Bioenergy for Sustainable Rural Development in China: Cost-Benefits and Policies

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China in Two Faces

- **Large disparity in living conditions between urban and rural residents**
- **Widening gap in economic and social development**
- **Strong policy measures are needed to reduce this gap**

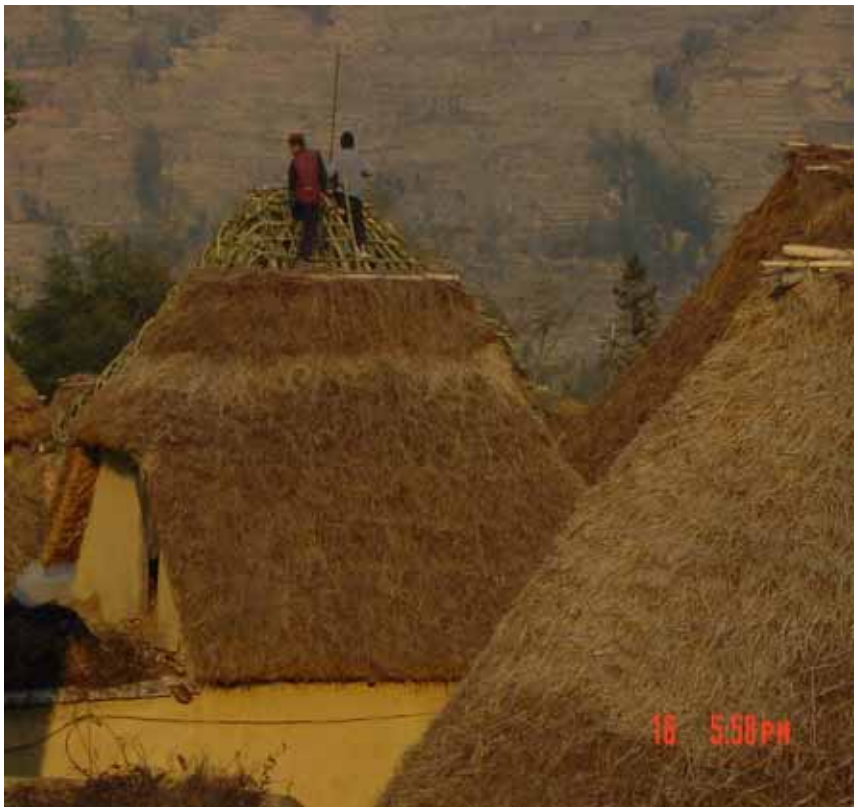
Agriculture Sector Development

- **Agriculture: shortage in supply and increase in consumption, e.g. food price increase**
- **Increase in imports and reduction in exports, due to population growth, decline in arable land and environment degradation**
- **Growing disparity between the rich and the poor**
- **Energy use divided: switch to fossil fuels in coastal regions and rely on traditional biomass and coal use in poor west regions**
- **56% people depend on biomass and 33% on coal for household energy use (2003)**

Western Regions

- **Lag behind in economic development than the coast regions**
- **Vulnerable in eco-systems**
- **Poverty: a social development challenge (40-80 million live under 1 US$/day)**
- **Farmers rely on traditional use of agriculture biomass for cooking and space heating**
- **Focus on raw materials industry and energy resources will not make the regions rich**
- **Ecological consequences of industrial development**
- **Weak in human resources and management capacities**

Traditional Use of Biomass



Biomass for Cooking and Heating

Fuelwood and Children’s lives

Miao in Guizhou

Traditional lifestyle

Open Stove Use and Food Drying Lead to Intake of Pollutants

Impact of Indoor Air Pollution

- **Household use of coal for cooking, heating and drying of agriculture products**
- **Open stove use as local culture and tradition**
- **45 million people are affected**

Skeletal Fluorosis

- **It leads to disability of people**
- **One major cause of poverty**

Children Are Mostly Affected by Dental Fluorosis

Dental Fluorosis

- **Effects to teeth and bones**
- **Air, soil and water pollution**
- **Once affected, it remains for life**

Arsenic poison in Guizhou

- **Concentrated in Southwestern region**
- **Household coal use related**
- **Due to local resource, climate, economic situation and tradition**

Bioenergy Transition

- **Requires an Integrated Approach for bioenergy development**
- **Decentralized energy systems development: household stoves vs. biomass power generation**
- **Agricultural wastes for biogas, heat and power production**
- **Efficient biomass burning to reduce coal use**
- **Develop biomass market in rural households: stoves for cooking and heating**
- **Develop heat market for bioenergy use**
- **Large potential on biofuels in transport**
- **Biomass CHP relevant for local residential areas**

Social Benefits

- **Income generation**
- **Job creation from biomass production, transport, equipment and services**
- **Improvement in Health and living conditions**
- **Reduce migrant pressure to urban areas**

Biomass Applications

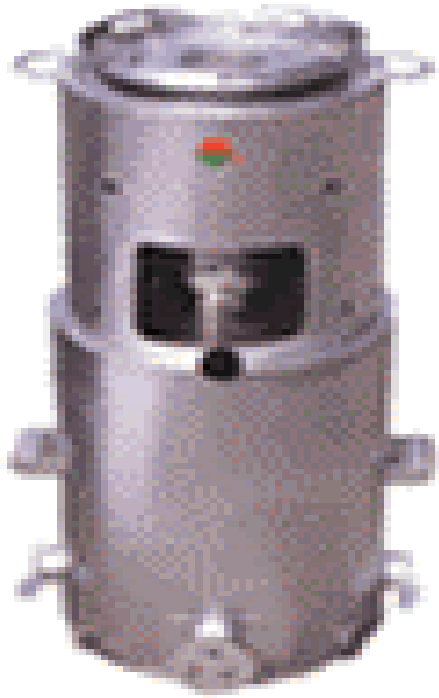
- **Biogas CHP plants in feedstock farms**
- **Biogas with municipal and residential residues**
- **Biofuels (non-food ethanol & biodiesel)**
- **Pellets and bio-briquette production**

Pellets Burning Stove

- Pellets processing technology
- A cooking stove for households
- It is not for heating purpose

Biomass Gasified Stove

双一气化炉



秸杆气化炉

Ashden Award: Daxu Stove

- **Innovation in stove design**
- **Effective in cooking and possible for heating in household**
- **It saves 8 tons of CO2/y**

Market Development

- **35000 units sold from Sept. 2006 till March 2007**
- **Need wider social acceptance**
- **Incentive policies needed for wider dissemination**

New Areas of Development

- **Combine wastewater treatment, wetlands restoration with bioenergy development**
- **Resource management, rural planning, technology transfer and dissemination**
- **Large social and environment benefits are expected**

Opportunities for Asian-Pacific Regional Cooperation

- **Biofuels resources and technology management, and strategy development**
- **Biomass resource assessment and management**
- **Biomass stoves for diverse applications, e.g. households, restaurants, schools**
- **South-South technology transfer**
- **Service company management and training**
- **Carbon credits on CDM projects with methodologies and regional programs**

Technology & Management Barriers

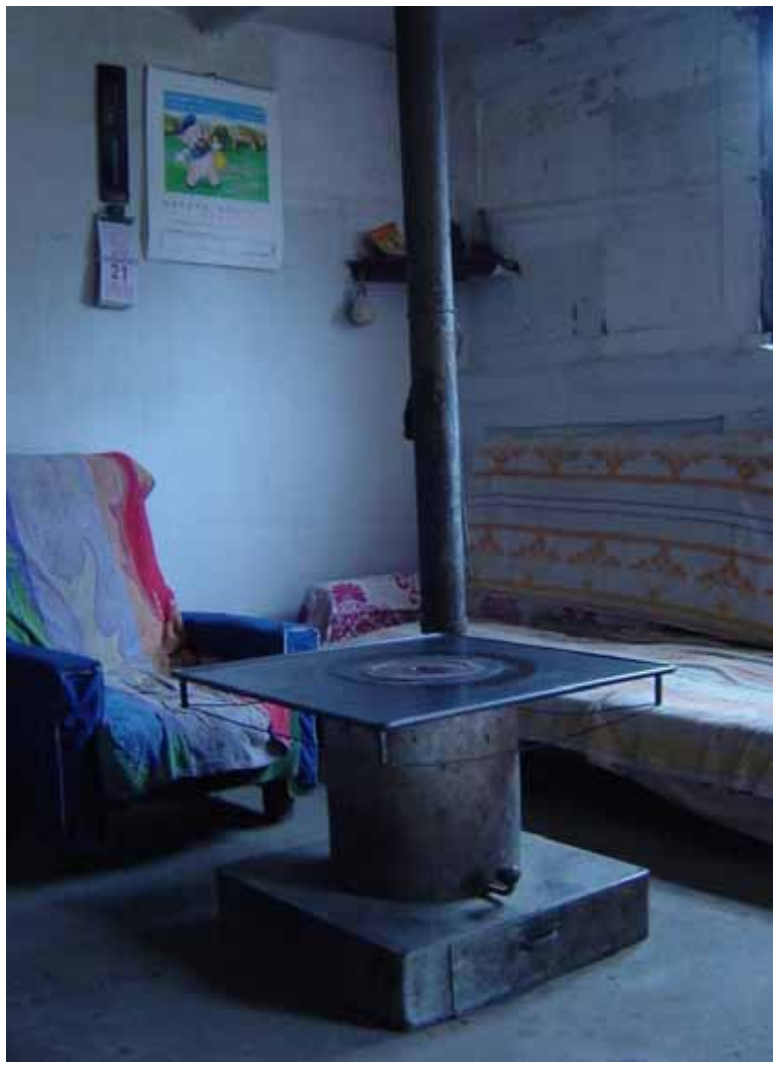
- **Modern bioenergy is new to developing countries**
- **Lack of cost-effective combustion and gasification technologies**
- **Lack of biofuel production capacity and technologies**
- **Disparity in the resource situation**
- **Little experience on resource costs, collection and transportation systems, business services in market application**
- **Lack of R&D capacity and management skills**

Market Barriers

- **Weak in incentive policies**
- **Lack of effective financial instruments, e.g. public funds, venture capital, tax policy, micro-credit**
- **Monopoly of utilities: access to e-grid**
- **Low coal prices**
- **Lack of appropriate technologies for rural applications, e.g. efficient stoves, small gasifies**

Social and Culture Issues

- **Coal and biomass burning stove as a social and culture entity**
- **It serves as a cooking, heating and family gathering facility**
- **Social acceptance of new technology important**



Stoves as Culture Entity

Key Issues for Consideration

- **Priorities put on meeting local energy demands for rural residents**
- **Substitutions for fossil fuel use important, linking climate change with indoor pollution and social development needs**
- **Local conditions and culture be respected**
- **Appropriate technologies more effective than modern and costly new technologies**
- **Capacity building and communications are important on local education and awareness**
- **Incentive polices are needed, e.g. tax reduction or finance for small companies**

Thanks for your Attention!