is actually being achieved in a harmonious way, as the FYP directs, and whether green development is, in fact, occurring. International experience suggests that a wider range of sustainability indicators is required to inform sustainable decisions and planning. The following are some situations where information is currently inadequate:

- Renewable and non-renewable natural resource stock or carrying capacity data and an assessment of the impacts of use on the resource base. For example, extraction of mineral and fossil fuel resources as a proportion of total stocks.
- Natural resource management, biodiversity and ecosystem health-related targets specific to the western region in addition to China as a whole.
- Regional data to support the effective implementation of the Main Functional Zoning supported in the Five-Year Plan.
- Data and associated information management systems to monitor progress in the achievement of an integrated set of green development targets in both central and other levels of government.
- Accurate state of human health data relative to environmental quality indicators.

4.5.2 Why a Roadmap for Green Development is needed for Western China

Key finding 2: Western China requires particular attention and should be a priority for application of the roadmap approach to green development in China.

The roadmap approach clearly has potential application for China as a whole. However, recognizing the resource and human capital constraints, a risk/reward based approach suggests that the most immediate pressing needs and opportunities lie in Western China. Without adoption of a roadmap there is considerable risk of repeating old mistakes, but with higher negative consequences to a valuable but fragile natural environment and indigenous cultures, both of which are central to improved green outcomes. The rate of new development raises the level of risk considerably if it is not effectively targeted toward a green development model that effectively deals with regional disparities, resolves past problems and delivers new green growth.

Western China is very distinct and presents a situation where all of the challenges for green development and many of the opportunities co-exist. Most importantly the critical environmental challenges present a significant risk for the whole of China while Western China’s natural resource wealth is becoming an increasingly important underpinning of the national economy.

The money and effort already invested in Western China forms a valuable investment base for green development but some problems remain stubbornly unresolved, not only because they are so large and complex but also because the solution to such challenges lies in the strategic and coordinated approach that underlies the roadmap concept. Moreover, many of the opportunities for a green pathway remain as unrealised potential requiring a new approach, not a continuation of past practice.

Finally, there is an opportunity here to “test” new approaches in a situation where change is a recognised necessity and to do so before all of the “new” government and business initiatives begin or are so far advanced that they cannot be re-directed. It is an opportunity at a scale to be found nowhere else in China today and it is one that will not be available again if the challenge is not addressed soon.

4.5.3 The Roadmap for Green Development of Western China

The following observations about the application of the roadmap approach to Western China serve as an illustration of the approach and as examples of the potential contents. It is not intended as a replacement for the detailed work that the Government of China needs to pursue to undertake such a strategic planning approach.

Table 4-4 The Green Development Roadmap for Western China

DESTINATION →	GUIDANCE →	ROUTES & PATHS →	METHODS →	POSITION LOCATOR
Goals & Objectives	Principles	Policy Foci	Governance Mechanism	Monitoring & Evaluation Framework
*Overall goal (green development in western China) • Indigenous capacity • Eco-friendly growth • Social inclusiveness *Objectives for Eco-system protection & management • Mineral and energy management & pollution control • Poverty reduction & labor quality promotion • Sustainable urbanization • Industry transformation • Economic growth & social equality	*Government leadership *Regional differentiation *Interdependence & coordination *Shared targets & accountability *Informed decisions *Long term *Market and non-market signals and mechanisms combination	*Improved ecological protection & construction & wealth creation *Green energy and mineral exploitation & pollution control *Enabling & regulating new green industry *Enhanced green urban development *Improved institutions	*Government regulation (central/provincial/local) • Plans • Legislation & regulation • Tax & fiscal transfers *Market adjustment • Carbon market • Emission market *Natural resource pricing reform *Legal system	* Environment assessment * Monitoring and evaluation matrix targeting at each policy focus area * Life-time monitoring mechanism charged by the third party * Public participation * Evaluation on four ‘capitals’ • natural • economic • social • human

4.5.4 Goals and objectives for green development in Western China

Key finding 3: Specific goals are required for green development of Western China.

Developing specific goals for achievement of “balanced, coordinated and sustainable development” in Western China is a task for government, but the Task Force considers they should be founded in protection and enhancement of the “four capitals” by delivering:

- Goal 1: Eco-friendly growth
- Goal 2: Social inclusiveness
- Goal 3: Indigenous capacity

4.5.5 Guiding green development of Western China

Key finding 4: Further guidance and engagement at all levels is required from senior leadership to achieve green development goals.

When the Task Force met with a range of officials in Beijing and the two provinces (Sichuan and Qinghai) they noted that the Five-Year Plan goals are not always effectively “translated” into practical guidance for officials at the various levels of government. These officials identified a number of conditions and commitments needed to achieve green development in Western China, presented here as a set of eight principles: (see Annex 1 for full listing)

- Government leadership at most senior levels
- Regional differentiation of the issues and solutions
- Interdependent and coordinated mechanisms
- Shared targets and accountability
- Local and accountable actions where appropriate (subsidiarity)
- Integrated and accessible information to enable better informed decisions
- Decision-making mechanisms focused on long-term outcomes
- Market and non-market signals and mechanisms

4.5.6 Policy areas and institutional mechanisms

Key finding 5: Integrated solutions are required to protect ecosystems, reduce poverty and expand economic opportunities to deliver green development in Western China.

- (a) *Prosperity and ecosystem protection through focus on infrastructure, employment and investment in human capital.* Effective solutions to poverty require coordination of infrastructure provision (roads, schools, healthcare, communications and environmental services) with improved educational programs and provision of employment. Since many of the most poverty-stricken communities are situated in locations of greatest ecological fragility where eco-compensation and eco-construction programs are required, and where there is significant potential for both nature-based and culturally focused tourism, there is significant potential to develop long-term programs which deliver joint benefits.
- (b) *Industrial transformation based on regional assets to expand employment and prevent the spread of polluting industry.* W. China has significant assets that can be capitalised on to create and expand employment and investment. Examples include eco-construction programs, tourism, agricultural product processing, and a service economy. At the same time the pollution from old “brown” industry needs to be cleaned up while preventing the relocation of new “brown” industry in the region. Such initiatives will require extensive initiatives in coordination and re-prioritising, in particular central government funding programs. This includes (but is not limited to) new applications of infrastructure works, extension and local retention of resource taxes, incentive funding for innovation, establishment of thresholds for waste emissions inside the restricted development zones.

- (c) *Sustainable urbanization to provide attractive functional new centres for growth.* Adopt a differentiated and tailored urbanization policy that is coordinated with the implementation of the Main Functional Zoning. Urban development should strive to be a vehicle for achieving Main Functional Zoning within its larger regional context, rather than undermining it.

Enhance urban infrastructure investment as a preventative measure against the negative environmental impacts of urbanization. Given the strategic importance of the western region in terms of water resources in China, and given the relatively low development and financial capacity for the region to build costly urban infrastructure from the beginning, it is essential to develop an effective and efficient financial mechanism to install urban environmental infrastructure upfront, rather than waiting for the cities to obtain financial power to do so.

Develop a long-term, green, eco-city development strategy as follows: building standards and regulations need to be established and implemented; a compact urban development model needs to be adopted to avoid urban sprawl; public transportation systems should be given higher priority; a long-term, green industrial development strategy needs to be established as an integral part of urban development strategy to support urban functions; and state-of-the-art and suitable technologies, planning and management approaches need to be sought out and adopted.

Invest in “soft” infrastructure. Invest in building a number of medium-sized, attractive and highly livable cities that provide a state-of-the-art physical and cultural living environment, with higher education institutes and R&D centers. These cities can be anchors of the region in attracting and retaining high-level human capital and high-value-adding industries, eventually hubs for regional innovation and incubation.

Adopt a systems approach towards integrated urban-rural development to enhance urban-rural mutual support and co-development. This should enhance and harness positive spill-over effects from urban development.

Key finding 6: Innovation is needed in institutional structures and approaches

- (a) *The Main Functional Zoning challenge.* The Main Functional Zoning system is a key mechanism for planning and decision-making that protects essential ecosystems and directs development to appropriate locations. It is in its early stages of development and application and much can be learned from experience internationally. It currently appears to have limited application by local officials and is not well understood by key stakeholders in both the government and industry. The Main Functional Zoning needs to progress from the “strategic” level to become a vehicle to drive evidence-based planning of all four “capitals” and delivery of decisions which guide development and ecosystem protection at the local level. It also needs to be supported by appropriate data sets and trained staff and it needs to be well tied into planning for urban development, ecosystem protection and environmental impact assessments of industrial and infrastructure developments. Such improvements will require cooperation among a wide range of officials at all levels and across a range of disciplines.
- (b) *Financial mechanisms and infrastructure development.* These are critical “investment programs” made by central government but they are often characterized as being uncoordinated, short-term, crisis- or issue-driven responses to needs and pressures. They are the key strategic tools which can be employed by government to drive green development and innovation, but that will require adoption of integrated goals and putting in place or re-invigorating a central organizational “architecture” to oversee the delivery of a concerted program.
- (c) *Market institutions.* This is the other key mechanism. Green development requires innovation and entrepreneurial solutions to problems and approaches that go beyond the traditional “command and control” measures of regulatory agencies. China clearly intends to employ market approaches. However, the nation lacks much of the necessary architecture that is essential for a fully functioning marketplace. Experimentation and a long-term plan will be required, one that is driven from a central agency.¹⁰⁰

100 Han, G., M. Olsson, K. Hallding, et al. *China's Carbon Emission Trading: An Overview of Current Development*, January, 2012

(d) *Independent monitoring and assessment systems.* Green development will require creative adaptation as well as new integrative approaches. Effective adaptation requires publicly verified monitoring and assessment. Without accurate and transparent information and a neutral publicly accountable entity this initiative will fail to produce the necessary results.

4.5.7 Monitoring and evaluation framework

Key finding 7: New monitoring framework and evaluation approach required for green development.

All successful change initiatives require continuous adjustment. This can only be successful if there is a well-developed system that is based on dependable and accurate information that can be used to continuously monitor, report and evaluate progress. In China there has been much work on such systems in recognition of the need to provide officials with accurate reporting and as part of the system to recognise and reward officials. However, officials report that it has been hampered by lack of consistent, accurate, reliable, integrated and publicly verified information. In addition the basis for evaluation and action on green values and data is not as well recognised and developed as it is for such things as GDP. The Monitoring and Evaluation Framework is a first step in developing such an approach.

The objectives of the Monitoring and Evaluation Framework are to collect and provide accountable information that will be used to:

- Track progress on implementation of all components of the green development
- Identify gaps and weaknesses in service function provision
- Plan, prioritize, allocate and manage resources
- Monitor the impact of development in Western China on four kinds of “capitals”
- Measure effectiveness of treatment
- Report publicly on current status of key values and progress toward targets.

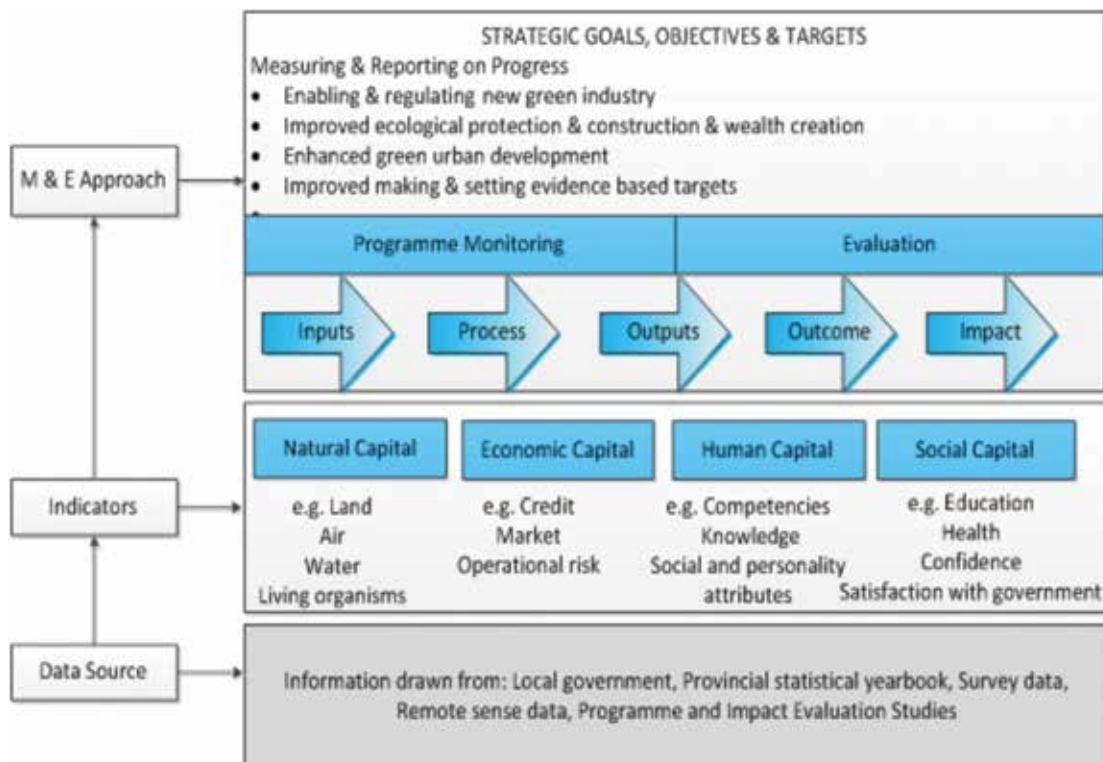


Figure 4-7 Monitoring and Evaluation Framework

4.6 POLICY RECOMMENDATIONS

Consistent with the Task Force key findings and the proposed Green Development Roadmap, the following pages present those items which in the opinion of the Task Force are the most important and necessary items for short-term action that would generate significant momentum for change to a green development outcome in Western China. They require decision and action by the central government.

(1) The Government of China should prepare and implement as soon as possible a Green Development Strategy for Western China.

The Task Force has identified that there is significant need and potential in Western China for green development. However, despite various government announcements and the many initiatives underway in Western China, there is no comprehensive strategy in place that will deliver green development there. A business-as-usual approach will fail. Indeed such an approach endangers the achievement of some of the 12th Five-Year Plan objectives and will limit what might be accomplished in later five-year plans, since various objectives still operate at cross-purposes or are not optimized. Consequently the potential to achieve a different development model and outcomes reflecting the particular assets of Western China will be reduced. The Green Development Strategy should consider the following matters:

- Use the Roadmap for Green Development proposed in this report as a guide.
- The need for a single comprehensive and long-term green development plan (to 2030) covering appropriate infrastructure, human resources investments, urbanization, industrialization, environmental pollution control and, ecological construction and services provision.
- Each province should have a green development implementation plan based on a broader agreed Western China Green Development Strategy, with appropriate differentiation based on its assets and development needs. Sub-provincial level plans can then be developed within each western province.
- Ongoing investment and revenue sources to sustain this approach should be identified and set in place.

(2) Programs to deliver eco-construction and other means of protection of Western China's ecological services, ecosystems and biodiversity should be better integrated and coordinated with those for poverty reduction in provinces and at local levels as a long-term seamless set of programs with a more unified basis of delivery.

It is clear that in Western China (as in other parts of the world) the problems of poverty and ecological protection are completely intertwined and that a solution to the one involves also finding a solution to the other. There are significant new potential education, training and employment opportunities associated with eco-construction and eco-protection. However, current programs are short-term relative to needs and not particularly well coordinated. Local people need to be far more involved in and responsible for these projects and for the continuing management of the projects when they are completed. A more unified program should include the following:

- Develop extensive, innovative pilot initiatives as the basis for long-term major ecological restoration and conservation.
- Central government to lay out and direct the program, and provide funding, guidelines and monitoring.
- Funds should go direct to communities to undertake this work where possible.
- Individuals should have long-term funding assurance for sustainable land management practices.

- Grasslands protection should be given high priority for this approach.
- Funding priority should go to evidenced-based programs.

(3) Invest substantially more in programs specifically designed to increase and improve human capital in Western China to reduce poverty, and to enable the pace and quality of green development to accelerate, especially through green infrastructure construction and servicing.

All studies of successful poverty alleviation indicate that an effective approach is through investment in infrastructure (transportation, communications and education), which China is now undertaking. However, green development requires a well-targeted focus on infrastructure critical for ecological and environmental services provision and protection (for example, water and waste, environmental monitoring stations, tourism services, grassland protection schemes). This needs to be done for both large and smaller communities as quickly as possible. A coordinated focus on human capital is an essential underpinning of this approach, including the following:

- Improve education and training opportunities, focused especially in poor and ecologically fragile communities by coordinating investment in hard and soft infrastructure for schools (and related institutions), health services, communications and teacher training.
- Build human capacity for green development by targeting opportunities to take advantage of the natural and indigenous potential for such businesses.
- Provide micro-credit and enable cooperatives to develop the capacity of women to improve their own, their families' and their communities' wellbeing.
- Fund local eco-protection, management and environmental engineering programs and training through long-term sustainable initiatives in rural areas.

(4) Reform financial programs and mechanisms at all levels of government to more effectively target and drive green development via sustained funding.

Significant central government financial resources have been and are continuing to be focused on environmental management and community development in the western region. However, the current approach of episodic and uncoordinated funding from a multiplicity of sources is resulting in sub-optimal results. Moreover, the complexity of the system presents difficulty for the poorest communities with the lowest capacities to take full advantage of the available funds. These are, however, the very communities that most need certain types of funding. Three key initiatives should be to establish a *Green Development Fund*, use the *Royalties to Regions* tax policy to support local green initiatives, and to accelerate environmental fiscal reform. In addition, there are other high priority needs for action on improved financial mechanisms that could be undertaken by central and local governments.

Green Development Fund

Given the strong historical reliance on government investment for growth, it is apparent that future growth in Western China will be strongly influenced by the availability of sustainable revenue sources. Commitment to a Green Development Fund will provide greater certainty and appropriate incentives for green development outcomes. The Green Development Fund should encourage “green development” and innovation at the provincial and local levels and ideally provide opportunities for some direct benefits to flow to communities. It may be targeted at both the macro and the micro levels: supporting appropriate “green industry” at the provincial or local level; and providing direct incentives at the local level to start up new ventures capitalizing on the region’s unique features;

or undertaking activities to improve the management of ecosystem health. Funding can be directly provided by central government, ideally supplemented by industry-based levies sending price signals concerning more effective utilization and recycling of resources; (waste levies or pollution levies, or increased resource rents are examples).

Royalties to regions

Tax policy can be used more explicitly to provide funds for specific small projects in the western regions. Regions currently receive insufficient direct benefits from resource extraction industries, while bearing the associated direct costs of remediation. The government has publicly announced it intends to use a resource rent tax and other financial measures to progress broader economic, environmental and social measures. These measures need to be implemented as a matter of urgency. Funding should be tied and focused on priorities agreed between the national and provincial governments on a partnership or matching basis, ideally in accordance with a provincial green development strategy that includes job creation and skills development.

Accelerate the application of environmental fiscal reforms, such as eco-compensation

Eco-compensation needs to move from being a concept to a policy tool that drives green development. The central government needs to prescribe the operating terms for an equitable eco-compensation system at level of the individual, the community and the province. The system should acknowledge the value of ecosystem services provided by Western China but also reimburse the individual rural residents on a long term basis for undertaking desired resource stewardship responsibilities. Clear definitions need to be determined regarding the level of general transfer payments to provinces rather than an ongoing reliance on more short-lived grant programs. Government at central and local levels should undertake the following actions:

- Gradually move away from time-limited, project-based funding toward a more programmed and predictable long-term funding model for eco-compensation, and focus compensation based on better performance concerning the specific ecological services provided. Funds should go directly to farmers and villagers to support sustained results with a generational time span.
- Establish a Green Development Fund as a revenue stream to drive new green industry, to enable restoration and to incentivize change through funding, particularly at the community level.
- Require strategic environmental impact assessments (EIA) for all major projects to ensure green development concerns are addressed. Fund the development of an appropriate risk assessment model for use by provinces.
- Encourage integration or improved coordination of financial programs to avoid duplication and competition for resources, and set differentiated targets for program performance in various regions.
- Target additional support to specific green industries and businesses that have natural advantages in Western China or potential to become such: for example, services to or innovations in environmental technologies related to resource industries and environmental management, agriculture and food processing; eco-tourism business and services; production of traditional medicines, cultural industries, woolen carpet production, tourism and recreational businesses, such as the “agri-tainment” complex (farm-based tourism) near Chengdu.
- Apply the recently announced resource tax to specifically promote green development initiatives in the new “royalties-to-regions” program as proposed by the Task Force. That would ensure the flow of benefits from the resource tax back to the communities as a dedicated fund targeted at specific programs.
- Encourage foreign investment in energy, environmental protection, infrastructure and mineral resources, including research and development.

- Extend the user-pay principle to all mining and resource development. Require this industry to actively contribute to community development needs above and beyond job creation. This would include health-care programs, education and trade schools and programs, eco-restoration works and tourism opportunities to provide tangible returns to the local level
- Provide financial support to encourage transition from existing non-sustainable industrial and pollutant-generating practices, with a special focus on SMEs.
- Establish a Green Infrastructure Fund and ensure that regular (current and future) infrastructure expenditure is consistent with green principles. The aim should be to ensure that existing infrastructure spending reflects green development priorities and is also carried out in accordance with green development principles. This will allow the government to utilize a significant amount of its existing budget as supporting green development rather than requiring new funding. This is also intended to lead to better planning and coordination of infrastructure and can be used to leverage provincial spending.

(5) Make Main Functional Zoning work effectively to support decisions and actions which lead to regional balance and green development.

Main Functional Zoning is a relatively recent but critical concept and initiative to guide ecosystem protection, industrial development and urbanization in China. In Western China, where developments interact intimately with key ecosystem functions, zoning is essential to guide officials to make decisions based on ecosystem knowledge and green principles which underlie the Main Functional Zones. However, the current system is still under-developed and not always taken into account in decision-making. The Main Functional Zoning is at such a macro scale that it lacks clear boundaries at the appropriate level of detail. It requires urgent attention to improve implementation in planning, development supervision and enforcement to improve its performance. Otherwise the Main Functional Zoning may fall into disuse and prove to be a hindrance rather than a benefit to ensuring regional balance and green development. Central government should improve the Main Functional Zoning system and its approach:

- Provide more detailed and specific directions concerning “restricted zones” and “key development zones” and establish zoning at a more detailed geographic scale in order to provide better information to local officials for detailed planning.
- Identify eco-functional conservation areas, values and ecological services that must be protected, including more focus on biodiversity and critical habitat identification and protection. Such areas are within the restricted and key development zones, but outside designated nature reserves or “no-development” areas. They are critical corridors or sensitive areas requiring special management.
- Integrate planning for national nature reserves and for urban and industrial planning along with the Main Functional Zoning system.
- Clearly identify the purpose and acceptable activities in “restricted development” zones and establish clear and measurable thresholds for development that reflect the characteristics of the zones.
- Strengthen the regulatory regime for the mining industry, including eco-compensation, and increase supervision of existing mining enterprises.
- Adopt a monitoring system (and use high technology satellites) to be applied to all “restricted areas” to ensure compliance with regulations.
- Strengthen enforcement capacity by enlisting local community support. Build the capacity of enforcement staff. Local government accountable for non-compliance.

- Improve the coordination of EIA with the Main Functional Zoning and include risk assessment, cumulative impacts and social impact assessment into EIA decisions, especially within restricted development zones.
- Improve natural resource data concerning ecological values and potential, to support decisions in the Main Functional Zones.
- Commit to state-of-natural resources auditing to be used to monitor progress and achievements in the application of decisions in Main Functional Zones.
- Improve granularity (geographic scale/detail) of the data and planning approach to address regional and local green development (including land, water use, biodiversity and resources issues).
- Give priority to progressing a sustainable water planning and allocation framework and appropriate natural resource pricing to support green development.

(6) Develop and adopt a sustainable urbanization model, including an eco-city approach tailored specifically to the needs and interests of provinces in Western China.

Urbanization is an important conduit to ensure the green development of the western region. New urban areas can act as a focus for investment, innovation and the development of new opportunities. They can also be a magnet to attract people from poor and fragile rural areas and provide them with improved opportunities. However, done poorly, urbanization can concentrate and increase pollution, diminish the quality of life for residents and add to the regional burden of environmental problems. Government should do the following:

- Adopt a differentiated and tailored urbanization policy, which is coordinated with implementation of the Main Function Zoning Plan.
- Enhance urban infrastructure investment as a preventative measure against negative environmental impacts of urbanization.
- Develop a long-term, green, eco-city development strategy in accordance with local assets. As rapidly as possible, move beyond the existing pilot level initiatives to make the eco-city approach widely accepted. Draw upon the experience of existing eco-cities in China and other parts of the world.
- Invest in soft infrastructure to enhance the livability and attractiveness of western region cities. Invest in building a number of medium-sized, attractive and highly livable cities that provide a state-of-the-art physical and cultural living environment, with higher education institutes and R&D centers that can eventually become regional innovation and incubation hubs.
- Take an integrated urban-rural development approach enhancing urban-rural mutual support and co-development as is found around Chengdu. Urban environment and development related planning, management and policy should maximize positive spillover effects of urbanization, and minimize negative resource, environmental or social impact in peri-urban areas.
- Ensure building and workplace safety issues are given a high priority.

(7) Encourage new green industries that reflect the character of Western China in the key and limited development zones, especially in areas of high poverty and areas of the greatest potential.

There is significant unrealized potential for green development focused on the particular characteristics of Western China. Much of the current industrial development in the region is focused on a narrow band of industry offering relatively low levels of employment and which do not sufficiently provide opportunities based on the special character of the region. It is important to encourage new industry and green development based on the indigenous characteristics and values of the region. There is also considerable pressure and negative potential for “brown” industry to re-locate in Western China from the east and to spread poor practices into a region of greater ecological fragility. Government should do the following:

- Assist and encourage through specific funding and incentive programs the development of “green development industrial parks” where there is demonstrated potential.
- Identify a list of green potential development situations throughout Western China. For example, in Xining consider the potential to enhance existing initiatives using products from the grasslands to expand and enhance employment of rural residents while protecting the grasslands.
- Set a “green entry standard” for all industrial development, particularly in the restricted development zones, to ensure that polluting industry does not re-locate into the western region from elsewhere in China.
- Expand existing foreign investment channels while ensuring that any foreign direct investment (FDI) complies with China’s standards for environmental and social quality and, where appropriate, go beyond these standards.

(8) Strengthen institutional innovation to drive long-term green development.

External assessments and statements by China’s senior leaders all recognize that innovations in the organization and management of institutions will be an essential part of achieving green development. This is particularly relevant in Western China, where the capacity of governments at the provincial and local levels is often limited and resources are stretched over vast areas. Innovations in improved approaches to vertical and horizontal coordination and cooperation appear to be essential aspects of a transformative change towards green development. Government should do the following:

- Adopt the principles proposed in the road map and commission an implementation process to complete the Green Development Strategy for Western China with appropriate targets and milestones.
- Strengthen/reinvigorate the Western Development Office and require all ministries to coordinate through this office initiatives for infrastructure and human capital development intended to enhance green development.
- Focus performance management for green development on senior local officials and shift to a broader outcome focus in assessing public officials.
- Establish a neutral monitoring and reporting function in a central agency of government and commit to public scrutiny and reporting.
- Establish in each province a coordinating function/committee of senior officials mandated to strengthen coordination of initiatives for green development (for example, all green infrastructure, human development, compliance and enforcement).

- Enhance and promote the roll out of the Ministry of Environmental Protection program to establish strengthened regional centers, and better coordinate it with similar initiatives by other ministries.
- Undertake in each province a set of pilots to transfer management responsibility and accountability for eco-construction programs to specific communities with appropriate resourcing.
- Coordinate and integrate fiscal programs to deliver the Green Infrastructure Program as identified in other recommendations.

If China is to continue its successful development path while simultaneously correcting past damage to environmental services and enhancing those same services, it will have mastered the most challenging set of circumstances encountered by any nation in history. In Western China that task is more daunting because this region is so environmentally fragile, many of the people are so poor and are representatives of minority groups for whom their traditional heritage is so important. Only by setting out and implementing a new integrated long-term strategy with a clear roadmap will this task be possible. Western China is the right region to begin the journey.

CHAPTER 5

ENVIRONMENTAL STRATEGY AND MEASURE FOR TRANSFORMATION OF DEVELOPMENT MODE IN EASTERN CHINA

GLOSSARY

EIA	Environmental Impact Assessment
FYP	Five-Year Plan
GDP	Gross Domestic Product
GIOV	Gross Industrial Output Value
MEP	Ministry of Environmental Protection
OECD	Organisation for Economic Co-operation and Development
PRD	Pearl River Delta
RSP	Respiratory Suspended Particulate
SAR	Special Administrative Region
SERC	State Electricity Regulatory Commission
SEZ	Special Economic Zone
SOE	State Owned Enterprise
SPV	Solar Photovoltaic
TVE	Township and Village Enterprise
UNEP	United Nations Environment Programme

ABSTRACT

This study has three main objectives: first, to develop a conceptual framework identifying key elements of green development. Second, to review economic development in the three focus areas of Eastern China, i.e. Beijing, Shanghai and the Pearl River Delta (PRD), and the environmental challenges it has given rise to. Third, to analyze the qualitative and quantitative data and formulate policy recommendations to facilitate economic restructuring and green development in Eastern China.

Analysis and findings show that all three focus areas have experienced rapid development of the tertiary sector after 2000. Another important observation is the decoupling trend between Gross Domestic Product (GDP) growth and pollution emissions (i.e. the economy grew faster than the rate of emissions). Findings from the PRD also indicate the diffusion trend of environmental pollution, possibly due to the relocation of industries to inland prefectures to benefit from lower land and labour costs. Data also show a strong cross correlation between environmental parameters at the regional level (e.g. Hong Kong and Guangdong). The pattern of energy use and pollutant emissions in these areas show a marked shift from industrial to domestic demand and is anticipated to be the future trend along with lifestyle change.

Mega events in the three focus areas (i.e. Beijing Olympics, Shanghai Expo and Guangzhou Asian Games) have seen expedited investment in clean infrastructure (e.g. rail), wastewater treatment plants, solid waste treatment, changing the fuel structure to increase use of natural gas, commercialization of green technologies and products, and most importantly, providing the impetus for the public to take ownership in the “green” life-style movement, and effectively forging regional co-operation.

Proceeding from four basic propositions concerning pathways for green development in China, the study highlights both successes and shortcomings in existing policy approaches to balancing economic development and environmental quality based on qualitative and quantitative analysis. The report suggests it is essential that policy mechanisms and institutional strengthening are reinforced at all levels to ensure that the pursuit of green development is confirmed as a core and continuing task of government.

Building on nine guiding principles to facilitate green development in China, this report sets out six general recommendations applicable to the whole country and additional six intended to further strengthen green development in the developed part of Eastern China specifically.

The former include greater emphasis on policy integration and coordination among sectors, strengthening monitoring capacity and measures and developing the potential for regionally-based policy initiatives, more effective and stringent control on development impacts, strict implementation of accountability of job performance in relation to green development at local government level, fostering public awareness building and environmental education at all levels, and accelerating green development process by means of demonstration projects.

Recommendations for Eastern China include the adoption of more stringent environmental standards and targets, disclosing information more widely to facilitate public monitoring, promoting green consumption through targeted taxation measures, providing funding for local environmental protection and pollution prevention projects, establishing a regional financial transfer payment mechanism to promote environmental protection in less developed areas to encourage co-development initiatives between neighbouring regions, and promoting corporate environmental governance.

Keywords: *Eastern China, green development, structural economic change, regional co-operation, policy recommendations*

5.1 INTRODUCTION

Background

Since the beginning of the Open Door Policy in 1978, China has begun to develop rapidly and became one of the world's fastest growing economies. In 2010, China overtook Japan to become the world's second-largest economy. The introduction of the Open Door Policy also triggered enormous changes in the country's economy, society and environment on a scale and at a speed that has not been witnessed in any other country.

From 1978 to 2010 per capita GDP of China increased 79-fold from 381 yuan to 29,992 yuan while over the same period exports grew 129-fold. Other economic indicators show similar dramatic changes. Economic growth has however come at a considerable environmental cost although there are now some indications that the rate and scale of environmental degradation may be slackening off as economic development becomes de-linked from damage to the environment. For example, between 1995 - 2010, SO₂ emissions increased by 15.5% and wastewater discharges increased by 65% but per capita GDP increased almost six-fold over the same period. Nonetheless, the Chinese environment remains under acute stress due to continuing high rates of economic growth and urban development, and associated environmental pollution, and habitat and biodiversity loss.

In recent years, the Chinese government has progressively addressed these concerns by pursuing a more appropriate balance between economic development and its environmental consequences. This has been achieved through the explicit and consistent statement of environmental objectives and targets in the 11th and 12th Five Year Plans (FYPs). In particular, the 11th FYP has laid down stringent targets on energy saving and emissions reductions, e.g. to reduce the energy intensity per unit of GDP by 20% and reduce the emission of major pollutants by 10% etc. Traditional sources of environmental pollution, including SO₂, NO_x and COD are to be significantly reduced during the period of the 12th FYP. Forest cover is also set to be protected and increased during the period of the current Plan.

This study was premised on some important observations: the more proactive and preventive approach attached by the Chinese government in tackling unacceptable levels of environmental damage and wasteful resource use (in particular water resources) resulting from thirty years of rapid economic growth, especially in the most developed, eastern coastal provinces and regions; the growing concern that removing these problems from one part of the country (e.g. Eastern China) might result in the geographical displacement of the same problems to other regions or localities (e.g. Central and Western China) unless more effective environmental and resource use safeguards are put in place; and the recognition of the need for cost-effective policies, regulations and other administrative measures to speed up and intensify the implementation of green development in Eastern China as well as in the rest of China.

Study Objectives

The goal of the study is to identify critical elements of green development for Eastern China. Expected outputs include sets of operational principles and guidelines for the promotion of green transformation, and effective modes and instruments of environmental governance, policy and regulation.

Three key objectives and research issues are identified:

(1) Development of a conceptual framework that identifies the crucial factors associated with green development

The processes of industrialization and urbanization are commonly seen to be in conflict with ecological well-being. Environmental pollution and degradation are often regarded as the price that a province has to pay for economic development and the urban transition. Most forms of urbanization begin with rapid industrialization involving

intensive resource inputs (i.e. water and minerals) and substantial environmental impacts (i.e. air and water pollution, solid waste, impact on biodiversity) at the downstream end of the production cycle.

However, some scholars and policy-makers have argued that environmental degradation does not necessarily have to go hand-in-hand with economic development. Concepts such as sustainable development, ecological modernization, green growth and green economy suggest that, subject to a range of factors and conditions, economy and ecology can be effectively integrated in a way that preserves the environment while maintaining economic growth. Building on the assumption that more effective management of resource use and pollution control can be balanced with economic development, these concepts promote economic efficiency and technological innovation within a framework of sound environmental governance.

(2) Review of the economic development trajectory in Eastern China (Beijing, Shanghai and the Pearl River Delta) and associated environmental challenges

The coastal cities in the Eastern China have experienced over three decades of rapid economic development based upon industrialization. In the last decade, some of these cities have undergone the economic restructuring process, which has led to permanent shut down of some polluting industries, reductions in industrial production, upgrading of industries to comply with stricter environmental standards or relocation of industries to the less developed Central and Western China. While the socio-economic contexts and detailed characteristics of the urbanization process differ from one city to another, in-depth study into the development trajectory of these coastal provinces can provide important insights into the pull and push factors that facilitate a greener economic restructuring process. Three study areas are identified for in-depth review and analysis: Beijing, Shanghai and the PRD (including Hong Kong Special Administrative Region (SAR)).

The review of the three areas examines five aspects of data and information, and statistical analysis is conducted to explore possible relationships between these aspects: (i) the key features of economic development and/or restructuring; (ii) application and effectiveness of environmental regulations and policies; (iii) other factors associated with the economic restructuring process (i.e. the role of the market, public awareness, etc.); (iv) natural resources, energy production and consumption, and energy use efficiency; and (v) changing environmental conditions.

(3) Identifying lessons learned from the qualitative and quantitative analysis, and setting out policy recommendations for green development in China

Based on the above objectives, the study provides a detailed assessment of whether the current economic restructuring in Eastern China provides a positive context for environmental improvement. The extent to which environmental policies and regulations, natural resource constraints, public awareness, market forces, etc., serve as barriers and/or catalysts for the green development process is highlighted. Proceeding from four basic propositions concerning pathways for green development in China, the study highlights the successes and shortcomings in existing policy approaches to facilitating both economic development and environmental quality based on qualitative and quantitative analysis. The study sets out six general recommendations applicable to the whole country and an additional six intended to further strengthen green development in the developed part of Eastern China.

Methodology

(1) *Desktop research*: the study builds upon existing CCICED initiatives such as the recently completed reports on “Development Mechanism and Policy Innovation of China Green Economy” and “Green Transformation of China Economic Development Mode” and various other initiatives focusing on energy, environment and sustainable cities. Literature reviews have been carried out on recent reports on green development and green growth published by OECD and UNEP, and others.

- (2) *Quantitative data analysis*: in order to provide an evidence-based investigation, quantitative data for Beijing, Shanghai and PRD (including the Hong Kong SAR) on economic structure and transformation parameters (GDP, Industrial Output Value, energy production and consumption etc.) and environmental conditions (emission inventories, wastewater discharge, water quality, biodiversity etc.) over recent years have been collected from relevant government published sources. We note, however, that analysis is constrained by incoherent data sets (different time span, measurement units, etc.)
- (3) *Qualitative and Case study analysis*: qualitative analysis of three mega events (the Beijing Olympics, Shanghai World Expo and Guangzhou Asian Games) has been carried out to understand their impacts in terms of providing a stimulus for short to long term environmental improvement. Local case studies are also used to illustrate the effects of economic transformation on environmental conditions. These include a review of the Suzhou Creek Revitalization in Shanghai and the introduction of Ultra Low Sulphur Diesel fuel in Hong Kong. The two international case examples studying the de-industrialization process of Malmö in Sweden and the role and functions of air pollution control policies and regulations in Los Angeles also provide insights to help analyze the situation in Eastern China.
- (4) *Brainstorming sessions*: based on the statistical analysis and case study observations, intensive discussion sessions have been conducted to formulate the study recommendations. The study team has drawn upon the views and feedback from academics and senior government officials from the three study areas, CCICED's chief advisors, and higher-level policy makers to help finalize the analysis and recommendations.

5.2 EASTERN CHINA: Development Trajectory and changes in Environmental Quality

Economic Change, Restructuring and Environmental Quality in Eastern China

Different parts of Eastern China had different development patterns and trajectories as each area has its unique features such as historical context and strategic function. In order to complete the perspective of Eastern China, this study considers three focus areas that demonstrate more advanced development, i.e. Beijing, Shanghai and the PRD, so as to illustrate the relationships between economic performance and environmental quality.

Serving as the country's bridgehead, Eastern China was the first region to initiate the modernization process. The most rapid growth can be observed in the past three decades when industrialization and urbanization took place. GDP increased both sharply and continuously. There was a population influx from rural to urban areas over the past three decades. Relocation activities also occurred as production plants moved away from core city areas to peripheral areas or suburbs owing to various factors like saturation in traditional industrial markets, spiraling production costs and planning policies. The industrial structure also entered a transformation phase in which areas with a comparatively advanced economy saw secondary industry overtaken by the higher value-added industry / tertiary industry. The contribution from tertiary industry then incrementally grew to over 50% of GDP, resulting in the establishment of a "3-2-1" economic structure. For example, in Beijing and Shanghai the tertiary sector has accounted for over 50% of GDP since 1994 and 1999 respectively. The tertiary sector has become serviced-based and the major economic driver, and signifies the post-industrial characteristics of the more developed cities in Eastern China.

While Eastern China has undergone industrial relocation and restructuring, these activities have resulted in different levels of adverse impact on the environment. However, the study indicates that the industrial restructuring shows some success in localized environmental improvements in terms of reduction in the rate of environmental

deterioration. For instance, manufacturing plants that use diesel-powered generators have been closed and cleaner power plants (for electricity generation) have been progressively introduced into the market; the development of centralized heating systems for urban households and encouraging urban residents to use more natural gas instead of coal, etc., have reduced pollution emissions.

These development trends are not extraordinary and have been observed in western countries as they have industrialized and urbanized. However, the development in China is at an astonishing speed and on such a huge scale that both positive and negative impacts have emerged very rapidly. It is therefore essential to establish the major characteristics of the economic transformation in Eastern China to prevent the recurrence of problems there in the near future, as well as to assist the formulation of development policy in less developed areas such as Central and Western China. As business-as-usual is no longer a viable option, pursuing the transition to a greener development path is deemed an appropriate response for the purpose of creating a low-carbon, resource-efficient and environmental-friendly society – a sustainable growth paradigm that should also be advocated in Central and Western China regions, so as to avoid repeating the mistake of “polluting first and cleaning up later”.

Beijing

Being the national capital, Beijing has multiple roles. It serves as the country’s political, cultural, education and international exchange centre. It is also the national economic and financial policy-making and management centre. Over the years, Beijing has actively initiated development of urban infrastructure and this can be divided into four phases. The first phase occurred (between 1949 and 1980s) and focused on the development of a heavy industry-led economy. During the second phase (1980s – mid-1990s) its role as an economic centre weakened gradually and the economy shifted from industry- to the service-sector. During the third phase (mid-1990s – early 2000s), Beijing enhanced its functions through globalization and the advocacy of a “capital economy” development strategy. In the fourth phase (since the early 2000s), the 10th FYP defined the four aspects of capital economies, namely technology-based economy; service-based economy; culture-based economy; and open economy. At present, the “capital economy” development concept continues to develop and intensify, and this is driving the city towards a knowledge-, headquarter- and green-based economy.

The population of Beijing has grown dramatically over the past 35 years. The reform and opening up policy resulted in a large population influx and an over-flow of the registered and floating populations in the urban area. The rapidly expanding population exceeded the city’s carrying capacity, causing impacts on natural resources and ecosystems that triggered off a chain of social, economic and ecological problems. In 2011, the city recorded a total population of 20.186 million (including both registered and floating residents). Compared with 1978, the registered population and floating population have increased by 2.2 times and 32 times respectively.

Regarding the economic performance, Beijing experienced a rapid growth in GDP starting in the 1990s. The annual economic growth rate reached double digits after the application to host the Beijing Olympics was submitted in 2001. By 2011, Beijing’s GDP exceeded 1,600 billion yuan. The GDP was 4.5 times the 2000 level and the GDP per capita was over 80,000 yuan.

As highlighted in the previous paragraph, the opening up policy and official recognition of “capital economy” in 1998 has encouraged the growth of tertiary industry in Beijing. At the same time, it has gradually encouraged Beijing to transform from a key industrial base to a tertiary-based service economy. The city’s industrial structure first shifted from “2-3-1” to “3-2-1” in 1994. Divergent development between secondary and tertiary industries are noted thereafter. The ratio of primary, secondary and tertiary industry changed from 5.9 : 45.2 : 48.9 in 1994 to 0.9 : 24.0 : 75.1 in 2010. This implies that the transformation from manufacturing- based to service-based has been completed, and the city has entered the post-industrialization era.

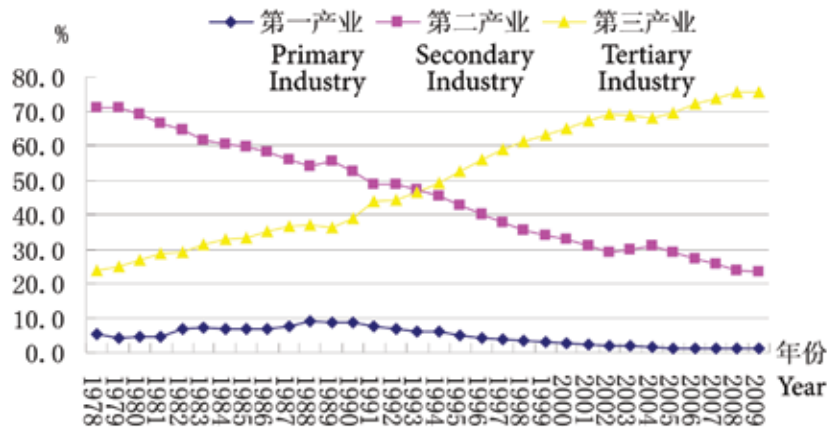


Figure 5-1 Changes in composition of primary, secondary and tertiary sectors in Beijing (1978-2009)

Source: Beijing Statistical Yearbook (1979-2010), Beijing Municipal Bureau of Statistics

Notwithstanding this transformation, the industrial sector in Beijing also experienced modernization. Within the primary industry, the operation changed from the traditional planting and breeding industries to modern urban agriculture, such as seed agriculture and agri-tourism. For secondary industry, hi-tech industries were the driver with automobiles, electronics and construction materials as pillars, and machinery, iron and steel and chemicals providing the base. In the tertiary sector, there was steady growth in the traditional service industries such as transportation and logistics, wholesale and retailing, while modern service industries such as financial, information, and technology services also developed rapidly. The pattern of urban construction evolved from single-centre to multi-cores. The industrial pattern has become more rational with the formation of industrial development zones, hi-tech zones, cultural zones, and special-characteristic zones. However, observations over the past decades suggest that Beijing has only a limited influence on the economic development in its surrounding areas. Economic and industrial synergy between Beijing city and the nearby provinces has been limited.

The environmental management of Beijing is mainly the responsibility of the Office of Treatment of Three Wastes, which was set up in 1972 with the objective of reducing emissions of soot and dust, controlling pollution by phenols, cyanogens, mercury, chromium and arsenic, and also to promote work of environmental protection. Since the Open Door Policy, the rate of environmental treatment has not been keeping up with the speed of development, and could only contain increases in pollution; and so the quality of the city's environment continued to degrade. In the 1990s, coal consumption reached almost 30 million tons causing serious pollution. Ownership of vehicles has risen rapidly and along with it vehicular emissions. However, from 2000 to 2009, days with air quality of Grade 2 or above has increased, indicating various environmental control and industrial restructuring policies have taken effect. This index, however, accounts for only some pollutants, leading to on-going public concern.

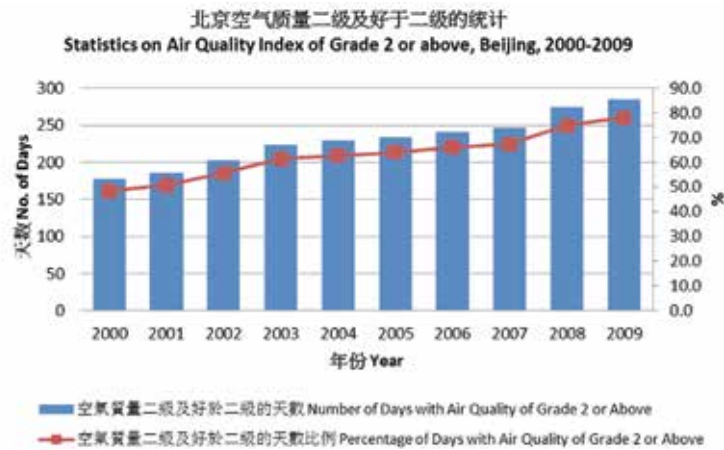


Figure 5-2 Statistics on Air Quality Index of Grade 2 of above in Beijing (2000-2009)

Source: *Beijing Statistical Yearbook (2001-2010)*, Beijing Municipal Bureau of Statistics

Shanghai

Shanghai has a long history of development. Being China's largest trade port and industrial base, the city is now serving as a key economic, technology, industrial, financial, trade, exhibition and shipping centre. Since the economic reforms, Shanghai has undergone tremendous changes in its city positioning and development strategy, evolving from an industrial base to a multi-functional city. Its development path can be divided into three phases. The first phase occurred between 1978 and early 1990s. Under the influence of the reform and opening up policy, Shanghai repositioned itself from its sole economic function as an industrial production base to become one of the main economic, technology and cultural hubs in China and as an important international port city. The second phase took place during the 1990s. At that time, the government officially affirmed the development strategy that Pudong was being identified as the "leading head" in order to further open up coastal cities along the Yangtze River, turning Shanghai into one of the international economic, finance and trading centres to drive the economy of the neighboring Yangtze River region. The third phase commenced in the late 1990s. The "Master Plan of Shanghai (1999-2020)" was published and explicitly positioned Shanghai as a modern international city and one of the international economic, financial, trading and shipping hubs (i.e. "one dragon head and four centres").

The population of Shanghai has sharply risen over the past three decades particularly due to the influx of a floating population. During the 1990s, Shanghai spearheaded the economic development of China with the development of Pudong. This attracted an influx of external labour to Shanghai seeking job opportunities, causing a rapid increase in the migrant population. By 2010, the resident population of Shanghai reached 23 million, with an increase of 108.6% since 1978 (annual increase of 2.3%). The registered population in 2010 was 14.05 million, with an increase of 27.9% compared to 1978 (annual increase of 0.8%). The floating population recorded in 2010 was 8.98 million.

The GDP of Shanghai has grown rapidly over the last three decades. In 2011, Shanghai's GDP was 1,900 billion yuan. During the drive to develop Pudong in the late 1990s, the economy of Shanghai grew very rapidly with its GDP recording double-digit increases for 16 consecutive years (1992-2007). Since 2008, economic growth has slowed down (growth rate of 9.7% and 8.2% in 2008 and 2009 respectively) due to the international financial crisis and domestic economic downturn. The World Expo in 2010 drove economic growth back to 10.3% temporarily but it dropped to 8.2% in 2011.

Shanghai has served as an "industrial base" for a long period of time even before the Reform and Open Door Policy. Entering the 1990s, greater efforts were made to develop the tertiary sector. By 1999, the tertiary sector overtook

secondary industry for the first time. At the end of 1998, in the view of international and domestic development trends, the Shanghai government decided to build hi-tech industrial zones by boosting industrial investment. Starting from the 11th FYP, the industrial structure of Shanghai underwent further adjustment guided by an energy-saving and carbon reduction strategy. The tertiary sector rapidly expanded while secondary industry started to slow down and became less important. The ratio of industrial structure was 57.3%, 42.1% and 0.7% for tertiary, secondary and primary industry respectively, implying the gradual formation of a well-developed “3-2-1” industrial structure.

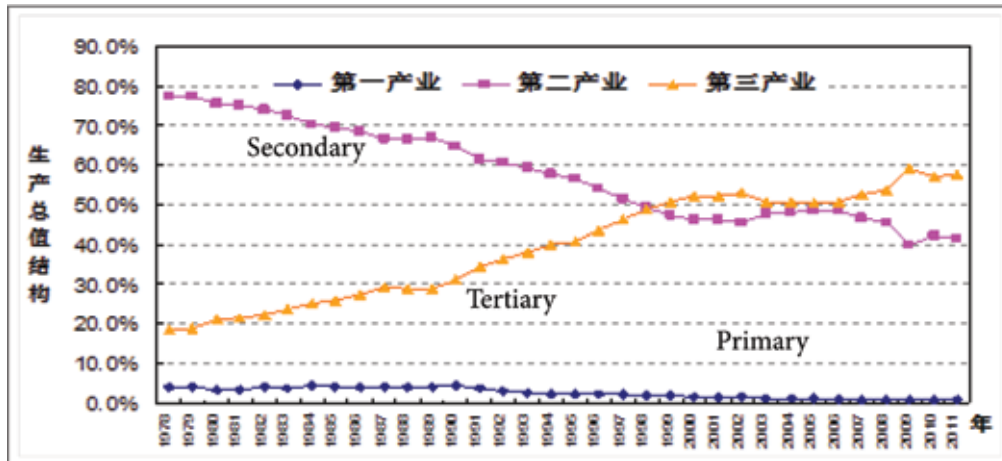


Figure 5-3 Changes in composition of primary, secondary and tertiary sectors in Shanghai (1978-2010)

Source: Shanghai Statistical Yearbook (1979-2011), Shanghai Municipal Statistics Bureau

Regarding environmental quality, the total waste gas emission of Shanghai city has been rising every year. The total waste gas emissions reached 1366.7 billion cu. m in 2010 which is three times the 1991 level. This increase is mainly due to the growth in industrial activities. Total emissions of SO₂ have fluctuated over the past 20 years. However, a significant drop in industrial emissions of SO₂ has been recorded recently. Dust emissions dropped rapidly between the 1990s and the early 2000s, and have remained steady since then. Concentrations of SO₂, NO₂ and PM₁₀ in Shanghai have been decreasing over the past decade. All three pollutant concentrations reached Grade II of the National Ambient Air Quality Standards. The rate of “good” ambient air quality in Shanghai reached 92.1% in 2010, in which Air Quality of Grade 1 also reached 139 days.

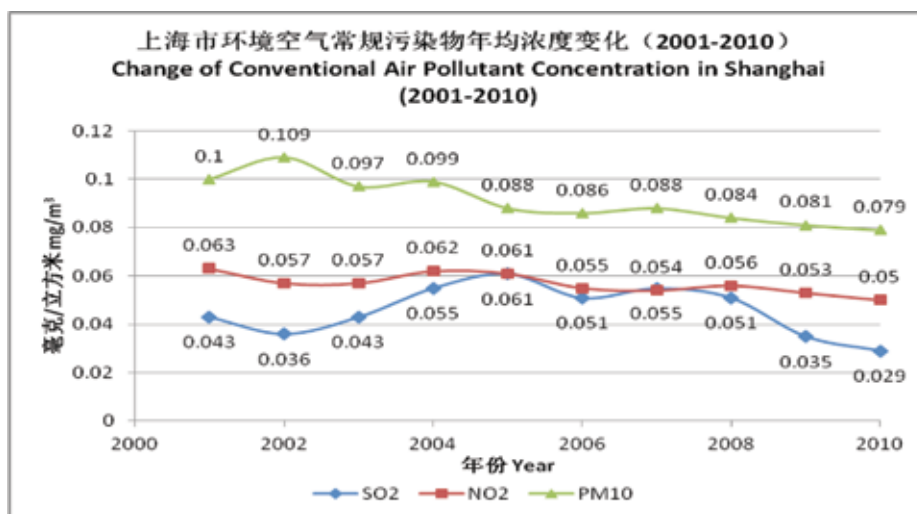


Figure 5-4 Changes in pollutant concentration level in Shanghai (2001-2010)

Source: Shanghai Statistical Yearbook (2001-2011), Shanghai Municipal Statistics Bureau

Wastewater pollution has continued to increase as a result of rapid industrialization, urbanization and increase of population. Over the past 30 years, wastewater discharges in Shanghai have increased every year. The volume was 1.835 billion tons in 1981 and 2.483 billion tons in 2010. While the industrial wastewater discharges have dropped, domestic discharges exceeded the amount of industrial wastewater discharged in 1996 for the first time. During the same period of time, COD of both industrial wastewater and domestic wastewater have decreased.

The Pearl River Delta Region¹⁰¹

The PRD region has a different development pattern from Beijing and Shanghai. Located within Guangdong province, the emergence of the PRD Region has a close relationship to the development of Guangdong Province, which can be classified into the following stages: These include Pre-reform era (1950s to 1980) when few financial resources were invested in industry. During the Staged Reform (1980 to early 1990s), three major sets of reforms were proposed: major shifts in the structure of agricultural production; pricing reforms; and opening up of contacts and investment to the outside world. Guangdong's PRD led-boom peaked between the early 1990s and 2000 when the low land costs, tax breaks, and low-cost, surplus labour of the Special Economic Zones (SEZs) attracted the relocation of industrial firms from Hong Kong. The rapid economic growth in Guangdong also attracted an inflow of unskilled or semi-skilled workers from outside Guangdong. Producers of intermediate inputs were subsequently attracted to these "specialized towns", forming the Township and Village Enterprises (TVEs). Owing to uncontrolled and sprawling growth of urban areas and industry, the province has faced serious environmental challenges. Restructuring commenced after 2000 in which two major trends in the development strategy were defined. These are (1) increased share of higher value activity in information and communications technology, and (2) an important shift from labour-intensive to high value-added industry.

In 2010, the province had a total population of 104.3 million and the highest urbanization level of all Chinese provinces, excluding provincial-level municipalities like Shanghai, Beijing and Tianjin. Guangdong Province is the largest economy in China and has been a principal driver of the national economy over the last 30 years. In 2011, the province had a GDP of 5,300 billion yuan, making it the largest economy in China, representing 12% of the country's GDP. Since the inception of the "reform and opening-up" policy in 1978, Guangdong has transformed itself from a backward agricultural economy to an industrial-based economy. The provincial economy is characterized by a larger percentage of industrial sector and lower percentage of primary sector than the national average. In 2009, Guangdong's GDP was based on the following structural composition: 50.1% from the secondary sector, 47.4% from the tertiary sector and 2.5% from the primary sector.

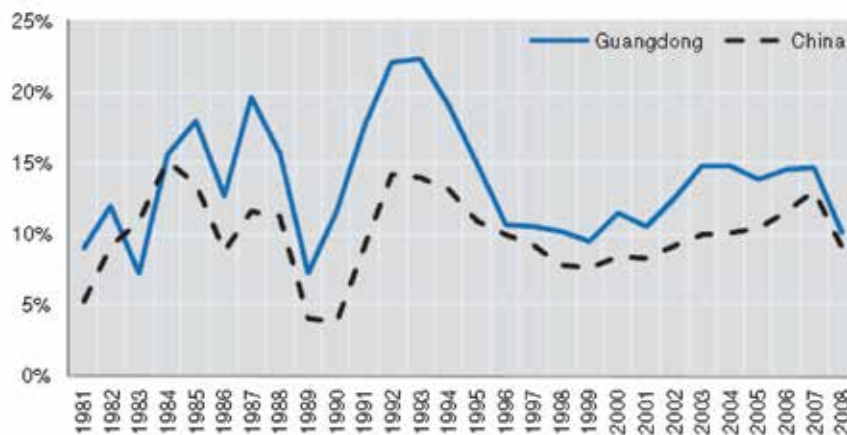


Figure 5-5 Annual GDP growth rate of Guangdong and China (1981-2008)

Source: Extracted from OECD (2010), *OECD Territorial Reviews: Guangdong, China*
 Note: The data are calculated at comparable prices.

¹⁰¹ The Pearl River Delta region includes Guangdong Province and Hong Kong and Macao regions. The analysis of this study mainly focused on Guangdong Province.

Guangdong's model of economic development differs greatly from those found in industrialized countries. Over the last 20 years of industrialization, Guangdong's manufacturing contributed to growth in total value added from industry. Guangdong's economic growth has been characterized by a high trade to GDP ratio. A key development feature of this model has been "processing trade", which allows companies to benefit from importing, assembling, and exporting via Hong Kong. This has allowed Guangdong to become the largest exporting province in China, accounting for 28.7% of China's total exports in 2010.

Regarding industrial restructuring, the shift in GDP composition was from primary industry to secondary and tertiary industries. Cities in the PRD demonstrate two extremes – de-industrialization and accelerated industrialization. Guangzhou is a typical example of de-industrialization. Shenzhen has also started the process while other cities are still in the process of industrialization. In recent years, heavy industry (e.g. car manufacturing) has shown signs of returning to Guangdong. This accounted for the fluctuating composition of secondary and tertiary industry specifically over the past 20 years.

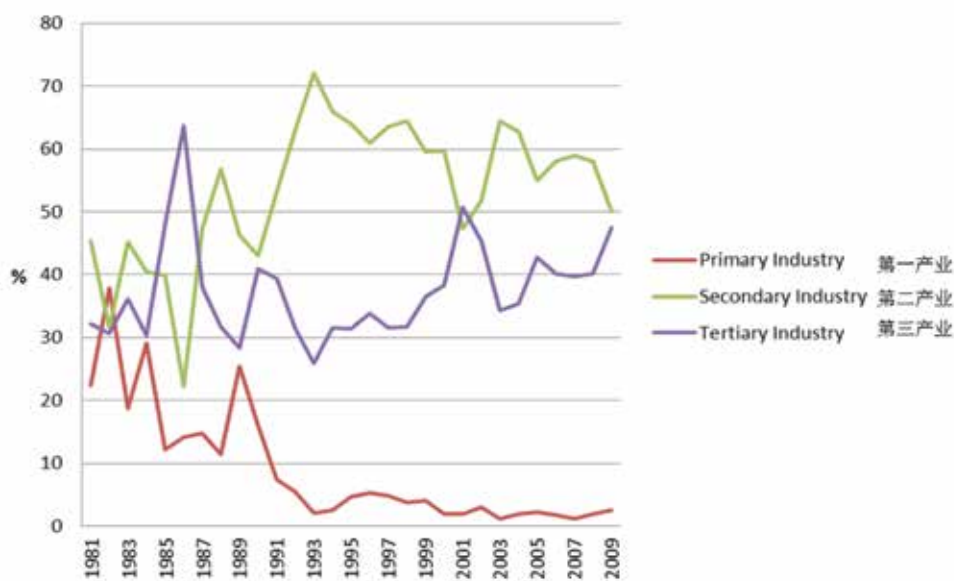


Figure 5-6 Share of the Contributions of the Three Strata of Industry (%) in Guangdong (1981-2009)

Source: Guangdong Statistical Yearbook (1982-2010), Statistics Bureau of Guangdong Province

Environmental data for the PRD region shows that emissions of industrial dust and SO₂ decreased gradually from peak levels in 1996 and 2005 respectively, while the total volume of industrial waste gas emissions has continued to rise within the same period (1996 – 2010). Similar trends are also found from the data released by the PRD Regional Air Quality Monitoring Network, which came into operation in 2005. The annual average concentrations of NO₂, SO₂ and Respiratory Suspended Particulates (RSP) between 2006 and 2011 reveal that the air pollution problem over the PRD region is gradually improving. This view is confirmed by comparing the PRD Regional Air Quality Index maps between June 2006 and June 2012, which show the most polluted area, Dongguan, already has improved. However, the air quality grading in neighboring areas (e.g. the north of Guangzhou city and Zhaoqing city) is decreasing. The situation may actually be worse since secondary contaminants such as PM_{2.5} and ground level ozone are not fully covered in these measures.

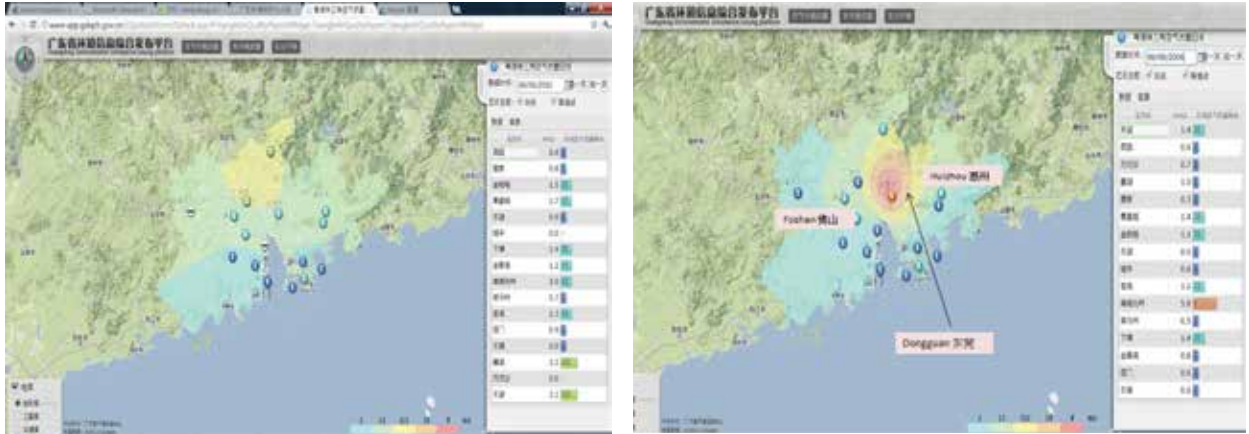


Figure 5-7 Air quality grading in PRD region on June 2006 (Left) and June 2012 (Right)

Source: Guangdong Environmental Information Issuing Platform, Guangdong Environmental Protection Bureau

To further investigate air quality from a regional approach, cross correlation was used to examine the relationship between air quality in Hong Kong and Guangdong using time series analysis. Significant relationships in the time series were found in concentrations of SO₂ and RSP in Guangdong and Hong Kong. Initial results showed that “RSP in Hong Kong” follows “RSP in Guangdong”. RSP in Guangdong is a leading and/or current indicator predicting RSP in HK currently (lag=0) and one year later (lag=1). “SO₂ in Guangdong” also serves as an indicator predicting “SO₂ in HK” currently (lag=0).

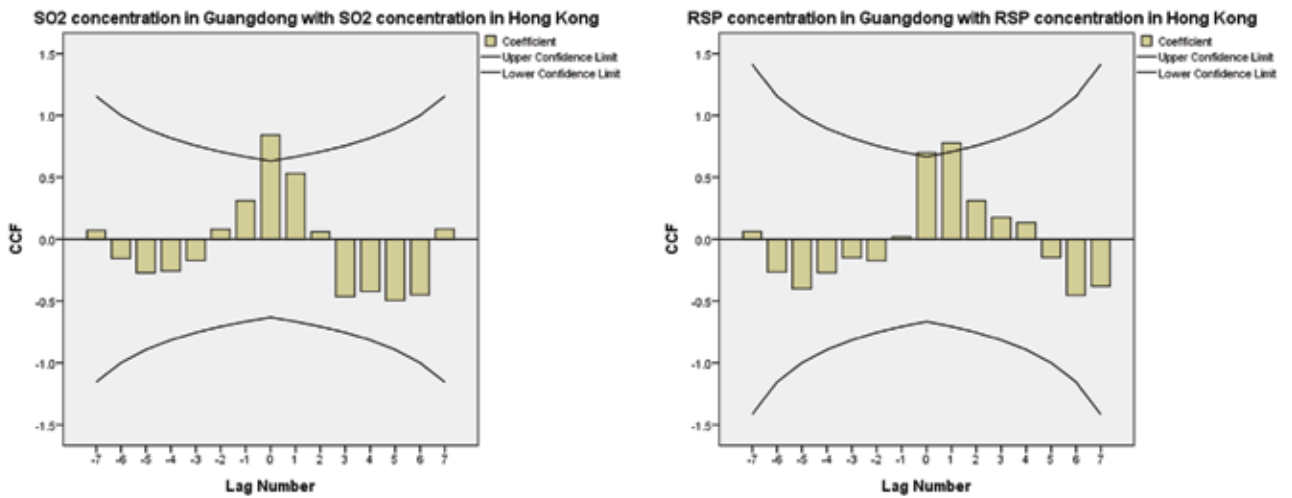


Figure 5-8 Cross-correlations of SO₂ concentrations in Guangdong and Hong Kong (Left) and Figure 5-9. Cross-correlations of RSP concentrations in Guangdong and Hong Kong (Right)

Source: Data are drawn from the PRD Regional Air Quality Monitoring Network

Mega-events and their Impacts

In reviewing the economic and environmental conditions of Eastern China from a macro perspective, it is clear that mega events have played a special role in accelerating the development trajectory (economic growth, social development, infrastructure construction etc.) and enhancing environmental conditions through a leapfrogging process. These mega-events are generally characterized by a long period of preparatory work ranging from 6-10 years. The events also have resulted in increase of GDP and reduction of energy intensity. This study covers three mega events, the Beijing Olympics in 2008, the 2010 World Expo, and the 2010 Asian Games.

Beijing Olympics

The Beijing Olympics is considered as the first mega-event introduced into China bringing significant changes in economic development and environmental management in Beijing. The earliest preparatory work dates back to 1999. Various measures were carried out based on the requirements of the “Green Olympics” laid down by International Olympics Committee. These measures follow the principle of sustainable development regarding the protection of the environment, resources and eco-balance. A key focus was on air pollution. Some key measures involved modification of the energy structure by using more natural gas and clean energy, expansion of rail and public transport, leap-frogging to more stringent vehicular emission standards (from Euro I to Euro III), relocation of heavily polluting industries, (e.g. Capital Steel Works), effective regional cooperation in pollution control, and adoption of a scientific approach in specific source identification through the use of a regional air model.

Another insight from the Beijing Olympics is the commencement of promotion and education. This is supported by a series of projects like “Green community”, “Green school” and “Green Commuting” as well as the development of ecological districts, leisure rural towns, and ecological culture, etc. These projects occupy an important niche to enhance environmental awareness and responsibilities among the community through public participation. They also induced behavioural changes in consumption, greener and safer production, and a sustainable living environment. While some policy measures were transient, many have remained in place. The Beijing Green Olympics set a model for “Green Development” leaving a legacy not only in Beijing but also in the rest of China.

World Expo

The World Expo served as another showcase for green development. In the lead-up to the Expo, Shanghai implemented various policies and measures that laid out in a Three-Year Environmental Action Plan in order to enhance the environment: strengthening of the integrated environmental management system; joint unit pollution prevention and control over the Changjiang Delta; improvement of environmental risk prevention and emergency response system; initiation of all-directional environmental monitoring and inspection work; and the promotion of “Green Expo” and “Low Carbon Expo” concepts. The evaluation concludes that Shanghai has achieved considerable improvement in environmental quality in the past decade, with the rate of “good” ambient air quality reaching 98.4% during the event period and air pollutants such as SO₂, NO_x and PM₁₀ reduced to the minimum in the last decade. The event also facilitated the socio-development of cities, and provided a platform to facilitate the exchange of environmental protection work and ideas at both the domestic and international levels.

Asian Games

The Guangdong government followed a similar approach to that adopted in the previous two mega-events and implemented various measures during the pre-games and games periods. Some key measures included joint unit air quality monitoring work; desulphurisation and emission reduction in industrial plants; promotional use of National III vehicle fuel; and the green commuting campaign to encourage use of public transport and control private vehicle use. The data demonstrates that the emissions of CO, HC, NO_x and PM₁₀ were reduced by 42%, 46%, 26% and 30% respectively during the games period. Together with the infrastructure development for road and rail transport, the Games also provided a boost to tourism and other forms of economic development.

Mega events embracing a green theme indeed have served as an excellent catalyst for green development. They attracted enormous additionality of financial investments for the improvement of environmental conditions. Many such green measures are permanent, providing long-term benefits. Obvious examples are the expanded mass transit railway systems, and the leap-frogged vehicle emission standards. However, there are those measures that could only be temporary, such as the scaling down of production volume to reduce energy consumption and associated

air pollution. The most important yet less tangible aspect of green development is the greater public awareness and people's empathy for a better environment.

Table 5-1 Key temporary and long-term measures implemented during the three mega-events

Temporary	Long-term
Reduction in industrial production	Infrastructure – railway construction
Closure of polluting industries during the event period	Industrial relocation
Drastic traffic control	Wastewater treatment
Intensive regional cooperation	Solid waste treatment
International tendering	Fuel ratio adjustment
	Traffic management and vehicle ownership policy

5.3 GREEN DEVELOPMENT EXPERIENCE IN EASTERN CHINA: Progress and Lessons

Four Propositions

Based on the literature and the statistics and case studies of the Eastern China reviewed, we identify four propositions to illustrate the elements influencing the progress of green development in the region in the recent decades. The four propositions relate to government policies and regulations, natural resources and public awareness, market forces and regional cooperation as the pull and/or push factors as well as major sources of opportunities and challenges for green development in Eastern China:

Proposition 1: Government policies and regulations facilitate green development – Eastern China's experience suggests that industrial restructuring and the transition in economic growth patterns were largely initiated by government through overarching policies, regulations and administrative measures. It should be noted, however, that there is considerable room for improvement in policy implementation and institutional arrangements.

Proposition 2: Natural resource constraints and increased public awareness give impetus to green development – limitations in the provision of natural resources and greater public awareness of the impact of environmental degradation may serve as two important push factors for green development. Natural resource endowments available to an economy or an area is a factor that influences the growth of certain industries, and the growing public awareness drives the government to achieve higher environmental standards and continuous improvement in environmental performance. It is also noteworthy that the rise of living standards and consumerism have posed considerable challenges to future work for environmental protection.

Proposition 3: Market forces as a factor influencing green development – the market is a basic mechanism for effective resource allocation, while the progress towards green development depends on the degree of market efficiency. The transition towards market-based economy started in the Eastern China region and such an ideology has contributed to various aspects of green development. These aspects include internationalization of production process and standards and the change in the economies of scale. However, also noteworthy is the fact that market forces can also lead to surplus production and increases in production cost and employment issues.

Proposition 4: Regional economic and environmental cooperation is a key enabling condition for achieving green development – in view of the regional differences in resource endowments, development status, industrial structure and human capital as well as the cost of pollution control, regional cooperation through co-development initiatives will ensure more efficient and cost-effective use of resources. However, the need for regionally-based initiatives addresses the challenges derived from the competing and reciprocal relationships among provincial and local units in contributing together to green development in China.

Decoupling Economic Development and Environmental Stress

The decoupling trend

To identify and evaluate the elements that influence green development under rapid economic development, it is important to investigate the interaction between economic growth and environmental quality. Statistics were collected on Gross Industrial Output Value (GIOV) and GDP to reflect economic development. Emissions data and pollutant concentration data also were collected for portrayal of environmental condition.

Correlation analysis is used to test if there is relationship between economic development and environmental quality in the three focus areas of Eastern China. Significant relationships (either positive or negative) were found in almost all cases indicating the two have been inter-related. For example, the results concerning Beijing reveal that the selected environmental variables (e.g. emission concentration) negatively correlate with economic variables, suggesting that the environmental pressure in Beijing has decoupled from economic growth.

Simply reviewing the results of a correlation test might not show the decoupling of economic growth and environmental quality as the relationship is absolute, but through observation of trends, we could observe the relative decoupling of the two. Analyzing the statistical trends is helpful to examine the pattern of relationships between economic growth and environmental conditions over the past decade and even for the projection of future trends. The three figures below present the situation in Beijing, Shanghai and Guangdong. Trends of economic and environmental variables of all three areas demonstrate the relative decoupling of economic growth and environmental quality, where the rate of economic growth is much higher than the rate of environment degradation.

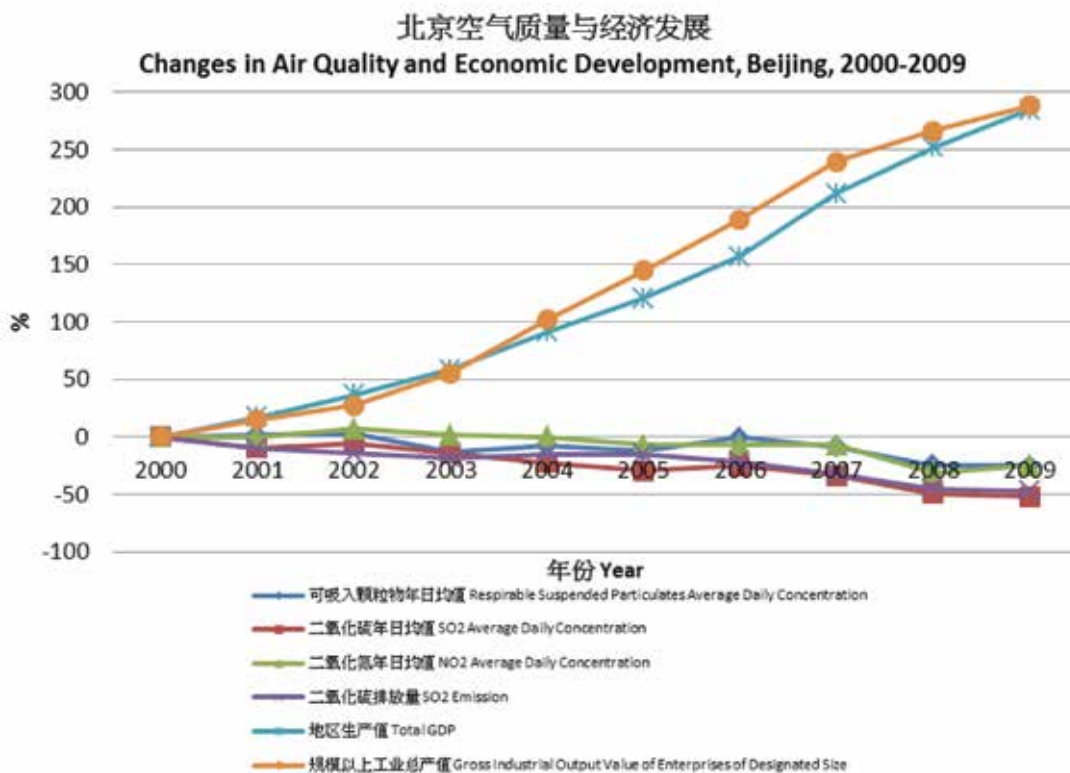


Figure 5-10 Changes in economic development and pollutant emissions and concentration in Beijing (2000-2009)

Source: Beijing Statistical Yearbook (2001-2010), Beijing Municipal Bureau of Statistics

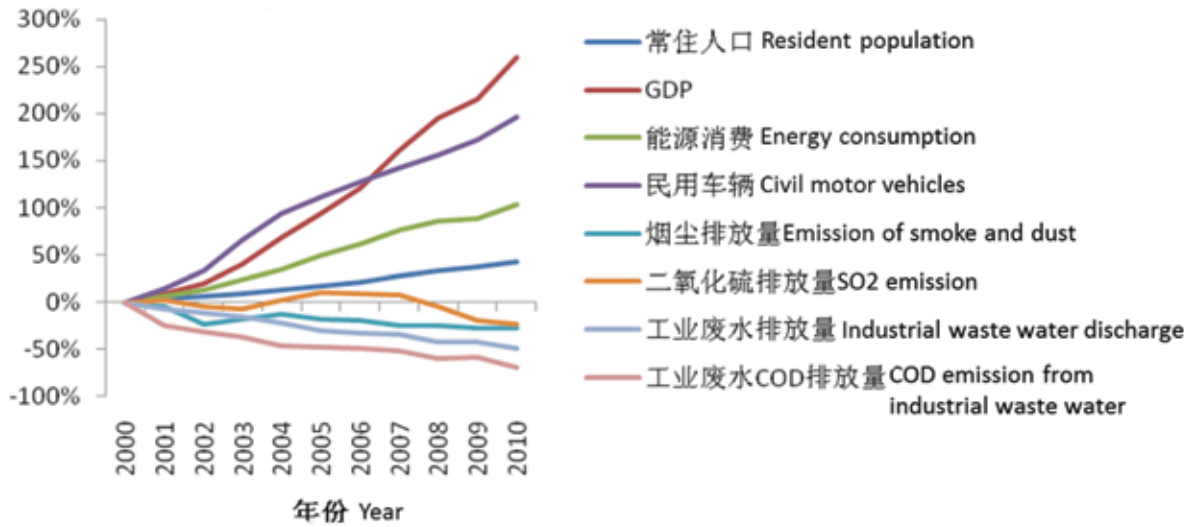


Figure 5-11 Changes in economic development and pollutant emissions in Shanghai (2000-2010)

Source: Shanghai Statistical Yearbook (2001-2011), Shanghai Municipal Statistics Bureau

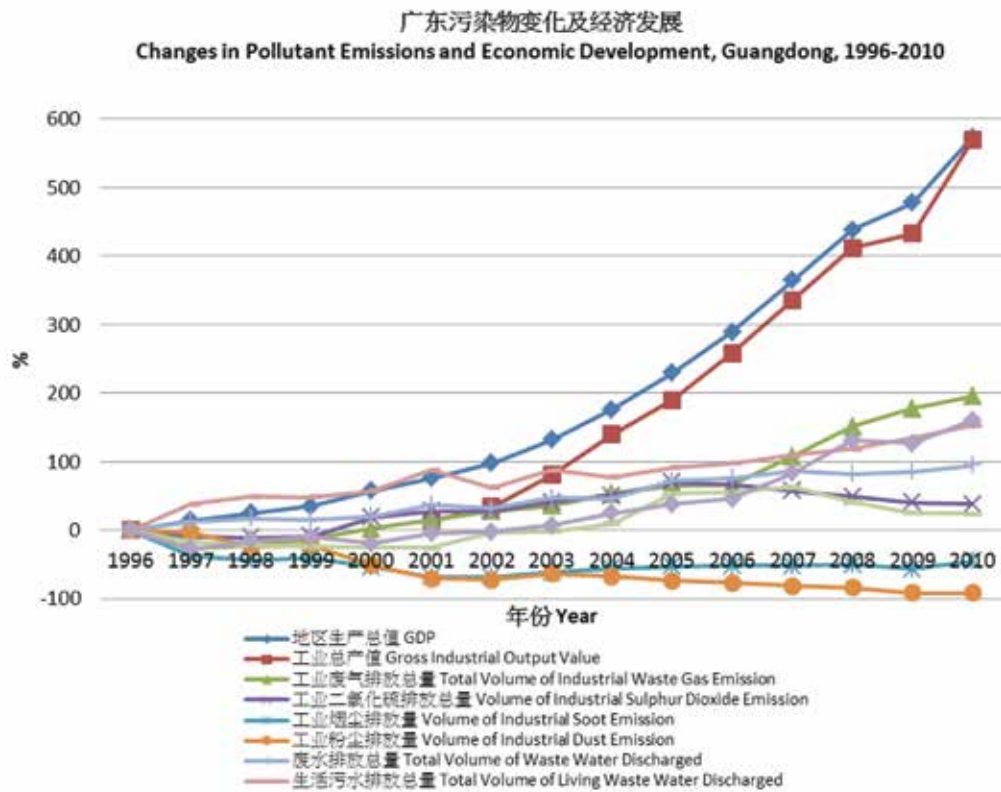


Figure 5-12 Changes in pollutant emissions and economic development in Guangdong (1996-2010)

Source: Guangdong Statistical Yearbook (1997-2011), Statistics Bureau of Guangdong Province

Changes in energy consumption

Energy consumption also captures the dynamics between economic growth and environmental quality. In particular, energy consumption data by sector can, to some extent, reflect the possible effects resulting from economic restructuring and changes in energy structure. The data suggest that the tertiary sector has become increasingly important and is now the most important energy consuming sector in some areas. Data on energy production and consumption by energy source show the society is moving towards green development when the contribution from greener fuels is increasing. Data also show that usage of clean energy remains low while total energy consumption is rising rapidly every year.

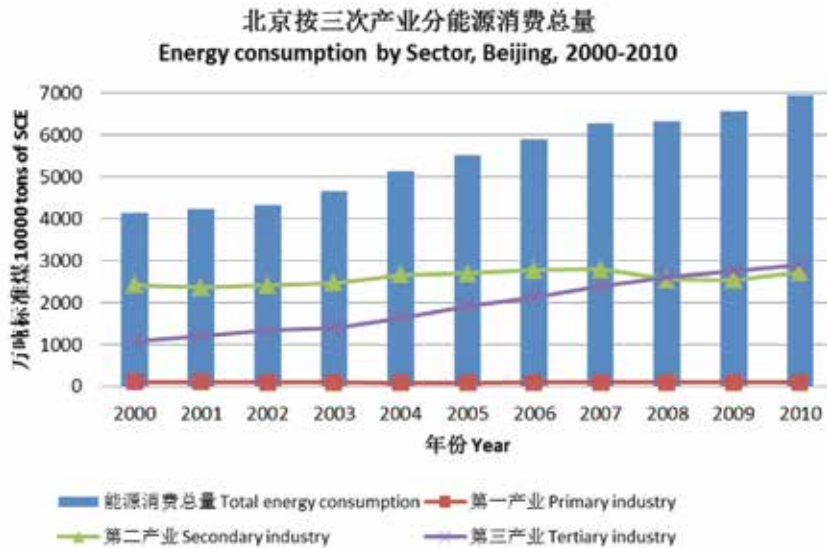


Figure 5-13 Energy consumption by sector in Beijing (2000-2010)

Source: *Beijing Statistical Yearbook (2001-2011)*, Beijing Municipal Bureau of Statistics

Domestic consumption and emission

Industrial enterprises have been the significant contributor to pollution emissions. With rising living standards and emerging consumerism, the domestic sector becomes an increasingly important source of pollution. Figure 5-14 and 5-15 show the trends of increased possession of durable consumer goods, such as air conditioners, computers, mobile phones and motor vehicles in Beijing's and Shanghai's urban households.

Increasing consumption inevitably leads to increasing pollution. Data suggested that the domestic sector contributed more than half of the NO₂ emission in Beijing from 2006-2008 (Figure 5-16). It shows that possible over-consumption is leading to greater stress on the environment, and that consumption behavior is becoming more significant in affecting the progress of green development.

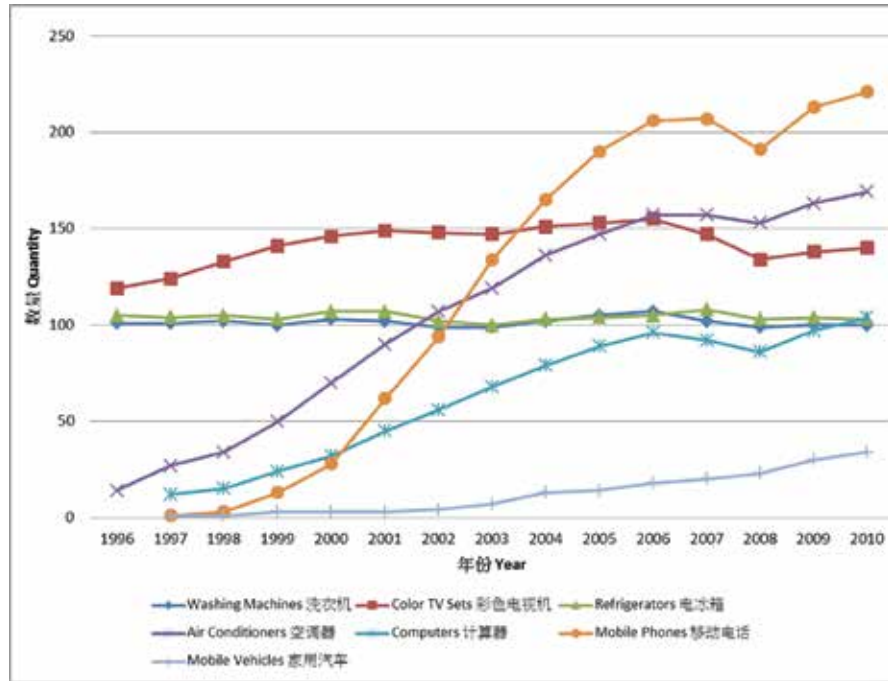


Figure 5-14 Per 100 Urban Households Annual Possession of Durable Consumer Goods in Beijing (1996-2010)

Source: Beijing Statistical Yearbook (1997-2011), Beijing Municipal Bureau of Statistics

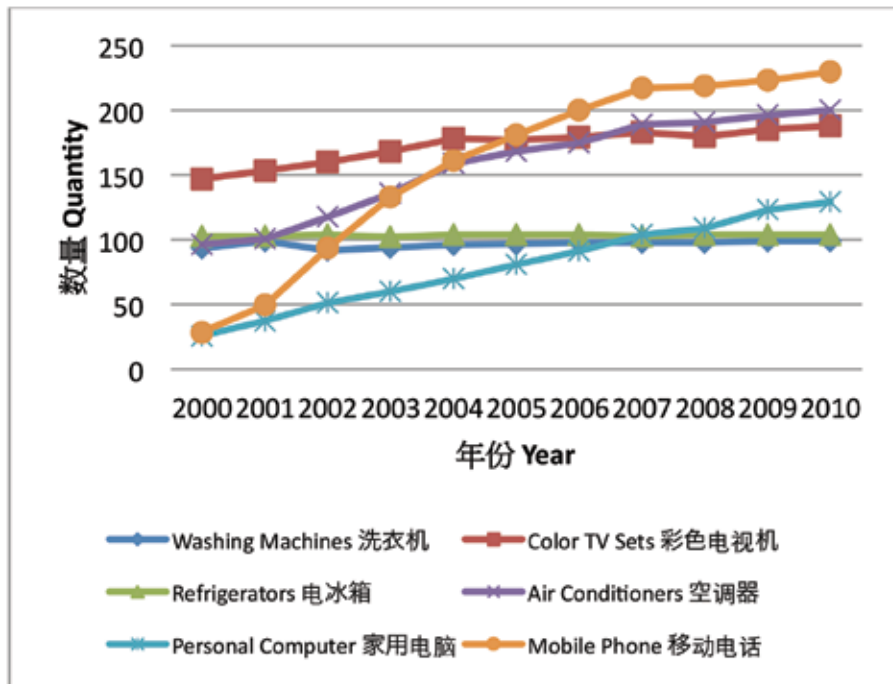


Figure 5-15 Per 100 Urban Households Annual Possession of Durable Consumer Goods in Shanghai (2000-2010)

Source: Shanghai Statistical Yearbook (2001-2011), Shanghai Municipal Statistics Bureau

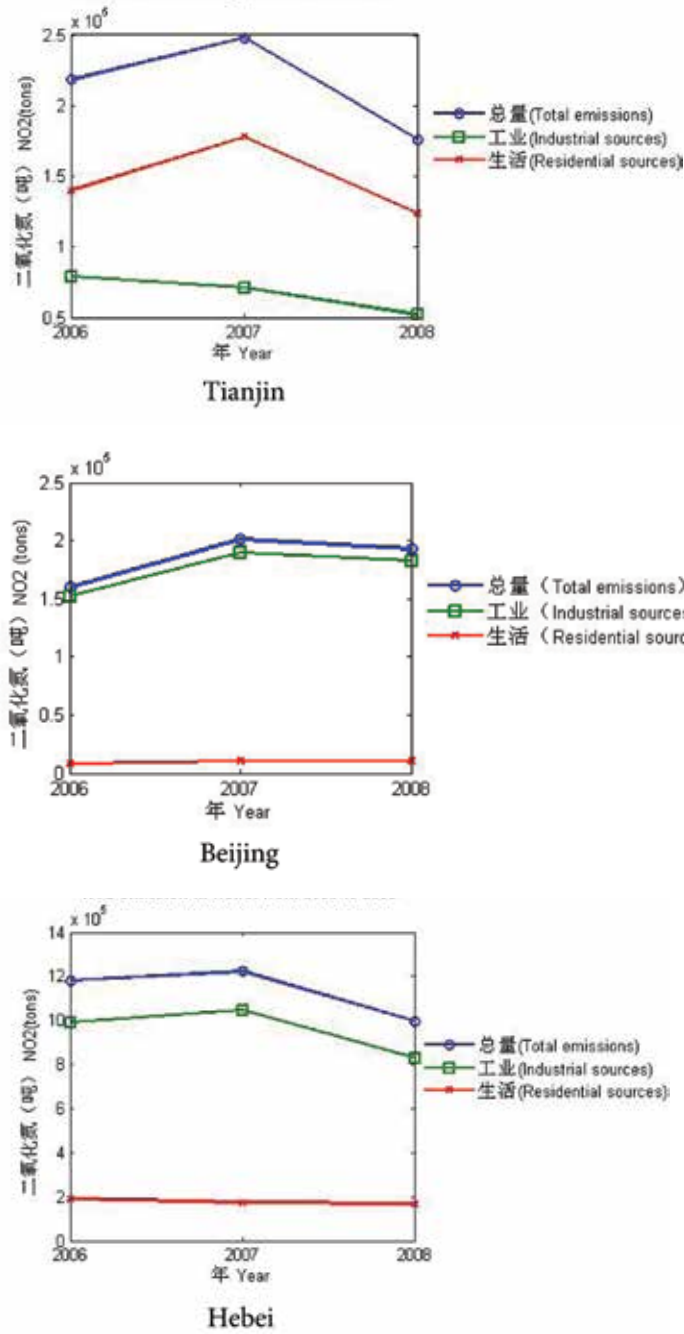


Figure 5-16 NO₂ Emission (2006-2008)

Source: China Statistical Yearbook on Environment (1999-2009),
National Bureau of Statistics and Department of Environmental Protection

Conclusions

Successful decoupling of economic growth and environmental quality may suggest that measures and policies for pollution reduction have been effective, which indicates that policies and regulations can serve as a pull factor towards green development. The rapid growth of economy is also worth noting as it would put pressure on the environment, while the influence of domestic and international markets would also affect progress towards green development. Energy is a major factor in environmental protection especially when consumption is continuously increasing and clean energy accounts for only a low proportion of total consumption. The adjustment of energy structure and raising energy efficiency are the key challenges ahead. The growing significance of the domestic sector

in contributing to emissions raises concerns about the role of the general public in green development. Domestic consumption should become key focus in future environmental and social development policies. Emission data within the same airshed as well as the experience of mega-events indicate the importance of regional cooperation and co-development arrangements for more effective resource allocation and for reducing negative impacts on green development at the regional level.

To promote green economic restructuring and green development through effective policy implementation and institutional arrangements

China considers green development as an inevitable strategic choice that fits the context of the fundamental realities of a huge population, unbalanced development, shrinking natural resources and a fragile ecological environment. The Chinese government has been intentionally determining the pathway of its environmental policies. From the 1970s and 1980s, China defined environmental protection as a basic state policy, with its emphasis on industrial pollution control and prevention (especially end-of-pipe pollution control). In 1994, the Chinese government approved and issued China's Agenda 21, and developed a more comprehensive strategy, countermeasures and action plans for sustainable development. The notion that economic development should be based on the "circular economy" was officially confirmed, along with the establishment of "scientific outlook on development" and the promotion of an environmental-friendly and resource-efficient society. These efforts have yielded considerable results, which have effectively curbed some environmental deterioration and resource depletion, although major existing problems and some new ones continue to limit success.

Thus there is still considerable room and much need to improve. (1) *Increasing government efficiency and responsiveness.* It has been generally accepted that government bodies (at the provincial and local levels) responsible for the implementation of environmental laws and regulations are hindered by their weak institutional capacities. More importantly, a clear line dividing the functions of the government and enterprises is often missing under the largely state-owned economy where the roles of the government authority and private enterprise are unclear. Thus, local authorities typically give priority to economic growth and investments over the stringent enforcement of environmental regulations and standards, which makes regulatory enforcement at the local level inefficient and sometimes virtually non-existent. (2) *A critical disconnect still remains between central government planners who lay down the broad policy directions and the local governments that are responsible for formulating plans and implementing the FYPs.* Critics also argue that some government departments have not developed enough awareness of green development, and without in-depth thought on what social, economic and environmental policies adjustments are needed in order to achieve green economic transformation. (3) *From an environmental governance perspective, the interactions between the government, enterprises and the public in the integrated decision making process for economic and environmental planning are very limited.* It is suggested that stakeholders' participation and information dissemination are particularly important, and the government should provide incentives to actively encourage industries and enterprises to become more self-regulatory and adopt international best practices. (4) *It is also widely acknowledged that China is moving away from a rigid, command-and-control system to a decentralized and more flexible environmental policy-making and implementation system.* However, more efforts should be made to achieve policy integration and strengthen institutional arrangements for fostering green development. These include more effective monitoring and implementation mechanisms, fostering use of market-based instruments, providing more opportunities for public participation, as well as increasing government transparency and accountability.

The recent proposal by the Ministry of Environmental Protection (MEP) to promote large scale environmental projects involves the construction of model sustainable cities with strategic planning covering all aspects of development including spatial design, industrialization and urbanization, innovative technology support, etc. This may

provide a platform for focused efforts on institutional and policy innovation for the advancement of the environmental decision-making mechanism in China.

To achieve economic development goals with minimum natural resources depletion and environmental quality degradation while simultaneously increasing public awareness can give an impetus to green development

Natural resource endowments available to an economy or an area determine the development of certain industries, and the growing public awareness drives the government to achieve higher environmental standards and continuous improvement in environmental performance. It is also noteworthy that the rises of living standards and higher levels of consumerism have posed considerable challenges to future work for environmental protection.

The heavy reliance on fossil fuels energy has limited the progress of green development in Eastern China. Rapid economic development since the Open Door Policy has relied on manufacturing industries that also turned out to be the major sources of pollution. Manufacturing has always been the leading sector in energy consumption, accounting for over half of the overall energy consumption in some areas. In Guangdong, final energy consumption has been rising steadily each year with 30-40% of the fuel mix comprised of polluting coal and oil. Electricity accounts for over 40-50% throughout the past decades but according to data from the China Electricity Council, electricity generated by renewable energy contributes to less than 20% of the total production. The use of natural gas and other clean energy sources for electricity production remained relatively insignificant.

Indeed, our analysis in the three focus areas of this study shows that domestic and other consumption of energy have been rising, and so too has their contribution to pollutant emissions. It is foreseeable that even though Eastern China is moving more towards the development of the tertiary sector. With rising living standards, the domestic sector would bring about more pollution than ever. Yet, public awareness of the impact of materialism on environmental quality remains limited.

But things are beginning to change. The promotion of green development has always been initiated by the government in a top-down manner but civic society is now gaining momentum in this area. Limited by regulations and with little resources and mobilizing ability, green groups have often encountered difficulties in assessing and monitoring environmental quality. But more green groups are becoming increasingly influential as some are now capable of monitoring the environmental impacts associated with business practices.

The advancement of society has created factors that can both slow down and speed up the progress of green development. Rapid industrial development led to a heavy reliance on non-renewable energy which continues to create pressure on the environment. Yet, with the increasing development of renewable energy and accelerating concerns about environmental quality and the growing influence of green groups and civic society, it is possible that the effects of these constraining forces could be minimized.

Harnessing market forces to accelerate progress on green development

Market forces could serve as both a pull and push factor for green development in Eastern China. The influence of market forces would be internal or external. They help to drive the development of sustainable urbanization and to facilitate the development of knowledge- and innovative- based economies which are key contributors to green development.

- 140 Since the Open Door Policy, China has been experiencing a transition towards a market-based economy. China has moved from the planned economy, where economic activities were largely controlled by the state, towards the development of special economic zones, the development of private owned business and the introduction of foreign

direct investment. The opening-up of markets has not only facilitated the growth of tertiary industries, but also improved living standards in the Eastern region.

The transition to a market-based economy has also made China more vulnerable to the influence of the global economy. While the macro-economic environment has been experiencing a downturn and slow recovery, China has to expand her domestic demand in order to maintain the continuous growth in GDP. Economic restructuring, the development of tertiary industry, urbanization, regional cooperation for development and increased individual consumer demand are sources of growth in domestic demand. While the government has played an important role in stimulating the domestic market and facilitating urbanization, it has also contributed to economic restructuring through various measures including setting up industrial parks. The private sector also has played a part in restructuring by relocation and upgrading of manufacturing factories. The trend of economic restructuring has also been reinforced by the development of tertiary industries. The growth of the tertiary sector has been identified in different regions. The proportions of tertiary industries in Beijing and Shanghai have already exceeded traditional secondary industries and have become the sector that generated the highest proportion of GDP. All these have contributed to the steady growth of domestic demand, which has facilitated economic restructuring and the development of tertiary industries and eventually has helped promote green development in China.

The experience of mega events demonstrates the role of the market in facilitating good practices in green development via economy of scales and international tendering. The huge market created by mega events created economy of scale for both the domestic and international market. These helped lower the price of costly technology that facilitated the adoption of green innovation.

The market-based economy also facilitated green development through more stringent environmental standards on export products. International markets are concerned about environmental and safety standards of products and production process. More countries have been imposing stricter standards for raw materials, domestic and imported goods and product life-cycles, and promoting environmental labelling. The pressure to conform to international environmental standards and to satisfy the requirements of customers around the world has encouraged China to move towards a more environmentally sensitive manufacturing process.

The influence of the international market also has encouraged China to place greater emphasis on research and development. The amount spent on R&D by enterprises has increased each year. Enterprises also spend huge amounts on applications for patents. All of these influences derived from an R&D emphasis are paving the way towards a knowledge- and innovation-based economy.

The transition towards market liberalization has, however, created other problems such as surplus production and possible destructive competition. State Owned Enterprises (SOE) have been privileged in capital and resources allocation, and have been protected by the state from competition. They tend to continue with product manufacturing even when the market cannot absorb surplus production. These supply-demand unbalances have occurred in various sub-sectors, for example, solar photovoltaic (SPV) production.

With increasing privatization, competition has become more intense with more regions of China, especially the inland regions, having opened up their markets. Regional governments strive for local GDP growth but at the cost of environmental quality. The private sector faces growing pressure in its operation. Production costs including land, material and labor cost have risen tremendously throughout the past decade. With increased competition and increased costs, some businesses were forced to close down or relocate inland without upgrading production facilities that slowed down the progress of green development.

On the whole, in view of the important role of the market forces on the economic restructuring process, it is essential for the government to strengthen the institutional arrangements and harness the market forces for more efficient environmental management and to encourage green economic restructuring.

To incentivize and advocate regional co-operation for achieving green development

With the experience of economic liberalization over the past 30 years, regional co-operation has now been intensified and more widely adopted in China. In the Pan-PRD Region, the “Administrative Measures for the Resolution of Conflicts on Trans-boundary Pollution in Pan-PRD Region” prompted the environmental protection agencies to establish regional joint commission for the handling of trans-boundary pollution disputes. Participating provinces are also required to introduce an information exchange platform, pollution enforcement inspectors and a border water quality monitoring system. In the Yangtze River Delta Region, various regional co-operation programmes are set out with a focus on remediation for water pollution and emissions of SO₂. Examples include the establishment of joint cities water pollution remediation system and water resources information dissemination system.

Regional co-operation mechanisms were also introduced through mega-events, including the Beijing Olympics, the Shanghai Expo and the Guangzhou Asian Games. Three major observations may be made.

First, these regional co-operation programs adopt a holistic approach, which comprises targets, action plans, implementation measures, monitoring systems and even contingency plans in some cases, to cover a wide range of areas such as environment, economy, transportation and urban planning. One of the examples of large-scale regional co-operation is the air quality assurance and monitoring work during the Beijing Olympics. It has developed computerized airshed modeling that takes into account the air pollution trends and meteorological factors over a wide region covering Beijing, Tianjin, Inner Mongolia, Shanxi, Hebei, Baoding and other peripheral areas. Apart from setting out various pre-games remediation and temporary control measures, the airshed modeling was effective in identifying the contingency measures needed when air quality deviated from the pre-determined level just before the opening ceremony.

Secondly, the focus of regional co-operation has shifted from purely economic in the past to both economic and environmental at present. Since China's Agenda 21, the aim of launching regional co-operation is no longer only to achieve high productivity levels, but also to safeguard the environment.

Thirdly, regional co-operation serves as a possible way to solve the trans-boundary pollution problems. The trend analysis and cross correlation test that were conducted between Hong Kong and Guangdong on selected air pollutants demonstrates the air quality of each place is affected by the other. The dispersion of air pollutants due to cross-border human and natural (e.g. wind) activities cannot be solely tackled by mitigation measures within their own administrative boundaries.

While regional co-operation facilitates sustainable development in China, there also exist difficulties and challenges. Economically, enterprises tend to opt for provinces where lower environmental transaction costs exist. Cooperation becomes difficult when provinces compete with each other in attracting enterprises to boost provincial GDP. Low or even no compliance with institutional arrangements from the participating provinces is resulted. There also exist challenges under the current political arrangements where different jurisdictions have made regional collaboration on air and water management between Hong Kong SAR and other cities in the PRD region difficult.

5.4 FROM POLITICAL CONSENSUS TO INSTITUTIONAL AND POLICY DEVELOPMENT: Principles and Recommendations for Green Development in China

Green development now forms part of a global policy agenda that has emerged in response to the imperatives of environmental degradation, biodiversity loss, climate change and global economic slowdown. For China, green development represents a strategic option that is consistent with the key challenges confronting the country, including huge population size, unbalanced development, declining natural resource base and environmental quality, and fragile ecological systems.

The Chinese Government has been attaching great importance to the promotion of green and sustainable development since the 1990s. In 1995, the 9th FYP initiated the concept that the economic growth model in China must be transformed from an “extensive” to an “intensive” growth. In 2005, the 11th FYP expanded the idea and proposed to bring into being a pattern of economic development with “low input, low consumption, less emission and high efficiency”. It also laid down some concrete targets such as reducing energy consumption per unit of GDP, as well as the long-term goals of promoting the capability of independent innovation, vigorously developing the circular economy, and accelerating the construction of resource-saving and environment-friendly society. In 2007, the 17th National Congress of the Communist Party of China put forward acceleration of transforming the mode of economic growth and optimizing and upgrading the industrial structure. The way of promoting economic growth was shifted from mainly relying on investment and export to relying on the coordination of domestic consumption, investment and export; from mainly relying on the secondary industry to relying on the coordination of the primary industry, the secondary industry, and the tertiary industry; from mainly relying on increased consumption of material resources to relying on technological development, improvement of labor quality and management innovation. From 2010 onwards, China continued to emphasize accelerating the transformation of its mode of economic development, in order to cope with the effects of the international financial crisis; adapt to the changes in the global demand structure; rationalize the distribution of national income; promote social harmony and stability; construct a moderately prosperous society, and meet the new expectations of the people for a better life. More recently the recommendations of the CPC Central Committee for Formulating the 12th FYP for National Economic and Social Development also highlighted that to accelerate the transformation of the economic development mode in China will constitute a profound reform in the economic and social fields, and each field will need a comprehensive, systematic and strategic transformation, including the reform of the development concept, transformation of the development mode and innovation within the development path.

Guiding Principles and Prerequisites

As mentioned earlier, a clear political commitment and policy direction is the most important prerequisite for green transformation in China. This study suggests it is essential that policy mechanisms and institutional adjustments are introduced and reinforced at all levels of government to ensure that the pursuit of green development is confirmed as a core and continuing task of government for all of China.

This study also proposes the following nine guiding principles to facilitate green development in China.

1. This is a long-term transition process that in China’s case will need to be continued in subsequent FYPs and major national strategies, and which will extend over many decades;
2. Green development is not just about economic growth but also about promoting social progress; green development is a process and not a single end-state;

3. Policy continuity is essential at both the central and local government levels;
4. An integrative, holistic view of the development process is adopted, one that extends across all policy domains;
5. The potential as well as the limits of both technology and market dynamics are recognized;
6. Sensitivity to the social dimension of the development process and its goals and objectives is required;
7. Both the positive and negative impacts of development are managed in a balanced way;
8. The importance of stewardship and the need for responsible management of natural systems and national heritage resources are recognized; and
9. The enhanced commitment to adhere to international conventions on sustainable and green development.

Progress towards green development will be influenced by the extent to which these principles can be articulated and made operational through policy systems and their supporting mechanisms. Policy makers are encouraged to recognize the importance of these principles and they should be refined and reaffirmed periodically to reduce the likelihood of “policy drift”.

General Recommendations for Facilitating Green Development in China

The pursuit of a green development strategy in Eastern China and elsewhere in the country will require systemic changes at both the macro (strategic or state level) and the local and implementation levels. On the basis of our study we put forward six general recommendations that are applicable to the whole country.

Recommendation 1: Improve policy integration and coordination

To integrate and coordinate different policy sectors, especially energy, transport and infrastructure, education and economic development, under the framework for green development in China:

1. Future FYPs should explicitly and consistently indicate in their objectives and quantitative indicators that environmental quality must not be traded off for economic advancement; and
2. The FYPs should be subject to an improved auditing, reporting and disclosure process that highlights potential problem areas and which alerts provincial and local decision makers to potential conflicts between key policy objectives (e.g. economic prosperity, environmental quality, biodiversity, heritage and so forth).

Recommendation 2: Strengthen regional monitoring capacity and measures

1. Enhance the supervisory and regulatory role of the Regional Environmental Protection Inspection Centre:
 - The Centre should be equipped with appropriate and additional manpower and resources, including state-of-the-art equipment (hardware) and database management (software) for performing its expanded duties;
 - The Centre should be endowed with specific regulatory powers to facilitate inspection and enforcement in an effective and efficient manner, e.g. to audit the emission inventory of industrial operations, including thermal power generation, and setting up a database with annual updates of the results; and
 - The Centre should become the overarching authority to oversee environmental monitoring on operations where an Environmental Impact Assessment (EIA) has stated the expected environmental quality outcome through the implementation of mitigation measures.
2. Establish a coordinating body under the State Council (proposed name, Green Development Commission or Environment and Green Development Commission):

- The main tasks of this coordinating body are to provide a platform for discussion of policies relating to energy, industry, transport, infrastructure, economy, agriculture, environmental protection and nature conservation; and to recommend the considered policies to the State Council for implementation by the relevant Bureau(x) in a coordinated and timely manner; and
- All relevant Ministry heads should be core members of the Commission and should be obligated to meet on a regular basis to discuss policy priorities, review implementation strategies and formulate future plans; this co-operation should go beyond the individual project level.

Recommendation 3: Strengthen policy implementation

To enforce more effective and stringent controls on minimizing the impact of development on the environment:

1. Strictly implement the Environmental Admittance System (e.g. more stringent emission standards and requirements of pollution abatement technologies) in order to prevent new sources of environmental pollution and displacement of polluting industries emerging in less developed regions;
2. Strengthen the EIA system and increase the rigour of its implementation to match international best practice:
 - Soil and groundwater pollution of industrial brownfield sites have become a barrier in the process of land redevelopment. However, the effective regulatory and institutional framework for brownfield management has yet to be established. There should be more comprehensive regulations and laws on brownfield site planning and more specific requirements for land decontamination / remediation under the EIA system;
 - Environmental performance committed to in the EIA reports should be strictly monitored. Enterprises and local government departments that fail to comply with the regulatory requirements of the EIA should be disclosed and reported on a regular basis; and
 - A corporate environmental profiles database should be established to facilitate the development of a corporate environmental performance and behavior assessment system. The environmental performance of enterprises should be assessed by the government on a regular basis, with the results made available for public inspection.

Recommendation 4: Develop a performance-based accountability system on green development at local government level

1. The performance of local officials should be closely monitored and based on consistent assessment and reporting criteria. Green development targets, specific indicators and incentives should be developed to motivate local officials to take proper account of their economic, environmental and social performance (index of economic growth, social progress, people's livelihood, protection of the ecological environment, etc.).

Recommendation 5: Increase public awareness on environmental protection, green development, and promote public participation

1. Greater transparency in environmental management and information disclosure, e.g. pollution emissions (amount and sources), pollution status and trends and details such as the nature, duration and location of pollution incidents;
2. More openness of the public feedback system for receiving comments and interacting with the community;
3. Public awareness building and education programmes at all levels and more effective use of media channels; and

4. Widespread promotional campaigns of low carbon lifestyle, energy-efficient behavior, and green development decisions at community level and in households.

Recommendation 6: Accelerate the green development process by means of pilot and demonstration projects

1. Set up pilot green development zones as demonstration areas for modern service sectors, hi-tech industries, sustainable energy and transportation systems, etc.;
2. Stimulate integrated economic, industrial and environmental policies and measures through the construction of industrial parks for achieving centralized emission control; and
3. The State Electricity Regulatory Commission (SERC) should initiate the installation of a “Smart Grid” in selected urban centres as pilot projects so that the efficiency of renewable energy could be explored and the benefits of demand-side-management (DSM) maximized.

Recommendations for Green Development in Eastern China

This study also sets out six specific recommendations to strengthen green development in the more developed part of Eastern China. They involve: the adoption of more stringent standards and targets; increased information disclosure; promotion of green consumption; provision of regional funds for pollution prevention and protection; establishment of a regional financial transfer payment mechanism; and promotion of corporate environmental governance.

The recommendations are based on the following rationales:

First, in view of the increasingly open market environment, Eastern China needs to adopt higher environmental and safety standards in the production life-cycle, with more innovative technologies or management techniques in order to enhance global trade competitiveness and respond to the growing public environmental awareness.

Second, it is the duty of the government to provide maximum information to the public, both in response to requests and by regularly publishing key information. With more information and data made available to the public, the cost of governance may be reduced and the interaction and communication between government and citizens enhanced.

Third, as there is an increasing impact of consumer behavior on the environment, with over-consumption being a major cause of waste and pollution, greater effort should be made to encourage more sustainable forms of consumption in the context of societal efforts to reduce emissions. As Eastern China gets richer, sustainable consumption should be given a high priority since consumers will be financially capable of paying more for environmental-friendly products and their behaviour will have a direct impact on the production patterns.

Fourth, the past 30 years of rapid development in Eastern China have created a massive amount of environmental risk to air, water, and to biodiversity. Citizens are exposed to these risks while it is often difficult to find the ‘polluter’ that caused or exacerbated the pollution. Therefore, regional funds should be set up to facilitate an integrated approach to environmental prevention and protection.

Fifth, the call for a holistic approach in regional co-operation hinges upon environmental protection efforts in less-developed areas. The provision of financial incentives would create a positive stimulus to more effective regional co-operation in environmental protection, ecological conservation, prevention of pollution transfers, and encourage co-development of areas at different levels of development.

Sixth, corporate enterprises have an increasingly important role to play in the society. They need to meet various environmental regulatory obligations laid down by the government and heightened expectations from the public

with regard to their environmental performance. The promotion of corporate environmental governance should be given a higher priority in advancing green development.

Details of the recommendations are as follows:

Recommendation 1: Implement more stringent standards and targets

Adopt more stringent environmental standards and targets in Eastern China than national standards, e.g. impose more rigorous emission standards for key pollutants in industries that are energy-intensive and highly polluting.

Implement a performance management system at the local government level for evaluating achievements in carbon emission reduction and energy-saving.

Recommendation 2: Establish greater information transparency

Disclose information more widely and regularly to facilitate public monitoring, in particular:

- information that concerns most citizens, e.g. data on particulate matter emissions (PM_{2.5} etc.), ground-level ozone, and heavy metal emissions that would have a marked effect on human health; greater transparency in environmental management and information disclosure, including the amount and sources of pollution emissions, pollution data and trends and details such as the nature, duration and location of pollution incidents; and
- information and data that are fundamental for research and development and policy-making.

Recommendation 3: Promote green consumption

Advocate “green consumption” concepts and behavior by means of:

- voluntary actions through raising environmental awareness and information sharing to instigate behavioural change; and
- the introduction of taxation measures (e.g. environmental taxes and resource taxes) to promote positive changes in corporate and consumer behavior, and enhance the market competitiveness of environmentally friendly service and products.

Recommendation 4: Set up a regional fund for environmental protection and pollution control projects

Set up a pilot “Regional Fund for Environmental Pollution Prevention and Protection”, that can facilitate:

- the assessment of environmental health risks (e.g. hazardous chemicals left behind by former industrial plants which have led to soil and groundwater contamination);
- industrial brownfield site decontamination / detoxification / remediation;
- compensation to and resettlement of affected persons; and
- the provision of funding for local environmental protection and pollution prevention projects.

Recommendation 5: Establish a regional financial transfer payment mechanism

Establish a regional financial transfer payment mechanism, in order to:

- promote environmental protection in less developed areas; and
- encourage co-development initiatives between neighbouring regions.

Recommendation 6: Promote corporate environmental governance

Promote corporate social responsibility and green corporate governance through the establishment of green business coalitions and development of green supply chain management strategies.

5.5 FUTURE RESEARCH AGENDA

Several areas related to this study have been identified for future research work:

- An in-depth study focusing on the institutional barriers to policy integration for environmental protection and green economic development, including how the current system operates and where the blockages are;
- A correlation study between environmental quality and health impacts and related policy implications (e.g. land-use planning, urban design, public health policy etc.);
- Case studies for assessing the relationship between air / water pollution and the loss of biodiversity at the local and regional levels (with case studies);
- A feasibility study of using shale gas as an interim replacement for coal, focusing on gas exploration, storage, transportation and consumer usage. The medium-term energy policy should be formulated in the light of shale gas availability nationally and globally;
- Detailed studies of business decisions regarding location and investment in the course of economic restructuring / green transformation in China. Data should be collected on what actually makes companies in different sectors, and of different types, sizes and cost structures, locate in different regions and move around, i.e. the influence of different factors, (e.g. environmental costs, land and labour costs, and external economic environment etc.). It is also important to know more about the investment incentives offered by localities (e.g., provinces, cities, counties) to attract industry and how consistent these are and how they relate to national priorities and guidelines; and
- The CCICED as a high-level advisory body to the Chinese government should consider setting up a Special Task Force to bring together experts from industry, government and academia to carry out integrated studies on climate change and energy policies targeting both local and regional development contexts. The studies should be regularly reviewed and updated for designing long-term sustainable energy and industrial development strategies and action plans.

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CHAPTER 6

CHINA'S MARINE ENVIRONMENTAL MANAGEMENT MECHANISM – BASED ON CASE OF BOHAI OIL SPILL

ABSTRACT

The special policy study (SPS) team has, based on shared and available information, assessed the impacts on the ocean environment from marine economic development in the Bohai Sea. Through case studies of the oil spill accident on the Penglai 19-3 oil field in the Bohai Sea of China in 2011, the oil spill accident of US “Deepwater Horizon” drilling rig in the Gulf of Mexico in 2010 and the oil spill accident on the Norwegian “Statfjord” field in the North Sea in 2007, together with analysis of the main problems with China’s marine environmental management, the SPS team have formulated seven policy recommendations to improve China’s marine environmental management mechanism:

1. Develop an integrated national marine development and environmental protection plan. This plan should be a national master plan for the development and layout of the main marine industrial sectors: *China’s National Coastal and Marine Spatial Plan*. Such a plan should address and integrate all existing marine development-related strategic plans for coastal and offshore areas in the various provinces.
2. Establish a national marine emergency response plan, “*National Contingency Plan (NCP)*” for marine environmental incidents. The NCP should cover the entire country and include specific *Area Contingency Plans (ACP)* that apply to coastal provinces, large areas of the coast or bays, etc.
3. Harmonize marine-related national environmental laws and marine environmental administrative functions. Among other changes, the “*Three Provisions*” issued by the State Council needs to be modified. To improve inter-ministerial coordination and cooperation, a new department of environmental emergency and environmental protection coordination should be established within MEP.
4. Improve legislation for marine environmental management, including rules for the approval and supervision of all off-shore oil field development planning, the implementation of pollution prevention control and safe production regulations, information disclosure procedures, ecological damage assessments, and improved compensation systems and mechanisms to cover the cost for the emergency responses.
5. Strengthen the enforcement of laws and regulations to protect the marine environment by establishing a unified offshore law enforcement team.
6. Enhance corporate environmental responsibility and improve the environmental risk prevention capacity of enterprises.
7. Strengthen research related to marine environmental management through the support of environmental marine public projects or special national science and technology development programs. International cooperation is a very important way of achieving these goals.

Keywords: Bohai Oil Spill, Marine Economy, Marine Environment, Emergency Management, Normal Management, Organizations System and Mechanism, Laws and Regulations, Overall Plan, Emergency Response Plan, Double-effect Mode (efficient and effective), Inter-ministerial Coordination, Corporate Environmental Responsibility

FOREWORD

Although an important part of the marine economy, offshore oil and gas exploitation and transportation also can result in marine oil spill accidents. Tankers and offshore oil production may result in particularly large oil spills.

The subsea oil leakage accident of Penglai 19-3 oilfield in the Bohai Sea of China in 2011 has revealed the inadequacy of the emergency response capacity, an uncoordinated institutional arrangement and the weakness of the support system. In addition the accident has highlighted deep-rooted conflicts between China's marine economic development and the environmental management of the oceans. CCICED approved this Special Policy Study on the Bohai Oil Spill as a Case for China's Marine Environmental Management Mechanism. The study is to: promote sound interaction between marine development and environmental protection, facilitate green transformation of the "blue economy" development mode, and explore the new mode of environmental management, i.e., "environmental protection under development, and development under environmental protection". The need to harmonize marine resources development and marine environmental protection has become an urgent problem for China. In this regard, the Bohai Oil Spill accident has provided a classical case study for improving marine environmental management mechanism and facilitating "green transformation" of integrated land and marine economy.

China's offshore oil development began in the 1960s, and international cooperation began in the early 1980s. Over the past 20 years, China marine oil spill accidents have been characterized as high risk, wide damage range, long lasting and difficult to evaluate. With ever expanding offshore oil development, the Bohai Sea has become the main offshore area for oil production, with 21 offshore oil fields with 178 drilling and production platforms¹⁰² by the end of 2009. In total there have been 1419 production wells completed in this area.¹⁰³ The annual oil production reached 30 million tonnes in 2010,¹⁰⁴ which makes the Bohai Sea a prolific production area. In addition to the Bohai Sea, oil production in the East China Sea and the South China Sea is also expanding. All these activities lead to increasing risks of oil spill accidents.

In recent years, more than 500 marine oil spill accidents happen every year with a trend of further increase. Moreover, China's offshore oil transportation is only exceeded by that of USA and Japan at present, oil throughput of ports is increasing at a rate of more than 10 million tonnes/year,¹⁰⁵ shipping intensity is increasing, and the size of tankers is becoming larger. China's current marine-based economy is increasing at an average annual growth rate of more than 20%, which will surely increase the risk of marine oil spill accidents.

For China's current marine development and environmental protection situation, we can learn from the experiences and lessons from many oil spill accidents in the world, including the emergency response to the explosion and oil spill accident of the US "Deepwater Horizon" drilling rig in the Gulf of Mexico in 2010 and the oil spill accident of Norwegian "Statfjord" field in the North Sea in 2007. Drawing on these experiences will help strengthen and improve China's current marine environmental management.

This study aims at revealing the existing institutional, systematic and legislative problems in both emergency response and normal management of China's marine environment through the case analysis of the "Bohai Oil Spill in 2011" and the comparison of international lessons/experiences of marine environmental disaster emergency response. The study lays out practical policy recommendations on environmental management for a coordinated approach to marine economic development and marine environment protection.

102 CCICED, *Ecosystem Issues and Policy Opinions Addressing Sustainable Development of China's Ocean and Coast* (2010), p33.

103 CCICED, *Ecosystem Issues and Policy Opinions Addressing Sustainable Development of China's Ocean and Coast* (2010), p33.

104 Guo Xiaozhe, *World Offshore Petroleum Development history*, Petroleum Industry Press, Beijing, 2012, p337.

105 CCICED, *Ecosystem Issues and Policy Opinions Addressing Sustainable Development of China's Ocean and Coast* (2010), p18.

6.1 MARINE ECONOMY DEVELOPMENT AND THE CHALLENGE OF MARINE ENVIRONMENTAL PROTECTION IN CHINA

6.1.1 Marine economy development is accelerating while marine development strategy needs to be improved in China

China has a solid foundation for marine and coastal economy development

China is a country with substantial land and sea areas. There are 380,000 km² of territorial sea area, about 3 million km² of the sea under national jurisdiction,¹⁰⁶ a 32,000 km coastline (including 18,000 km mainland coastline) and more than 6,900 islands.¹⁰⁷ China's more than two thousand years of historical experience with economic development shows that coastal development and overseas trade have been important components of the national economic development. Historically, the prosperous periods of country unity and social economic development were all accompanied by opening of coastal economic development and increases in overseas maritime trade. With national economic development and increasing international economic linkages, China's economic activity has shifted gradually from inland to coastal areas.

National marine economy development strategy is being implemented

At the present stage, China is a country at a strategic period of national rejuvenation and stable economic development. Coastal and marine economic development has broad prospects, further boosted by China's constantly strengthened awareness of marine economic development strategies. In 2003, the State Council issued the *Outline of National Plan for Marine Economy Development*. The *Eleventh Five-Year Plan (FYP) for National Economic and Social Development* in 2006 further elaborated the strategic directions as “strengthening ocean awareness, safeguarding marine rights and interests, protecting marine ecology, developing marine resources, implementing comprehensive marine management and promoting marine economic development”. In particular, the 5th plenary session of the 17th CPC Central Committee in October 2010 put forward a detailed marine economic development strategy, namely “adhering to integrated land and sea area plan; formulating and implementing marine development strategy; improving marine development, control, and comprehensive management ability. Scientifically planning marine economic development; developing industries such as offshore oil and gas, transportation and fishery, etc.; rationally developing and utilizing marine resources; strengthening construction of fishing ports; and protecting island, coastal zone and marine ecological environment. Guaranteeing safety of sea transportation channels; and safeguarding China's marine rights and interests.” In Chapter 14 of *Promote Marine Economy Development*, the 12th FYP (2011-2015) provided specific tasks for China's marine economic development in the future.

The marine economy plays an important role in the national economy

Since the 1990s, the status of the marine economy in the national economy has steadily improved, and has become an important pillar of development of the national economy. According to data from the State Oceanic Administration (SOA), total gross marine production reached 2.1 trillion yuan in 2006, with a year-on-year growth of almost 14%, and accounts for 10% of GDP; this number increased to 4.6 trillion yuan in 2011, with a year-on-year growth of 10.4%, and takes up 9.7% of GDP. According to predictions from the Marine Development Strategy Research Institute of State Oceanic Administration, the proportion of China's marine economy will further increase at least until 2020.¹⁰⁸

106 Yang Jinshen, *China's Maritime Strategy Study Collection*, Ocean Press. Beijing, 2006, p271.

107 Working Group on Legislative Affairs of the NPC, *People's Republic of China Law of Island Protection Interpretation*, Law Press. Beijing, 2010, p165,182.

108 China Institute for Marine Affairs, *China's Maritime Development Report (2010)*, Ocean Press. Beijing, 2010, p226.

Future marine economic development strategy needs to be adjusted

Compared with marine development strategies and marine economy development measures of other marine powers in areas such as North America, European Union, East Asia and Oceania, there are still some deep-rooted problems for China's marine economic development.

First, there is a lack of orderly arrangements at the strategic level for marine economic development. The existing coastal economic strategy is derived simply by adding up the various regional strategies. There is a lack of a clear marine economic development strategy, policies that can harmonize development and protection, and policies that integrate the terrestrial and marine economy.

Second, marine development activities in the coastal provinces are carried out simply as an expansion of extensive land-based economic development towards the sea. This has led to overcrowded coastal zones and environmental quality degradation in the nearshore waters. In contrast, full development of the Exclusive Economic Zone (EEZ) and deep and high seas has yet to be undertaken.

Third, leading enterprises and industrial clusters of traditional marine industries tend to be “marginalized” and are losing out in the global economic competition.

Fourth, China's marine economic development needs to address international relations with surrounding countries in terms of disputes concerning islands and jurisdictional boundaries. These disputes impose unprecedented challenges on further marine development. The competitive development of involved countries brings an ever-increasing uncertainty for marine environmental protection, and risk of environmental disasters.

Historical experiences and realistic outlook of national economic development has demonstrated that marine economy development is a strategic choice for medium and long-term development of China. High economic growth over the past 30 years has laid a solid foundation for future marine economic development. “Top-down” and “bottom-up”¹⁰⁹ marine economic development strategies have set the stage for marine development as the predominant direction of economic development in coastal areas.

6.1.2 Marine environmental problems are emerging and getting worse

Significant negative environmental effects of marine industry development

Generally, compared with countries with a developed marine economy, China's marine economy is still in the early stage, and the marine industry structure is still dominated by secondary industry. The added values of the primary, secondary and tertiary marine industries in 2011 accounted for 5.1%, 47.9% and 47.0% respectively among the total marine output value.¹¹⁰ The three leading industries, i.e., marine fishery, marine shipping and transportation industry, and coastal tourism, all belong to the labour and capital-intensive traditional industries. The shipbuilding industry, marine engineering industry, marine oil and gas industry and marine petro-chemical industry, as well as second-tier industries, also mostly belong to the capital-intensive industries, where technological innovation abilities are lower than the international advanced level. Marine biological medicine, marine power and mariculture industries have developed rapidly in recent years, but their proportions are relatively low, and it will be difficult for them to become leading marine industries in the near future.

¹⁰⁹ “Top-down” here refers to the national strategy of strengthening the country by guiding coastal provinces and cities to develop the coastal and marine economy. Meanwhile, “bottom-up” refers to coastal local economy entities spontaneously developing marine economy-related plans and to upgrade the plans within the context of a national marine development strategy.

¹¹⁰ SOA of China, *Statistical Bulletin of China's Marine Economy* (2011).

Table 6-1 Environmental Effects of China's Marine Industry Development¹¹¹

Marine Industries	Relative Growth	Environmental Impact	Degree of Environmental Impact
Marine fishery	++	Loss of marine ecological system	++
Marine oil and gas	+++	Oil spill pollution	+++
Marine mining	++++	Seabed (coast) damage, seawater pollution	++
Marine salt industry	+	Coastal land occupation	++
Marine chemical industry	++++	Pollution discharge to ocean	+++
Marine biological medicine	++++	Pollution discharge to ocean	++
Marine power	+++	Coastal (wind power) land occupation	++
Seawater utilization	++++	Possible pollution discharge to ocean	+
Marine shipbuilding	++++	Coastal land occupation	++
Marine engineering construction	+++	Coastal land occupation	++
Marine transportation	++	Emission to ocean and air	+++
Marine tourism	++	Tourism garbage	++

Environmental problems brought about by different marine industries varies due to differences in industrial scale and technical levels. Especially for the large-scale traditional industries and the rapidly developing medium-scale industries¹¹² their operation can become main sources for marine environmental disasters. For industries such as tourism, fishery and shipbuilding, which are relatively small scale activities, the disaster potential is lower. However, their production and service facilities are generally outdated, and their environmental awareness, responsibility and capacity for handling environmental problems are relatively low. Although marine transportation, offshore oil, and marine chemical industries are relatively large-scale and are in a strong position in the Chinese market, their awareness of marine environmental obligations and emergency prevention/handling capacities can still be improved.

Increasing environmental pressure from spatial layout of the marine economy

Spatially, almost all coastal provinces have become “national-level” marine economic or coastal economic zones. In addition a number of sub-provincial strategic new zones such as Hengqin, Pingtan, and Zhoushan have been appointed. This makes regional marine economy development initiatives increasingly rise to the level of a “national activity”, and will surely result in greater tensions between coastal economic development and marine environmental protection.

China's major marine economic activities are located in and around the Bohai Sea Economic Zone, the Yangtze River Delta Economic Zone and the Pearl River Delta Economic Zone. Among these three zones, the Bohai Sea Economic Zone is the largest and its growth in recent years is still relatively strong (Table 6-2). Its marine economic activities are dominated by resource-intensive and labour-intensive traditional industries, which generate relatively large pressure on shoreline space and the marine ecological environment. In addition, some large coastal industrial parks and engineering construction projects are not included in the statistics, e.g., the “coastal new city” in Tianjin. These construction activities occupy and destroy valuable natural coastline and offshore space, and impose long-term threats to the water quality.

Taking into account the cumulative land source pollution over the years due to inland economic development, the Bohai Sea can hardly sustain greater environmental impacts from future coastal and marine economic development. The Bohai Sea therefore warrants “special attention” in terms of a more sustainable marine economy and improved environmental governance. Furthermore, the more vulnerable coastal areas often face greater pressure

111 According to data in *Statistical Bulletin of China's Marine Economy (2011)* issued by SOA of China, some descriptions in *Marine Environment Bulletin of China (2011)*, and other related references.

112 Large-scale traditional industries refer to marine transportation, marine fishery and marine tourism, which have not developed quickly. Medium-scale industries refer to offshore oil and gas, marine shipbuilding and marine engineering construction.

from land reclamation that will result in loss of coastal wetlands and mud flats, loss of biodiversity, and aggravated regional marine disaster risks.

Table 6-2 Major Marine Economic Activities Distribution and Environmental Impact

Marine Economic Zone		Around-Bohai Sea Economic Zone	Yangtze River Delta Economic Zone	Pearl River Delta Economic Zone
Proportion of gross marine production in national total (%)	2008 ¹¹³	36.1	32.3	19.6
	2009 ¹¹⁴	37.6	29.6	20.7
	2010 ¹¹⁵	34.5	31.4	21.6
	2011 ¹¹⁶	36.1	30.1	21.5
Year-on-year growth (%)	2008	0.1	-1.4	0
	2009	1.5	-2.6	0.5
	2010	-0.1	-0.6	0.9
	2011	1.1	-1.9	0.6
Major marine industry		marine transportation, fishery, coastal tourism, oil and gas	coastal tourism, marine transportation, shipbuilding and fishery	coastal tourism, marine transportation, oil and gas and fishery
Marine environmental impact		Relatively heavy pollution from land-based source; high density of industry activities in shoreline and sea area; and large marine environmental pressure	Medium pollution from land-based sources; relatively high density of industry activities in shoreline and sea area; and relatively large marine environmental pressure	Relatively light land-source pollution; relatively high density of industry activities in shoreline and sea area; and relatively large marine environmental pressure

The existing marine economic development mode is characterised by the traditional land-based economic development and individual industrial sector development mode. This is not compatible with the requirement of modern-day marine economy development, which demands overall coordination, integration and open interaction among stakeholders. The current development mode neglects stakeholder's concerns about the protection of the marine ecological environment. The results are increasing destruction of coastal resources and problems with near-shore pollution.

6.1.3 Marine pollution in the Bohai Sea is serious and characterized by combined pollution sources

The Bohai Sea drainage basin includes seven major river systems: the Yellow, Haihe, Luanhe, Dalinghe, and Liaohe Rivers, plus the Shandong Peninsula water system and the Liaodong Peninsula water system. The semi-enclosed character of the Bohai Sea limits the exchange of water with the Pacific Ocean. The competition for marine resources, and the fragmented and haphazard development of various marine activities have resulted in environmental degradation over large parts of the area. At present, environmental pollution in the Bohai Sea is very serious with increasingly contaminated near-shore areas. The main pollutants are nutrients and petroleum.

The marine biological quality monitoring results from 37 sampling points in the Bohai Sea during 2010 show that the pesticide hexachloro-cyclohexane (Soprocide), DDT and PCB all comply with the Class I of marine organism quality standard. The percentage of compliance with the Class I standard for total mercury, petroleum hydrocarbon and cadmium are 92%, 73% and 68% respectively. The residual level of hexachloro-cyclohexane and PCB in shellfish in Liaodong Gulf has been decreasing continuously for the past three years.¹¹⁷ The residual level of petroleum hydrocarbon and lead in shellfish from the Bohai Gulf (an alternative name for the Bohai Sea) has, however, been

113 SOA of China, *Statistical Bulletin of China's Marine Economy* (2008).

114 SOA of China, *Statistical Bulletin of China's Marine Economy* (2009).

115 SOA of China, *Statistical Bulletin of China's Marine Economy* (2010)

116 SOA of China, *Statistical Bulletin of China's Marine Economy* (2011).

117 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2010)

increasing over the last three years, while the residual level of cadmium has continuously dropped over the last three years. Even so, the status of the ecosystem in the Bohai Sea is still unhealthy. In terms of pollution types, it can be seen that environmental pollution in the Bohai Sea has gradually transformed from single industrial pollution featured by oil and heavy metals, towards combined pollution of industrial, domestic and agricultural non-point source pollution.¹¹⁸

6.1.4 Marine pollution in the Bohai Sea is dominated by land-based pollution, with an increasing proportion of ocean-based pollution

Total pollution discharge from land-based sources remains high and marine function of some areas is seriously damaged

In 2010 and 2011,¹¹⁹ the compliance rate from pollution sources along the Bohai coast was only 46% of all the sources monitored. According to the monitoring results of total pollutants discharged into the sea from main rivers in 2010, more than 70% of the pollutants are discharged into sensitive marine functional zones, resulting in a water quality compliance rate of 79.8%, 68.5% and 58.8% for nature reserves, tourist areas and fishery areas respectively. The sediment contamination in key areas is severe, especially for mercury, lead, arsenic, copper, petroleum hydrocarbon and DDT. Meanwhile, shrinkage of wetland areas and reduction of fresh water into the sea from river basins has resulted in seawater intrusion in the Bohai region in Liaoning and Shandong Peninsula Coastal Region of up to 1300 km². This represents 90% of the total national seawater intrusion area.¹²⁰ Furthermore the contribution of large quantities of nutrients from terrestrial sources to the sea is one of main causes of frequent offshore red tide and green tide disasters in China.¹²¹

Sea-based pollution is increasing and the overall pollution is getting worse

Marine ecological environmental disasters are frequent. In 2010, 69 outbreaks of red tide was observed in all Chinese sea areas,¹²² covering a total area up to 10,892 km², including 7 times in the Bohai Sea with a total area up to 3,560 km² (mainly from *Noctiluca scintillans* and *Cryptomonas* outbreaks). In 2011, outbreaks of red tide occurred 13 times in the Bohai Sea,¹²³ with an area of about 217 km².

Seasonable increase of atmospheric pollution deposition in certain sea areas. The monitoring result of atmospheric pollutant settlement in the Bohai Sea area in 2010 shows that atmospheric dry deposition of pollutants in the Bohai Sea in spring and autumn is higher than that in summer, and atmospheric wet deposition flux is higher in summer than in spring and autumn. Among 11 kinds of pollutants being monitored, ammonium salt and nitrate are relatively high. For heavy metals, zinc is relatively high in the Bohai Strait and eastern sea area of the Liaodong Gulf, zinc and cadmium are relatively high in the Bohai Gulf and the Laizhou Bay sea area.¹²⁴ In 2011, atmospheric pollutant wet deposition in the Bohai Sea is predominantly by nitrate. The maximum wet deposition of inorganic nitrogen appeared in the Tanggu monitoring station ($11.0 \times 10^3 \text{kg/km}^2 \cdot \text{a}$), and maximum heavy metal as copper appeared in the Tanggu monitoring station ($4.9 \text{kg/km}^2 \cdot \text{a}$), and maximum lead appeared in Yingkou Xianrendao monitoring station ($0.7 \text{kg/km}^2 \cdot \text{a}$).

118 CCICED, *Ecosystem Issues and Policy Opinions Addressing Sustainable Development of China's Ocean and Coast* (2010), p31.

119 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2011).

120 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2010).

121 CCICED, *Ecosystem Issues and Policy Opinions Addressing Sustainable Development of China's Ocean and Coast* (2010), p21.

122 SOA of China, *Marine Environment Bulletin of China* (2010).

123 SOA of China, *Marine Environment Bulletin of China* (2011).

124 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2010).

The eutrophication situation is getting worse. In the most recent ten years, compared with the last century, the outbreaks of red tides has increased in frequency and total area affected by such blooms have gone up. The main source of such blooms of toxic microorganisms is pollution generated from human activities.

6.1.5 Intensifying conflicts between economic development and environmental pollution in the Bohai Sea

Frequent oil spill accidents degrade the marine environment

Ocean oil spills can cause serious damage to biological resources, and thus are regarded as the most important pollution threat in the sea. In 2010, there were 195 offshore oil gas platforms in operation in China,¹²⁵ in which the Bohai Sea is the largest marine oil area. Up to 2009, there were 21 offshore oil and gas fields in the Bohai Sea with total 1,419 production wells and 178 offshore oil production platforms.¹²⁶ On average, one oil spill accident happened every four days in China's coastal areas. From 1998 to 2008, 733 ship oil spill accidents occurred in the sea areas under China jurisdiction.¹²⁷ On 16 July 2010, an oil pipeline of PetroChina Dalian Newport Oil Reserve had an accident involving an explosion and subsequent oil leakage. In June 2011, what was perceived to be a major oil spill accident happened in the Penglai 19-3 oil field on Bohai Bay. In addition, small oil spill accidents also happened in Bozhong 28-2 south oil field, Chengdaoxi A platform, Suizhong 36-1 oil field and Jinzhou 9-3 oil field.¹²⁸ In recent years, oil spill and oil leakage accidents due to oil and gas development activities have taken place frequently, leading to a large number of crude oil spills into the sea and causing serious impacts on the surrounding marine environment.

Increasing discharge of pollutants from marine oil and gas drilling areas continuously affect water quality

The main source of pollutant discharge from offshore oil and gas regions comes from production wastewater, drilling fluid, drillings and domestic sewage. In 2010, discharge amounts of production wastewater, drilling fluid, drillings, and domestic sewage from offshore oil and gas fields in the Bohai were $623.19 \times 10^4 \text{ m}^3$, $1.04 \times 10^4 \text{ m}^3$, $3.04 \times 10^4 \text{ m}^3$ and $12.05 \times 10^4 \text{ m}^3$, respectively. In 2010, seawater environment monitoring in the Bohai Sea (from 17 offshore oil and gas fields) showed that petroleum hydrocarbon concentrations in Jinzhou 21-1 oilfield area in the spring exceeded the Class I of sea water quality standard.¹²⁹ Although the petroleum concentration in other oil and gas fields has complied with the standard, which indicating obvious improvement compared with 2009, the overall water environment quality is not adequate. In 2011, monitoring results in 22 marine oil and gas regions (clusters) and in Bohai Sea show that the "Penglai 19-3 oilfield oil spill accident" had a serious influence on environmental conditions. The impacts of the "7.16 Dalian oil pollution accident" on the marine environment so far have not been fully eliminated; obvious petroleum pollution still exists in the marine environment, and its effects on Boshiwan beach and intertidal zone organisms still exists.¹³⁰

Increasing instances of dumping of solid waste seriously affects the marine environment

Monitoring results in 2010 of the water and sediment quality, and in benthic communities, in five relatively large marine dumping areas in the Bohai Sea show that temporary dumping is not in compliance with the Class I seawater quality standards; and the dumping activities impacted water depth and submarine topography. For instance, water

125 SOA of China, *Marine Environment Bulletin of China* (2010).

126 CCICED, *Ecosystem Issues and Policy Opinions Addressing Sustainable Development of China's Ocean and Coast* (2010), p33.

127 <http://news.sohu.com/20110707/n312681416.shtml>.

128 SOA of China, *Marine Environment Bulletin of China* (2011).

129 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2010).

130 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2011).

depth south of C1 temporary dumping area of Huanghua port has decreased to less than 60% of the original water depth.¹³¹ In addition, wastes such as plastic bags and fishing nets are found in large volumes. In 2010, monitoring results of Gaolin Wanjia sea area near Huludao City show that the average density of submarine garbage (rubber pieces, plastic bottles, paint buckets, etc.,) is about 313.8 kg/km². The approved garbage dumping into the Bohai Sea in 2011 is 22.68 million m³, a 31.3% increase over 2010.¹³²

Increasing pollution from aquacultures in the Bohai Sea increase the problems with eutrophication

Since 1990, China's aquaculture production has remained the largest in the world, and China is the only country in the world with aquaculture production higher than fishing production. At present there is a total of 226 seawater aquaculture areas in the Bohai Sea, taking up 16.8% of the offshore area. Intertidal mudflat aquaculture has the largest share, 4,240 km², accounting for 71.7% of the total area of aquaculture. Raft culture has the second largest culture area, 559 km², accounting for 9.5% of the total area.¹³³ The rapid development of aquaculture brings serious pollution to the sea. Research shows that 20% of the food input for cage culture is not eaten, thus becoming waste. Although the pollution discharge arising from marine culture operations only accounts for about 5 % of gross pollutant discharge into the sea, a large portion of the pollutants are nutrient substances, such as residual food and excrement that cause eutrophication of the surrounding water. This makes offshore aquaculture an important contributor to the occurrence of red tides.

Pollution from intensive ship and port operations seriously affects offshore aquaculture environment

In 2008, China had more than 240,000 ships with a total DWT of more than 70 million tonnes, ranking second largest in the world. China has 1,430 ports and 34,000 berths.¹³⁴ There are 79 ports around the Bohai Sea shoreline, at an average port interval of 65 km, of which there are 9 major ports with individual capacity of more than 200 million tonnes.¹³⁵ Ports and ships are an important source of marine pollution. Ships docking at ports and various operations at ports will directly pollute the surrounding water environment. In addition, oil spills caused by ship collision/sinking, and wastes from ship dismantlement (residual oil, waste oil, oil sludge, oil-contaminated sewage, heavy metals, etc.,) pose a serious threat to marine and coastal environments. According to available statistics, 35% of marine environment pollution comes from ship oil spills.¹³⁶ These pollution sources are a serious threat for development of near-shore and offshore aquaculture.

6.2 EXPERIENCES, LESSONS AND IMPLICATIONS FROM TYPICAL CASES OF MARINE OIL SPILL RESPONSES

6.2.1 Ineffective marine oil spill management and insufficient emergency response capacity in China

On June 4 and June 17, 2011, two oil spills occurred in the *Penglai 19-3 oilfield in the Bohai Bay*. It has been said that they caused seawater pollution around the oilfield and northwest sea, covering an area of several thousand

131 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2010).

132 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2011).

133 North China Sea Branch of SOA, *Marine Environment Bulletin of North China Sea* (2010).

134 Dinesh C. Sharma, *Pollution in Harbors are Attracting More Attention*, Environmental Health Perspectives in USA (Chinese Version), March, 2007, Vol. 115, No. 1c, p5-6.

135 http://www.idoican.com.cn/ido/paper/briefArticle.do?article=nw.D210200xsb_20110311_4-03.

136 http://www.simic.net.cn/news_show.php?id=113965

square kilometres (non-compliance with Class I seawater quality standard) and a large area of sediment pollution. Exact figures are not quoted since there are various views about the extent.. However it has been suggested that some 870 km² of the sea area was severely polluted (the content of petroleum-based pollutants apparently exceeding Class IV seawater quality standard), which caused significant impact on marine ecology and fishery production. The accident investigation report from the State Oceanic Administration pointed out that the operator, ConocoPhillips China Inc. (COPC), violated the overall plan of oilfield development during its operation. There were defects and negligence in the safety of the operations, and preventive measures were not in place. This finally resulted in the Penglai 19-3 oil spills. In accordance with the Chinese-foreign cooperation contracts signed, COPC was the operator of this oilfield and therefore must take full responsibility for this oil spill accident.^{137, 138}

Inadequate and late information disclosure

It took as long as one month for the information about the oil spill to be disclosed by relevant parties under media and public pressure. Furthermore, the State Oceanic Administration (SOA) only announced causes of the accident and did not publish any results for other investigations in time. On July 27, 2011, the North China Sea Branch of SOA started to publish updated information on the oil spill on its website.¹³⁹ So far, the basis of damage evaluation for marine ecology compensation and fishery losses and the content of the agreements reached between the relevant parties have still not been published. Due to the absence of systematic measures related to the handling of oil spill accidents in China, there is a lack of corporate social and environmental responsibilities at the part of the enterprises. This puts the public in an unfavourable situation with respect to information disclosure. In the Penglai 19-3 case, the relevant parties didn't disclose information related to the accident timely, actively and adequately according to relevant regulations in "*Regulation on the Disclosure of Government Information*". This has caused widespread public criticism and undermined the credibility of the government. It also hindered the mobilization of all parties to timely respond to the accidents. In particular, it failed to enable fishery operators to timely control and minimize losses and collect evidences to be able to put forward damage claims.

Ineffective regulation and missing responsibilities

According to the SOA Joint Investigation Group there was a lack of self-regulation and environmental responsibility on the part of the COPC. Its petroleum production operation and reinjection of debris violated the overall development plan, and caused the spill as a result of a well kick (blowout). Furthermore, when signs of the accident appeared, operations were not stopped in a timely manner in order to investigate the cause of the pollution. This aggravated the extent of the pollution. In addition, the depth of the surface casing of this well was too shallow. This violated the requirements in the environmental impact assessment and undermined the emergency handling capacity, so additional leakage occurred.¹⁴⁰

There have been various comments about why information was not released in a timely fashion, and much finger pointing among the key players. In the Joint Investigation it was suggested that the COPC did not recognize the seriousness of the accident, and hid the truth through reporting false information and covering up mistakes. This caused continued oil spill and widespread pollution and aggravated damage. On June 4, 2012, another oil spill

137 SOA, *the Joint Investigation Group of PL 19-3 Oil Spill Accident Announced the Findings and Cause*, November 11, 2011. <http://www.soa.gov.cn/soa/news/importantnews/webinfo/2011/11/1320551791757083.htm>

138 SOA, *Report on the Accident Investigation Process by the Joint Investigation Group of PL 19-3 Oil Spill*, June 21, 2012. <http://www.soa.gov.cn/soa/news/importantnews/webinfo/2012/06/1339980559103721.htm>.

139 <http://www.ncsb.gov.cn/oilspill/index.asp?pageno=8&pagesize=1>.

140 SOA, *the Joint Investigation Group of PL 19-3 Oil Spill Accident Announced the Findings and Cause*, November 11, 2011. <http://www.soa.gov.cn/soa/news/importantnews/webinfo/2011/11/1320551791757083.htm>.

accident occurred in the Penglai 19-3 oilfield during the process of transferring crude oil and a small amount of oil was spilled.¹⁴¹ This indicated severe problems in the internal management of COPC.

China National Offshore Oil Corporation (CNOOC), as one of the central-level SOE and a main investor and partner of COPC in China, failed in performing the responsibility of direct supervision on its partner's operation as required in accordance with “*Regulations on the Exploitation of Offshore Petroleum Resources in Cooperation with Foreign Enterprises*”. As the department in charge of the administration of environmental protection in the exploitation and development of offshore petroleum stipulated in “*Regulations on the Administration of Environmental Protection in the Exploitation and Development of Offshore Petroleum*”, the SOA and its North China Sea Branch were unable to locate the oil spill in time in order to start the clean-up in the early phase of the accident. The Ministry of Environmental Protection (MEP) did not play an overall supervision and coordination role as specified in the “*Environmental Protection Law*”, and only participated in the joint investigation group. It has been suggested that the Ministry of Transportation (MOT) had responsibility for coordination.

Furthermore, the investigation group was led by SOA, a sub-ministerial body, which according to the regulations should coordinate other ministries. This misalignment of levels would certainly affect the effectiveness of the coordination. Up to now, SOA has not fully explained the issues of causality and coordination that increased the difficulty of handling the Bohai Bay oil spill accident. This also implies that the subject of liability related to the affected fishermen became more complicated. The scope and depth of the joint investigation led by SOA (with participation of seven administrative bodies and ministries) were insufficient. It lacked participation from the judicial department, People's Congress, and the securities and state-owned assets management authorities. In addition, the relevant coastal provinces and departments did not actively engage in the accident handling (e.g., investigation, response and rights claim).

The main reasons for these failures are:

- *the interests of regulator and the enterprises are not separated but mingled;*
- *excessive bureaucracy prevented effective action;*
- *technology was out-dated;*
- *the number of agencies involved prevented effective regulation of the operation;*
- *weak regulations not clearly expressing the responsibility of the operator.*

Currently, the administrative supervision and management system neither clarify the liability of the responsible party nor foster an appropriate quality assurance system through imposing strong obligations.

Insufficient emergency response and slow reaction

a) *Emergency response capacity was insufficient.* The SOA does not have the ability of emergency response for marine environmental accidents; the remediation was mainly conducted by CNOOC and by renting vessels from industrial enterprises, while the Ministry of Transport, which has the oil clean-up capacity, was not directly involved. Since the authority in charge has no ability to mobilize emergency response, while the department with this ability did not participate, the time of oil removal and recovery lasted from June to September. Meanwhile, the accident also revealed the weakness of some marine oil exploitation and drilling technologies in China.

b) *Relevant parties did not act according to the corresponding emergency plans.* According to regulations in the “*Execution Procedures of Oil Spill Emergency Response to Marine Oil Exploitation and Development*”, both the volume and area of spilled oil in this accident were classified as belonging to the Level I response standard, i.e.,

¹⁴¹ <http://www.ncsb.gov.cn/oilspill/file.asp?idnum=149>.

a significant environmental pollution incident. However, SOA did not start the Level I response procedures stipulated in *Emergency Plan of Oil Spill Accident of Marine Petroleum Exploitation and Development*, and the North China Sea Branch started only a Level III emergency response procedures. Moreover, losses in this accident exceeded RMB10 million yuan, which is classified as an extraordinarily significant environment incident. However, MEP did not start Level I responses according to the *National Emergency Response Plan for Abrupt Environmental Accidents* issued by the State Council. The State Administration of Work Safety (SAWS) did not start the *Emergency Plan of Accidents and Disasters of Marine Petroleum and Natural Gas Operation*.

- c) **Warning levels of emergency plans in different government levels and departments were inconsistent.** Although there are corresponding emergency plans at all levels from national government to local governments and even to ports in China, they are not unified and coordinated. For instance, the warning level of oil spill from ships is inconsistent with that for oil spills originating from an oil platform; therefore, the final response efficiency is low.
- d) **There is a lack of a national emergency plan.** The *Emergency Plan of Oil Spill Accident of Marine Petroleum Exploitation and Development* of the SOA is only a sectoral plan from a single department under the State Council. With the increasing expansion of marine oil exploitation and increasing impact on coastal fishery, tourism and economy by marine oil spill accidents, it is necessary to upgrade this emergency plan to a national level plan, or to formulate a national emergency plan for significant marine environmental accidents (including oil spill), so as to unify warning standards and classes, establish various levels of emergency response organizations, establish a smooth inter-departmental coordination mechanism, construct an emergency response infrastructure, and allocate emergency resources in a unified way.

Light punishment and low compensation

- a) **Penalties for violating laws and regulations to protect the environment too low.** The SOA could impose only a RMB 200,000 yuan penalty on COPC in accordance with relevant provisions of the *Marine Environmental Protection Law*.¹⁴² In addition, there is no judicial intervention, and thus no criminal prosecution for significant environmental pollution crimes as stipulated in the *Criminal Law*. Considering the economic turn-over in the offshore oil industry a penalty of 200,000 yuan does not play a significant role either as punishment or deterrent in general.
- b) **Claims and compensation for environmental damages must be coordinated and payment made without delay.** SOA claimed 1.683 billion yuan for marine ecology compensation and the Ministry of Agriculture (MOA) claimed 1.35 billion yuan of damages for fishery resources compensation. COPC paid 2.303 billion yuan of the total claim by SOA and MOA, while the remaining amount was paid by CNOCC. Furthermore, CNOCC has promised to pay substantial money for ecological compensation including research funding. However, civil claims have not yet been started. The civil claims from Shandong, Hebei and Liaoning have far exceeded claims by the central government.¹⁴³

The current Maritime Environmental Protection Law is basically a single law for preventing marine pollution, with the main purpose of serving economic development. It lacks content needed for adequately protecting and improving marine ecological environment through compliance measures such as high fines and other claims.¹⁴⁴

142 SOA, *Report on the Accident Investigation Process by the Joint Investigation Group of PL 19-3 Oil Spill*, June 21, 2012. <http://www.soa.gov.cn/soa/news/importantnews/webinfo/2012/06/1339980559103721.htm>.

143 Dinesh C. Sharma, *Pollution in Harbors are Attracting More Attention*, *Environmental Health Perspectives in USA* (Chinese Version), March, 2007, Vol. 115, No. 1c, p5-6.

144 Wang Shuguang, *Marine Management in China*, Ocean Press. Beijing, 2004, p56-57.

Ineffective law enforcement and incomplete laws and regulations

It seems from the Bohai Sea oil spill that there is, in the normal management of marine resources, a lack of specifications of how to compile, review, approve, implement and supervise the operations in marine oilfields. The Environmental Impact Assessment (EIA) and environmental review system is not fully implemented during the process of developing an oil and gas field, and the environmental safety supervision and regulation on operating entities is deficient. From the discovery of the 19-3 oil field in 1999 to the accident in 2011, i.e. over more than 10 years, the company and relevant authorities have not tracked and evaluated the implementation of the overall oil field development plan. Proactive reporting from enterprises and disclosure of government information fell behind. The legislation on environmental information disclosure in China is incomplete and weak in actual operability. The supporting system of supervision, liability mechanism and remedy system for protecting the public's right to know is also incomplete.

The existing legal basis related to assessment of marine oil pollution damage and claims for marine ecological environment in China is insufficient and there is no unified system for litigation procedures. There is also a lack of operability, resulting in confusion and difficulties in enforcement.¹⁴⁵ Although the Marine Environmental Protection Law has identified the compensation system for ecological damages in principle, responsibilities for compensations for damages from marine oil spills have not been clearly defined, and the contents, procedures and standards of compensation as well as the rights and obligations between parties receiving compensation and parties paying compensation, are not specified. Besides, lower-level regulations on marine ecology damage compensation¹⁴⁶ have not been detailed, so the compensation for marine ecology damage is difficult to implement.

In 2007, SOA issued the ocean sector industrial standard *Technical Guidelines for Ecological Damages Assessment on Marine Oil Spills*, but it is not a regulation designed as an administrative penalty. Therefore, the standard could only be a reference for court decisions instead of the basis for litigation. In 2008, MOA took the lead in formulating the national standard of *Calculating Methods on the Economic Loss of Fishery Pollution Accidents*. In June of 2010, Shandong Province was the first to issue regulations related to marine ecology damages and compensation in China. Although the above regulations and acts identified the subjects to be compensated, the compensation standard was not explicitly defined (e.g., specific standards and fixed number of years of compensation, etc.), so the operability still remains to be seen.

6.2.2 Effective marine oil spill management system and rapid emergency response in the United States

On April 20, 2010, *Deepwater Horizon*, a drilling platform in the Gulf of Mexico, under the control of the BP Company suffered from an explosion and sank due to a burst of methane gas from the well. The accident killed 11 workers and injured 17 others, and more than 200,000 million gallons (about 750,000 m³) of oil spewed out of the well, contaminating a sea area of 1500 km². The oil leakage continued for 85 days. The full evaluation of the damages to the Gulf environment caused by this oil spill may take decades to carry out. It is clear, however, that the oil spill severely impacted the economic development of residents around the Gulf.

The main reasons for this accident involve three aspects: **(a) Weak self-supervision by the industry and lack of sufficiently robust technological safety mechanisms and procedures.** There were inadequate communications between

¹⁴⁵ China Institute for Marine Affairs, *China's Maritime Development Report (2012)*, Ocean Press, Beijing, 2012, p233.

¹⁴⁶ Lower-level law and upper-level law are the two basic categories used to differentiate the legal levels established in *Legislation Law of China*. The former is the derived law according to the principle and procedures, i.e., regulated by the latter. And the former needs to be subordinate to the latter, as clause 87 stipulates in *Legislation Law of China*. For *Marine Environmental Protection Law*, the laws related to marine ecology damage compensation belong to the lower-level ones.

the management systems of the various parties involved in drilling operation of the oil well, and inadequate risk awareness in decision-making. The drilling technology adopted was not the most advanced, with serious technical faults. At the critical moment operational safety procedures were not followed and serious mistakes were made. **(b) Weak government regulations failed to control the risk of explosion.** Minerals Management Service of the U.S. Department of the Interior was the supervisory organization for offshore crude oil development, and was accused of negligence in their management. The staff in the Minerals Management Service had no experiences of supervising deepwater drilling and did not receive relevant training, and in addition failed to follow the rules and regulations. The Service's risk assessment failed to keep up with deepwater drilling development. Besides, when the Obama administration announced that the "ban" on offshore oil exploitation in the Gulf of Mexico was lifted, no strict measures for supporting supervision were taken. No proper environmental assessment was performed when the offshore oil and natural gas drilling permit was issued. **(3) An imbalanced national energy policy has encouraged overdependence on oil and gas.** The US government over the past 30 years or more failed to make decisions on offshore oil exploitation and other domestic actions for energy security, leading to the situation where the current generation of Americans has become heavily dependent on external oil resources to an extent that threatens a way of life.¹⁴⁷ There were thus great pressure to produce this well at a high flow as quickly as possible.

Quick and effective emergency responses

- a) Emergency response is quick.** When an oil spill accident occurs, the US government initiates national, regional and local emergency command systems to unify and coordinate all departments in the effort to stop leaks, undertake treatment and recovery from an offshore oil spill. On the day of the explosion at the *Deepwater Horizon*, the US government started the national marine oil spill emergency response system and established a local emergency command centre with the US Coast Guard (USCG) as the core body. The next day, the regional emergency group started to coordinate the federal Coast Guard, Department of Homeland Security, Department of Commerce and Department of the Interior, and to offer technical suggestions and assemble goods and materials from subordinate bodies and emergency response reserve station for taking preventive/remedial measures and performing search and rescue. On the third day, the national oil spill emergency response group was tasked with the responsibility of coordinating emergency preparations and handling pollution of oil and harmful substances, and a decision was made that the BP Company should be in charge of stopping leakage and oil clean up operations. Meanwhile, US Environmental Protection Administration (USEPA) experts provided guidance on oil clean up. The National Oceanic and Atmospheric Administration (NOAA) provided forecasts on the oil drift trajectory to help the clean up group adjust remedial measures according to weather changes.
- b) Multiple technologies were used to remove and prevent oil leakage.** At first, the BP Company assigned underwater robots to repair the safety valves and assigned ships to remove leaked oil, and drilled two new wells to relieve the pressure and reduce the rate of oil leakage. Although remedial technologies adopted are mainly conventional techniques during the remedial process, the final remediation effects were obviously due to the support of national marine oil spill emergency response system, adequate reserve of goods and materials, rational deployment and proper treatment.
- c) Active participation of volunteers was encouraged.** About 2,000 volunteers helped with oil clean up. BP Company set up a website for receiving suggestions from the public over the world. Tens of thousands of suggestions were received; some of them were classified as adoptable suggestions. The government recruited volunteers to clean up oil contaminations on birds and wild marine animals.

¹⁴⁷ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deepwater Report to President*, January, 2011, pp. 87-307.

d) **System reforms and remedial measures were actively promoted.** President Obama established an independent committee to investigate this accident. Granting of new deep-water exploration permit was suspended for half a year, and those permits already issued were subject to re-evaluation to prevent similar accidents. The Department of Interior announced the separation of the National Mineral Management Service into three independent agencies, the Bureau of Ocean Energy Management, Bureau of Safety and Environmental Enforcement and the Office of Natural Resources Revenue. It is also planned to revise the \$75 million upper limit of an oil company's damage compensation stipulated in the *Oil Pollution Act of 1990*, either to increase the upper limit, or not to have an upper limit. Moreover, the government actively intervened in the claim for compensation, and especially, the Department of Justice initiated civil and criminal investigations to force the BP Company to set up a \$20 billion compensation fund.¹⁴⁸

Complete emergency management system for marine oil spill

6.2.3 Problems in the oil spill emergency response¹⁴⁹

The emergency preparedness was insufficient to actively respond to a large-scale deep-water oil spill. When the oil well exploded, the federal government was unable to monitor the containment of deep-water oil well, underestimated the amount of oil leakage which in turn resulted in poor implementation of measures, plans and analyses of oil well containment. In the absence of effective techniques to stop the blow-out, the BP Company used unproven measures to try to control the spill. A key technical problem was the blowout preventers which did not function properly.

In addition the massive use of oil dispersants might cause secondary pollution although it probably prevented shoreline contamination. About 7,000 tons of dispersants were used to treat the spilled oil. Some of those dispersants contained petroleum products with significant toxicity (Crystal Clear Oil Dispersant and kerosene). However, despite these problems, the emergency management system for marine oil spills in the US is effective.

The *Oil Pollution Act of 1990* provides a fundamental base for the establishment of an emergency response system for offshore oil spills. An emergency command and response systems for all levels (including national, regional and local levels) has been established. The US Coast Guard (USCG) has the role to make the final decisions on behalf of the government, to coordinate and with a responsibility to combine the administrative areas and districts. The USCG can initiate national emergency response plans and authorize coordination whenever necessary to facilitate communication among relevant national and regional authorities and the stakeholders involved. It plays a decisive and important role in carrying the national emergency response strategies forward.

A system of oil spill clean up funds has been established. The federal government has established a \$1 billion oil spill clean up fund, and could demand accountability of the oil spill polluters. Meanwhile, a \$100 million oil spill clean up fund was established through legislations of various states. The main sources of the federal oil spill fund come from: 25 cents per barrel levied on domestic and imported crude oil; bank interest on the oil spill fund; damages paid by polluters for oil spills; penalties paid by polluters for oil spills; and money from other funds in an emergency situation. The oil spill fund is managed by the National Oil Pollution Trust Fund Centre.

The drilling and production operators are members of oil spill clean up associations. Such associations have been set up for mutual benefit to any operator in case of an accident. They maintain the stocks of equipment and has trained personnel on stand-by and will start operating immediately in connection with an accident. The specialized

¹⁴⁸ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deepwater Report to President*, January, 2011, pp. 87-307.

¹⁴⁹ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deepwater Report to President*, January, 2011, pp. 87-307.

spilled oil clean up associations are non-profit organizations, and their main expenses and equipment cost are covered through membership fees paid by members including oil refineries and oil companies.¹⁵⁰

6.2.4 Effective marine oil spill management system and emergency response in Norway

On December 12, 2007, an oil spill accident happened when one platform on the Statfjord oil field in the North Sea in Norway pumped oil to the tanker Navion Britannia via pipelines. About 3,220 tonnes (24,150 barrels) of crude oil was spilled into the North Sea. This oil spill accident is the country's second largest ever.¹⁵¹ However, the emergency response was active and effective to a large extent due to the sound overall marine oil spill management system.

6.2.5 Effective marine oil and gas exploitation management system

Integrated marine oil and natural gas exploitation management system is implemented. In Norway, there are a number of Ministries involved in management of marine oil exploitation activities. The Ministry of Petroleum and Energy has the overall responsibility for exploration and exploitation activities; the Ministry of Finance is in charge of finance, including taxes; the Petroleum Safety Authority of the Ministry of Labour is responsible for operation safety; the Climate and Pollution Agency of the Ministry of the Environment is in charge of pollution discharge permit (including pollution prevention and response requirements); the Ministry of Health and Care Service is responsible for workers' health; and the Coastal Administration of the Ministry of Fisheries and Coastal Affairs is in charge of the Governments' response system to oil spill accidents, including oil remediation. Although different agencies have specific division of responsibilities, the effective integrated management is carried out during the management of oil and gas development activities. In case of oil spill accident, the Petroleum Safety Authority will be notified by the Operator and report it further to the other Ministries.¹⁵²

Pollutant discharging permit system for oil production is carried out. The oil company that has obtained the rights to conduct exploration and exploitation in a certain area of the continental shelf is required to apply for a pollutant discharge permit before starting its drilling operation. The pollutant discharge permit is issued by the Climate and Pollution Agency. It covers every activity of the company that may have an impact on the environment, including oil spill emergency plans and response requirements as well as all requirements to address environmental risks. The company has a constant obligation to review and revise its emergency response plan to accommodate actual conditions. The relevant departments (such as environment protection authorities) will conduct regular inspections of the operation of the company to ensure that its daily operations comply with relevant rules and regulations and special requirements in permits. This system emphasizes trust, communication and transparency between governmental departments and petroleum industries, and has been implemented for more than 30 years.¹⁵³

It is specified that the production company is responsible for accident prevention and emergency response. *Pollution Control Act* of 1981 is the legal basis of preventing and responding to oil spill accidents. It explicitly stipulates that those responsible for oil and gas exploitation activities bear the obligations for oil spill prevention and emergency response. It also requires that the developers whose activities might possibly cause contamination shall have necessary oil spill prevention and response plans to prevent, detect, stop, eliminate and limit impacts caused by pollution. The oil spill prevention and response plans shall be drawn up according to probability of pollution and extent of

150 Peter K. Velez, *Summary of the United States Offshore Oil Pollution Prevention and Response Regulatory Scheme*, August, 2012.

151 <http://www.coes.org.cn/shownews.asp?id=101>.

152 Per W. Schive, *Oil spill preparedness and response – Norwegian legislation and administrative arrangements regarding preparedness and response for accidental oil spill from offshore oil and gas activities*, July 2012.

153 Per W. Schive, *Oil spill preparedness and response – Norwegian legislation and administrative arrangements regarding preparedness and response for accidental oil spill from offshore oil and gas activities*, July 2012.

damage. A risk-oriented approach is adopted, which requires that all operators must have a prevention and response plan that always matches with the dynamic business risks.¹⁵⁴

6.2.6 The national marine oil spill management system must be improved

Emergency plans fully ensure the sharing of emergency response resources.

The petroleum industry, the municipalities and the Government all have prepared emergency plans based on environmental risks and oil spill emergency evaluation. The main principle is that the operators must have a well prepared and implementable oil spill emergency plan and all the necessary response resources to handle any oil spill situation caused by the offshore operations. Generally, they should have their own resources (trained personnel, oil booms, skimmers, vessels and other equipment) which could be used according to the emergency plans to handle the spill. They shall also be responsible for having guaranteed availability of any additional reserves of equipment resources and that these can be mobilized without delay in a worst-case situation. This may include resources owned by others or owned mutually, and available through agreements in the case of a major accident. If necessary, as the supervisory organization of oil spill incidents, the Coastal Administration could take over action management by laws and mobilize all available resources obtained from private and public departments as national prevention and response reserves. In addition, an advisory group consisting of representatives from government and public consulting entities may be established.¹⁵⁵

National oil spill prevention and emergency plan system functions well. The point of departure according to the Norwegian Pollution Control is that in the case of oil spill accidents caused by offshore oil and gas exploitation activities, the remediation of these accidents would be entirely under the responsibility of relevant enterprises. By law, these enterprises/operators must always have effective emergency plans in place. The municipal government shall have necessary oil spill prevention and response plans to cope with minor accidents that cause pollution. In addition, the Coastal Administration has the responsibility to provide for the necessary oil spill prevention and response plan at the national level to handle major pollution accidents (e.g., oil spills from ships) that are beyond the prevention and response range of municipal government or private companies. For fulfilling this responsibility the Coastal Administration needs to ensure that private sector, municipal and national oil spill prevention and response plans are compatible and coordinated.

Professional organizations for oil spill prevention and response has been founded. Relevant administrative authorities could require enterprises to found an independent professional oil spill prevention and response organization based on agreements. If there is no agreement, the pollution control authority could make a decision on the cooperative organization for oil spill prevention and responses, and allocate the cost sharing among participants. As a result, the petroleum industrial enterprises have established the Norway Marine Cleaning Allied Company, responsible for managing the oil spill emergency plans. In addition, if the company's resources were insufficient, the oil companies can mobilize resources from this organization.

Furthermore, **public participation** is an integral part of effective implementation and enforcement of environmental laws and regulations. The public has the rights to know the results of work, inspections and audit reports of relevant departments.

154 Per W. Schive, *Oil spill preparedness and response – Norwegian legislation and administrative arrangements regarding preparedness and response for accidental oil spill from offshore oil and gas activities*, July 2012.

155 Per W. Schive, *Oil spill preparedness and response – Norwegian legislation and administrative arrangements regarding preparedness and response for accidental oil spill from offshore oil and gas activities*, July 2012.

6.2.7 Pay great attention to offshore oil spill management systems and accelerate the construction of an efficient and effective emergency response model

Oil spill emergency response management system is clearly specified in relevant laws in foreign countries^{156, 157, 158}

The legal contents are relatively complete. The laws cover the following issues: organizations and their responsibilities; funding sources; required prevention equipment and recovery system for oil spill; procedures and standards for oil spill disposal; penalty system; and regulations on use of dispersants. For example, the US *Oil Pollution Act of 1990* and Norway's *Pollution Control Law* mainly focus on the protection of natural resources. In contrast, in China's *Marine Environmental Protection Law*, relevant provisions are not clear or absent. The main purpose of the law is to promote offshore economic development.

Legislation is general and covers all types of incidents. In the aspect of legislative technique, advantages of Norwegian laws are features of statute law in the continental legal system of Germany. Norway's *Pollution Control Law* can be applicable to all kinds of pollution. Compared with the situation in China, where there are many complex and interrelated administration structures that result in confusion in practice, the Norwegian law only use one "pollution control authority". Therefore, any change of institutional arrangements will not impact the integrity and authority of the law. Norwegian regulations on oil management put environmental protection, health and safety into one framework, and achieve these three social goals by supervising industrial activities. To a great extent, prevention of oil spill in oil development is achieved by ensuring production safety, equipment safety and worker operations.

Rules and guidelines covers details to ensure its applicability. The legislative advantage of the US is the level of detail that is addressed. US laws and regulations, such as *Oil Pollution Act*, *Federal Water Pollution Control Act* and *National Oil and Dangerous Article Emergency Response Plan*, have detailed provisions and a rigorous logical structure. Their applicability is ensured through auxiliary provisions such as guidelines and rules.

China must improve its laws and regulations and their enforcement. At present, the industrial technical standards used as the basis of claims are weak, while associated clauses in *Marine Environment Protection Law* are too general. Therefore, China should take the oil spills in Bohai as a turning point to establish a more demanding and strict legal system. The US *Oil Pollution Act of 1990* can be used as a reference to establish a law for oil spill emergency response by the state and relevant departments. The upper penalty limit in *Marine Environmental Protection Law* should be increased or abolished, clauses relevant to determination of damage compensation should be added, and law-enforcing departments should be authorized to take the mandatory measures when needed. Clauses should be detailed to differentiate slight and severe damage behaviour, differentiate categories of pollutants, define and specify the land and sea area zoning department responsibilities so as to enhance the law enforcement operability. Because environment and resources have many values, environmental legal relationships have both public right and private right aspects; therefore, the environmental protection law should be advanced from administrative regulation law towards social law. A public participation mechanism needs to be set up, and corporate information disclosure obligations should be strengthened.

156 Wang Zhugang, Dong Hua. *The Emergency Response, Disposal Measures and Revelations of Mexico Gulf Oil Spill in US*. The International Petroleum Economics. June, 2010, p1- 4.

157 Yang Yufeng, Miao Ren, An Qi, etc., *The Causes Analysis of Mexico Gulf Oil Spill and It's Enlightenment and Suggestion*. Energy In China. August, 2010, Vol. 32 No. 8, p13-17.

158 Wang Guanghui, Chen An. *Study on Mechanism for Handling Offshore Oil Spill Events*. Journal of Natural Disasters, December, 2011, Vol. 20 Suppl., p35-42.

One responsible authority should be in charge of offshore oil spill emergency management with coordination and cooperation from other relevant departments in foreign countries^{159, 160}

In the USA, the USCG is in charge of supervising and responding to offshore oil spills. In Norway, the Climate and Pollution Agency of the Ministry of Environment is in charge of supervising environment pollution caused by offshore oil, and the Fishery and Coastal Administration is in charge of responses to accidents.

In China, the SOA is in charge of supervising and responding to offshore oil spill from oil production platforms, and the MOT is in charge of supervising and responding to oil spills of ships. In China, offshore oil spill emergency response responsibility is divided by sectors, with the same function duplicated in various agencies. Such a situation is counterproductive to marine environmental protection.

By contrast in the foreign countries surveyed, authorities have good coordination for offshore oil and gas development and accident emergency management, and prevention and supervision of pollution is conducted by the responsible sectoral authority. In Norway, the Petroleum Safety Authority plays an important role in prevention and supervision of oil pollution. In the USA, the prevention of oil pollution is mainly supervised by the Environment and Safety Executive Agency. This arrangement shows the emphasis on industrial sector supervision and makes full use of industrial technologies, and tries to ensure industry's awareness of self-regulation. In Norway, the normal management authority for marine oil development is the environment protection authority, which exercises a "professional management" function, such as issuance of pollutant discharging permits for offshore oil development and approval of the use of oil dispersant. Such an arrangement is good for the uniformity of environment protection and reflects the "cross-sector" characteristics of environment protection. Certainly, this professional management is built upon a foundation of scientific monitoring data such as total amount of pollutants and chemical and biological characters of pollutants.

China must improve its emergency response mechanism. By establishing an integrated land and marine planning and coordination mechanism between ministries, cooperation and joint management can be developed and consolidated, so that enforcement of policies and laws can be better assured. A national level joint-action mechanism should be established with participation of many ministries. Stakeholders should share information through joint meetings in order to avoid overlap, ensure simultaneous implementation of rapid spill clean-up; efficient investigation of accident causes, acceptance of public claim litigation, remedial plans, information disclosure etc. A special risk fund should be considered with main contributions from oil enterprises. For serious environmental accidents such as offshore oil spills, an inverted burden of proof can be considered, and civil litigation and punitive compensation mechanism can be introduced. Proactive information disclosure and accountability mechanism of responsible parties need to be established so that the enterprise and relevant functional departments actively will disclose any relevant information, and engage in the damage mitigation process. A third party supervision and monitoring mechanism should be established to clarify environment protection responsibility of enterprises. An ecological compensation negotiation mechanism should be established to internalize the ecosystem damage activities, i.e., assess the value of marine ecological damages and let the liable party compensate the full cost of ecological damages. This effort will adjust relationships between environmental and economic interests, and will encourage environmental protection.

159 Wang Zhugang, Dong Hua. *The Emergency Response, Disposal Measures and Revelations of Mexico Gulf Oil Spill in US*. The International Petroleum Economics. June, 2010, p1- 4.

160 Yang Yufeng, Miao Ren, An Qi, etc., *The Causes Analysis of Mexico Gulf Oil Spill and It's Enlightenment and Suggestion*. Energy In China. August, 2010, Vol. 32 No. 8, p13-17.

Foreign emergency response emphasizes efficiency and effectiveness^{161, 162}

Emergency management should be both efficient and effective. An efficient response should be implemented without delay. It should be built on a comprehensive emergency handling system under the leadership of an emergency response agency. Effectiveness refers to operations that minimize the impacts of accidents. The emergency response should be built on sufficient contingency resources in the form of containment and clean up techniques and well-trained support personnel. Relevant laws in foreign countries specify the emergency response mechanism, organizations, responsibilities and authority of emergency management. An effective and efficient authority that has centralized power, reliable capital guarantees, and unified leadership, should have the capability of organizing, coordinating and commanding. There are multi-level management mechanisms from national to local levels with command institutions and rescue powers at different levels. Factors such as type of accident, scale of accident, probability of occurrence and potential social and environmental impacts, should determine the hierarchical disaster management system. When an accident occurs, a response is triggered depending on the size and type of the accident and the potential threats to environmental and economic resources. The collaboration of non-government organizations and volunteers in response to a clean-up effort should be carefully managed in order to be meaningful and safe.¹⁶³ Then the high efficiency of emergency response and the high benefits will be ensured.

China must develop an emergency response arrangement that will be able to respond immediately in the case of an accident. Currently, several governmental departments are involved in cases of oil spills offshore. An authority with overall responsibility for the situation must be appointed; emergency resources from the various departments should be integrated, and unified arrangements be made with clear distribution of responsibilities. The emergency disposal of minor offshore oil spills should be managed by the local and relevant departments according to different sectors. Drawing on US experiences, a national oil spill emergency response command system needs to be established in China, and cooperation among departments with overlapping functions should be strengthened to increase the response speed.

6.2.8 Improve China's offshore oil spill management system and improve the emergency disposal capability in a comprehensive way

Oil spill emergency management in several other countries is more efficient and effective

The national emergency plan usually takes the lead, and there are national and regional multi-level emergency command institutions whose responsibilities are identified according to the scale and range of the accident.^{164, 165}

In general, foreign emergency response organizations can be divided into a management layer and an operational layer. The management layer is mainly responsible for commanding and coordinating the oil spill response, and the operational layer is mainly responsible for pollution clearing on site. Meanwhile, the national emergency response systems will have a standing body such as a 24 hour spill alarm institution and emergency response command centre with supreme decision-making power.

161 Wang Zhugang, Dong Hua. *The Emergency Response, Disposal Measures and Revelations of Mexico Gulf Oil Spill in US*. The International Petroleum Economics. June, 2010, p1- 4.

162 Yang Yufeng, Miao Ren, An Qi, etc., *The Causes Analysis of Mexico Gulf Oil Spill and It's Enlightenment and Suggestion*. Energy In China. August, 2010, Vol. 32 No. 8, p13-17.

163 Gao Zhenhui, Yang Jianqiang, Wang Peigang, etc., *Theory, Method and Case Study of Ecological Damage Assessment of Offshore Oil Spill*, Ocean Press. Beijing, 2007, p389.

164 Wang Shuguang, *Marine Management in China*, Ocean Press.

165 China Institute for Marine Affairs, *China's Maritime Development Report (2012)*, Ocean Press. Beijing, 2012, p233.

At present, China has established ship oil spill emergency response centres at various levels with the Rescue Centre of Maritime Authority of MOT as the main body, with a set of emergency measures of its own. The other key departments, such as the China Meteorological Administration (CMA) and MOA, are not incorporated into the overall emergency system, while SOA, CNOOC, PetroChina and Sinopec also set up their own offshore oil spill emergency centres. In some countries, the oil spill clean-up is conducted by professional clean-up companies, or by special institutions of the government, or by both. Oil spill clean-up is implemented in the form of contracts in US and in the form of prior contracts in Norway, and the operator uses their own equipment or rented equipment or contracts professional oil clean-up companies. Both USA and Norway have national emergency plans, while China only has ministerial emergency plans.

China should prepare a national special emergency plan for serious offshore oil spill accidents, and form a well-coordinated emergency response system operative at national, regional and local levels. The different regional emergency plans should be prepared according to the needs and local conditions of the different sea regions. Based on the multi-level preparedness principle, an emergency response capacity compatible with local, regional, national or international level oil spill accidents should be formed at the various levels. Training and drill exercises must be carried out in an effective way so that personnel are well acquainted with the equipment and how to use it.

Foreign oil spill emergency management mechanisms are built on mutual agreements and cooperation

Both in Norway and the USA emergency response is based on the condition that the operator is responsible for both preparedness and response and that the company shall enter into prior agreements with pollution clean-up companies to guarantee that adequate pollution response is always available. Only when the accident is considered very serious, should the government get involved in the emergency response. The costs of pollution clean-up and environmental recovery can only be compensated by clearly identifying the responsibilities for compensation for such costs. The operator is responsible for emergency plan preparations, setting up of oil spill emergency teams and emergency response actions including training, equipment test, periodical drilling and emergency equipment inventory. This mode follows the “polluter pays” principle, and as a result, the person liable shall carry all emergency costs. This stimulates the enterprise to improve its prevention capacity, promote the development of an emergency response industry, and facilitate environment protection under a market framework. However in China, the government is mainly in charge of mobilization and organization, and the establishment of response-level principles and mechanisms. The enterprise is the person liable after an oil spill accident occurs, and the government supervises the oil spill emergency response.

The operator is required to immediately report the occurrence of oil spill accidents and the application of oil dispersant to the authority.¹⁶⁶ If violating the obligation of reporting, the operator will have to carry the administrative, civil and criminal responsibilities. The relevant authority is required to make relevant information available to the public. There also exist regulations in China that require government to disclose environmental information to the public. However, the scope of information disclosure is not specified. For instance, the public has no right to know the results of inspections and supervisions by the marine environment authority. This is different from practices in many other countries.

The ecological damage compensation system and oil clean-up fund system are well developed in US, which guarantee the resources needed for ecosystem restoration.¹⁶⁷ In the US, the natural resource damage compensation system, (similar to the ecological damage compensation in China) was set up by the *Oil Pollution Act of 1990* and

¹⁶⁶ Peter K. Velez, *Summary of the United States Offshore Oil Pollution Prevention and Response Regulatory Scheme*, August, 2012.

¹⁶⁷ Peter K. Velez, *Summary of the United States Offshore Oil Pollution Prevention and Response Regulatory Scheme*, August, 2012.

relevant laws, and an Oil Spill Responsibility Trust Fund was established according to *Internal Revenue Code of 1986*. In Norway, the *Pollution Control Law* stipulates the pollution damage compensation system, and *Oil Activity Law* stipulates the marine ecological damages due to offshore oil and gas exploitation in detail. In China, the national ecological damage compensation system (including management and utilization of ecological damage compensation fund) has yet to be set up. The only reference is the *Management Regulations of Collection and Use of the Ships Pollution Damage Compensation Fund* issued by the MOT in May 11, 2012.¹⁶⁸

In the foreign countries studied, besides emergency response by professional clean-up companies, great attention is paid to civil and social participation in supervision and actual pollution cleanup, which fully ensures the public's right to know and right to participate. The public participation is good for promoting the nationwide environment protection awareness, as well as motivating the practice of environment protection. However, the safety of such volunteers must always be a priority.

With respect to research and technological innovation related to oil spill preparedness and clean up, Norway mainly takes advantage of continuous investment from oil and gas enterprises and entrusts the research institutions and universities to carries out relevant research.¹⁶⁹ As a result the offshore oil spill emergency management system is highly risk averse, and its emergency system is effective and efficient.

6.3 MARINE ENVIRONMENTAL MANAGEMENT ISSUES AND SOME ROOT CAUSES IN CHINA

6.3.1 Marine environmental management in China is outdated and must be improved

Many departments are involved in marine environment management, without strategic planning and overall coordination mechanism, and the overall efficiency is low.¹⁷⁰

The *Marine Environmental Protection Law* stipulates that governmental agencies with sectoral responsibilities related to the oceans should protect the marine environment as a priority in their daily operations. According to this provision, MEP is in charge of providing guidance, coordination and supervision on issues related to marine environmental protection. SOA is responsible for investigations, monitoring and assessments. MOT is in charge of pollution management and prevention as it relates to ships and ports. MOA is responsible for offshore fishery resources and environmental conditions in waters of importance to fisheries. Environmental protection agencies at the provincial, municipal and county-levels along the coast are responsible for providing guidance, coordination and supervision of local marine environmental protection. However, the present situation means that there are a number of barriers between higher and lower administrative levels and between different departments and regions. This has lead to a situation where important aspects are not managed by any agency while there are overlaps in other areas.

The monitoring of seawater quality may be taken as an example: SOA, MOA and MSA all have their individual monitoring systems and data gathering arrangements. For some other concerns, no agency carries out any implementation of the regulations due to the lack of an inter-ministerial coordination agency and regional and a cross-sectoral joint-efforts mechanism. Multi-department management itself does not inevitably result in administrative inefficiencies. However, the lack of an overall strategy, oversight, and effective coordination between departments

¹⁶⁸ http://www.gov.cn/zwgk/2012-05/28/content_2147033.htm.

¹⁶⁹ Guo Xiaozhe, *World Offshore Petroleum Development history*, Petroleum Industry Press, Beijing, 2012, p175-176

¹⁷⁰ Xu Xiangmin, Li Bingqiang, et al. *Study on System Issues of Bohai Management Law*, People's Publishing House, Beijing, 2011, p1-26.

creates administrative inefficiencies. At present China's marine environmental management displays many such weaknesses.

Currently, there are two main forums for inter-ministerial joint coordination to achieve environmental protection in China. ***These are the Inter-ministerial Joint Meeting of National Environmental Protection led by MEP***¹⁷¹ and ***the Inter-ministerial Joint Meeting of the Bohai Sea Environmental Protection led by NDRC***.¹⁷² The former is a temporary authority coordinated by the General Office of MEP and supported by other related departments within MEP. It focuses on water pollution prevention in coordination with the Ministry of Water Resources (MWR) and the coastal provinces, but not on marine environmental protection. The latter is to promote the coordination required for strengthening the environmental protection in the Bohai Sea and for implementing the *Overall Plan of the Bohai Sea Environmental Protection*. However, with the present management set-up, MEP has not been able to implement its statutory management function for integrated supervision of China's marine environment in the above two forums.

In March 2012, MEP and SOA signed a framework agreement on the *Communication and Cooperation Mechanisms in Establishing Marine Environmental Protection* and decided to strengthen cooperation in marine pollution control and marine ecological protection of marine areas in order to promote coastal and marine economic development in harmony with the marine environment.¹⁷³ However, at present, there are no effective marine ecological regulation and control policies to promote the coordination of the marine economy and at the same time ensure environmental protection. As a result a number of acute marine environmental issues remain unsolved due to the lack of practical administrative regulations and departmental rules, and without corresponding technical standards at a level sufficient for effective protection of the marine eco-environment.

China lacks an overall strategic plan for national marine development and marine environment.¹⁷⁴ Marine environmental protection must become a priority in China and no economic development in offshore areas or in coastal regions or important drainage areas should be allowed if it impacts the marine environment. The government must develop operational strategies based on scientific information, that both achieve marine development in coastal and offshore areas and at the same time protect the marine environment. The productivity and biodiversity of China's marine environment can only be preserved for coming generations if laws and regulations set up to protect the environment are followed. Since the start of the 12th FYP period (2011-2015), the State Council and related ministries have issued many measures, such as *The 12th FYP for National Economic and Social Development of the People's Republic of China*, *The 12th FYP Environmental Protection Program*, *The 12th FYP for National Marine Science and Technology Development*, and *The 12th FYP for National Marine Environment Monitoring and Estimation System*. However, none of these can be considered as the overall strategic plan of China's marine development and marine environment.

The marine-related environment laws are not fully consistent with the "Three Provisions" (State Council Regulation on Government Organization and Functions) about marine environment management and the functional division of responsibilities issued by the State Council. China has two laws related to marine environment, *Environmental Protection Law* and *Marine Environmental Protection Law*. The former is the fundamental law for China's environment management, while the latter is a specialized law for marine environment. The relation between the two laws is the same as that between other fundamental laws and special laws. The two laws establish a management system that is built on a unified supervision of the marine environment in combination with individual responsibilities in different departments.

171 http://www.110.com/fagui/law_146722.html.

172 http://www.sdpc.gov.cn/gzdt/t20110727_425564.htm.

173 http://www.lrn.cn/media/seanews/201003/t20100315_471876.htm.

174 Tang Baiping, *Study on the Legislative System of Marine Resources Protection*, Law Press. Beijing, 2008, p218-221.

Based on these two laws, the State Council stipulates “*Three Provisions*” for departments involved in marine environment management. However, the overall and unified supervision and management duties are not clearly defined for specific work and responsibility (Table 6-3). The result is a lack of overall coordination related to marine environment management. The barriers at different levels and between regions have not been resolved and marine environment problems increase. The normal practices in national marine environment management have been very sector-specific and unable to solve inter-departmental and cross-regional marine environment problems. As a result the statutory unified supervision and management department of marine environment in MEP was able to do little to react to the serious marine environment accident. The total pollution control from offshore activities and land-based sources has not been effective.

There may be three options for solving the problem. The first option, ideally, is to assign marine environment management to MEP, as well as other management functions related to the aquatic environment, rural environment, and water and soil conservation. However, this option might have to include adjustments of national authorities and ministerial obligations. It can only be considered when political system is reformed fundamentally. The second option is to revise or adjust the current provisions related to marine environment management in *Environmental Protection Law* and *Marine Environmental Protection Law*. However, this will take time, because legislation and law amendments will have to go through a relatively long procedure as determined by the National People’s Congress (NPC). **The third option is to revise or adjust the current “Three Provisions” of the State Council, which is considered the easiest one to be implemented.**

Table 6-3 Provisions in Statutory Laws in comparison with Responsibilities in “Three Provisions” of the State Council

Supervision and Management Function	Basis in Statutory Laws		Functional Division in “Three Provisions”	
	<i>Environmental Protection Law and other laws</i>	<i>Marine Environmental Protection Law</i>	MEP	SOA
1. Control of total amount of pollution discharged into key sea area		Clause 3		Yes
2. Marine functional division	Clause 12	Clause 7		Yes
3. Nationwide marine environmental protection plan	Clause 12	Clause 7		Yes
4. Regional marine environmental protection plan in key sea area	Clause 12	Clause 7	Yes (jointly with other organization concerned)	Yes
5. Inter-department coordination for serious marine environment incident		Item 2 in Clause 8	Yes	
6. Pollutant discharge standard into ocean and mechanism of total pollution control	Clause 10	Clause 9		Yes
7. Environment monitoring standard	Clause 11	Clause 14		Yes
8. Pollution discharge fee	Clause 12 in Management Regulation on Pollution Discharge and Management	Clause 11		Yes
9. Offshore joint law enforcement		Clause 19		Yes
10. Approval of report of environmental impact assessment on marine engineering project	Environmental Impact Assessment Law	Clause 47	Yes (Accreditation)	Yes (approved)
11. Supervision of environmental impact assessment on marine engineering	Environmental Impact Assessment Law	Clause 47	Yes	

The emergency management mechanism to deal with accidents is ineffective and inefficient.

Although the oil spill in from the Penglai 19-3 oil field was identified as a serious environment incident, Level 3 of emergency response was applied by SOA. MEP did not trigger a Level 1 response to this serious environment incident, either. The main reason is that **China has not set up a national special emergency response plan and emergency management institution for serious marine environment incidents.** *The National Environment Emergency Response Plan* only outlines the mechanism for responding to environment accidents, but does not include the basic principles and specific measures for emergency response for offshore pollution (such as an offshore oil spill). **In addition, there is no specific inter-ministry and inter-provincial coordination and management authority to deal with such environmental emergencies.**

The *National Environment Emergency Response Plan* identifies the inter-ministerial joint-meeting of MEP as the comprehensive coordinating institution in charge of the response to a national environment accidents. However, this plan has not yet been developed. Furthermore, the “**Three Provisions**” of the State Council has not defined the organizer of the inter-ministerial joint-meeting, who the members are, and the corresponding administrative body in the State Council. At present, **ministerial emergency response plans** for marine environmental accidents mainly includes the *Emergency Plan for Oil Spill in Offshore Oil Exploration and Exploitation* issued by SOA and the *Emergency Plan for Disaster in Offshore Oil and Gas Operation* issued by SAWS. However, it is difficult to handle inter-departmental and cross-regional cooperation and coordination in cases of serious marine environment emergencies based on those plans. Therefore, the corresponding response is likely to be late and lack overall coordination and technical and scientific rigour.

The marine environment management system is incomplete, and law enforcement is ineffective.

MEP is unable to implement its statutory “unified supervision and management” role and the punishment for the responsible party for the marine environment accident is insufficient. The information sharing mechanism among ministries does not function. The information disclosure system is not effective.¹⁷⁵ There is no unified supervision and law enforcement team in offshore areas.¹⁷⁶ The preparation, approval, revision, implementation and supervision of offshore economic development plans are not effective. Related laws need to be progressively revised and updated. Offshore rescue mechanisms and loss compensation mechanisms need to be improved.

6.3.2 Until now the main emphasis has been on short-term economic exploitation of offshore resources while less attention has been given to marine environmental protection

China places emphasis on marine economy development and not on effective regulation of the environmental performance of the offshore industry

The environmental performance of the offshore industry has not been effectively supervised by the central government and relevant authorities. There is a lack of strict enforcement of environmental protection standards in offshore oil and gas production activities. Too little attention has been given to marine environmental impacts during the change or revision of development and production plans. There has been a relative lack of investments in marine environmental protection, inadequate emergency response planning and emergency disposal capacity,

¹⁷⁵ Tang Baiping, *Study on the Legislative System of Marine Resources Protection*, Law Press. Beijing, 2008, p218-221.

¹⁷⁶ Xu Xiangmin, Li Bingqiang, et al. *Study on System Issues of Bohai Management Law*, People's Publishing House. Beijing, 2011, p1-26.

and the adoption of preferential policies with low environmental protection standards in order to attract foreign investments. Overall, marine pollution is mainly caused by land-based pollution sources. However, sea-based pollution is becoming more important, accompanying the increase in marine economic activities. In particular, most marine environment emergencies can be attributed to either production accidents or negligence of environmental management on the part of enterprises.

Although the *Environmental Protection Law* stipulates that all enterprises are obliged to protect the environment, and that whoever pollutes the environment shall take the responsibility of remediation, some enterprises seek to maximize profits at minimum cost by sacrificing environment and resource use efficiency, and by not voluntarily fulfilling their commitments on environmental protection. As long as the supervision and enforcement of laws and regulations are insufficient, some enterprises will continue to try to escape from their environmental protection responsibilities. This will result in new environment problems that will jeopardize future generations' possibilities to utilize the full potential of China's ocean areas.

The main reasons why corporate environmental responsibility cannot be implemented seriously at the present time are as follows: lack of environmental ethics and voluntary awareness of social responsibilities; unclear environmental liability, complicated relationships between causes and results of environment pollution—where results may not occur immediately and could be attributed to many sources; lack of governmental environment protection responsibility, supervision and enforcement; and lack of strict governmental requirements for large enterprise's environment protection responsibility. With high demand for capital, technology, equipment, material and personnel, marine industries are monopolized by large enterprises, such as large state-owned enterprises and joint-venture companies. These enterprises have strong connections and public relations capabilities. Some state-owned enterprises have a superior administrative level by comparison to the marine environment management authority. Once environmental issues appear, relevant governmental departments may be unable to punish adequately these large enterprises for the damage they have done.

The 2011 Bohai oil spill incident clearly showed that the government did not exert its full role as a regulator. The responsible governmental agencies should have demanded at a much earlier stage that the enterprises involved should perform based on high environmental protection standards. How to solve the problems of an enterprise's environmental protection performance? On one hand, the government needs to improve the system for the prevention of pollution and of other public nuisances from the marine industry by clarifying the pollution prevention and accident response responsibility of the enterprise. On the other hand, the enterprise should be much more active in both internal and external awareness building and education in order to meet their environmental protection responsibilities, exert much better internal supervision, and strengthen the internal control carried out by the managers and personnel of the companies.

China pays inadequate attention to marine environmental protection planning and management practices, and the supporting capacity of science and technology is insufficient

Marine environmental management mainly includes management of marine environmental planning, marine environmental quality and marine environmental technology. The marine environmental planning focuses on resolving the policies and planning issues associated with the coastal areas, including: development and construction, population expansion, various pollution controls, water quality control and emergency response reserves. Marine environmental quality management focuses on the formulation of marine environmental standards, marine environmental monitoring, and marine ecosystem restoration. Marine environmental technology management focuses on handling of pollution prevention technology, forecasting and early-warning technology, developing information platform technology, emergency disposal technology and other technologies associated with the planning and quality management.

Currently, the national marine environment monitoring capacity and technology system need to be enhanced. The marine environmental early-warning system is incomplete. The marine environmental emergency information system and the information command platforms urgently need to be established. The formation process of disaster chains caused by marine emergency and emergency technology system need further research. The theory and method for evaluating the marine environmental loss need to be further studied.

In general, the investment in science and technology supporting capacity is insufficient. Although, from the 9th FYP to the 12th FYP, the national investments in scientific research in the marine environmental field has been rising. But, in comparison with fields like marine energy, marine exploration and marine resource utilization, neither the amount of funds nor the number of projects are enough. The investments in scientific research on marine environment from relevant departments of the government are mainly provided to the quality control field, such as surveys, and exploration and monitoring of marine environments. Fewer investments are directed to research into the fields of planning management and technology management. This has led to the problem that many actual demands cannot be matched by existing capacity. For example, in the cleanup of the spill in Bohai Bay in 2011, the oil dispersant used might result in additional damages to the marine ecosystem over the longer term. With sufficient technology preparedness, this issue might have been avoided. Therefore, it is necessary to sort and classify relevant issues, and resolve them by systematic scientific research.

6.4. POLICY RECOMMENDATIONS

The analysis of the recent oil spills in China and the experiences from oil spills abroad makes it possible to draw a number of conclusions. These are:

- ***The government must develop proactive regulations and effective supervision of high-risk activities such as offshore oil and gas exploration and production.***
- ***At the government level there must be an integrated inter-agency coordination mechanism and a national emergency response plan that is kept updated in order to respond immediately and effectively in the case of an oil spill.***
- ***The responsibility of the operator of offshore oil and gas exploration and production to protect the environment must be clearly spelled out in the regulations applicable to such activities.***
- ***The operator of offshore oil and gas activities must be able to provide or guarantee the immediate activation of the oil spill response plan with deployment of equipment and personnel to respond in the case of an accident.***
- ***In order to enhance the emergency response capacity, regional and local cooperation and resources sharing are necessary for effective emergency response.***

6.4.1 Speed up the formulation of an integrated national marine development and environmental protection strategy and plan

NDRC should take a leading role, with the participation of MEP, MLR, SOA, MOT (Maritime Safety Administration), MOA (Fishery Administration) and coastal provincial governments, to develop a national master plan for marine development and environmental protection. This plan should be based on national development strategies, existing land and marine zoning plans, and the development plans of coastal governments. The plan should cover all coastal and marine areas of China including the Exclusive Economic Zone and islands. The plan will identify fundamental policies and strategies for balancing economic development and the need for marine environment protection. Such a plan will need to provide requirements for the management of the marine and coastal environment and should

provide a positive interaction mechanism between marine economic development and environmental protection while at the same time balancing the interests among various industries, stakeholders and coastal regions.

Further integrate marine development-related strategic plans for coastal and offshore areas in the various provinces.

In order to establish a sustainable marine economy in combination with effective marine environmental protection in the Yellow Sea, Bohai Sea, East China Sea and South China Sea, planning for the development of offshore areas should be integrated with plans for near-shore waters areas and coastal plans for coastal provinces.

Develop a national master plan for the development and layout of the main marine industrial sectors

The Master Plan (*National Coastal and Marine Spatial Plan of China*) should be drawn up based on existing sectoral plans for different maritime industries and the development plans for the different regions and local governments. The Master Plan should take into account the need for environmental protection and the importance of securing the full protection of sufficiently large key habitats and ecosystems to enable true long-term sustainable use of the resources such as fisheries and aquaculture. The plan must include renewable resource activities such as fisheries and aquaculture, tourism, offshore oil and gas, coastal nuclear power, ports, wharfs, ports and shipping lanes, coastal real estate, heavy industries such as chemical and petrochemical plants, and metal smelters. The master plan should incorporate any sub-sector plans into the overall coastal and marine spatial plans taking into account individual sub-sector needs for adequate environmental and ecosystem protection and enhancement of ecological services. NDRC needs to be responsible for the coordination, implementation, and maintenance of such a plan, including linkages to Five-Year Plans.

The planners should promote the maintenance and the strengthening of the national maritime rights and interests, through orderly investments in marine development and protection and the management of marine industries. In order to enhance the quality of the marine ecosystems, issues related to environmental protection should be given priority in international negotiations related to the development of marine resources, including for disputed sea areas.

6.4.2 Establish a national marine emergency response plan for environmental incidents including the system for managing such a plan

A *National Emergency Marine Response Plan for Major Environmental Incidents* should be established. Such a plan should be based on existing, relatively uncoordinated laws including:

The *National Environmental Protection Law*, the *Marine Environmental Protection Law*, the *Safe Production Law*, the *Overall Emergency Response Plan for National Public Incidents* and the *Emergency Response Plan for National Sudden Environmental Incidents*, and through consolidation of the existing *Emergency Response Plan for Oil Spill in Offshore Oil Exploration and Development* and the *Emergency Response Plan for Accidents and Disasters in Offshore Oil and Natural Gas Activities*, as well as the relevant regulations in the different coastal provinces.

The plan system should be made up of a *National Contingency Plan (NCP)* that applies to the entire country and different *Area Contingency Plans (ACP)* that applies to coastal provinces, large areas of the coast or bays, etc.

Led by MEP, together with administrative units such as SOA, SAWS, the Maritime Safety Administration of MOT and the Fishery Administration of MOA, a NCP (*National Marine Emergency Response Plan for Major Environmental Incidents*) should be jointly compiled, and then used as the *Special National Contingency Plan*. Existing plans from relevant departments should comply with this plan or be integrated with this plan. The Master Plan should provide

the regulatory framework and guidelines for handling major marine environmental accidents, which affect more than one sector, region or country. The marine departments and coastal provinces/districts need to take their responsibilities in compiling emergency response plans for marine environmental events, respectively. Those plans shall be the *emergency response plans of departments under the State Council* and the *local or regional emergency response plans*, which may equal the ACP to some degree.

The Master Plan should include special emergency response plans and on-site emergency handling plans

The system should formulate special emergency response plans and on-site emergency handling plans for various tiers and types of potential marine environmental accidents. The responsibilities of relevant departments and companies for various types and at different stages of accidents (before, at the beginning of, during, and after accidents) should be defined. The tiers of response refer to the severity of marine environmental accident, and might include four levels: extraordinarily severe, severe, relatively severe and moderate. These types refer to risk sources posing significant environmental threats including oil spills, leakage of dangerous chemicals and radioactive contamination, or the risk of such events.

The Master Plan should define specific institutional responsibilities of organizations

The Master Plan should identify the responsibilities of the leading agency, the coordinating/commanding authority, and the roles and responsibilities of supporting agencies. It should be made operational through the “*Three Provisions*” of the State Council and be part of the integrated national, local and sectoral emergency response network through coordination between the State Council (lead agency), the Emergency Management Office of the State Council (administrative body), relevant departments of ministries (operating bodies) and relevant departments of provinces and cities (regional bodies). The establishment of a proper emergency response equipment reserve and the conducting of regular drill exercises will improve overall national emergency response capacity.

The Master Plan should pay special attention to the efficiency of emergency response and effectiveness of emergency handling

China's marine environmental management must be both effective and efficient, and its response and preparedness must be built into every step of the operations of potentially harmful activities such as oil and gas operations offshore. Disaster chain characteristics of major environmental accidents should be taken into consideration during the construction of the system. Marine environmental accidents can be caused by natural disasters such as typhoons, or accidents in offshore exploration and production units, or a combination of events. Although an oil spill may originate in offshore areas, it can affect coastal zones and result in severe damage for example to aquaculture and tourism. Such coastal impacts make it necessary to involve both sectoral agencies and provincial authorities. The system also must consider clean up in coastal areas and along shorelines. Therefore, the system must be both inclusive, covering the activities of all potentially important sectors, and considered operational and effective by all concerned parties.

6.4.3 Harmonize marine-related national environmental laws and marine environmental administrative functions

Modify the State Council's government organization and responsibility regulations

Provisions such as “establish and enhance the enforcement and supervisory system for marine environmental protection” should be added to the “*Three Provisions*” in order to harmonize the responsibilities of relevant departments with the *Environmental Protection Law* and *Marine Environmental Protection Law*. Since marine environment protection is the overriding goal for all marine environmental management authorities, the provisions should clearly specify the function of the “unified supervision and management of marine environment protection”. The recommendations on specific function adjustments are noted in Table 6-4.

Set up a new Department of Environmental Emergency and Environmental Protection Coordination within MEP

A new Department of Environmental Emergency and Environmental Protection Coordination within MEP should be set up. The new department should be assigned the responsibility of managing national environmental emergency accidents, and the coordination of MEP with other governmental agencies. As the national emergency management department for environmental accidents, it can carry out its coordination and command functions in the case of serious marine environment accidents. It can also act as the operating office for the *Inter-Ministerial Meeting of National Environmental Protection* of MEP and of the *Provincial and Inter-Ministerial Meeting of Bohai Environmental Protection* of NDRC, and carry out its coordination function and administration of the marine environment. Three offices might be considered under the new department:

- “Emergency Management Office”, responsible for the emergency management of severe and extraordinarily severe environment accidents;
- “Environmental Coordination Office”, responsible for the daily tasks of the “Inter-Ministerial Meeting of National Environmental Protection” and “Provincial and Inter-Ministerial Meeting of Bohai Environmental Protection”, and for coordinating MEP, the other ministries of the State Council and provinces in the environmental protection;
- “Program Planning Office”, responsible for compiling the annual environmental protection emergency programs and program coordination, and the corresponding budgets.

Table 6-4 Recommendations on function adjustments of key institutions

Basic system of unified supervision and management	Legal Basis		Recommendations on Division of Functions	
	<i>Environmental Protection Law</i> or other environmental protection laws	Marine Environmental Protection Law	MEP	SOA
1. total quantity control for pollutants discharged to important sea areas		Clause 3	Development of plans and allocation of total quantity	Implementation, supervision and monitoring
2. Marine functional zoning plan	Clause 12	Clause 7	Developed together with Environmental Functional Zoning Plan and Main Functional Zoning Plan	Implementation, supervision and monitoring
3. National Marine Environmental Protection Plan	Clause 12	Clause 7	Compiling jointly	Participant in compiling
4. Regional marine environmental protection plan for important sea areas	Clause 12	Clause 7	Compiling jointly	Participant in compiling
5. Inter-departmental coordination for serious marine environmental accidents		Item 2 in Clause 8	Key responsibility	
6. Proposing the sewage discharge standard and the total quantity control system	Clause 10	Clause 9	Organize the proposal development	Implementation, supervision and monitoring
7. Proposing the environmental monitoring specification	Clause 11	Clause 15	Organize the proposal development	Implementation, supervision and monitoring
8. Pollution fee	Clause 12 in the <i>Regulations on the Administration of Collection and Use of Pollution Fees</i>	Clause 11	System establishment	Implementation, supervision and monitoring
9. Approval of EIAs for marine projects	<i>Environmental Impact Assessment Law</i>	Clause 47: recommend revision of the legal provisions	Change “for record” to “for approval”, in order to be consistent with <i>Environmental Protection Law</i> and <i>Environmental Impact Assessment Law</i>	Approval
10. Supervision on EIAs for marine projects	<i>Environmental Impact Assessment Law</i>	Clause 47	Marine environmental supervision	Supervision and monitoring
11. Joint law enforcement on ocean matters		Clause 19	Marine environmental supervision	Marine environmental supervision

Establish an effective inter-departmental coordination mechanism for marine environmental management by enhancing the responsibilities of relevant departments with duties related to marine environment protection following the principle of prevention

Drawing on experiences from Norway and USA, it is necessary to emphasize the roles and responsibilities of the energy authority, the safety regulatory agency, the maritime administrative agency and the environmental protection agency in the prevention of oil spills and the immediate emergency response. The Maritime Safety Administration of MOT has extensive experiences in managing marine oil spills from shipping and has cooperated with many oil spill clean-up companies over a long period. It is thus rational that the Central Staffing Office in China has assigned a coordinating role to MOT in cases of serious marine oil spill accidents. The SOA specializes in monitoring, water quality analysis, supervision and ecological damage assessments. It is recommended that SOA continue to exert this important role in marine oil spills emergency responses in the future. Simultaneously, it needs to strengthen the capacity in oil spill emergency response support system. Under the centralized leadership of the Emergency Office of the State Council, the new department proposed will be responsible for coordinating the response work

for the severe, and extraordinarily severe categories of marine environmental accidents. This office should ensure that all relevant agencies carry out their individual duties in handling environmental accidents in their professional fields, and ensure various supporting agencies to adequately support this work according to their respective duties.

6.4.4 Improve legislation for marine environmental management

Improve the institutional and regulatory system for the approval and supervision of overall off-shore oil field development planning

The improved system should consider the rules and regulations for environmental assessment as articulated in the *Environmental Impact Assessment Law and Regulation on Environmental Impact Assessment of Planning*. The overall oil fields development plan for offshore oil fields, which is a special sector plan, must follow strict environmental protection review procedures. The environmental authority's responsibilities and review procedures of the plans for oil field development must be followed. The Energy Administrative Authority and Environmental Protection Authority should jointly formulate sector rules and regulations associated with planning, approval, revision, implementation and supervision of the overall development program for oil fields.

Strengthen the implementation of pollution prevention control and safe production regulation in oil development

The safety regulations of offshore oil production to prevent environmental damage by accidents should be strictly enforced. The key role and full responsibility of the operator for all damages must always be emphasized. Technical requirements and specifications of equipment and measures related to oil exploration and production should be incorporated into legal provisions. For example, the National Energy Administration should formulate technical requirements of equipment and facilities for safe oil production. Well-organized inspections of industrial enterprises should be routinely arranged to check that environmental safety procedures are followed, and that the facilities to be used in an emergency are in order and ready to be used. The regulations should also explicitly stipulate that they have the obligation to identify problems, eliminate hidden troubles and disclose violations, and that penalties can be imposed immediately when problems related to environmental risks have been identified.

Improve the information disclosure procedures

As an initial priority, a unified mechanism of receiving and publishing the information should be established. Legislation such as the *Marine Environmental Protection Law* should provide clear and specific provisions on information collection and publishing, in accordance with the unified information publishing mechanism provisions stipulated in the *Law of Dealing with Emergence Incidents*. As the second priority, the enforcement of *Regulations on Open Government Information* should be strengthened to ensure the public's right to know. Furthermore supporting regulations on procedures for complaints and litigation to make the information disclosure regulations operational should be formulated. An approved information disclosure system will enable accident victims to receive information on time and to get ready for emergency preparation and for making pollution damage claims. In addition, the improvement of the information disclosure system is beneficial for the establishment of public participation mechanisms and for the enhancement of the implementation and compliance of environmental laws.

Improve the ecological damage assessment and compensation system

180 Specific regulations and provisions for ecological damage assessment and compensation need to be formulated, e.g., in the *Ordinance on Claim for Compensation of Marine Ecological Damage*. The regulations and provisions shall provide specific rules for case identification, compensation scope, liability exemption conditions, claiming subject

of ecological damages and rights and liabilities, claim procedures and remedy methods. The existing *Technical Guidelines on Marine Ecological Damage Assessment* shall be improved and their applicability in legal practices strengthened. That means clarification of the criteria for ecological damages and for the obligations of the operator of oil and gas facilities to, as a routine, carry out monitoring of key environmental parameters of relevance to the legal provisions.

Furthermore an Ecological Compensation Fund funded from the economic transactions of the offshore oil developers should be established. It is important that the money accumulated in such a Fund be used strictly to compensate for damages that cannot be traced to any individual operator's failure to meet the regulations. An Ecological Damage Compensation Fund was developed in connection with the Bohai Sea Oil Spill accident. This Fund should be made functional and any economic transactions from such ecological compensation funds should be made available to the public to promote transparency of operation.

Establish and improve the mechanisms to recover the cost for maintaining emergency response

On the one hand, the damage compensation system should clearly and explicitly identify that the party responsible for the accident should bear the full cost of emergency response. The environmental damage compensation system needs to be articulated in laws such as the *Environmental Protection Law* and *Tort Liability Law*, or through the special *Oil Pollution Damage Compensation Law*. The regulations should clearly indicate the cost-bearing responsibility of the operator. In addition, the emergency response obligations and cost-bearing responsibilities of the operator need to be strengthened by the means of compulsory insurance, corporate environmental reserve fund and industrial funds. The insurance or other financial mechanisms provided by the operator shall fully cover all potential damages that the operation may cause. Large corporations may be able to self-insure the cost of any damage.

On the other hand, the emergency response equipment and management industry shall be encouraged to establish a market mechanism for the operation of an emergency response service to be provided to the industry. Based on existing international experience it is clear that the private sector can be an important component of the national emergency response capacity. Therefore, it is necessary to establish a sound market environment (including improving the pollution damage compensation system and establishing the emergency service system) to make emergency pollution cleanup a market activity. Specific measures include the strengthening of the qualification and capacity of emergency response service entities, ensuring that compulsory pollution cleanup agreements are signed by enterprises, and that the financial guarantee system for emergency pollution cleanup expenses is in place. The clean-up organizations will need responders' immunity from liability as they are responsible for doing the cleanup and not for the accident.

6.4.5 Strengthen law enforcement of marine environmental management

Through legislation and State Council authorization, strengthen the enforcement and supervision capacity in the marine environmental protection of the national oceanic administrative authority and establish a system for the administrative supervision in the marine environmental protection and law enforcement of the national environmental protection administrative authority.

Establish a unified offshore law enforcement team

In order to strengthen the supervision and enforcement capacity of the marine environment administrative authority, an offshore law enforcement team should be established. Such a team will ensure that law enforcement is the key supervision function of the marine environment administrative authority.

Establish China's marine environment administrative supervision and law enforcement system

In order to enable better supervision and guidance to other marine environment administrative agencies, the national environmental protection administrative authority should be strengthened. That will enable the identification of cross-regional and inter-departmental marine environment issues that need to be coordinated through daily administrative supervision.

Strengthen the supervision of the environment impact assessment system for marine energy development activities

China's marine environment administrative authority and the supervision agency should enhance their supervision and inspection capabilities by carrying out assessments of environmental impacts and damage evaluations. Provisions for such evaluations, their frequency and report contents should be specified in the legislation. The exercise of responsibilities by the relevant authorities in charge of environmental impact follow-up and post-evaluation, as well as of violations needs to be well supervised.

6.4.6 Enhance corporate environmental responsibility and improve environmental risk prevention capacity

Express the responsibility of operators for developing and complying with the emergency response plan and revising the emergency response plan as necessary

Oil and gas companies exploring and operating in offshore areas must be required to have adequate emergency response plans. Relevant laws should be revised drawing on experiences from Norway and the USA to clearly specify that the operator (the oil/gas companies) shall have the full responsibility to meet any need for immediate emergency response. The governmental authority role is to check that the companies fulfil all such obligations. By law in Norway and the USA, the operator, before entering into any activity that may cause harm to the environment, has to either guarantee that the company/operator itself is able to provide full emergency response capability or, as an alternative, has signed an agreement with a capable emergency response company/organization as a prerequisite condition for approval of oil development activities.

Develop a complete set of applicable specifications of appropriate disaster response, exploration/production and engagement permission for the operators

It is recommended that the national environment administrative authority (MEP) should take the lead and work with industry associations and leading enterprises to prepare the specifications by consulting the relevant international standard of the same industries, such as offshore oil/gas.

Strengthen corporate environmental awareness and responsibilities

The information departments of various marine administrative authorities should contribute to the building of environmental awareness among the public and inform the private sector of their responsibilities in protecting the environment. Corporate environmental protection capacity will be considered an essential condition for approval of the enterprises' involvement in any activity related to marine development and resource exploitation. Local maritime courts and procuratorates should clearly address enterprises' legal responsibilities for pollution and damages of marine environment due to their operation. Such actions will discourage operators from risking environmental damage in order to save costs. The authorities for the industrial sector shall require the preparation of response plans, insurance and compensation guarantee systems to spread the risks for enterprises through industrial sector associations, enterprise alliances and insurance companies.

6.4.7 Enhance the prevention of environmental risk from marine-related enterprises

Legislation departments in the National People's Congress (NPC), NDRC and MEP must consider the environmental responsibility of foreign and national companies in cooperative offshore development projects. Relevant laws and regulations should clearly define the responsibility of the government and the operators respectively in cooperation and joint development projects, in order to mitigate or decrease the risks of marine accidents leading to environmental damage.

6.4.8 Strengthen capacity building of science and technology in marine environmental management

Strengthen research, technology development and monitoring related to marine environmental management

Environmental or marine public projects or special national science and technology development programs, should emphasize the need for theoretical and technological research. Research and development is particularly needed in areas such as the overall strategic spatial planning of ocean and coastal, coastal and marine emergency response, marine environmental management laws and regulations, marine environmental monitoring and early-warning systems, methods for networking and information dissemination, marine pollution control technologies and standards, marine ecological loss evaluation and remediation methods, and marine disasters risk assessment and prevention tools. One very important way of stimulating research and development is through stimulating international cooperation.

Strengthen special studies on oil spill emergency management technologies

Priority areas for research are environment impact assessment methods for offshore oil and gas development projects and procedures for ecological risk assessments caused by disasters, guidelines for oil spill damage evaluation and compensation, oil spill emergency monitoring and pollution control and clean-up technology, as well as research on the environmental state and capacity of the Bohai Sea and other Chinese seas. Other priority research areas include decision-making support systems for emission reduction, oil spill source tracing technologies, oil spill risk monitoring and assessment technology, national oil spill emergency response systems, risk identification for offshore oil spills, risk prevention and comprehensive management technologies, research related to marine industrial policies and restructuring, national energy policies and structure adjustment. Oil and gas developers should be obliged to invest in such research and to establish regional marine environmental research funds.

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As an important part of the research activities, the SPS team held 7 working meetings, including 3 joint working meetings of Chinese and international members and 4 Chinese member working meetings. In addition, the team has organized 3 workshops in Qingdao and Beijing. Thanks to the experts present on the special policy study meetings from Academy of Sciences of the Ministry of Transportation, North China Sea Branch of SOA, National Marine Environmental Monitoring Center, Pollution Control Division of MEP, and Yellow Sea Fisheries Research Institute of MOA, etc., for their valuable information, experience sharing and recommendations. Also thanks to Mr. Knut Alfsen, the member of Chief Advisers' Support Team and the former director of CICERO - the Center for International Climate and Environmental Research in Norway (Oslo), for his guidance and recommendations in the joint working meetings and in compiling relevant reports.

This report was submitted by the Special Policy Study on the Bohai Oil Spill as a Case for China's Marine Environmental Management Mechanism.

CHAPTER 7

REGIONAL AIR QUALITY INTEGRATED CONTROL SYSTEM RESEARCH

Executive Summary

7.1 CHINA IS FACING SEVERE REGIONAL ATMOSPHERIC POLLUTION

China is facing severe air pollution. Though the traditional coal-burning pollution problems have not been solved, a more complex regional air pollution challenge characterized by O₃ (ozone) and PM_{2.5} (Particulate Matter having an aerodynamic diameter less than 2.5 μm and thus can suspend in the atmosphere for a long time) has emerged. According to the WHO's evaluation of the PM_{2.5} annual average concentration from over 1082 cities around the world, China's best rank is 808 for Haikou and the worst city only ranks 1058, almost at the bottom of the list. PM_{2.5} will become the most important pollutant that influences China's air quality, based on the *Environmental Air Quality Standard* (GB3095-2012) that was revised this year and is about to go into effect.

7.1.1 High concentration and heavy pollution of PM_{2.5}

There are three basic characteristics of PM pollution in China. **(1) High PM_{2.5} concentrations.** High PM_{2.5} concentrations are frequently found in Chinese cities. For example, the annual average concentration of PM_{2.5} is as high as 60-90 μg/m³ in Eastern China, whereas PM_{2.5} could exceed 100 μg/m³ in industrial areas. These concentrations are significantly higher than the standard recommended by international organizations and other countries (below 10 μg/m³). **(2) High contribution of PM_{2.5} to PM₁₀.** Results from long-term measurements conducted in Beijing suggested that the ratio of PM_{2.5} to PM₁₀ tended to increase during the last decade, indicating that the contribution of PM_{2.5} to PM₁₀ became more important. **(3) Apparent spatial distributions.** PM_{2.5} concentrations varied considerably in different regions. Generally, PM_{2.5} is higher in the northern region compared to the southern region, and is higher in the western region than the eastern region. Moreover, PM_{2.5} is usually higher in winter than the other seasons. Figure 7-1 presents the annual average PM_{2.5}/PM₁₀ concentrations of Beijing, the capital city of China.

7.1.2 Complex PM_{2.5} sources with high percentage of secondary PM

The mass concentration and chemical speciation of PM_{2.5} is highly dependent on the measurement region. Generally, POM (particulate organic matter, organic species in particles) and SNA (the sum of sulfate, nitrate and ammonium) are the major components in PM_{2.5}, and are significantly influenced by emissions (which usually show spatial and temporal variations) and atmospheric oxidation activity (which control the conversion from the gaseous pollutants to atmospheric particulates). In the eastern region (including urban, rural and forest areas), SNA is the dominant component in PM_{2.5}, accounting for 40%~57%; the contribution of POM was 15%~53%, which is lowest at the Changbai Mountain and highest in Urumchi. The sum of POM and SNA constitutes 53% of PM_{2.5} in Beijing, the rest being crustal dust and other un-identified or un-analyzed components.

污染特征2: PM_{2.5}/PM₁₀比值持续上升

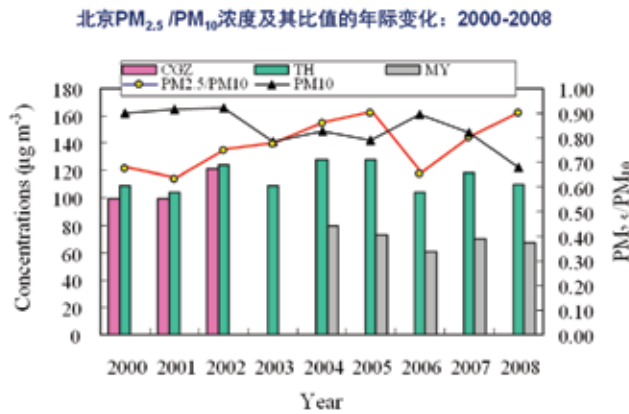


Figure 7-1 Annual variations of the PM_{2.5}, PM₁₀ and the ratio of PM_{2.5}/PM₁₀ during 2000 to 2008 in Beijing*

* Sampling was conducted in three sites in Beijing, i.e. ChengGongZhuang(CGZ, an urban-center site), Tsinghua University Campus (TH) and Miyun (MY, a regional background site)

Source: Atmospheric Particular Matter and Regional Complex Air Pollution, He Kebin et. al., Science Press, 2011

When significantly impacted by dust, the contribution of minerals to PM_{2.5} could be considerable. It should be pointed out that in addition to the regions near the source areas of dust (e.g., northern China, which holds a large area of desert, is more inclined to be affected), dust could also be transported to central and southwestern China. Thus, PM_{2.5} in China is also characterized by high contribution of mineral dust relative to the developed countries

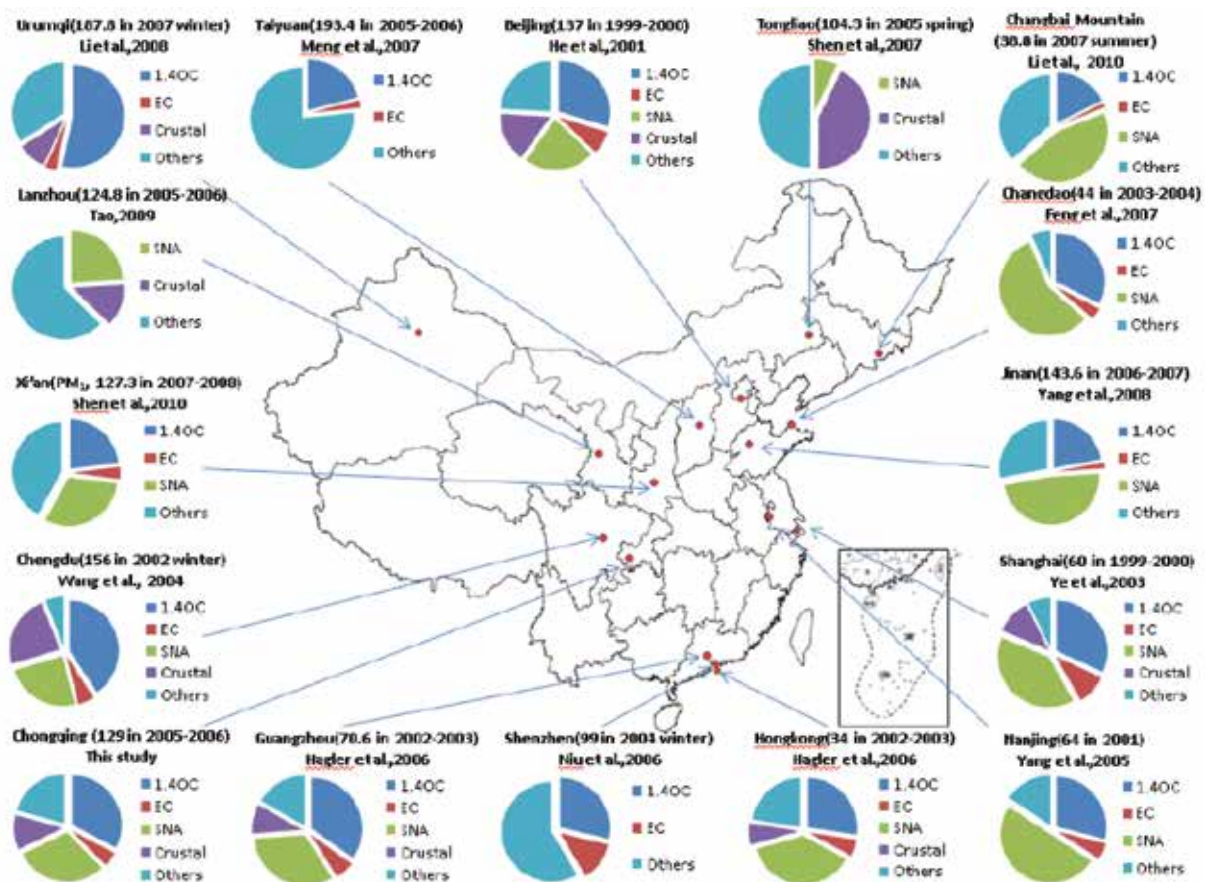


Figure 7-2 Chemical composition of PM_{2.5} across China (OC—Organic Carbon, EC—Elemental Carbon, SNA—sulfate, nitrate and ammonia ions, Crustal—Crustal dusts)

Source: Atmospheric Particular Matter and Regional Complex Air Pollution, He Kebin et. al., Science Press, 2011

Moreover, total carbon (TC) and SNA in $PM_{2.5}$ were found to be comparable in Chinese cities such as Beijing, Chongqing, Guangzhou, and Shanghai, whereas SNA was 26% higher than TC in Los Angeles, indicating that the secondary species represent a major source of $PM_{2.5}$ in the mega-cities of the developed countries. The contribution of EC (Elemental Carbon, the aggregate of compounds composed with nearly pure carbon) to $PM_{2.5}$ is much higher in Shanghai and Shenzhen compared with other Chinese cities, but much lower than that of Los Angeles and Brisbane. There are large seaports in all of the cities, indicating that emissions from shipping might be an important source of EC.

The transportation and evolution of PM are influenced by the meteorological parameters, thus, the composition of $PM_{2.5}$ is expected to exhibit seasonal variations. The contribution of inorganic species among the distinguishable matters in $PM_{2.5}$ tends to be highest in summer, based on the $PM_{2.5}$ samples of Beijing. But **the percentage of secondary species continued to grow in $PM_{2.5}$** from 1999 to 2008. On a yearly basis, the SNA fraction in identified $PM_{2.5}$ mass rose from 29% in 2002 to 36% in 2007 (Figure 7-3).

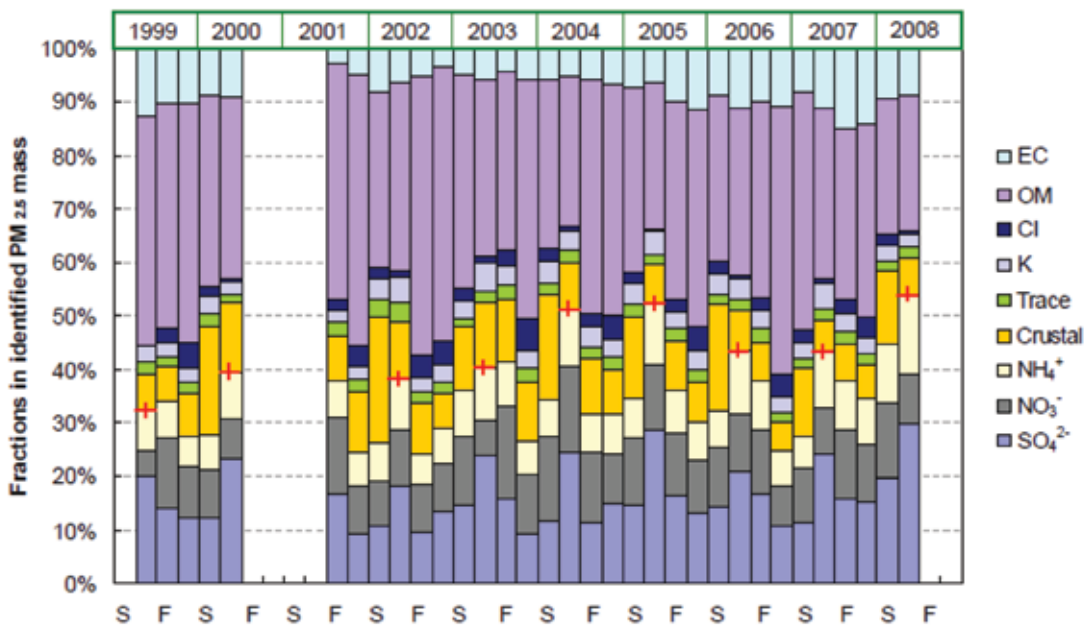


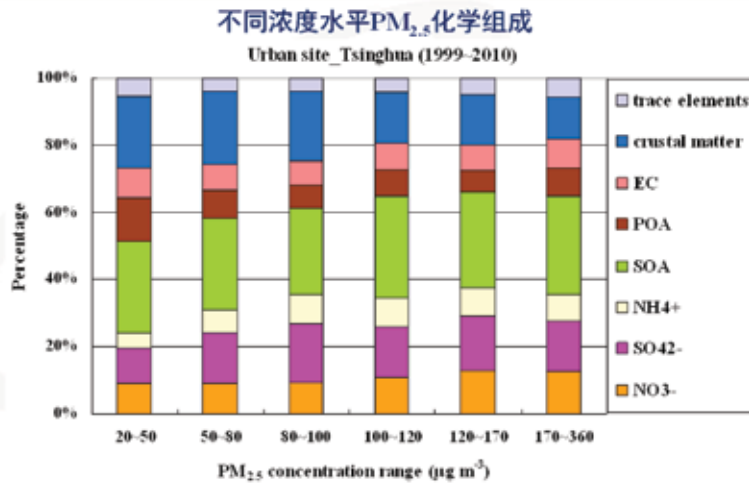
Figure 7-3 Seasonal $PM_{2.5}$ speciation abundances at Tsinghua in Beijing from the summer of 1999 through the summer of 2008

Average percentages of SNA in each summer are marked with cross symbols. S refers to Spring and F refers to Fall.

Source: *Atmospheric Particular Matter and Regional Complex Air Pollution*, He Kebin et. al., Science Press, 2011

The ratio of secondary species is higher than usual during high $PM_{2.5}$ episodes. Figure 7-4 presents the relationship between the $PM_{2.5}$ speciation abundances and the $PM_{2.5}$ mass concentration, which was based on a long-term measurement. When the $PM_{2.5}$ concentration was below $120 \mu\text{g}/\text{m}^3$, the contribution of secondary species (including SNA and secondary organic aerosol) was found to increase with the $PM_{2.5}$ concentration; whereas the contribution of secondary species did not increase significantly when the $PM_{2.5}$ concentration was above $120 \mu\text{g}/\text{m}^3$. These results indicate that the secondary species are some of the important factors responsible for the high $PM_{2.5}$ concentrations observed in Beijing.

污染特征6：重污染时段二次成分比例高



> 浓度序列分析表明：

出现PM_{2.5}高浓度重污染时二次成分（SNA/SOA）比例明显升高



Figure 7-4. The relationship between the PM_{2.5} speciation abundances and the PM_{2.5} mass concentration

Source: Atmospheric Particulate Matter and Regional Complex Air Pollution, He Kebin et. al., Science Press, 2011

7.1.3 Regional transport

Rapid development of urbanization and regional economic development aggravate the complex air pollution in the Yangtze River Delta. Cities in the Yangtze River Delta are suffering from regional air pollution beyond local pollution while serious regional pollution is becoming more and more frequent. In winter and spring, influenced by complex factors like inland pollution, northern sand-dust and adverse local meteorological conditions, the impact of regional fog, haze and floating dust stands out. In early summer and late autumn, stalk-burning contributes atmospheric fine particle pollution to the city and surrounding areas, which triggers large-scale regional haze pollution, resulting in a simultaneous variation trend of air quality in key cities of the Yangtze River Delta.

Table 7-1 shows that in 2011, there were 28 polluted days altogether in Shanghai. Taking Shanghai, Nanjing, Suzhou, Nantong, Lian Yungang, Hangzhou, Jiaxing and Ningbo as references, over half of these cities were simultaneously polluted on 22 of these days, which amounts to 78.6% of all the air pollution days; the days when all 8 cities exceeded the standard occupied 14.3% of the pollution days, and the situation when only Shanghai exceeded standard occurred on just 2 days.

Table 7-1 The air quality of 8 cities around Shanghai in the days when Shanghai failed to comply (Year 2011)

	All cities (8) failed to comply	Half cities (4) failed to comply	All the cities meet the air quality standards	Shanghai's API higher than the regional medium
Days	4	22	2	20
Percentage	14.3%	78.6%	7.1%	71.4%

7.1.4 High frequency and elevated levels of heavy pollution days

The annual average concentration of atmospheric pollutants including PM_{2.5} is high for Chinese cities. More than that, the heavy pollutant days occur with greater daily average concentrations and higher frequency. Consider Shenzhen, with relatively better air quality, for example. Since 2006, haze days happen much more frequently, the

pollution index has grown and the oxidation level of the atmosphere has increased. The highest hourly concentration of PM₁₀ reached up to 428 $\mu\text{g}/\text{m}^3$, twice the national second-level standard. Some stations have days with the O₃ highest hour concentration over the limit nearly 10% of the time.

7.1.5 Single-factor to multi-factors: excessive pollution causes shift

With PM_{2.5} and O₃ concentrations increased, the mixed air pollutants promote the chemical and photochemical reactions in the air and result in even more complex air pollution in Eastern China. Especially in summer, the oxidation level of the atmosphere increases with higher O₃ concentration, and convert more SO₂ and NO_x into secondary particulates such as sulfate and nitrite. Consider Shanghai for example; the pollution levels remain high from April to July and reach the peak in May, as shown in Figure 7-5. The oxidation level of the atmosphere in summer is enhanced which is one major reason for the high PM_{2.5} pollution.

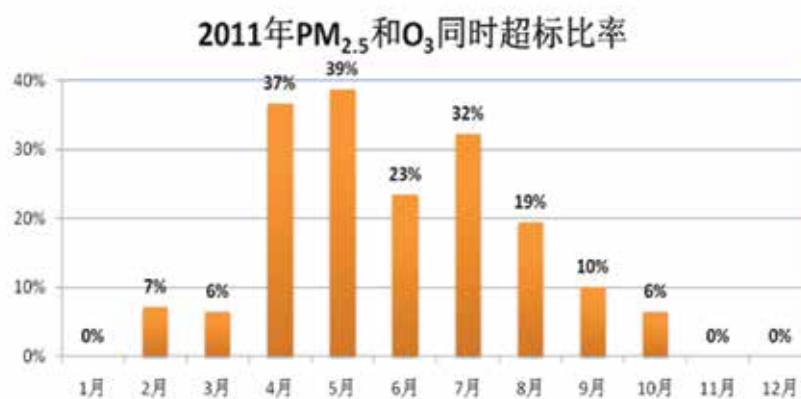


Figure 7-5 Monthly distribution of the PM_{2.5} and O₃ simultaneous pollution in Shanghai, 2011

Source: Air quality monitoring data from Shanghai Environmental Monitoring Center

The main reason for China's regional air pollution is abundant emissions and concentrated distributions of many air pollutants. China's coal consumption is growing at the rate of more than 200 million metric tons per year and has accounted for more than 48% of the world total, whereas the population of motor vehicles also grew rapidly from 120 million to 190 million during the 11th Five-Year Plan. These two factors cause China's emissions of primary particulate matter, SO₂, NO_x and VOCs to be more than 20 million metric tons. The emissions are mostly concentrated in Eastern China and result in deterioration of air quality in some areas such as Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River Delta.

The severe air pollution not only did serious harm to the public health, but also caused massive economic loss. The consequences estimated by the WHO and other organizations worldwide: millions of people die of air pollution every year; many respiratory and cardiovascular system problems result in an inability to work or study; grain production shrinks due to the high concentration of O₃; acid rain causes damage to the forest and ecological environment, and even to the quality and appearance of buildings. China is experiencing all of these problems. Last year the public alarm induced by the long-time, wide-spread haze days in Beijing very badly impacted the government's credibility.

7.2 IMPROVING THE AIR QUALITY IN CHINA IS A LONG AND ARDUOUS TASK

Although PM_{2.5} monitoring has not been introduced in most cities in China, the environmental monitoring data for SO₂, NO₂ and PM₁₀ indicate that the urban air quality remains much worse than the standards for a well-off and

modernized society. According to the atmospheric environmental monitoring data in 333 cities at the prefecture level or above in China, the annual mean concentration of SO₂, NO₂ and PM₁₀ in prefecture-level cities was 35µg/m³, 28µg/m³ and 79µg/m³ respectively in 2010. In accordance with the *Ambient Air Quality Standards* (GB3095-2012) which was revised this year and is about to be implemented, cities where the annual average concentration of SO₂, NO₂ and PM₁₀ is higher than the standards number 18, 51 and 201 of the 333 cities respectively. Even with the PM_{2.5} and O₃ pollution not taken into consideration, as many as 216 cities cannot meet the standards, accounting for 2/3 of the total number of cities.

Based on the 2005 World Health Organization (WHO) ambient air quality guidelines, China lags far behind the WHO requirement (20µg/m³) for PM10 in terms of the annual average concentration. Even Haikou, the city with the lowest concentration of PM10 in China, fails to meet the requirement. And the average PM10 concentration national-wide is three times higher than that of Haikou. The results from domestic and international scientific research show that the PM2.5 mass concentration is equivalent to about 50%-60% of PM10 mass concentration. In view of this, China's PM2.5 mass concentration is at least three times higher than the level specified in the WHO guideline, though PM2.5 monitoring data is relatively inadequate in China. **Pollution of atmospheric particulate matters represented by PM10 and PM2.5 will remain the primary atmospheric environmental problem facing China for quite a long period of time.**

As China marches on the path to a well-off and modernized society, its people, especially those in cities that are concerned about human health hazards associated with air pollution, are demanding greater attention be given to ambient air quality problems. *Ambient Air Quality Standards* (GB3095-2012), with reference to the WHO air quality standards, has introduced a stricter limit for PM₁₀ and included PM_{2.5} in the index system in the revision this year, so that the PM₁₀ and PM_{2.5} standards are in line with the WHO Phase I target for air quality improvement. To meet people's increasing requirements, the vast majority of cities in China need to achieve the ambient air quality standards in 15 to 20 years. In 2025, 80% of the cities are expected to do so. It means that the compliance rate for PM₁₀ urban mean concentration should be raised by 40 percentage points during the 12th, 13th and 14th Five-Year Plan period from the current 40% (as shown in Figure 7-6).

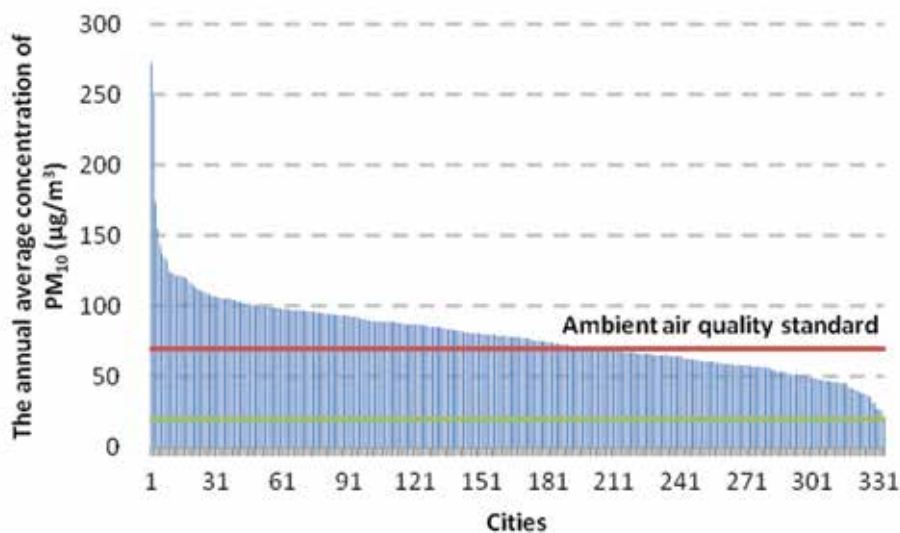


Figure 7-6 Annual average concentration of PM₁₀ in 333 cities of China, compared to ambient air quality standard for PM₁₀

Source: Air quality monitoring data from China National Environmental Monitoring Centre

Such targets necessitate a reduction of over 10% in PM₁₀ average concentration in major cities in each FYP period

(as shown in Table 7-2). According to existing $PM_{2.5}$ monitoring data, $PM_{2.5}$ accounts for more than 50% of PM_{10} in urban areas, which speaks for much more severe non-compliance with $PM_{2.5}$ standards than PM_{10} standards. To achieve a compliance rate of 80% for $PM_{2.5}$ in 2025, **$PM_{2.5}$ mean concentration in major cities needs to decrease by at least 13% in each of the coming FYP periods.**

$PM_{2.5}$ resulted from complicated sources, including primary particulate matters directly emitted from pollution sources and secondary particles formed from SO_2 , NO_x , VOCs and NH_3 in the atmosphere. For most cities in China, especially more polluted eastern cities, it is more difficult to control the $PM_{2.5}$ pollution than the PM_{10} pollution. In light of the nonlinear characteristic of the impact of natural sources and the formation process of secondary particulate matter, **precursor emissions must be reduced by more than 15% in each FYP period**, so that a decrease of 13% in $PM_{2.5}$ concentration and a compliance rate of about 80% around 2025 are attainable.

Table 7-2 Compliance rate of urban annual average PM_{10} concentration under different scenarios

	2010	2015	2020	2025
PM_{10} concentration down by 10% every 5 years	40%	50%	63%	77%
$PM_{2.5}$ concentration down by 13% every 5 years	27%	44%	60%	79%

Note *: Results are obtained through the conservative estimation on the premise that $PM_{2.5}$ accounts for 55% of PM_{10} due to the absence of $PM_{2.5}$ monitoring data in majority cities.

7.3 CURRENT CONTROL MEASURES ARE NOT EFFECTIVE ENOUGH TO ACCOMPLISH THE SET TARGET IN AIR QUALITY IMPROVEMENT

China has introduced a series of control measures over the years, giving a strong impetus to the prevention and control of atmospheric pollution. In particular, national total SO_2 emissions have declined for the first time owing to the innovative policy measures implemented since the 11th FYP period. It significantly lowers SO_2 and PM_{10} concentrations in urban ambient air and improves urban air quality. These measures include:

Develop and implement more stringent pollutant emission standards. Air Pollutant Emission Standards are an important legal basis for managing the sources of air pollution. To control the most contributive categories of stationary sources of atmospheric pollutants, China has developed and implemented various emission standards since the 1980s and introduced more stringent standards for improving pollution control requirements (as shown in Table 7-3). Among them, emission standards for power plant boilers are in line with the international advanced level. Efforts were also made to drive forward the emission standards for mobile sources. National emission standards I was rolled out for light vehicles in 1999 and it has evolved into standards IV for light gasoline vehicles but weaker requirements for heavy vehicles, motorcycles and non-road mobile machinery.

Table 7-3 Emission standards for stationary sources of major atmospheric pollutants

Control Object	Standard No.	Year of Implementation and Revision
Power plant boilers	GB13223	1991, 1996, 2003, 2011
Industrial boilers	GB13271	1983, 1991, 1999
Coking process	GB16171	1996, 2012
Iron and steel production process	GB28662-GB28666	2012
Cement production process	GB4915	1985, 1996, 2004

Control the total emissions of atmospheric pollutants. On the basis of the *Law of the People's Republic of China*

on the *Prevention and Control of Atmospheric Pollution*, China specifies two control zones and kicks off the control of total SO₂ emissions. A series of policy measures aimed at this binding target was implemented during the 11th FYP period, such as a preferential tariff for desulfurization, replacing small units with large ones, backward capacity elimination, and regional restrictions; remarkable achievements were accomplished in reducing emissions in the engineering, structural and management aspects. During 2005-2010, the desulfurization proportion of thermal power units has increased from 14% to 86%, and small thermal power units with a total installed capacity of 76.83 GW have been shut down. Outdated production capacity equivalent to 120 million tons of iron, to 72 million tons of steel, and to 370 million tons of cement was eliminated. SO₂ total emissions were reduced by 14.29%, which exceeds the emission reduction target in the 11th FYP period. On this basis, a reduction of 8% in SO₂ emissions remains a binding target during the 12th FYP period, and a reduction of 10% in NO_x emissions is included in emissions reduction requirements.

Comprehensively improve the urban atmospheric environment. A national policy to promote service and commerce while restricting industry has been carried out in cities. Specifically, a large number of heavily polluting enterprises were relocated from urban areas to more remote areas. In urban clean energy transformation, cogeneration and central heating were developed and a number of small coal-fired boilers were eliminated. Oil and fuel recovery was introduced in gas stations in the Beijing-Tianjin-Hebei region, Yangtze River Delta, and Pearl River Delta to reduce VOC emissions from oil and gas. Urban atmospheric environmental remediation has achieved positive results. In 2010, the annual average concentration of SO₂ and PM₁₀ in cities at the prefecture level or above were 35µg/m³ and 81µg/m³, down by 24.0% and 14.8% from the 2005 level respectively. In accordance with the then Ambient Air Quality Standards (GB3095-1996), 83% of the cities have meet the Grade II air quality standards, rising from the 52% in 2005 (as shown in Figure 7-7).

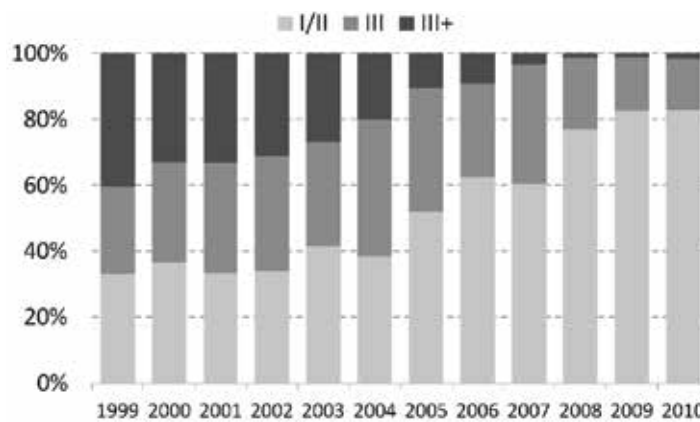


Figure 7-7 Proportion of cities up to Grade I, II, and III air quality standards and below Grade III standards in China during 1999-2010

Source: State of Environment, Ministry of Environmental Protection

Actively explore the joint prevention and control mechanism for regional atmospheric pollution. To ensure the air quality during Beijing Olympic Games, Shanghai World Expo and Guangzhou Asian Games, North China with six provinces (autonomous regions and municipalities), Yangtze River Delta with three provinces (municipalities) and Pearl River Delta, regardless of the administrative boundaries, have jointly set up the Leading Group, signed the Environmental Protection Cooperation Agreement, and rolled out the air quality assurance program for inter-provincial collaboration and inter-departmental interaction. Concerted efforts with close cooperation were made for the overall control of SO₂, NO_x, PM and VOCs emissions, harmonized environmental law enforcement and supervision, and unified environmental information disclosure. Such a strong joint force for pollution control

has produced positive results, guaranteeing good urban ambient air quality in the events. Moreover, useful experience has been accumulated for further regional joint prevention and control of air pollution.

In future years, most of the above measures will continue to play an important role in the prevention and control of air pollution in China. However, this is not enough to cut down the precursor emissions by over 15% in each FYP period, let alone to achieve the target of air quality improvement. There are four types of challenges. First, the legal basis for air pollution control remains very weak, providing inadequate support of air pollution control policies and measures. Second, the capacity building for overall air pollution control lags behind in all aspects, ranging from the national level to the local level, from stationary sources to mobile sources, and from policy making to management and practice. Human input and scientific support are insufficient, hindering the formation of a complete management system and undermining the response to regional atmospheric pollution with its complex and composite features. Third, with the advance of industrialization, urbanization and mobilization in the future, annual consumption of coal in China will keep increasing and exceed 4 billion tones, and the population of light-duty gasoline vehicles will increase by approximately 15 million every year. China faces tremendous pressure to digest new emissions and to further substantially cut down atmospheric pollutants. Fourth, the pollution control level for coal-fired plants and motor vehicles remains low. Pollution control mainly depends on the end treatment and systematic, comprehensive and efficient control measures are absent.

In accordance with the previous analysis, China needs to make improvements in regulations, management mechanism, capacity building and control measures in order to achieve the goal of air quality improvement. This study summarizes the air quality management experience in the United States and Europe, and comes up with five policy recommendations for regional air quality control based on China's practices.

7.4 POLICY RECOMMENDATIONS FOR REGIONAL AIR QUALITY CONTROL

7.4.1 Accelerate the amendment to the Law on the Prevention and Control of Atmospheric Pollution

The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution was enacted in 1987. With the process of air pollution control, amendments were made in 1995 and 2000 respectively, on which basis a series of laws and regulations has been rolled out and implemented to promote the prevention and control of air pollution. This law has played an important role over the years in reducing emissions of air pollutants, preventing and controlling air pollution, protecting people's health, and promoting sustainable economic and social development. However, air pollution has undergone a huge change since 2000, shifting from typical coal smoke pollution to combined vehicle and coal pollution. More specifically, the major components of air pollutants changed from SO_2 and PM_{10} to PM_{10} , $\text{PM}_{2.5}$, O_3 and their precursors as air pollution expands from cities to regions. Mobile sources and industrial process sources joined coal-fired sources in producing air pollution. The existing Law is hardly adapted to the new trend in the prevention and control of regional, combined and complex air pollution shaping in the process of rapid industrialization, urbanization and motorization. To this end, amendments are required in the following aspects to provide legal support for the corresponding policy measures:

First, $\text{PM}_{2.5}$ and O_3 , having an important impact on human health, should be placed in a core position in the prevention and control of air pollution in China. Secondary PM formed in the chemical reactions of such pollutants as SO_2 , NO_x , VOCs and NH_3 accounts for more than 50% of $\text{PM}_{2.5}$ in the air. NO_x and VOCs are also the reactants of O_3 . In view of this, the Law shall stress the integrated control of multi-pollutant emissions. In addition

to SO₂ and smoke dust, important precursors of PM_{2.5} and O₃ formed from NO_x, VOCs and NH₃ should also be brought under strict control. In terms of sources, as industrial pollution control deepens, prominence should also be given to non-point sources such as small and medium-sized boilers, dust, food and beverage fumes and painting spraying, as well as motor vehicles and other mobile sources.

Second, incorporate air quality improvement as the core content of atmospheric environment management.

Government responsibilities and obligations in air quality compliance management within the jurisdiction should be clarified, and more responsibilities and corresponding power should be given to governments at all levels in air quality management. A technical roadmap for urban air quality compliance management should be developed, specifying the compliance deadline based on the status and gap in different cities, as well as the goals and priorities in different phases of the whole process. Consequences for the government of the cities that fail to meet the ambient air quality standards should also be clarified

Third, improve the joint prevention and control mechanism for regional air pollution to address the transmission of atmospheric pollutants across administrative boundaries. Based on the experience of Europe and the United States, the control mechanism for regional total emissions should be improved to address pollutants that travel long distances and affect regional air quality, such as SO₂, NO_x and VOCs. The Ministry of Environmental Protection determines the target of total emission control and assigns it to each administrative region, reducing the impact of upwind atmospheric pollutants on downwind air quality. Joint prevention and control mechanisms for regional atmospheric pollution should be introduced to ensure that the target is achievable.

Fourth, further strengthen the penalties for violations and increase the cost of atmospheric environment illegalities. Punishment and penalties for illegal actions should be raised. Penalty standards provided in the existing Law for excessive emissions, non-compliance with ambient air quality standards and data falsification are too low. As a result, the cost for violations is far less than that for compliance, which is not conducive to the prevention and control of atmospheric pollution. Moreover, the provisions on treatment and control within specified deadlines should be refined, and the decision-making power clearly allocated to competent administrative departments of environmental protection in governments at all levels. In addition, it is necessary to make law enforcement more cost effective, step-up law enforcement efforts, and refine the legal responsibilities of environmental regulators to ensure that those convicted receive appropriate penalties.

Fifth, put emphasis on the control of emissions from non-road mobile sources. Emissions from ships, aircrafts, trains, and non-road machineries should also be included under the Law, with clarified management responsibilities of MEP for dealing with non-road mobile sources.

7.4.2 Improve the air quality management mechanism, and enhance air quality management capabilities

China launched the prevention and control of air pollution in the 1970s. Since then, the emphasis has been put on the emission intensity of key pollution sources and the total emissions of major pollutants, rather than ambient air quality. Targets of atmospheric pollutant emissions reduction are primarily based on emission reduction technologies and economic potential, rather than on the requirement of human health for air quality. Air quality assessment takes into account three “traditional” atmospheric pollutants, SO₂, NO₂ and PM₁₀, instead of PM_{2.5} and O₃, both of which have a more severe impact on human health. To insure a healthy, comfortable and safe atmospheric environment where the masses live, China has to change its thinking about air pollution control—identify compliance with air quality standards as the core and the ultimate management goal, and tackle the emission reduction of PM_{2.5} and related precursors as an important means to improve air quality. Such an air quality management mode needs the support and backup from a sound management mechanism and powerful management capabilities. Compared with

Europe and the United States, China is faced with more complex air pollution and a more difficult management task, but has weaker support in terms of the number of managers, institutional facilities, financial inputs and technologies. In order to meet the requirements of air quality standards and pollutant emission reduction for environmental management, it is urgent for China to enhance the mechanisms and capacity building in the following aspects:

First, allocate the appropriate resources with reference to the air management system of Europe and the United States. Atmospheric administration functions are dispersed in several business units of MEP, such as Department of Total Pollutants Control, Department of Pollution Prevention and Control, Department of Planning and Finance, Department of Environmental Monitoring, and Department of Science, Technology and Standards. Overlapping management responsibilities among business units undermine the efficient coordination in the entire atmospheric management. Meanwhile, human resources for atmospheric administration are limited. There is, at most, one dedicated division taking the responsibilities of air management within each department, and there are only a total of four established persons in the Department of Pollution Prevention and Control directly responsible for air quality management. In contrast, the Office of Air and Radiation (OAR) led by the Assistant Director of U.S. Environmental Protection Agency (EPA) is directly responsible for atmospheric management. It is one of the 11 central bodies of the EPA and has 1,400 managerial persons and four sub-offices, namely air quality planning and standards, atmospheric program, transportation and air quality, radiation and indoor air. Like the U.S., most European countries set up a dedicated coordination organization for atmospheric management and allocate human resources for meticulous management. The U.S. management framework for atmospheric management enables uniform and efficient coordination and refined labor division and duties for specific work. It has laid the institutional and personnel base for raising atmospheric management capabilities. To improve atmospheric management capabilities for quantitative and meticulous management, China needs to comprehensively integrate associated functions and resources, and set up a dedicated atmospheric management department for overall coordination, that is similar to the management mode applied in medicine supervision, water resource and nuclear safety. It also requires substantially increased technical support and human resources to pave the way for quantitative and meticulous air quality management.

Second, improve the joint prevention and control mechanism for regional air pollution to facilitate overall regional management in severely polluted Beijing-Tianjin-Hebei, the Yangtze River Delta and Pearl River Delta. Under the Chinese jurisdiction-based environmental management system, departments of environmental protection account to government at the same level. This is not conducive to the control of regional air pollution. Meanwhile, local management and technical personnel engaged in the prevention and control of air pollution, compared with national atmospheric management, are even more inadequate. In contrast, dedicated representatives in the 10 regional offices under the US EPA cooperate with the state governments. Apart from coordinating regional atmospheric management, they also cultivate leadership talents and skilled specialists with atmospheric management expertise, thus enhancing capabilities to address the issue of regional atmospheric environment. China needs to set up specialized agencies in areas with serious air pollution, such as the Beijing-Tianjin-Hebei region, the Yangtze River Delta and the Pearl River Delta, to take charge for the overall regional air quality management. Joint meetings should be held to facilitate the unified and coordinated regional joint prevention and control mechanism. A joint law enforcement and regulatory mechanism for regional atmospheric environment should be introduced for enhanced enforcement and supervision. Regional consultations are needed under the environmental impact assessment and consultation mechanism for major projects. In addition, mechanisms should be introduced to facilitate regional exchanges and sharing of environmental information and regional early warning and linkage in atmospheric pollution. All these measures are aimed to increase the capacity in local air quality management under “unified planning, monitoring, supervision, assessment and coordination” in regional air pollution prevention and control by setting up local departments on air quality management and vehicle emission control in some key cities.

Third, increase the funding for air quality management, and advance the implementation of the National Clean Air Action Plan included in the national budget. In the 11th FYP period, the investment in environmental protection accounted for about 1.35% of the GDP, well below the level of developed countries. Also, the inputs for the prevention and control of atmospheric pollution have been insufficient in water environmental protection, heavy metal pollution control, and ecological protection for a long time. It directly leads to inadequate investment in atmospheric management capacity building, and a serious lack of data and research to support quantitative and meticulous management. In terms of funds, the central government should set up special funds for atmospheric pollution prevention and control and increase the introduction of specialized management and technical talents to enhance research capacity and basic management capacity. Meanwhile, it should also develop an investment mechanism for diverse investment subjects and approaches, and lead and encourage local governments and enterprises to put in place financial incentives for air pollution control. In terms of technologies, a number of national special research projects should be carried out in China as soon as possible, in hope of breakthroughs for such major scientific issues as the generation mechanism of air pollution in different regions, source apportionment, and control and prevention paths.

7.4.3 Accelerate the transformation of economic development mode and promote the continued reduction of pollutants

The U.S. and European experience show that improvement of air quality accompanies transformation of economic development mode. In the recent three decades, the decreasing proportion of heavy chemical industries in such industrialized regions as Europe and the U.S contributes to the gradual reduction of air pollutant emissions in the industrial process. However, now in the late stage of industrialization, China still depends heavily on energy-consuming and high-polluting industries for economic development. Although the emission intensity of air pollutants per unit of GDP is 40% to 80% lower than the 1990 level, SO₂ and NO_x emissions are still one to three times higher due to the fast growth of heavy chemical industries in the process of rapid economic expansion. In particular, China's crude steel and cement outputs have increased by four and two times respectively since 2000 (as shown in Table 7-4). In 2010, crude steel output in the Beijing-Tianjin-Hebei region and cement output in the Yangtze River Delta region were 1.9 times and 4.3 times as much as that of the U.S respectively. To substantially cut down emissions of atmospheric pollutants amid stable and rapid economic expansion, it necessitates a faster decline in the emission intensity per unit of GDP than that in last two decades to offset the negative effects of rapid GDP growth on pollution reduction.

Table 7-4 Steel and cement outputs in 2000 and 2010 (100 million tons)

	1990	2000	2010	Proportion of global output in 2010
Crude steel	0.66	1.29	6.27	44%
Cement	2.10	5.97	18.68	60%

Taking the opportunity of socio-economic transformation, it is pressing for the National Development and Reform Commission (NDRC), Ministry of Industry and Information Technology (MIIT) and MEP to jointly develop proactive policy measures to push ahead industrial restructuring, reduce the massive emissions from heavy chemical industries, as well as adjust industrial output by gradually eliminating the capacity in regions with concentrated heavy chemical industries and severe air pollution. These measures include the following suggested actions:

- **Shape a sustainable investment and consumption pattern that will reduce the dependence of local economic development on heavy chemical industries.** Increase the proportion of the tertiary industry and high value-added industries, and slow down the development of energy-consuming, high-polluting industries. It is forecasted that China will maintain stable and fast economic development in the next 15 to

20 years, the urbanization process will further accelerate, and the feature of heavy chemical industries will remain prominent. China needs to promote the development of strategic emerging industries, and guide the sustainable transformation of investment and consumption patterns via differentiated economic policies. Meanwhile, total pollutant control and energy consumption should become drivers to achieve peak iron, steel, and cement outputs in the 13th FYP period, followed by decline in their output, with improved air quality.

- **Improve the technical level and reduce overall energy consumption and air pollutants while enhancing the industrial output value.** China should raise the industrial access threshold, prioritize such indicators as energy-efficiency, environmental protection and security in the strict implementation of energy efficiency assessment and review, and environmental impact assessment in accordance with the law. Construction land review and loan approval should also be stricter. On the other hand, with the elimination of backward production capacity in such polluting industries as thermal power, iron and steel and building materials, China can improve the overall technical level to drive ahead industrial optimization and reduce air pollutant emissions. Throughout this process, efforts should be made to promote the universal and efficient utilization of best available technologies for cleaner production and pollutant emissions control, for instance, reducing the use of volatile materials in coating and cleaning processes. At the same time, the industrial chain should be extended and the proportion of refined high value-added products increased to reduce pollutant emissions along with the development of heavy chemical enterprises.
- **Progressively reduce the capacity of heavy chemical industries in the Beijing-Tianjin-Hebei region, Yangtze River Delta and Pearl River Delta to reduce severe combined and complex air pollution.** These regions and their cities are experiencing the transition from late industrialization to post-industrialization. In some cities and regions, with the evacuation of heavy chemical industrial production and the substantial adjustment of energy structure, the emissions of multiple atmospheric pollutants are being reduced, thus creating or having created conditions for reducing emission intensities. Strict technical and environmental requirements for access thresholds should be set for transfer of industry from these regions, so as not to affect the realization of air quality improvement goals in other areas such as Central or Western China.

7.4.4 Optimize the energy structure to achieve efficient, clean, and sustainable coal utilization

Coal is an important basic energy resource for China. China's coal consumption has been on a rapid rise since 2000, up from 1.4 billion tons to 3.1 billion tons in a decade. In 2010, China accounted for 48.2% of the world's total coal consumption. Compared with clean energy such as natural gas, the coal utilization process generates more air pollutants including SO₂, PM, heavy metals and CO₂. Due to the limitations of resource endowments, coal has been in a dominant position in the energy structure. It has accounted for about 70% of primary energy consumption since the 1980s, far more than the 20% in some other countries. Such coal-dominated energy structure is an important contributor to the massive emissions of atmospheric pollutants. More specifically, it is responsible for 90% of the SO₂ emissions in China, 67% of the NO_x emissions, 40% of the soot emissions, and 70% of human-caused atmospheric mercury emissions. Coal consumption intensity is also significantly consistent with the spatial distribution of regional air pollution, especially PM_{2.5} pollution (as shown in Figure 7-8). In view of this, a substantial reduction of air pollutant emissions in coal combustion is a must to improve ambient air quality in China and particularly the severely contaminated eastern regions.

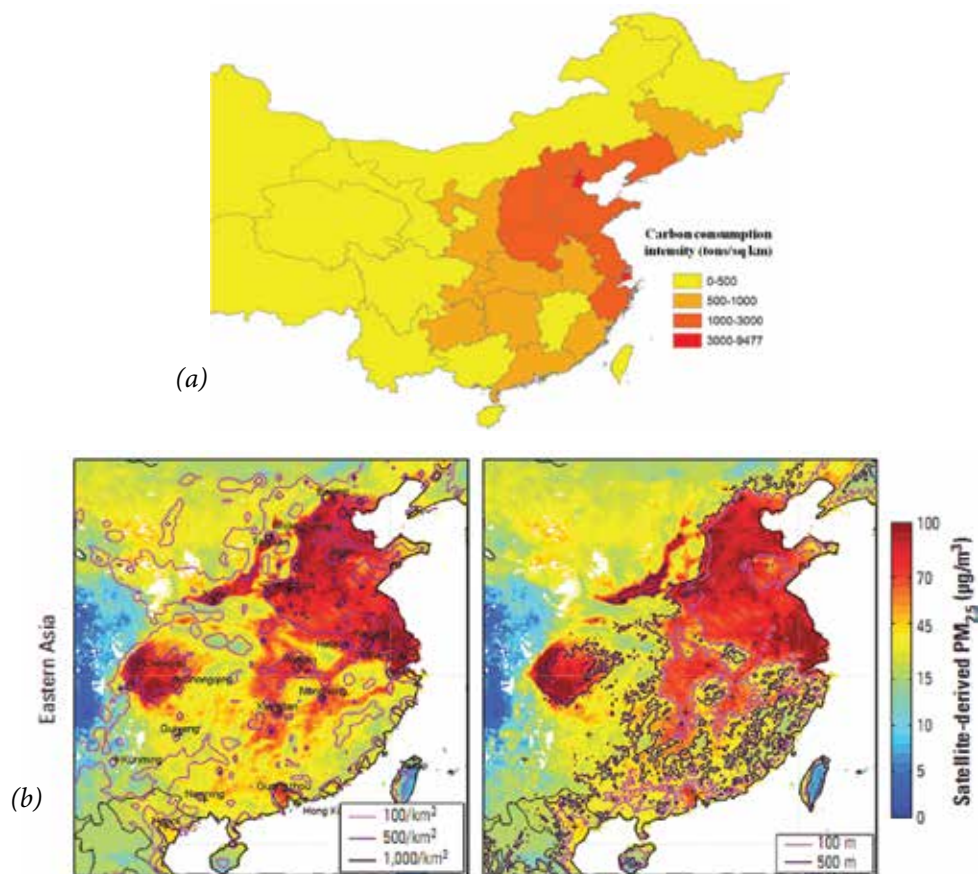


Figure 7-8 $PM_{2.5}$ pollution in eastern regions is more serious (b), consistent with the spatial distribution of coal consumption intensity (a)

Source: Chinese Energy Statistical Yearbook 2011, China Statistical Press, 2012; van Donkelaar et al., 2010. Global Estimates of Ambient Fine Particulate Matter Concentrations from Satellite-Based Aerosol Optical Depth: Development and Application, Environmental Health Perspectives, 118 (6): 847-855

Energy resource endowment determines that coal will dominate China's energy structure for a long time to come. Hence only sustainable, clean and efficient coal use will provide prerequisites for controlling the emissions of air pollutants from coal combustion. It is also advised that the NDRC, MEP, and relevant ministries introduce policies for energy system optimization in order to push forward the gradual shift from coal to natural gas and other clean energy sources, the strategy of sustainable, clean, efficient use of coal, and technological advancement in the use and conservation of all energy sources. Major policies include:

- **Optimize the energy structure by reducing the proportion of coal in primary energy.** In the near future, massively increase the supply of natural gas and develop nuclear energy; in the mid- and long-term, develop wind, solar, biomass and other renewable energy sources aiming at a reduction of 3 to 5 percentage points in the proportion of coal to primary energy during each FYP period.
- **Optimize the spatial distribution of coal consumption by controlling regional total coal consumption.** Reduce coal consumption in Beijing, Shanghai and areas with high coal consumption intensity in their late stage of industrialization, and restrain the growth rate of coal consumption in eastern regions, so as to reduce coal consumption in regions with serious air pollution, including the Beijing-Tianjin-Hebei region, the Yangtze River Delta, and the Pearl River Delta.
- **Improve the coal consumption structure, promote the transfer of coal consumption to large-scale coal-fired equipment with best available technologies, and reduce the terminal coal consumption in the industrial and commercial sector.** The power sector's coal consumption should account for 60% and 65% of the total in 2020 and 2030 respectively.

- **Put emphasis on pollution control in the whole coal life cycle to advance coal washing and distribution.** Efforts should be made to increase the proportion of washed coal to more than 70% in 2030 to be in line with the international level.
- **Vigorously promote clean fuel adoption in households.** Reduce the direct combustion of raw coal and biomass in households and promote gas energy and briquette use.

In addition, China as the largest coal consumer in the world should develop and use the world's best coal-fired pollution control technologies, and gradually establish a leading position in clean coal utilization. Stringent emission standards and access measurement method should be introduced to promote the research, development and use of best available technologies for air pollution control, such as efficient desulfurization, denitration and dust removal, and ensure the efficient and stable operation of these technologies in the coal-fired pollution source to reduce the emissions of pollutants.

7.4.5 Comprehensively strengthen pollution control in mobile sources

Mobile sources have become a prominent factor in causing ambient air quality problems. Mobile sources contribute 20% -25% of $PM_{2.5}$ in major cities such as Beijing and Shanghai, as well as the eastern densely populated areas. Some factors such as the rapid increase in the vehicle population, weak promotion and ineffective enforcement of stage two vapor recovery or onboard refueling vapor recovery, and loose standards on summer time fuel vapor pressure have resulted in high VOCs emissions from gasoline vehicles, and hence lead to ozone nonattainment. Pollution from rapidly growing mobile sources has posed one of the greatest challenges in air quality management. Its control to a large extent determines whether regional air quality is effectively improved in China, but also majorly impacts the public satisfaction about relevant government policies and implementation. At present, both developed and developing countries are facing unprecedented challenges from the prevention and control of mobile source pollution and attach a high degree of attention to this issue. Countries across the world are active in summarizing lessons learned and exploring a more scientific, rational and efficient program for mobile source pollution control. China is the world's largest auto market and the rapid increase in the number of motor vehicles leads to severe congestion. Simultaneously pollutants which are not brought under effective control pose short and long-term hazards to the health of the residents in highly populated urban areas. For the purpose of effective control of mobile source pollutants, China should work out comprehensive policies regarding fuel quality, vehicle emissions standards and road use, covering mobile sources management, vehicle energy and urban planning.

With regard to fuel quality, it is necessary to rapidly introduce near zero sulfur levels in both diesel fuel and gasoline. Modern, efficient purification processing for mobile source emissions requires high quality gasoline, and diesel fuels, in which it is essential to achieve at least low-sulfur content (sulfur content less than 50ppm) or the best, near zero-sulfur content (sulfur content below 10ppm). In promoting low-sulfur and sulfur-free gasoline and diesel, only a few cities in China such as Beijing and Shanghai have made significant progress in the last decade. As a result of such slow advancement, the implementation of more stringent vehicle emission standards has been delayed, hindering the realization of ambient air quality improvement targets. According to studies, if low-sulfur and sulfur-free fuels were introduced across the country on the schedule that MEP intended and National Emission Standards IV for heavy-duty diesel vehicles was implemented on schedule (rather than delayed 30 months), PM emissions from new trucks would have been reduced by about 80% over the level specified in National Emission Standards III and NO_x emissions by about 30%. Such a difference in emissions will impose a 5-10-year effect on ambient air pollution over the lifetime of these vehicles. In fact, large oil refineries in China are largely capable of producing low-sulfur and sulfur-free gasoline and diesel. Appropriate price policies and economic incentives could be effective in actualizing the market supply in the short term. It thus will play a substantial role in controlling mobile source pollution and improving ambient air quality. In light of this, it is recommended that the Chinese

Government attach a high degree of attention to low-sulfur and sulfur-free fuels, and bestow the right of oil quality management on MEP. With a clarified schedule and firm targets, effective policies should be quickly carried out to advance the realization of low-sulfur fuel and sulfur-free fuels for vehicles and promote low-sulfur fuels in non-road mobile sources.

With regard to vehicles, accelerate the development and implementation of a full-range of emissions standards.

International experience has shown that stringent emission standards provide essential regulatory conditions for mobile source pollution control. Over the past decade, China has developed a relatively strong emission standards system for vehicles which largely constrained emissions growth in spite of the tremendous increase in the vehicle population. However, in comparison with developed countries, China still lags behind in the stringency of its limits, the scope of coverage and reasonable implementation for which further improvement is required. For example, the emission standards for railways, waterway vessels, agricultural and construction machinery, power generation sets, and small general machinery with internal combustion engines, as well as the emission standards for vapor emissions during refueling and otherwise, need to be improved. For this consideration, government departments should accelerate the development and implementation of full-range emission standards for internal combustion engines with wide participation from all walks of life (not limited to people engaged in internal combustion engines) for opinions and suggestions. Such standards shall take into account the world's most advanced and reasonable technical requirements, and be promulgated as soon as possible. Advanced, rigorous standards are expected to actively promote the innovation and development of partial zero emissions vehicles (P-ZEV) and zero emissions vehicles (ZEV), and pose requirements on emission processes not covered by the current standards (such as VOCs emissions in gasoline refueling process). China is advised to advance the implementation of as rigorous and comprehensive as possible set of emission standards consistent with the availability of low sulfur and ultra low sulfur fuels. New diesel vehicles should be required to meet the National Emission Standards V as soon as possible but no later than in 2015 and Euro VI standards requiring active regeneration diesel particulate filters (DPF) should be required in key regions and cities by the same time. New light gasoline vehicles should be required to adopt all the emission control measures specified in National Emission Standards V, including the on-board refueling vapor recovery (ORVR) which controls refueling vehicle emissions as soon as possible. In addition, if fuel quality conditions permit, it is encouraged to carry out retrofit projects for diesel vehicles. A clear roadmap regarding fuel quality and emissions standards for all categories of on and off road vehicles should be a high priority for MEP in the immediate future.

In the aspect of roads, create a new sustainable urban transport system. Developed countries' experience and lessons learned show that a sustainable urban transport system is crucial to traffic pollution control. A new, characteristic urban transport system is required, which emphasizes the development and design of urban public transport, cycle track and pedestrian walkway design, and traffic optimization, and introduces such management means as low-emission zones and zero-emission zones, green passenger and freight transport, and peak traffic management. It is advised to delineate low-emission zones and zero-emission zones in cities in urgent need of air pollution control and work out appropriate management measures in 2013, so as to reduce the emissions of buses and taxis in such zones. Peak and traffic management of high-emission private cars is also recommended.

In addition to the above three, vessels have been significant emission sources polluting the air of port cities such as Shanghai, Shenzhen, Guangzhou, Nanjing and Ningbo. However, the local government is not able to effectively supervise these sources based on the existing management framework. A cooperative mechanism should be established between the Ministry of Environmental Protection and the Ministry of Transportation to identify the duty and responsibility in local vessel emission control. China should implement a vessel sulfur emissions control zone in Yangzi River Delta (YRD) and Pearl River Delta (PRD), and install the shore side electricity facilities in ports. Emission standards, oil standards and management standards should also be introduced as soon as possible for non-road mobile sources such as construction and agriculture machineries, and locomotives.

CHAPTER 8

CCICED 2012 WORK REPORT

LI GANJIE

CCICED SECRETARY GENERAL

As a high-level policy advisory institution in the field of environment and development, the China Council for International Cooperation on Environment and Development (CCICED or the Council) has received considerable attention and strong support from the Chinese Government over the past two decades. Senior Chinese leaders have attended CCICED Annual General Meetings (AGMs) and met with International Members 45 times. Premier Wen Jiabao has taken part in CCICED AGMs for 15 consecutive years since 1998, and has spoken highly of CCICED. He said: **“The strong vitality of CCICED lies in its focus on an eternal theme – sustainable development. CCICED is a platform, its importance not only reflected by the environmental cooperation between China and other countries, but also by China’s influence on environment and development globally. CCICED will continue and become better and better.”** In his opening speech at the CCICED 2011 AGM, Vice Premier Li Keqiang also spoke highly of CCICED activities and expressed his expectations for CCICED Phase V. He said: **“CCICED has been engaged in China’s environment and development over a long period of time, and has carried out a great number of fruitful activities. Many policy recommendations by CCICED have been adopted by the Chinese Government and have achieved positive results, which has contributed to China’s sustainable development. I hope that the new phase of CCICED will continue to take full advantage of the wisdom and vision of its experts, actively introduce advanced ideas and international practices, carry out in-depth studies on key issues based on China’s current and future needs in environment and development, and make its contribution to China’s transformative development.”**

In 2012, the global economy was still reflecting the impact of the financial crisis and was fragile and sensitive, which slowed momentum in global sustainable development. Although the United Nations Conference on Sustainable Development was a significant development in enhancing people’s understanding of environment and development issues, sustainable development still lacks strong commitment and cooperative action from the international community. The environment and development process is facing unprecedented challenges. Under the background of a global economic slowdown, China’s economic growth is facing continuous decline, and its “maintaining a steady growth” strategy has increased pressure on environmental protection. Facing this complex and grave situation, the Chinese Government has coordinated its plans for tackling environmental issues both at home and abroad, actively taking part in international cooperation and governance in environment and development, firmly promoting the development of ecological civilization as a national strategy, and actively facilitating the green transformation of its economic development mode. Based on the new situation, tasks, and requirements that China faces, the Government has taken a series of strategic measures. In particular, environmental protection has been strategically embodied in development, and embodied development environmental protection and China has actively explored a new path to environmental protection that is low in cost, high in benefits, low in emissions and sustainable in development.

CCICED entered its Phase V in 2012, and has conducted its work based on the objectives, tasks and policy research directions identified in CCICED Phase V’s mandate. Under the strong leadership of the Bureau and with the support

of Chinese and international partners, CCICED has successfully completed its work this year and has met expected objectives. Some areas of progress in 2012 are the following:

I. The Success of CCICED Rio + 20 Side Event highlighting the role of CCICED as a high-level international platform for dialogue on environment and development policy.

CCICED held a Side Event at the United National Conference on Sustainable Development (Rio + 20) in Rio de Janeiro, Brazil on June 21, 2012 with the theme “Rio + 20, CCICED at 20”. Mr. Wen Jiabao, Member of the Standing Committee of the CCCPC Political Bureau and Premier of the State Council, chaired the meeting and exchanged his views with participants on relevant issues related to sustainable development in China and the world.

The CCICED Rio + 20 Side Event was CCICED’s first overseas event and its success is reflected in the following six aspects:

1. CCICED Rio + 20 Side Event was the only high-level Chinese interactive side event attended by a State Leader during the United Nations Conference on Sustainable Development. The attendance of Premier Wen and the warm and candid discussion between Premier Wen and international participants demonstrated the strong support on the part of the Chinese Government and Premier Wen Jiabao for CCICED. It further demonstrated the important role and significance of CCICED as a unique high-level international policy platform for dialogue on China’s environment and development.
2. The side event attracted considerable attention from Chinese and international stakeholders. The participants in the side event were of senior rank and from a wide range of areas. The Chinese participants included 13 ministry leaders from the Ministry of Environmental Protection, Ministry of Foreign Affairs, NDRC, Ministry of Finance, Ministry of Agriculture, Ministry of Commerce and the Research Office of the State Council. International participants included heads of such international institutions and organizations as UNEP, WWF, World Business Council for Sustainable Development and ADB, as well as 12 ministry-level officials from Germany, Italy, Denmark, the Netherlands, Australia, Sweden, Japan and the United States. A total of 16 Chinese and international Council Members attended the meeting.
3. The Side Event covered a wide range of topics, including significant challenges facing China, understanding of the world situation, matters related to China in its external relationships, and the value of CCICED and possibilities for applying this model of international cooperation elsewhere. Some international participants commented that, through his answers and statements, Premier Wen Jiabao demonstrated his personal as well as the Chinese government’s commitment to enhancing the relationship between environment and development and China’s commitment to sustainable development. The recognition of the commitment and achievements made by China at the Rio + 20 side event may be seen as a turning point and demonstrated that China can be a source for new ideas, technology and experience in environment and development.
4. The appreciation and full affirmation given by Premier Wen Jiabao to CCICED have greatly strengthened the confidence of Council Members, donors and partners and their willingness to support the long-term development of CCICED.
5. The Side Event received active media attention. CCTV evening news aired a 3-minute program on the meeting. All major newspapers and network media in China reprinted in full the speech by Premier Wen Jiabao.
6. CCICED used in this case a large international conference as a platform for sharing CCICED experience and achievements over the Council’s past 20 years, as well as for expanding the understanding of international communities about CCICED and for further enhancing CCICED influence internationally.

II. Implementation of CCICED Phase V activities

In 2012, all activities planned for the first year of CCICED Phase V were launched effectively and made substantial progress thanks to the strong support of the Chinese Government, active promotion of Ministry of Environmental Protection and close cooperation of CCICED's major donors and partners. They included the following:

(I) Nomination of the Members for CCICED Phase V

Twenty years of evolution and growth has enhanced CCICED's role as a high-level mechanism for dialogue and cooperation on environment and development policies between China and the international community, engaging the highest level of government and exerting considerable influence on policies on environment and development. Its achievements are inseparable from the prominent role played by Chinese and international Members. As one of the important activities of the new phase of CCICED, the nomination and appointment of the Council's membership have been completed after consultation with many stakeholders. There are 57 Members in CCICED Phase V, 32 Chinese Members and 25 International Members.

The Council's Phase V membership comprises approximately 50% new Members. In comparison to that of Phase IV, Phase V membership has the following three major characteristics: First, diversification in areas of expertise was accomplished by including members with backgrounds in such areas as energy, resources, environment, ecology, society, economy, finance, law, macro policy, regional development, and academia. Second, a balance was struck between regions and countries by including representatives from major developed countries and economies, developing countries, emerging economies, international organizations and institutions, as well as NGOs and enterprises. Third, an age balance was achieved by including younger Members.

(II) Completion of the draft Charter for CCICED Phase V and supplementary provisions

The draft Charter for CCICED Phase V and its supplementary provisions has been compiled and improved after communication and consultation with major donors and partners of CCICED and after internal procedures were completed on the Chinese side, to prepare for its review and adoption at the first AGM of CCICED Phase V in December 2012.

The CCICED Phase V Charter has two major characteristics. First, it inherits the objectives, tasks, organizational structure and operational mechanisms identified for Phase IV. Second, it makes necessary changes and improvements based on the changing domestic and international situation and includes more attention to the interaction and implications of environment and development issues both in China and globally; provides for policy recommendations to the Chinese Government that focus on more active participation in global environment and development processes; further enhances the organization and management of policy research projects in order to strengthen the influence and relevance of CCICED policy recommendations; includes a provision for conducting policy demonstration projects to improve the workability and feasibility of policy recommendations; expands activities to publicize the findings of CCICED to Chinese and international stakeholders through various channels and methods; and strengthens capacity building of the Chief Advisors and their supporting group as well as the Secretariat and improves the overall management and operation of CCICED.

(III) Identification of priority areas for policy research in CCICED Phase V

Policy research and policy recommendations to the Chinese Government on environment and development are basic activities and the core mandate of CCICED. Understanding its position and historic mission, CCICED's new phase will identify guidelines, objectives and tasks for policy studies; place China's economic and social development stage in the context of current conditions as well as past experience; give priority to the "12th Five-Year Plan" while

looking forward to the “13th Five-Year Plan”; aim at the achievement of a comprehensive *Xiaokang* society by 2020; focus on the development of ecological civilization and achievement of a resource-saving and environment-friendly society; carry out studies on difficult and key environment and development issues at the macro, medium and micro levels; and put forward far-sighted, strategic, and feasible policy recommendations to the Chinese Government. In the next five years, CCICED will concentrate on topics such as regional balance and green development, environmental and social issues in the process of green transformation, management and policy innovation for green development and China’s role in global green development as priority areas for policy research. Its work will not only serve China’s green transformation and social progress, but also contribute to global sustainable development.

(IV) Fund raising for CCICED Phase V has obtained expected achievement

Through various forms of communication and consultations over the past year, CCICED Phase V has secured financial and intellectual support from a wide range of Chinese and international stakeholders. In order for CCICED to play an even more significant role, the Chinese government has doubled its financial support to Phase V compared to its Phase IV contribution. Some major donors have also increased their financial support to CCICED. To date, approximately \$24 million in operational funds are in place.

It should be noted that CCICED’s cooperation framework has gradually changed from development assistance to bilateral environmental cooperation. Major donors to CCICED, including Canada, Sweden and Germany have confirmed that they have shifted their CCICED support programs from bilateral development aid to bilateral environmental cooperation. This has put CCICED’s long-term development on a more solid foundation.

III. Relevant Policy Research

In 2012, CCICED launched a series of policy research projects focused on the theme of Regional Balance and Green Development, in preparation for the 2012 AGM and the preparation of policy recommendations for the Chinese government.

1. Completing policy research on schedule

The CCICED has completed the following two task forces and three special policy research projects in 2012; their research findings will be presented to the 2012 AGM:

1. Task Force on Policy Mechanism Towards Environmental Targets for “12th Five-Year Plan” (2011-2012)
2. Task Force on Strategy and Policies on Environment and Development in Western China (2011-2012)
3. Environmental Strategy and Measures for Transformation of Development Mode in Eastern China (2012)
4. Regional Air Quality Integrated Control System Research (2012)
5. China’s Marine Environmental Management Mechanism Based on the Case Study of the Oil Spill Incident in the Bohai Sea (2012).

Meanwhile, the following two new task forces were established following approval by the Council’s 2011 Bureau Meeting and AGM. They will report their findings at the 2013 AGM.

1. Environmental Protection and Social Development (2012-2013)
2. Consumption and Green Development (2012-2013)

2. Important role of Council Members and donors in policy research

Four Chinese and International Council Members have served as co-chairs of research projects, contributing considerable time, energy and wisdom through direction involvement in and coordination of research, field trips, information exchanges and workshops leading to high quality reports. The financial and expertise contribution from CCICED donors and partners to the research has played an important supporting role.

3. Strategic ‘Salon’ held in success

CCICED Strategic ‘Salon’ is an innovation for policy research in Phase V. It aims to establish a new platform to provide new instruments and explore new pathways for enhancing the study of major issues. A group of senior experts will be gathered for brainstorming on research topics from a multidisciplinary perspective and through a combination of theory and practice. They will focus on current difficult and key issues in the field of environment and development in order to make the Council’s policy recommendations more forward-looking and strategic. According to the Council’s 2012 work plan and with careful arrangement, the first CCICED Strategic ‘Salon’ was held in October. The meeting attracted a number of renowned Chinese experts and scholars in economics, sociology and environment, whose information, analysis, views and suggestions will serve an active role in enriching and expanding the Council’s policy research. The ‘Salon’ has also helped extend CCICED’s influence in related fields in China. It will continue as a ‘branded’ institutionalized activity and will inject new vitality into the Council’s policy research.

IV. Operation and Management of the Council

Over the past year the Council has made a number of improvements in its operation and management that have contributed to its successful implementation of its work.

1. Chief Advisors and the Supporting Experts Group

CCICED Phase V will continue to use the established work mechanism engaging the Chief Advisors and their supporting expert group, for, among other duties, providing direct support to the Council’s policy research. To strengthen the functions of the Chief Advisors in Phase V, an assistant to the Chinese Chief Advisor has been appointed, and an international expert and a domestic expert have been added to the supporting expert group.

The work mechanism for Chief Advisors has worked well in the course of the year. They have played a more prominent role in advising the Secretary General on policy research, which has been instrumental in securing the smooth progress of the Council’s work. Their main activities include the followings:

1. Strengthening guidance on policy research

The Chief Advisors provided comprehensive advice to the Secretary General on Task Forces and other policy research projects and provided advice, guidance and assistance to the policy research teams. Various mechanisms ensure effective communication between Chief Advisors and the TFs. The newly revised “*Work Mechanism for CCICED Chief Advisors*” specifies detailed tasks for the Chief Advisors. They include drafting the project concept paper, examining and approving work programs, and reviewing mid-term research findings and final reports, all of which will help improve the quality of research reports.

2. Cooperating with the Secretariat to carry out various tasks

Joint Meetings of CCICED Secretariat and Chief Advisors were held five times in 2012 and the Chinese Chief Advisor and the supporting experts group held regular monthly work meetings. These meetings

ensured close cooperation and consultation between the Chief Advisors and the Secretariat and effective operation of various tasks.

3. The Chinese and International Chief Advisors attended the Council Rio+20 Side Event and supported the preparation of relevant documents.

4. Drafting documents for AGM

The Chief Advisors support team has completed their tasks as planned, including the draft of *Policy Recommendations of 2012 AGM, Issues Paper, Progress on Environment and Development Policies* and *Report on CCICED Policy Recommendations Impact*. Their efforts will contribute significantly to the success of the 2012 AGM.

5. Studying and identifying directions and priority areas for policy research during CCICED Phase V

With careful study and extensive consultations both at home and abroad, the support team and International Chief Advisor have drafted a framework for the directions and priority areas for policy research during Phase V, and set the objectives and tasks for the next stage. This document will lay a solid foundation for policy research over the next few years.

2. CCICED Secretariat and its International Support Office

The year 2012 is a transitional year for the Council. The Secretariat and its International Support Office have faced a variety of complex tasks. Thanks to the leadership of the Executive Vice Chairperson and the Secretary General, the cooperation of Chief Advisors and their supporting experts group, the Secretariat has completed all its tasks successfully.

1. Management of policy research projects.

To strengthen management of policy research projects, the Secretariat has prepared the *Measures related to the Management of CCICED Research Projects* as a supplement to the Charter of CCICED Phase V to regulate the implementation and operation of various types of policy research projects. Meanwhile, the Secretariat and its International Support Office have strengthened the guidance and coordination on the establishment and operation of task forces and special policy studies, providing comprehensive support and assistance to project teams. In the course of the implementation of the four task forces and three special policy research projects in operation in 2012, the Secretariat organized and attended over 40 related meetings and activities, which have ensured smooth operation of all the research projects.

2. Organizing and preparing the CCICED Rio+20 Side Event.

To organize and prepare the CCICED Rio+20 Side Event was a complex challenge and test for the Secretariat. First, the delegates were high-level officials. Arranging their participation required close coordination and confirmation beforehand and attention to exacting requirements on the form, content and outcomes of the meeting. Second, the meeting venue was in Rio de Janeiro. The less-than-ideal accommodation and working conditions presented great difficulties and uncertainty in the preparation work. Third, there were limited manpower and funding resources, which demanded careful planning. In spite of these difficulties and adverse conditions, the Secretariat staff worked steadily and conscientiously, and, with the active support from all parties, and particularly with the significant contribution GIZ of Germany, the side event was a great success, attracting significant attention from domestic and international audiences. In the end, the Council accumulated rich experience that can be applied when holding similar activities and the Secretariat has strengthened its capacity.

3. Preparing for CCICED Phase V.

Preparing the launch of CCICED Phase V was one of the key tasks for the Secretariat in 2012. The Secretariat completed a variety of tasks as scheduled, such as nominating Chinese and International Council Members and submitting the list of candidates for approval, drafting the Charter for CCICED Phase V and supplementary Annexes, obtaining input on the direction and priority areas for policy research, and putting in place operating funds for the new phase of the Council.

4. Strengthening contact and communications with Chinese and International Council Members and partners.

A total of 10 issues of newsletters in electronic form were distributed to disseminate information about the Council over the course of the year. The Secretariat listened to and adopted suggestions from its partners to further improve the work of the Council. It also has invited Council Members and partners to participate in Council activities and provided services to them.

5. Secretariat capacity building.

The Secretariat applied more stringent requirements to its work, strived to apply better overall management skills, and sought to improve its performance through various courses and training programs at home and abroad. In the meantime, it further standardized fund management procedures to ensure the smooth operation of policy research and other activities.

V. Dissemination of the Achievements of CCICED

The Council's activities and achievements have been disseminated in different formats and through a variety of channels to expand CCICED's influence. The effort has had positive results.

1. Active outreach overseas.

Taking advantage of major international events related to environment and development activities, CCICED actively strengthened its communications and expanded its outreach overseas in 2012. Apart from holding the CCICED Rio+20 Side Event and Exhibition, the Council also joined with WWF to hold a side event at the 5th Ministerial Conference of the Forum on China-Africa Cooperation in Beijing. The Council was also invited to the Regional Workshop on Green Economy held in Mozambique and several other countries' and organizations' side events during Rio+20. By sharing its achievements with the international community, the Council has attracted wider international attention.

2. China's mainstream media gave special coverage to the CCICED Rio + 20 Side Event.

The Council's AGM was broadcasted live online. Newspapers, magazines and other forms of media have been utilized to promote the Council's policy research achievements and policy recommendations.

3. Printing and distributing publications.

The Council has compiled and distributed more than 10,000 copies of its publications including the *Proceedings of the 2011 AGM*, *Annual Policy Report 2011*, *Work Report of CCICED 2011* and *CCICED at 20: Activities, Impacts and Future Opportunities*.

4. Improving the Council's website in Chinese and English

The Council's website underwent comprehensive revision in both Chinese and English, including design of the website and of its various pages, their contents, and links. The website is now more informative with timely updates and convenient search tools and is easier to navigate. Its access rate has increased by 25% compared with the same period last year.

APPENDIX

CHINA COUNCIL FOR INTERNATIONAL COOPERATION ON ENVIRONMENT AND DEVELOPMENT (CCICED)

Phase V (2012-2016)

Report on Funding: 2011-2012

INTRODUCTION

Phase V of the China Council for International Cooperation on Environment and Development (CCICED) will be inaugurated at the December 2012 Annual General Meeting. However, due to the timing of the AGM and the availability of financial data, this report on funding covers the period from 1 October 2011 to 30 September 2012, and thus encompasses the final months of Phase IV as well as the initial months of Phase V.

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 as of September 30, 2012, appear in Table A1. Contributions were made in a number of currencies. The US\$ equivalent amounts shown were calculated using rounded exchange rates valid on 30 September 2012. 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.

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 initial months of Phase V, SISO managed the contributions to the Council on the part of CIDA, AusAID, and Energy Foundation, as well as funds provided by the Secretariat from Norway's and Sweden's contributions that are allocated to meet the international costs of specific task forces. In a few instances, donors manage their contributions through their own offices.

During 2011/12, 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 are used to facilitate task force financial management.

Expenditures 1 October 2011 – 30 September 2012

Table A2 displays expenditures from 1 October 2011 to 30 September 2012 by donor. Some of these expenses were paid during the final months of Phase IV. Consequently the table shows actual amounts expended, regardless of whether they covered Phase IV or Phase V costs or were paid from donors' Phase IV or Phase V contributions. Expenditures for this period totalled US\$ 5,007,571. A number of other costs related to this period were processed through donor financial systems either before or after the October 2011 – September 2012 period and were included in last year's data or will appear in the 2012-2013 figures.

Table A1 CCICED Phase V – Donor Contributions / Commitments As Of September 2012

	Donor	Amount in original currency	Approximate value in US\$ at 30 Sept 2012 rates (see Note 1)	Details
1	China	CNY 40,000,000	6,350,000	
2	Canada	CAD 7,290,000	7,290,000	
3	Norway	NOK 25,000,000	4,300,000	
4	Sweden	SEK 10,000,000	1,500,000	Fund for 2012-2013. Fund for 2014-2016 to be confirmed later.
5	Germany	EUR 274,134	358,205	For year 2012. Fund for 2013-2016 to be determined later.
6	Australia	AUD 1,500,000	1,530,000	
7	Italy	EUR 500,000	650,000	
8	The Netherlands	EUR 500,000	650,000	
10	US EDF	USD 650,000	650,000	
13	Shell (China) Limited	USD 600,000	600,000	
15	UNDP	USD 40,000	40,000	
21	Energy Foundation	USD 200,000	200,000	Fund for 2012. Fund for 2013-2016 to be determined later.
22	University of Hong Kong	HKD 1,500,000	200,000	Fund for 2012. Fund for 2013-2016 to be determined later.
	TOTAL (USD\$)		24,318,205	

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, rounded rates valid on 30 Sept. 2012 were used.

Table A2 Expenditures: CICCED Phase IV: October 2011 - September 2012 (US dollars)

Category	China	Canada	Australia	Norway	Sweden	HKU	Germany	Italy	Nether-lands	SHELL	EDF	UNDP	EF	Total
I. Task Forces / Special Studies														
Innovation														0
Low-Carbon Economy		(120,055)	(30,569)		104,032									-46,592
Green Development		(126,902)	2,755	285,551										161,404
Low Carbon Industrialization	30,220	62,879	(11,521)	119,213	49,505									250,296
Investment and Trade		(136,871)	(23,040)	173,802	56,998									70,889
China E&D Outlook	32,260	(134,769)		141,823	128,000									167,314
Special Study: China's Marine Environment		11,454											6,337	17,791
Western China Harvard Devt.	64,520	359,309	18,724											442,553
12th Five-Year Plan	38,710	124,656	11,044	129,029			27,499							330,938
Mercury Pollution		87,102	10,235		84,093									181,430
Green Consumption		4,525												4,525
Other policy background reports														0
Sustainable consumption	74,680						34,128							108,808
Social development	86,180											40,000		126,180
Special Study: Regional Air Quality	76,640						199,439			32,258				308,337
Special Study: Bohai Oil Spill	64,520									24,194	150,000			238,714
Special Study: Eastern China	48,390					200,000								248,390
Pilot project preparation	43,550													43,550
CICCED Strategic Salon	13,470													13,470
Subtotal	573,140	131,329	(22,372)	849,418	422,628	200,000	261,066	-	-	56,452	150,000	40,000	6,337	2,667,997
2. Council AGM	80,645	228,903	138,999	124,952	103,775									677,274
3. Rio Side event	48,387	(10,858)			37,097		97,138		48,387	41,936	50,000			312,087
4. Secretariat operations (SERI)	290,322							96,774						387,096
5. Chief Advisor Group	161,290	312,814												474,104
6. SISO Administration / Training		489,013												489,013
Total expenditures	1,153,784	1,151,200	116,627	974,370	563,500	200,000	358,204	96,774	48,387	98,388	200,000	40,000	6,337	5,007,571

2012

Regional Balance and 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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CCICED Secretariat

No. 5 Houyingfang Hutong
Xicheng District, Beijing, China 100035
Tel: +86-10-82268656, 82268659
Fax: + 86-10-82200535
Website: www.cciced.net