Rural Renewable Energy Development & Promotion Policies in China

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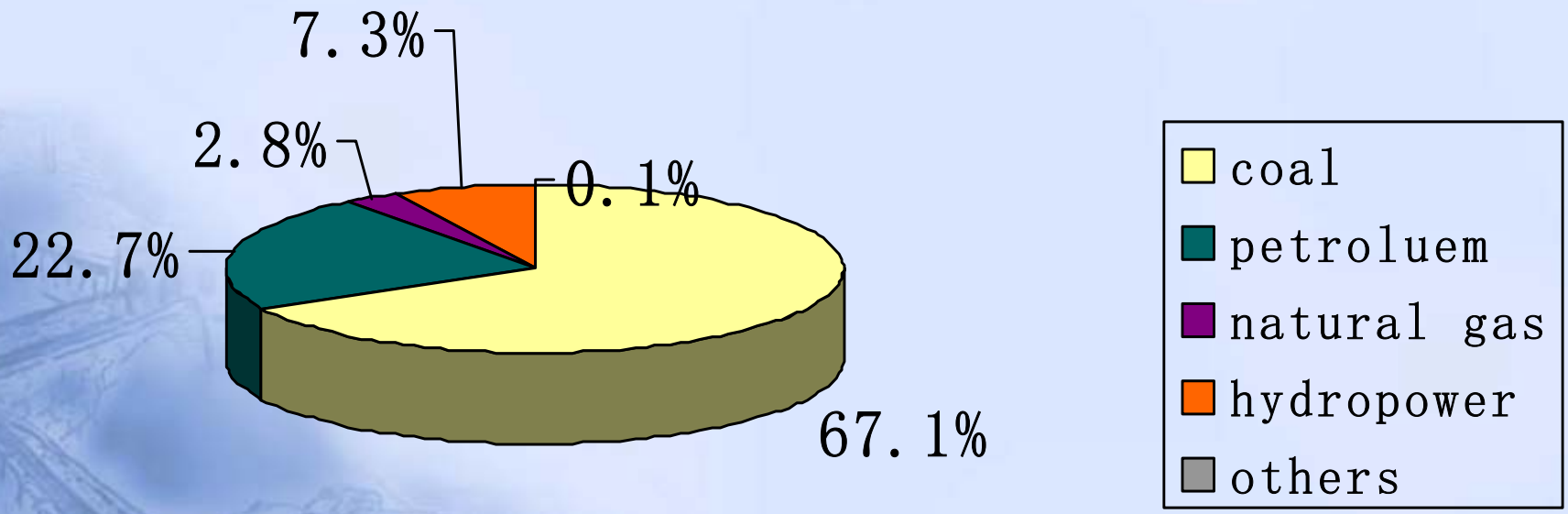
1. Energy Production, Consumption and Demand

Energy Production

- In 2003, the commercial energy production was 1.603 billion tce, increased by 11% than that in year 2002. In which,
- Primary energy sources:
  - energy Coal: 1.667 B tons
  - Crude oil: 170 M tons
  - Natural gas: 34.5 B m^3
- Power generation: 1,900 B kWh, increased by 15.5% than that in 2002.

Energy Consumption

- In 2003, the energy production was 1.68 billion tce totally, increased by 13% than that in year 2002.



Energy Demand

- Overall national economic development goal: GDP doubles twice in 2020 than that in 2000. GDP per capita in 2003 was over 1000 US$, and it should reach 3000 US$ in 2020.
- To achieve the target, the total energy demand is forecasted as 2.3 and 3.0 billion tce respectively in year 2010 and 2020, based on assumptions including technical progress, adjustment of economic development structure, adoption of high-efficient energy utilization measures etc..
- By 2020, it is estimated that reliability on international market of oil and natural gas would reach 60% and 40% respectively.
- In 2050, GDP per capita is expected to reach 12000 US$, triple times than that in 2020. And the total energy demand would be around 7.0 B tec, twice as that in 2020.

Constrains of Energy Development

- Shortage on energy resource availability
  - Total energy reserve: 820 B tec;
  - Total energy exploitable: 150 B tce, 10% of the world total and mainly coal;
  - Per capita Chinese possession:
    - Coal: 70% of the world average;
    - Oil: 10% of the world average;
    - Natural gas: 5% of the world average;
  - Rich in hydropower resources
- Too much rely on coal – resulting in heavy environment pollution
  - Coal consumption in first energy consumption: 67.1%;
  - 90% of total SO_2 emitted and 70% dust in atmosphere are from coal combustion;
- Backwards energy utilization technology with low efficiency
  - Average total energy utilization efficiency is around 32%, 10 % lower than advanced countries;
  - Output efficiency of resource is much lower than the world advanced level;
  - The output efficiency of resource in China is 28.6% of that in US, 16.8% of that in EU, and 10.3% of that in Japan.

2. Renewable Energy Resources & Development

Hydropower

- Resources
  - Economically exploitable hydro resource: 390 M kW that can yearly generate about 1700 B kWh of electricity.
  - Among which, small hydropower resource (definition of small hydropower: total installed capacity < 50,000 kW): 125 M kW and widely distributed in over 1600 counties
- Development status
  - By 2003, the total installed capacity of existing stations were 90 M kW, in which 30 M kW is small hydropower stations. Another 50 M kW of stations are being constructed.

Wind energy

- Resources
  - Exploitable installed capacity inland: 250 M kW;
  - Exploitable installed capacity off-shore: 750 M kW.
- Development status
  - Installed capacity of grid-connected wind generators: 570,000 kW;
  - Off-grid small-scaled wind generators: 180,000 sets with an total installed capacity of 35,000 kW;
  - Wind energy resource is being re-evaluated, and a pre-feasibility study on 30 large-scaled wind farms are being done.

Solar energy

- Resources
  - Two third of the national territory are with the yearly sun-hours over 2,200;
  - Total annual sunshine radiation: 3,340-8,400 MJ/m^2.
- Development status: By 2003, the following solar energy utilization facilities have been installed:
  - PV panel:
    - 50,000 kW, mainly for remote households, transportation, and communication;
    - There are over 10 PV panel manufactures/ assemblers with a total production capacity of over 20,000 kW/y.
  - Solar water heaters:
    - 52 M m^2 were being used, 40% of the world utilization amount;
    - Annual production: 12 M m^2 of heaters;
    - One square meter solar water heater can save around 120 kgce.

Biomass

- Resources

  Totally, it is estimated that about 500 M tce of biomass can be used yearly.
  - Annual crop residue production: over 600 M tons, of which 350 M tons are available as energy use, equivalent to 150 M tce;
  - Organic waste water from industries and livestock farms can be fermented to produce about 80 M m^3 of biogas, equivalent to 57 M tce;
  - Firewood forestry and waste from wood processing: equivalent to 200 M tce;
  - Annual municipal solid waste production: 120 M tons, and estimated to reach 210 M tons by 2020.
- Development status
  - Household-scaled biogas digesters: 13 M sets with annual gas production of 3.3 B m^3;
  - Large/medium biogas plants: 2200 places with a yearly gas production of 1.2 B m^3;
  - Total installed capacity of biomass-fueled power generation: > 2 M kW, mainly bagasse, rice husk, biogas, wood processing wastes, municipal solid waste, etc.

Others

- Geothermal energy:
  - popularly used in residential space heating and agricultural production where with rich resources;
  - Heat pump: with a prospective future, especially for heat supply in buildings.
- Ocean energy:
  - mainly tide energy power generation. Little practical use due to its limited source and high cost.

3. National Renewable Energy Development Plan

- **Hydropower:**
  - **By 2020, total installed capacity: 75 M kW to replace 80 M tce;**
  - **By 2030, most of the small hydropower resources should be exploited and the installed capacity 100 M tce.**
- **Wind power:**
  - **By 2020, total installed capacity: 20 M kW to replace 15 M tce;**
  - **By 2030, most of the small wind power resources should be exploited and the installed capacity 50 M tce.**

National Renewable Energy Development Plan

- **Biomass energy by 2020 :**

  Key technologies used to convert biomass into clean gas, bio-fuels, electricity etc.
  - **Total installed capacity of biomass-fueled power generation: 20 M tce;**
  - **50 M households with biogas digesters to produce 12.5 B m^3 of biogas, equal to 9 M tce;**
  - **Biogas produced from wastes from industries and livestock farms: 10 B m^3 ;**
  - **210 M tons of municipal solid wastes will be produced annually. Considering to use 30% of them as combustion power generation and 60% as landfill to produce biogas, then the installed capacity can reach 2.5 M kW.**
- **Solar energy by 2020:**
  - **Total area of solar water heaters: 270 M m^2 ;**
  - **Total installed capacity of PV panels: 1 M kW.**

4. Rural Renewable Energy Development

In general, rural households are decentralized located in remote areas with low afford ability and accessibility to conventional fuels.

- Average annual net income per rural capita: 2,622 RMB yuan, while

  urban citizens: 8,472 RMB yuan

Rural energy consumption:

- Low per capita energy consumption: 0.396 tce per capita;
- Big share of biomass energy in total energy consumption and of coal in total fossil fuel consumption:
- Low energy use efficiency: cooking stoves: ～10%
- Large number of off-grid rural residents: 30 M households without grid power supply

National Rural Energy Consumption in 2001

	Total energy consumption for life	Per capita average	Of which, Total biomass consumption	Per capita biomass consumption	Share of biomass in the total
	M tce	tce	M tce	tce	%
National	370.134	0.396	182.120	0.195	49.2
Eastern China	129.360	0.379	51.744	0.152	40
Middle China	140.887	0.452	70.443	0.226	50
Western China	99.887	0.356	59.932	0.213	60

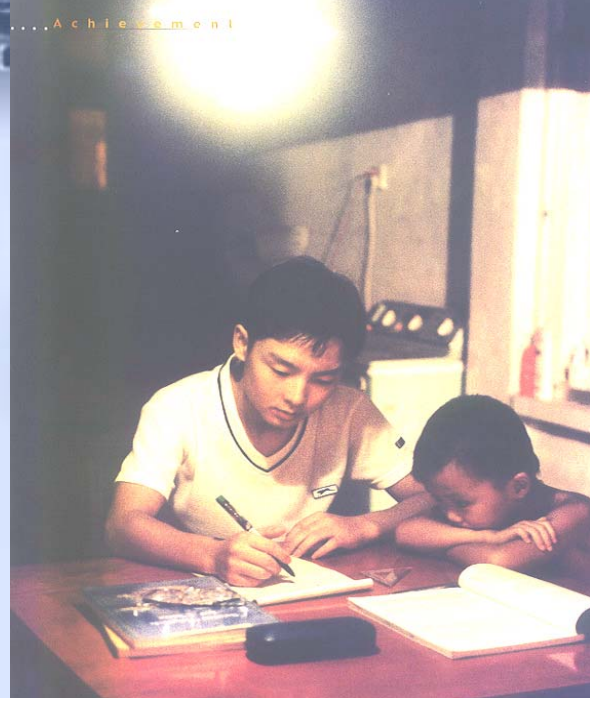
Rural Renewable technologies popularized in China

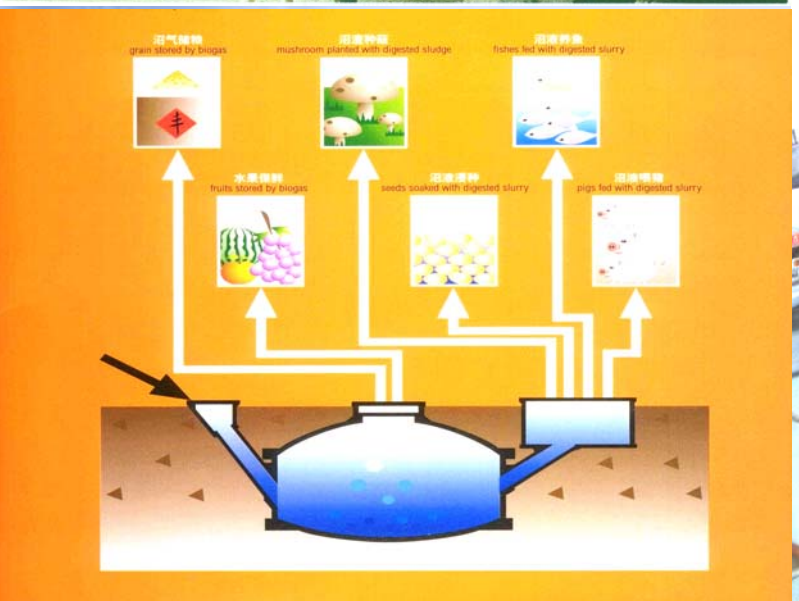
Rural renewable energy technologies popularly extended in China include:

- Biomass energy – biogas, crop residue gasification;
- Solar energy – water heaters, cookers, houses, rural family-sized PV systems；
- Mini hydropower generators；
- Energy efficient stoves (firewood and coal) & Kangs (brick-constructed bed used in Northern China;
- Small – scale off-grid wind power generators.

Rural family-sized biogas digesters:

disseminated to 11 Million households



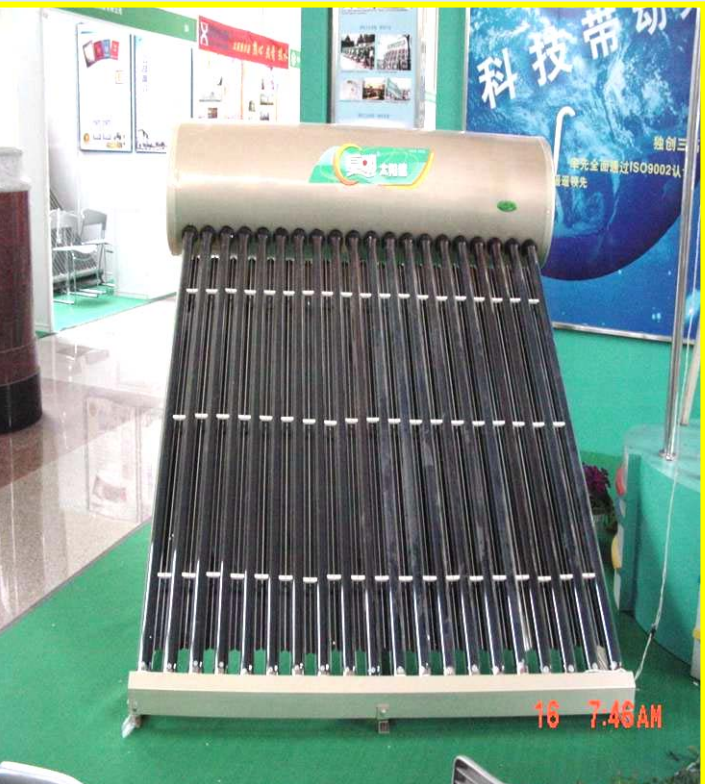


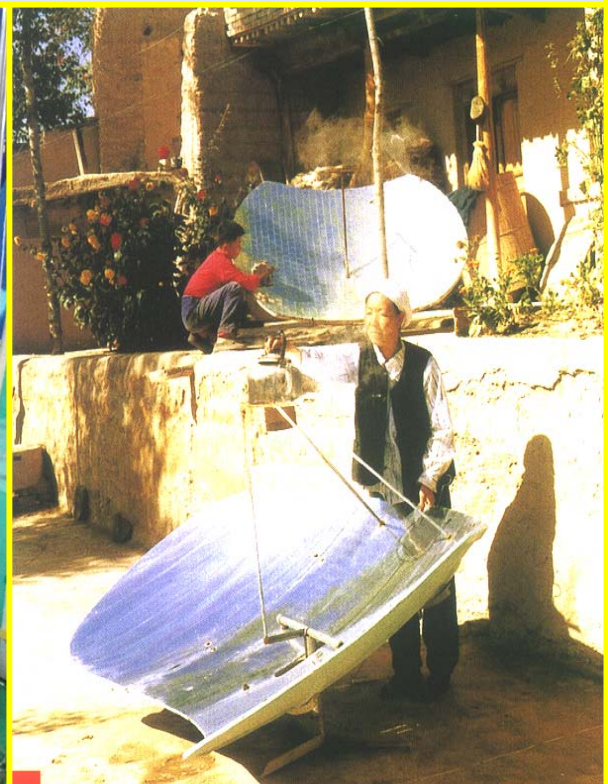

Large/medium biogas plants at
intensive livestock farms：1,171 plants
'95 12 9

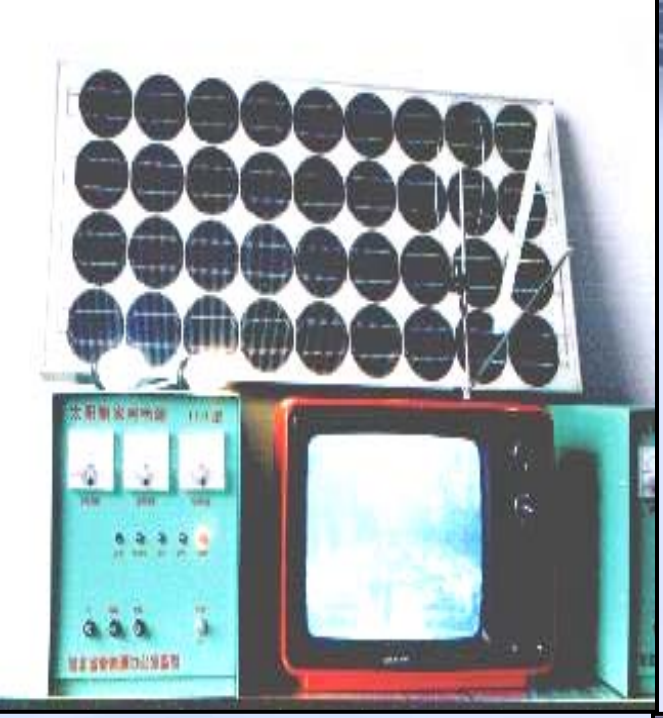
- Energy efficient stoves：189 M households；
- Energy efficient Kangs：20.08 M sets

Crop residue gasification plants for central gas supply： 426 plant providing gas to 82,100 households

- Solar water heaters：over 20 M m^2
- Passive solar houses:10.95 M m^2
- Solar cooker：390,000 sets







Small-scale wind generators: 23 MW

Family-sized PV systems: 15 MW

Mini hydro power generators: 173MW

5. Category of Chinese RE Policy

- Guidelines and directives
- Economic incentives
- RE technology R&D
- Information campaign

Guidelines and Directives

- 21st Century Agenda for China
- Countermeasures on Environment and Development
- Guidelines for new and renewable energy development of during 1996-2000 and target for 2010
- Electricity law
- Energy conservation law
- RE industry development planning
- Five-year RE energy development plan

Economic incentives

- RE technology cost subsidies

  - household biogas digester (800-1,200 Yuan each system)

  - household wind generators (200 Yuan per 100W).

- RE price subsidy

  - electricity price from wind farms

Economic incentives (continued)

- Government credit and interest rate subsidy
  - wind farm projects
  - loan interest subsidy
- Tax relief
  - value added tax (central government)
  - Income tax (local government)

RE Technology R&D

- Most (Ministry of Science and Technology) key research program
- MOA (Ministry of Agriculture) scientific research program

Information Campaign

- Demonstration projects by MOA and MOST

  - MOA: biogas, energy-efficient cookstoves, biomass gasification etc

  - MOST: Gasification-based biomass power generation, biogas power generation, etc.

  - Ministry of Water Resources: hydropower stations

  - National Bureau of Forestry: firewood forestry plantation

- Training

RE Policies under Discussion

- Renewable Portfolio Standard (RPS)

  RPS is a quantity-based policy that establishes a target quantity of renewable energy to be included in the electricity mix by a specific date.

- Feed-in Tariff

  A feed-in tariff is a price-based policy that specifies the price to be paid for renewable energy.

- Public Benefit Fund (PBF)

Promotion Law on RE Exploitation and Utilization

- The Environment and Resource Protection Committee of the People's Congress has started the process of drafting *Promotion Law on RE Exploitation and Utilization* since Sept. of 2003. It is anticipated that the law would be officially approved by the People's Congress in 2005.

- Two versions from two drafting teams:
  - NDRC
  - Tsinghua University

Draft version by NRDC

Overall objectives of the national renewable energy development:

- By 2010, the renewable energy utilization takes account for 5% of the total national energy consumption, and by 2020 10%.
- Generators with total installed capacity over 5 M kW should have not less than 5% of renewable energy power installations in the total (excluding hydropower generation) by 2010, and by 2020, not less than 10%.

Draft version by Tsinghua University

- Eight chapters detail as:
  - Chapter I: General principles
  - Chapter II: Feed-in of RE power generation
  - Chapter III: Other uses of RE
  - Chapter IV: Specific regulations
  - Chapter V: Technical progress
  - Chapter VI: Measures on financial taxation and check
  - Chapter VII: Regulatory obligations
  - Chapter VIII: Supplementary

Conclusion

- The energy demand will increase dynamically along with the national economic development in China.
- The renewable energy will take more share in energy consumption due to the considerations on environmental protection and energy security.
- To develop renewable energy in rural China will be a long-term target to improve the living condition of farm households and ensure a sustained agricultural and rural development.
- The Chinese governments will put greater efforts to promote renewable energy development by launching laws and regulations and setting up market-oriented mechanism etc., which not only benefits to China, but also thus contribute to global environmental protection.

Thank You ！

For More Information…

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