Review and Evaluation of the Implementation of the Renewable Energy Law of China

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I . Overview of the Renewable Energy Law

With the rapid economic development of China, the conflict between energy demand and supply is increasingly obvious. The environmental problems, associated with the development and use of conventional energy, are becoming serious. It becomes a significant strategic option to speed up renewable energy development. In 2003, the 10th Standing Committee of the National People's Congress (NPC) put the establishment of a Renewable Energy Law of People's Republic of China on the legislation agenda. In December 2004, the Environment and Resource Protection Committee of the National People's Congress finished the draft of the Renewable Energy Law of People's Republic of China and submitted it for NPC's review. The draft was made with the joint efforts of related departments of the State Council, research institutes and social groups. The Renewable Energy Law of People's Republic of China (hereinafter referred to as RE Law) was passed on February 29, 2005 and came into effect on January 1st, 2006.

RE development and utilization is considered as an important strategy and measure to meet the present energy demands and as a key to solve future energy problems in many countries of the world. It can be observed from the experience in countries that rank at the top in RE development and use that their governments have a clear public responsibility to promote RE development and use. RE scale-up and commercialization can be achieved through a favorable price policy, a compulsory quota or the share of the extra cost of RE development by the society as a whole. Currently in China, the government is the key enforcement power for RE development and use to speed up the commercialization and scale-up of the sector. The main responsibilities of the government include establishing the market by regulating and standardizing it in order to stimulate RE development driven by market rules. Therefore, in the RE Law there are five important instruments as follows: an overall target, compulsory grid connection, a classified tariff, a cost sharing mechanism and special funds. These five instruments currently form the policy framework for RE

development in China. The overall target for RE development is set by the government and implemented and achieved through the national and provincial RE development plans. The government sets the RE tariff and the grid company is required to purchase all grid connected electricity produced by RE power generation enterprises with an administrative permit or record, at the price published by the government and the bidding price for the tendering projects. The extra costs of RE tariff compared to the average tariff of the conventional generated energy are shared by all the end users of the national grid.

Box 1：Instruments of the RE Law

1. Overall target: Since RE is a new industry in its early stage of commercial development, its current development and use is accompanied by high costs, large risks and low return rates for investors. With these conditions, it would be impossible for a spontaneous formulation of the market and framework for the development and use of RE sources. Such a new industry that is of strategic importance, has a long term approach, high risk and low returns needs the push from the government and mainly through the establishment of a development target. A specific overall target is equal to a guarantee of the scale of the market, which gives a signal to the market in terms of when and what the government is supporting, encouraging and restricting. This works as a guide for investment. The total target instrument is the core of the RE Law as well as the combination of government push and market pull.

2. Compulsory grid connection: the implementation of a compulsory grid connection rule is determined by the RE technology and its economic particularities. The RE is usually an intermittent power source that is not always welcomed by the grid due to technical and economic issues. Under current technology and economic accounting, most RE products (such as wind power and biomass power) can not compete with conventional energy products. Thus the implementation of a compulsory grid connection rule is key to guarantee the development of the RE industry under the conditions of monopolistic operation of energy sale network and concession sale. The compulsory grid connection rule can help reduce RE transaction costs, can assure projects to be connected in time and can improve the credibility of project financing, all of which will enhance the rapid growth of the RE industry.

3. Feed-in Tariff: the core of RE development and use is the power technology and the main factor that confines its development is the grid tariff. Since the cost of RE power is higher than that of conventional power, it is not feasible to set the power price based on the bidding mechanism that has been implemented since the power reform. Therefore the government needs to set a specific price for RE power over a specific period of time. Bidding price of power to grid is the right direction for power market reform under the framework of power institution reform. A feed-in tariff is necessary for RE power generation, i.e. to establish a different set price in each category according to the average social cost of the different RE

technology and publish it to the public. It saves the investor the administrative approval procedure, negotiation time and unnecessary conflicts of signing power purchase agreement with the grid company. This reduces the transaction costs of RE power connected to the grid.

4. Cost-sharing: Confined by its technology and cost, the development of RE has a higher cost that makes it difficult to compete with conventional power generation technology such as thermal power, except for hydro power. RE resources are not evenly distributed in different areas. This is why some measures have to be taken to buffer the negative impacts of the high costs of RE power in some areas and to share these additional costs throughout the country to help the development of RE. The key principle is to combine citizens' obligation and responsibility of the government and requests all areas to share the costs of RE development evenly, which reflects equality of policy and law. The equality problem among areas and enterprises is solved by a cost-sharing instrument that can enhance the scale up of RE use and development.

5. Special fund: One of the obstacles for RE development and use is the lack of an efficient and sufficient fund. The sustainable development of RE utilization depends to a certain extent on sufficient financial support. The establishment of a cost-sharing instrument solves the problem of the extra costs of RE, while a special fund is needed for solving the bottleneck of other financial problems of RE development and use. Therefore, the law subscribes a special fund for RE so as to specifically provide subsidies and other financial support for RE development and promotion projects that the cost-sharing instrument can not cover.

II. Progress and Problems of the Implementation of the RE Law

The RE Law, passed on 28 February 2005, set up relatively complete regulations with respect to the improvement of RE development and use and created the legal and policy framework for the development of the RE market.

Therefore the RE law is basically a general framework of legislation and policy. To further foster the effective implementation of this law, associated work should be conducted in three aspects: Firstly, to address the research and establishment of associated administrative procedures and technical standards so as to be able to formulate a complete legal system consisting of national and local laws, regulations, administrative regulations, rules, technical standards, etc; secondly, to set up implementation mechanisms and instruments of the Law as well as complete administrative management procedures, monitoring and governance systems by encouraging public participation and social supervision; thirdly, to further cultivate the

RE market system and industry development in order to create favorable market environment and industry foundations.

1. Establishment of RE Law and Associated Regulations and Rules

Since the RE Law became effective public concern has developed as to whether it can be effectively enforced, especially among RE and environmental protection groups. Practitioners in energy and environmental protection areas were concerned that the RE Law would fall into the same pattern of the Energy Conservation Law the implementation of which was postponed for a long time. They expected that the associated regulations and rules could be established and published soon after the the RE Law came into force and thus an effective implementation governance framework could come into existence so as to ensure the implementation of the rules and regulations. This concern had been taken into consideration by related legislation and governmental departments during the drafting and review of the Law. Right after the adoption of the Law, a meeting regarding its implementation was held jointly by the Legislation Committee of the NPC, the Environment and Resources Committee of the NPC, the Legislation Working Committee of the Standard Committee of the NPC, the Legislation Office of the State Council, the National Development & Reform Commission (NDRC), Ministry of Finance (MoF), General Administration of Quality Supervision , and Inspection and Quarantine (AQSIQ). The meeting aimed to push related departments of the State Council to carry out research and draft associated regulations, rules and technical norms and standards. The Office to the Standing Committee of the NPC also officially addressed the Office to the State Council to supervise and coordinate the research and drafting of twelve sets of associated rules and regulations, technical norms and standards. With the supervision by the Standing Committee and the Environment and Resources Committee of the NPC and coordination of NDRC, related departments of the State Council worked to establish associated rules and regulations, technical norms and standards. According to the subscription of the RE Law, the establishment of associated rules and regulations, technical norms and standards should cover the following twelve aspects:

- Hydro power and the RE Law;
- RE resource investigation and technical regulation:
- Overall target of RE development;
- RE development and utilization planning;
- Catalogue for the guidance for RE industry development;
- Grid tariff of RE policy;
- Measures for cost-sharing of RE power generation;
- Special fund of RE development;
- Fiscal support policy for RE development in rural areas;
- Fiscal subsidy and favorable tax policy;
- Regulations of integration of solar energy use and building;
- Grid connection of RE and related technical standards.

Based on the division of tasks made by the State Council, seven of the twelve items were the responsibility of NDRC, and the remaining five the responsibility of MoF, Ministry of Construction (MoC) and AQSIQ.

So far, the following associated regulations have been published:

- Catalogue for the Guidance of RE industry: brief introduction of RE industry, technologies, devices and technical indexes that are promoted by the government that laid a foundation for the further stipulation and implementation of industry policy and tax policy;
- Measures for RE Power Generation: clear stipulation of the management instruments, project management and connection to grid of RE power generation
- Interim Measurement for RE Power Price and Cost-sharing: detailed

regulations of grid tariff stipulated in the Law and cost-sharing systems;

- As for the RE resource investigation and technical standards, NDRC has organized and finished the review work with respect to hydro resource and has a clear picture of the status of the hydro resources; currently the investigation of wind resources and site selection of wind farms are ongoing, as is the biomass resource assessment;

- The MoF has allocated a budget for the Special Fund for RE development and stipulated Measurements for the RE Special Fund. Policies regarding fiscal subsidy and favorable tax are being developed according to the Catalogue for the Guidance of RE Industry.

The following technical norms and standards have been published:

- The MoC has finished compiling the *Technical Standards of Solar Water Heater System Application on Domestic Buildings* and *Technical Standards of Ground Source Heat Pump Application;*

- The Standardization Committee has adopted and published six items of national standards including: Technical Requirements of PV System Grid Connection, Wind Power Generator Part I: Genetic Technical Conditions, Wind Power Generator Part II: Genetic Experiment Methodology, Technical Regulations of Integrating Wind Power into the Power Grid System, Technical Regulations of Integrating Geothermal Power into the Power Grid, and Technical Regulations of Integrating PV Station into the Power Grid. Some technical standards are still under development including technical conditions of flat-plate solar collectors, experiment methodologies for testing solar collector performance and vacuum tube solar collectors.

In addition to the associated documents and regulations mentioned above with regards to the generic development of RE, NDRC, MoF, MoC have formulated specific regulations and guidelines such as Implementation Notes of Wind Power Industry Development and Implementation, Notes of Biomass Development and Tax

Supporting Policy of Biochemical Industry issued by jointly issued by NDRC and MoF; Notice of Strengthening Bio-fuel Ethanol Project Construction and Management and Promotion of Sound Industry Development issued by MoF and other ministries; Interim Measures for Special Fund for RE application on Buildings and Review Measures for Demonstration Project of RE Application on Buildings jointly issued by MoF and MoC. These regulations and policies have played an important role in fostering the development of some specific RE technologies.

Box 2：Published law, regulations, policies and standards

1. Renewable Energy Law of the People's Republic of China

（Adopted by the 14th meeting of the Standing Committee of the 10th NPC on Feb. 28, 2005）

2. Catalogue for the Guidance of Renewable Energy Industry Development

NDRC Energy No.（2005）2517

3. Interim Measures for Renewable Energy Power Price and Cost-sharing

NDRC Price No.（2006）7

4. Management Rules of Renewable Energy Power Generation

NDRC Energy No.（2006）13

5. Interim Measures for Management of Special Fund of Renewable Energy

MoF Construction No.（2006）237

6. Implementation Notes of Enhancement of Renewable Energy Industry Development

NDRC Energy No.（2006） 2535

7. Interim Measures for Allocation of Additional Benefits from Renewable Energy Tariff

NDRC Price No.（2007）44

8. NDRC, MoF about Strengthening Bio-fuel Ethanol Project Construction and Management, Enhancing Healthy Development of the Industry

NDRC Industry No. [2006] 2842

9. Measures for Management of Product Oil Market

Ministry of Commerce Mandate No. 23 (2006)

10. Transformed Fuel Ethanol

GB 18350-2001

11 Vehicle use Ethanol Gasoline

GB 18351-2004

12. Interim Measures of Special Fund for Renewable Energy Use on Buildings

MoF construction No.（2006）460

13. Review Measures for Demonstration Project of Integrating Renewable Energy with Buildings

MoF construction No. [2006]459

14. NDRC about Requirements of Management of Wind Farm projects

NDRC Energy No.〔2005〕1204

15. Interim Measures of Management of Land use of Wind Farm Construction Project and Environmental Protetion

NDRC Energy No.〔2005〕1511

16. Technical Regulations of Application of Solar Water Heater Use in Domestic Buildings

GB50364—2005

17. National Grid Company about Regulations of Connecting Wind Farm into the Power Grid (tentative)

National Grid Development No. [2006]779

18. National Grid Company about Further Regulation of Design of System Connecting Wind Farm into Grid (tentative)

National Grid Development No. [2006]779

From the present status of associated regulations and rules established, there are the following main problems:

- The RE development plan has not been published yet, nor has the specific plan or development path for the different RE technologies. Therefore a clear guidance mechanism of plans and targets have not been formed yet;
- The management mechanisms for RE power generation projects and price system are still ambiguous and not clear enough. Basically, the price is controlled by the central government whereas the project is governed by either the central or local government according to the project scale. However, the relationship between project and price, and central and local management still needs to be clarified. A reasonable pricing mechanism has not been formed yet regarding wind power concession system;

- The measures regarding grid connection of RE power, full power purchase and its associated monitoring instruments also need to be improved and to include a clarification of the responsibilities for each of the departments in charge of energy issues and those of the Power Supervision Committee;
- Detailed cost-sharing measures of RE costs and its associated supervision mechanisms need to be established.
- There is currently a lack of finance for the Special Fund for RE development. A general coordination mechanism is absent in order to connect the development plan and the Special Fund;
- Various favorable tax policies need to be grounded and implemented;
- The issue of publishing technical standards of the resource investigation and its results;
- The issue of establishing associated technical norms and standards.

Currently carrying out research on the various RE technologies and setting up associated regulations and standards, remains a complicated process since RE involves many categories of energy, a complex resource distribution, different technology types and levels of development. The involvement of different authority departments makes the situation even more complicated as they need to coordinate with each other in order to identify RE development targets, resource status, technical and industry development levels and conduct in-depth research and repeated investigation before setting up regulations and rules. Most of the associated regulations and rules, that have been established already, are still in a stage of demonstration and far from being complete and concrete. There are comments in the RE sector like “the implementation guideline is not easy to put into practice” or like “the implementation guideline is impossible to be implemented.”

To sum up, we can state that improvements are necessary in the establishment of regulations, rules, technical norms and standards.

Box 3: Implementation status of projects under wind power concession program

To foster the development of the wind power industry, the Chinese government has adopted four sessions of wind concession projects with the format of franchised operation. The program is characterized as follows:

(1) The government selects investors through public tendering and the bidder with the lowest promised grid power price wins the bid (in 2005 this criteria was changed so that power price is now weighted as just 40%.)

(2) The concession period for the wind projects is 25 years.

(3) The provincial grid company is required to purchase the full amount of electricity generated from the wind projects according to a power purchase agreement signed with the bid winner.

(4) The price difference of the wind electricity generation and the conventional power generation will be shared among the provincial grid companies (the cost is shared in the national grid since 2006).

(5) The price policy of the project is implemented in two stages. During the first stage, when the accumulated amount of electricity contributed to the grid is below 30,000 equivalent hours of full load, the power price is the bidding price. After that, in the second stage, the power price will be the average grid tariff in the power market.

The four rounds of the wind concession program solved some major problems before 2002 that hindered the wind power development. For instance, currently wind power is regulated as through limited market competition; the government promises fixed power price for an specific amount of electricity; the grid company purchases the full amount of electricity produced by wind farms; the price difference is shared, the grid company is responsible for investing in the construction of transmission lines and associated facilities that lie between the wind project site and the nearest grid; the local government is responsible for coordinating the preparation of the projects and access roads to the site; the provincial government and the provincial grid company sign concession agreements and power purchase agreements respectively with the bid winner. The above-mentioned policies are basically covered by the RE Law.

From 2003 to 2006 there have been 11 project tenders. The highest bidding price has so far been 0.5190 yuan/kwh, the lowest 0.3820 yuan/kwh. The total tendering size has been 1650 MW and the size of the bidding has been 2450 MW. Currently, the lowest price wins the bid and the bidding price is the basis for the future power price verification.

This current policy induces the following risks and problems for wind power investment:

(1) Whether the investment in wind project is profitable or not depends on the power price. As subscribed, the wind power price should implement the price set by the government and the price standard is determined by the State Council based on the price formed during the

tender. In practice, the bidding price and approved price are implemented in parallel. This leads to fairly low grid prices for wind concession projects and thus has had the consequence of non-profitable projects.

(2) With well-maintained equipment and a set grid price, wind resource should be the key factor that determines whether the project is profitable or not. Competition among developers should not come from bidding for the lowest price, but from selecting the best sites and optimizing their electricity output through an accurate wind resource assessment and quality micro-siting. With the current site selection, wind resource assessment system and micro-siting technology, accurate estimation of electricity exported to the grid in the 20 years' life-span of the wind farm can not be guaranteed. In fact, the actual electricity sale from wind projects is usually lower than what is calculated in the feasibility study.

(3) Performance of equipment is the guarantee for the benefits of wind projects. The current operation of wind turbines in bad weather conditions and the fact that the production is not optimal reflects the reliability of the turbines and actual use rate are lower than what the producers are promising. This increases maintenance costs, fails to produce the expected amount of electricity, and thus reduces the overall benefits of wind power. To ensure the performance of wind turbines, manufacturers should provide a two to five year warranty for their technology and therefore take the technical risk during this period. This will ensure project revenues security, if the wind energy production is properly estimated. At the same time high **technical standards** will also be necessary to reduce long-term risks and increase the revenue reliability. Wind turbines are complex systems and it is essential to integrate the whole manufacturing value chain sharing responsibilities along it in order to ensure the quality of all parts.

(4) With the increase of the installed capacity of wind turbines, the grid's constraints will be increasingly higher. Wind power is an intermittent power source that makes it difficult for the accuracy of estimations of grid loads, which at the same time influences the stability of the grid, its allocation and operation pattern, the frequency control, pressure adjustment, current distribution, incident standards and operational costs. This poses technical and management difficulties for the grid company to distribute all wind power purchased into grid. That is the reason why forecasting systems for wind electricity production are a key element in grid integration and load management control.

(5) At present, the government departments and power groups tend to increase the installed capacity of wind projects without full consideration of available land for wind farm and quality of the wind turbines. After reaching the target of installed capacity of wind projects, it has happened that projects have produced less power than expected or even failed to produce electricity at all. For example, by the end of 2005, at least 25 MW units failed to produce electricity among the 1260 MW installed capacity of wind power projects. This is the reason why for a government target to fulfill its purpose it should be formulated in terms of electricity generation (MWh) rather than capacity installed (MW) so it reflects the real energy production from renewable sources in the country.

（6）These low bidding prices are leading to the reduction of investment in wind turbines and construction, which affects the quality of equipments and engineering works. This confines the healthy development of the whole wind power industry.

The key to solve the above problems is to alter some regulations with regards to wind concession programs by adjusting grid price and ensuring a reasonable return for the project.

Box 4: Several problems faced by the wind power development

The Deputy Director of Longyuan Power Corporation summarized six problems that exist in the development of the wind power market in China: (1) the estimation of wind resources and grid electricity output is not accurate; (2) the bidding system for the electricity tariff in wind projects is not reasonable and leads to very low grid prices, so the grid tariff policy needs to be improved; (3) the grid planning and construction is slower than the wind power plan and construction; (4) there are no operation testing or authority for certification before accepting large purchase orders, which probably results in low reliability of full operation of wind turbines for 20 years; (5) there is a trend of simply pursuing installed capacity of wind power while neglecting electricity production and profitability of wind farms; (6) the basic R & D of technologies in wind power sector is still in an early development and there is a repetition of import of low standard technologies.

Prof. Shi Pengfei from the Chinese Academy of Renewable Energy summarized problems in wind power development into three categories: (1) the grid price does not enable the profitability of wind power projects; (2) there is a lack of incentives for grid companies in the current policy framework; (3) the enterprises and local governments simply care about installed capacity rather than grid electricity generation that is not considered as an index of performance.

（from meeting minutes of the RE Industry Development Seminar organized by the Advisory Office of the State Council）

2. Implementation and Supervision of the RE Law

The situation of the RE Law implementation in China reflects that there are three-dimensional implementation and supervision systems that are formed by the supervision of the national authority, its implementation and supervision by the administrative departments, and its implementation and supervision by the society.

The national authority could follow up the implementation status of the law and push the related administrative departments for its effective implementation through legal examination, listening to reports of governmental departments, special research and other methods that are conducted by the Standing Committee of NPC at all levels. Currently the Environment and Resources Committee of the NPC and the corresponding committees in charge of environment and resources as well as finance and economy at local levels take the responsibility of examination and supervision work.

With regards to the administrative implementation and supervision, the national and local Development and Reform Commissions dominate the implementation of the RE Law and at the same time the departments in charge of finance, science and technology, technical supervision, etc. exert specific legal functions according to the law and their administrative obligations. Within the State Council, it involves over ten ministries and departments (see Table 1).

Table 1 Organization Structure of the Implementation and Supervision of the RE Law within the State Council

(1). General administrative ministries and departments
National Energy Leaders' Group and its Office
NDRC and its Energy Bureau in charge of general management
Ministry of Finance
Ministry of Science and Technology
(2) Specific management departments
Ministry of Agriculture
Ministry of Construction
State Environmental Protection Administration
General Administration of Quality Supervision ,Inspection and Quarantine, China National Standardization Management Committee(China National Standardization Management Bureau)
National Forest Bureau
China Meteorology Bureau
(3) Independent supervision organization

The implementation and supervision experiences show that civil organizations have become an important force in supervision of the law's implementation in recent years. Some of the environmental protection and energy organizations including industry association and environment civil organizations are greatly concerned about RE development and use. On the one hand, they give active support for the utilization of wind power, solar power and biomass, and on the other hand, they worry about the biological damages that are brought by the rapid development of hydro power. These organizations have greatly pushed the participation of the whole society in the establishment of these laws and regulations. These organizations that pay attention to RE can be divided into three categories: those on behalf of the RE industry association and groups including All-China Federation of Industry & Commerce, Chinese Renewable Energy Industries Association, etc; the RE academy groups and organization including the Academy of Renewable Energy, Chinese Society for Environmental Sciences, etc; and civil environmental protection organizations that conduct special activities in RE area. In addition, the international environmental protection organizations have also exerted important influence in the RE development in China (see Table 2).

Table 2 Related social groups and civil organizations of China

All-China Federation of Industry & Commerce
Chinese Renewable Energy Society
Solar Thermal Utilization Association
Solar Photovoltaic Association
Solar Photochemistry Association
Solar Building Association
Wind Energy Association（China Wind Energy Association）
Biomass Energy Association
China Rural Energy Industry Association
Small Power Source Association
Bio-gas Association
Biomass Energy Conversion Technology Association
China Energy Enterprise Management Association
China Agriculture Environmental Protection Association
China Energy Research Society
Chinese Renewable Energy Industry Association
China Society for Hydro Power Engineering
China Energy Conservation Association
China Resource Recycling Association
Chinese Hydraulic Engineering Association
Chinese Society for Environmental Sciences
China Association of Environmental Protection Industry
Environment Education Center of Beijing Earth Village
Friends of Nature

This shows that the public participation and social supervision have played a positive role in RE development in China. Some associations have even been actively involved in the research and drafting of the RE Law, associated rules and regulations, technical norms and standards as well as in the RE planning. They have also

participated in information dissemination and education activities as well as implementation of some projects that make considerable contributions to the establishment and implementation of the related laws, policies and planning,

However, there are still many problems in the implementation and supervision of the RELaw. These are as follows:

- There is a lack of general coordination mechanisms. Different departments in the NDRC are in charge of different functions. These departments include the Energy Bureau, the Economic Operation Bureau, the Price Department, the Industry Department, the High-tech Industry Department. These are in charge of RE planning, project approval, energy allocation, prices and industry development respectively. MoF is in charge of the related budget and the arrangement of the RE Special Fund; The Ministry of Science and Technology (MoST) is in charge of project demonstration of important technologies; The State Power Supervision Committee is in charge of market supervision of RE power. It would not be possible for just one single department or ministry to overall manage the administrative functions, take responsibilities of related resources investigation and planning, nor can any department take all responsibilities of scientific and technological research, technical demonstration and promotion or be responsible for supporting industry development, project approval and pricing.

- There is a lack of independent and efficient supervision capacity. The Development and Reform Commission or Economic and Trade Committee at the national and local levels are designed for functioning to provide planning, industry guidance, investment approval and price supervision rather than monitoring and supervising the various RE developments and uses (including information collection, administrative examination and penalties). The State Power Supervision Committee is simply in charge of the supervision of the power market and confines its capacity of supervision to resources development, processing conversion, market sale and the

whole complicated system.

- The planning, policy stipulation and project decision-making processes are not transparent enough. The implementation of the RE Law requires a series of transparent legal implementation instruments including identifying an overall RE target, the development of planning, pricing, project approval and procedures of tendering that involve the previous collection of public opinions and later publication of results and other progresses based on the principle of publicity and efficiency. Currently, there is a lack of transparency in the management of the RE expect for the tendering processes in the wind concession programs.
- The approval procedure of RE project is tedious. Comparing to coal-fired power projects, wind power and biomass projects have a relatively smaller size but however the current approval regulations require the same procedures that are highly time consuming and require huge human and economic resources.
- There is a lack of reporting and supervision systems for law implementation. There is no clear and standard reporting and evaluation system for the administrative departments that implement the law. It is not clear who is responsible for reporting, who the report has to go to and whether the report should be published or not. The lack of reporting and evaluation systems is being compensated by listening to irregular legal examinations and specific reports conducted by the Standing Committee and other related special committees of NPC.
- There is a lack of coordination and efficient systems for planning and policy implementation. The overall development target for RE and planning do not match with the associated measures and its actual implementation. The responsibilities of the state Council and energy departments of local governments are not clarified in terms of guidance and forwardness of the planning. There is not a clear answer yet to whether the associated

measures are taking forms or being implemented.

The major problems in social implementation and supervision are as follows:

- The government departments and civil society have not sufficient understanding about associations and there is a lack of enthusiasm and support to them.
- The government's information and decision-making process is not transparent. This is clear in the setting up process for the RE planning and the establishment of its policy that makes it hard for the public and civil societies to get timely information.
- There is not an appropriate channel for the public and civil society to participate in the government's decision-making process. For example, there are no formal procedures and instruments for the stakeholders public comments in the process of RE policy and planning establishment.
- The public has no legal channel to sue the different government departments for not complying with regulations or other non-action behaviors. For example, the DRC sometimes has not approved projects in time or the grid companies have not given access to RE power projects to the grid. In such cases, even though the State Power Supervision Committee (SPSC) is entitled to impose penalties, there are no independent social forces to pursue the non-action of the SPSC.
- Associations have been widely challenged by insufficient finance. According to the survey made by the China Environmental Protection Association, 76.1% of environmental protection associations have no fixed finance resources.
- Associations lack the professional personnel and their work foundations are weak. Most of them have insufficient capabilities and they cannot succeed in participating in the establishment of the policy, planning and supervision,

except for a few associations with specific research projects.

III. Renewable Energy Market and Industry Development

1. Overall Development Status of the RE Market

The year 2006 witnessed the fast progress of various RE: the annual installed capacity of hydro power reached 10 GW and the accumulated installed capacity reached 125 GW, 25% of the total exploitable amount; the installed capacity of wind power in 2006 was 1332 MW, more than the sum of the past 20 years, and with a 270% growth compared to 2005; the production capacity of solar PV cells reached 300 MW, increasing 150 MW and took over a 10% of the world's production capacity; the production capacity of solar water heaters reached 18 million square meters, increasing by over two million square meters and its accumulated use reached nearly 100 million square meters; the biomass development and use also experienced a rapid growth. The domestic use of biogas reached over 19 million households and more than 2000 biogas facilities of medium and large size were built. The total biogas use exceeded nice billion cubic meters. The annual use of renewable resources reached 200 million standard coal equivalent (excluding biomass use in a conventional way), taking the 8% of the primary energy use and with an increase of 0.5% from 2005, among which hydro power took more than 15 million standard coal equivalents, and the use of solar, wind and biomass energy with modern technology provided the equivalent energy of over 40 million standard coal equivalents. This is laying a solid foundation for reaching the target of 10% of RE use in the energy generation mix by 2010.

Investment also saw a clear increase in RE. The implementation of the RE Law roughly removed the risk in investment in RE projects. Various investment bodies participated in the investment in the RE industry. Domestic state-owned enterprises that entered into the RE market include the State Power Grid, the top five power corporations, the top three petroleum companies, Shenhua Group, Yangtze Power and other energy investment companies. Large-scale equipment manufacturing

groups were also involved in RE equipment manufacturing including Shanghai Electrics, Orient Turbine Company and Harbin Electrics. The main international wind turbine manufacturers also started to enter the RE market in China. Private-owned enterprises have also entered the market. For instance, the solar energy industry was basically controlled by private capital. In the mean time, risk investment and domestic capital has also began to be involved in the RE investment market. By the end of 2006, about 15 RE companies (or RE departments of big corporations) were included in the stock market in New York, London, Hong Kong, Singapore and China. Their market value exceeded 10 billion US dollars, the largest of them being Suntech Power Co., Ltd with a market value of over 5 billion US dollars. Currently there are at least 20 companies getting ready or waiting for being included in the stock market. By the end of 2007 it is estimated that there will be over 20 RE companies included in the stock market with a total market value of over 20 billion US dollars.

The policy and market have pushed investment in the RE industry, especially private and risk investment, that have added dynamics in the RE equipment manufacturing industry and more specifically for the fast developing wind power and solar PV cell production markets. By the end of 2006, there were more than 100 enterprises involved in wind power production and spare parts manufacturing, among which 36 are large-scale wind turbines manufacturers. These include four foreign wholly owned enterprises, three joint-venture companies and 29 domestic enterprises. The domestic produced wind turbines have an increasing share of the market. Among all the wind turbines that finished installation by the end of 2006, over 40% were made in China. Over 10 solar PV cell manufacturing enterprises have a production capacity of over 100 MW, among which two are listed among the top ten in the world. Among the producers of solar water heaters there are more than 3000 enterprises and over 10 enterprises have revenues of more than one billion RMB. Meanwhile, the big foreign manufacturers have got involved in the market, including GE from the US, Gamesa from Spain, Vestas from Denmark, Nordex from Germany and Suzlon from India. All these companies have set up wind turbine manufacturing facilities in China. The RE

manufacturing industry is taking shape in China.

2. Application and Development of the Different Types of Renewable Energies

Hydro Power

According to the 2003 national hydro resources survey, technically exploitable hydro resources in China are about 542 GW, equivalent to 2470 TWh per year; economically exploitable hydro resources are about 400 GW, equivalent to 1750 TWh. If we assume that the life time for an economically exploitable hydro resource is 100 years, then the hydro resources will represent 40% of the remaining conventional energy resources, only a little less than the coal resources. Hydro resources are widely spread but western China has the highest share. About 70% is located in south-west China, including the main branches of the biggest rivers such as Changjiang, Jinshajiang, Yalongjiang, Daduhe, Wujiang, Hongshuihe, Lanchangjiang, Huanghe and Nujiang. The size of the hydro power programs along these rivers is quite high and cover 60% of the total capacity of economically exploitable hydro power resources in China. By end of 2006, the total installed capacity of hydro power in China was 125 GW, representing 19% of the total national power installed capacity. The output of the hydro power was 390 TWh, covering 13% of the total power generation. Among the total capacity, small hydro shared 40 GW, with an output of 140 TWh, providing electricity to half the land, one-third of the counties or one-fourth of the population. Besides, 653 counties were completed with primary hydro electrification and 400 counties have construction plans to meet the goal of well-off societies mainly through hydro power. At least the investigation, design, implementation, installation and equipment manufacture technology has met the international standards and a comprehensive industry has been formed. The ecological protection along the valleys and other relevant social issues are still a concern for the future.

Biomass

Biomass includes crops straw, forestry wastes, fuel plants, energy plants, urban wastes and other organic wastes. At present, crops straws which could be used as

energy means about 150 million TSC per year, and forestry waste involves about 200 million TSC per year. Potential areas of Jatropha curcas, rapeseed, castor-oil plant, sumach, mastic and kaoliang could supply the raw material for 50 million tons bio-fuel. Theoretically speaking, the industries of organic waste water and poultry waste water could produce 80 billion m2 methane, equivalent to 570 million TSC. By 2006, the installed capacity of biomass power exceeded 2.2 GW. Among the total, bagasse power covered 1.7 GW, rice hull power shared 50 MW, and urban waste power represented 400 MW. Besides, there were some other small-sized biomass power programs. In 2006, the implementation of favourable pricing policies for renewable energy brought a boom in the development of straw and forestry power. The central government approved 39 biomass power programs in total. The total installed capacity was 1.28 GW and the total budget is 10.03 billion Yuan. In addition, 220 million home methane tanks, 140 thousand living waste water purifying methane tanks, and 2000 poultry and industry waste water processing methane programs and 800 industry methane plants were built in the rural areas. These programs provide fuel for 80 million of rural population with a total annual production of 10 billion m^2 methane. During the “the tenth five year” period, 4 bio-ethanol pilot projects using old crops were constructed, which produced 1.02 million tons of bio-ethanol annually. Since 2004, bio-ethanol powered car programs were initiated in Helongjiang, Jilin, Liaoning, Henan, Anhui provinces and another 27 cities in Hebei, Shandong, Jiangsu, and Hubei provinces. At the moment, a small-sized experiment on producing bio-ethanol using kaoliang and cassava is on going. The main concern at present is the shortage of biomass resources, but ecological impact cannot be ignored in the future.

Wind Power.

China has rich wind resources because of its vast large areas and long coastline. The total wind resource potential is about 3.2 TW, of which 1 TW could be realistically exploited according to a primary analysis. The areas with rich wind resources are mainly located along the south-east coast, Inner Mongolia, Xinjiang and Hexi Corridor of Gansu. Some other areas in North-east, North-west, central North and Qinghai-Tibet

plateau have also strong wind. Other inland areas also have good wind resources. China first connected wind power to the grid in the 1980s. The wind power developed very fast during the “tenth five year”. The total installed capacity has increased from 350 MW in 2000 to 2.6 GW in 2006, with an annual growth rate of 30%. China used to be positioned top 10 in terms of wind power installed capacity, but reached top 6 in 2006. The major concerns for wind power at the moment include the lack of a feed in tariff, grid construction and integration, the implementation of the policy, including targets, regulations and standards, the localization of wind turbine manufacturing and the components supply chain.

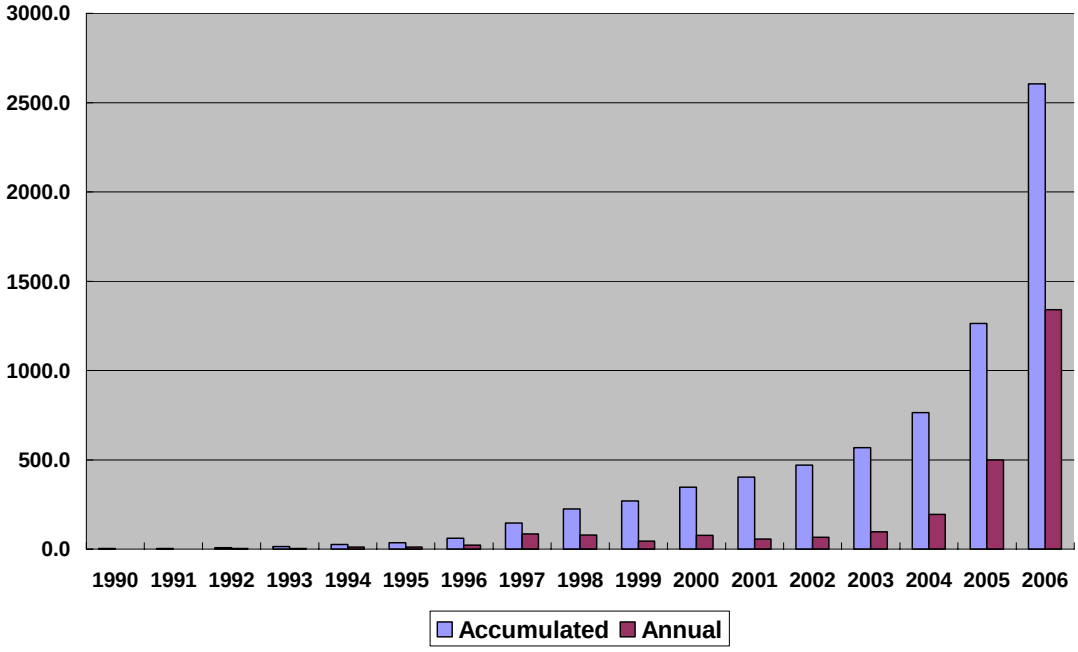

Figure 1 Installed Capacity of Wind Power in China (MW)

Table 3 Installed Capacity in 2006(MW, in order of capacity)

No.	Province	2005	New installation in 2006	Abandoned in 2006	Accumulation in2006
1	Inner Mongolia	166.0	343.15		509.2
2	Hebei	108.0	217.5		325.5
3	JIlin	109.0	143.35		252.4
4	Liaoning	127.0	104.8		231.8
5	Guangdong	141.0	67.95		209.0

6	Xinjiang	181.0	25.2		206.2
7	Heilongjiang	57.0	105.0		162.0
8	Ningxia	113.0	46.5		159.5
9	Shandong	84.0	60.75		144.8
10	Gansu	52.0	75.55		127.6
11	Jiangsu		111.0		111.0
12	Fujian	59.0	30.0		89.0
13	Zhejiang	34.0	1.5 (1)	3	32.5
14	Shanghai	24.0	0.0		24.0
15	Hainan	9.0	0.0		9.0
	Total(excluding Hongkong, Maco and Taiwan)	1264.0	1332.3	3	2593.3

Box 5: Wind Turbine Manufacturing

According to primary statistics, there are over 100 companies involved in the manufacturing of wind turbines and relevant components. Among the total, only 36 companies are able to produce the whole wind turbine, of which 4 are foreign companies, 3 are joint-ventures and 29 are local companies. In 2006, the domestic companies which were able to produce large scale wind turbines include Xinjiang Golden Wind, Zhengjiang Yuda, Dalian Huarui and Oriental Gas Turbine Factory. At present, Golden Wind dominates the market. Besides, improvement has also been made in the manufacturing of gearbox, blades and generators. The manufacturing of components could support the production of thousands of wind turbines per year. At the moment, China has the technology to manufacture wind turbine of 750 kW or less. In 2006, a 1.2 MW direct driving turbine that was developed with transferred technology was installed. The 1.5 MW wind turbine was also completed and installed.

Components manufacturing capabilities have also been strengthened driven by the national policy of localizing wind equipments production. China is now able to make gear boxes, blades and engines which are already been sold to foreign companies. In 2006, local products shared a 45% of the total wind market, 10% growth over 2005. Foreign products covered the other 55%. Besides, accumulated market share of local products increased to 20% and foreign products covered 80%.

Lastly but not the least, there are about 70 organisations involved in the wind business, including 35 universities and research institutes, 23 enterprises, 12 components manufacturers (batteries, blades, inverters etc.). The companies with big production include Jiangsu Shenzhou, Inner Mongolia Longxinbo, Inner Mongolia Tianli, Guangzhou Hongying and Beijing Boli (foreign investment). China is now able to produce small wind turbines ranging from 100 W to 10 kW. In 2006, over 30,000 small wind turbines were produced. Thus, China has formed the biggest industry and market for small size wind turbines. By the end of 2006, 350,000 small wind turbines (with a total capacity of 70 MW) had been installed ccumulatively to provide electricity to the population in remote areas. Of the 350,000 units, it is estimated that 300,000 are still on operation. In 2005, about 33 thousand small wind turbines were made and about 5800 units were exported to 24 countries in the world, realizing good economic and social benefit.

Solar Photovoltaic.

China is rich in solar resources and over 2/3 the land has sufficient potential for solar energy. The total annual radiation is over 6 billion J/m^2 and the solar energy reaching

the land is equivalent to 1700 billion TSC. There are plenty of solar resources especially in North-west China, Tibet and Yunnan. With respect to the solar PV market, the central government initiated “SDDX” program during the years 2002 to 2004 with a total investment of 4.7 billion Yuan from central and local governments. Under this program, stand-alone PV systems, wind-hybrid systems and small hydro power systems were set up in 1065 townships of 12 provinces (municipals or districts), for example, Inner Mongolia, Qinghai, Xinjiang, Sichuan, Tibet and Shanxi. PV systems shared the biggest proportion. Altogether 17 MW solar modules were used, which accelerated the development of the solar PV industry in China. Because solar PV systems are very expensive, the PV industry in China develops slower if compared to the booming international PV industry. However, the PV industry in China is keeping a steady growth year by year. The application of Building Integrated PV and solar street lights in cities is especially promoting the development of the solar PV industry in China. By the end of 2006, the accumulative installed capacity of solar PV was 80 MW, 42% of this were stand-alone systems, providing electricity to the households in remote areas. In addition, the market share of solar PV in the telecom-industry is also increasing. However, at present, the local market for solar PV is still small. In 2006, 300 MW solar cells were produced, but only less than 10 MW were used in the domestic market, the other 95% were exported.

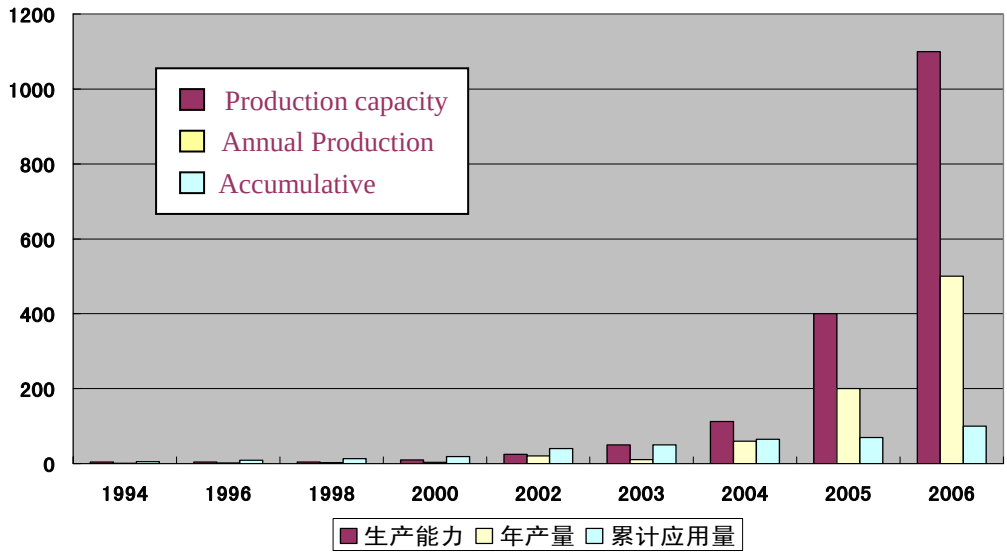

Figure 2 Solar Module Production Capacities, Annual Production Output and Accumulative Installation in China (MW)

Box 6: Solar PV Manufacture

Solar PV is a mature technology and the only market barriers are the high cost and shortage of silicon material. At present the cost for solar PV is about 4-6 Yuan/kwh, far from commercial application. However, since 2004 and driven by the supportedl solar PV markets especially in Germany and Japan, the development of solar PV industry is growing very fast. The production capacity of wafers, cells and modules has increased dramatically and a number of competitive cell manufacturers with good reputation in the international market have appeared. There is still a key issue in the PV industry chain: the complete PV industry chain includes silicon raw material with high purity, ingot, wafer, cell and module. In 2000, the domestic production capacity of solar modules was less than 10 MW. However, by end of 2006, the production capacity of silicon material, ingot, wafer, cell and module was 25 MW, 580 MW, 500 MW, 1400 MW and 1087 MW respectively. These data indicate that the PV industry chain in China is unbalanced. This means, firstly that there are still some technology barriers which we did not overcome, like purifying silicon for example; and secondly, that the composition of the industry is not good for sustainable development. The 95% of the silicon raw material depends on imports and the 95% of the final products relies on export. The international market is bringing a critical impact on the domestic PV industry. For example, in 2006, the European market decrease brought great

Solar Thermal Application

At present, the most popular solar thermal application is the solar water heater technology. It provides warm bath water, increasing the quality of living of people in small or medium size cities. By 2006, the cumulative installed capacity of solar heat collector reached 90 million m^3. The annual production capacity was 18 million m^3, 20% more than that in 2005. Both the installation and annual production have exceeded 50% of the international market. In recent years, the technology of integrating solar water heaters into buildings has been improved and a number of solar water heaters integrated in buildings have been completed. The concept of considering solar water heaters during the design, implementation and completion of a building is already widely accepted. Apart from solar water heater technology, China is now starting R&D and pilot projects to broaden solar thermal applications, such as

solar heating, solar air conditioner, sea water purified through solar thermal technology and industry heating process. According to the statistics in 2006, disregarding hydro power and conventional biomass application, solar water heaters shared more than 50% of the total installation (equivalent to 50 million TSC) of renewable energy.

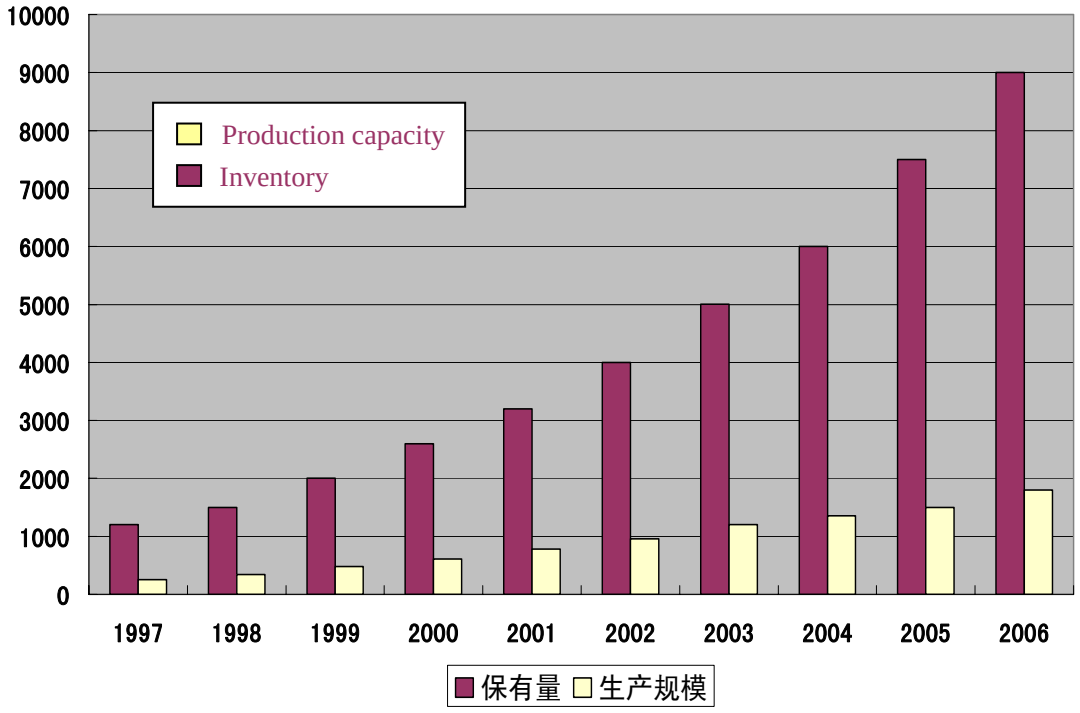

Figure 3 Production Capacity and Inventory of SWH in China (10^4 m^3)

Geothermal Application

Geothermal could be used directly or for producing electricity. The geothermal flow used for producing electricity should have a high temperature. Usually 150 or even 200 should be economic. There are limited areas in China with high temperature geothermal resources, mainly locating in Tibet and Hengduan Mountain of Yunnan. Yangbajing of Tibet and Tengchong of Yunnan are the areas with highest temperature geothermal resources of those investigated. Currently the total installed capacity of geothermal is 32.08 MW and 88% is located in Tibet. Yangbajing is currently the only geothermal power plant of big scale. In 2004, Tengchong geothermal power plant (phase I) was started with a capacity of 48.8 MW. After completion, it will be the second big scale geothermal power plant in China.

Direct geothermal application requires relatively low temperature. China is rich in geothermal resources with medium or low temperature, ranging all over the country. Medium or low temperature geothermal could be applicable for heating, green house, both or medical treatment.

Box 7: Solar Water Heater Manufacture

Solar water heater industry has been commercialized and formed the system from raw material processing, product development and manufacture, engineering design and after-sale service. At the same time, this industry promotes the development of relevant industries such as glass, metal, temperature holding materials and vacuum equipments. Solar water heater industry is now a new industry with rapid development and there are more than 1300 companies involved in it. The vacuum tube technology developed with our own patent has leading the technology in the world. The vacuum tube solar water heaters are widely used in China. Annual production reaches 18 million m3, covering more than 90% of the international vacuum solar water heater market. Because of good performance, the vacuum solar water heaters are exported to dozens of countries in Asia, Europe and Africa. In China, electric water heater, gas water heater and solar water heater share the water heater market.

But, the dominating products in China are still direct solar water heaters. Compared with internationally advanced separate pressure-resistant secondary circulation solar water heaters (in-direct), the direct solar water heaters have simple structure and low technology, which still has a big gap in terms of feasibility, comfort, combination with conventional power system, and integration into buildings.

The direct application of medium or low temperature geothermal grew fast in 1990s in China with an annual increase of 10%. Especially in North China, the government accelerates the development of geothermal application for heating (heating the house and providing warm water). In 2005, the total application of geothermal reached 30 million m^3, providing warm water to 600 thousand households.

Ocean Energy Application

Ocean energy includes tide, wave and current energy. China has completed eight tide power stations and is currently making technical research and pilot projects for producing electricity through new approaches. Besides, progress has been made in developing wave energy. Since “the seventh five year”, China has made great achievements in the technology for wave transfer efficiency, wave energy stable output and wave energy equipments manufacturing. In 2004, the stand-alone power

system developed domestically could transfer unstable liquid energy (average power 8Kw, waver value 8 kw) to stable electricity in lab. In 2005, China successfully transferred unstable wave energy to stable electricity. By end of 2005, there were two off-shore water column wave energy equipments of 100kW and 20 kW respectively. There are also more than 700 small equipments of 1 kw or less.

IV. Overview of the Development of Renewable Energy in the World

Entering the 21st century, many countries in the world began to develop renewable energies to ensure energy supply and slow down climate change. The renewable energy market has grown very fast in the world since then. Some renewable energy technologies like solar PV and wind power have increased by 20% per year (see graph 7). Renewable energy has become the most important alternative energy in order to diversify the energy supply, slow down climate change and realize sustainable development. In the last two years, the fluctuation of the international price of petroleum and effectiveness of the Kyoto Protocol has brought renewable energy to focus in the global energy context.

By end of 2006, the installed capacity of renewable energy exceeded 200 GW, of which small hydro power covers 80 GW, wind power 70 GW, Biomass Power 50 GW, Geothermal Power 10 GW and solar PV 7 GW. The worldwide installed capacity of wind power in 2006 was 15 GW, which became the fourth major power resource in the world after thermal power, hydro power and nuclear power. The annual increase of solar PV is over 60% and the production capacity is close to 2 GW; The annual production output of biomass liquid fuel is about 35 million tons, of which American shares 14 million tons, Brazil 14 million tons and the rest of the world share 7 million tons (from which China has 1 million tons, Europe 3 million tons and Japan 2 million tons). The annual production output of fuel ethanol is over 30 million tons, playing an important role in replacing oil fuel.

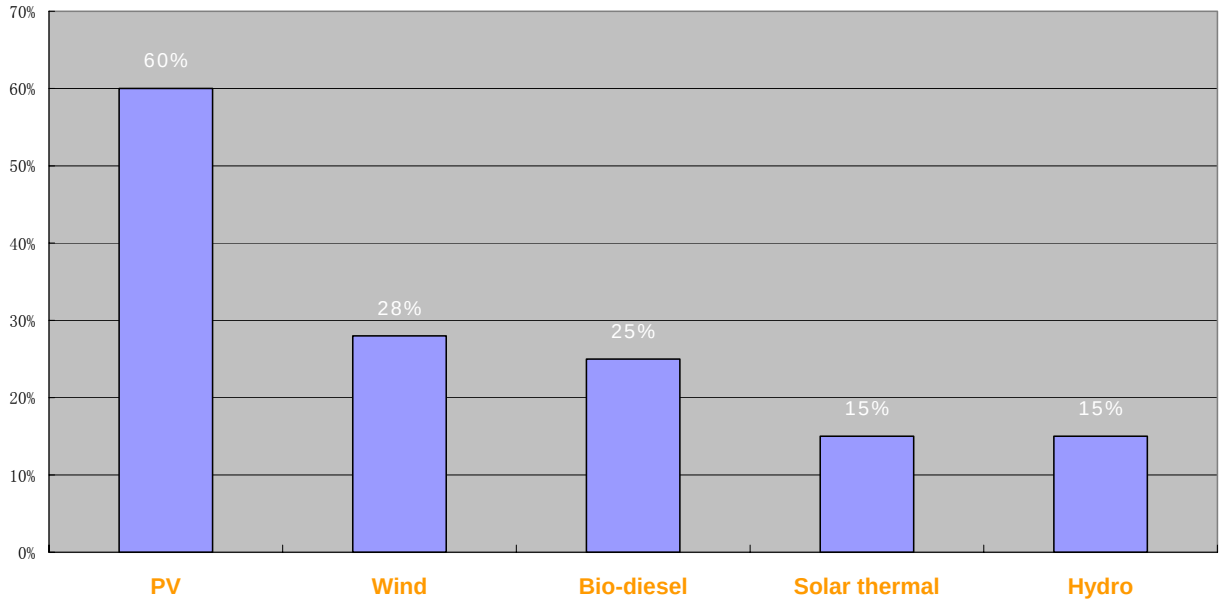

Figure 3 Increase of Renewable Energy in the World (%)

Government policy and support is key in developing the renewable energy market. With respect to the cost and price, the cost of wind power is about 5-10 cents/kwh, and the cost of biomass power is about 8-12 cents/kwh, twice the cost of coal power; the cost of solar PV is about 30-50 cents/kwh, 5-10 times the cost of coal power; the cost of bio liquid fuel is equivalent to 50-70 dollars per barrel. Regarding prices, the application and development of renewable energies depends on government policy in terms of support for a certain period. At present more than 50 countries have implemented laws, regulations and action plans to support the development of their renewable energy markets.

1) America attaches great importance to renewable energy. In 2005, president Gorge W. Bush put forward the strategic plan for the development of renewable energy, i.e. wind power will cover 20% of the total energy supply in the short future; application of bio liquid fuel will double by the year 2012 than that in 2005 and bio liquid fuel will

share 30% of the vehicle fuel market by 2030. Further, the governments of California and Pennsylvania increased their investment to support the application and development of renewable energy technologies, and specifically for wind power and solar PV.

2) The European Union reviewed the target for renewable energy made in 1997 and set a new development direction, target and slogan, including the commitment of reaching a share of renewable energies of more than 20% in the total primary energy generation mix. Targets for each of the renewable energy technologies were also set. The targets for wind power for the years 2010, 2020 and 2030 are 188 TWh, 523 TWh and 965 TWh respectively, that will represent the 5.5%, 13.4% and 22.5 % respectively of the total power generation at that time.

3) Japan initiated the “new sunlight plan” since 1993 in order to accelerate the application and development of solar cell, fuel battery, hydrogen energy and geothermal energy. In 1997, Japan also started the “70 thousand roof program” aiming at 7.6 GW installation of solar cells by 2010. Driven by that program, the solar PV technology developed very fast in 1990s. The solar PV technology and market is developing faster in Japan than in other countries in the world.

4) Brazilian government initiated a bio liquid fuel plan in 1970s, focusing on ethanol fuel obtained from cane and ever since required petrol companies to provide ethanol mixed oil fuel or pure ethanol fuel for vehicles. After 3 decades Brazil became an important country in terms of bio liquid fuel application with an annual output of 15 million tons. Nowadays Brazil does not only provide bio liquid fuel to tens of millions of cars and of motors domestically but also exports millions of tons of fuel to other countries.

The renewable energy technologies are clearly scaling up.

1) Wind power is developing on a large scale. Before 2000, the average capacity of a wind turbine was less than 1 MW, but now higher power wind turbines are being developed. The average capacity of wind turbines installed in 2005 was 2 MW.

Nowadays the 1.5 MW to 3 MW wind turbines are the most popular ones. Besides, 4-5 MW wind turbines are being developed by international wind turbine manufacturers and have began commercial experiments. They are supposed to be put into the market in the next 2 or 3 years. At the same time, wind turbines of over 10 MW are under development. Apart from this, more and more wind farms are being built offshore, which is another future application of wind power especially in countries such as Germany, Great Britain, Denmark and Holland. The research and development of off-shore wind turbines is becoming a major competition area for manufacturers.

2) More and more solar PV systems are being installed in cities instead of remote areas. Grid-connect solar PV is replacing stand-alone systems as the largest market. In 2006, about 900 MW solar PV systems were installed in Germany. These systems are mainly solar PV roof systems or large scale PV stations. Apart from Germany, solar PV, especially grid-connected solar PV, is developing very fast in Japan, Spain and the USA (specifically in Texas and Pennsylvania). Europe, Japan and America already consider solar PV as being the most important alternative energy for the future. It is estimated that solar PV technology will play a very important role around 2030.

3)Liquid bio-fuel technology relied once on crops for raw material, whereas nowadays it depends more and more on non-crops plants and forestry waste. At present, cane (Brazil) and corn are the major raw materials for producing liquid bio-fuel. But large consumption of crops has lead to an increasing price in crops, which can threaten crops and food supply. In this case, non-crops plants and forestry waste will become the next generation of raw materials since they have no conflict with human interests or crops land. America and Europe have spared no efforts in developing a technical roadmap and an industry experiment in producing liquid bio-fuel using cellulose and lignin. It is estimated that the progress for replacing crops with non-crops raw materials will be made within 10-15 years.

4) Focus swifts from high-tech to practical application. In Europe and the USA, besides the rapid development of wind power and solar PV, importance also is given to the application of solar heat, geothermal and distribution of energy supply, which is supposed to be low cost and low technology. The European Union has set the plan for 1 m^3 solar per capita in the future, and East European countries have planned to provide heat to households by wind turbines in winters.

5) Each country is also giving great importance to developing technology for energy storage. Energy storage technology is the best approach to overcome the instability of renewable energy. Europe, the USA and Japan are putting a lot of effort on research and development. At the moment, the most popular way to store the energy is by producing hydrogen through renewable energy.

V. Recommendations on Strengthening the Implementation of Renewable Energy Law

In the long run, China should set up a “unified, comprehensive, cooperative and open” system for legislation implementation and monitoring. China should guarantee the efficient implementation of the laws by using systems that are unified, able to monitor, and cooperative, and at the same time are systems that allow for a comprehensive policy making and social participation.

It is recommended to take the following actions in order to strengthen the implementation of Renewable Energy Law.

First, China should further complete the pricing policies for renewable energy. At present, some notices issued by NDRC have stated that “the price should be determined by administrative department of the State Council based on the bidding process”, which is only a principle. According to practice, the government departments in charge of energy are responsible for organizing the bidding for all projects, which increases the operational cost of both the government and the investors. Therefore, it is advisable that only the price of large scale wind power projects over 100 MW and listed in the national plan should be determined by means of bidding. The price of other medium or small-sized wind power projects should be determined by reference to the price set in the big wind power projects nearby and at a level that is appropriate for the feasibility and profitability of investors.

Specific research should be carried out on the impact of the bidding price system when implementing Renewable Energy Quota policies because it is common practice for some power companies to intensively decrease their bidding price in order to win the bid when taking into consideration the quota responsibility they should take later. Some bidding prices are even being awarded at a price lower than the operational costs. This is having a negative effect on the industry that will end up ruling out independent investors and destroying the interest of power enterprises in investing in wind power in the long term, slowing down the development of the wind industry.

Second, it is recommended to complete taxation policies as soon as possible. At present, MOF is investigating the approaches for financial subsidies and favourable tax policies, as it is indicated in the Renewable Energy Law. It is recommended to decrease VAT for wind power in a reasonable way and at the same time keeping it at an appropriate level in order to encourage local interest in the development of wind power. It is also advised to establish clear mechanisms for offsetting input VAT in the purchase of wind power equipment. Investigating the best configuration of the different policies to lower the investment cost of wind power would also be interesting. These policies include discount interest loans for R&D on local wind turbines, purchase of local wind equipments and wind power projects as well as extending loan periods. The tax policies for high-tech enterprises, renewable energy and electric devices industries should also apply for the solar water heater industry.

Lowering the cost of wind power by supporting local manufacturing of wind turbines is key. It is recommended to eliminate the zero tax policy for importing complete wind turbines in order to limit wind turbines imports. Zero tax policy should apply for importing those components that are not able to be produced domestically, in order to encourage localization and technology transfer of complete wind turbine manufacturing. In the big national wind power projects localization should be a requirement in order to support the development of the wind turbine manufacturing industry in China. Finally, favourable policies should be applied to support the wind turbine manufacturing industry according to the policies for high-tech enterprises and the industry catalogue for renewable energy.

Third, it is recommended to set a target and a medium and long term plan for the development of renewable energy. Specific plans should be made for the wind power, biomass and solar industries. It is very important to later implement these plans in the renewable energy projects organized by local governments. The roadmap for renewable energy should be open to the whole society. It is also recommended to determine the relationship between the renewable energy target and the renewable

energy plan in reference to the Renewable Energy Law and international practice. A clear target should be established first and a specific plan and policies should follow, enabling the target not to be only the overall target for renewable energy plan but also for renewable energy policies. It is strongly recommended to set a compulsory quota for renewable energy excluding hydro power. By the years 2010 and 2020, the electricity generated from non-hydro renewable energy sources should account for more than 1% and 3% respectively of the total capacity of the main grids. For investors who reached a total claimed installed capacity of more than 5 GW, the share of installed capacity of non-hydro RE power should account to 5% and 10% respectively of the total claimed installed capacity. It is also important that the national target is set in terms of electricity production (MW/h) rather than installed capacity (MW) in order to truly reflect the renewable energy generation.

Fourth, the implementation body for the renewable energy plan and its responsibility should be clarified. The national plan for each renewable energy technology should be implemented in each province through local industrial plans. A clear timetable should be made for this implementation. The plan should be implemented periodically and in a sustainable way. It is also important to establish systems for harmonizing the plan, projects, technology and industry. With respect to big projects that are planned and under implementation as for example 30 big wind farms of 100 MW each in “the eleventh five year plan”, an overall timetable should be published as soon as possible to reduce uncertainty. In this regard, it is also advised to pay attention to the electrical grid integration.The electrical transmission network should be extended and upgraded according to the approval of new wind energy projects to ensure their effectiveness.

Fifth, a resources investigation responsibility and some resources investigation projects should be specified. Priority should be given to the assessment of wind and biomass resources. The investigation activities should start as soon as possible. The NDRC and State Meteorology Bureau should arrange a fund for investigating and searching for sites that are suitable for building wind farms. Wind measurements should start at the same time. Besides, the NDRC, The Ministry of Agriculture and the

State Forestry Bureau should arrange a fund for investigating biomass resources. These investigation data should be open to the public as soon as possible to reduce the market uncertainty.

Sixth, the government should support innovation of renewable energy technology. It is recommended to include a scientific research and technology development plan for renewable energy in the national technology development plan. Renewable energy projects should be added to the category of high-tech industry and large equipment support plans. The government should support national research institutes and renewable energy enterprises to innovate in technology and re-creation on foreign technologies. It is also recommended to combine existing renewable energy technology resources, establish comprehensive renewable energy research institutes in charge of researching about policies, strategies and plans for the development of renewable energy. The government should also establish industry service systems and organize big events on renewable energy research and development.

Seventh, it is recommended to set up a reporting system in order to make data and information about the implementation of the law available to the public. The government should improve the information gathering processes for drafting plans, approving projects and setting prices,enabling the public to have access to the policy making information process and have the opportunity to participate in the policy decision process by obtaining their support. In addition, a periodic reporting system on the implementation of the Law should be developed. The energy departments of the State Council and at the provincial government levels should report the implementation of the law to the People’s Congress at the time as they do to the public.

Eighth, it is recommended to strengthen institutional management on energy. A united energy administrative department should be set up to meet the requirements of overall national benefit and comprehensive energy management. This department should be responsible for harmonizing the development and benefiting from the different energy industries, making a comprehensive national energy development

strategy and policies. Based on the principle of the separation of institutional management and supervision systems, it is advised to establish concentrated energy supervision institutes, which would be responsible for supervising the different energy activities according to the laws and rules.

Ninth, it is recommended to reform the institutional approval procedure in order to allow economic management and social monitoring systems on public security, resource application and environment protection. The approval process for renewable energy, excluding hydro power, should be simplified, the approval right should be given to local governments and the whole development process for renewable energy projects development should be clearly established and transparent, allowing for an equal treatment between foreign and Chinese companies.

Tenth, it is recommended to establish an investment and financing system for renewable energy. After guidelines for establishing the priority use of renewable energy are issued, local governments should arrange a special fund to support renewable energy enterprises who own technical patents. Besides, the state-owned banks should provide loans to enterprises that are involved in the priority renewable energy area and obtain financial support from the government.

Eleventh, it is recommended to support the development of industry associations and NGOs. They are encouraged to participate in the policy making process, monitoring and supervising as well as acting as an intermediate service.

Twelfth, it is recommended to increase social awareness of the need of renewable energy. Government and public institutes should be open to the development of renewable energy. Public renewable energy pilot projects should be constructed to show the technology. Big enterprises should be more encouraged to use renewable energy and invest in the development of renewable energy technology, equipment manufacture and renewable energy production. Incentives for grid companies could be introduced to make it more attractive for them to connect renewable power to the electrical grid and thus aligning efforts in the development of the wind industry. It is

recommended to issue “green certificates”, “energy conservation certificates” and “environment protection certificates” to those who voluntary purchase renewable energy at a higher price.

Annex: Application of Renewable Energy in 2006 in China

	Capacity		Annual Production Output		SC Equivalent (10^4 tons/year)
1. Electricity generation	13001	10WM	4018	100MWh	15270.6
Hydro power	12500		3900		14820
On-grid wind power	259.33		51.9		197
Off-grid wind power	7	(350 thousands units)	0.7		3
Solar PV	8		1.0		4
Biomass power	224		63.9		242.8
Bagasse	170		37.4		142.1
Forestry wastes	5		2.0		7.6
Methane	5		2.5		9.5
Waste burning	40		20.0		76.0
Lanfill	4		2.0		7.6
Geothermal Power	2.5		1.0		3.8
2. Gas Generation			100	100 M m3	712
Home methane	2200	10 thousands units	81		577
Large poultry methane	2000	units	4		28
Industry waste water methane	800	units	15		107
3. Heat Generation					3850.3
Solar water heaters	9000	10 thousand m3			3600
Solar cooker	45	10 thousand units			10.3
Geothermal	3000	10 thousand m3	6000	万吉焦	240
Heating	1500	10 thousand m3			
Warm water	60	10 thousand households			
4. Fuel					111
Solid bio-fuel					
Ethanol for vehicles	100	10 thousand tons			100
Bio-oil	8				11
Total					19943.9

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