Household Biogas Digester
An Underutilized Potential

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Objectives

- To present the overview of *Renewable Energy programme* in India

- In view of the above to introduce the development and diffusion of biogas technology in India

- To provide the historical perspective and evaluation of biogas technology in China
Overview of Renewable Energy Programme in India

- Biogas
- Biomass
- Wind energy
- Solar energy
- Small Hydro Power
- Other Technologies
- Hydrogen Energy
- Transportation - Battery operated vehicles
- Geothermal Energy
- Ocean and Tidal Energy
- Biofuels
Diffusion of Biogas Technology in India

It is the main programme under rural energy development

Objectives

- Provide fuel for cooking purpose
- Provide organic manure to rural poor
- Reduce pressure on forest
- Improve sanitation by linking toilets with biogas plant
The Advisory Board on Energy (May, 1985) indicated a potential for setting up 16 to 22 million small biogas units in the country.

MNES and Ninth Five Year Plan Document have indicated a potential of 12 million plants based on 1981-82 livestock census and availability of cattle dung.

A cumulative of 3.37 million biogas plant has been installed which is a 25% of potential
**Historical Perspective of Biogas (Gobar Gas) In India**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>1950</td>
<td>First units constructed. Some research on the process and design</td>
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<tr>
<td>1950-72</td>
<td>Industrial development of India and agriculture. First practical designs constructed, small projects, mainly one organization involved, one design disseminated.</td>
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<tr>
<td>1972-1975</td>
<td>Energy crisis attracts attention to the technology, start of national interest. Fossil fuel dependency identified. Indira Gandhi to power.</td>
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<td>1975-1980/81</td>
<td>National interest and research. National programme developed</td>
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<tr>
<td>1985-1992</td>
<td>Improving designs, improving the organization and results from dissemination.</td>
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<tr>
<td>1992-1996</td>
<td>Decrease in subsidies, new structures of dissemination and extension</td>
</tr>
<tr>
<td>1996-2000</td>
<td>Ministry of Non-conventional Energy Sources (MNES) has achieved 97% to 108% of annual target during the five years. At the instance of MNES, the Programme Evaluation Organisation (PEO) undertook evaluation of National Project of Biogas Development (NPBD) primarily to examine the implementation methods.</td>
</tr>
<tr>
<td>2000-2003</td>
<td>MNES and Ninth Five Year Plan Document have indicated a potential of 12 million plants bases on 1987-82 livestock census and availability of cattle dung. During the Ninth Plan, a target of installing 12.6 lakh plants has been fixed, while the proposed Tenth Plan target is 15 lakh plants. Subsidies continue.</td>
</tr>
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Scope of Biogas Technology in India

- India has the largest cattle population in the world.
- There are about 75 million farm families 60 percent families own 4 or more cattle, which are sufficient to operate a small biogas plant.
Study area
Land use pattern of Jakhi village
Land holding pattern of Jakhi village
Direct Energy Calculation

DE = 1.96 HLH + 80.7 BPH + 56.31 DC + 11.93 EC

DE = Direct energy input MJ
HLH = Human Power hours used per ha
BLH = Bullock power hours used per ha
DC = Diesel consumption per ha
EC = Electricity consumption per ha, KWH
Indirect Energy calculation

\[ \text{IE} = C \times \text{WM} \times \frac{\text{HUM}}{\text{OA}} \]

- **IE** = Indirect Energy calculation MJ/ha
- **C** = Energy coefficient
- **WM** = Weight of machinery used per hour
- **HUM** = Hours of machinery used
- **OA** = Operation area, ha
Energy consumption in household activities (MJ/year/household)
Rural Area
Energy use pattern

Rural Area

- Most people depend on traditional fuels of wood, cowdung, crop residues
- Often using inefficient and primitive technology
- Commercial fuels are used for lighting
- Cooking alone consumes around 85.5% of the total energy
- Household activities consume about 74.4% of the total energy
Organizational Structure of National Programme on Biogas Technology in India

Support system

Training, feedback research and development

- NABARD/RBI
- National banks
- State lead banks
- Bank branches
- Regional training and development centers
- Research institutions

Implementation

Nodal agencies (state departments/corporation)

- District offices
- Block offices
- Turnkey workers

Autonomous bodies (KVIC/DIC)

- NGOs
- State offices/co-operatives
- NGOs

Implementation

Autonomous bodies (KVIC/DIC)

- NGOs
- State offices/co-operatives
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Fig 2 Share in achievement of targets by various agency
Receipt and expenditure of funding under NPBD in Selected States (MNES, 2002)
Classification of Biogas Model

- Batch Type
  - Stage type

- Semi continuous type
  - Plug flow type

- Continuous type
  - Well mixed type

FLOATING DRUM
- KVIC Model
- Pragati Model
- Ganesh Model
- Ferro cement

FIXED DOME
- Janata Model
- Deenbandhu Model
- Janata – II Model
- VINCAP Model
- Ferro cement Deenbandhu
Over View of Floating Type Biogas Plant
Structural View of Digester of Floating Type Biogas Plant
Biogas Plant in Rural Area of West Bengal (Kharagpur)
6 MW MSW plant in Lakhnow, UP
Schematic Presentation of Pragati Type of Biogas Plant
Schematic Presentation of Janta Type Biogas Plant
Schematic Presentation of Floating Type of Gas Holder
Schematic Presentation of Deenbandhu Biogas Plant
Plug flow digester
Plug flow digester
Biogas Development in China

*Initial phase*

Mr. Luo Guorui founded the first Chinese company to disseminate biogas technology in Shantou in the summer 1929.

The company has developed along the Yangtse River and more than 10 provinces along the eastern and southern coast.

The first specialized technology training material on designing and construction and operation of biogas technology was published in 1935.
Second Phase

Second upsurge for promoting the biogas technology in China initiated in Wuchant City of Hubei province in 1958.

Although new hydraulic biogas digester they have developed but still Guorui Biogas plant was mostly adopted.

More then 100 thousand plants were dismantled due to poor scientific construction and blind construction.
Third Phase

In the 70 and 80s the energy consumption and fuel supply was poor as 122 kg/capita. 66% of the stalks was used as farmers cooking fuel.

The central Govt. pointed out that dissipation of biogas technology in rural area could effectively utilize agriculture resource and forest protection

These leads to professional management organisation and leading group of biogas development, and professional institute namely, Chengdu Biogas Institute
Rural Energy Programme in China

Rural household biogas digesters were widely disseminated some cities and town in Northern China

Since 1983, China is emphasizing the policy of rural energy in every five year development plan.

Rural energy development has been arranged into national economic planning for 20 years. An unique way of China rural energy development has been explored.
Medium and large size biogas plant in different part of China
No of Biogas decontamination system in China, 2001
Percentage contribution of energy sources utilized in Rural China (2001)
In 2000, population in China rural areas was 0.82 billion around 65% of Chinese total population 1.26 billion. In 2001, China rural areas were 9.57 million households having biogas digesters of which 8.57 million (90%) plants are working.

If those plants work properly they can produce yearly around 2.98 billion Cumec biogas amounting to standard coal 2.13 million tones.
Positioning of bottom hemisphere and outlet for fixed dome type of biogas plant
Joining of two hemisphere of biogas plant
Top view of fixed dome type of biogas plant
Trainees of biogas training programme (Feb 12-17, 2004), Mechada, India
Trainees with Mr. Pandey in Gadbeta Dairy Farm, Aug 12-28, 2003, India
Mr. Pandey, and Mossa Kareem, owner of a poultry biogas digester, 26, June, 2005
Visit in a kusiari village, May, 2005
Masson Training for biogas plant designing
Speech for biogas in National level seminar for farmers, at IIT, Kharagpur, Feb, 12, 2004
Prof. T. Nejat Veziroglu, International Hydrogen President, with Mr. Pandey in his laboratory
Dr. T. Kasturirangan, eminent space scientist, and Mr. Pandey
Isolated bacteria for anaerobic digestion
Thank You