

## **Problems and Countermeasures on Energy-saving in China**

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### **CURRICULUM VITAE**

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Since 2000, energy-supply shortage has recurred in China. Up to this year, energy supply is still faced with a severe situation. Building a well-off society in an all round way impels more and more rural population into the city. It is predicted that till 2020, 50-58% of the population will live in cities and towns with modern economy, cultural life and energy services. The urbanization will accelerate the development of service industry and transportation industry. The developing speed of the tertiary industry will exceed that of the second industry, while the relevant total floor area and infrastructure will double. The average living area of urban and rural residents will be further improved. Heating, air-conditioning and hot water will be popularized, which will make life more comfortable. With an increasing income, more and more families begin to own a car. The rural residents will make more use of commodity resources, thus the growth of the energy demand in the next twenty years is inevitable. With a limited energy supply capacity, energy saving becomes an important means to ease the conflict between energy supply and energy demand in China. Whether we can set sound energy saving objectives and make effective energy saving policy will influence the realization of quadrupling the GDP.

## **1 Energy Demand for Building a Well-off Society in an All Round Way**

### **1.1 The Different Predictions of Energy Demand in China in 2020**

Putting forward the goal of building a well-off society in an all round way, China has aroused an attention-catching problem, that is, how much is the energy demand in China in 2020 in order to realize the goal of quadrupling GDP? Whether the energy supply in the future can support the goal?

Currently, the energy consumption per capita in the United States is about 8 tons of oil equivalent (converted to 11.4 tons of coal equivalent); the energy consumption per capita of the member country of OECD is about 4.7 tons of oil equivalent (converted to 6.7 tons of coal equivalent); even in Japan who has the highest energy efficiency, the energy consumption per capita is as high as 4 tons of oil equivalent (converted to 5.7 tons of coal equivalent). At present, Beijing and Shanghai have an average GDP of more than 3000 U.S. dollars, taking the lead in realizing a well-off society in an all round way, with a energy consumption per capita over 4 tons of coal equivalent. If the overall level of the Chinese urban residents reaches that of Beijing or Shanghai in 20 years later, if the energy using level in rural areas is improved, the energy demand in China will exceed 40 tons of coal equivalent at that time.

Some foreign and domestic organizations have also analyzed and predicted on the energy demand in China in 2020 (refer to Table 1). Make a comprehensive view of these predictions; the foreign organizations are conservative about the future economic growth of China and pessimistic about the energy using efficiency of China, therefore, they have a higher estimation on the energy demand under the same developing speed. For instance, in 2000, IEA assumed the average annual economic growth rate of China is 5% before 2020, the energy consumption in China will reach 2.77 billion tons of coal equivalent in 2020; in 2002, IEA modified it and assumed that till 2030 the GDP of China will be four times over that of 2000, and the energy demand of China at that time will reach 3.05 billion tons of coal equivalent. And the domestic research organizations will consider more of the resources and environmental restraints and expect that the energy efficiency will be improved to a great extent. Most predict that the energy demand of China will be

controlled within 3 billion tons of coal equivalent in 2020. Also some predict that the energy consumption in the next 20 years will be similar to the other industrialized countries with a relatively high energy consumption supporting the economic development because in the recent years, the electronic power consumption elastic coefficient is higher than 0.8 and even higher than 1.

**Table 1 Comparison of the Predictions of Different Organizations on China's Energy Demand**

Organization	Time	Base Period	Method	Result, Energy Demand (0.1 billion tce)			
	Year	Year		2000	2010	2020	2050
IEA	2002	2000		12.14	18.6		30.47(2030)
Tsinghua University	1994	1990	Sector Analysis; Whole Residential Energy Consumption Flow Analysis	14.4-15.3 13.9-17.1		23.8-26.8 22.0-27.8	34.8-44.0 33.0-42.0
The former Ministry of Energy	1994	1990	Sector Analysis	14.4-15.3		23.8-26.8	34.8-44.1
Chinese Academy of Engineering	1996	1990	Sector Analysis	16.6-17.0	22.7-24.0	29.0-31.5	35.7-41.3
IEA	1993	1993		13.9-14.0	20.5-20.9		
EIA		1990		12.49	16.96		
EDMC		1991		16.21	26.37		

Note: IEA, International Energy Agency;

EIA, Energy Information Administration of the U.S. Department of Energy;

EDMC, The Energy Data and Modeling Center, the Institute of Energy Economics, Japan

Sources: "Chinese Long and Medium-term Energy Strategy", China Planning Publishing House, 1999; "2002 China Energy Outlook" (IEA)

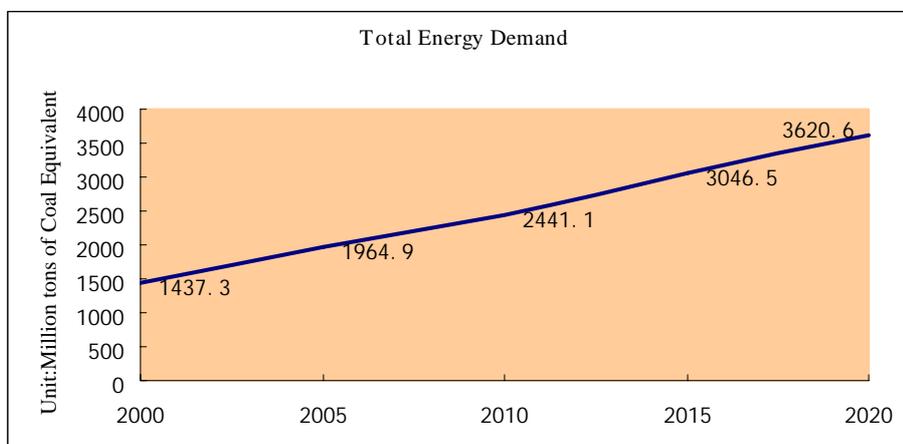
Different predictions show that various parties have different views on the social economic development and energy demand in the next 20 years in China and also reflect that great uncertainties exist in the future energy demand in China.

## 1.2 Energy Demand in 2020 in BAU Scenario

According to the social and economic developing trend in the recent years, a scenario analysis on the possible Chinese energy demand in 2020 is carried out. If follow the current developing trend, without any reinforcing effort of policies and measures, till 2020 when the GDP of China is "quadrupled", the overall energy demand<sup>1</sup> in China will reach 3.62 billion tons of coal

<sup>1</sup> The energy sources mentioned in this article all refer to commodity energy, excluding bio-energy. When

equivalent, with an average annual growth rate reaching 4.7% within 20 years and a corresponding energy consumption elastic coefficient as high as 0.66 (refer to Picture 1). The result indicates that without adopting energy strategies and relevant policy measures required by sustainable development, the future Chinese energy demand will increase at a high speed, the energy supply will be faced with a severe challenge.



**Picture 1: The Total Energy Demand of China in 2020 (Business As Usual Scenario)**

## 2 Problems on Energy-saving in China

### 2.1 There is little possibility in energy saving through adjusting irrational energy prices, thus new methods to stimulate energy saving market are required.

Great changes have occurred to the energy prices in China during the last 20 years. Among the prices of different energies, the lowest increase is seven times as before, while the highest increase is 30 times as before. The increase of energy price is apparently higher than the average increase of commodity price. In 2000, the energy consumption of per unit GDP is only 36% of that of 1980, in which the adjustment of energy price has played an important role. Currently, though there is still some irrationality in the energy price, it has been more or less the same as the international energy price. It has been unrealistic to promote energy saving through merely adjusting the energy price as twenty years ago, other economic means adaptive to the current Chinese developing stage and sustainable developing strategy must be sought after.

### 2.2 Lack of an effective, rational energy saving system

The problem in the Chinese energy saving system is the key factor for the failure of energy saving policy. A complete energy saving system should include sectors like, centrally, locally and industrially harmonious legal policies, up-to-bottom energy saving implementation system, active energy saving financing mechanism, legally effective and interactive energy saving supervisory mechanism, energy saving service agencies capable of providing quality service, mechanism encouraging people to participate in energy saving, as well as energy saving information spreading

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converting different types of energy resources, the nuclear electricity of primary electric power is converted according to 33% of efficiency while the other kinds of primary electric power is converted according to 100% of efficiency.

mechanism. In terms of the current energy saving system, many sectors are weak, and the energy saving system is incomplete.

### **2.3 Lack of new measures to interfere in the market and promote energy saving after change of the governmental function.**

Effectively carrying out necessary governmental functions is required by the market economic system, the market failure especially requires the government to interfere in energy saving through macro-control measures. However, clear-cut and effective governmental controlling measures are still absent in the field of energy saving. There is no clear boundary between those energy saving measures that are fully dependent on market for implementation and those that need governmental assistance. The grass root energy saving work is difficult to carry out. If the enterprise has a leadership highly aware of energy saving, it will do a good job. Contrarily, it will lack activism and enthusiasm in energy saving. Thus, we must explore effective measures for the government to encourage energy saving and carry out governmental functions under market economic system.

### **2.4 Economically stimulating policy for energy saving is not sufficient.**

China is rich in energy saving policies, but weak in economically stimulating policies. Most of the economic policies on energy saving are not specialized in energy saving, but include the contents on energy saving and environmental protection into the preferential policies encouraging technical transform and scientific innovation. Thus, these economic policies do not support enough of the energy saving, and reduce the attractiveness and competitiveness of the energy saving programs. Therefore, in order to save energy and improve the energy efficiency, we should make economically stimulating policies including tax reduction and exemption, loan preferential treatment and energy saving fund, increase the attractiveness of the energy saving programs, improve the investment competitiveness of energy saving programs, and incline the economic lever towards energy saving.

### **2.5 Energy saving technology progresses is slow.**

The technological innovation and popularization on energy saving still incur barriers in terms of system, capital and management. The inadequate energy saving investment has led to the difficulties in carrying out the research and development of energy saving technology and the promotion of key model programs and a low penetration rate of energy saving technology. Moreover, the key energy saving technology and equipment depend excessively on import, and are short of uniform plan and effective management.

## **3. The Objectives and Key Areas of Energy Saving**

### **3.1 Main energy saving objectives**

Try to realize that in the next twenty years the national economy will be quadrupled, while the energy sources will be doubled, the energy consumption elastic coefficient stays from 0.35 to 0.53, the energy saving rate stays from 3.0 to 4.3%, the accumulative energy saving reaches 0.6 to 0.8 billion tons, the per 10,000 RMB GDP energy consumption reduces from 2.68tce in 2000 to 1.17 - 1.33tce in 2020 (at 1990 constant price), and the energy consumption of 2020 will not

exceed 3.1 billion tce, which will be tried to kept at 2.4 billion tce.

By adjusting the structure, improve the technological level of various industries and promote the application of advanced energy saving technology so as to reduce the per unit energy consumption of major energy consuming products by a large margin. For instance, the coal consumption of thermal power generation reduces from 392 grams of coal equivalent per kilowatt-hour in 2000 to 322 grams of coal equivalent per kilowatt-hour in 2020, the comprehensive energy consumption per ton steel in key enterprises reduces from 906kgce to 720kgce, and the comprehensive energy consumption of cement clinkers reduces from 143kgce per ton to 104kgce per ton.

### **3.2 Key energy saving fields**

At present, the industrial production still occupies a dominant position in energy consumption, while the energy consumption of buildings and transportation that more directly reflect people's living standard is on a continuous rise. Because the housing condition of urban and rural residents is improving, the related heating equipment and various home appliances are also improving. The development of tertiary industry greatly increases the number of non-residential buildings and their energy consumption capacity, thus the energy consumption of building is rapidly increasing. Due to the rapid development of various transportation industries including tourism and the improvement of household transportation tools, the energy consumption of transportation also grows quickly. Compared with industry, as different energy saving technologies and policies of different levels of force are adopted, the future energy demand of buildings and transportation will be more affected. Thus, in the first ten years, industrial departments are the key areas for energy saving, while after 2010, the focus of energy saving works in China will shift to transportation and building.

## **4 Strategic Focus and Key Tasks**

### **4.1 Consider intensifying energy saving and improving energy efficiency as one of the major energy developing strategies in the next twenty years, really implement development and saving at the same time, and put energy saving as the priority.**

Create a developing pattern different from that of the developed countries, which is based up consuming a great amount of energy sources and other natural resources. The overall objective of industrialization can only be realized in a developing country with a huge population like us by developing an energy efficiency level much higher than that of the developed countries. Both efforts in improving energy efficiency and increasing supply are needed to realize a balance between energy supply and demand. Therefore, energy saving and energy efficiency improvement must be regarded as the important components of the later energy developing strategy. We should develop an energy developing policy based upon the incentive mechanism of the market, implement development and saving at the same time and put energy saving as the priority.

### **4.2 Establish a mechanism and management system ensuring the sustained growth of the energy efficiency; try to quadruple the national economy on the basis of doubling the energy.**

Keep on realizing quadruple the national economy on the basis of doubling the energy. Establish incentive mechanism and management system guaranteeing sustained high energy efficiency and promoting energy saving. Further intensify the social consensus on energy saving. Explore energy saving legal system and economic policy suitable to the market economic system. Improve legal supervision and policy stimulating mechanism. Reduce the energy demand and release the energy supply pressure through guiding the consumers to have self-conscious energy saving behaviors.

The selection of different economic developing ways and life styles will have great impact on energy demand. To achieve a same or similar social economic objective, the sustainable selection and implementation of different energy, environment and consumption policy will result in different energy demand. Through choosing the structure, technology and policy, the future energy demand can be controlled within a rational range. In 2020, 0.8 billion tce of energy can be saved, the energy consumption elastic coefficient can be kept at 0.5, or even smaller than 0.5, and the national economy can be quadrupled on the basis of doubling the energy or less.

### **4.3 Establish market energy saving promotion mechanism, and reinforce the governmental capacity in interfering in the market.**

The government should bring the function of the “invisible hand” – the market- into full play to save energy, making use of the economic policy to regulate the market and guiding the consumers to realize the energy saving objectives through market. The government is responsible for making the rules of the market environment of energy saving, safeguarding a fair market competition environment on the premise of realizing the optimization of resources allocation, energy safety and environmental protection, fully reflecting the principle of “interest” motivated in the market economy and benefit the country, the producing enterprises and users. Establish a rational market mechanism, maintain a good market environment, and make sure every social group have a clear role in the energy saving task. Every sector should have explicit responsibility, right and benefit. Those contributing to energy saving will benefit from it, whereas, it will be punished economically and legally. Fully mobilize the enthusiasm of the society to participate in energy saving. Improve the supervisory, coordinate and evaluation system of the policy implementation. Rectify the direction of the policy timely. Fulfill the tasks that the enterprises and individuals cannot or are not willing to do. Reinforce the public promotion and education on energy saving and the spread of energy saving information.

## **5 Policy and guarantee measures suggestions**

### **5.1 Policy suggestions**

#### **5.1.1 Promote the use of high quality energy and improve the energy efficiency**

The Chinese energy structure focusing on coal is the main restraint on energy efficiency. The energy consumption structures of those countries with higher energy efficiency mainly focus on petroleum, natural gas, hydraulic power and nuclear power. Within the energy consumption structure of Japan, Germany, the United States and Britain, petroleum and natural gas account for 61 to 73%. As for the distribution of Chinese energy efficiency, the coastal provinces import more of the good quality energy, having a better-optimized energy consumption structure than those areas with a higher proportion of coal consumption. For instance, the proportion of coal consumption of Beijing, Guangdong, Shanghai, Fujian and Hainan in the energy structure is lower than the average national level, which is from 30% to 58%. Their per unit GDP coal consumption is about 1/3 of those provinces with a larger coal consumption.

Under the market economy, the tendency to choose high quality energy is increasingly apparent. The fierce social competition, the improving living standard and the economic globalization have enabled the users to choose efficient, clean and convenient kinds of energy. Respecting the rules of market economy, developing recycled high quality energy, guiding the consumers to select efficient and clean energy is the only way for the government to improve the energy efficiency of the whole society and to save energy.

#### **5.1.2 Make economically stimulating policies on energy saving that is compatible with the market economic rules.**

China is at a stage with a fast development of national economy, and the tension recurs in the energy supply. The objective of quadrupling GDP also requires a safe guarantee of the energy. Therefore, it is a good time to study and make energy saving stimulating policies. The energy saving economic policy is urgently needed, either from the perspective of the need of the short-term balance between energy supply and demand, or from the perspective of the long-term objective of sustainable development.

It can be discovered from the successful foreign experience on energy saving, the economic policy on energy saving are always independent of other developing objectively. For instance, the energy saving credit foundation of Britain, the energy saving credit foundation of Hungary and the energy efficiency joint financing plan are all specially established for saving energy and improving energy efficiency, with a explicit purpose and guidance, which has strengthened the position of energy saving. China should make stimulating policies specialized in energy saving as soon as possible, like energy saving foundation, tax reduction and exemption, fuel tax and so on.

#### **5.1.3. Reinforce the energy saving technological policy, and realize the leap-forward development of energy saving technology.**

The less developed energy saving technology is one of the main reasons for China to lag behind of the advanced countries, therefore the technological development is an important means to improve the energy efficiency. In order to realize the grand objective of attaining the economic level of the mid-ranking developed countries, China should not follow the back of the developed

countries, adopt the eliminated technology or even the current technology of the developed countries, instead China should apply the “leapfrog” method and realize leap-forward development so as to catch up with the developed countries within 50 years. Thus, renovating and improving the energy saving technological policy appears to be especially important. Develop, import, make, issue and implement energy saving technological policy, unite and coordinate industrial management organizations with great potential, guide the renewal of the technological level of various industries, promote the application of advanced energy saving technology so as to improve the energy efficiency of China.

## **5.2 Carry out strategic guarantee measures**

### **5.2.1 Organize research and make key economic policies suitable to the situation of China.**

The study, making, promulgation and implementation of key economic policies should be carried out on the premise that the governmental organizations of different functions have realized the strategic significance of energy saving. Information sharing, mutual understanding, mutual support and coordination are the very important ways for the governmental organizations to cooperate intimately. Rely fully on the research institutions. Explore the suitability and feasibility for China to adopt economic policies like energy saving foundation, tax reduction and exemption and fuel tax. Make economically stimulating policies on energy saving based upon market mechanism as soon as possible. Encourage activities on saving energy and improving energy efficiency.

### **5.2.2 Organize the amendment of the policy outline on energy saving.**

“National Policy for the Saving Energy Technology” reflects the developing direction of the energy saving technology, the promotion and application areas for the advanced technologies as well as the encouraging policies for promoting the application of advanced energy saving technology. In 1996, National Planning Committee, State Economy and Trade Commission and State Science and Technology Commission have jointly issued “National Policy for the Saving Energy Technology”. As the energy saving work in China is faced with problems like slow speed of technological renewal, long cyclic period of new technology promotion and application and the realization of leap-forward development, the government will work on revising the “National Policy for the Saving Energy Technology”, include the domestic and foreign mature energy saving technology and advanced technology into the “National Policy for the Saving Energy Technology” to guide the newly constructed projects and technologically transformed projects.

### **5.2.3 Carry out energy saving promotion, education, training of various forms, and establish energy saving information Dissemination system.**

Making the whole society aware of saving energy and protecting the environment is one of the key functions of the government. By carrying out energy saving promotion, education and training suitable to different social groups by the governments of all levels, pass on the energy saving idea, policy, information, and technology to the enterprises, community and individuals to create a social environment favorable to energy saving. By establishing energy saving information transfer system, pass on the latest information on energy saving policy and technology and extend the technologies that can save energy and improve energy efficiency.

**5.2.4 Improve the related laws of the “Energy Conservation Law” and the legal execution supervisory mechanism, and reinforce the energy efficiency standard and identification system.**

As a law specialized in energy saving, complete set of related laws, legal supervision and law execution mechanism must be set up to ensure the legal effect and the practicability of the “Energy Conservation Law”. The improvement of the related laws must be conducted according to the concrete situation of different areas and industries. Try to quantify the indexes in the laws and lay down a foundation for supervising the law execution. The establishment of the execution supervision mechanism of “Energy Conservation Law” should be consistent with the other economic laws, thus the execution supervision of “Energy Conservation Law” can be integrated into the normal execution system of economic laws. Reinforce the formulation, promotion and execution of energy saving standard. Improve the energy saving design criteria of new buildings, the energy saving reconstruction standard of already-existing buildings, and use the foreign experience on making automobile fuel standard as the reference. On the basis of improving energy saving standard, enlarge the certification range of the energy saving products. When the situation is permissive, carry out the certification and identification system of energy saving buildings and high efficient automobiles, and make use of the means in market economy to strengthen demand management.

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