CCICED Task Force Summary Report

Policy Mechanisms toward Environmental Targets for the 12th Five-Year Plan:

Strategies and Policy Studies on

Medium-to-Long-Term Efforts to Reduce Pollution

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Executive Summary

From the "one control, two standards"[1] 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.

Chapter I. 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.

[1] "One control" refers to the control of 12 main industrial pollutants, including SO_2, 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.

1. *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 (SO_2) by 4.93 million tons, to meet the 10 percent pollution reduction goal in the 11th FYP.

Table 1-1. 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‰ [2]	**[+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.

[2] 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.

By 2010, China had surpassed the emissions reduction goals in the 11th FYP, with COD discharges and SO_2 emissions declining by 12.45 percent and 14.29 percent, respectively, from 2005 levels. COD discharges dropped by 6.94 million tons and SO_2 emissions dropped by 10.44 million tons. Specifically, China reduced extra COD discharges by 5.18 million tons and SO_2 emissions by 6.80 million tons[3] to offset faster-than-expected economic growth (Figure 1-1).

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.

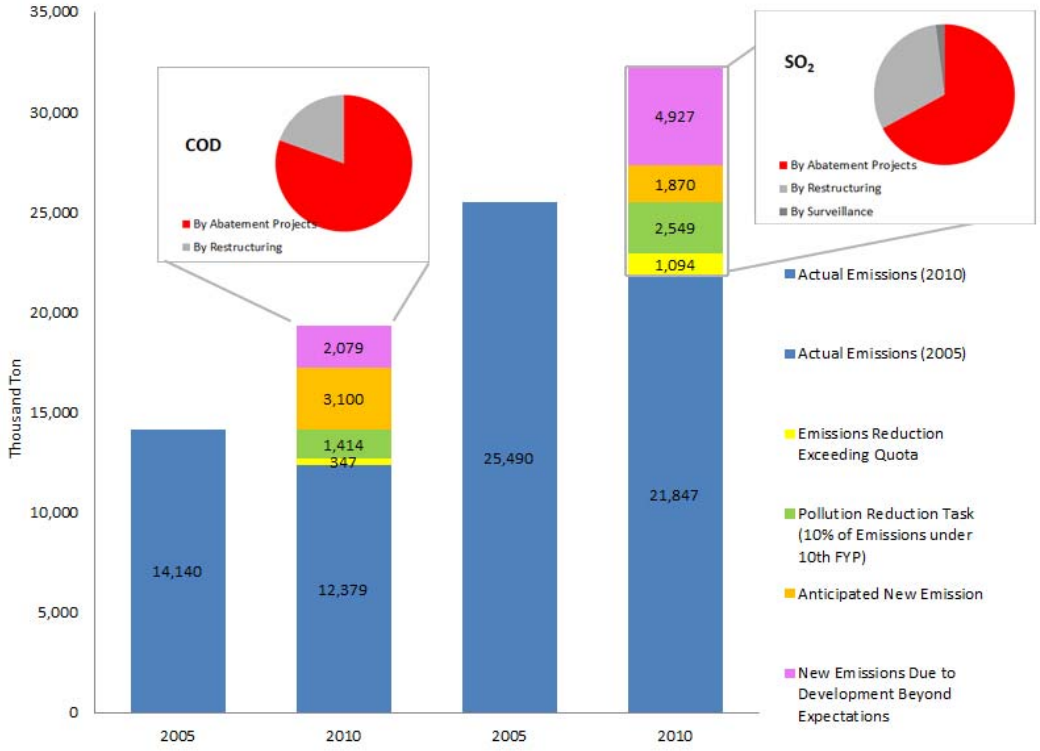

Figure 1-1. Reductions in total COD discharges and SO_2 emissions under the 11th FYP

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

2. *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

[3] 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).

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 billionYuan 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 SO_2 (Figure 1-2, Table 1-2, and Figure 1-3).

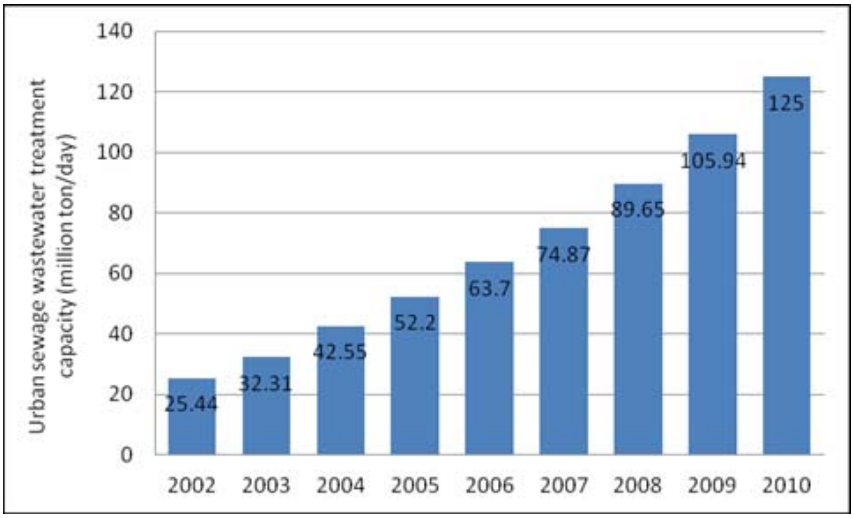

Figure 1-2. City sewage wastewater treatment capacity, 2002–2010

Source: Environmental Statistics Communique, Ministry of Environmental Protection.

Table 1-2. 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.

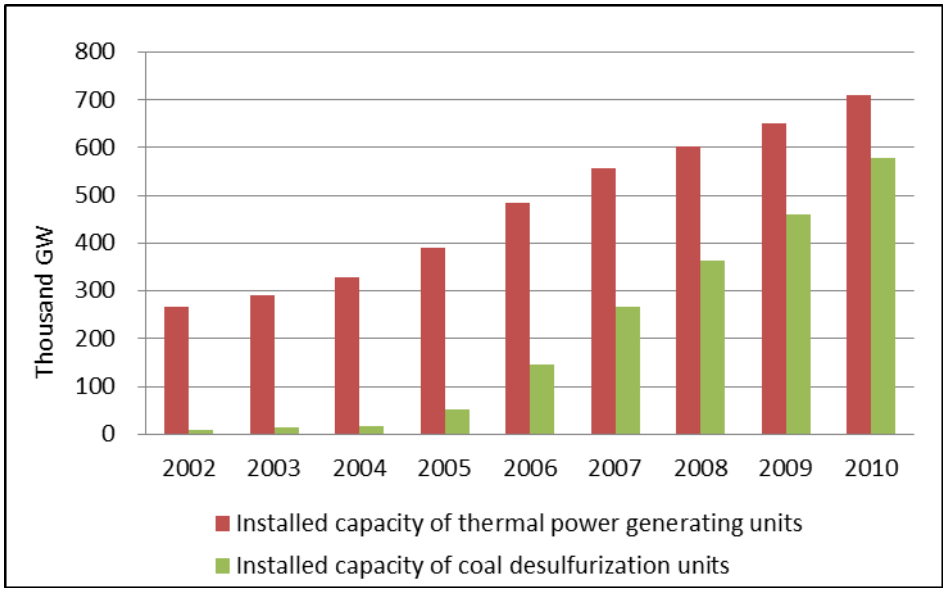

Figure 1-3. Growth in installed capacity of coal desulfurization units
Source: Power industry statistics; Environmental Statistics Communique, MEP.

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. SO_2 reduction achieved through project construction accounted for 67.2 percent of the SO_2 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.[4]

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

Reductions have decreased the COD and SO_2 pollution intensities of most industries—and the gap between industries—under the 11th FYP. In 2010, industrial COD and SO_2 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 SO_2 emissions by 3.6 million tons, accounting for 31 percent of total SO_2 reductions. Closure of small plants reduced SO_2 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

[4] For example, SO_2 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.

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.

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.

4. China has put in place a package of polices 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 SO_2 emissions one year ahead of schedule. In fact, the power industry accounted for 79 percent of the total reduction in SO_2 emissions.

However, to attain the reductions required in future years, efforts to control SO_2 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.

5. 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 cities[5] 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,[6] and "double 30"[7] to broaden accountability beyond local officials and target specific environmental problem areas. City 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.

6. 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.

[5] Yingtan in Jiangxi, Sanya in Hainan, Hechi in Guangxi, Yuxi in Yunnan, Shuangyashan in Heilongjiang, and Wenzhou in Zhejiang.

[6] "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.

[7] 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.

The Task Force used a qualitative approach (the traffic light method[8]) 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.

7. 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 1-4). Environmental quality in some key river basins has improved remarkably.

Because of declines in SO_2 emissions, the share of total land area affected by acid rain dropped by 1.3 percentage points. Average SO_2 intensity in key cities targeted for environmental protection declined by 26.3 percentage points in 2010 compared with 2005 (Figure1-5). Using satellite surveillance data, the U.S. Environmental Protection Agency confirmed that atmospheric SO_2 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.

[8] 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.

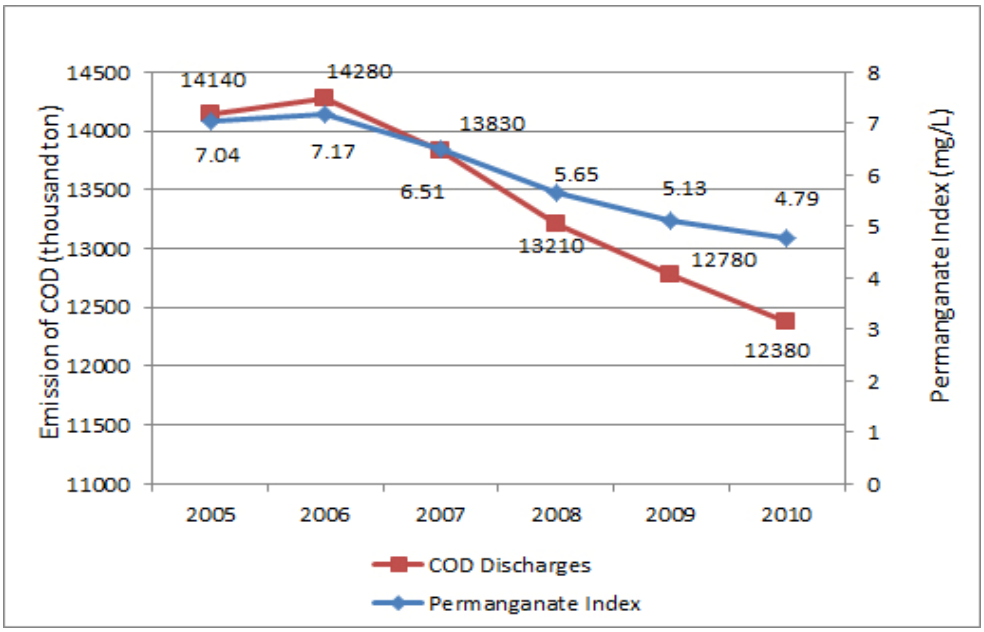

Figure 1-4. Changes in COD discharges and the Permanganate Index for surface water under the 11th FYP

Source: Environmental Statistics Communique, MEP; National Water Environmental Monitoring

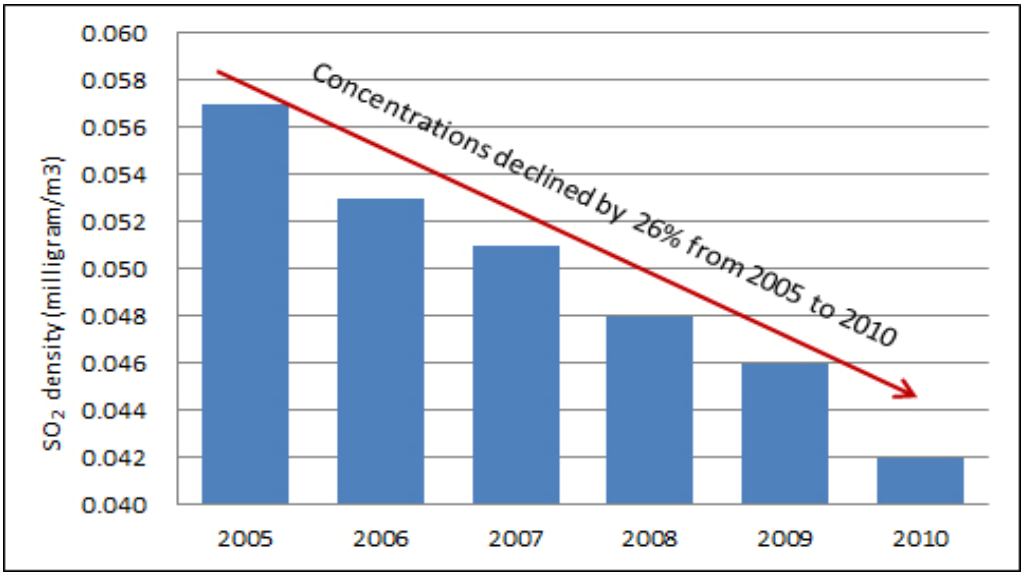

Figure 1-5. SO_2 concentrations in key cities targeted for environmental protection under the 11th FYP

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"[9] construction projects; the costs of operating industrial and municipal wastewater treatment facilities; and the costs of running industrial air treatment facilities.

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 SO_2 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.

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

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.

Chapter II. 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.

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

1. 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.

2. 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 2-1), 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.

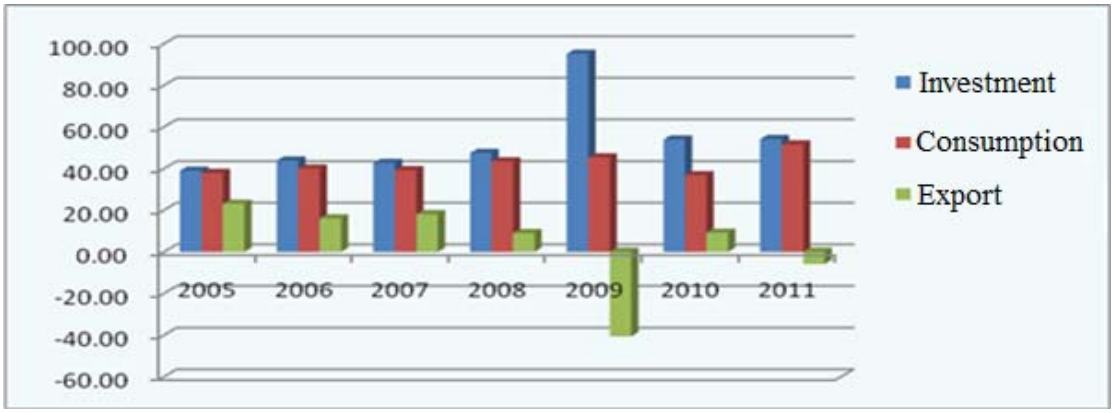

Figure 2-1. Contribution of investment, consumption, and export to GDP (%)

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 2-2), posing a steep challenge to efforts to strengthen environmental protection.

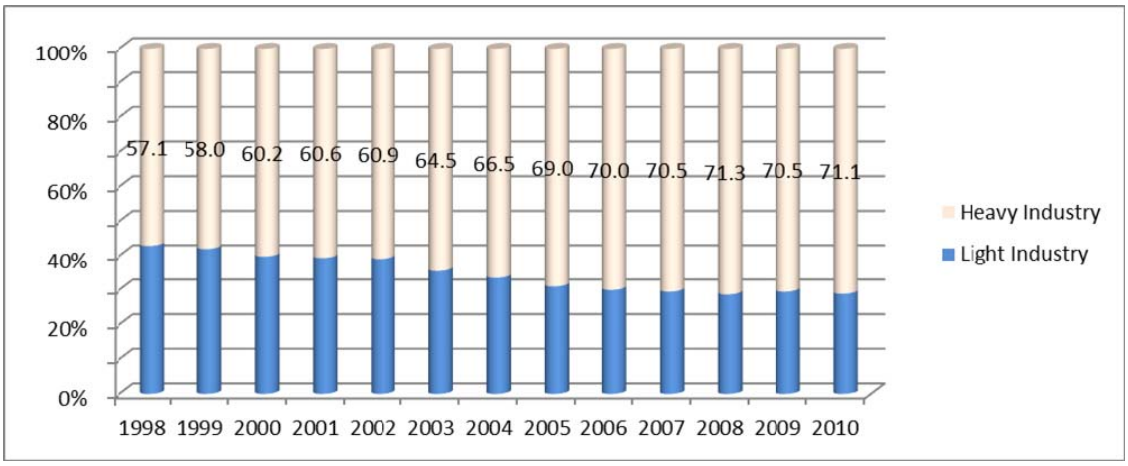

Fig. 2-2 The contribution of light and heavy industry to industrial value-added, 1998–2010

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.

3. 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 2-3).

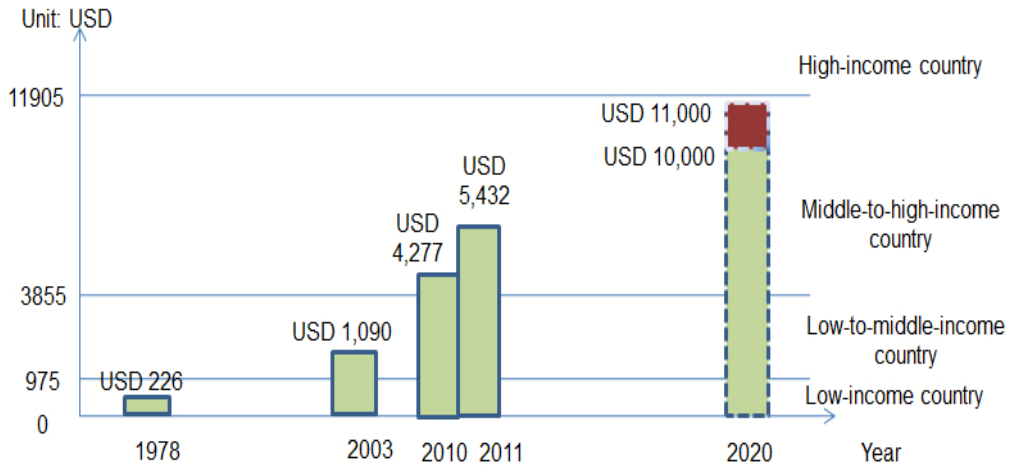

Figure 2-3. Projections for China's per capita GDP

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 2-1). 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.[10]

Table 2-1. 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 percent[11] in 2030.

[10] 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

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

4. 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,[12] 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.

II. The public will demand more environmental protection.

1. 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,

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

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.

2. 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 able to fulfill those public expectations for environmental protection.

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

1. 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 10^{th} 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.

2. *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.

Chapter III. 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 3-1 and Figure 3-2).

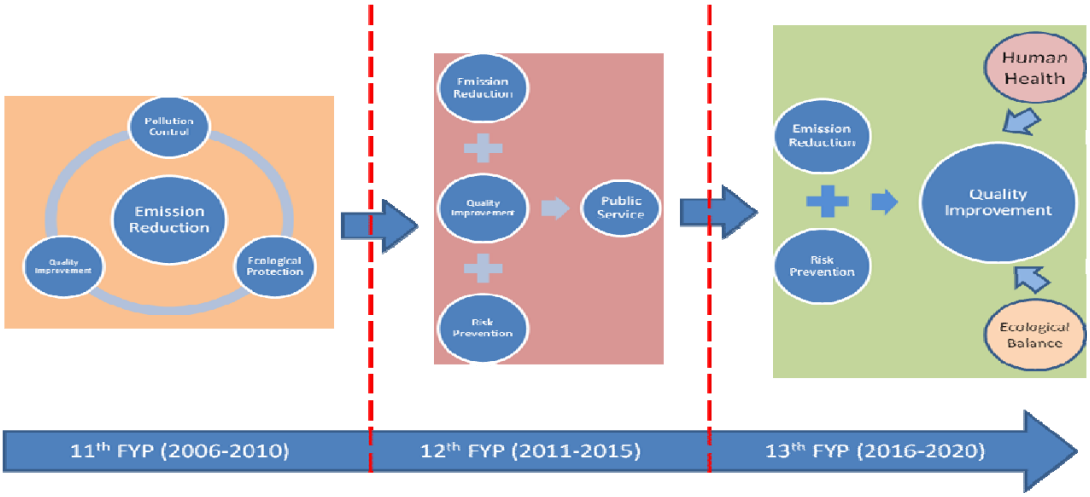

Figure 3-1. The focus of environmental protection during different stages of economic development

Note: "Public service" refers to environmental services that the government provides to society.

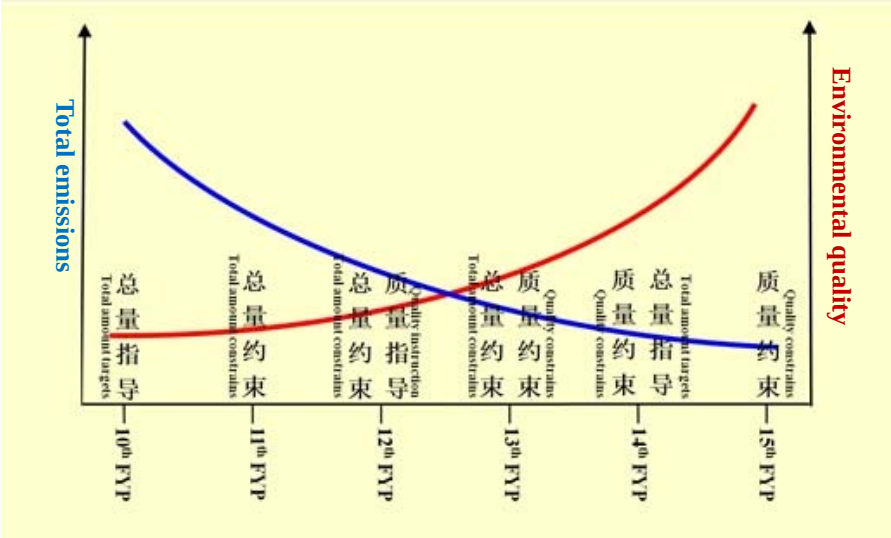

Figure 3-2. Trajectory of total emissions and environmental quality during different stages of development

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 3-3).

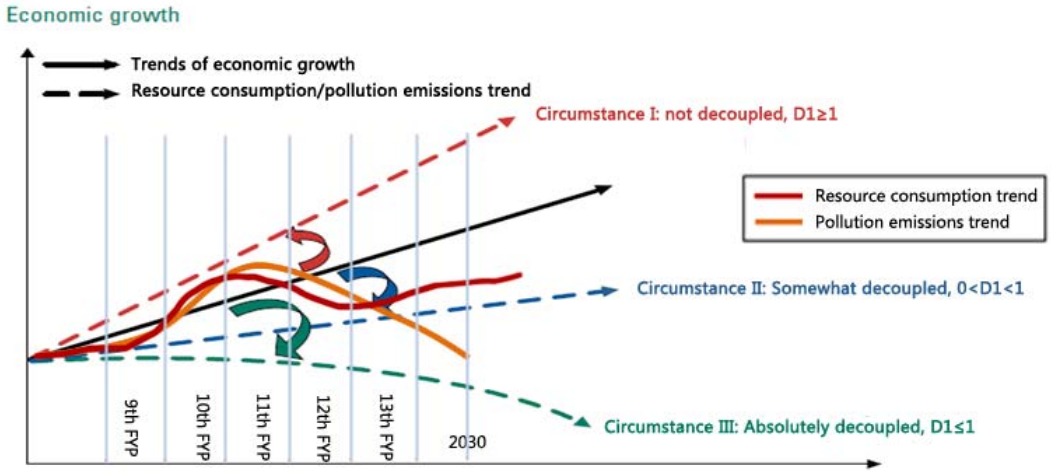

Figure 3-3. Decoupling economic development from more pollution and more intensive use of energy and other resources

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 3-4 and 3-5; Table 3-1).

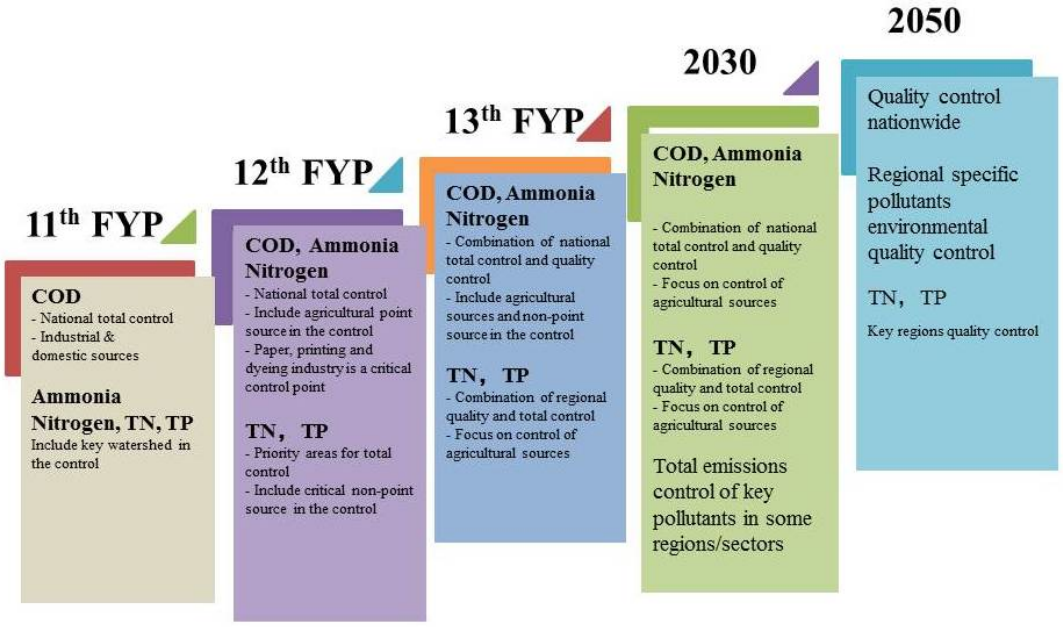

Figure 3-4. Roadmap for controlling water pollution

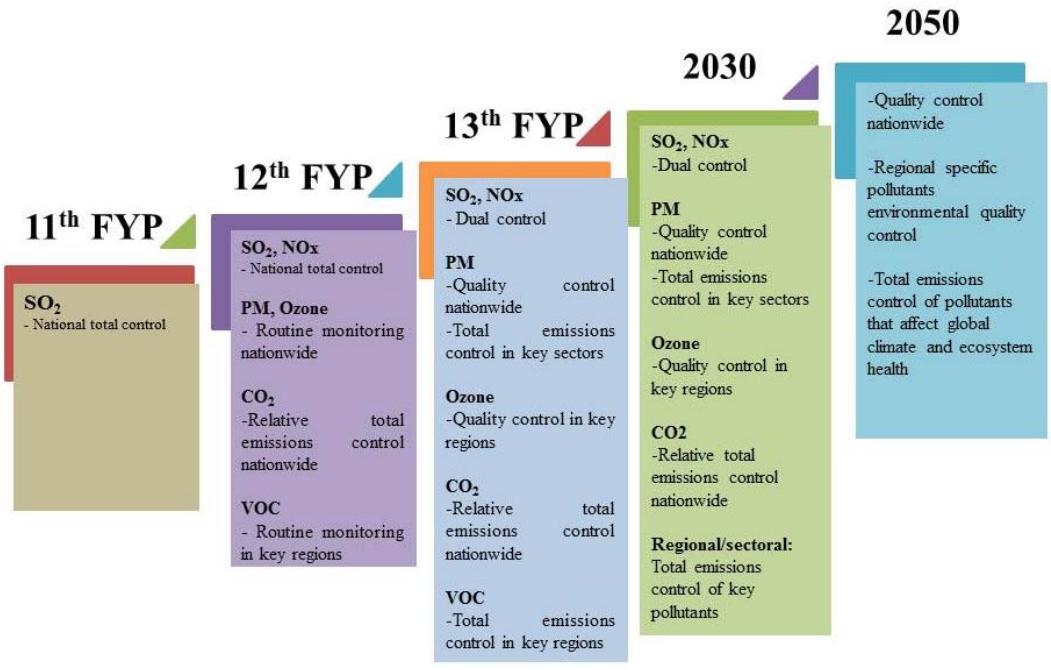

Figure 3-5. Roadmap for controlling air pollution

Table 3-1. Roadmap for mid-term and long-term pollution control and emissions reduction

	11th Five-Year Plan	12th Five-Year Plan	13th 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	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

			phosphorus in key areas		
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

Chapter IV. 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.

1. 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.*

2. 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.

3. 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.

1. ***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.

2. ***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.

3. Improve co-control of multiple pollutants.

At the regional level, pollutants such as SO_2, NOx, 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 CO_2.* 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.*

III. Chapter V. 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 SO_2 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 SO_2 emissions data. The 10th five-year plan set a goal of reducing SO_2 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% SO_2 reduction, but this time from the much higher 2005 baseline. Actual SO_2 reductions came in 14% below the 2005 base. What accounts for this dramatic difference in environmental performance?

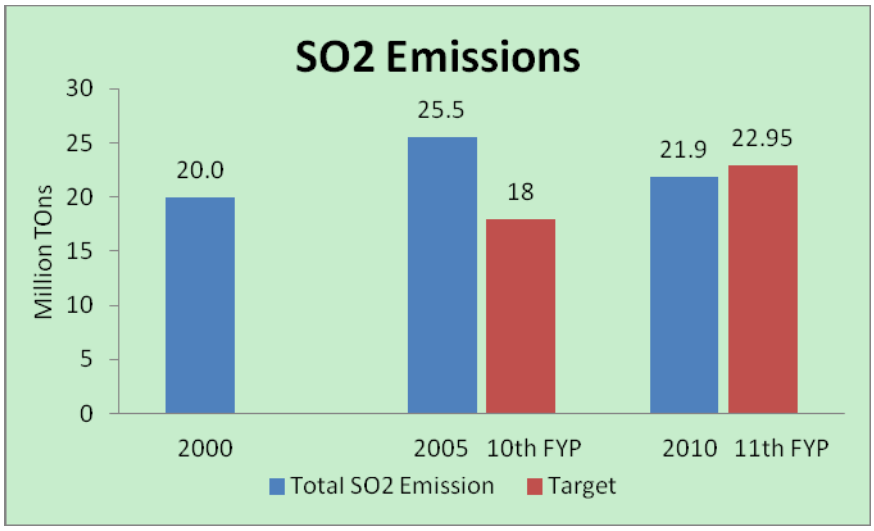

Figure 4-1 SO2 emissions and targets

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 SO_2 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 SO_2 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, SO_2, 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:

1. 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.

2. 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 SO_2 emissions, the chief precursor of acid rain. However, at the local level, SO_2 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 NOx emissions) for the major industrial source sectors such as electricity, cement, iron and steel and automobile industries.

3. 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 SO_2 and NOx. These databases should be coordinated for consistency.

4. 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.

5. *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.

6. 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.

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.

7. 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.

8. 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.

9. 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.

10. Promote the use of market mechanisms

China has been experimenting with market instruments such as Eco-Compensation Mechanisms (ECMs), SO_2 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.