Household Biogas Digester

An Underutilized Potential

Pramod Pandey

Research Assistant (PhD candidate)

Biological System Engineering Department

Washington State University, Pullman, WA

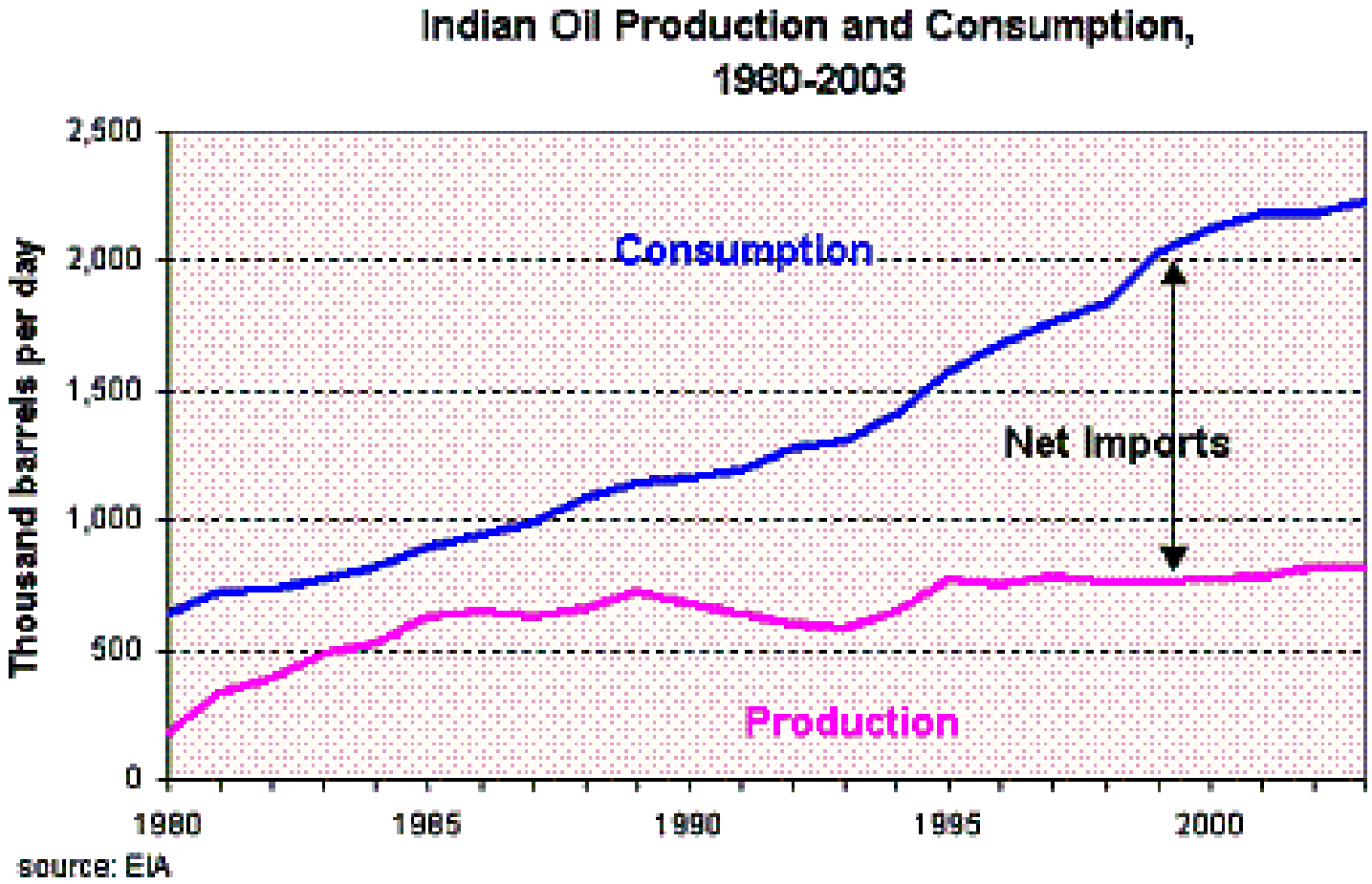
Supervisor: Prof. Schulin Chen

Email: schen@wsu.edu

Phone: 011-509-335-3859

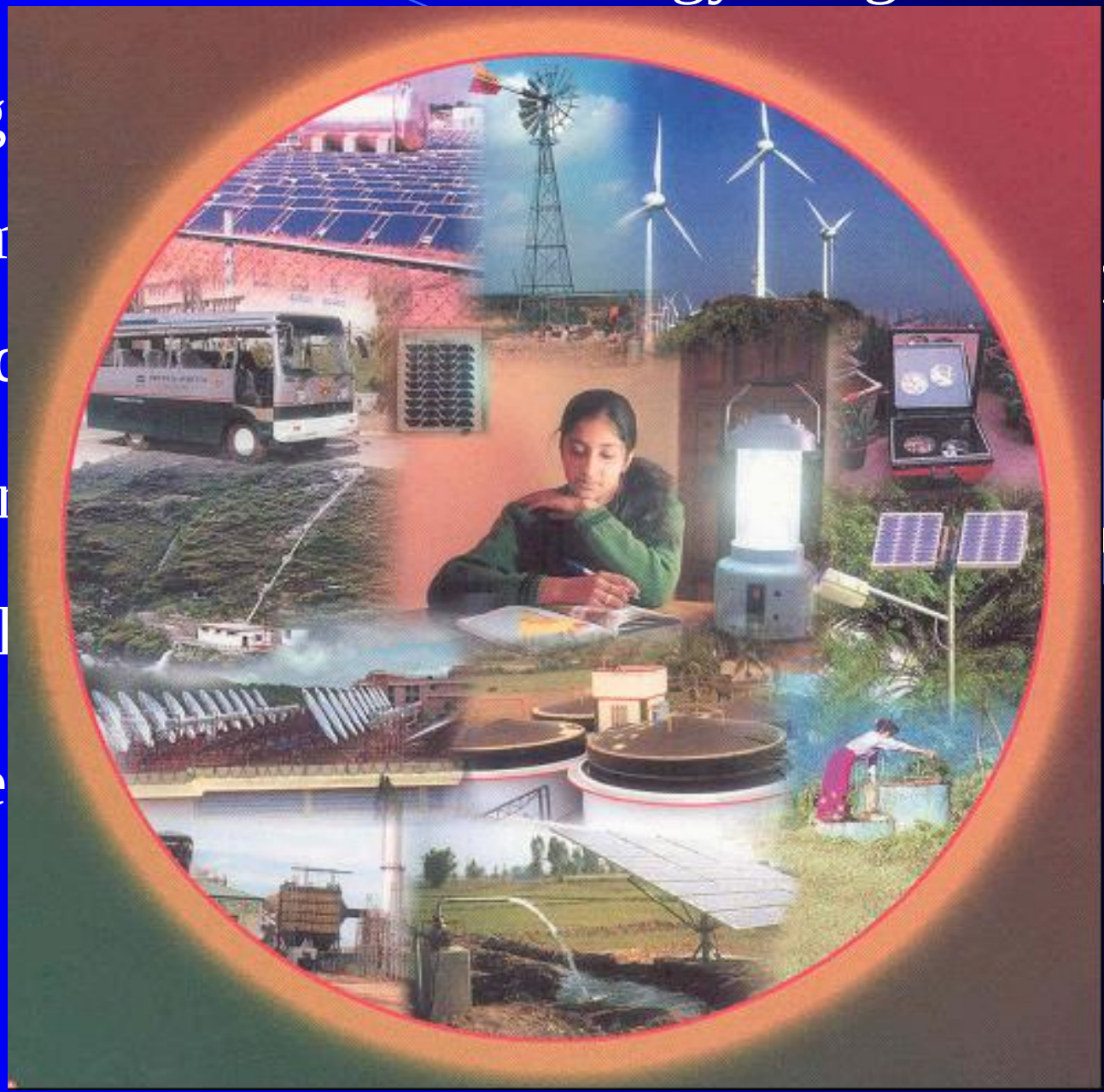
Objectives

- 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


Indian Oil Production and Consumption, 1980-2003
Thousand barrels per day
2,500
2,000
1,500
1,000
500
0
1980
1985
1990
1995
2000
Consumption
Net Imports
Production
source: EIA

Overview of Renewable Energy Programme in India

- Biog
- Biom
- Winc
- Solar
- Smal
- Othe



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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**

Target and Potential

✓**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.**

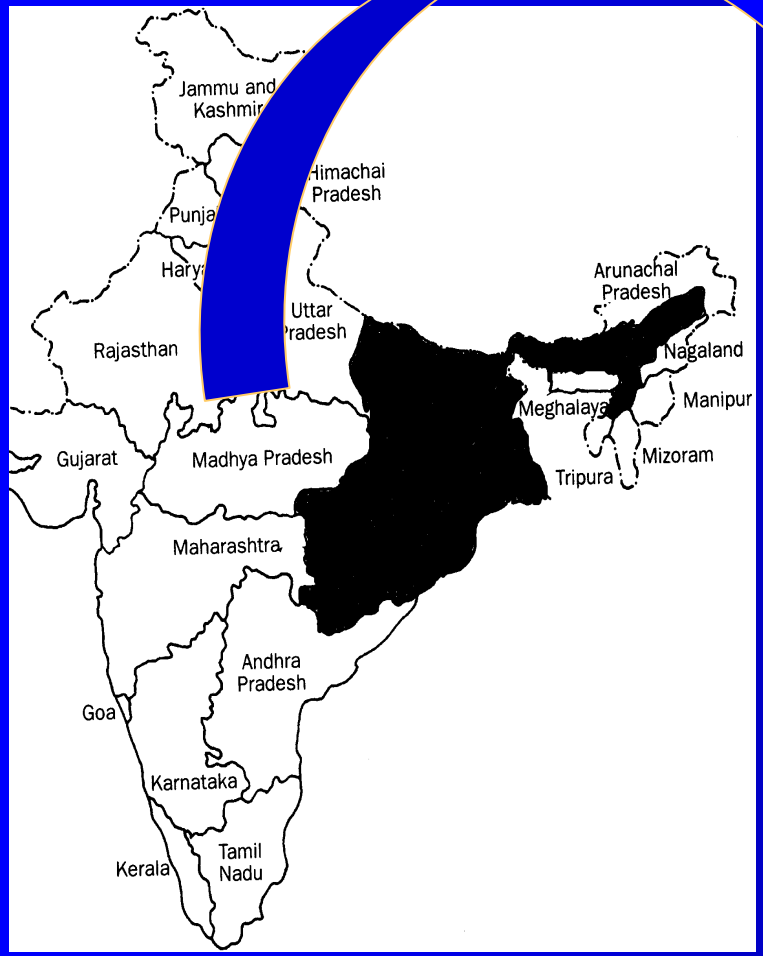
✓**A cumulative of 3.37 million biogas plant has been installed which is a 25 % of potential**

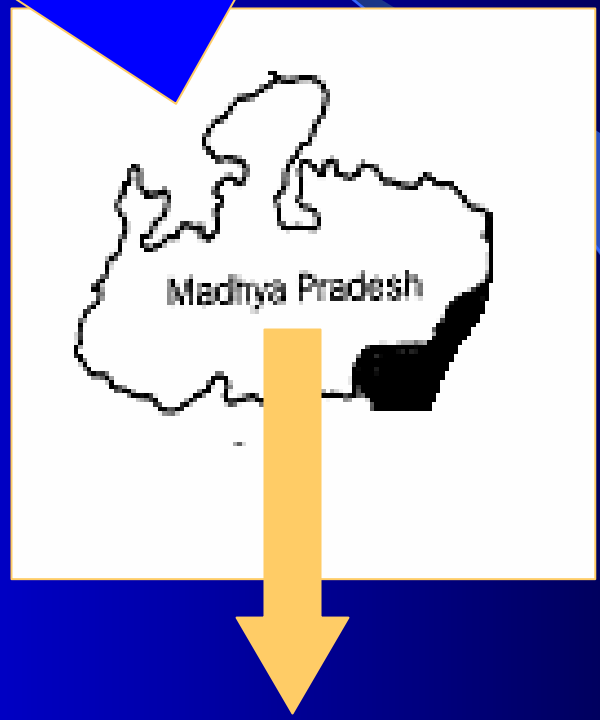
Historical Perspective of Biogas (Gobar Gas) In India

1950	First units constructed. Some research on the process and design
1950-72	Industrial development of India and agriculture. First practical designs constructed, small projects, mainly one organization involved, one design disseminated.
1972-1975	Energy crisis attracts attention to the technology, start of national interest. Fossil fuel dependency identified. Indira Gandhi to power.
1975-1980/81	National interest and research. National programme developed
1980/81-1985	Initiation of large national programme relying on subsidies. Multi organization, multi-design approach.
1985-1992	Improving designs, improving the organization and results from dissemination.
1992-1996	Decrease in subsidies, new structures of dissemination and extension
1996-2000	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.
2000-2003	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

Scope of Biogas Technology in India

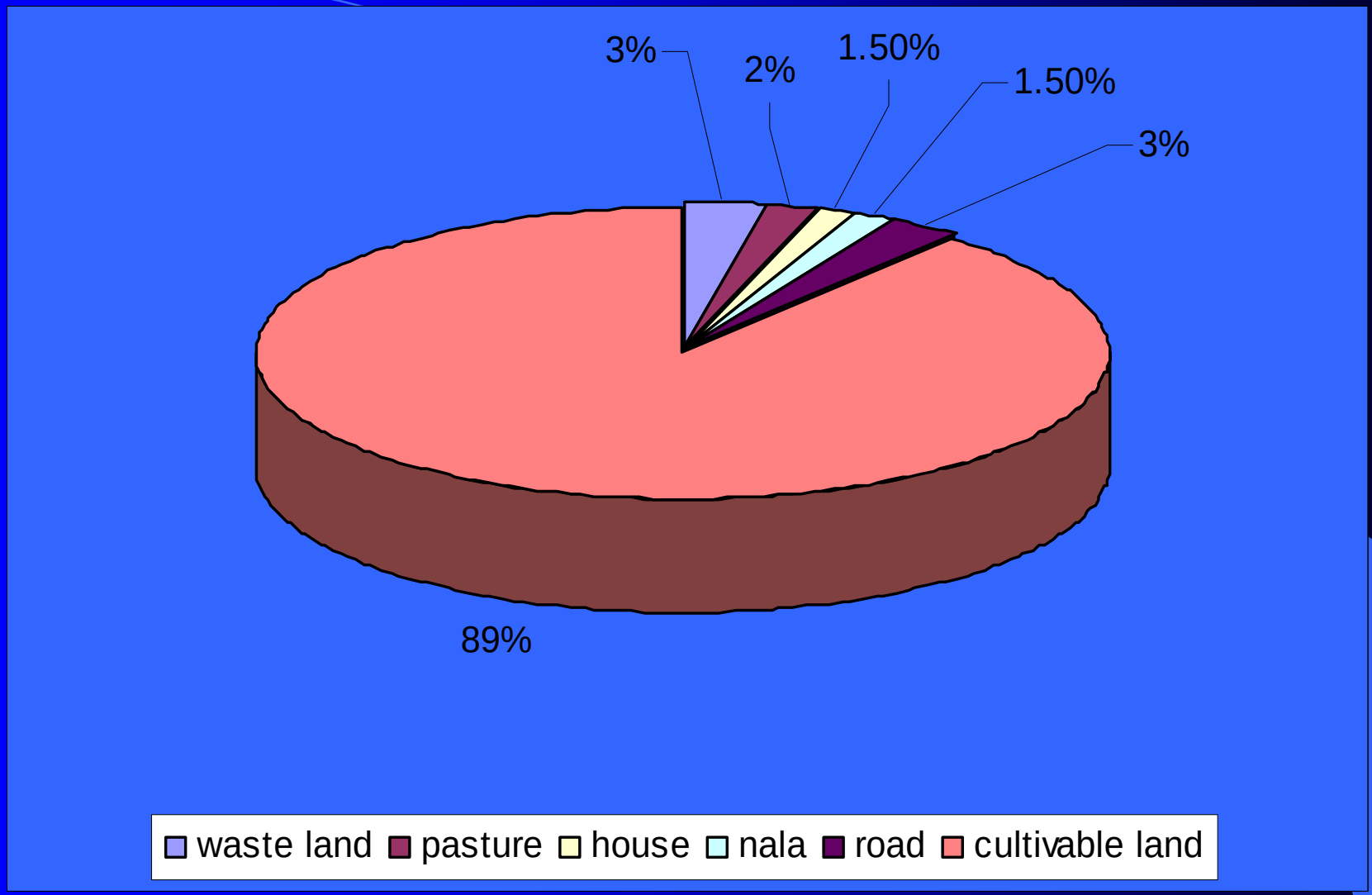
- India has the largest cattle population in the world.
- There are about 75 million farm families 60 percent families own 4 or more cattle, which are sufficient to operate a small biogas plant.



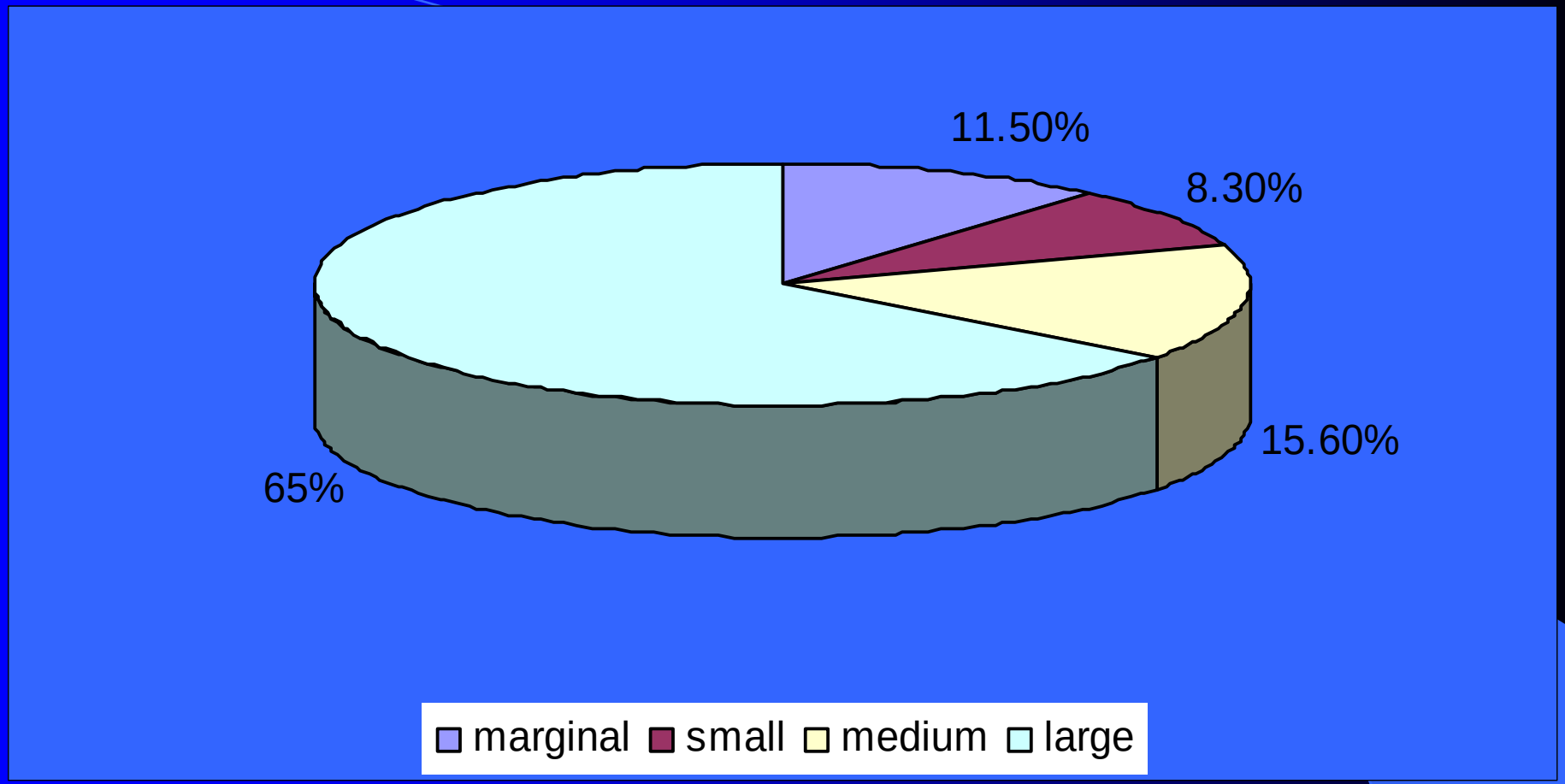


SATNA

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

$$IE = C \times WM \times HUM/OA$$

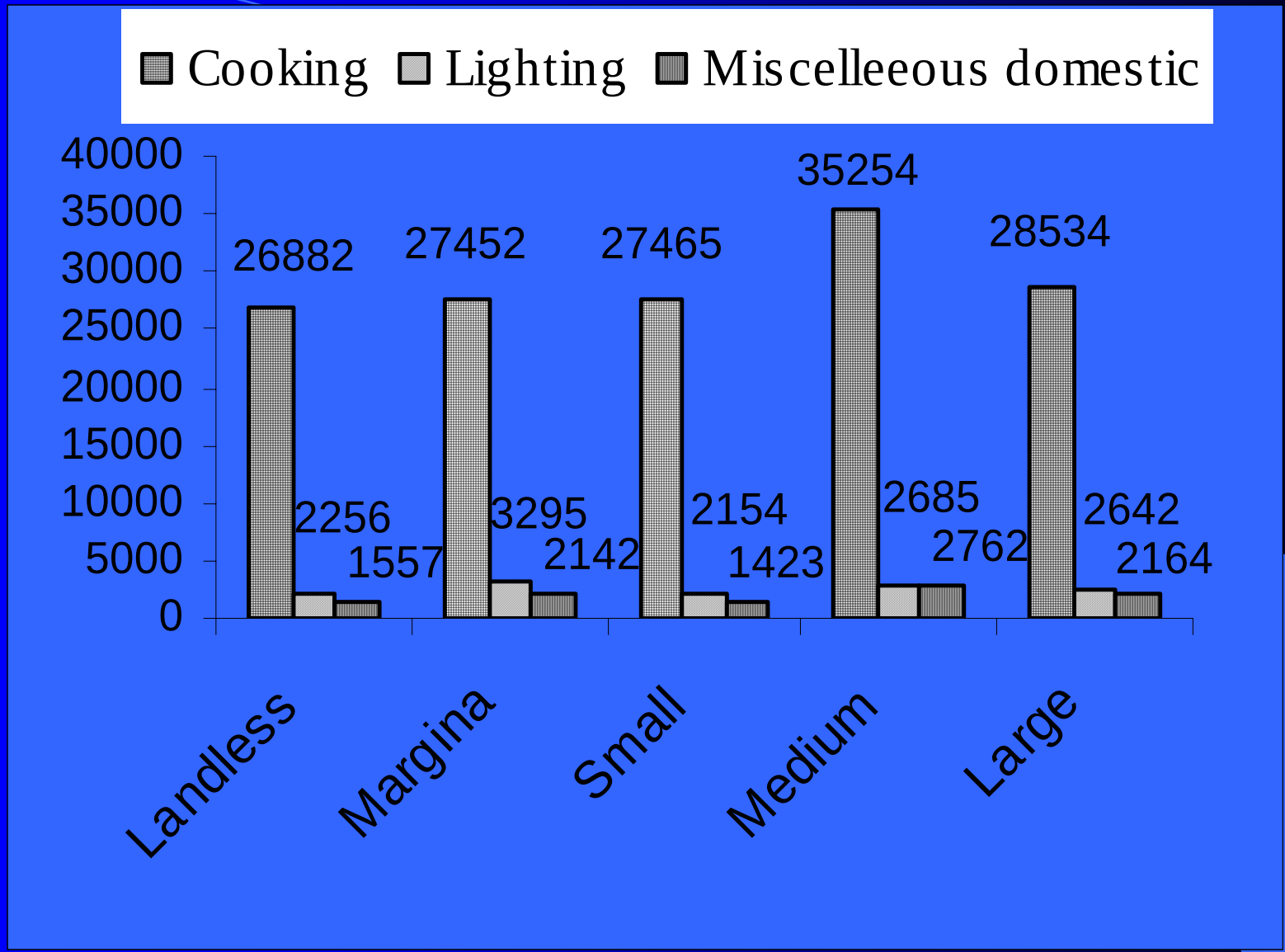
IE =Indirect Energy calculation MJ/ha

C = Energy coefficient

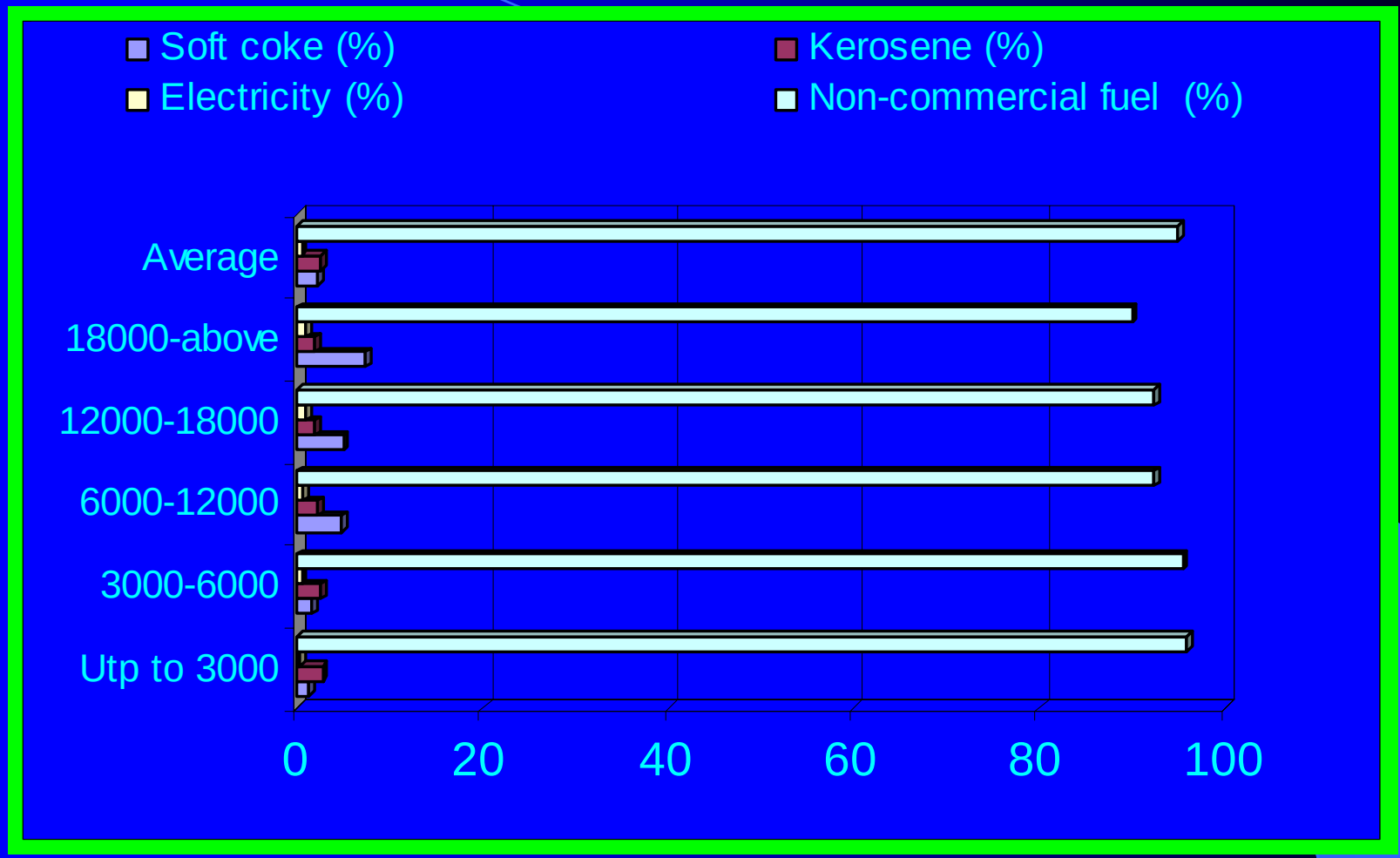
WM = Weight of machinery used per hour

HUM = Hours of machinery used

OA = Operation area, ha



Energy consumption in household activities (MJ/year/household)


Soft coke (%)
Kerosene (%)
Electricity (%)
Non-commercial fuel (%)
Average
18000-above
12000-18000
6000-12000
3000-6000
Utp to 3000
0
20
40
60
80
100

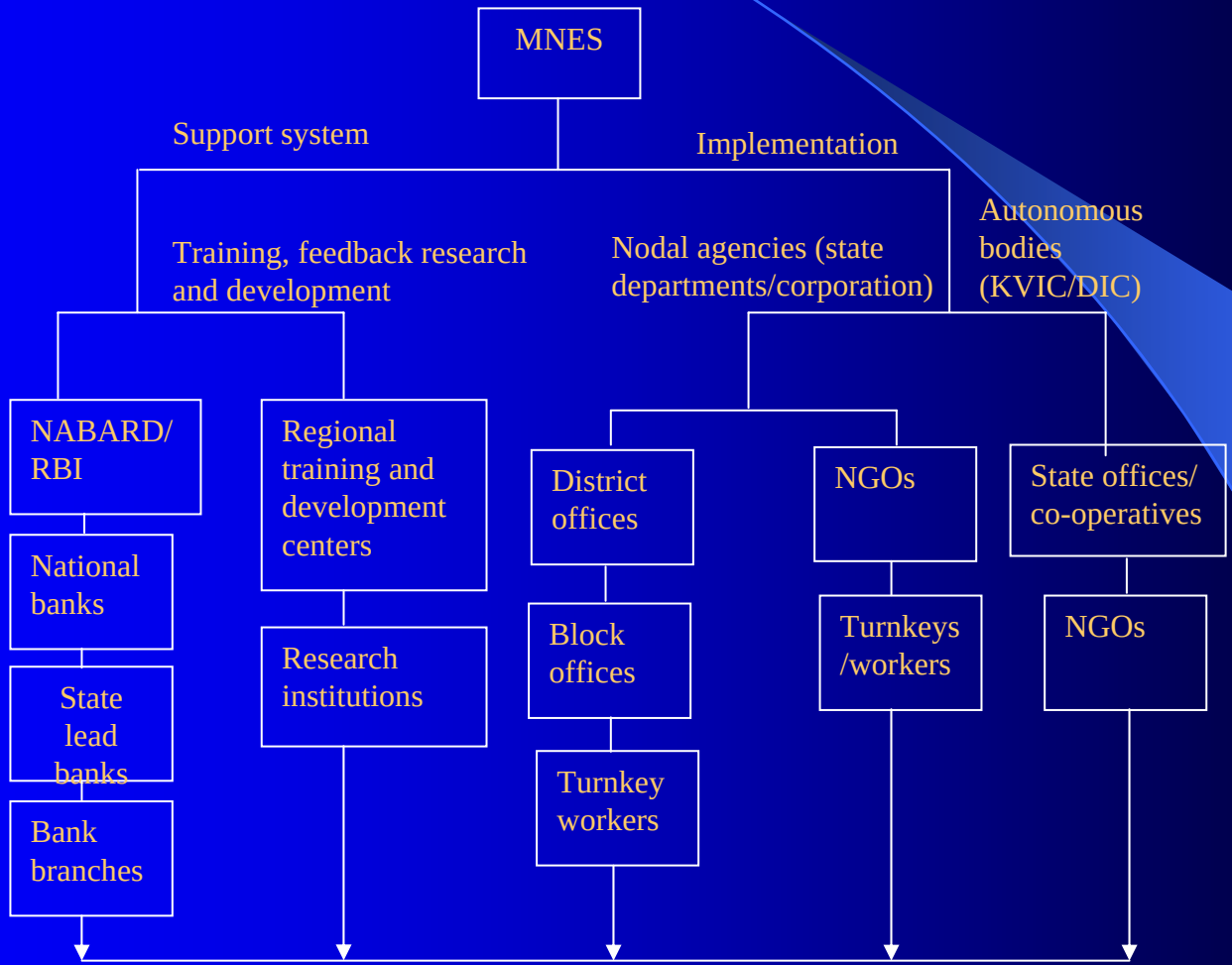
Rural Area

Energy use pattern

Rural Area

- Most people depends 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 consumes about 74.4% of the total energy

Organizational Structure of National Programme on Biogas Technology in India



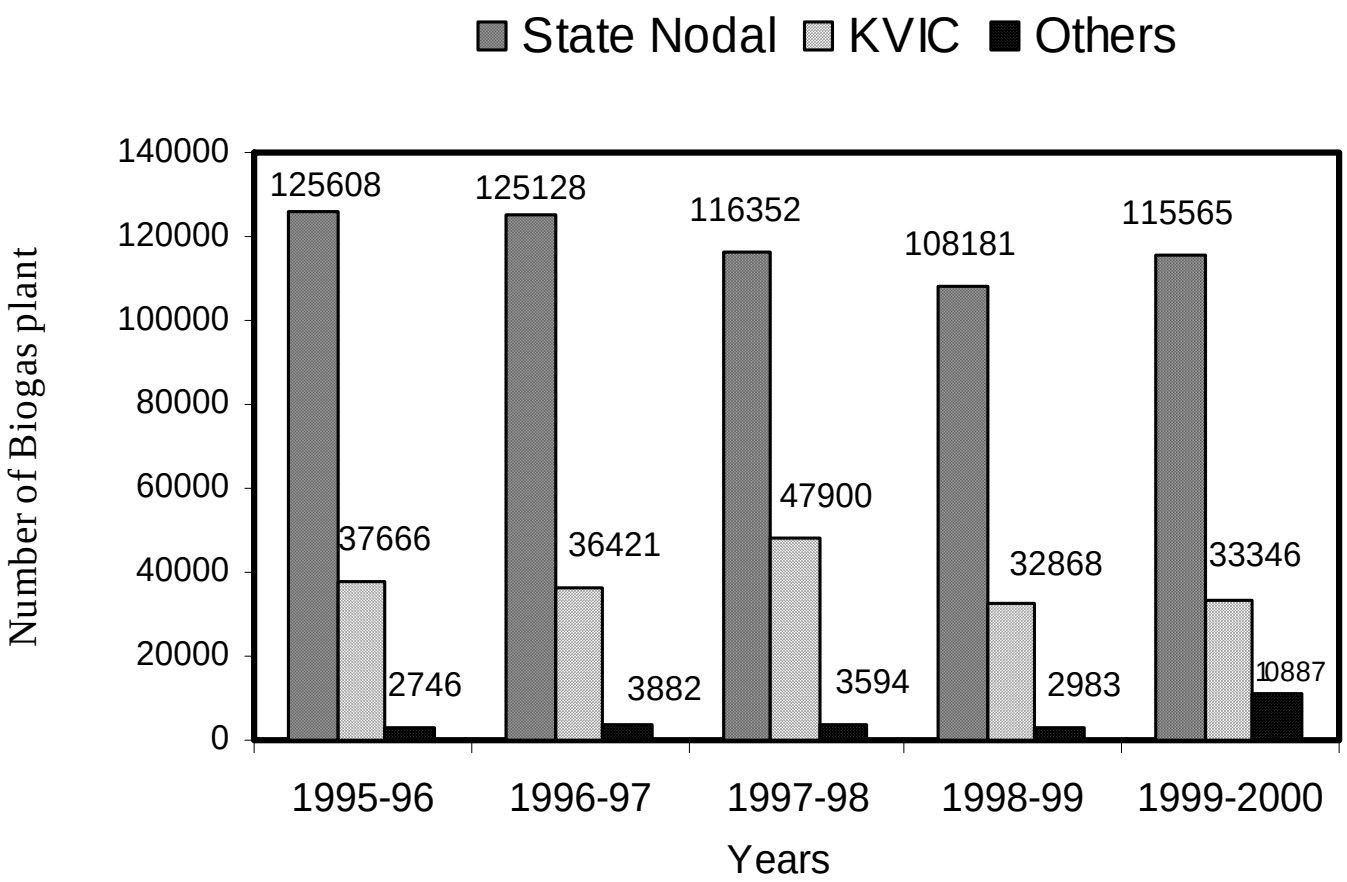
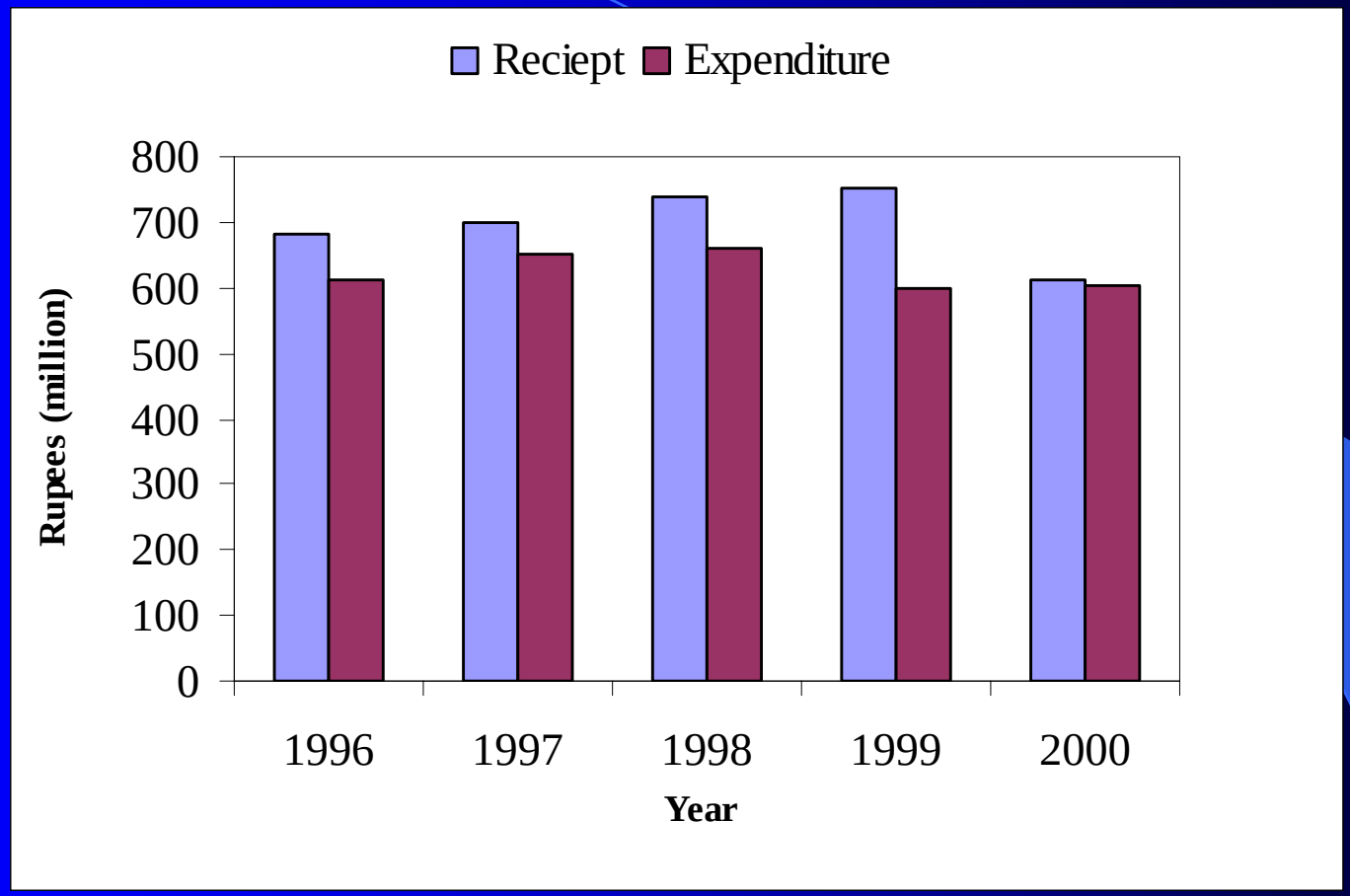
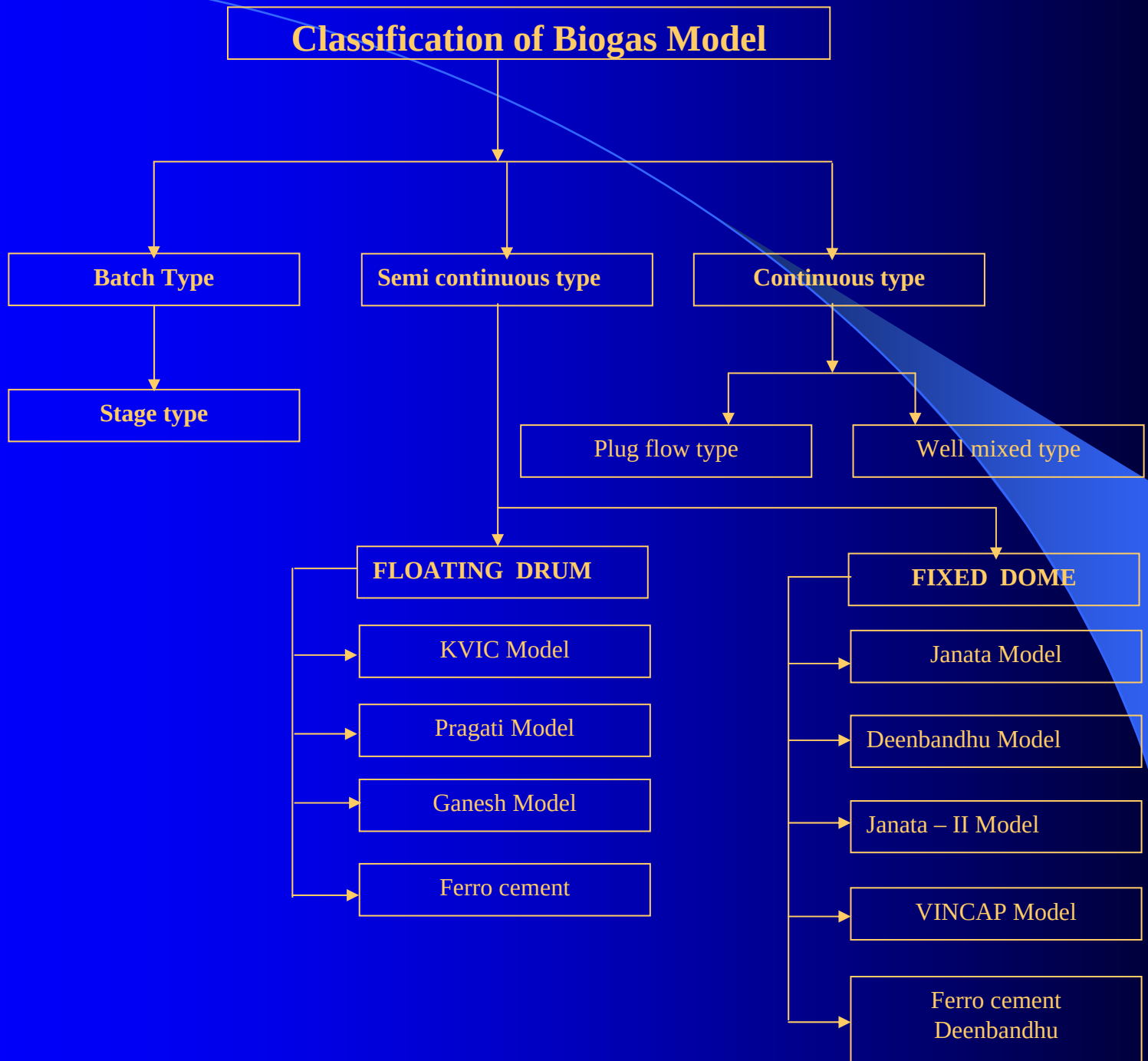
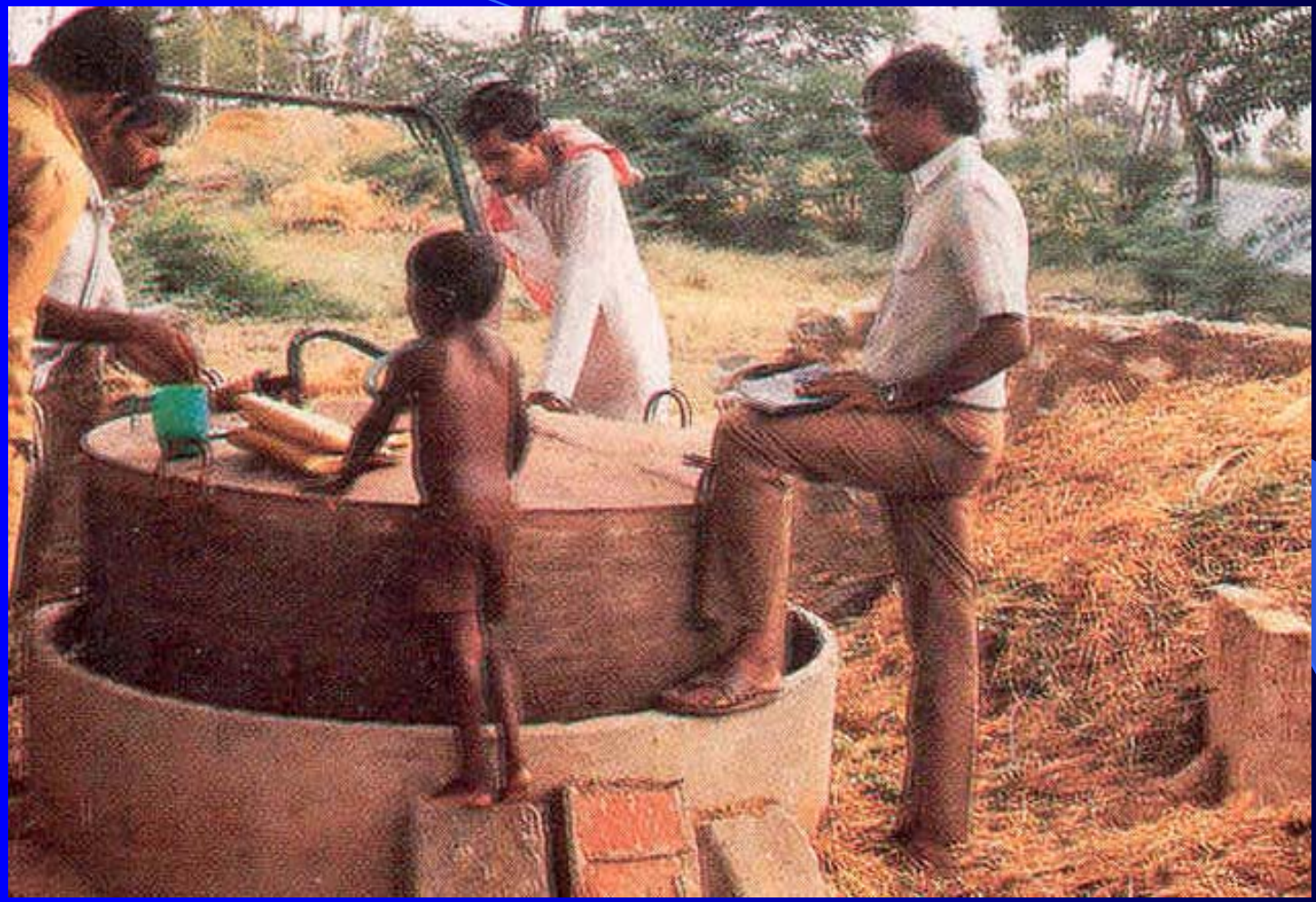


Fig 2 Share in achievement of targets by various agency

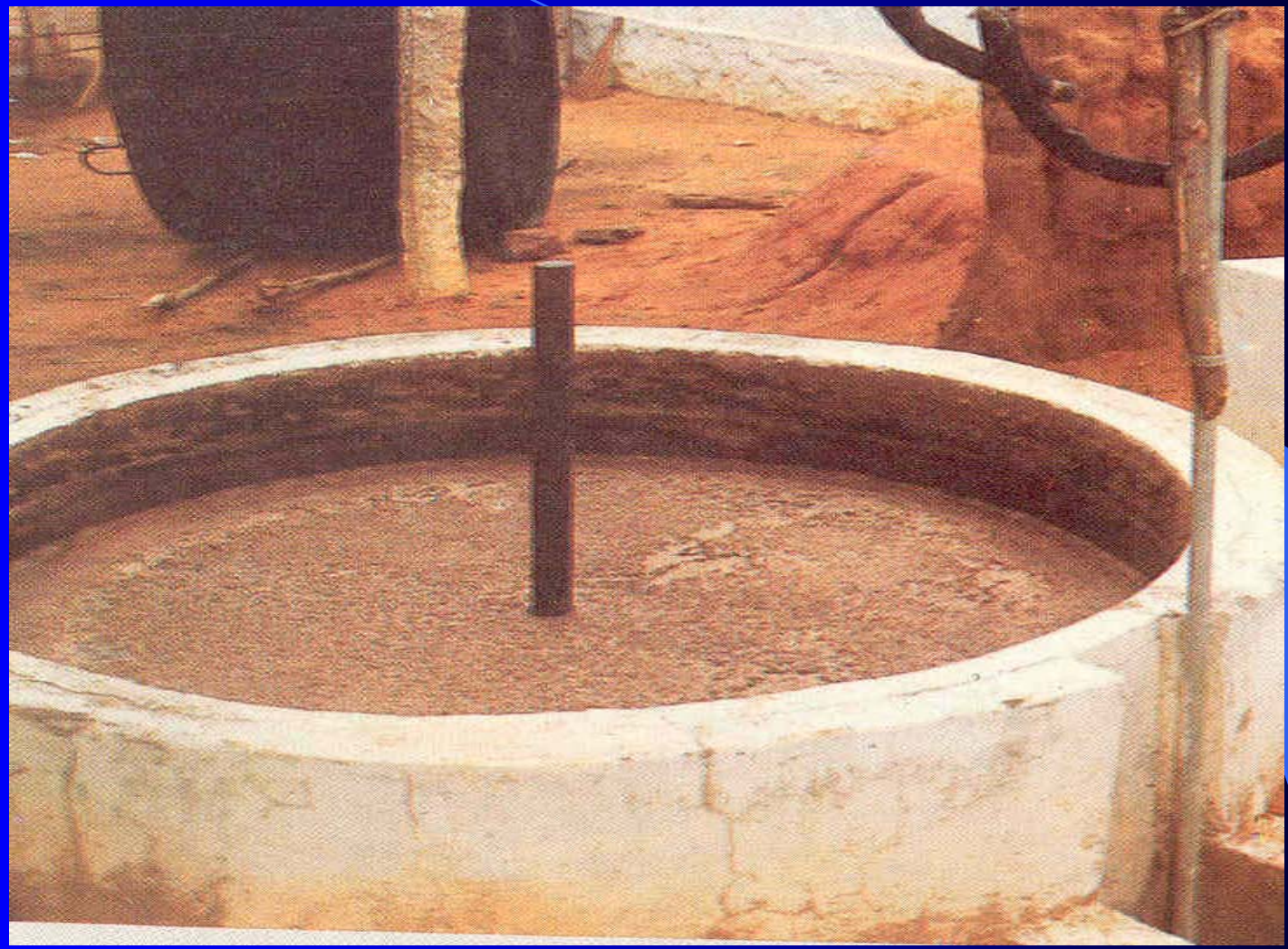


Receipt and expenditure of funding under NPBD in Selected States (MNES, 2002)

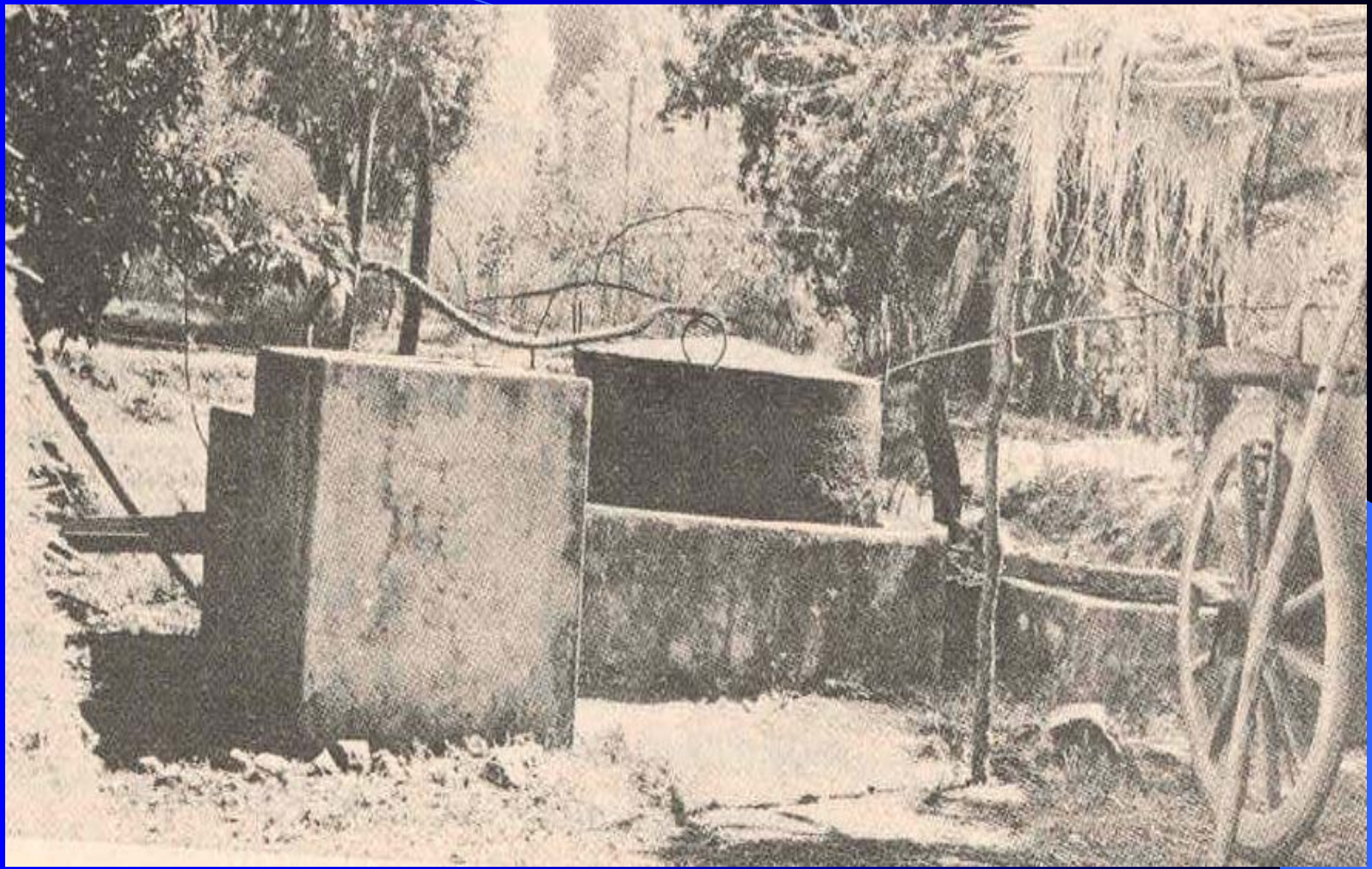

Classification of Biogas Model
Batch Type
Semi continuous type
Continuous type
Stage type
Plug flow type
Well mixed type
FLOATING DRUM
KVIC Model
Pragati Model
Ganesh Model
Ferro cement
FIXED DOME
Janata Model
Deenbandhu Model
Janata – II Model
VINCAP Model
Ferro cement Deenbandhu



Over View of Floating Type Biogas Plant

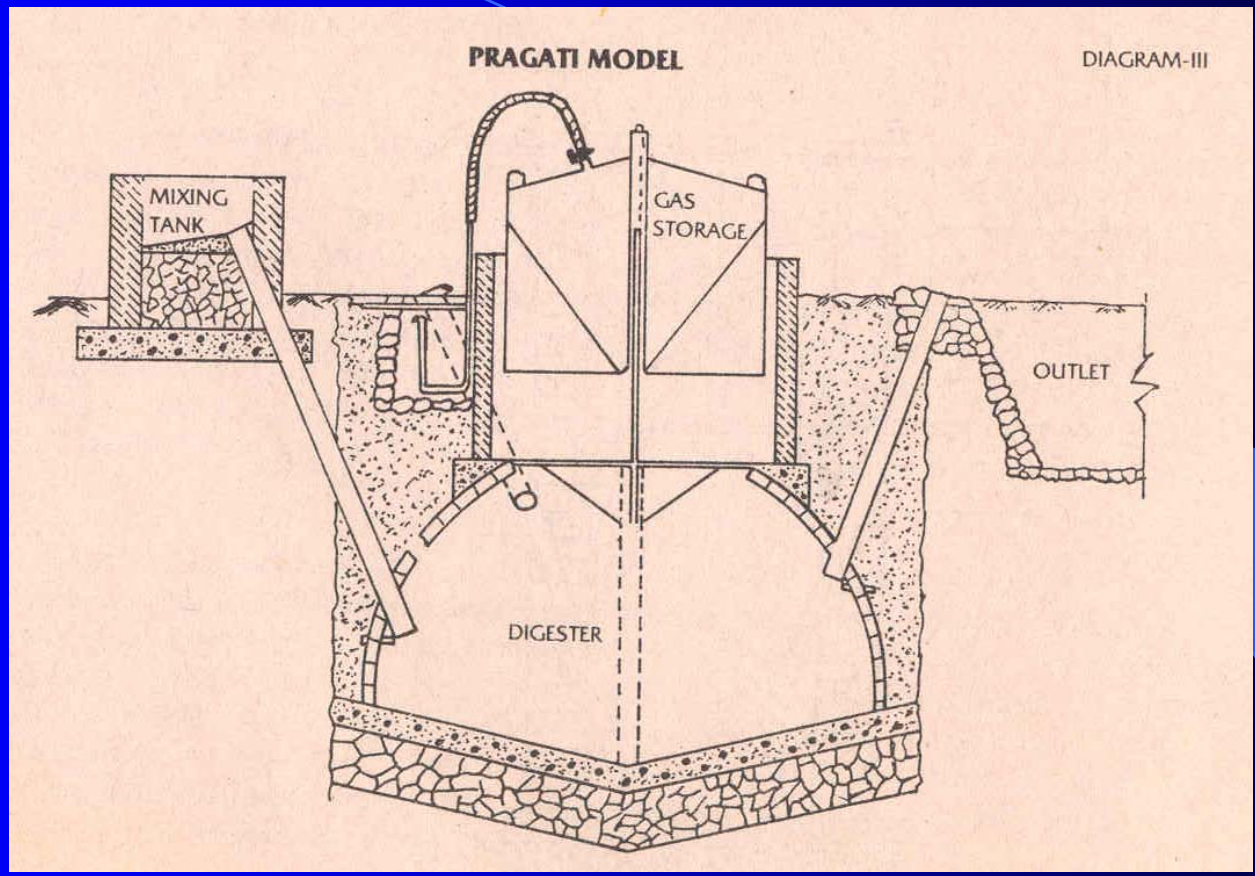


Structural View of Digester of Floating Type Biogas Plant

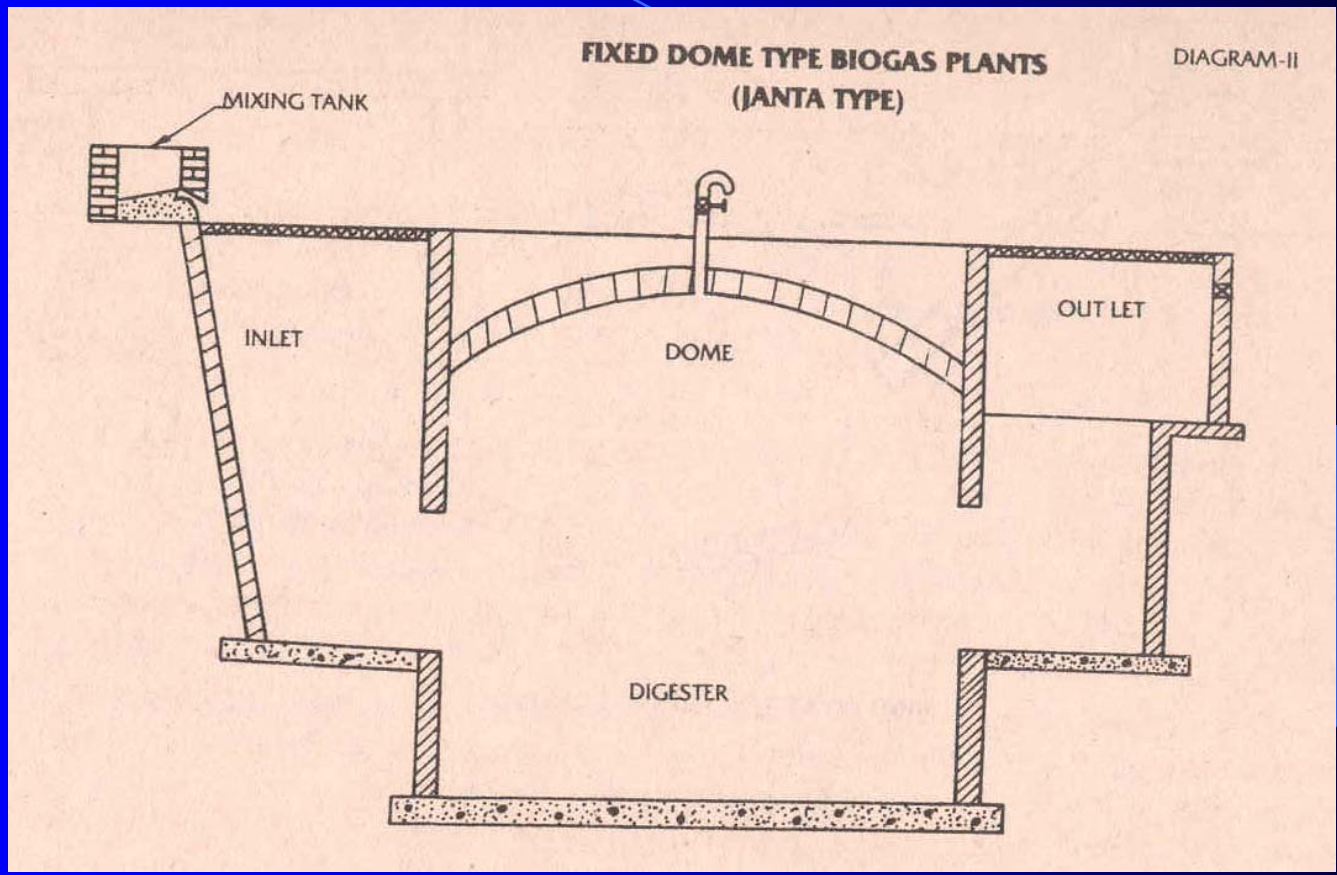


Biogas Plant in Rural Area of West Bengal (Kharagpur)

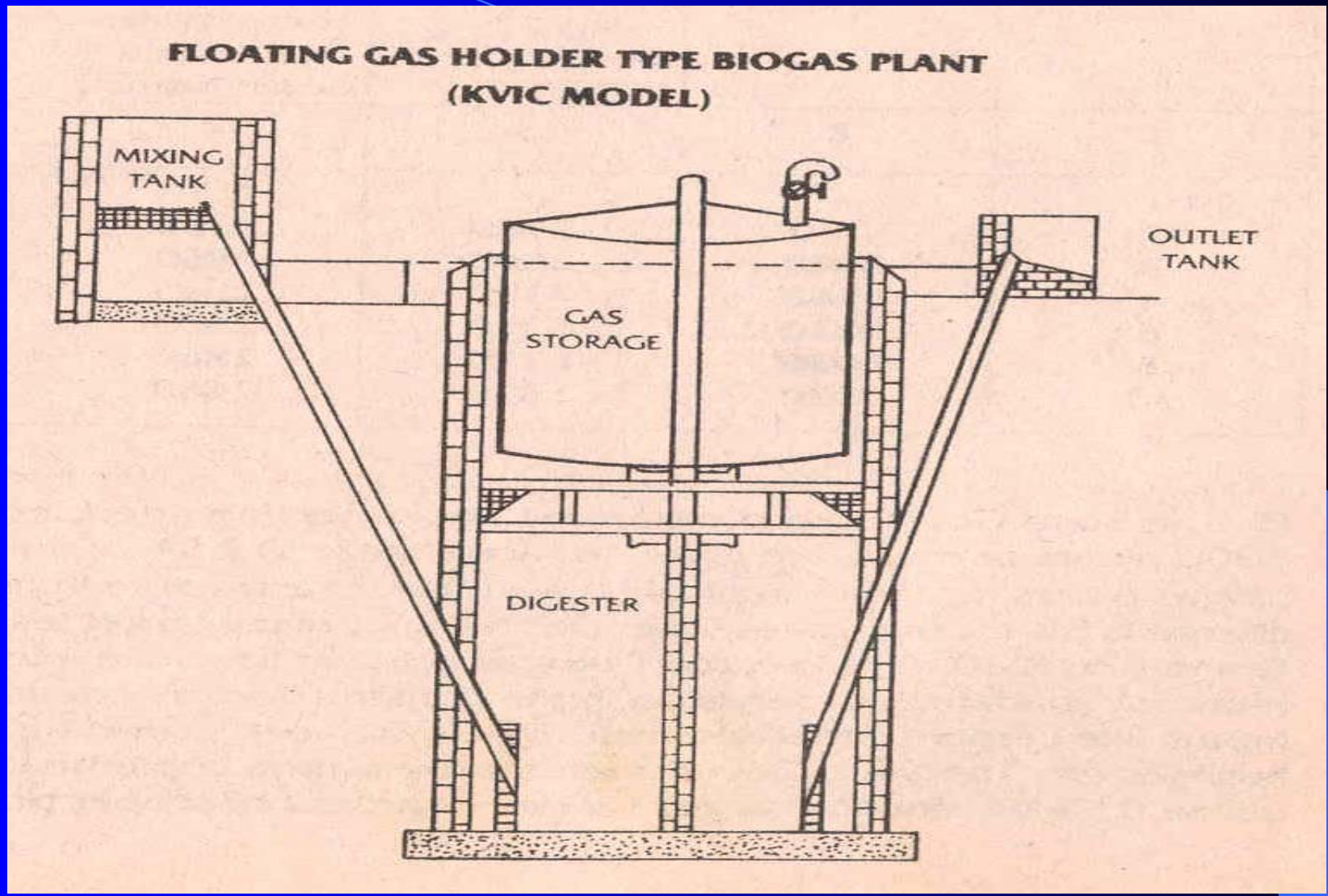
6 MW MSW plant in Lakhnow, UP



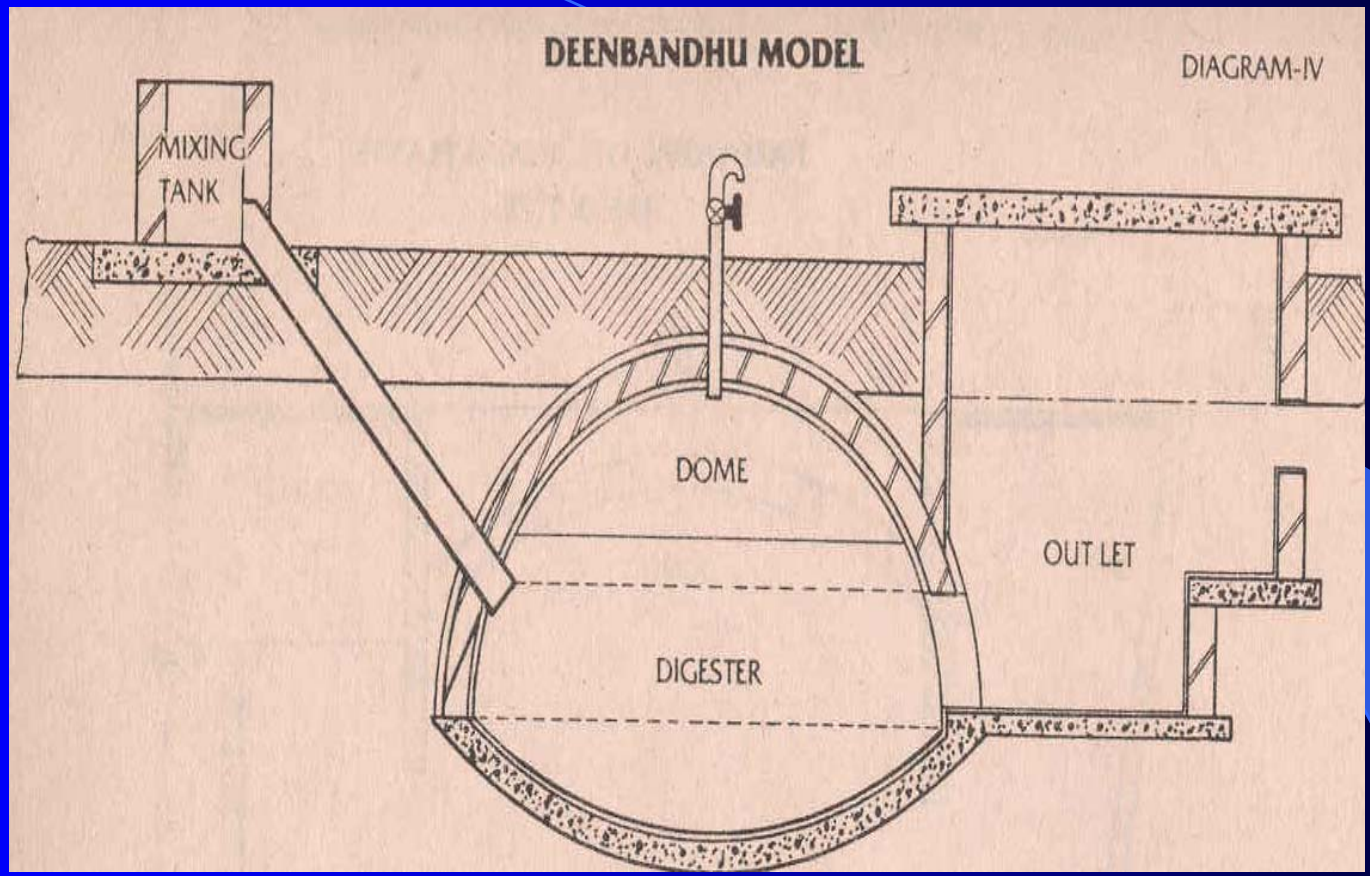
Schematic Presentation of Pragati Type of Biogas Plant



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 then 10 provinces along the eastern and southern coast

The first specialized technology training material on desing 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

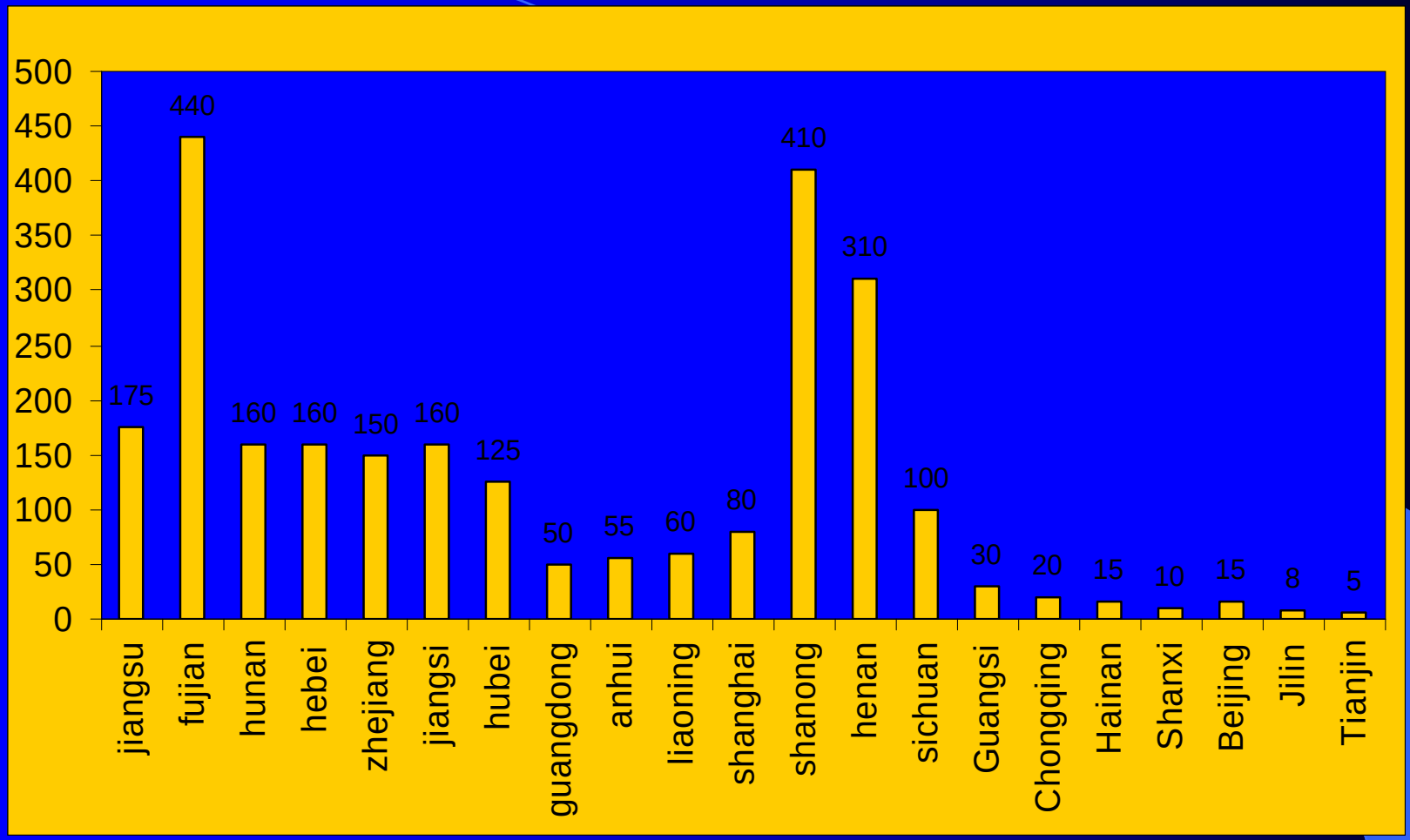
These leads to professional management organisation and leading group of biogas development, and professional institute namely, Chengdu Biogas Institute

Rural Energy Programme in China

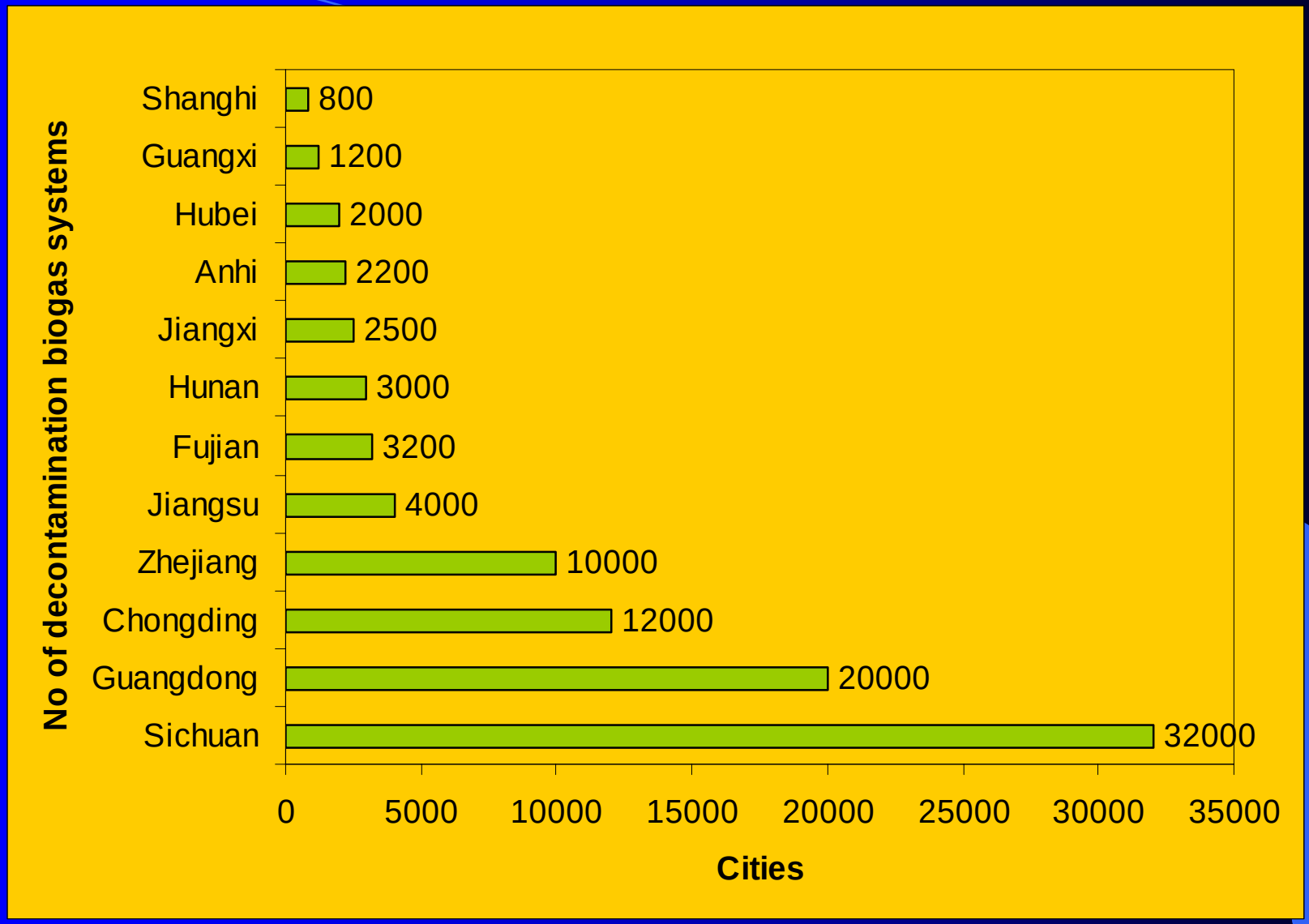
Rural household biogas digesters were widely disseminated some cities and town in Northern China

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

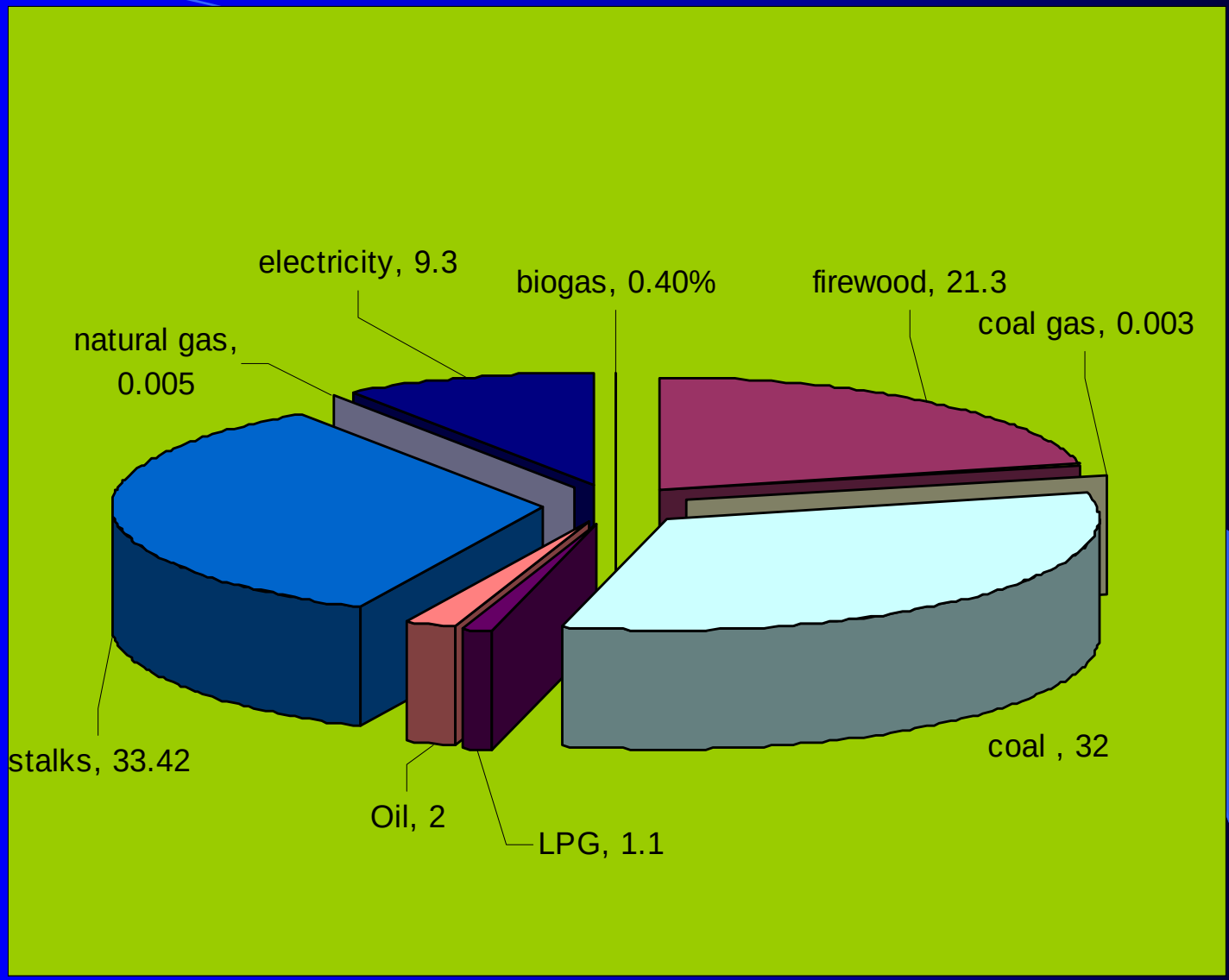
Rural energy development has been arranged into national economic planning for 20 years. An unique way of China rural energy development has been explored.



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.


THE 31ST INTERNATIONAL TRAINING
COURSE ON BIOGAS TECHNOLOGY
BRTC,CHENGDU,CHINA
(Oct.4 — Nov.18,2003)

Positioning of bottom hemisphere and out let 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, Aug12-28, 2003, India

Mr. Pandey, and Mossa Kareem, owner of a poultry biogasdigester, 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 laboratery

Dr. T. Kasturirangan, eminent space scientist, and Mr. Pandey


Indian National Academy of Engine
ANNUAL CONVENTION
December
New De
Prof. DK Dutta Majumde
Prof. R Natarajan

Isolated bacteria for anaerobic digestion


Thank You