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Related Policies to Energy Saving and GHG Emission Reductions in China and the US

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Abstract *– Energy consumption and GHG emissions are the two global problems. With energy consumption soaring high, China contributes to highest GHG emissions in the world and road transport especially depending on oil is in important position. Compared with the United States (US), although lacking statistics of oil consumption and GHG emissions of road transport results that it is difficult to evaluate the effectiveness of policies, China commits itself to this work. Recently, China promulgates several policies for saving oil and reducing emissions and puts them into practice. These policies can be classified into three general ways, which are strengthening management through introducing entry certification system, increasing energy efficiency by improving transport mode such as drop-and-pull transport for freight and public transport for passenger, and developing technology through extending electric vehicles and applying alternative fuels in which renewable fuels are the best. Corresponding policies are also analyzed for evaluating the policies and directing the operation. As a result, at present strengthening management and increasing energy efficiency have already shown positive effect, while developing technology faces enormous difficulties and needs long transitional period.*

Keywords *– China, energy, greenhouse gas, oil and policy, US.*

1. INTRODUCTION

Energy is the most important and indispensable material base for the development of human society including economic growth, living quality and others. The most of global primary energy production derives from fossil energy [1]. Fossil fuels accounted for 87.1% of the total primary energy consumption in 2011, with 33.1% share for oil, 23.7% for natural gas and 30.3% for coal [2]. In 2011, global primary energy consumption grew by 2.5%, broadly in line with the historical average [2]. The United States (US) and China represent the biggest and second-biggest economy in the world and they respectively account for 18.5% (2269.3 million tons oil equivalent) and 21.3% (2432.2 million tons oil equivalent) of global primary energy consumption [2]. In addition, there are two important milestones for energy consumption occurred in 2010. One is that the world primary energy consumption grew by 5.6%, which is the largest increase (in percentage terms) since 1973. The other is that Chinese energy consumption grew by 11.2%, with 20.3% share of global energy consumption which surpassed the US as the world's largest energy consumer. Moreover, economic growth ratio of China is the highest in the world, and this situation will surely and continually promote obvious increase of energy consumption.

As well as energy consumption, problem of greenhouse gas emissions (GHG) has already became a worldwide crisis which threatens harmonious coexistence of human and environment, sustainable development of economic, and even survival of mankind. At present, most countries have already realized, that high energy consumption and emission model of economic growth are difficult to continue and the only way is to promote low-carbon economy for sustainable development. In order to meet the challenge of climate change many countries in the world signed United Nations Framework Convention on Climate Change and the Kyoto Protocol for controlling GHG emissions in the United Nations Conference on Environment and Development. As a whole, China and the US have the largest responsibility and duty to save energy and reduce GHG emissions.

Since the basic goal of climate policy is to reduce CO_2 emissions from the extensive use of fossil-based energy, there exists a close link between climate policy and energy policy [3]. Accordingly, in the following policies and practices for energy consumption (oil consumption particularly for road transport) and GHG emissions are discussed together. This research firstly explains the whole situation of oil consumptions and GHG emissions in China and the US; then describes the policies for saving energy and reducing GHG emissions of the US; thirdly studies recent policies of China respectively compared with the US; lastly gives the conclusion involving suggestion for China.

2. BACKGROUND

2.1. Macroscopic Policy Background

The Energy Policy Act of 1992 and national action plan on global climate change were formulated by the US government. The act was passed by Congress and addressed energy efficiency, energy conservation and energy management (Title I), natural gas imports and exports (Title II), alternative fuels and requiring certain

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fleets to acquire alternative fuel vehicles, which are capable of operating on nonpetroleum fuels (Title III-V), electric motor vehicles (Title VI), radioactive waste (Title VIII), coal power and clean coal (Title XIII), renewable energy (Title XII), and other issues. During this period, the US government mainly aimed to save energy and improve energy efficiency, and no target of GHG emission reduction was confirmed.

After 1993, then US President Clinton declared new national action plan on climate change, admitted that human activities had increased the atmospheric concentrations of greenhouse gases, thereby causing ecological imbalance, sea-level rise and other consequences, identified that in 2000 the level of GHG emissions in the US would be the same with 1990, and expressed the hope that the US would play a leading role in addressing problem of global warming. However, during this period, the US government failed to complete the goal, and GHG emissions in 2000 obviously increased.

In March 2001, the Bush administration announced that it would not implement the Kyoto Protocol, an international treaty signed in 1997 in Kyoto, Japan that would require nations to reduce their greenhouse gas emissions, claiming that ratifying the treaty would create economic setbacks in the US and would not put enough pressure to developing nations. In 2002, the US government declared to reduce the GHG intensity of the US Economy by 18 percent in the next ten years that the 183 metric tons of emissions per million dollars GDP in 2002 will be lowered to 151 metric tons in 2012. Actually the total GHG emission had not been limited and it was evaluated that the US President Bush had not taken specific and substantial measures for reducing GHG emissions.

Obama has made positive and effective efforts on the climate change by three policies. First of all, he promoted constructing cap and trade system for controlling the total carbon emission. In the second place, improvement of energy efficiency was treated as the best way for saving energy and reducing GHG emissions. Lastly, he positively negotiated with developing countries and brought pressure on them.

China is the first developing country to establish a national action plan on climate change under the framework of sustainable development on June 4, 2007. The plan did not include targets for carbon dioxide emission reductions, but it has been estimated that, if fully implemented, China's annual emissions of greenhouse gases would be reduced by 1.5 billion tons of carbon dioxide equivalent by 2010. In January 2012, as part of its 12th five-year plan, China published a report 12th Five-year Plan on Greenhouse Emission Control, which establishes goals of reducing carbon intensity by 17% by 2015, compared with 2010 levels and reducing energy consumption intensity by 16%, relative to GDP. The plan will also pilot the construction of a number of low-carbon Development Zones and low-carbon residential communities. In addition, the government will include data on greenhouse emissions in its official statistics.

2.2. Oil Consumption and GHG Emission Background

Oil (petroleum) remains the world’s leading fuel, at 33.6% of global energy consumption in 2010 and 33.1% in 2011. Global oil consumption in 2011 is 88034 thousand barrels per day which increase 0.7% compared with 2010. The transport sector worldwide almost entirely relies on fossil fuels, oil in particular [4]. The sector is one of the major components of globalization and makes a vital contribution to the economy. Besides, it plays a curial role in daily activities around the world. Unfortunately, this activity is major energy consumption and use most of the limited non-renewable energy that creates a negative impact to living environment [5]. More specifically, the majority of transport GHG emissions (95%) are composed of carbon dioxide (CO_2). An additional one percent comes from methane (CH_4) and nitrous oxides (N_2O). The leakage of hydro fluorocarbons (HFCs) from vehicle air conditioning systems is responsible for the remaining three percent of GHG emissions [6].

Figure 1 shows energy and oil consumption in China and the US and the data come from BP2012 [2]. From 2001 to 2011, oil consumption of China increases more than twice from 4859 to 9758 thousand barrels per day, while that of the US varies from 19649 to 18835 thousand barrels [2]. Consumption difference between the two nations will certainly reduce which attributes to the high economic growth of China. Regarding GHG emission of the US, from 1990 to 2010, it fluctuated from 6,175.2 to 6,821.8 Tg CO_2 equivalent, with CO_2 emission from 5,100.5 to 5,706.4 [7]. Since 1990, the US GHG emission has increased at an average annual rate of 0.5 percent [7]. Figure 2 indicates CO_2 emission from consumption of energy [8]. The emission of China is the highest in the world and the difference between China and the US increases. Factors resulting the condition are not only attributed to the highest energy consumption in China, but also due to the unreasonable energy consumption structure. Figure 3 gives the comparison of the structure between China and the US.

3. POLICY FOR ENERGY SAVING AND GHG REDUCTION OF ROAD TRANSPORT

3.1. Policy in the US

Statistics of Oil Consumption and GHG Reduction

Statistics of oil consumption and GHG reduction are premise and base of policy for saving energy and reducing emission in all sectors, moreover, data statistics especially can be used as evaluation basis for effectiveness of corresponding policy.

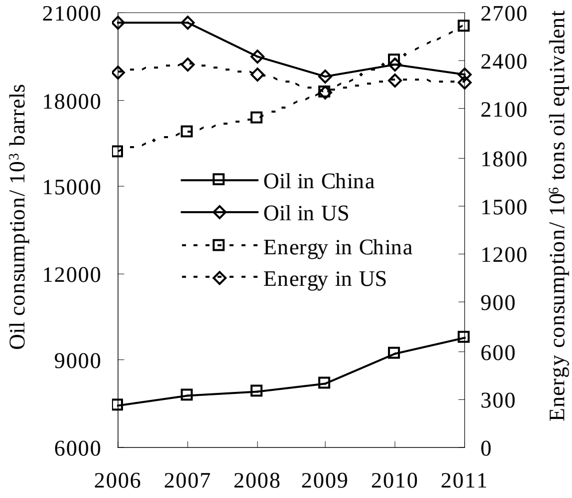

Fig. 1. Energy and oil consumption in China and the US.

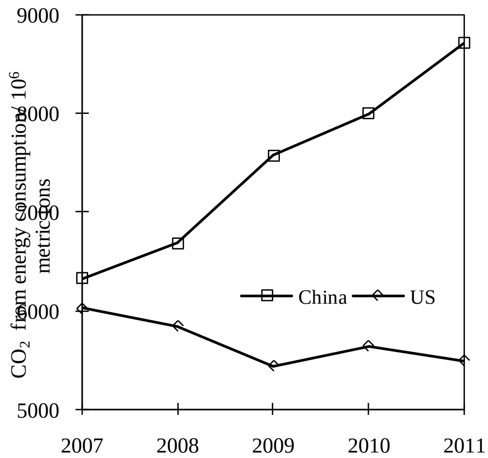

Fig. 2. Carbon dioxide emissions from energy consumption in China and the US.

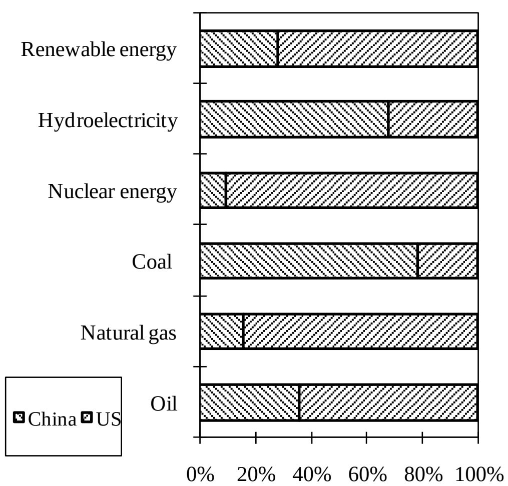

Fig. 3. Energy consumption structure in China and the US.

In the US, transport sector dominates oil consumption which accounts for 70.6% of total oil consumption. In 2010, particularly the proportion of road oil consumption in transport sector is 85.9% and in total consumption is 60.7%. Table 1 shows the specific consumption data according to the structure of transport [9]. Oil consumers in road transport can be classified into light vehicles (63.6% of total transport consumption/ 44.9% of total oil consumption) involving cars (32.4%/ 22.9%), light trucks (31.0%/ 21.9%) and motorcycles (0.2%/ 0.1%), buses (0.7%/ 0.5%) including transit (0.3%/ 0.2%), intercity (0.1%/ 0.1%) and school buses (0.3%/ 0.2%), and medium/heavy trucks (21.6%/ 15.3%) incorporating class 3-6 (4.1%/ 2.9%) and class 7-8 (17.5%/ 12.4%). As well as oil consumption, in 2010 GHG emission share of road transport in total transport is 84.7% and in total GHG is 22.8%. Table 2 indicates structural GHG emission statistics. Specific distributions of GHG emissions are listed as light vehicles (61.9% of total transport/ 16.7% of total GHG) involving cars (42.9%/ 11.5%), light trucks (18.8%/ 5.1%) and motorcycles (0.2%/ 0.1%), buses (0.9%/ 0.2%), and medium/heavy trucks (21.9%/ 5.9%). Consequently, in US the light vehicles and medium/heavy trucks are the main oil consumers and GHG emitters in transport.

Specific Policies

For road transport sector, in the US several programs to reduce greenhouse gas emissions have been implemented. First of all, the Corporate Average Fuel Economy (CAFE) program required automobile manufacturers to meet average fuel economy standards for the light-duty vehicle fleet sold in the United States. The Energy Independence and Security Act of 2007 contains the first increase in fuel economy standards for passenger cars since 1975, and the establishment of the first efficiency standard for medium-duty and heavy-duty commercial vehicles. In the second area, Renewable Fuel Standard under the Energy Policy Act of 2005, indicated regulations to ensure that gasoline sold in the US contains a specific volume of renewable fuel. The standard was intended to double the amount of renewable fuel usage by 2012. As of 2011, 4% of the energy consumed by transportation was supplied by renewable fuels. Moreover, three energy policy acts have been passed, respectively in 1992, 2005, and 2007, which include many provisions for conservation, such as the Energy Star program, and energy development, with grants and tax incentives for both renewable energy and non-renewable energy. Thirdly, FreedomCAR and Fuel Partnership, and Vehicle Technologies Program show determination to develop improved technology for fuel cell and hybrid electric vehicles, which include the hybrid electric components (such as batteries and electric motors). Fourthly, Congestion Mitigation and Air Quality Improvement (CMAQ) program is relative to saving energy and reducing GHG emissions. The last but not the least, in 2009 the first GHG reduction act, American Clean Energy and Security Act, shows the determination of the US government to control the GHG emissions, although it was defeated in the Senate.

Analysis for Policies

Above policies are been contributed to two aspects: one is improving energy efficiency and constructing entry certification system, the other is encouraging new energy vehicles and alternative fuels. Energy Independence and Security Act of 2007 is an act which reflects the above aspects and its specific contents are analyzed as an example. By the year of 2020 American savings of a total of $22 billion and a significant reduction in emissions equivalent to removing 28 million cars from the road are estimated. For example, the act increases corporate average fuel economy standards. Automakers are required to boost fleetwide gas mileage to 35 mpg (14.8 km/L) by 2020 which applies to all passenger automobiles, including light trucks and manufacturers must meet the average fuel economy standard of 27.5 miles per gallon or come within 92% of the standard for a given model year. Fuel cell, hybrid and other new energy vehicles are in great expectations for reducing oil consumption and GHG emissions. For instance, in part B of Title I, the Energy Independence and Security Act of 2007 requires improved vehicle technology: (1) requires vehicle technology and transport electrification which are incentives for the development of plug-in hybrids; (2) establishes a loan program for advancing battery technology; (3) awards grants to automobile manufacturers to promote production of electric transportation technology; (4) establishes incentives for fleet buying of heavy-duty hybrid vehicles. On the whole electric propulsion systems are inherently more efficient than gasoline and diesel engines, but too costly for mass-market penetration. In 2013, the US Department of Energy eased off President Barack Obama's stated goal of putting 1 million electric cars on the road by 2015, and laid out what experts called a more realistic strategy of promoting advanced-drive vehicles and lowering their cost over the next nine years [10]. In view of their potential to reduce petroleum consumption and GHG emissions, considerable research is being directed towards reducing their costs [11]. Accordingly, in the US electric vehicles encounter resistances. When it comes to the alternative fuels, ethanol, biodiesel and other fuels are applied in the US for saving oil and reducing GHG emissions of road transport. In Title II of the act, the Energy Security through Increased Production of Biofuels, contains the first legislation that specifically requires the creation of biomass-based diesel fuel, which is the addition of renewable biofuels to diesel fuel. To be labeled as biomass-based diesel, fuel must be able to reduce emissions by 50 percent when compared to petroleum diesel. As of now, biodiesel is the only commercial fuel that meets this requirement. In this title, biofuels research and development, and renewable fuel standard are determined, for example the Secretary of Energy is required to initiate studies on the use of algae as feedstock for biofuel production, studies on the durability and performance of engines with biodiesel, and studies to optimize the use of E-85 fuel in flexible fueled vehicles. Based on the policy, the US mainly depends on renewable fuels with ethanol for blending with gasoline and biodiesel for diesel. As a result, in 2011 both the production and consumption of ethanol and biodiesel of the US are the highest in the world. Accordingly, the US policy indeed promotes the application and the production and consumption of fuel ethanol and biodiesel are respectively shown in Table 3 and Table 4 [12]-[15].

Table 1. Specific consumption data according to the structure of transport [9].

Classification		Oil consumption per day/ thousand barrels	Percentage of total transport consumption	Percentage of total oil consumption
Light vehicles	Cars	4,395.2	32.4%	22.9%
	Light trucks	4,193.1	31.0%	21.9%
	Motorcycles	27.8	0.2%	0.1%
	Subtotal	8,616.1	63.6%	44.9%
Buses	Transit	41.5	0.3%	0.2%
	Intercity	14.0	0.1%	0.1%
	School	34.8	0.3%	0.2%
	Subtotal	90.3	0.7%	0.5%
Medium/ heavy trucks	Class 3-6	557.2	4.1%	2.9%
	Class 7-8	2375.4	17.5%	12.4%
	Subtotal	2932.6	21.6%	15.3%
Total road transport		11,639.0	85.9%	60.7%
Total transport		13,547.5	100%	70.6%
Total oil consumption		19,180.0	-	-

Table 2. Specific GHG emissions data according to the structure of transport [7].

Classification		GHG emission	Percentage of total transport	Percentage of total GHG
Light vehicles	Cars	787.9	42.9%	11.5%
	Light trucks	346.4	18.8%	5.1%
	Motorcycles	3.8	0.2%	0.1%
	Subtotal	1,138.1	61.9%	16.7%
Buses		16.5	0.9%	0.2%
Medium- and Heavy-Duty Trucks		402.3	21.9%	5.9%
Total road transport		1556.9	84.7%	22.8%
Total transport		1,838.6	100%	27.0%
Total GHG		6,821.8	-	-

Table 3. Fuel ethanol production and consumption per day [12],[13].

Country	Production/ thousand barrels per day		
	2009	2010	2011
US	713.49	867.44	908.62
China	37.00	37.00	39.00
Country	Consumption/ thousand barrels per day		
US	719.93	838.78	841.05
China	37.00	37.00	39.00

Table 4. Biodiesel production and consumption per day [14],[15].

Country	Production/ thousand barrels per day		
	2009	2010	2011
US	33.65	22.40	63.11
China	6.00	6.00	7.80
Country	Consumption/ thousand barrels per day		
US	21.23	17.15	57.84
China	6.00	6.00	7.00

3.2 Policy in China

China is not only subject to the constraints of domestic resource endowment and environmental carrying capacity, but also confronted with the challenges associated with climate change and CO_2 emissions mitigation during her rapid industrialization and urbanization.

Statistics of Oil Consumption and GHG Reduction

Energy consumption in transport is only partly documented in official Chinese statistics. First of all, demarcation of function is not clear. Freight transport and public passenger transport are managed by the ministry of transport, while passenger cars are not involved. Secondly even within the range of authority, in China, energy consumption is not registered according to the kind of its consumption (transport) but assigned to the originating sector (vehicle industry). Thirdly, statistics and calculation of energy consumption are influenced by many social problems, such as overload in freight and in some public passenger transport routines, and low carrying rates in other routines.

Now in China, buses, medium/heavy trucks, and taxis are managed by the ministry of transport. Statistics of oil consumption is only for these commercial operation vehicles and corresponding method is not reasonable. Firstly, statistics objects are divided as buses (intercity buses and urban buses), medium/heavy trucks, and taxis. Secondly according to the different models, several vehicles are chosen in a city for monitoring and recording, and then the total consumption in this city is calculated. Lastly, the Ministry of Transport adds all the consumptions in the whole country, and GHG emissions is calculated. However, the statistics and calculation are not accurate in two aspects, the one is that the sample volume is too small and the other is that vehicles chosen are not representative. Specifically, in some regions, only 30 to 50 vehicles are chosen for statistics and the age or mileage is not carefully considered.

Specific Policies

Although the demarcation of consumer sectors is not conductive to statistics, Chinese government effectively puts forward policies for saving oil and reducing GHG emissions of road transport by improving energy efficiency and developing new energy vehicles and alternative fuels.

As for the first policy, the key driver is to improve the energy efficiency. Specifically, entry certification system for oil consumption is compulsorily implemented for commercial vehicles. The system includes two parts: one is the limit and measurement of oil consumption for commercial buses (JT711-2008), the other is the limit and measure of oil consumption for commercial trucks (JT719-2008). Fuel consumption limit of passenger vehicles (GB19578-2004) is promulgated in 2004. Secondly, drop-and-pull transportation has been promoted by the Ministry of Transport. As an efficient and popular transport mode with global recognition, drop-and-pull transport has been concerned by numerous scholars and logistics enterprises. With this transport mode, the turnover of tractor-trucks and transport capacity utilization can be improved so that the energy consumption and the GHG emissions can be reduced sharply [16]. Semi-trailer trucks and tractors are indispensable vehicles for drop-and-pull transport. In the US they often operate containers for road transport, multimodal transport with water, rail and other modes, and international transport. However, the drop-and-pull transport in China is still in the initial phase. China accelerates the development of drop-and-pull transport for transforming organization mode of road freight transport, adjusting the structure of transport capacity, and improving actual loading rate and puts forward some policies listed in Table 5. In 2011, the Chinese government decided to implement two national policy on drop-and-pull transport: first is the promotion for development of drop-and-pull transport, and the other is the pilot implementation plan for drop-and-pull transport. Nationwide, road transport enterprises in appropriate areas and road lines are organized to develop the pilot job. On the basis of the pilot, policies, regulations and standards for drop-and-pull transport development will be improved, and then long-term mechanism for drop-and-pull transport will be constructed aiming for improving road freight transport and energy utilization efficiency, and reducing oil consumption and GHG emissions.

Promoting and improving public sector of road passenger transport is a long-term policy. Although in China rail and air transport modes develop quickly, road transport is still the most important in public passenger transport. As for urban public transport, rail and road are the main choices. Public sector of road passenger transport is managed by the ministry of transport and it mainly incorporates urban buses and intercity buses. As everyone knows, cities in China are densely populated and oil consumptions and GHG emissions per unit distance per person using public passenger transport are low compared with private cars. Accordingly, promoting public sector of road passenger transport is useful for saving oil and reducing GHG emissions. However, there exists two practical problems, first is that share rate of urban public transport is low, the other is that passenger carrying rate (number of persons divided by the number of seats) of intercity buses is low. At present, average share rate of urban public transport in China is less than 20% and only in some large cities it may reach 30%, while in Japan it is 60% or so. In 2011, national demonstration pilot projects for public transport of urban construction [(2011)635] is promulgated and in practice thirty pilot cities should improve the share rate to 45% including urban rail transport or 40% only with urban public road transport. As for carrying rate of intercity buses, early in 2010, regulations for road passenger transport to promote energy saving and emission reduction [(2010)390] requires that annual carrying rate of intercity buses must be higher than 70%.

Secondly, the Chinese government formulates several policies for developing new energy vehicles and alternative fuels. Table 6 shows these policies. As a developing country with relatively poor technology, China mainly learns from developed countries and forms its own features. In China, new energy vehicles mainly involve electric, hybrid, natural gas and liquid petroleum gas vehicles. Alternative fuels specially refer to traditional vehicles' substitutive fuels, such as ethanol or methanol blending with gasoline for substituting gasoline, and bio-diesel for diesel. Chinese government is making great efforts to curb oil demand and greenhouse gas (GHG) emissions in the road transport sector by introducing alternative fuels and regulating vehicle fuel economy [17], [18]. First of all, in policy file of [(2012)22], by 2015 total productions and sales of pure electric and plug-in hybrid vehicles are planned for beyond 500 thousand and by 2020 for 5,000 thousand. Secondly, using bio-fuels in place of fossil fuels would potentially reduce GHG emissions since bio-feedstocks absorb CO_2 from the atmosphere during growth and release it upon combustion of the feedstock or the energy products derived from them. Thus bio-fuels in part recycle CO_2 mitigating greenhouse gas emissions and in turn slow down climate change [19]. In [(2007)2174], by 2020 annual consumption of ethanol, a kind of bio-fuels, reaches 10 million tons and annual consumption of biodiesel reaches 2 million tons, replacing about 10 million tons of refined oil.

Analysis for Policies

i. ***Improvement of Energy Efficiency***

In China energy efficiency is mainly improved through compulsory entry certification system and optimization of transportation organization mode. Drop-and-pull transportation mode is developed for cargo transportation and public transport is improved for passenger transportation.

Table 5. Policies about drop-and-pull transport.

Department (promulgating time)	Name of policy file (by the Department of Transportation, China)	Number of policy file
Ministry of transport (2008.09.23)	Framework for energy-saving of road and water transport	(2008)331
Ministry of transport (2010.10.18)	Pilot implementation plan for drop-and-pull transport	(2010)562
Ministry of transport (2011.06.27)	Highway and waterway transportation energy saving and emission reduction "Twelfth Five-Year Plan"	(2011)315
Ministry of transport (2012.01.20)	First batch of recommended vehicles for road drop-and-pull transport	(2012)27
Ministry of transport (2012.04.06)	Special fund subsidy and management for pilot of road drop-and-pull transport	(2012)137

Table 6. Policy for new energy vehicles and alternative fuels.

Department (promulgating time)	Name of policy file	Number of policy file
The central people's government (2012.6.28)	Energy saving and new energy automobile industry development planning (2012-2020)	(2012)22
National development and reform commission (2007.8.31)	Medium and long term development planning for renewable energy (2007-2020)	(2007)2174
Ministry of science and technology (2012.3.27)	"Twelfth Five-Year Plan" for technology development of electric vehicle	(2012)195

Table 7. Standards for truck tractor semi-trailer interchange coupling dimensions.

Standards	Fifth wheel height	Variation	Front of trailer to kingpin	Swing radius	Kingpin to trailer support clearance
GB/T 20070-2006 (China)	1150-1400	250	No req.	≤2040	No req.
SAE J701 (U.S.)	48 (10.00/ 20 tires)	±1	36	60, 62-1/2	90 64

Note1: SAE J701: TRUCK TRACTOR SEMITRAILER INTERCHANGE COUPLING DIMENSIONS; GB/T 20070-2006: Road vehicles/ mechanical coupling between tractors and semi-trailers/ interchangeability.

Note2: In SAE J701, swing radius (60inches for 96inches width, 62-1/2inches for 102inches width). Kingpin to trailer support clearance 64inches (short trailer with two-axle tractors). All dimensions in SAE J701 are given in inches and in GB/T 20070-2006 are given in mm.

Practice for drop-and-pull transport can be divided into three phases. For the first stage, in 2008, the framework for energy-saving of road and water transport in which the drop-and-pull transport was firstly mentioned in policy file was promulgated for aim guide and then in 2010, the pilot implementation plan for drop-and-pull transport made the work more clear. In the second phase, according to the [(2010)562] file, many enterprises apply this road freight transport mode and most of them failed. It can be concluded from SAE J701 in Table 7 that in the US the interchange coupling dimensions between truck tractor and semi-trailer are certain and perfect which is very easy and feasible for interchange coupling, while in China due to auto-historical and social reasons the dimensions exist technological problems, such as the large range of fifth wheel height and no requirement for both front of trailer to kingpin and kingpin to trailer support clearance, which in practice results that the interchange coupling may not be proceeded. Accordingly, in the third phase, urgent situation for saving oil and reducing GHG emission, promotes the department of transportation of China selecting and introducing drop-and-pull vehicles as the government file [(2012)27] and corresponding subsidy will be given for buying new vehicles for developing drop-and-pull transport [(2012)137]. After that, a transport enterprise in Anhui province of China declared that oil consumptions for adopting drop-and-pull transport in certain pilot freight routines decrease 28.6% which is expressed as consumption per unit distance per unit mass of cargo transported, as a result GHG emissions per unit distance per unit mass of cargo transported must decrease. In the future, it is reported that, containerization for semi-trailer (now only applied in the international ports in China), revising standard for interchange coupling between truck tractor and semi-trailer, entry mechanism for trucks according to drop-and-pull transport, classification and standardization for road freight stations, information process for organization of cargos will be improved and promoted.

It is considered that beyond 70% the saving potential for oil consumption per unit is small. In practice, GPS and video monitoring systems are used in two experimental vehicles in a transport company in Chuzhou, Anhui province and the diesel consumptions with different carrying rates are recorded in Table 8 and Table 9. It can be concluded that improvement of carrying rate is highly effective for saving oil, and also for reducing GHG emissions.

ii. Developing New Energy Vehicles and Alternative Fuels

In practice, policy for new energy vehicles and alternative fuels faces enormous resistance and challenge. First of all, by 2011, the total amount of hybrid and pure electric vehicles is less than 10 thousand. Looking at two advanced technologies for increasing engine efficiency, fuel cell electric vehicles (FCEV) and plug-in hybrid electric vehicles (PHEV), neither of these technologies is commercial at the current time and, in addition to significant cost reductions, massive changes to fuel infrastructure systems are needed for consumers to embrace them [11]. As for practice in China, for hybrid and pure electric vehicles, infrastructure is very difficult to construct, because China is in process of urbanization and has so many people that the shortage of land is prominent. People all live in thirty to forty storied buildings and real estate developers will certainly be unwilling to construct plug-in infrastructure. As a result, infrastructure will completely depend on the government and its extension is very difficult. At present, only public sector of transport department buys hybrid buses for public transport and enterprises will produce hybrid buses only when they have governmental orders which results in poor production.

Secondly for bio-diesel, cumulative emissions reductions would total 3.4% and 3.7% for Particulate matter and CO, respectively; total hydrocarbon emissions would be reduced by 5%; CO_2 emissions would be considerably reduced [20], [21]. In China it is still in the initial phase and is not commercialized. Four large-scale forest basis of bio-diesel are now being constructed respectively in Anhui, Inner Mogonia, Hainan and Yunnan provinces. However, Table 4 indicates that development of biodiesel in China is almost standstill. Unlike commercial bio-diesel from soybean in the US, China presently applies it with small-scale which derives from waste cooked oil and some plants [22], [23]. On the other hand, diesel engines are used mostly in buses and medium/heavy trucks, and the share of diesel in passenger cars is only 0.2% reported in 2005 (after 2005, there is no official report on statistics of diesel cars). China suggests people to buy diesel cars and want to improve the proportion to 30% in 2020, but the effect is not obvious.

In the third area, low volume content ethanol gasoline is widely used in several places before 2007, however, after that, Chinese government urgently stops the ethanol production for fuel with the feedstock of "foods" and application of ethanol gasoline is affected and not expanded. From 2008, only non-grain sources can be chosen as the feedstocks of ethanol fuel. Lignocellulose and straw are considered the best choice, however, they develop slowly and production is still in small scale. Due to the brand effect of ethanol gasoline in some regions, many private stations sell horse meat as beefsteak by using methanol for substituting ethanol. It can be concluded from Table 3 that ethanol in China developed very slowly.

Fourthly, natural gas (NG) is applied nationwide in China. Compared with gasoline it provides 20% reduction in GHG emissions in internal combustion engines [11]. Application forms of NG as energy of vehicles can be classified into three kinds: compressed natural gas (CNG), liquid natural gas (LNG) and gas to liquid (GTL). In China, the major form is CNG which shares more than 95% and both LNG and GTL have increasing trend. GTL technology is recovering and enjoying growth due to recent technology and catalyst advancements [24]. However, reserve of natural gas in China is 1.5% in the world by 2011 and it is the major fuel for people living including cooking, heating and bathing. Accordingly, although more than 1 million NG vehicles are used in taxis and buses for public transport, development space of improvement is limited.

When it comes to methanol, it is a highly controversial issue. In the international background, some developed countries firstly develop methanol as alternative fuel for gasoline. However, major feedstock of methanol is natural gas which results in high cost and particularly natural gas itself is the energy for vehicles. Moreover, methanol mainly derives from fossil energy. Accordingly, these countries turn to develop ethanol which is a kind of renewable biofuels. At first, China realizes that ethanol is a good choice by learning from other countries, and indeed uses it as vehicles' fuel. From 2007, the only choice for China to develop ethanol fuel is non-grain feedstocks and the government pays attention on methanol that the main feedstock is coal in China. Low volume content methanol gasoline (volume content is less than 15%) is widely used for traditional gasoline cars in 12 provinces. Especially in Shanxi province, more than one thousand stations sell M15 (volume content of methanol is 15%). In 2012, ministry of industry and information technology of China decides to implement pilot of methanol vehicles fueled with M85 and M100 in Shanghai, Shaanxi and Shanxi provinces.

To sum up, China tries the best for saving oil and reducing GHG emissions. From the view of policy, China finally chooses electric vehicles and bio-fuels in the future. As for now, ethanol, methanol, and NG commonly share the road transport market and the situation will lasts for many years in the transitional period.

Table 8. Diesel consumptions corresponding to different carrying rates before the requirement for 70%.

L=7m		L=10 m	
Diesel consumption (L/100t·km)	Actual carrying rate (%)	Diesel consumption (L/100t·km)	Actual carrying rate (%)
22.89	33	27.41	18
21.98	36	26.16	23
20.38	37	17.19	35
15.49	41	16.43	36
13.77	46	13.38	40
13.32	49	11.77	52
13.85	49	10.99	45
12.09	60	11.86	47
9.87	65	10.29	61
9.67	67	10.86	66
9.52	72	9.09	72
8.95	78	8.50	76
8.41	86	8.52	78

4. CONCLUSIONS

The United States and China are the top two countries in both energy consumption and GHG emission. Policies of energy savings and GHG emission reduction in both the US and China reflect the common approaches and general methods including improving energy efficiency and developing new energy vehicles and alternative fuels.

Common grounds of policies in both countries involve entry certification systems for vehicle manufacturers, and improved new energy vehicles such as electric and hybrid electric vehicles which face enormous resistance both in China and the US.

Different grounds of policies concentrate on statistics and alternative fuels. Firstly, the US has detailed statistics of energy consumption and GHG emissions of road transport. However, in China not only energy consumption and GHG emissions sheets of different types of vehicles, but also those sheets of road transport and transport sector cannot be achieved. China only has the total statistical data. Secondly, US positively develop biodiesel and ethanol for vehicles which belong to renewable fuels and are helpful for reducing GHG emissions. Due to national domestic conditions, biodiesel and fuel ethanol in China develop very slowly and China chooses methanol and NG which belong to fossil fuels as the major alternative fuels. Especially for coal-based methanol in China, it is unfavorable for reducing GHG emissions.

Additionally, drop and pull transport is an effective organization mode for saving energy and thus reducing GHG emissions. As everybody knows, it is in common use in the US. However, drop and pull transport in China is still in the initial phase and China formulates several policies for its promotion.

To sum up, it is very likely that nations will hardly arrive at the same opinion on this highly controversial issue, due to the different conditions, conflicting values and the issue's own complexities. Nevertheless, current policies are suitable to national conditions and are helpful for saving energy and reducing GHG emissions. China should accelerate development of biofuels, construct energy consumption and GHG emission inventories as soon as possible, and extend the application of advanced transportation mode such as drop-and-pull transport.

Table 9. Diesel consumptions corresponding to different carrying rates after the requirement for 70%.

L=7m		L=10 m	
Diesel consumption (L/100t·km)	Actual carrying rate (%)	Diesel consumption (L/100t·km)	Actual carrying rate (%)
9.93	72	9.16	72
9.76	72	9.11	72
10.02	72	9.02	74
9.29	72	8.87	75
9.25	74	8.66	75
9.31	74	8.70	75
9.20	75	8.73	76
9.16	75	8.49	76
9.01	76	8.46	78
8.87	78	8.55	78
8.96	78	8.47	80
8.82	80	8.43	80
8.77	84	8.21	84

ACKNOWLEGEMENT

Author thanks the Natural Science Foundation of Shaanxi Province and the Special Fund for Basic Scientific Research of Central Colleges, Chang'an University (2013G1221018).

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