Lucknow

Kachra Lao, Biogas Ley Jao*

Waste is all around us. It comes from homes, kitchens, markets, animals, farms, etc. There exists a dire need to consume waste productively. The Government of India’s animal waste from a livestock population of 485 million in India contributes excess nutrients, pathogens, organic matter, solids, and odorous compounds to the environment (Ministry of Agriculture 2006). Hence there is a need to focus on animal waste management, along with other sanitation-related issues.

The Total Sanitation Campaign (TSC) has allocated 10 percent of its budget for undertaking activities related to the safe disposal of solid and liquid wastes. It has been established that the anaerobic (without oxygen) decomposition of organic waste leads to methane production, and methane is a useful fuel. As such, the large-scale availability of cow dung and other organic waste in rural areas can be used to produce methane gas in an organized way. It is estimated that given the existing cattle population, India can produce enough methane gas to entirely replace LPG and kerosene in cooking, and can use it as a substitute for petrol in transportation vehicles. In terms of calorific value, one kg of methane gas is more or less equal in energy content to one kg of petrol, LPG, kerosene or diesel. Moreover, the byproduct can serve as excellent organic manure, doing away with the need for expensive chemical fertilizers that, once again, require LPG as raw material.

Description of Best Practices

The Bio-energy Cell in Lucknow’s Department of Planning, in collaboration with UNICEF, developed a solid waste-based biogas system in 2008 that offers an effective solution to the problem of managing solid wastes. This simple technology, blended with user-friendly operation and maintenance features, is attracting rural and urban masses interested in its wide-scale adoption. In the new bio-energy mission model, it is possible to accelerate the natural anaerobic process by putting organic wastes (manure and vegetable matter) into insulated, air-tight containers called digesters. All kinds of agro and other organic household waste are collected and fed into the bio-digester. In this model there are 10 digesters,
each with the capacity of 200 kg of waste per week, which implies that 2,000 kg of raw material can be fed to these digesters on a weekly basis. After filling the required quantity, the bio-digester is sealed with a pre-fabricated dome of inert materials. Initially, after four or five days, the gasification begins under anaerobic conditions. This gas is composed of 65 to 68 percent methane and 31 to 33 percent carbon dioxide, along with hydrogen sulfide (H2S) and moisture (1 to 2 percent) as traces of ammonia. However, the gas is treated by passing it through lime water to remove carbon dioxide, then over iron fillings to remove H2S before it can be used.

This methane gas, similar to natural gas, can be used for heating, light, stored for future use, or compressed to power heat engines. Around 50 percent of feeding material (after gasification) is collected in the outlet of the plant; it is called the biogas slurry. It is a good fertilizer, rich in nitrogen and phosphorus. This type of plant was established at village Mishrawallia (two units) in Ballia district in 2008 and in village Mullahikhera (one unit) in Lucknow district in 2009 on a pilot basis with financial support from UNICEF and under the technical coordination of the Bio-energy Mission Cell, Department of Planning, Uttar Pradesh. Both plants are functional and their O&M are ensured by the user groups.

Benefits of the Biogas Plant

- With the proper management of animal and other agriculture/organic wastes, the village will be clean, leading to better health and hygiene.
- Conversion of organic waste into methane and its use as fuel will lead to energy security because fossil fuel is not going to last for more than 30 or 40 years.
- Dependence on electricity for lightening can be reduced substantially.
- Normally, aerobic decay of organic waste leads to emission of greenhouse gases, such as carbon dioxide or carbon monoxide. The process of methanization reduces greenhouse gas emissions and helps in arresting depletion of the ozone layer. This is likely to earn carbon credits.
- These kinds of plants can be easily set up and operated at the village level and can be managed by women self-help groups or local entrepreneurs. Since the product has a captive market, the plant is bound to be
economically viable and it can also generate employment opportunities for a large number of people.

**Community Participation**

Communities are involved from the planning stage of the project. Around 15 to 40 families were involved under each 100 cum biogas plants. In total, 90 families are benefiting from three community biogas plants commissioned by the Bio-energy Cell. The land required for each plant has been donated by the community. Further, the community had contributed 20 percent of the capital cost of the plant in the form of cash, labor, and material. Every user community had been organized and registered as a society. Later, these plants were handed over to the respective societies. Each family either contributed 20 kg of raw material per day or paid ₹250 per month for the optimal production of biogas.

**Sustainability**

The Bio-energy Cell had trained the selected people in the operation and maintenance of biogas plants. Further, it had facilitated every society to build strong backward and forward linkages with various government programs and banks. This enabled the societies to mobilize financial resources for various income generation programs (purchase of livestock, vermicomposting, etc.). Two out of three community biogas plants are well managed by the community. The third plant is not producing optimal biogas due to irregular feeding of the biogas digester. However, the Bio-energy Cell is planning to strengthen community actions and ownership through various means.

**Replication**

Many officials, communities, and NGOs have started visiting these pilot plants and were fully convinced with their results. The Bio-energy Cell additionally designed a family model costing ₹31,500 per unit. Under the TSC program, Uttar Pradesh had approved both these models (community and family-size models) and issued a government order to construct similar kinds of plants under the TSC program. Some states (Tripura, Meghalaya, Gujarat, Andhra Pradesh, Tamil Nadu, Kerala, Pondichery, etc.) have started replicating this model.

**Key factors Behind the Success of this Best Practice**
- Active support of technical agency, Bio-energy Cell, Uttar Pradesh.
- Financial support from UNICEF.
- Operation and maintenance by users.
- Multiple benefits.

**Challenges and learnings**

- The biggest challenge is how to mobilize the capital cost (8 to 10 lakhs per community plant) for a community biogas plant. Even more difficult is mobilizing a 20 percent community contribution.
- Another challenge is ensuring the operation and maintenance of community plants in terms of collection of raw material for regular feeding of biogas digester, meeting repair costs, etc.
- Though this plant can run with 20 percent cow dung and 80 percent agro waste, households who do not have any livestock are not able to collect even 20 percent cow dung on a regular basis, which finally affects the functioning of the biogas plant.
- The community biogas plant is well managed in instances where the user community developed strong backward and forward linkages.
- Biogas from the community plant, when supplied to households for cooking through long pipelines, has cost implications in addition to difficulties related to pipeline maintenance. Alternately, when supplied for lighting through wire, the plant is functioning efficiently with reduced O&M costs.  
  *(Source: MDWS)*

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