Economic viability of gobar gas plants in Coimbatore district of Tamil Nadu

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Abstract: A study conducted in Ilakaraiibuvampatty village in Coimbatore district to study the economic viability of Gobar gas (Biogas) plant advocates the popularization of community size plants at the Pay Back Period, Benefit Cost Ratio and Internal Rate of Return were 3 years, 2.75 and 51.66 per cent respectively for 4 cu.m plant, when compared to 15 years, 1.37 and 23.71 per cent, respectively, for the one cubic meter plant due to economies of scale. (Key Words: Gobar gas plant, Pay back period, Benefit cost ratio, Internal rate of return).

Gobar gas is one among the renewable energy resources, which constitutes the potential asset base to rural economic growth and development and environmental sustainability. Gobar gas has often been hailed as the appropriate technology that satisfies several criteria like supply of cooking fuel, optimal use of local resources such as cow dung, plant residues and other organic wastes and promoting local skills and technologies. Economic development is basically a process which relates crucially on the availability of resources such as energy and environmental factor inputs. Therefore, the developmental efforts should pay dividends on the activities that generate energy, while protecting environment from pollutants.

Gobar gas technology in India dates back to 1897. But research into the technology began only in the 1950's, when several Gobar gas plants came into existence. It was only in 1974 that Gobar gas became in issue of public interest in view of oil crisis in the Gulf countries. In India, the per capita population is about 0.4 cattle. It is estimated that 3-5 cattle are needed to run a Gobar gas plant of 2 cubic metre (cum), capacity, which is efficient to meet the cooking fuel requirement of 4-5 individuals. Hence there would be a great demand for the Gobar gas plants in the coming years to meet the yawning energy gap, especially in the rural areas of Indian sub-continent.

The objectives of the present study were to (i) analyse the performance pattern of different types and sizes of Gobar gas digesters in terms of its economic feasibility, (ii) to evaluate the economics of different sizes of the Gobar gas plants, (iii) to study the problems encountered in the adoption of Gobar gas plants and (iv) to examine the influence of various parameters on the adoption behaviour of Gobar gas farmers.

Methodology

A total number of one hundred Gobar gas users were considered for the present investigation in Thodaminur block of Coimbatore District, where the All India Co-ordinated Research Project on Renewable Energy Sources (ORLIE & NSS) is in operation. Data on the size of the Gobar gas plants, cost of construction, source of finance, type of Gobar gas plants, nature of feeding materials were collected, besides the factors affecting the running of the Gobar gas plants. Both percentage and functional analysis were done to estimate the contribution of various components. Under-functional analysis, both discounted and undiscounted methods of analysis were followed (For detailed discussion refer Gittinger, 1972).

General characteristics of the respondents

The present investigation reveals that about 52 per cent of the Gobar gas users belonged to the category of middle age group followed by old age group with 27.52 per cent. Three fourth (72.51 per cent) of the Gobar gas users had upto primary level education followed by secondary level education (12.17 per cent). It is in line with the fact that the dissemination of innovative technologies has significant relationship with educational level.

Majority of Gobar gas users (81.72 per cent) had agriculture as their main occupation. Almost half of the Gobar gas users (57.29 per cent) had a
family size of more than five members. Most of the
users (69.75 per cent) possessed a live stock strength
of more than five animals. The analysis of the
results further shows that many of the Gobar gas
users (89.92 per cent) did not have any extension
training on Gobar gas. About 91 per cent obtained
loan from commercial banks because of lower rates
of interest and extension of subsidy through Block
Development Officials.

Perception of gobar gas plants by the respondents

The present investigation implies the fact that
98.47 per cent users were using Gobar gas
exclusively for cooking purposes. The advantages
of Gobar gas as perceived by the users were
smokeylessness (100 per cent), reduction in drudgery
(82.17 per cent), easy cleaning of utensils (91.48
per cent) and reduction in the dependability
of firewood (87.26 per cent). The main environmental
factor associated with the gobar gas in the
introduction of substitute of firewood, which
indirectly means conservation of forests and decline
in air pollution.

Economic analysis of various sizes of Gobar gas
plants

The discounted methods of analysis (viz., Net
Present Worth [NPW], Benefit Cost Ratio [BCR]
and Internal Rate of Return [IRR] as well as the
undiscounted method of analysis were undertaken
for different sizes of Gobar gas plants. While
working out the total cost of operation, both capital
and operating costs were considered. The capital
cost of the Gobar gas unit covers the cost of civil
construction and the cost of pipelines and appliances.
The major components of the operating cost of Gobar
gas plants were the labour cost for collecting cow
dung, operation and maintenance cost and repair
and replacement costs of various components of the
plant. The cost of dung was taken as zero, since
the value of the biodigested slurry is higher than
the cost of raw dung. The life span of Gobar gas
plant was taken as 30 years. In the ORP study
area, majority of the Gobar gas farmers possessed
Deenabandhu type Gobar gas model. The PBP,
BCR and IRR for various sizes of Gobar gas plants
are presented in Table 1.

From the table, it is evident that the
investment repayment period became shorter as the
size of the plant increased. The pay back period
was very low for smaller size Gobar gas plants at
12.5 per cent discount rate. The BCR compares
the discounted benefit stream with the discounted
cost stream. The decision criteria is to accept the
plants whose BCR is greater than one. The IRR
was also calculated to appraise the plants of various
sizes and IRR shows the discount rate at which the
NPW is equal to zero.

Operational and structural deficiencies

Major stumbling blocks for Gobar gas plants
becoming non operational were broadly divided
into two components. They are structural [ie
construction oriented problems] and operational
difficulties. About 48 per cent of the non functional
plants suffered due to operational problems with
structural deficiencies accounting for the rest. In
KVIC [Khadi and Village Industries Commission]
model, the corrosion of the metal dome was found
to the major problem that led to leakages and it
needs frequent repainting.

The KVIC models were reported to have
suffered for structural failures. On the operational
side, the major problem was the availability of
adequate quantity of cattle dung required for initial
filling of the digesters. Insufficient availability of
dung was reported by 42.57 per cent of the users,
which form the stumbling block for the operation
of the digesters. The problems encountered during
the operation of gobar gas plant were the choking
of pipelines by water accumulation. It was reported
by 38.42 per cent followed by scum formation in
the digesters, which led to clogging of inlets and
outlets.

It was revealed by 20.17 per cent of the
sample respectively. Lack of technical guidance
and service and paucity of funds were perceived
by 21.53 per cent and 40.72 per cent, respectively.
Even small repairs had forced many to abandon
the operationalization of the digesters and 57.54
per cent were of the view that during winter seasons
the productivity of gas fell drastically. It might be
due to the inactiveness of the bacteria in low
temperature. Non-availability of sufficient
numbers of cattle due to restricted fodder supply
was revealed by 72.47 per cent of the Gobar gas
farmers. The study shows that the percentage of
Gobar gas plants owned by SC (scheduled caste)
farmers were negligible [2.78 per cent]. It might
be due to the possession of more number of small
cattle and lack of finance to be met the working
capital needs of cattle rearing.

Conclusions and policy options

From the foregoing analyses, the following
policy options were derived for adoption and
further research.
### Table 1. I PBP, BCR and IRR for Various Sizes of Gobar gas Plants

<table>
<thead>
<tr>
<th>Size of the Plant</th>
<th>Discount Rate</th>
<th>Pay Back Period</th>
<th>BCR</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Cum.</td>
<td>12.5%</td>
<td>15 Years</td>
<td>1.37</td>
<td>23.71</td>
</tr>
<tr>
<td>2Cum.</td>
<td>12.5%</td>
<td>7 Years</td>
<td>1.90</td>
<td>38.62</td>
</tr>
<tr>
<td>3Cum.</td>
<td>12.5%</td>
<td>4 Years</td>
<td>2.53</td>
<td>49.74</td>
</tr>
<tr>
<td>4Cum.</td>
<td>12.5%</td>
<td>3 Years</td>
<td>2.75</td>
<td>51.66</td>
</tr>
</tbody>
</table>

- To make use of the Gobar gas available to marginal and scheduled caste farmers, who are actually in need of it, cost effective designs of Gobar gas digesters must be fabricated to meet the actual requirements of the target group.

- In some cases, even small problems like formations, clogging of inlets and outlets etc., forced many users abandoning the existing plants, which needs rectification and alternate solution to maneuver the problem.

- The analysis of BCR implies that as the size of the plant increases, the BCR also increases substantially, which suggests the construction of community Gobar gas plants to economies the dung use efficiency.

- Feedback information need to be collected then and there from the Gobar gas farmers to re-orient basic research towards the requirement and make the biogas programme location specific by giving weightage to construction and operation oriented problems.

**References**


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**A computer model for design and evaluation of surge flow furrow irrigation systems**

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**Abstract:** Successful performance of Surge irrigation system depends chiefly on the design of Surge Cycle Timing parameters and prediction of the net Waterfront Advance times to reach the furrow tailends within the stipulated duration of irrigation. Extensive experimentation with different practical combinations of furrow inflow rates, furrow sizes, length and gradients for selected Surge Cycle Ratios and Number of Surges to complete irrigation has resulted in the development of a comprehensive computer model entitled SurgeModel. Validation of the model SurgeModel has also revealed that the predicted and the observed values of net waterfront advance times to reach furrow tailends lie in an acceptable range of ±10% deviation while those of the soil moisture distribution efficiency lie in a range of ±0.8%, making the developed model reliable for design and pre-evaluation of surge irrigation systems to suit the conditions prescribed in the text. (Key Words : Surge flow, Cycle timing, Cycle Ratio, SurgeModel, Model, Waterfront advance, Moisture distribution efficiency).

In Tamilnadu, surface irrigation is accomplished through shortstrip furrow and checkbasin layouts for most crops. In addition to a significant loss of land for cultivation to the tune of 30% and more these layouts also lead to inevitable losses of irrigation water through deep percolation and run-off. The irrigation efficiencies under these conventional systems often lie below 65% owing to