

Clean Transportation for Beijing2008

Green Olympics

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ABSTRACT The Olympic Movement's Agenda 21 is the Beijing's guideline for hosting the 2008 Olympic games. One of the mottoes for Beijing 2008 is "Green Olympics". Transportation is one of main reasons of air pollution in Beijing. In this paper some of the considerations were presented of Transportation for Beijing 2008 Olympic games, including Transport Construction and Traffic Management Plan, Vehicles Emission Control Plan and Clean Automobile.

The Olympic Movement's Agenda 21 is Beijing's guideline for hosting the 2008 Olympic games. One of the themes for Beijing 2008 is a "Green Olympics". Hosting of the games in Beijing will serve as a "catalyst" for environmental improvement and help promote sustainable development in Beijing and China. By the time the Olympic games opens in 2008, Beijing will have met the required environmental quality standards. A new Beijing of fresh air, beautiful environment and sound ecosystem will emerge in the eyes of the people of the world.

In order to achieve Green Olympics, Beijing has made the Sub-plan for Environmental Protection. The sub-plan proposed the objective of ambient air quality, which is shown as follows: By 2008, the main air pollutants should meet the national standards based on the remarkable regional ecosystem improvement. During the Olympic period in 2008, concentration of SO₂, NO₂ and O₃ in urban area should reach the WHO guidelines and the particles should be comparable to that in the major cities

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in the developed countries [1].

Vehicles emission is a main reason of air pollution in Beijing[2]. Now there are nearly two million vehicles in Beijing. studies indicate that 74 per cent of the hydrocarbons, 63 per cent of the carbon monoxide and 37 per cent of the nitrogen oxide in the city's air came from tailpipe emissions. The transportation share of emission has leaped from the third place to the first place among the air pollution sources and the transportation share of emission will reach 64 percent by 2010. Indeed, worsening air pollution has become a key barrier to Beijing's application to stage the Olympic Games of 2008. So it is also very necessarily to prevention and control of the vehicle emission pollution. Beijing's plan about clean transportation will be introduced in this paper.

1. Transport Construction and Traffic Management Plan

This plan is formulated based on the aims and objectives of Beijing Olympic Action Plan, to accelerate the modernization process of transport construction and traffic management in Beijing for convenient, rapid, safe, orderly, efficient and environmentally friendly transportation services, and to create first-class traffic environments for staging a best-ever Olympic Games in history.

1.1 Guidelines

(1) Necessary and sufficient transport support will be provided to guarantee the realization of Beijing's global objectives for social economic development and city construction. At the same time, responding to the unique opportunities created by Beijing Olympic Games, the modernization process of transportation construction, operation and management will be accelerated by utilizing the favorable conditions made available by Beijing's rapid social and economic developments based on Beijing's advantages in science & technology and human resources.

(2) The urban transport infrastructure construction will be aimed to meet Beijing's global demand in urban developments while the temporary and localized special traffic demand during the Olympic Games will be satisfied through scientific traffic organization and traffic demand management.

(3) As a guiding principle, the construction and management of transport facilities will be integrated while equal attention will be paid to both traffic demand management and facility operation management.

(4) The policy of public transportation priority and modern logistics system development will be adhered to so as to improve the Beijing's daily commuter trip structure and passenger freight transport modes. The growth of private car ownership will be guided while their use be properly restricted.

(5) The public transportation system will also be fully exploited as a functional instrument in guiding Beijing's urban development. Urban land development with transit-oriented development (TOD) will be employed to rationalize Beijing's layout and provide reliable transportation supporting facilities for the development of scattered groups and small towns in the suburbs.

(6) Interurban traffic of Beijing as the nation's capital will be enhanced to provide necessary transportation support for the integrated development of Beijing and neighboring cities.

(7) The organizational system for urban transportation construction and management will be improved and regulated to provide more efficient institutional support for Beijing's urban transportation planning, construction, operation and management.

1.2 Urban Transportation Development Objectives for 2008

The modernization process of transportation construction and management in Beijing will be greatly advanced to provide convenient, rapid, safe, orderly, efficient and environmental friendly transport services. The construction of railway, urban road, expressway, interurban transport hubs and modern transportation operation administration system will be accelerated to provide sufficient transport support that guarantees the development of Beijing's social economic development and urban construction, and to offer first class urban transport services for the Olympic Games.

(1) A multi-functional system of airport hub and land transport hubs will take shape with the integration of spoke and point-to-point patterns.

(2) Beijing's integrated urban transportation system will be established with proper functional structure, high capacity and efficiency, and more human orientation.

(3) The urban trip mode structure in Beijing will be substantially improved. With railway transport as the backbone, buses and trolley buses as the mainstay, the public transportation system will carry up to 60% of daily commuters, upgrading its share in total daily trips from 26% to 40%.

(4) World-class road traffic management system will be established. The framework of Integrated Intelligent Transport System will be formed. The capacity and efficiency of Beijing's passenger and freight transport will be of world advanced level. Intelligent management in transport dispatch, loading service and transport information service will be realized.

(5) The average auto speed on urban expressways in rush hours will reach 35~50km/h, and the average speed on main roads in urban areas will reach 20km/h. The average time for commuter trips within the 5th ring road will not exceed 50 minutes.

(6) During the Olympic Games, it will take no more than 30 minutes for athletes, coaches and Olympic officials from residential places to venues. On the Olympic transport priority lanes, the average speed will be no less than 60km/h.

(7) Intelligent road traffic management will be available. Police controlled area will be increased to 10~15%. The times of vehicle stopping will be reduced by over 50%. The queuing lines at intersections will be decreased by 50%. The traffic accidents will be reduced by 20%.

(8) Traffic environment quality will be substantially improved. Vehicle exhaust and noises will be efficiently controlled.

1.3 Urban Transport

1.3.1 Road System

By the year of 2008, a modern urban road network will be completed, which will be rationally structured both in function and structure, and backboneed by the urban expressways and main roads. The density of road network within the 5th ring road will reach about 2.62km/km².

Priority will be given to the construction of some key urban expressways, main roads, minor roads and branch roads, the re-construction of some key intersections and the elimination of the bottle necks in the road network. Special attention will be directed to the construction of collecting networks between the 2nd and 4th ring roads, and the construction of corridors connecting downtown areas and the 10 scattered groups. Both the road network layout and the functional structures will be improved. Newly built and rebuilt urban roads will reach 318km, including 54.1km urban expressways, 86.7km main roads and 96km roads in central area.

Bicycle lane network and pedestrian areas (streets) will be planned and constructed. This will be started in the old town areas and newly built communities.

1.3.2 Public Transportation System

1.3.2.1 Urban Railway Transport

Using the guiding policy of public transport priority, the urban railway transport will be fully employed to support the execution of “two strategic transitions” in the city master plan and the realization of strategic objectives for urban transport development. The operation strategy is to speed up the construction of new lines and the rebuilding of old lines, to improve the service facilities and upgrade the services, which will substantially increase the urban railway transport’s share in the total passenger transport, and relieve the city’s traffic congestions. By the year of 2008, 154.5km urban railway will be newly built, expanding the total length of urban railway lines to 249.5km in the downtown areas. Some suburb railway lines will also be constructed, increasing Beijing’s urban railway operation lines to over 300km in total. The urban railway system is expected to carry 1.8~2.2 billion passengers per year.

Eight new subway lines will be built in the urban area, including Subway 5th Line (from Songjiazhuang to North Taipingzhuang, 27.6 km), Subway Batong Line (from Sihui East Station to Tongzhou Tuqiao, 19 km), Subway 4th Line (from Beigongmen to Majiabao, 23.9 km), the north section of Subway 10th Line (from Huoqiying to Dabeyiao, 23.9 km), Olympic Line (from Olympic Park to Panda Roundabout, 4 km), Yizhuang Line (from Songjiazhuang to Yizhuang, 26 km), Airport Special Railway Line (from Dongzhimen to Capital International Airport, 22 km), the middle section of Subway 9th Line (from Baishiqiao to Beijing West Railway Station, 5.8 km). Subway 1st Line and 2nd Line will also be renovated by upgrading their signs and signal systems, installing the automatic ticketing systems and introducing new carriages.

1.3.2.2 Buses and Trolley Buses

In the coming 7 years, priority will be given to the optimization of bus line network, the construction of transit terminals and the rapid development of high capacity public passenger transportation. The terminals at Dongzhimen, Xizhimen, Beijing Zoo, Wangjing, Sihuiqiao and some other places will be constructed or renovated so as to form a rationally located, easily accessible and efficient public

passenger service network, centering in the downtown area and radiating to the scattered groups and residential zones.

By the year of 2008, the capacity of Beijing's buses and trolley buses transport will reach 4.5 billion passengers per year, and the number of operation vehicles will reach 18000. There will be more than 650 public transit lines with a network density of 2.16km/km².

In the coming few years, the key tasks will be as follows:

(1) Optimize the bus and trolley bus service network, expand the service areas, and form an efficient passenger transport network by rationally grading and structuring the expressway network, the trunk line network and the branch line network with the support of urban expressways, main roads, minor roads, branch streets (including roads in residential area), and highways.

(2) Accelerate the construction of bus interchange terminals and improve the service facilities. The fleet of buses and trolley buses will be expanded or renovated to upgrade the service and operation.

(3) Accelerate the research and development of bus dispatch centers, GPS, wireless communication systems and lower chassis vehicles to upgrade the operation level and the application of science and technology.

(4) Promote the application of clean energy in public transit vehicles, aiming at over 80% of the buses using clean energy and all the buses operating in the Olympic Park and major venues using clean energy by the year of 2008.

(5) Improve the public transport information service system to meet the demand of high quality communications and information search during the Olympic Games and ordinary daily passenger transport.

1.3.2.3 Taxi

Taxi, as an auxiliary and assistant part of the public passenger transport system, will be governed by Beijing's passenger transport plan and brought to full function. In the coming 7 years, taxi services in Beijing will be developed into an efficient, energy saving, safe, environmental friendly urban transport tools and offer good services of international standards.

The vehicles used as taxis will be upgraded and conform to the Technical Standards for Special Vehicles Used as Taxis. By the year of 2008, middle and high class vehicles will be over 70% of the total operating taxis, clean energy vehicles will be over 70%, and all of the operating taxis will meet the environmental standards. At the same time, taxi service dispatching system will be established with integrated service modes of phone call service, station call service and roadside call service. The enterprise computer management system and Beijing taxi industry service standards system will be formed and all the taxi drivers are expected to be able to speak most frequently used 100 English sentences for taxi services.

1.3.2.4 Automobile Rental

The automobile rentals in Beijing will be developed with unified planning and size control. The development plan of automobile rental will be established to promote the automobile rental in Beijing.

1.3.3 Parking Construction

In view of the possible increase of civilian motor vehicles, the civilian parking lots (primarily those for night parking) in urban area will reach 1.5 million, upgrading the ownership of fixed parking lots for motor vehicles from 66% to 100%. The number of public parking lots will be increased to 225,000, raising the rate between public parking sets and motor vehicle ownership from 12% to 15%.

The public parking facilities will be constructed in conformity with the capability of road network according to the city plan and downtown area traffic demand management plan. The supply of public parking space will be measurably controlled in the downtown areas. At present time, the night parking certificate system is being enforced while flexible charging will be introduced in order to regulate the in-come flow of cars in the downtown areas for a better balance of dynamic and static traffic.

The construction of public parking facilities outside the downtown areas will be encouraged. Car parking and bicycle park will be constructed as auxiliary facilities at railway terminals and bus centers. Park-and-ride will be encouraged. In the peripheral areas, parking facilities will be constructed along main radial highways for the temporary parking and cleaning of freight trucks from other provinces and cities.

1.4 City and Interurban Transportation

1.4.1 Construction of Highway Network

The construction of national highway, city highway and rural highway network will be accelerated in order to form main radiate routes consisting of 12 national highways and national arterial highway, subordinate radiate routes consisting of 11 city highways, 9 connection highways and 2 ring roads. By the year of 2008, 10 suburban counties/districts in Beijing will be connected to the downtown area by either expressway or first-grade highway; the centers of neighboring counties/districts will be connected by expressways, first-grade or second-grade highways; the towns and the centers of their counties/districts will be connected by highways of third-grade and above.

By the year of 2008, it will take approximate one hour's drive to travel from the centers of suburban counties/districts to the downtown area. It will take less than one hour's drive to travel between the centers of neighboring counties. It will take less than one hour's drive to travel from the centers of towns to the center of their county. In addition, it will take less than 2 hours to reach the downtown area from the border of Beijing, and less than 3 hours to pass through.

In order to realize the above objectives, 1509km highway will be constructed and 2530km highways will be renovated, including 5 national highways of 132km in length, 33 city highways of 751km in length and many county highways totaling 751km in length to be constructed or renovated.

By the year of 2008, 15400km highways in the suburbs of Beijing will be built, including 718km expressways, 713km first-grade highways and 2882km second-grade highways. The density of highway network will reach 91.6km/100km².

1.4.2 Interurban Highway Passenger Transport

In the coming 7 years, the interurban passenger transport of Beijing will be developed under the principle of overall planning, structural readjustment, focus orientation, intensified operation, standardized administration and technology renovation, so as to improve the interchange between interurban passenger transport and urban public transportation, and to establish an interurban highway passenger network with Beijing as the center based on the expressways and high grade highways connecting with the whole country. During this period, inter provincial passenger transport routes will be increased by 15% while expressway routes account for up to 10%, reaching 24 provinces, municipalities and autonomous regions and satisfying the demand for long distance highway passenger transport.

1.4.3 Highway Freight and Urban Logistics Transport System

By the end of 2007, five important freight terminals will be constructed, including Majuqiao first-grade freight terminal, Yancun first-grade freight terminal, Tianzhu first-grade freight terminal, Shibali Dian second-grade freight terminal and Laiguangying second-grade freight terminal.

The restructuring of highway freight industry will be accelerated to optimize the vehicle composition and payload structure, and improve freight yards and logistics infrastructure. Priority will be given to the development of urban logistics distribution, container transportation and multi-mode combined transportation, upgrading Beijing's freight transport industry to the standards of a modern international metropolis with advanced facilities, professional management, well regulated markets and smooth flow of freight. The highway transport information platform will take shape for the intelligent and IT application in the dispatch of passenger and freight transport. The highway freight industry will realize its modernization in vehicle equipment, transport organization, yard facilities, information exchange and social service, and meet the freight transport and logistics service demands during the Olympic Games.

1.4.4 Railway

The construction of railway network and technical renovation will be accelerated to upgrade the transport capacity and quality, adjust the transport structure and sufficiently utilize advantages of railway to join in urban railway transport. In the coming 7 years, the focus of railway construction in Beijing are as follows: To connect Beijing—Shanghai High Speed Rail to Beijing railway network, to construct the special route for railway passenger transport from Beijing to Tianjin, to construct the straight underground route from Beijing Railway Station to Beijing West Railway Station, to expand and renovate Beijing Railway Station, Beijing North Railway Station and Beijing South Railway Station, to reconstruct the Beijing—Qinghuangdao route for high running speed, to reconstruct the Beijing—Shanghai route for electricity powered automotives, to expand and reconstruct the carriage organization place of Beijing West Railway Station, to reconstruct the railway freight logistics center and yards.

It is also an important task for the coming few years to renovate the present railways and operate more suburban railway routes.

The passenger and freight transport capability by railway will be adapt to the requirement of Beijing's economic and social development, with a reasonable layout

of railway facilities , advanced equipment , smooth routes, and coordinated functions. The major equipment and technology will be of the international standards of 1990s. During the Olympic Games, the railway authorities will reorganize running schedules and provide high quality services according to the demand of passenger transport.

1.4.5 Civil Aviation

With the goal to become a multi-functional large pivotal airport in Northeast Asia, Beijing Capital International Airport will be expanded and reconstructed to meet the need of the Olympic Games and the social economy development.

Under the precondition of ensuring that Beijing Capital International Airport can function as a complicated pivot, the middle-long term development objectives are illustrated as an airport with a passenger volume of 60-65 million per year, a freight and postal volume of 1.8-2 million tons per year, a taking-off and landing volumes of 0.5-0.6 million sorties per year.

In the coming 7 years, Beijing Capital International Airport will carry on many construction projects as follows: new airstrip construction projects, flight control and weather communications projects, special plane and administration building projects, aviation station area projects, freight projects, integrated supporting facility projects of the airport, urban waiting hall projects and so on. By the year of 2008, Beijing Capital International Airport will achieve a passenger volume of 48 million per year, a freight and postal volume of 1.3 million tons per year, a taking-off and landing-on volume of 0.4 million planes per year.

1.5 Traffic Management

Insist on reform and innovation to upgrade the management from empirical management to information based scientific management. Insist on optimizing the resource distribution of road and traffic police to upgrade the management from extensive to intensive. Strengthen the police resources with science and technology to upgrade the management from the labor-intensive to technology-intensive. Insist on human orientation and upgrade the administration-oriented management to service-oriented management. Insist on people first to achieve the conversion from administrative management to service management.

By the year of 2008, intelligent traffic management system, reflecting advanced management and technology, will be instituted, using the advanced science and technology to satisfy both the economic and social development of Beijing and the

transport requirements for the Olympic Games in conformity with Beijing Urban Master Plan up to the standards of international metropolises. The modernization of Beijing's traffic management will take shape and Beijing will join the most advanced traffic management cities in the world.

1.5.1 Intelligent Traffic Management System (ITMS)

Comprehensively upgrade the collection, analysis and integration of dynamic and static information of road traffic and administration, and the ability for scientific decision-making. Improve the ability in handling traffic accidents and the ability in emergency response. Upgrade the traffic information services to the public. The intelligent traffic management system will be available as a scientific instrument for Beijing's urban traffic management and the traffic organization during the Olympic Games.

By 2008, there will be two major systems and eight projects in traffic management. The two major systems include the intelligent traffic control system and advanced traffic management information system. The eight projects include the expansion and improvement of the urban road traffic real-time-dynamic information management system, the renovation of intelligent traffic signal control system, the establishment of integrated comprehensive intelligent transportation management system, the establishment of the wireless communication system of traffic management, the establishment of the intelligent communication network security system, the construction of the broadband communication integrated services network, the construction and improvement of integrated traffic management information application system, and the improvement of the traffic management information distribution system.

1.5.2 Build Efficient Organization and Management System

In view of the urban transportation development for 2008 and the road construction and renovation, the comprehensive road traffic organization master plan will be formulated to meet the requirements in the urban construction and development. The transportation organization structure will be further optimized to establish a scientific traffic organization and management system based on the urban highway network and public transit network with differentiated functions for the roads in different regions to meet various traffic demands. By relieving the interference among different types of traffic, the road resources will be optimized step by step for the efficient performance of different roads and the comprehensive improvement of traffic and transportation efficiency.

1.5.3 Improve Management Service to Meet Public Needs

The principle of “people first” will be represented not only by human friendly designing of transport facilities but also by the change from administrative management to service-oriented management. Priority will be given to service while seeking the management objectives on vehicles, accidents, surface traffic order, the construction and management of traffic facilities. The management policies and practices will be developed in order to make people’s daily trips as convenient as possible.

2. Vehicles Emission Control Plan

More stringent vehicle emission limits will be introduced in the city: from January 1, 2003, the light vehicles, heavy diesel vehicles will follow the second-stage emission limits that is equivalent to Euro II, and in 2005, the third-stage limits equivalent to Euro III will come into force. Moreover, emission limits for other types of automobiles will be tightened. No new automobiles failing to meet the limits will be allowed to enter Beijing’s market or be granted licenses. On the other hand, efforts shall also be made to organize supply and sales of fuels matching the new limits. At the same time, it will be encouraged to use the automobiles powered by cleaner fuels, fuel cell vehicles, electricity-powered vehicles and other types of lower emission vehicles. By 2007, 90% public buses and 70% taxies shall be converted to cleaner energy. Almost 200 liquefied petroleum gas stations and natural gas stations will be put into use [3][4].

Measures shall be made to accelerate the elimination of aging automobiles to guarantee reduction of total vehicle emission while the vehicle fleet keeps growing. Automobiles that have been in use by the end of 1992 will be discarded by 2007; the taxies with more than 500,000 kilometers’ driving age should be timely scrapped. Rules for eliminating the motorcycles will be formulated and enforced and national stipulations on eliminating the vehicles for agricultural use will be strictly enforced. More simplified dyna-mometer test lines will be provided to apply this exhaust test approach to all in-use vehicles and the limits will be lowered.

Environmental label management will be strengthened; traffic control will be tightened according to different automobile exhaust levels and I/M system will be mandated. Quality of the oil for automobile shall be safeguarded. Take stronger measures in law enforcement by relying on the departments of both environmental

protection and traffic control so that more than 90% of the automobiles' exhaust will come up to the limits.

On the basis of the improvement of the road traffic and the public transit systems, reasonable number of parking lots in the downtown area shall be provided with the price of parking set at reasonable level to control the traffic flow volume on the motorway in the urban area. Measures will be taken to divert transit vehicles from other parts of the country from entering the Fifth Ring Road by 2004. Moreover, other measures to reduce traffic jam and encourage people to use public transits and bicycles shall be adopted.

3. Clean Automobile in China

In the application for the Olympic Games and presentations made prior to the voting, Beijing and the Chinese Government made the commitment on environment and transportation, two issues that are sensitive in holding Olympics and of concern to the world: The number of days when air quality is good would exceed two-thirds of the total; vehicle exhaust index would meet Euro III standard; more than 90 per cent of buses used in urban transport would consume clean fuel or meet clean vehicle exhaust standard; the city would work on rail transit and rapid transit to dramatically raise the average speed of transit vehicle, alleviate traffic jams and pollution caused by car emissions[1].

However, Beijing indeed faces major challenges in addressing its environment and transportation issues. Take the growing population for example. Due to various reasons, despite an array of measures adopted by the Beijing Municipal Government, the population in the city is still increasing quickly. In 2008, the total population in this city is expected to hit 15 million, including 3 million floating population. The total transport volume is on the rise. Total transport volume (including passenger transport and freight) is proportional to the size of population, and its growth outstrips that of population and total output value.

Therefore, the total quantity of vehicles is rising quickly. From 2003-2008, the number of taxis will climb from 60,000 to 80,000, that of buses from 12,000 to 18,000, and that of private cars and non-private vehicles is increasing even faster. Such large quantities of vehicles are just like a dark dragon. Not only do they consume fuels at an astonishing speed and make petroleum resources increasingly scanty, they also pose aggravating environmental pollution.

To coordinate the relationship between vehicles, energy and environment, people are working on clean vehicle fuels and exploring ideal sources of power. Thirteen ministries initiated what were known as “National actions for clean vehicles” in April 1999, with 12 big cities chosen for the initial trials. Since then, a number of secondary cities have been added to the program. Leaded gasoline was phased out completely in July last year[5].

3.1 Guidelines

Around the technical bottleneck of adopted and popularized electric motor automobile and new type clean fuel automobile, we should strengthen technical study. By the year 2008, ensure that during the Olympic Games the bus that is used to meet and see off sportsman or sportswoman, or special vehicles and partial public traffic vehicles will be adopted as electric motor automobiles in the Olympic Games' ground, so Beijing will be a demonstrative city of used electric motor automobile in China, and ensure most of bus and hired cab will use clean fuel and make bus exhaust reach the standard of international current bus pollutant discharge in Beijing city.

We shall emphasize to develop and demonstrate electric motor automobiles, and research their industrialization and power Lithium ion battery and key materials. And develop and demonstrate CNG and LPG clean fuel automobiles. We are engaged in researching into the application of the technology of controlling the pollutant discharged by tail' gas of ultra-low discharged mixed dynamic automobile and vehicles and bus clean fuel technology etc.

3.2 Electric Vehicles

Electric vehicle, which offers energy-saving and environmental protection features, may become the most important means of transportation in this century. In the past more than a decade, car giants around the world invested heavily in the R&D of battery-powered electric vehicle. And technology of hybrid electric vehicle is reaching maturity; they are offered for sale or rental in the United States, Japan and Germany. Battery-powered electric vehicle is perceived as one of the main development trends of the automobile industry with immense development potential.

China lags behind the world's pacesetters in the field of vehicles driven by internal combustion engines for about twenty years, but in the field of electric vehicle, the gap spans only 4-5 years[6]. It is possible for China to obtain an advantageous position by leveraging the demand of the 2008 Olympics to achieve frog-leaping development in

the new round of competition in the world automobile industry.

Chinese EV R&D has undergone a groping, hesitation, charrette, expert decision-making up to the present expandedness. The national EV key science and technology industrial engineering project was started in 1996, on the design of proto-type EV, testing of key parts and refit cars as well as many other work have been done. In 1998, the National Shantou-Nanao EV Demonstration Base Zone was founded. Many local governments, government divisions or enterprises made some investment in the EV R. & D. Especially, the EV R & D was established as the key project of the National High Technology Research and Development Program (863 Project Program) by Ministry of Science and Technology of China and was launched in October 2001, 880million RMB was invested for the program to start, symbolizing that Chinese EV R& D has developed on an across-the-board scale. In addition, It is reported that the order of about 2 billion Yuan in RMB for electric vehicles will be provided by the time when the Olympics take place. A great upsurge in the research of electric vehicles is just rising. Main projects on electric vehicles in china can be seen in table 1[6][7].

China plans to invest 1 billion yuan (US\$120 million) in research of electric automobiles driven by fuel cells. China now has more than 20 institutes and enterprises specializing in fuel cells. A plan is also in development where the Shanghai municipal government will invest 100 million yuan (US\$12 million) per year in supporting the research and development of fuel cells[7][8][9].

The researches resulted in the establishment of China's first ever electric motorcar industrialized production base this month in Wuhan in Central China's Hubei Province. With an investment of 200 million yuan (US\$24 million), the base is expected to achieve industrialization in the production of electric cars in the coming three years[7].

Beijing, Tianjin, Wuhan in Hubei Province, and Weihai in Shandong Province have been selected as pilot areas to employ a number of electric buses. Several such buses are already running in Wuhan. By 2007, commercialization of such buses should be realized in Beijing and Shanghai, and expanded to 10 other cities by 2015[1].

China's two main cities, Beijing and Shanghai have also been selected by the Global Environment Facility (GEF), a unit of the United Nations Development Programme (UNDP) for the Fuel Cell Bus Demonstration Project. The GEF is funding a fuel cell bus project in developing and newly industrialised countries, such as Brazil, China,

Egypt, India and Mexico. Under this project, which started in 1996 with the planning process and will see the bus demonstrations from 2004 to 2007, the GEF will sponsor the deployment of six fuel cell buses and one hydrogen filling station each to both

Table 1 Main projects on electric vehicles in china

Vehicle type	Electric vehicle type	Product name	Main developed Unit
Car	Pure electric car PEC	Xiali PEC	Tianjin First Automobile Company
		Fukang Saloon PEC	Dongfeng Automobile Co. Ltd.
		QR PEC	Shanghai Jiao Tong University
		ZC7050A PEC	National EV Test & Demonstration Center Anhui Zhaocheng EV Company
		U2001 PEC	Hongkong University
		Edison EV100 PEC	Edison Institute of Automobile Technology
		BYD PEC	BYD Automobile Company
	Hybrid electric car HEC	Hongqi HEC	Changchun First Automobile Company
		EQ7200 HEC	Dongfeng Automobile Co. Ltd.
		QR HEC	Chery Automobile Corporation Limited
		ISG HEC	Changan Automobile(Group)Liability Co. Ltd
		Edison HEC	Edison Institute of Automobile Technology
	Fuel Cell Car FEC	Chunhui I FEC	Shanghai Automotive Industry Corporation (Group) (SAIC),
		Chunhui II FEC	
Chaoyue I FEC			
Phoenix FEC			
Bus	Pure Electric Bus PEB	Luxury Sightseeing PEB	Beijing Institute of Technology
		low-floor electric PEB	
	Hybrid Electric Bus HEB	Jiefang HEB	Changchun First Automobile Company
		EQ6100HEV HEB	Dongfeng Automobile Co. Ltd
	Fuel Cell Bus FCB	FCB	Tsinghua University

Beijing and Shanghai. The project is funded with US\$ 12 million from the GEF, US\$ 10 million from Chinese government, US\$ 5 million each from the cities of Beijing and Shanghai and US\$ 4 million from private companies. It is planned to drive 1.6 million kilometres during the 3-year demonstration trials[7].

In the last ten-day of this May, Beijing will launch about 20 lithium-ion-battery buses with zero emissions in the No 121 itinerary, forming China's first domestic electric bus team. The low-floor electric bus, jointly developed by the Beijing Jinghua Bus Company and Beijing Institute of Technology, was particularly designed for the Beijing Olympics. With a top speed of 80 km/h, the new "green" bus can run for about 200 kilometers after a five- to six-hour recharge. By the time the Olympics take place, a motorcade consisting of 1000 domestic electric vehicles will take shape, expected to be the biggest fleet of its kind in China[6].

Electric bicycles are a huge business in China. There are around 400 manufacturers, producing about 2.5 million electric bicycles. This is a sharp rise from the 15,000 units in 1997. This dramatic growth is largely due to legislation banning gasoline fuelled scooters in several major Chinese cities, including Beijing and Shanghai[7].

3.3 Gas Fuel Vehicles

Since the 1990s, China has increased its natural gas output, and made progress in the construction of gas pipelines. In recent years, several natural gas pipelines have been built, including ones from Jingbian (Shaanxi province) to Beijing and Xian, from Yincuan (South China Sea) to Hong Kong, and from the Pinghu (East China Sea) to Shanghai. Other pipeline projects are on the drawing board to send gas from Sichuan to Wuhan and from Xinjiang to Shanghai.

At the present time, many provinces and cities are making plans to use natural gas, indicating that China's natural gas industry could develop rapidly if appropriate policies are enacted. But with most gas resources concentrated in western China and consumption areas in the eastern region, massive transport of gas would be required. The West-East Natural Gas Pipeline Project is slated to help address this imbalance.

Chinese government encourages to use more AFV. In April of 1999, the demonstration program of clean vehicle was initiated in 12 large cities in China. there were total 153,000 LPG or CNG vehicles and 486 gas stations in the 12 large cities by the end of 2002 and 190,000 LPG or CNG vehicles and 560 gas stations in the 16 demonstration cities by October,2003[5][10].

Beijing has bought or remodeled Approximately 40,000 LPG or CNG taxis and buses and has built more than 90 gas stations. Beijing has become the city with the most gas fuel vehicles. From 2003-2008, the number of taxis will climb from 60,000 to 80,000, that of buses from 12,000 to 18,000, and that of private cars and non-private vehicles is increasing even faster. By 2007, more than 90 per cent of buses and 70% of taxis in Beijing will be fueled by clean fuel, respectively[5].

4. International Cooperation for the 2008 Summer Olympic Games in Beijing

The United States and China are the two largest energy consumers in the world. Energy security and environment protection are important priorities both for the countries.

The United States and China have established 11 teams to move forward on Green Olympics cooperation since a Statement of Intent was signed between the Department of Energy and China in September 2002. Two Joint Working Group Meetings were also successfully held in Beijing in 2002 and 2003 and have developed proposals for cooperation.

Academician XU Guanhua, Chinese Minister of Science and Technology, Dr. FAN Boyuan, Deputy Mayor of Beijing Municipality and Mr. Spencer Abraham, US Secretary of Energy jointly signed on January 12, 2004 the Protocol on the Cooperation in the Field of Clean Energy Technology for the Beijing Olympic Games in 2008[11]. The Protocol has laid up a basic framework for the cooperation between the two countries in clean energy technology for the Beijing Olympic Games in 2008. The cooperation will make its due contribution to realize the mottos proposed by the Beijing Olympic Games Committee for the “green, scientific and humanitarian Olympic Games” in 2008. Both the two sides have so far defined 11 cooperation fields relating to the efficient natural gas utilization, fuel cell, energy planning for the Olympic village, green structure demonstration, water quality, intelligent traffic system, energy efficiency, air quality, weather monitoring and forecasting, clean coal technology and making Beijing and Chicago sister cities for the sustainable development. To promote the Olympic games and Olympic Movements, international cooperation is encouraged between China and all the other counties in the world. We will greatly enhance the ties between China and EU and European counties for this purpose.

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