

中国农村能源与气候变化

Effort on Rural Energy and Climate Change in China

李景明

农业部农业生态与资源保护总站首席专家
中国沼气学会副理事长

中国云南昆明
2017年9月

LI Jingming

Chief Expert
Rural Energy & Environment Agency (REEA)
Ministry of Agriculture (MOA)

Vice President
China Biogas Society (CBS)

Kunming, China
September, 2017



目 录

Contents

- 中国农村能源建设情况
Rural Energy Development in China
- 中国农村能源对气候变化的贡献
**The Contribution of Rural Energy to
Climate Change in China**
- 几点结论
Conclusions



能源消费

Energy Consumption

2015年能源消费与经济发展

(资料来源: 世界银行、国家统计局)

Energy consumption and economic development in 2015

Sources: World Bank, National Bureau of Statistics)

		全球 The World	中国 China	中国农村 Rural areas of China
GDP	万亿美元 Trillion Dollars	77.3	10.98	0.99
总人口 Total population	亿人 Hundred million	73.16	13.74	6.03
人均GDP Per capita GDP	美元/人 Dollars/person	10138	7990	1642
总能耗 Total energy consumption	亿吨标煤 Hundred million tons of coal equivalent	187.8	43.6	6.5

2015年, 中国消费了全球23.3%的能源, 养活了世界18.8%的人口, 为全球贡献了15%的GDP, GDP总量排名第2名, 但人均GDP排名第76名。中国农村只消费了全国14.9%的能源, 却养活了43.9%的人口, 但仅为国家贡献了9%的GDP。

In 2015, China, with the world's 18.8% population, takes up 23.3% of the world's total energy consumption, contributing 15% of the total GDP of the world and ranking as the second in terms of the total GDP. While on the other hand, the per capita GDP only ranks No. 76. The rural areas of China only consumes 14.9% of China's energy by 43.9% of China's total population, while contributing only 9% for China's GDP.

农业部农业生态与资源保护总站

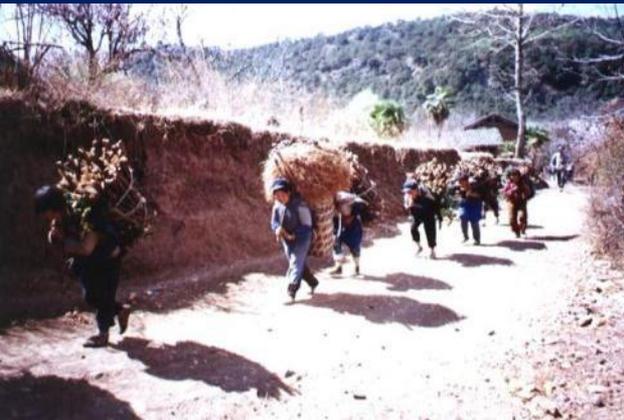
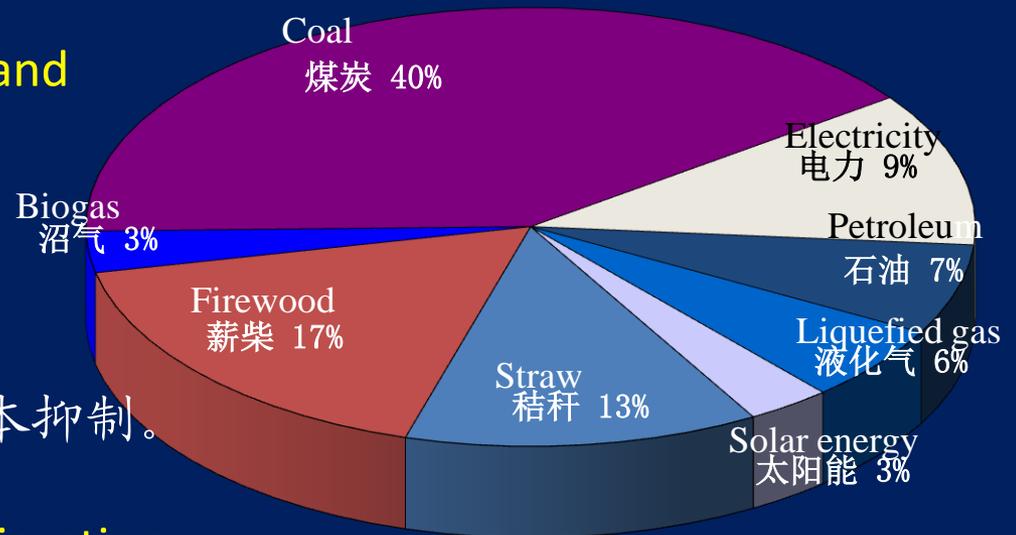
Rural Energy & Environment Agency, Ministry of Agriculture, P.R.China



能源消费

Energy Consumption

- 主要用能形式为生物质能和煤炭;
Mainly in forms of biomass energy and coals;
- 室内空气污染很严重;
Serious indoor air pollution;
- 环境和生态恶化趋于未能得到根本抑制。
Failure to completely control environmental and ecological deterioration.





能源消费

Energy Consumption

- 畜禽粪污随意排放和秸秆焚烧现象较为普遍，既污染了环境又浪费了资源；
Random discharge of livestock and poultry excrement and straw burning which causes pollution to environment and damage of resources;
- 许多城市出现严重的雾霾天气，导致部分地区高速公路关闭，机场飞机被迫停止即将起降，造成很大的社会影响。
Severe hazy weather occurred in many cities which cause the highway in some areas closed and airplanes not to operate properly and thus lead to huge social impacts.





政府支持

Governmental Support

- 中国政府始终认为农村能源作为国家能源战略的一个重要组成部分，在优化能源结构、节能减排、改善农民生产生活条件、增加农民收入、改善农村生态环境和缓解气候变化方面有不可替代的作用，且具有绿色、低碳、清洁、可再生等特点。

The Chinese government always holds that rural energies acts as an important component of China's energy strategy, and it has an irreplaceable role in aspects of energy structure optimization, pollution emission reduction, improvement of production and living conditions of farmers, increase of farmer income, rural ecological environment improvement and mitigation of climate change. And on the other hand, it also has advantages of being green, low-carbon, clean and renewable.





政府支持

Governmental Support

- 建国以来得到各届政府领导的关心和支持;
Leaders of Chinese central government have shown care and support since the founding of the P.R.C.;
- 中央政府已投入超过420亿元;
The central government has invested over 42 billion yuan;
- 多个全国性法律明确支持, 10多个省出台了地方法规;
Numerous national laws show support and over 10 provinces prepare local regulations;
- 有关部委出台了相关的激励和支持政策。
Relevant departments and committees establish incentive and supportive policies.





颁布法律

Laws Issued

- 《可再生能源法（修正案）》（2006/2009）
Renewable Energy Law (Amendment) (2006/2009)
- 《节约能源法》（1997/2007）
Law on Conserving Energy (1997/2007)
- 《循环经济促进法》（2008）
Circular Economy Promotion Law (2008)
- 《电力法》（1995/2015）
Electricity Law (1995/2015)
- 《环境保护法》（1989/2014）
Environmental Protection Law (1989/2014)
- 《环境保护税法》（2016）
Environmental Protection Tax Law (2016)
- 《能源法》（正在制订中）
Energy Law (in preparation)





颁布法律

Laws Issued

□ 以鼓励和引导为主

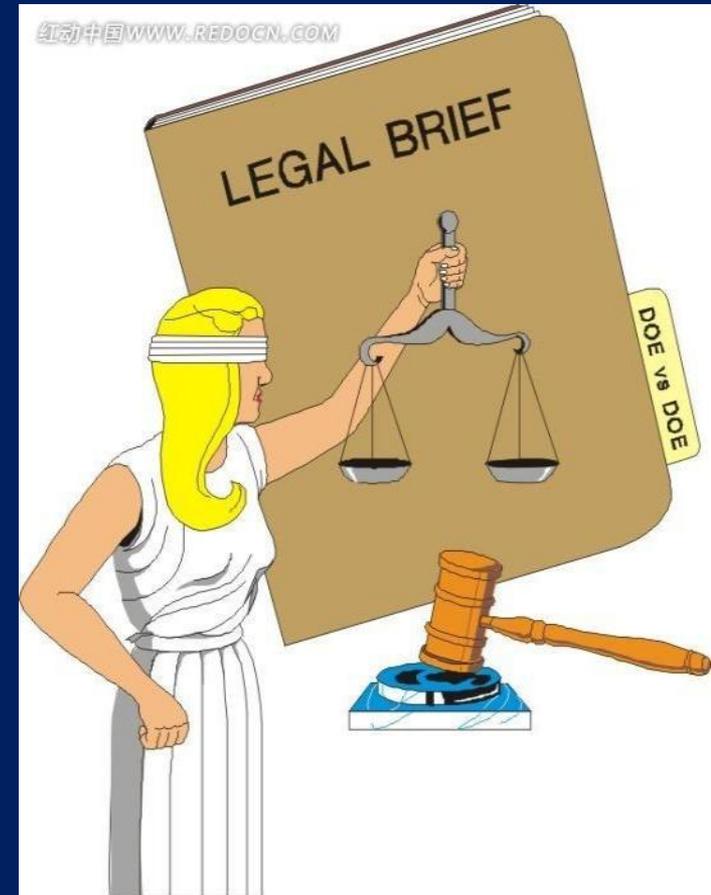
Mainly used to encourage and guide

- 要求所有的公民、企业和机构都要严格遵守；
All citizens, enterprises and organizations shall strictly abide by the laws;
- 要求各级政府都要支持，制定明确的定额目标；
All governments shall support the laws and establish clear quota targets.

□ 以限制和约束为辅

Supported by limitation and restraints

- 限制某些特定区域使用高污染化石能源，以及对大气、水源和土壤的污染排放；
Limit the use of high-pollution fossil fuels in some areas and restrain pollution discharging to the air, waters and soils;
- 利用罚款和纳税手段。
Make use of fines, taxes and other methods.



农业部农业生态与资源保护总站

Rural Energy & Environment Agency, Ministry of Agriculture, P.R.China



出台政策

Policies released

- 国家发改委、财政部、农业部、环保部相继出台了一系列推动农村能源建设与发展的政策

The NDRC, MOF, MOA, MOEP and other government agencies have releases a series of policies to promote construction and development of rural energies

- 可再生能源发电上网补贴政策，对生物质发电、太阳能光伏发电和风力发电上网执行不同的电价；
Provide subsidies for electricity generation and on-grid energy of renewable energy, and implement different electricity price for on-grid energy of biomass power generation, photovoltaic power and wind power;
- 对于利用农作物秸秆进行能源化利用给予补贴；
Provide subsidies for energy utilization by making advantage of crop straws;
- 对于以畜禽粪便为原料进行资源化利用给予补贴；
Provide subsidies for energy utilization by using livestock and poultry excrement as raw materials;
- 对沼气工程建设给予基础设施投资补助；
Provide infrastructure investment and subsidies for biogas project and construction.



制定规划

Plans Developed

□ 《可再生能源中长期发展规划（2006-2020）》

Medium and Long-term Development Plan for Renewable Energy (2006-2020)

- 到2020年，可再生能源（非化石能源）将占全国能源消费总量的15%，发电将占全国发电总量的20%；

By 2020, the renewable energy (non-fossil energy) will account for 15% of the total national energy consumption, and its electricity generation will account for 20% of the total electricity generation in China;

- 到2030年，可再生能源（非化石能源）将占全国能源消费总量的20%，全国污染物排放达到峰值。

By 2030, the renewable energy (non-fossil energy) will account for 20% of the total national energy consumption, and the discharge of pollutants around the country will reach its peak.



制定规划

Plans Developed

□ 《生物质能发展“十三五”规划（2016-2020）》

13th Five-year Plan for Biomass Energy Development (2016-2020)

- 年利用量约5800万吨标准煤，发电总装机容量达到1500万千瓦，年发电量900亿千瓦时，约占全国发电总量1%。其中，沼气发电装机50万千瓦；

The annual utilization quantity will reach about 58 million tons of coal equivalent, the total installed power generation capacity will reach 15 million kilowatt, the annual energy production will reach 90 billion kWh which accounts for about 1% of the total national electricity generation. Of which the installed power generation capacity of biogas will reach 500000 kilowatt;

- 液体燃料年利用量600万吨，生物质成型燃料3000万吨。

The annual utilization quantity of liquid fuel will reach 6 million tons, and 30 million tons for biomass briquette fuels.



制定规划

Plans Developed

□ 《全国沼气发展“十三五”规划（2016-2020）》

13th Five-year Plan for National Biogas Development (2016-2020)

- 到2020年，新建规模化生物天然气工程172个，新建规模化大型沼气工程3150个，新建中小型沼气工程25500个。

By 2020, there will be 172 newly-established large-scale bio-natural gas projects, 3150 newly-established large-scale biogas projects, and 25500 newly-established medium and small-scale biogas.

- 新增沼气生产能力约50亿立方米，总量达到200亿立方米左右；

With an increase of 5 billion cubic meters of biogas production capacity, the total production will reach about 20 billion cubic meters;

- “十三五”期间农村沼气工程总投资500亿元。

The total investment for rural biogas projects during the 13th Five-year Plan will be 50 billion yuan.



实施示范工程

National Programs

- 省柴节煤炉灶炕试点县项目;
Pilot county projects for firewood- and coal-saving stoves and Kang bed-stoves;
- 农村沼气推广项目及转型升级试点项目;
Biogas promotion project and transformation & upgrading pilot projects in rural areas;
- 秸秆综合利用项目;
Projects for comprehensive utilization of straws;
- 畜禽粪污处理及资源化利用示范县项目;
Modeling county projects for treatment of livestock and poultry excrement and resource utilization;
- 果菜茶有机肥替代化肥试点县项目;
Pilot county projects for replacing chemical fertilizers with organic fertilizers;

➤

农业部农业生态与资源保护总站

Rural Energy & Environment Agency, Ministry of Agriculture, P.R.China



健全体系 Framework Improvement

- 全国已经形成从中央到地方的管理与推广、研究与开发、培训与质检体系，从业人员4万人；

China has formed a system of management and promotion, research and development and training and quality inspection system from the central and the local government, with employees of about 40000;

- 已有省级实训基地18个206人；地（市）级服务站62个328人；县级服务站1178个6159人；乡村服务网点11.2万个18.6万人，服务农户3304万户；

There are 206 people enrolled in the 18 provincial-level training bases; 328 people enrolled in the 62 prefecture (city)-level service stations; 6159 people enrolled in the 1178 county-level service stations and 186000 people enrolled in the 112000 rural service outlets, providing service to 33.04 million households;

- 培养了一支40.8万人的农民技术员队伍。其中包括沼气生产工、沼气物管员、农村节能员、太阳能利用工。

We also have a team of farmer technicians involving 408000 people, including biogas producers, biogas storehouse keepers, rural energies-saving staffs and solar energy utility workers, etc..

农业部农业生态与资源保护总站

Rural Energy & Environment Agency, Ministry of Agriculture, P.R.China

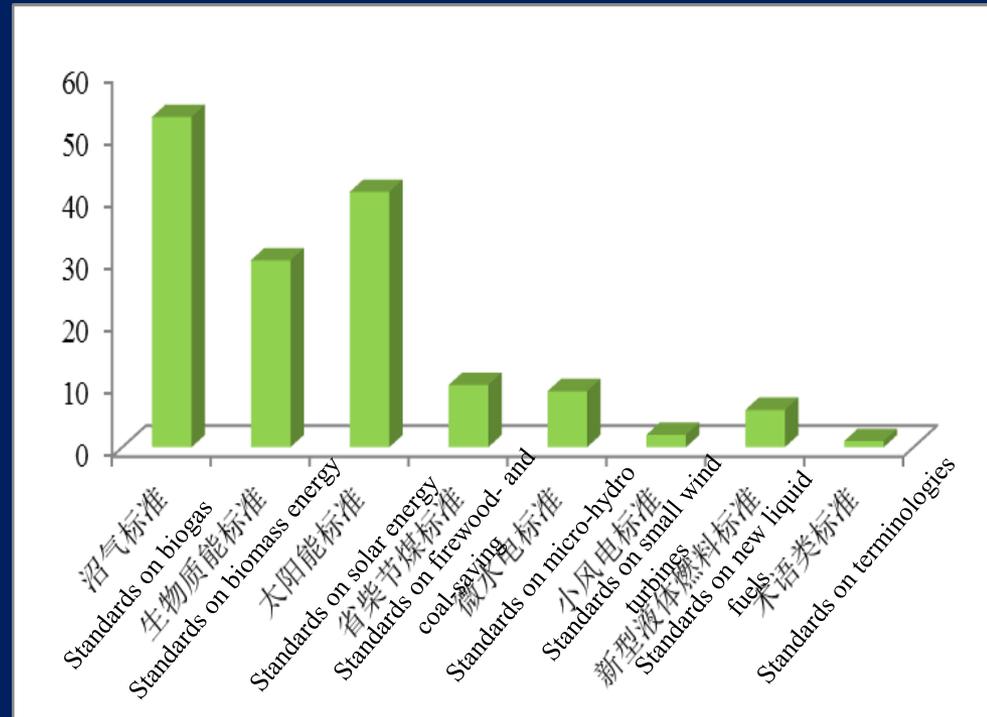


注重标准

Standard System

- 通过加强基础研究和技术创新，农村能源标准体系已经形成；
By strengthening basic research and technological innovation, a standard system has been formed;
- 已经颁布实施的农村能源标准为152项；
There have been 152 standards on rural energies issued and implemented;
- 成立了全国沼气标准化技术委员会，承担了国际标准化组织沼气技术委员会秘书处的的工作。

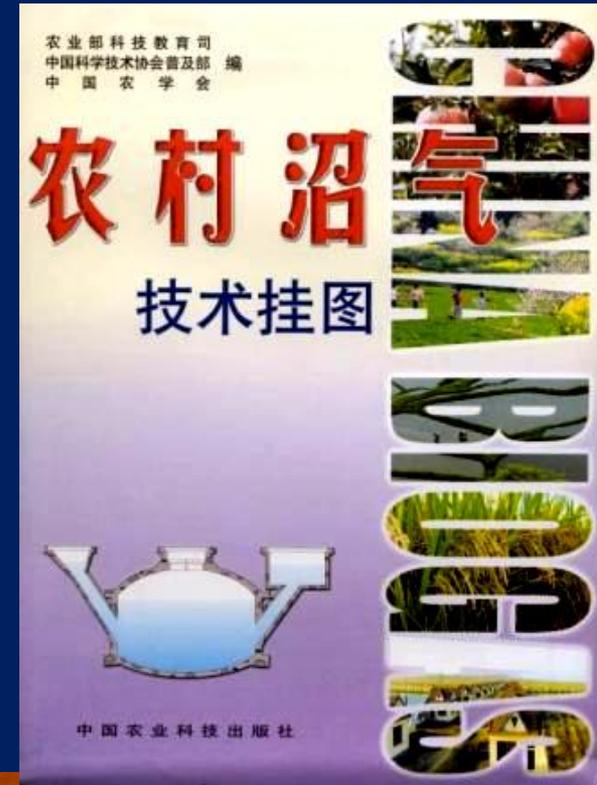
The National /International Biogas Standardization Technical Committee , SAC/TC515 and ISO/TC255 has been established





培训与教育 Trainings and Education

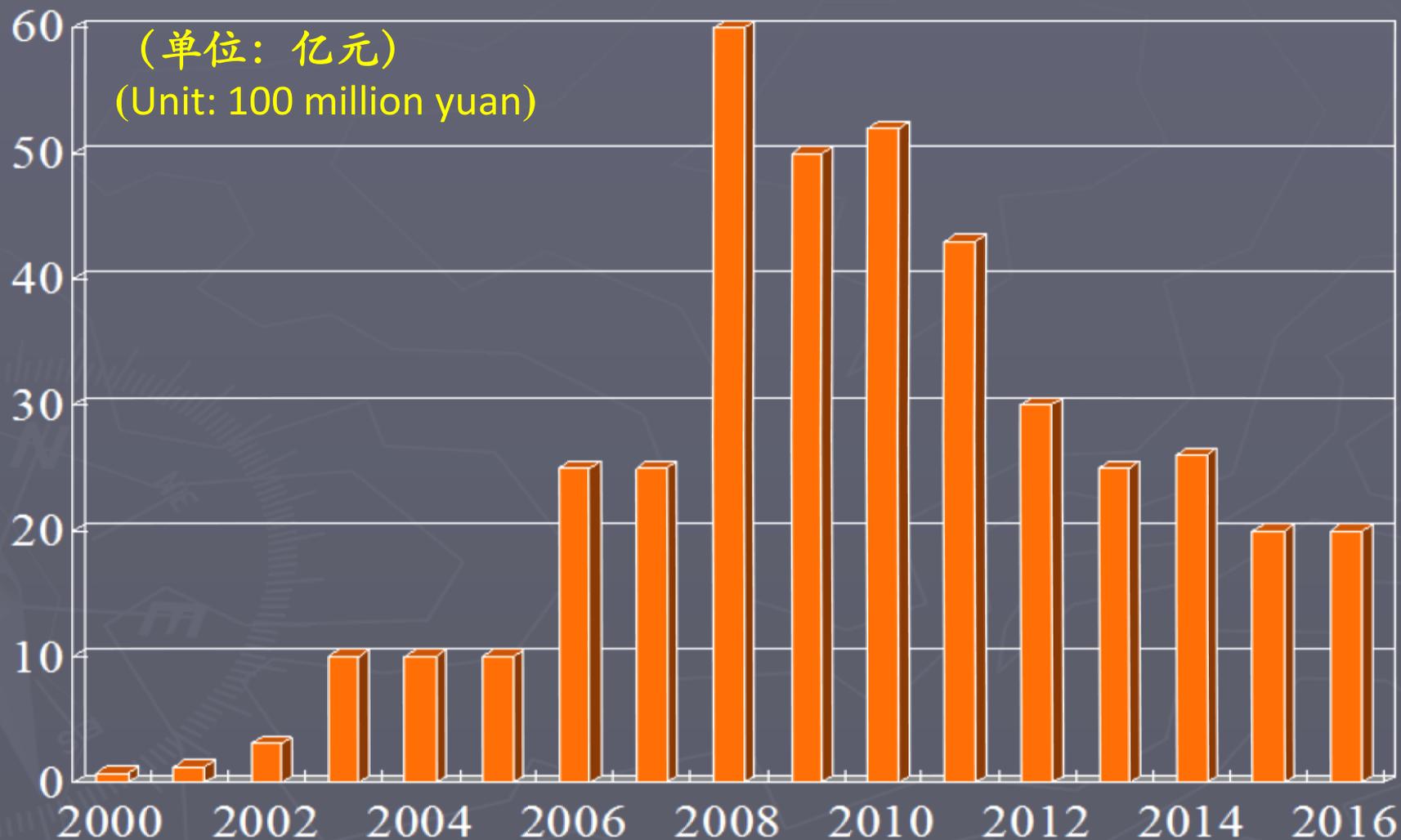
- 在各农业院校设立农村能源专业;
Establish rural energies majors in agricultural universities and colleges;
- 每年编印各种培训教材, 并在广播、电视台开设专栏节目;
Compile and print training materials each year and set up special program in on the radio and televisions;
- 每年组织各种类型的培训班, 培训各级管理、科技人员和农民技术员。
Organize all kinds of training classes each year to train the management, scientific and technical personnel as well as peasant technicians.





大力投入

Big Input





省柴节煤炉灶炕 Clean stoves and Kangs

- 开展研发、评比和创新;

Conduct research and development, evaluation and innovation;

- 制定产品和技术标准;

Prepare products and technical standards;

- 灶: 增加烟囱和篦子, 减少散热, 10%→30%

Stove: increase chimneys and strainers to reduce heat dissipation, 10%→30%

炉: 改变炉膛和燃料, 增加功能, 20%→40%

Furnace: change furnace chamber and fuels to increase functions, 20%→40%

炕: 改善烟道, 改变传统落地炕, 30%→60%

Kang: improve flue and change the traditional landing Kangs, 30%→60%





Firewood- and coal-saving stoves in 115 million households

- 节能炉3153万个
31.53 million energy-saving furnaces
- 节能炕1858万铺
18.58 million energy-saving Kangs

- 中国炉灶联盟和全球清洁炉灶联盟
China/Global Alliance for Clean Cookstoves

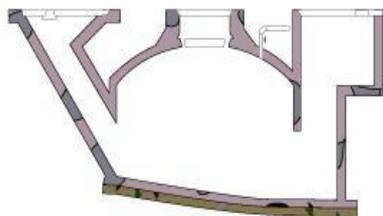




户用沼气 Rural Household Biogas

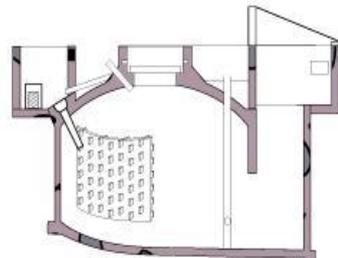
- 传统砖混和水泥现浇水压式;
Traditional brick-concrete structure and cast-in-place & hydraulic style biogas digester;
- 研发出玻璃钢、塑料等新材料商品化产品;
New materials and commercialized products such as fiber-reinforced plastic and plastics are developed;
- 由单一解决能源向综合利用和综合效益转变;
Conversion from only solving the energy problem to achieving comprehensive utilization and comprehensive benefits;

Bottom discharging hydraulic biogas digester



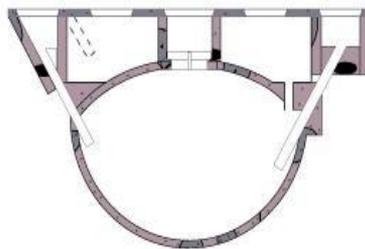
底层出料水压式沼气池

Automatic circulated biogas digester with rotational-flow material distribution



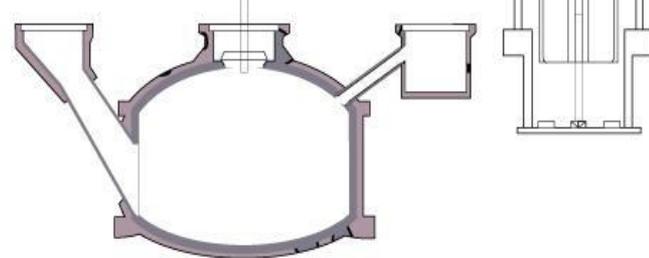
旋流布料自动循环沼气池

Strong back-flow biogas digester



强回流沼气池

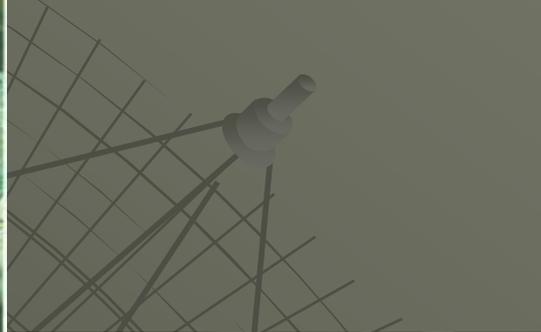
Separated gas-storing and floating cover biogas digester



分离贮气浮罩沼气池

农村户用沼气池4193万户，年产沼气能力123.2亿立方米

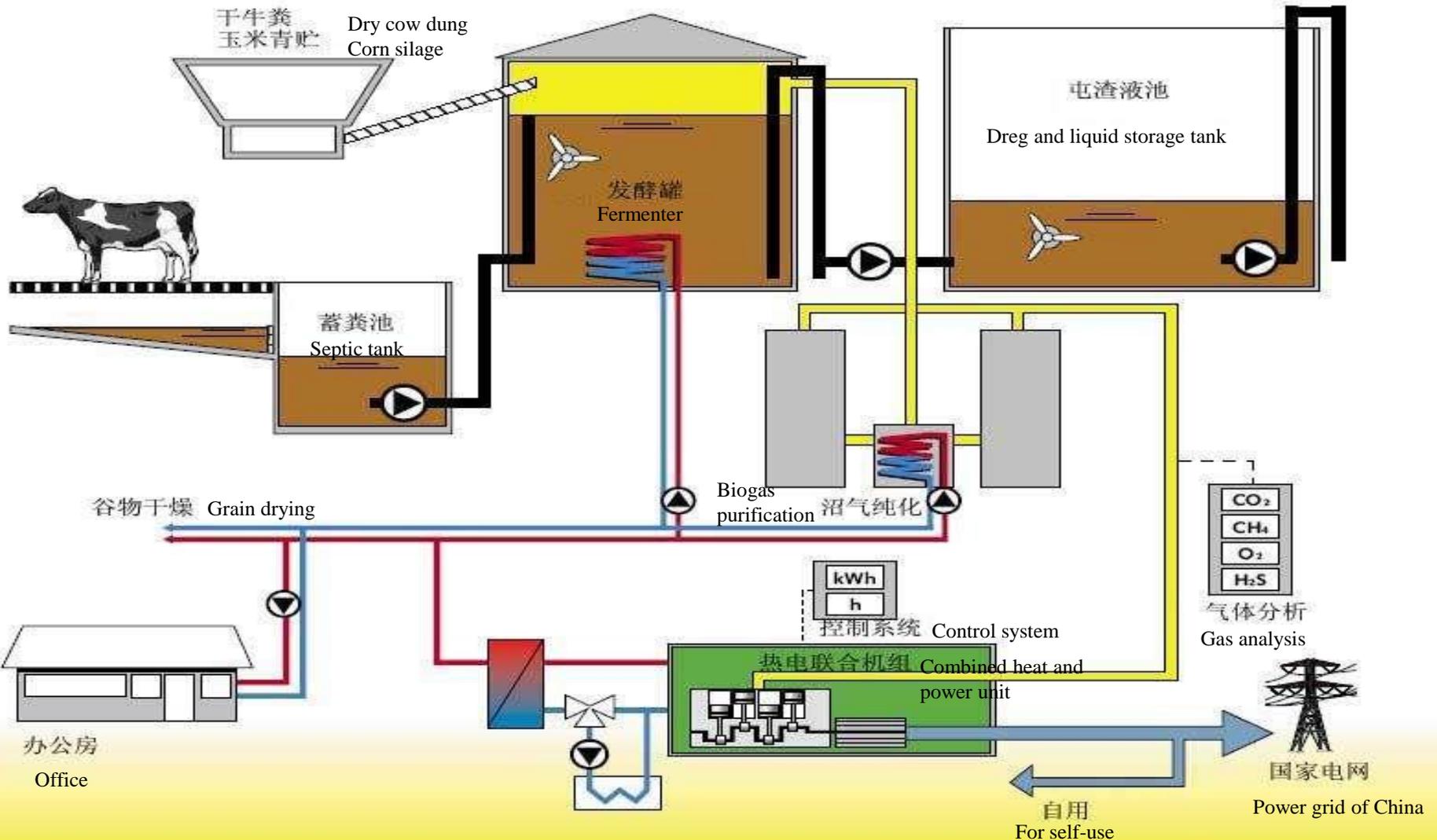
There are 41.93 million households in rural areas which apply biogas digesters, with an annual biogas capacity of 12.32 billion cubic meters.





沼气工程

Large-scale Biogas Plants



各类沼气工程11.1万处，其中大型0.71万处，中型1.05万处，小型9.34万处，年产沼气25.03亿立方米，供气户196万户，年发电5.69亿千瓦时。

There are 111 thousand biogas projects, of which there are 7.1 thousand large-scale projects, 10.5 thousand medium projects and 93.4 thousand small-scale projects, producing biogas of 2.503 billion cubic meters per year, providing gases for 1.96 million households and generating electricity of 569 million kWh per year.





转型升级 Transformation & Upgrading

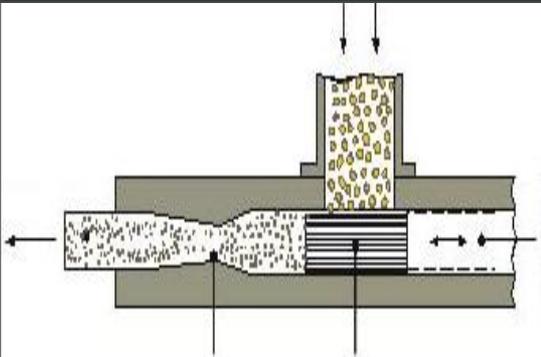
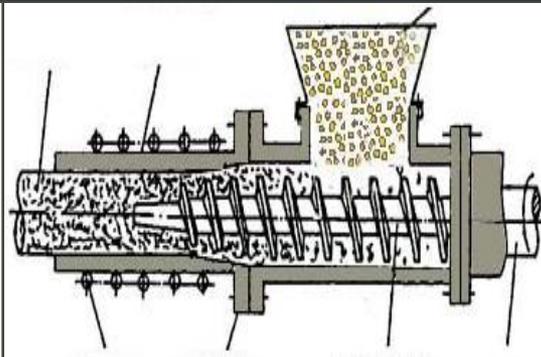
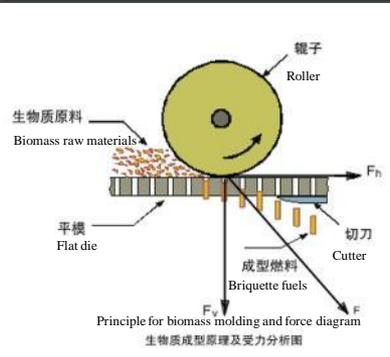
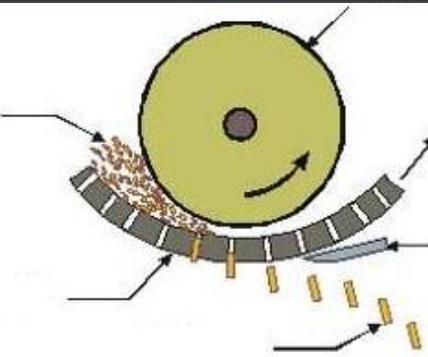
- 2015年和2016年，国家各投资20亿元分别支持25个和22个生物天然气试点项目、以及386个和522个规模化大型沼气工程。2017年继续投资20亿进行试点探索，支持了18个生物天然气试点项目和485个规模化大型沼气工程。

In 2015 and 2016, China respectively invested 2 billion yuan to support the 25 and 22 bio-natural gas pilot projects as well as the 386 and 522 large-scale biogas projects. In 2017, another 2 billion yuan will be invested in the pilot project to provide support to 18 bio-natural gas pilot projects and 485 large-scale biogas projects.



生物质成型燃料 Biomass Briquette

- 燃料有颗粒、棒状和块状;
The fuel can be in the form of grain, rod and block;
- 生产方式有环模、平模、螺旋挤压和活塞冲压形成;
Production methods include flat-mold, circular-mold, screw-extrusion molding and piston-stamping molding;
- 可民用、商业和工业用;
Applied in civil, commerce and industry;
- 国家鼓励替代散煤使用。
The government encourages to replace bulk coal.





秸秆固化成型1190处，493.5万吨；秸秆炭化106处，16.3万吨
There are 1190 places used for solidification and molding of straws with capacity of 4.935 million tons; and 106 places used for carbonization of straws with capacity of 163000 tons.





太阳能热利用

Solar Thermal

➤ 太阳能资源是取之不尽用之不竭的清洁可再生能源
The solar energy resources is a kind of endless and clean renewable resource;

➤ 热水器分闷晒、平板和真空管式，承压式和电辅助加热；

The water heater can be divided into integral collector storage, flat-plate type, evacuated tube type, pressurized type and electric auxiliary heating type;

➤ 太阳房分被动式和主动式、直接受益式和集热蓄热式；

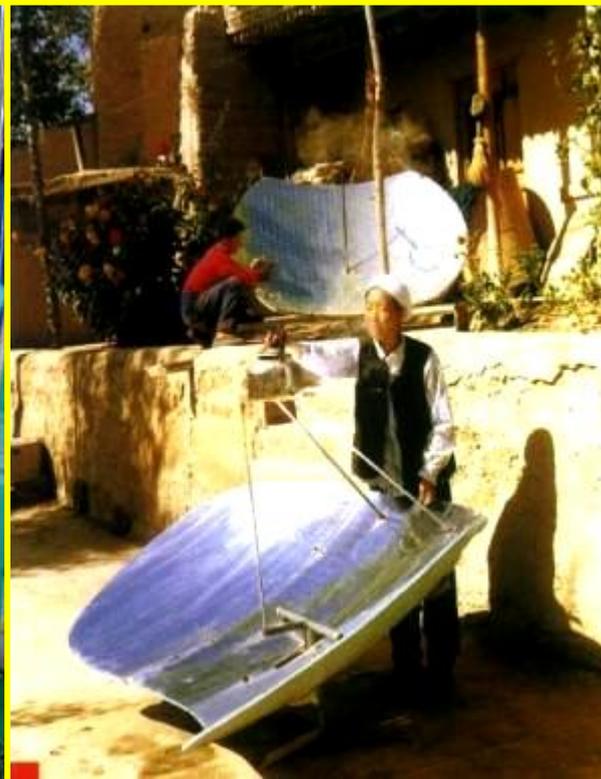
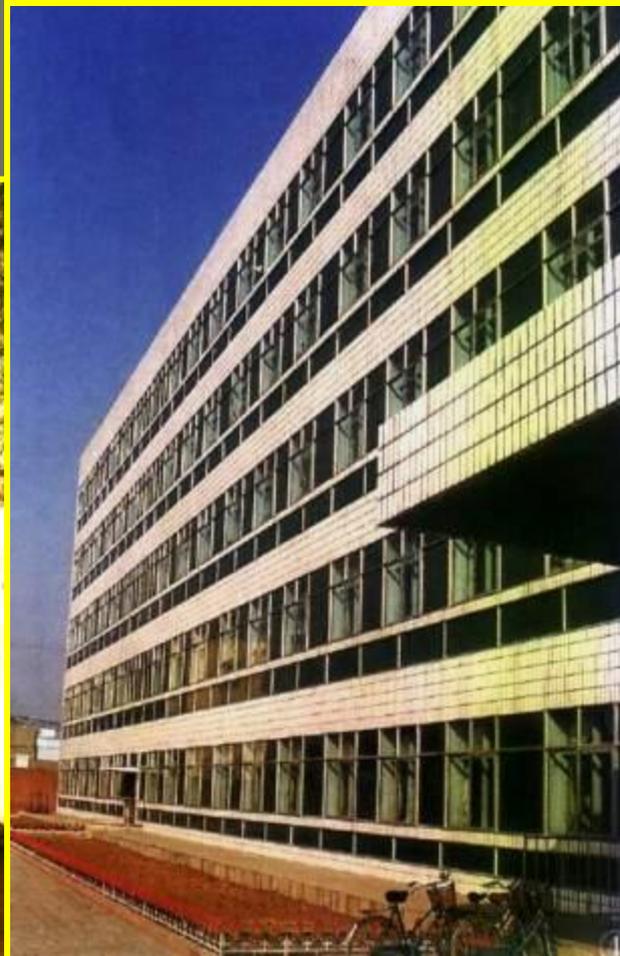
The solar house can be divided into passive, active, direct-gain type and heat collecting and storing type;

➤ 太阳灶有箱式和聚光型、手动和自动跟踪型；

The solar cooker can be divided into box type, focusing type, and manual and auto tracking type;



- 太阳能热水器: 8233万平方米
Solar water heater: 82.33 million square meters
- 被动式太阳房: 2549万平方米
Passive type solar house: 25.49 million square meters
- 太阳灶: 233万台
Solar cooker: 2.33 million sets





小型发电系统 Small Renewable Power

- 一般应用于偏远贫困且资源较丰富地区，包括家用光伏；
It is normally applied in remote and poor areas with abundant resources, like the household photovoltaic power generation system;
- 由于成本大幅度降低，小型光伏系统被越来越广泛地应用；
The small-scale photovoltaic system is increasingly used due to much lower cost;
- 国家正在推行分布式发电系统和微电网技术。
China is now promoting the distributed generation system and the microgrid technology.





小风电装机：11.0万台，
34.5兆瓦

Small wind turbines:
110000 sets with
capacity of 34.5MW



太阳户用光伏系统：约
35.0万处，213.1兆瓦

Household photovoltaic
solar system: about
350000 systems with
capacity of 213.1MW



微水电：2.9万台，
91.0兆瓦

Micro-hydro: 29
thousand sets with
capacity of 91.0MW



温室气体减排

Greenhouse Gases

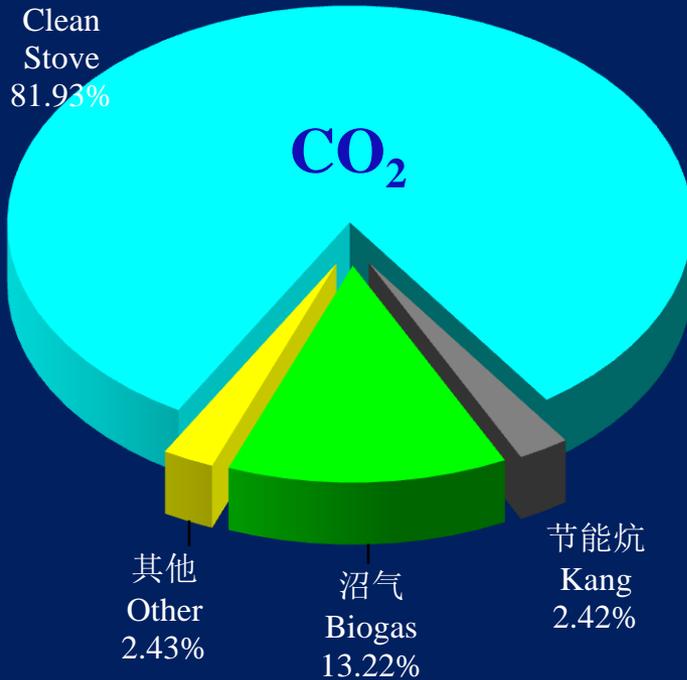
Renewable Tech.	Unit	替代能源 En. Alt, (t)	CO ₂ Re.	CH ₄ Re.	增加碳汇
省柴节煤灶 Clean cookstove	set	straw0.54、 firewood0.27、coal0.3	√	√	0.5 Mu
节能炕 Energy-saving Kang	set	straw0.1、firewood0.07、 coal0.09	√	√	0.1 Mu
户用沼气池 Household Digester	set	straw1.36、 firewood0.78、coal0.34	√	√	1.5 Mu
大中型沼气工程 Biogas Plants	m ³	coal0.24	√	3 pigs wastes 200 pigs wastes	
太阳热水器 Solar Heater	m ²	coal0.19	√		
太阳房 Solar House	m ²	coal0.02	√		
太阳灶 Solar Cooker	set	straw0.4、firewood0.2		√	0.4 Mu
小型风力发电 Small Wind	kW	coal0.625	√		
微型水力发电 Micro-hydro	kW	coal0.83	√		
秸秆气化供气 Gasification	point	coal2.1			



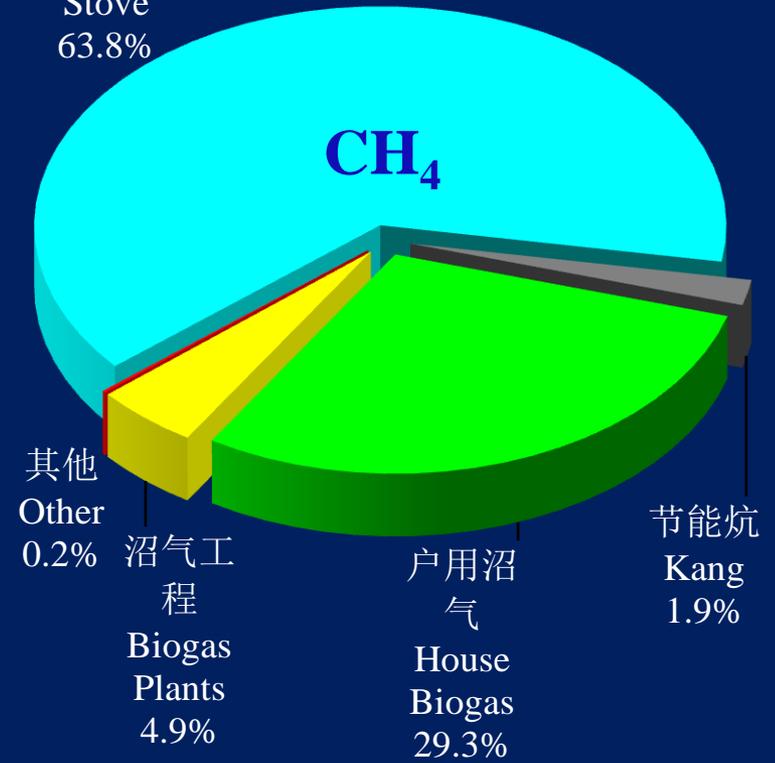
温室气体减排

Greenhouse Gases

省柴灶
Clean
Stove
81.93%



省柴灶
Clean
Stove
63.8%





第一口沼气池

First Biogas Digester



- 1974年，一位北京的年轻人在陕西省梁家河村带领村民建成了陕西省的第一口沼气池。

- In 1974, a young people from Beijing came to build the first biogas digester in Liangjiahe Village, Shaanxi Province together with the villagers.

农业部农业生态与资源保护总站

Rural Energy & Environment Agency, Ministry of Agriculture, P.R.China



我也是沼气专家 I was a biogas expert

2004年，在接受延安电视台采访回忆起1974年带领梁家河村民一起建设陕西省第一口沼气池时，深情地说：“我又是支部书记，又是沼气专家”



In 2004, when interviewed by the Yan'an Television, he recalled the time when leading the villagers of Liangjiahe Village to build the first biogas digester in Shaanxi Province in 1974 and said affectionately: "I'm not only a Leader of the village, but also a biogas expert"

农业部农业生态与资源保护总站

Rural Energy & Environment Agency, Ministry of Agriculture, P.R.China



几点结论

Conclusions

- 提高领导人和政策制定者的认识，对推动农村能源发展至关重要；

It is significant for promoting development of rural energies to enhance awareness of the leaders and the policy-makers;

- 确定本国农村能源发展战略和因地制宜制定阶段性发展规划极为必要；

It is extremely necessary to determine the development strategy for rural energies of a country and prepare periodic development plans according to local conditions;





几点结论

Conclusions

- 中国在农村能源发展方面具有长期的实践经验，具有众多优秀人才、技术成果和相关适合发展中国家的产品，我们愿意与发展中国家共享，并在南南合作和一带一路的平台上提供技术帮助。

China has gained long-term practical experience in developing rural energies and obtained many talents, technical achievements and relevant products which are suitable for the developing countries. We're willing to share these with all developing countries and provide technical support on the platforms of South-South Cooperation and the Belt and Road.



LOGO

共赢
Win-win

只有共同的利益和目标，才能实现共赢。
个人的利益是短暂的，集体的利益是长久的，只有集体利益才能实现共赢。

718723 www.reea.com

The background of the top half of the image features a large, semi-transparent watermark of the REER logo. The logo consists of a circular emblem with a central mountain-like shape, surrounded by the text 'REER' at the top and '生态与资源保护研究所' (Institute of Ecology and Resource Protection) in Chinese characters around the bottom. The background is a solid dark blue.

Thank You

Tel: 010-59196395

Fax.: 010-59196394

E-mail: lijingm@agri.gov.cn

