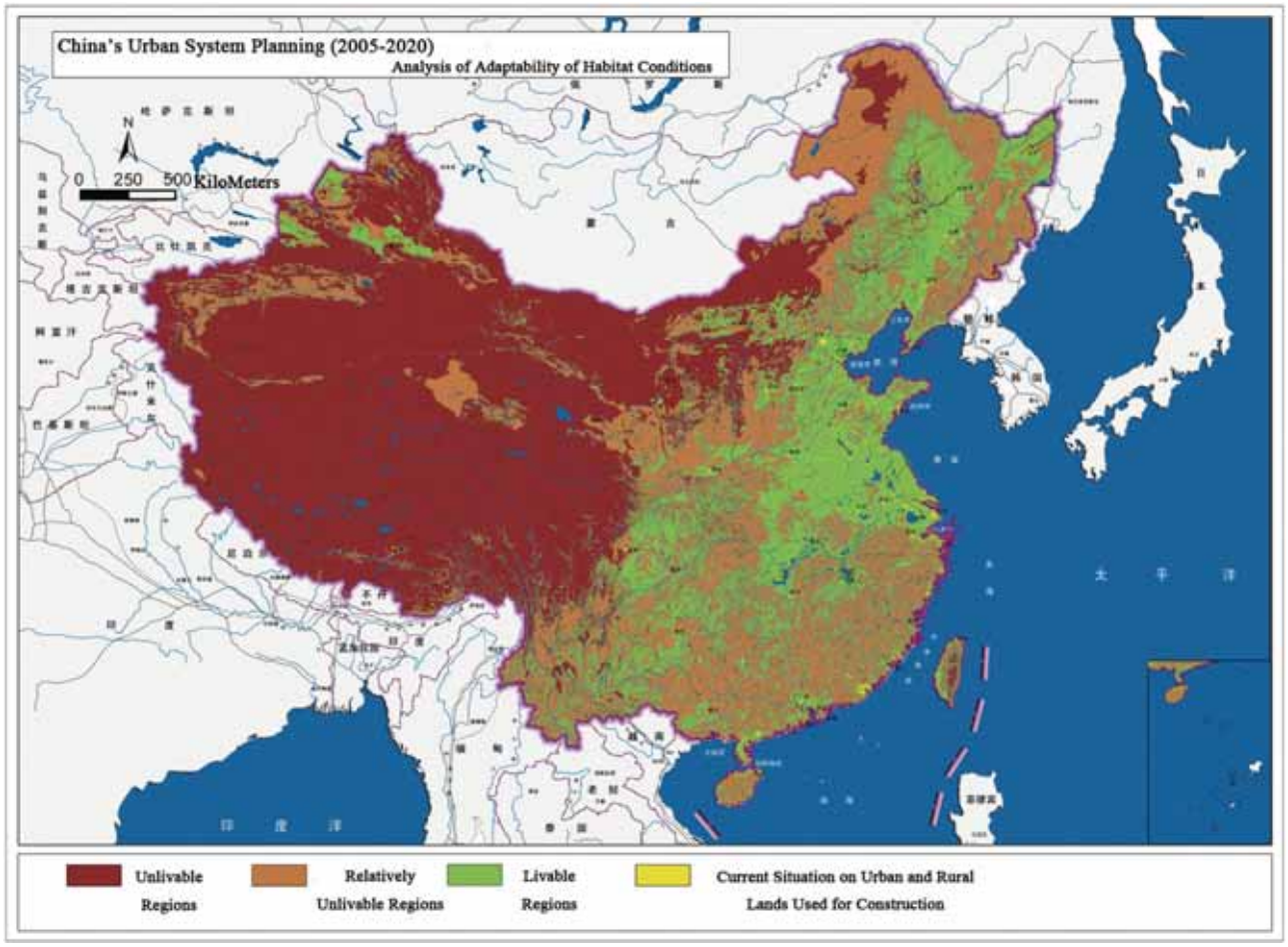
Chapter three

03

Urban Environment and Infrastructure in China

China has a vast territory, but not much land suitable for human settlement and urban development. Throughout China, the regions unsuitable for human survival and habitation approximately account for 52% of China's land area. Such regions are mainly distributed in the west of the "Aihui-Tengchong" line, with a large proportion of Gobi deserts, high and cold plateaus, and also including eastern wetlands and coastal tidal flats, etc.. The relatively unlivable regions account for 29% of China's land area, and are mainly distributed at the mountainous and hilly zones in central and southern China. The livable regions merely account for 19% of China's land area, and are mainly distributed at eastern plains, Sichuan Basin and other similar zones with smooth terrains (Figure 3.1). Being affected by the adaptability extent of the conditions for habitation, the spatial layout of China's urban regions is horizontally manifested in a differentiation regularity of "dense east and sparse west". Cities are mostly located at eastern and coastal regions, especially at the agglomerations such as the Yangtze River Delta, the Pearl River Delta, the Beijing-Tianjin-Tangshan and mid south of Liaoning regions. Meanwhile, it is vertically manifested in a differentiation regularity of "dense lower regions and sparse higher ones", the main cities and towns (cities, and towns with a population of over 50, 000) concentrate at eastern hilly regions and plains with an elevation of less than 500 meters. By making unremitting efforts under such disadvantageous natural environmental conditions, the Chinese government and Chinese people have achieved rapid development of urbanization and gradual improvement of the habitat environment.

In the 60 years since the foundation of the New China, China's urbanization level has been greatly increased. From 1949 to 2009, the number of cities increased from 132 to 654, and the urbanization level rose from 7.3% to 46.59%. With the rise of the urbanization rate and the enlargement of the urban scale, the urban infrastructural level has also been greatly uplifted, providing powerful support for urban economic development and improvement of the people's living standard. Meanwhile, more and more efforts have been made to control urban environmental pollution, the deterioration trend of the environmental quality has been basically stopped, and the urban living environment has been improved obviously. China has made great achievements in the field of human settlements, and has obtained extensive praise and affirmation from the international society. Since applying for the UN-HABITAT Scroll of Honor Award in1990,China has won the UN Habitat Scroll of Honor Award for 19 times.



Map3.1 Analysis of the Habitat Conditions in China / Source: China's Urban System Planning (2005-2020)

For the purpose of commending the cities, villages, towns and entities that have made prominent achievements and gained distinctive effects of improving the quality of urban and rural environment, enhancing the overall urban functions and creating a good living environment, as well as for the purpose of actively spreading the effective experiences and measures created by all regions in respect of adhering to sustainable development, strengthening comprehensive rectification of the environment and improving the living environment, China's Ministry of Construction established China Habitat Award and China Habitat Best Practice Award with reference to the United Nations Habitat Scroll of Honor and Best Practices Awards, aiming at encouraging the cities to pay high attention to the rebuilding and construction of the living environment, to provide residents with good life and work environment in respect of environmental protection, ecology, air, water quality, greening and traffic, etc., so as to meet the requirements of the Chinese urban residents for prosperity at a higher level, and to uplift the modern images of the cities or even the country. From 2001 when such awards were established up to now, 20 cities in China have won the "China Habitat Award", and 286 projects have won the China Habitat Award for Best Practices.

Box 3.1 Rizhao Municipality, Shandong Province, China - Winner of "UN Habitat Scroll of Honor Award 2009"

Washington, October 5 (Xinhuanet) - UN-HABITAT granted the "UN Habitat Scroll of Honor Award 2009" in Washington on October 5. to Rizhao Municipality, Shandong Province, China for the excellent planning to improve its ecological and living environment.

Today was the 24th "World Habitat Day", and its theme was "Planning Our Urban Future".

United Nations Secretary-General Ban Ki-moon pointed out in his speech that planning was the key to the urban development and that successful planning had to depend on good urban governance. He appealed that the international society should implement effective policies, improve urban planning, and create a more beautiful, greener and sustainable future for the increasingly urbanized earth.

Yang Jun, Chairman of the Standing Committee of Rizhao Municipal People's Congress, said in an interview with a reporter of Xinhua News Agency that Rizhao adhered to the "human-oriented" principle and powerfully implemented the long-term development strategy of "building an ecological city", which enabled Rizhao to make great progress in improving the living and ecological environment of the city.

Picture from: Rizhao Municipality

1 State of Urban Environment

1.1 Partial Improvement of Water Environment

Within the past 30 years after the founding of the New China, the environment pollution problem was not prominent, and the urban water environment quality was good. After the Reform and Opening-up policy was implemented in 1978, the water pollution problem began to arise and became more and more serious with the development of industrialization and urbanization. Especially, the pollution of the rivers passing through cities was more prominent. The main pollutants were ammonia and nitrogen, and aerobic organics and volatile phenol. In recent years, the pollution types are becoming more and more complicated, and emergent water pollution events arise frequently. Meanwhile, the water pollution control work is also gradually stressed and strengthened. In the 1980s, all regions throughout China mainly controlled and comprehensively utilized waste gas, waste water and waste residue. In the 1990s, the State put forward the sustainable development strategy, carried out large-scale pollution control as well as ecological construction and protection projects in major cities, river basins, regions and sea areas. In recent years, the State pays more attention to the environment pollution control, makes great efforts to implement clean production, develops circular economy, adopts the energy conservation and emission reducing policy, makes greater endeavors, and has made obvious achievements in controlling industrial waste gas, waste water and waste residue. As a result, the total amount of main discharged pollutants has been gradually controlled, among which, the discharge amount of COD in 2009 was 27.3% lower than that in 1997. But, the overall pollutant discharge is still at a high level (Figure 3.1). China's Present urban water environment quality takes on a feature of "being partially improved, being not entirely restrained, still facing a severe situation and having increasingly heavier pressure".

In 2009, in the major cities in China, 397 centralized drinking water sources were monitored, including 244 surface water sources and 153 underground water sources. The water quality monitoring result showed that the total water intake amount of major cities was 21.76 billion tons, with 15.88 billion tons of water reaching *Water Quality Standard for Drinking Water Sources,* accounting for 73.0%. The amount of unqualified water was 5.88 billion tons, accounting for 27.0%. There were 3219 water function zones under monitoring and assessment throughout China. The assessment made according to the water quality management objective of the water function zones showed that the annual standard-reaching rate of the water function zones was 42.9%. Specifically, the standard-reaching rate of the Grade I water function zone (excluding zones for development and utilization) was 53.2%, and that of the Grade II water function zone was 36.7%. The monitoring analysis on the underground water of 202 cities in China showed that the quality of underground water was mostly fine or slightly poor. The quality of deep underground water was commonly better than that of the shallow groundwater, and the quality of the water in less-exploited regions was better than that of the more-exploited regions. Generally, the quality of the underground water throughout China almost remained unchanged over the last year.

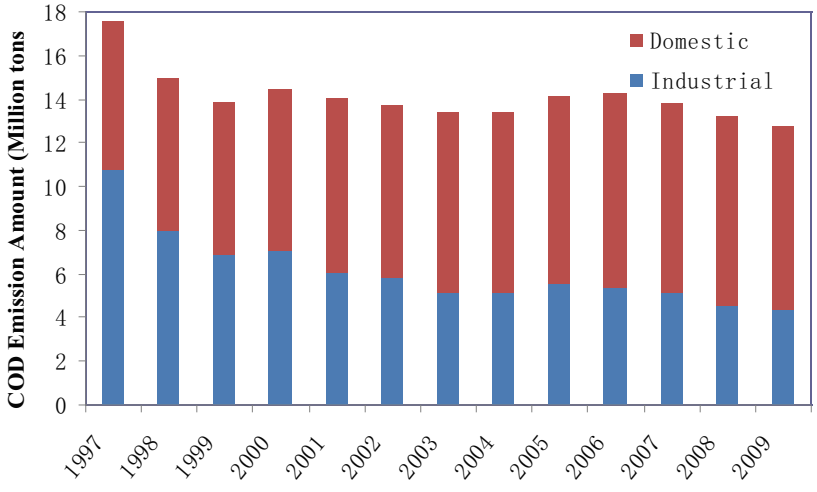


Figure 3.1 COD Emission in China, 1997-2009
Source: State of Environment in China, 1997-2009

Box 3.2 The Chinese Government Has Launched a National Special Program on "Control and Management of Water Pollution".

The National Special Program on "Control and Management of Water Pollution" (hereinafter referred to as the water special program) is one of the 16 major scientific and technical projects set up according to *China National Guideline on Medium- and Long-Term Program for Science and Technology Development (2006-2020)*.

The water special program aims to solve and make breakthroughs in the key technical areas of water pollution control and rectification in China, following the principle of solving primary problems, selecting typical drainage areas for conducting water pollution control and water environment protection and setting up comprehensive models. The project is designed to specially break the bottlenecks of major water pollution in science and technology that limit the economic and social development of China, and to focus on making breakthroughs in a wide spectrum of key technologies and common technologies in water pollution control and rectification, such as industrial pollution source control and rectification, agricultural non-point pollution control and rectification, urban sewage treatment and conversion of it into resources, water quality purification, and ecological restoration, drinking water safety guarantee, and early warning and management in water environment monitoring.

The program is also designed to realize the target of improving water environment quality and drinking water safety in the model areas to effectively improve the management and technical level in water pollution prevention and treatment, through a series of models, such as the comprehensive model of lake eutrophication control and rectification, the technical model of the comprehensive rectification of river water pollution, the technical model of the comprehensive rectification of city water pollution control and water environment, the comprehensive model of drinking water safety guarantee technology, the model of water environment monitoring and early warning technology in drainage areas, and the model of water environment management and policy research.

The water special program is a scientific and technical program which has the largest investment made in the fields of water pollution rectification and drinking water safety since the founding of the People's Republic of China, with the budget totaling more than RMB30.00 billion, and the implementation period from 2008 to 2020.

1.2 General Improvement of Air Quality

For a long time, the urban air pollution in China has mainly been coal smoke pollution, and the main pollutants have been smoke dust and sulfur dioxide. In recent years, automobile exhaust pollution has become increasingly heavier. The features of urban air pollution are as follows: it is heavy in winter and spring but mild in summer and autumn; the smoke dust pollution is heavier in northern cities, while in southern cities the sulfur dioxide pollution is heavier. In 1989, the State Council held the Third National Environmental Protection Conference, and specified 8 environmental management measures in respect of the environmental protection target responsibility system, the environmental impact assessment, "three items of work to be done simultaneously[1]", pollutant discharge fees, etc., which played an important role in controlling air pollution. By the end of 1992, 2750 smoke dust control areas had been built up in 386 cities in China, with a total area of 10468 square kilometers. In 2000, the amended "Law of the People's Republic of China on Control of Air Pollution" was promulgated for implementation. The said law stresses that the air environmental protection work must be incorporated into national economic and social development plans, and proposes that plans should be made to control and gradually mitigate the total amount of major air pollutant emissions in all regions. As a result, obvious achievements have been made in this regard.

In 2009, the sulfur dioxide emission amount in China was 221.44 million tons. Despite of an increase of 41.6% over 1989, it declined by 11% over 2000 (Figure 3.3). At present, the urban air quality in China is generally fine, but the air pollution in some cities is still serious, and the acid rain problem is still prominent. The environmental air quality monitoring carried out on 612 cities in China in 2009 showed that 26 cities (accounting for 4.2%) reached Grade I, 479 cities (accounting for 78.3%) reached Grade II, 99 cities (accounting for 16.2%) reached Grade III, and 8 cities (accounting for 1.3%) even failed to reach Grade III. In the cities at or above the prefecture level in China, the environmental air quality standard- reaching rate was 79.6%, while that in the cities at the county level was 85.6%. Among the 488 monitored cities and counties, there were 258 having acid rain, accounting for 52.9%.

[1] In construction development the environmental protection facilities must be designed, built and put into use simultaneously with the principal project.

Figure 3.2 Sulfur Dioxide Emissions in China, 1989-2009
Source: State of Environment in China, 1989-2009

Box 3.3 The Air Quality in Beijing Has Been Improved for 11 Consecutive Years

In 2009, the blue-sky days in Beijing (the days when the air quality is at or above Grade II[1]) accumulated to 285 days, accounting for 78.1% of the number of days during the whole year, exceeding the objective of blue-sky days in that year by 25 days. The air quality has been improved for 11 consecutive years. In 2009, Beijing achieved the whole year's air quality improvement objective 41 days in advance, and 2009 was the first year since 1999 for Beijing to achieve the whole year's objective. Meanwhile, the number of days at or above Grade II increased apparently, and the number of days of medium and heavy pollution above Grade IV decreased apparently. During the whole year, there were totally 285 blue-sky days, 16.8% higher than the average number during the same period since 2000. There were 5 days of pollution heavier than Grade IV. Among the past ten years, the year 2009 contained the least days of medium and heavy pollution during the same period of each year, decreasing by 18 days over 2000. The concentration of main air pollutants declined apparently, and such pollutants as sulfur dioxide and inhalable particulate matter ranked the lowest among the same periods of the 11 years. According to the preliminary statistics, the concentration of the inhalable particulate matter with complicated source from the air declined to approximately 120 micrograms/ cubic meter, decreasing by about 0.8% over the same period of 2008 when the Olympic Games were held. The emission of sulfur dioxide closely related to coal declined continuously after reaching the national standard, 5.6% less than the same period of the last year. The pollution from these two sources was decreaed by 52.1% and 25.3% respectively over the same period of 2000.

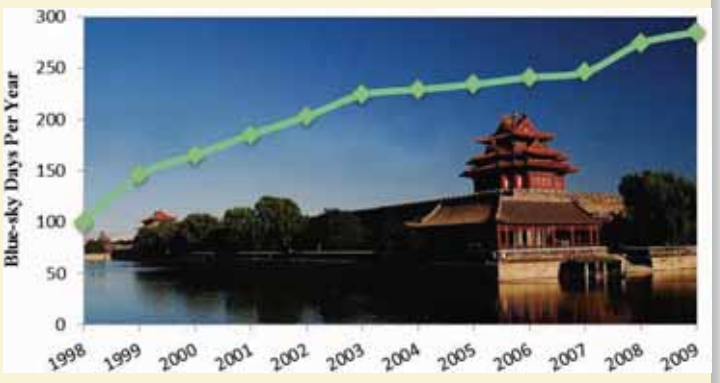


Figure 3.3 Blue Skey Days Per Year in Beijing
Source: Beijing Municipal Environmental Protection Bureau

[1] Grade II of National Environmental Standard of Air (Daily Average):
SO2, 0.15mg/m3; NO2, 0.08mg/m3; NOX, 0.10mg/m3; TSP, 0.30mg/m3; PM10, 0.15mg/m3.

1.3 Effective Control of Noise Pollution

With China's urbanization and motorization, the problem of urban noise pollution is becoming increasingly prominent, but has been effectively controlled. In 1989, the composition of urban noise sources in China was as follows: the road traffic noise accounted for 35%, the domestic noise 38%, and the noises in respect of industry and construction undertaking, etc. 27%. In the same year, the result of road traffic noise monitoring over 70 cities showed that, the major cities whose average equivalent sound level exceeding the standard (70 Dbs) accounted for 94%, and the ordinary cities which went beyond such a standard accounted for 67%. By 1992, 1487 environmental noise standard-reaching areas had been built up in 284 cities in China, with a total area of 2723 square kilometers. The "Law of the People's Republic of China on Control of Environmental Noise Pollution" which came into force on March 1, 1997 played an important role in controlling the environment noise pollution, protecting and improving the living environment and protecting human health.

In the end of 2009, the acoustic environment quality of 74.6% urban areas among the 354 monitored cities was at a good or relatively good level. The road traffic acoustic environment quality of 94.6% of the 334 monitored cities was good or relatively good. Among the 244 monitored cities, the monitored points of various functional areas reached the standard in the day time for 7288 point-times during the whole year, which accounted for 87.1% of the daytime point-times of monitoring; and they reached the standard at night for 5968 point-times, which accounted for 71.3% of the night point-times of monitoring.

1.4 Increased Use Solid Waste

Since the Reform and Opening-up, with the enlargement of the urban scale, the amount of solid wastes has been increasing continuously, and the environmental pollution caused from solid wastes has become more and more serious. In the end of 1989, the amount of industrial solid wastes was 570 million tons, and the accumulative piles of industrial solid wastes amounted to 6.75 billion tons, occupying 55400 hectares of land. For preventing the solid wastes from polluting the environment, the State successively formulated several laws and regulations such as the "Law of the People's Republic of China on Environmental Control of Solid Waste Pollution" (promulgated in 1995 and amended in 2004) and the "Law of the People's Republic of China on Promotion of Clean Production", which played an important role in restraining the rapid growth of solid wastes and in improving the comprehensive utilization rate of solid wastes. The comprehensive utilization rate of solid wastes rose from 45.2% in 1997 up to 67.6% in 2009 (Figure 3.4). In 2009, the national industrial solid wastes amounted to 2.04 billion tons, the discharges amounted to 7.107 million tons, and the comprehensive utilization amount (including the reserves utilized in the previous years), the reserve amount and the disposal amount 1383.486 million tons, 208.886 million tons and 475137000 tons respectively.

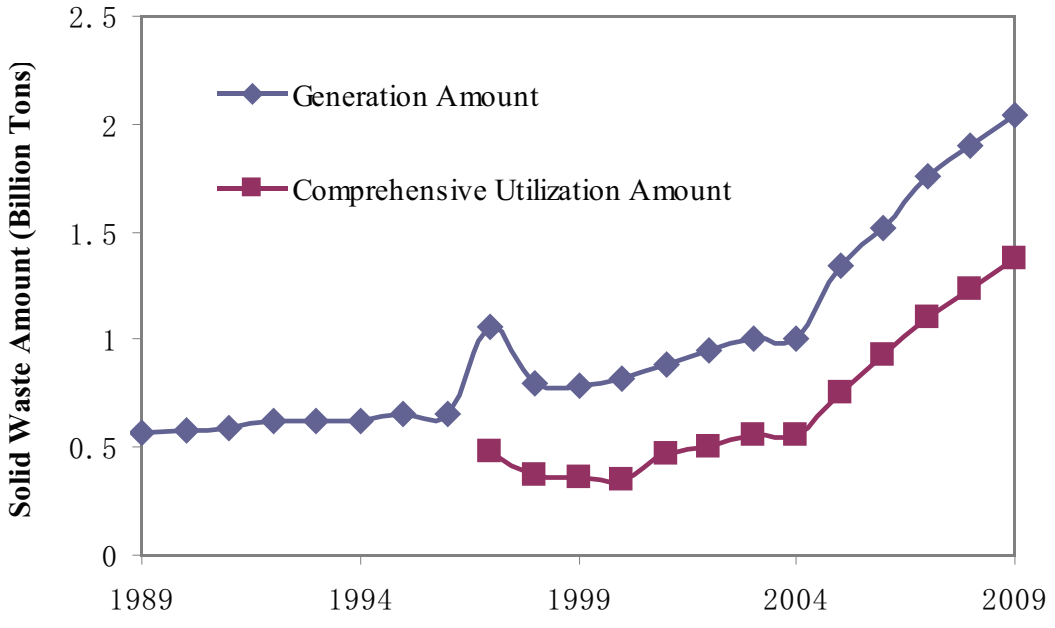


Figure 3.4: The Generation and Utilization of Solid Wastes in China, 1989-2009
Source: State of Environment in China, 1989-2009

2 Urban Water Supply and Water Discharge

2.1 Expansion of Water Supply Capacity

The urban water supply in China has a history of 120 years. The first water supply facility was built up in Lüshun in 1879. In 1949, there were only about 9 million people in 72 cities in China used tap water. The daily water supply capacity was 2.406 million cubic meters, and the length of water supply pipes 6589 kilometers. In 1978, there were 467 cities in China that built up water supply facilities, with a daily water supply capacity of 25.3 million cubic meters, and with the length of water supply pipes being 36000 kilometers. Since the Reform and Opening-up, the water supply undertaking has been developed quickly. By the end of 2008, the urban water supply capacity reached 266 million cubic meters/day, and the length of pipes reached 480,000 kilometers, 110.8 times and 72.8 times respectively of those in the 1950s, as well as 10.5 times and 13.3 times respectively of those in 1978 (Figure 3.5). Meanwhile, the urban water supply capacity has been increasing gradually. It reached 50.008 billion cubic meters in 2008, with an increase of 56 times over 1949. The tap water coverage rate reached 94.73% in 2008. The State began to implement the new "Sanitary Standards for Drinking Water" (GB5749-2006) on July 1, 2007. The water quality control indicators increased from the past 35 items to the present 106 items, meeting the relevant requirements of the World Health Organization (WHO).

The main problems existing at present are as follows: the water source pollution is serious; the Sanitary Standards for Drinking Water are not easy to meet for the water from water plants; the water supply pipes are old and worn out, and the damages, corrosions and scaling of the pipes are easy to impair the water quality; some secondary water supply facilities are simple and are not washed or disinfected in time, and the quality of tap water might be affected by their poor sanitary prevention conditions. Meanwhile, the existing urban water quality monitoring system is not sound, and the water quality supervision ability still needs to be strengthened.

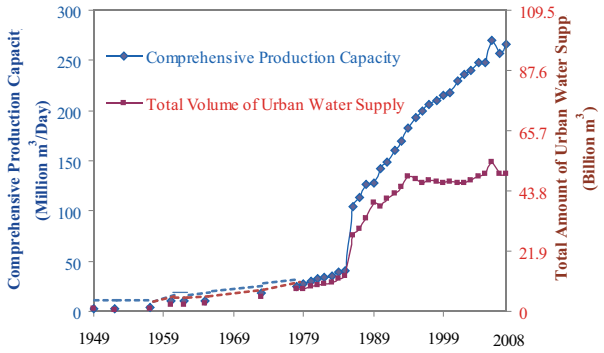


Figure3.5 Urban Water Supply in China, 1949-2008
Source: China Urban Construction Statistics Yearbook, 1999-2008

2.2 Gradual Improvement of Sewage Treatment Facilities

In 1949, there were only 4 small sewage treatment plants in Shanghai and Nanjing, with a daily treatment capacity of approximately 40000 cubic meters. The industrial waste water was seldom treated, and nearly all the waste water was discharged into nearby water bodies. After the founding of the New China, and since the First Five-Year Plan, the State organized the construction of modern water discharge projects in major cities and newly emerging industrial cities. Since the Reform and Opening-up, the problem of urban water pollution has been increasingly stressed, and the construction of urban water discharge facilities has been developed quickly. In 2008, the urban sewage treatment plants in China had a sewage treatment capacity of 81.06 million cubic meters / day, and the urban water discharge pipes in all cities reached 315200 kilometers, 2026.5 times and 52.2 times respectively of those at the beginning of the New China. In 2009, the urban sewage treatment rate in China reached 65.3%, and water recycling rate reached 9.2% (Figure 3.6 and Figure 3.7).

The existing problems are mainly as follows: (1) The coverage of sewage treatment facilities needs to be enlarged, as there are about 23% cities and nearly 71% counties have no sewage treatment plant yet; (2) The sewage collection pipes do not match the sewage treatment plant construction, and the sewage treatment plants operate in a low efficiency; (3) The sludge is not treated harmlessly enough, as most sludge is simply landfilled, piled up or is not treated at all, which is very easy to cause secondary pollution and affect the environmental safety and the health of the general public.

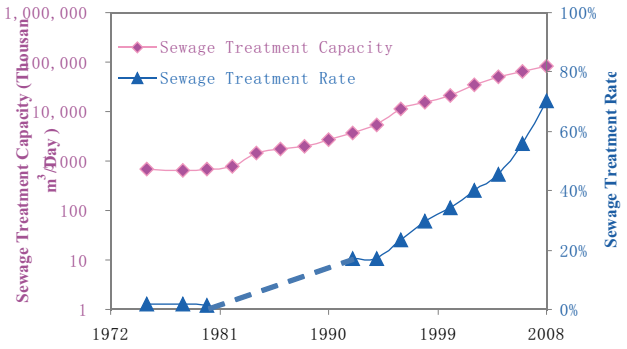


Figure3.6 Sewage Treatment in China, 1978-2008
Source: China Urban Construction Statistics Yearbook, 1999-2008

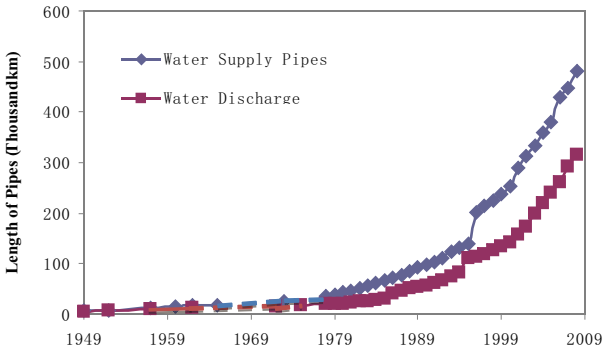


Figure 3.7 Urban Water Supply and Discharge Pipes in China, 1949-2008
Source: China Urban Construction Statistics Yearbook, 1999-2008

2.3 Great Achievements in Water Saving

China's water conservation work started in 1959 when the competent authority of the State first proposed the requirements of "advocating conservation, opposing waste, and saving water". After the Reform and Opening-up policy began to be implemented in 1978, with the rapid economic development, the contradiction of water resource shortage was becoming increasingly prominent, and saving water as a basic national policy was included into the important agenda of government authorities at all levels. Under the guideline of "expanding the sources and reducing consumption", the water conservation work was carried out in cities with great efforts. After entering the 21st century, the State put forward a new strategy which emphasized on "water saving pollution control, development of water resources" to solve the problems of insufficient urban water sources and more serious water pollution.

For more than twenty years, huge achievements have been made in urban water conservation by legal, economic, administrative and technical means. From 1983 to 2008, there were 67.4 billion cubic meters of water saved in cities, the recycling rate of industrial water increased from 18% to 86% (Figure 3.8), and the water consumption for each

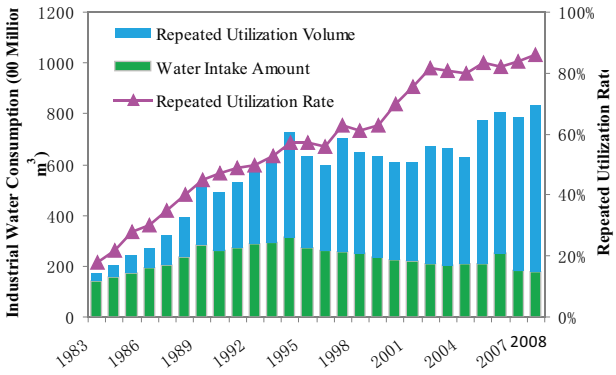


Figure 3.8 Urban Industrial Water Consumption Efficiency in China, 1983-2008
Source: China Urban Construction Statistics Yearbook, 1999-2008

ten thousand Yuan of industrial output decreased from 353 cubic meters to 130 cubic meters. From 1997 when the activity of creating water conservation cities was carried out throughout China to 2008, there were 40 cities that won the title of "Water Conservation City". The effective water conservation played an important role in relieving the contradiction of urban water consumption, as well as in promoting the sustainable utilization of water resources for the sustainable economic and social development.

3 Urban Gas and Heat Supply

People's Park in Haikou
Picture from: City Miracles – 60 Years of Urban Planning and Construction in New China

3.1 Continuous Improvement of Urban Gas Supply Facilities

In the past 60 years, the urban gas supply in China has experienced a development process from single coal gas to the combination of coal gas, liquefied petroleum gas and natural gas. Since the Reform and Opening-up, the main urban gas utilized in the 1980s was mainly from coke ovens and fertilizer plants. At the beginning of the 1990s, the coastal regions in Guangdong first used imported liquefied petroleum gas as the main source of urban gas. Thereafter, from the end of 1990s to the beginning of the 21st century, the natural gas was transmitted "from Shaanxi to Beijing" and "from the western regions to the eastern regions", and China's urban gas industry entered an unprecedented development stage. The State also paid high attention to the exploitation and utilization of natural gas at the level of energy strategy, and provided support in planning, construction, policy and funding for the development of natural gas. The urban gas supply facilities were improved continuously, and the length of gas supply pipes increased from 1900 kilometers in 1957 to 258000 kilometers in 2008, with an increase of 134.8 times. In 2008, China's urban coal gas supply amounted to 35.58 billion cubic meters, the natural gas supply 36.8 billion cubic meters, and the liquefied petroleum gas 13.291 million tons, respectively 20.6 , 53.3 and 68.3 times the amounts in 1978 (Figure 3.9). At presently, gas has been widely used in all areas such as domestic, industry, commerce, automobile sectors. Since gas, especially natural gas, is a high-efficiency, clean and convenient fuel, their wide use brings huge resource and environment benefits, and greatly promote energy conservation and emission reduction.

At present, for the urban gas in China there is still short of a reasonable sales price mechanism due to: (1) The commodity nature of natural gas is not yet commonly recognized by the general public, and the price is hard to be adjusted to the true level. (2) The gas sale fails to truthfully reflect the costs and to embody enterprises' reasonable profit and investment return. (3) It is short of a price interaction mechanism among the upstream, mid-stream and downstream industries, and thus the gas enterprises bear heavy business operation burdens. (4) The price is inflexible, and enterprises have no power to adjust the price.

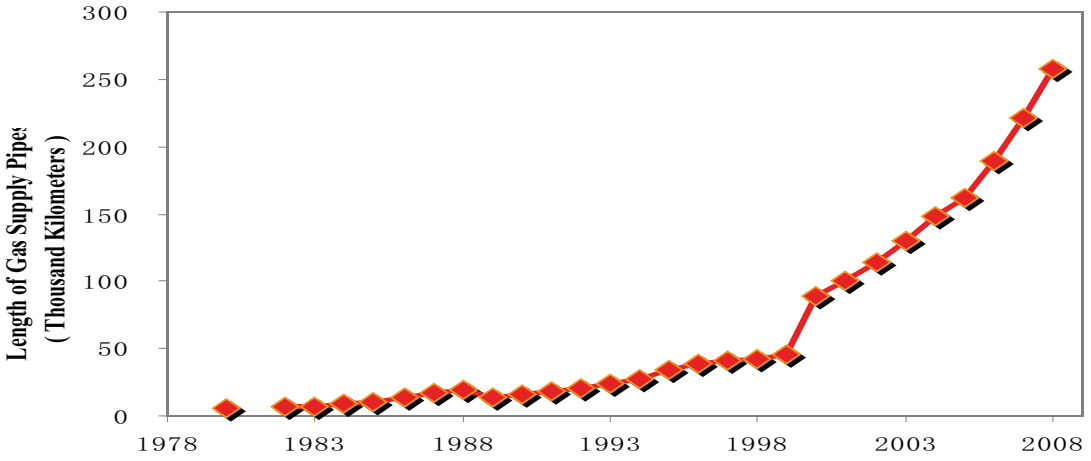


Figure 3.9 Urban Gas Supply Pipeline in China, 1978-2008
Source: China Statistics Yearbook, 1985-2009

3.2 Remarkable Enhancement of Urban Heat Supply Capacity

At the beginning of the New China, with the construction of industrial plants, there were some areas supplied with heat from small boilers in the northeastern regions of China. In the middle of the 1970s, due to the improvement of heat source equipments and technologies, China began to develop the centralized urban heat supply facilities. Since the Reform and Opening-up, the development of heat supply in China's northern regions has entered a period of rapid growth. The heat supply industry has been rapidly developed not only in the northeastern and northwestern regions, but also in North China along with the urban redevelopment. Moreover, the urban heat supply has gone beyond the regions north to the Yellow River, to the provinces and cities in the south of the Yellow River. At Present, China's urban heat supply capacity has been enhanced. The supply coverage has been expanded rapidly. Centralized heat supply has become the principal part of urban heat supply. The heat supply measurement reform is being propelled. Water heating for residents in the northern regions is guaranteed effectively. The energy saving and emission reduction work has been promoted. In 2008, the urban area with central heat supply in China was 3.49 billion square meters, with an increase of 15.6 times over 1990. (Figure 3.10)

Despite of the great enhancement of the heat supply capacity, some heat supply enterprises still face some problems such as: (1) the fee rate is not high, the defaulted heat fees are in a large amount and cannot be remedied; (2) the price of raw materials has risen, making heat supply enterprises difficult in operation; (3) there are no rebuilding funds for updating the old heat supply equipments and pipes, and the heat supply guarantee capacity is insufficient; (4) the operational system of some heat supply enterprises is backward, and there is no competition mechanism.

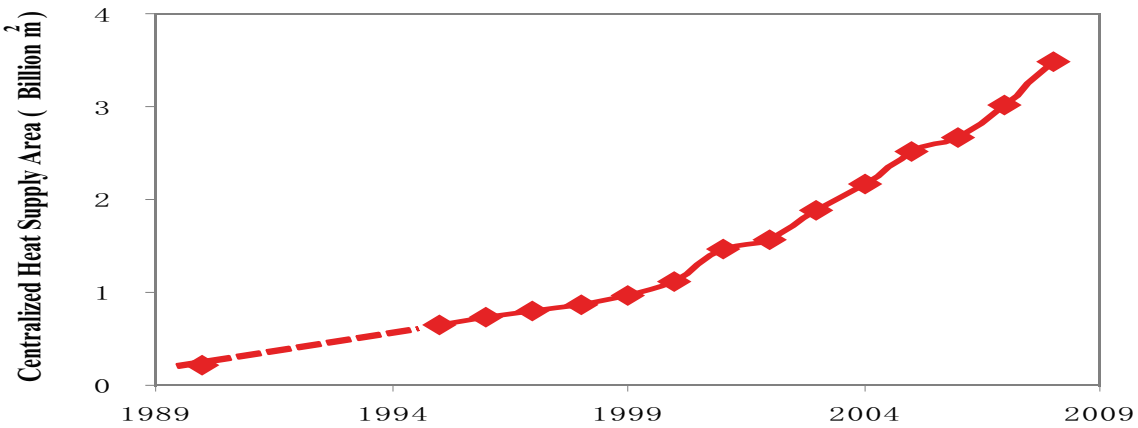


Figure 3.10 Central Heat Supply in China, 1990-2008
Source: China Statistics Yearbook 1989-2009

4 Municipal Roads and Traffic

4.1 Continuous Development of Urban Road Facilities

In 1949, there were only 11,000 kilometers of urban roads in China. With an area of 84.316 million square meters, the roads were narrow and their quality was poor. After the founding of the New China, especially since the Reform and Opening-up, the construction of urban road facilities was improved continuously, Modern road traffic networks composed of urban trunk roads, sub-trunk roads, slow traffic lanes, pedestrian roads, urban round lines and interchanges, etc. were built up. As a result, the urban traffic functions were enhanced rapidly. In 2008, the length of urban roads in China reached 260,000 kilometers, and the road area reached 4.524 billion square meters, with an increase of 22.6 times and 52.9 times respectively in the 1950s (Figure 3.11). More than 230 cities built up special public transport lanes (roads), with the total length of 2357 kilometers. The wide application of new technologies, new processes, new materials and new equipment has greatly improved the quality and carrying capacity of urban roads and bridges.

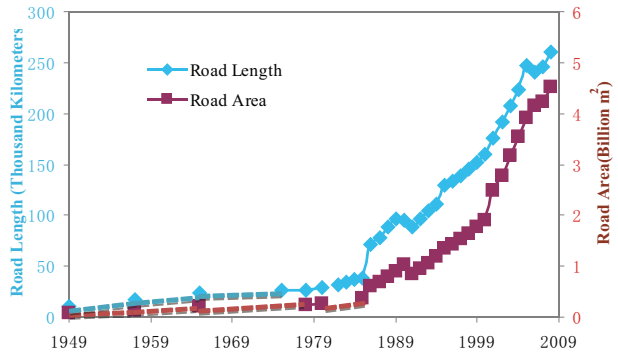


Figure 3.11 Urban Road Development in China, 1949-2008
Source: China Statistics Yearbook, 1985-2009

4.2 Continuous Optimization of Public Transport Facilities

Prior to the founding of the New Chin a, urban public transport facilities were underdeveloped. In large cities such as Beijing and Shanghai, trolley buses and automobiles were seldom seen. In 1949, there are only 27 cities that had transport traffic facilities, with 2299 buses (and trolley buses), and a annual total passenger transport volume of 508 million person-times. In the past 60 years, the urban public transport facilities have been developed rapidly, enabling urban residents to choose various transport means to travel. Buses, subways, city railways and taxies greatly facilitate urban residents in daily transportation. In the end of 2008, there were 367000 city buses and trolley buses in operation, 160 times of those in 1949. Every ten thousand people had 11.1 standard buses, with an increase of 8.9 standard buses over 1990. There were 10 cities, having 29 urban rail traffic lines, with the operation mileage of 776 kilometers, and the annual passenger transport volume 3.374 billion passenger-times (Figure 3.12).

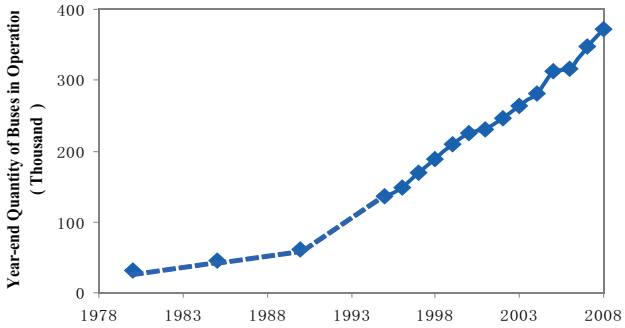


Figure 3.12 Public Transport Vehicles in China, 1978-2008
Source: China Statistics Yearbook 1985-2009

At present, there are also some problems with China's urban transport, which need to be settled urgently. In some cities, the development of private vehicles is overstressed, but the development of public traffic is ignored. In some other cities, pedestrian pavements and bicycle paths are reduced again and again, and the traffic environment for pedestrians and bicycles is deteriorated. In some cities, the various traffic lines are not effectively connected, and there are even adverse competitions, which has to certain extent lowered the overall urban transport efficiency and wasted limited public resources.

Dazhongsi Subway Station in Beijing / Picture from: Zhang Zhiguo

5 Environmental Sanitation

5.1 Continuous Improvement of Garbage Collection System

In the past, the urban environmental sanitation facilities in China lagged behind too much. The cleaning of urban streets and collection and transport of domestic wastes mainly depended on manpower and very simple instruments. After the founding of the New China, the Central Government paid much attention to the improvement of the urban environmental sanitation and the mitigation of the labor intensity of sanitary workers. At present, the urban domestic garbage sweeping, collection and transport system has been formed, and the mechanical level has been uplifted by a large margin. The garbage collection and transport method has been converted from the past open method into the closed method, and the past garbage collection and transport by small vehicles have been directly converted into compression by transit station and then high-efficiency transport by large vehicles. The compressive garbage collection and transport vehicles are widely used, and the mechanical level of urban domestic garbage collection and transport is improved continuously. In 2008, there were totally 76400 urban sanitary vehicles in China, and totally 154.38 million tons of domestic garbage was removed, 14.4 times and 6.2 times respectively of those in 1978.

5.2 Gradual Increase of Garbage Treatment Level

When the urban garbage collection system is improved gradually, the hazard-free garbage treatment level is also improved continuously. By the end of 2008, there were approximately 1.1 million sanitary workers and 509 urban domestic garbage hazard-free treatment facilities in China, including 407 sanitary landfills, 74 incineration plants, 14 composting plants and 14 other treatment facilities. The daily average domestic garbage treatment amount reached 315100 tons, and the hazard-free treatment rate reached 66.76%. The construction and operation of urban garbage treatment facilities are being developed toward a modernized, concentrative and large-scale operation. In recent years, a group of hazard-free domestic waste treatment experiment projects were built including Beijing, Tianjin, Guangzhou, Hangzhou, Qingdao and Shantou.

However, the urban sanitary facility construction and operation level still needs to be improved, and the garbage treatment technology market is not normalized enough. In some places, the improper selection and blind import of technologies cause the operation efficiency to be low or hard to work normally. Small garbage incineration equipments are still in use in some regions. The incineration temperature is low, the smog purification means is simple, and the pollutants such as dioxin are discharged above the allowed standard, which seriously harm the health of the masses. Generally, throughout China, the urban domestic garbage hazard-free treatment rate is still low. Some garbage treatment facilities have not yet reached the hazard-free treatment standard. A great amount of garbage, not disposed off properly, pollutes the water sources, soil and air, and disseminates diseases and harms the human health. There exist great partial of serious safety risks and incidents that should not be ignored.

Zhongguancun Street in Beijing
Picture from: Zhang Zhiguo

6 Parks and Public Green Space

6.1 Continuous Enlargement of Public Green Space

After the founding of the New China, all cities successively established their respective administrative departments for the development of parks and green space step by step according to plans. During the period from 1949 to 1959, turban gardens and public green space was developed and enlarged continuously. By the end of 1959, the total urban green area in China was 128,212 hectares, and there were 509 parks, with a total area of 16,581 hectares. By 1978, the area of urban green space in China declined to 81,735 hectares, and the area of parks was 15,228 hectares. During the 30 years since the Reform and Opening-up, the urban greening undertaking developed fast. In 1992, the State Council promulgated the "Urban Greening Regulation", and the urban greening construction was put on a legal track. In 2001, the State Council held a national urban greening conference, released the "Notice on Strengthening Urban Greening Construction", and determined the urban greening objective for the first ten years of the 21st century. Thereafter, the national urban greening was propelled powerfully. By the end of 2008, the total area of urban green space in China reached 1,747,493 hectares, and the total area of parks reached 218,260 hectares, 21.4 times and 14.3 times respectively of those in 1978. In China, the per capita public green space, greening coverage in built-up areas and vegetation coverage in cities are 9.71 square meters, 33.29% and 37.37% respectively, about 6.2 square meters more, 11.48% and 10.81% higher respectively over 1998 (Figure 3.13).

"To Make Motherland Green", Incription by Mao Zetong at Baiwangshan Forest Park in Beijing
Picture from: Zhang Zhiguo

At present, there are some problems with the urban greening in China mainly in the following aspects: (1) some cities are anxious to achieve quick success on greening construction, and blindly pursue the greening effect of "overnight forest" or "large grassland or landscape"; (2) the concept of "stressing landscape and ignoring ecological function" is not yet changed in the minds of some managers, designers, construction undertakers, residents and the masses, and the natural production capacity of green plants cannot be exerted to the largest extent.

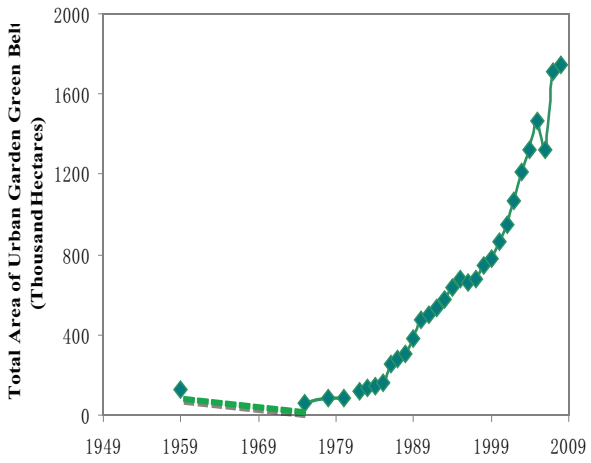


Figure 3.13 Urban Green Space in China, 1949-2008
Source: China Statistics Yearbook 1985-2009

6.2 Remarkable Improvement of Park Development Quality

When all regions are carrying out urban greening in large scales, more attention should be paid on the scientific garden construction, rational planning and design and diversity of plant combination. The gardens should be improved continuously, while foreign garden arts, ecological landscape concepts and different plants should be brought into the development of gardens in China and integrated with local culture and conditions.

By the end of 2008, China had 139 national garden cities, 7 garden downtowns, 40 garden counties, 10 garden towns and 11 national experiment ecological garden cities. The total area of the urban green space in China was 3.6 billion hectares, including 1.208 million hectares of parks and gardens and 1.356 million hectares of public green space in the built areas. When more and more efforts are made for urban greening construction and the urban greening qualities are raised, many cities are going to build a group of high-level and high-quality parks and green space according to the local territorial, historic and cultural features.

Humble Administrator's Garden in Suzhou
Picture from: City Miracles – 60 Years of Urban Planning and Construction in New China

7 Responding to Climate Changes

7.1 Strengthening Legal Restrictions and Policy Guidance

China pays high attention to climate changes in the process of development, and has made unremitting efforts and active contributions for responding to climate changes by starting from the long and fundamental benefits of the Chinese people and the mankind. China is the first developing country who has formulated and implemented the "National Program on Responding to Climate Changes". It has also successively formulated and amended a series of laws and regulations such as the Energy Conservation Law, the Renewable Energy Law, the Circular Economy Promotion Law, the Clean Production Promotion Law, the Forest Law, the Grassland Law and the Regulation on Energy Conservation in Civil Buildings. All this shows that China regards the laws and regulations as important means to respond to climate changes.

China is a country that made the greatest efforts in energy conservation and emission reduction in recent years. It improves taxation system continuously, propels the price reform of resource products actively, and promotes the establishment of a price formation mechanism that can fully reflect the market supply and demands, resource scarcity and environmental damage costs. It fully implements the Ten Major Energy Conservation Projects and the Thousand-Enterprise Energy Conservation Plan, and takes energy conservation actions in the key areas of industry, traffic and construction, etc. It deeply propels the experiment of circular economy, endeavors to extend energy-conservation and environmental-protection automobiles, and promotes energy-conservation products and projects in favorable to consumers. It also encourages the elimination of high-consumption and high-pollution backward production facilities.

China is a country where new energies and renewable energies are increased most rapidly. On the basis of protecting ecosystems, it develops hydropower orderly, develops nuclear power actively, and encourages and supports rural and remote regions and the regions with suitable conditions to develop bio-energy, solar energy, geo-thermal energy, wind energy and other similar new-type renewable energies. China is the country that has the largest area of afforestation in the world, continuously restores cultivated lands to forests, plants trees and cultivates forests at large scales, and makes great efforts to increase forest carbon sinks.

Box 3.4 China's "Solar Roofs Plan"

On March 26, 2009, the Ministry of Public Finance and the Ministry of Housing and Urban-Rural Development jointly released the "Implementation Opinions on Promoting the Application of Solar Photoelectric Buildings" and the "Interim Measures on the Administration of the Fiscal Subsidy Funds for Application of Solar Photoelectric Buildings". For the purpose of effectively addressing the insufficient application of optoelectronic products in China, China's "Solar Roofs Plan" was implemented by adopting demonstration projects at the beginning of the development process, accelerated to promote the use of optoelectronics in urban-rural construction, and meanwhile providing subsidy to the demonstration projects of qualified solar photoelectric buildings at the rate of 20 Yuan/Wp (the amount of such subsidy can cover 30% or more of the costs). China's "Solar Roofs Plan" mainly includes three aspects: (1) promoting exemplary development of optoelectronic buildings, and initiating the domestic market; (2) highlighting the key areas, and guaranteeing the effects of the demonstration project; (3) enlarging the exemplary effects, and creating conditions for large-scale dissemination.

The concept of "Solar Roofs Plan" is to start from energy conservation and environmental protection, install solar systems on roofs or other possible parts of buildings, and make full use of solar energy to get electric power and heat.

7.2 Exploring Ways for Low Carbon Urban Development

In July 2010, the National Development and Reform Commission determined to carry out the low carbon experiment work in five provinces (namely, Guangdong, Liaoning, Hubei, Shaanxi, Yunnan) and eight cities (namely, Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang and Baoding). The specific tasks covered the following five aspects: compiling a low carbon development planning, making ancillary policies that support low carbon development, accelerating the development of an industrial system with low carbon emission, setting up a greenhouse gas emission data statistics and management system, and actively advocating low-carbon green living and consumption modes. At present, nearly 100 cities have joined the initiative to become "Low Carbon cities". China is becoming one of the countries that actively explore ways to build low carbon cities.

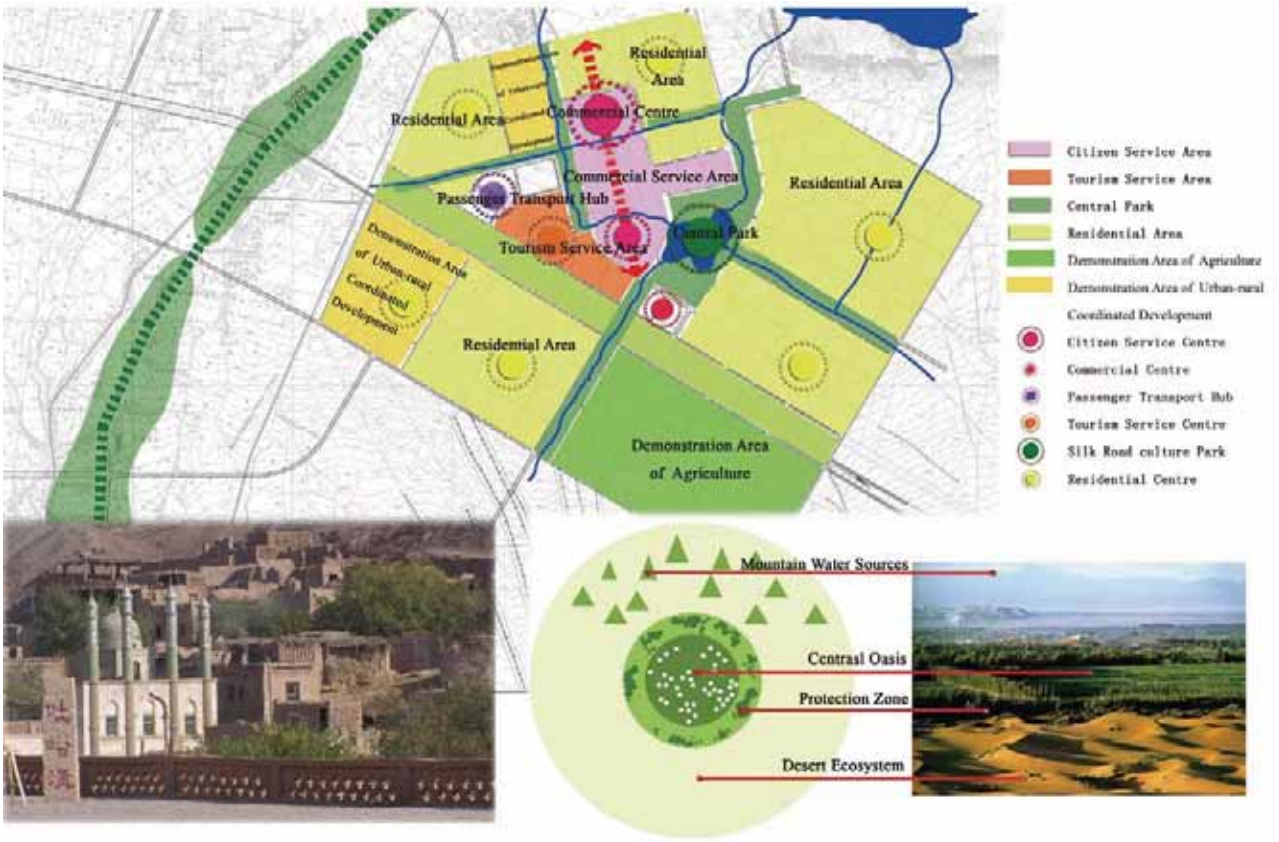
In low carbon city development, the energy-conservation buildings, low-carbon living spaces and urban public transport are highly stressed and rapidly developed in China. In the field of public transport, the rapid rail transit system is developed quickly in some big cities, and has become an important carrier of urban transport. Some other cities are turning to focus on "zero" emission bicycles and low-emission means of transport such as dual-fuel automobiles, electric vehicles and solar cars, so as to attain low-carbon operation. For the purpose of enhancing people's consciousness of energy conservation and emission reduction, and advocating green trips, all cities have organized the "Car-Free Day" publicity activities in September each year since 2005 as per the proposal of the Ministry of Construction.

In respect of energy conservation of buildings, there is a stock of more than 40 billion square meters of buildings in China. About 95% of them are high-energy-consumption buildings. The large public buildings account about 4 % of the total areas of buildings in China. But these buildings, highly intensive in energy consumption, account for 22% of the total energy consumption of urban buildings in China. The energy consumption of buildings has accounted for 27.5% of the ultimate energy consumption of the whole country. For promoting energy conservation of buildings, the energy conservation standards should be regulated for new buildings on one hand. On the other, energy conservation and emission reduction for the existing buildings should be pursued.

Box 3.5 Planning of Turpan New Area in Xinjiang

Turpan New Area is located at the Gobi Desert to the east of Turpan City, about 5 kilometers from the old downtown. The Area has a total planned area of approximately 8.93 square kilometers. The Area, though short of water resource, has rich solar energy, wind energy and other renewable energy resources. Five major concepts are identified in Turpan New Area's planning: ecologically sound distribution of urban space; livable and healthy residential areas; green transport and public transport first; supporting systems for water and energy conservation; cities and buildings with regional and cultural characteristics. In the framework of the planning , following aspects are particularly stressed: (1) the utilization rate of water, and the recycling rate of sewage resources; (2) the proportion of clean energies among the energy structure; (3) moderate energy conservation indices of buildings; (4) moderate indoor comfort indices; (5) suitable greening indices.

The energy conservation and water conservation technologies adopted in the Area mainly include: building new energy-conservation areas, intensifying energy conservation measures, particularly strengthening the passive energy conservation measures such as heat preservation and insulation of buildings, natural ventilation and lighting, and improving the energy utilization efficiency; developing wind power generation based on the rich wind energy and solar energy in Turpan; using the Karez Well low-temperature water and hot dry air for refrigeration; disseminating the use of water conservation devices and equipment, so as to raise the recycling rate of urban water; building up dispersive sewage treatment systems, and using recycled water for irrigation of nearby farmlands and ecological green areas.



7.3 International Exchanges and Technological Cooperation

Responding to climate changes is a common duty of the whole world. China has actively participated in the international exchanges and technological cooperation on global environment change, such as the four major international technological research programs under the framework of the Earth System Science Partnership (ESSP), i.e., the World Climate Research Program (WCRP), the International Geo-sphere-Biosphere Program (IGBP), the International Human Dimensions Program on Global Environmental Change (IHDP) and DIVERSITAS, as well as the intergovernmental Group on Earth Observations (GEO) and the observation plan of the Global Climate Observing System (GCOS). China has also carried out basic research on global changes with Chinese characteristics and global significance.

In respect of urban energy conservation, China has widely cooperated with international organizations and countries such as the United Nations Development Program, the World Bank's Global Environment Facility, Asian Development Bank, Germany, France and Singapore. The cooperation projects include: the "Project of China's Heat Supply Reform and Energy Conservation of Buildings" between China and the World Bank's Global Environment Facility (GEF); the technical cooperation between China and Germany, on the "Project of China's Energy Efficiency in Existing Buildings"; the cooperation with the United Nations Development Program (GEF), on the "Project of China's Terminal Energy Efficiency" (the part of building package); the China-France "Project on Energy Efficiency Improvement and Sustainable Development in China's Dwelling House Area"; the China-Netherland "Example Project on Sustainable Buildings"; the China-Germany technologically cooperative "Project on China's Urban Sustainable Development"; the China-Singapore "Communication and Cooperation Project on Urban Environment Control and Comprehensive Utilization of Water Resources"; and the Asian Development Bank's technical aid project, on the "Research on the Renewable Utilization Policy on China's Urban Sewage/Sludge Resources". The international cooperation and exchange have played an important role to share experiences, technologies, funds, and helped improve the energy conservation and emission reduction capacity and level of the cities in China.

Box 3.6 China-Germany Technical Cooperation- China's Energy Efficiency in Existing Buildings

The technical cooperation project "China's Energy Efficiency in Existing Buildings", which was jointly approved by Chinese and German governments, was formally launched in November 2005, and the implementation duration of the project was 5 years. The Chinese implementing agency was the Department of Building Energy Conservation and Technology of the Ministry of Housing and Urban-Rural Development, while the German Federal Ministry for Economic Cooperation and Development entrusted German Technical Cooperation Company to implement the project on behalf of the German government.

The main task of the project is, through demonstration projects, to import advanced construction energy efficiency programs and concepts from Germany, to develop the concepts, technologies and financing methods of energy efficiency in existing buildings suitable for the northern regions of China in light of the actual situation of China, to facilitate the domestic heat supply system reform, to promote the China-Germany industrial cooperation on construction energy conservation products, and to make contributions to the improvement of the living environment, reduction of the energy consumption in buildings, saving energy and resources, and reduction environmental pollution and greenhouse gas emission.

The overall objective of the Project is that the concept and standards of the energy efficiency in existing buildings in northern regions of China will be verified, and disseminated with the help of the Department of Building Energy Conservation and Technology of the Ministry of Housing and Urban-Rural Development of China. The assessment indicators will cover following three aspects: (1) By 2010, when the average indoor temperature of residential buildings of energy efficiency during the heating season is raised to 18°C, the heating energy consumption will be reduced by more than 30%; (2) By 2009, the relevant standards and technical programs of energy conservation in the existing residential buildings in northern regions of China will be recognized and spread by the Development of Building Energy Conservation and Technology of the Ministry of Housing and Urban-Rural Development of China; (3) By 2010, the experimental cities of heat supply system reform in northern regions of China will be able to adopt the standards and methods developed with the support of the project.

Source: China-Germany Technical Cooperation – the Office for the Project of China's Energy Efficiency in Existing Buildings
http://www.eeeb.org.cn/