

Report on China's Renewable Energy Development Strategy:2

The Road Map for the Renewable Energy Development in China

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The principles of the road map establishment

development target of RE

	2006	2020	2030	2050
wind power	2600MW (5906/2007)	80GW	180GW	500GW
solar PV	100MW (2007)	5GW	100GW	800GW
solar thermal utilization	90M m ²	540M m ²	980M m ²	1680M m ²
bio-pellets	thaosand s t	20M t	30M t	50M t
Bio-ethanol 2009-9-2	1.3M t	17M t	50M t	100M t
bio gas	8billion	44billionm	80billion	100billion

Wind power



1. In the short- and medium-term, priority would be placed on the development of onshore wind power. The offshore wind power would be proceeded on a trial basis;
2. Priority needs to be placed on the development of the grid integrated type wind power farm, and at the same time actions should be taken to carry out the scientific research on the distributable power system and the direct wind power bulk sale to the large end-users. When the conditions are matured, the results of the research get to be promoted.



光伏发电的通信基站, 青海, 1992

PV Powered Communication System, Qinghai, 1992

Solar energy



西藏拉萨凯拉斯酒店太阳能热水工程

1. Reducing the cost of photovoltaic power generation: to find solutions from the upper-stream industry chain, i.e. localizing the production of the highly refined silicon materials and enhancing the rate of utilization of the highly refined silicon
2. Promoting by enforcement the thermal utilization of solar energy : to vigorously promote the combined use of the solar energy with the building construction



Biomass energy

1. Coordinating development of Biomass energy with agriculture:
 - not competing with human being in terms of grain and sugar;
 - not competing with grain in terms of land and water;
 - not competing with livestock in terms of feeding materials
2. The comprehensive consideration and the planning by phase on the methods of biomass utilization

Hydropower



1. On the condition of environment and ecology protection, hydropower should be developed on an active and orderly basis. While the hydropower is being developed, the targets of making local economy prosperous and displaced people richer need to be achieved
2. Making the development of hydropower on a better and faster basis: The main task is to construct 13 large-scale hydropower bases. The emphasis is to construct hydropower stations with capacity level of 1 GW and more.

2. Renewable energy development road map

- Heat utilization
- Power generation
- **Transportation Biofuel
and Biomass Alternative for
Petroleum**

solar thermal utilization

- The equivalent amount of heat obtained is 0.156tce (standard coal) per square meter per year, consumed energy in the production process could be reclaimed within the period of 1.1 years (In Beijing area) ;
- By the end of 2006, the installation of solar water heaters in China was 90 million m². The figures of solar water heaters in operation would come to 540 million m² in 2020, 980 million m² in 2030 and 1680 million m² in 2050 respectively. By 2050, the target of the per capita 1 m² of solar heater would be achieved 。

Before 2010

- (1) The main task is to find a solution of how to better combine the solar thermal utilization with the building construction.
- (2) Improve the new national standard on solar energy applications and national test center and certification system
- (3) Solar water heaters from small town to medium and large cities



Before 2020

- (1) R & D of medium and high temperature utilization technology for solar air conditioning, industry and agriculture applications
- (2) Provide combi-system both hot water and solar air-condition, expanding the market
- (3) enhancing the R&D on the flat sheet heat accumulator products and other new products



The biomass heat utilization- Pellets and briquets

- Biomass, normally crop and forestry residues, can be made into pellet and briquette fuels with high energy efficiency and low emission of pollutants by mechanical compaction.
- Only thousands of tons of bio-pellets and bio-briquets were produced in 2006.
- 1, 20,30,50 million tons of bio-pellets will be produced by 2010,2020,2030, 2050.



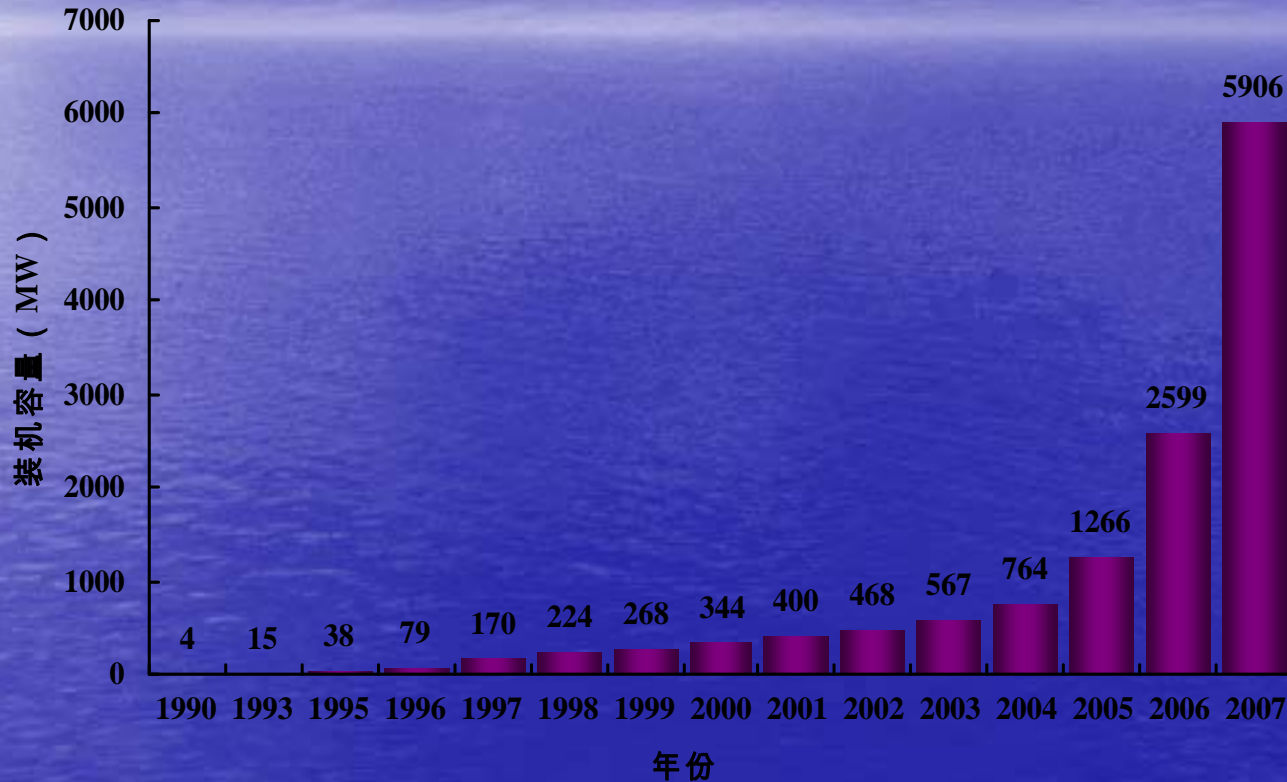
The biomass heat utilization- Biogas

- Developing the biogas in rural areas and the medium and large-scale biogas projects. Trying to achieve the targets of the biogas utilization of 44 billion m³ by 2020 and 80 billion m³ by 2030.
- Enhancing the technical research on selection and breeding of the quality type of shrub and its intensive planting. Developing the wind-proof and drought-resistant type shrub forest with quality of high yield. All these efforts are for the purpose of increasing resources of biomass energy.

2. Renewable energy development road map

- wind power
- solar power
- hydropower
- bio-power

The Situation of Chinese Wind Energy Development from 1990 to 2007



Statistic of total wind power installed capacity in China from 1990 to 2007

Prospects of Chinese Wind Energy

Targets of total Installed capacity

Year	Installed Capacity (GW)
2010	20
2020	80
2030	180
2050	500

Wind power – Basic Route Before 2010

- Three problems have restricted the development of wind power in China. They are wind energy resource detailed issues, grid connection with wind power farm and large scale wind power equipment with independent innovation.
- We will solve these problems before 2010 by national support and market force. We take the strategy of steady development and it will lead to firm foundation in the future

Wind power –

Basic Route Before 2020

- The aim before 2020 is to perfect wind energy industry system, make the cost of wind power close to that of thermal power
- Offshore wind power will become new direction of wind energy development.
- Wind power will play a great role in energy structure.

Wind power –

Basic Route 2020-2030

- Wind power industry and technology become mature, while enlarge domestic wind energy market .
- Construct the Wind Power “ Three Gorges ” with capacity of 10 GW.
- Combination of the direct wind power bulk sale clients with large –scale energy storage devices (off-grid wind farm) become new development direction.

Developing Direction of Chinese Wind Energy Industry

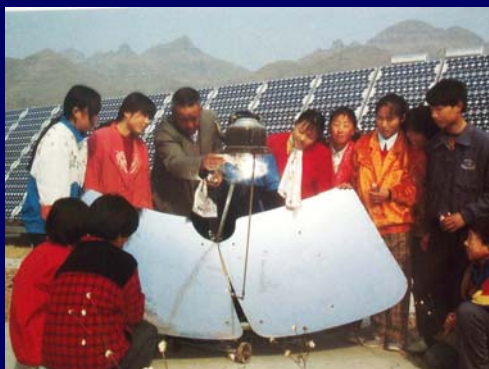
- Establish a perfect wind energy industry system
- Cultivate 3~5 world-class WTGS and components manufacturing enterprises
- Have the large-scale manufacturing ability of 1.5MW~3.0MW WTGS
- Establish standard, test and certification system

Developing Direction of Chinese Wind Energy Industry

- Wind energy resources detailed investigation and numerical simulation
- Offshore wind farm construction
- Wind energy complementary with other energy generating system
- Coordinated development of wind farm and power grids
- Low Frequency and HVDC transmission
- Off-grid wind power applications and large-scale electricity storage

Solar PV before 2010

- crystal silicon solar cell panel with ~20 RMB/Wp
 - Thin film solar cell panel with 16 RMB/Wp
- Reducing energy consumption of Si material
Improving solar cell technology
PV electricity will be around
2.8 RMB/kWh



太阳灶与光伏电站



光伏发电的通信基站, 青海, 1992

PV Powered Communication System, Qinghai, 1992

Solar PV before 2020

- Crystal silicon solar cell panel
with ~ 12 RMB/Wp
- Reducing the thickness of solar cells
- Improving PV efficiency
- Large scale production of high efficiency
of thin film solar cells with ~ 9 RMB/Wp
- PV electricity will be around 1.5 RMB/kWh

Solar PV before 2030

- New material of solar cells
- New structure solar cells
- PV production chain will be completed
- PV electricity will be around 0.7 RMB/kWh, able to compete with regular generation modes.
- With the gradual exhaustion of coal and oil sources, solar PV generation will become strategic energy sources in China .

key technologies of PV

- Crystal silicon cell technology.
- Thin film technology
- To explore technology of some new and high-efficiency cells
- The applied technology of PV generation system

Solar thermal power generation technology

- Before 2020, we'll complete the investigation in direct solar radiation resources, and make a breakthrough in key technology of solar thermal power generation.

The demonstrative experiment of the system will be simultaneously carried out. The relating technologies of solar thermal power generation listed in national Eleventh-Five-Year Plan and 863 Plan should be completed.

- Concentrated Solar Thermal Power (CSTP) will be constructed and tested

Hydro power

- We'll speed up to develop hydro-power resources. We'll construct 13 large-scale hydropower bases, and construct hydro power stations of 1 GW in scale
- The hydro power must be developed regularly on the basis of environmental-ecology protection and immigrants' benefits guarantee.

Goals of Hydropower Development

By 2010 Total 190GW (250M tce)

L/M scale 140GW

Micro-size 50GW

Utilization Rate of hydro resources 30%

By 2020 Total 320GW (370M tce)

L/M scale 245GW

Micro-size 75GW

Utilization Rate of hydro resources 50%

biomass power technology

- to encourage the diversity of the biomass power technology ;
Based on the possibility of the bio-material supply, either large- or medium- and small-scale power generations would be selected ;
- to promote the mixed combustion power technology ;
- to develop the high efficiency medium- and small-scale devices of gasification power generation ,
- to enhance the technical level on the biogas power generation and speed up the development of the poultry farm biogas power generation.

The Target of Bio-generation

- 20 GW of biomass power capacity will be installed by 2020
- 40 GW of biomass power capacity will be installed by 2030.
- Different scales of biomass power by direct combustion, co-firing, and CHP demonstration projects should be essential to develop commercial experience during the next 5 years.

Bio-ethanol

- 1.54 million tons of fuel ethanol were produced from corn and wheat, and used in nine provinces in 2006. but Mass production of bioethanol from food starch or sugar will threat China's food security.
- non-food feedstocks should be used to massively replace petroleum.
- Existing feedstock- cassava, sweet potato and other tuber crops are preferable.
- Emerging feedstock- sweet sorghum should be appreciated.
- Future feedstock- plant biomass will be the main feedstock of bioethanol.

Bioethanol- Before 2010

- Develop the bio-ethanol from starch plants
- Technical demonstration of direct ferment of sugar materials as sweet sorghum will be carried out
- Will pay efforts to make breakthrough in callulosic enzyme hydrolysis technology
- Demonstration of anti-adversity energy plant planting

Bioethanol- Before 2020

- The cellulosic-origin ethanol production technology should go into the application stage
- to make breakthrough in the planting of shrub and grass featured with high output, anti-wind and sand, and anti-drought
- The matching vehicles driven by biofuel will go into the market

Bioethanol- After 2020

- the mass production of fuel ethanol will be realized so that it can replace gasoline. The request for transportation biofuel with higher heat value (such as butane) is on the way.
- We'll also make breakthrough in the plant new technology, reduce the content of lignin, and improve the content of cellulose so that we can provide sufficient materials support for transportation fuel.
- Bioethanol production :17 million tons by 2020
50 million tons by 2030

Biodiesel

- Before 2010, we'll use garbage oil and cottonseed oil to produce bio-diesel with regular technology. we'll carry out fundamental research in new technologies used to produce diesel ;
- Before 2020, the advanced technologies for bio-diesel production will be extensively utilized. The wood-origin oil will become main material for bio-diesel. FT diesel will come go into demonstration phase.
- Biodiesel production : 5 million tons by 2020
20 million tons by 2030

Biodiesel

- After 2020, the industrial and sizable application of FT diesel would be fulfilled;
- demonstrating the technology of direct liquefaction of biomass;
- planting high-yielding, wind-resistant and sand-resistant as well as drought-resistant bush and grass in large area in order to assure feedstock supply of bio-diesel.。

Industrial Products of Biological Medium as Alternative for Petroleum

- Before 2010, the output of biodegradable plastic would reach 1 million tons per year, biomass chemicals would be up to a half million tons per year.
- Up to 2020, the yield from macromolecule such as biodegradable plastic and chemical fibre would reach 8 million tons per year, producing biomass chemicals made from stalk 7200 thousand tons per year.



Thank you