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LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND SUSTAIN WATER, SANITATION AND HYGIENE SERVICES

Community led integrated model for sustainable and inclusive faecal management and wash services

Guruprasad Sahu (India)

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For better WASH services, we need infrastructure, energy to clean water, incentives to ensure community participation and funds to make WASH services sustainable. An integrated model, which is a combination of a community biogas plant (CBP), a reverse osmosis (RO) plant and community toilets, provides a one stop solution for quality WASH services. In this model the sceptic tank is attached to the CBP, which produces biogas used to generate electricity to power the RO plant. Slurry, from CBP, is converted to vermicompost and the increasing demand for organic manure makes it a community led sustainable business model. Profits can be used to build community infrastructure so the community no longer has to depend on outside funds. It enhances the capacity of the community to work together, augments income and reduces disease. Community participation in this model addresses the major challenge of WASH professionals - community ownership of WASH services.

Introduction

In rural and suburban areas cow dung on streets, open defecation, contaminated water and smoke from *chulhas* (stoves using firewood) lead to major health issues and diseases like diarrhoea, Schistosomiasis, Trachoma, Ascariasis, pneumonia, asthma, blindness, lung cancer, tuberculosis, low birth weight, chronic obstructive pulmonary disease and other skin and respiratory diseases. More than 1.6 million deaths and over 38.5 million disability-adjusted life years (DALYs) were attributable to indoor smoke from solid fuels in 2000. Cooking with solid fuels is thus responsible for a significant proportion, about 3%, of the global burden of disease (Smith, 2004).

The Integrated model, which is a combination of a community biogas plant (CBP) integrated with a reverse osmosis (RO) plant and community toilet, provides a one stop sustainable solution to reduce all these diseases and makes WASH services sustainable and inclusive. It enhances cleanliness and health and provides a monetary income for the community. Esrey's (1996) multi-country study suggests that a mean reduction in diarrhoea of 37.5% is possible following the introduction of improved water supply and sanitation in developing country environments (Prüss-Üstün, 2004).

A case of community biogas plant

One of the very few successful CBP in India is the plant in Bhintbudrak village, Taapi district, Gujrat, constructed by Surat District Co-operative Milk Producer's Union Ltd (SUMUL).

The plant produces biogas which is distributed to the villagers through underground pipes. The gas supplied is used as a fuel for cooking by the villagers. The production of vermi compost from the output slurry makes this project economically viable. The village co-operative looks after the day-to-day operations. SUMUL continues to act as the mentor to the villagers providing crucial technical support. With an annual profit of USD 21,569 the plant has reached break even in less than two years and has been working successfully for more than last 20 years (Nasery, 2011). Details of the project are provided in the box.

Project details

- Number of beneficiaries: 121
- Cow dung per beneficiary: 30 kg per day.
- Total cow dung input using actual operations data: 3.5 tons per day.
- Rate of cow dung: $0.01 per kg.
- Cost of gas supply: $2.25 per month per beneficiary.
- Vermi compost produced using actual operations data: 20-35 tons per month.
- Rate of vermi compost: $0.05 per kg.
- Other expenses for the plant:
  - Supervisor salary= $37.51 per month. Worker salary= 4* $15 per month.
  - Laborer daily wages= $ 0.75 per day
  - Electricity and maintenance= $ 120.02 per annum
  -

Source: Nasery, 2011

Cost benefit analysis of the plant (Nasery, 2011)

The annual costs, revenue and additional benefits (Table 2; Table 3) show that this CBP reaches break even within one year and provides considerable profits for community which can be used to improve WASH services and overall well-being of the community.

Table 1. Initial cost of community biogas plant

Particulars	Installation cost in USD
Two digesters with 85 cubic meter capacity each	18003.42
Bio gas distribution pipelines	6676.27
Vermi compost Unit	2250.43
Pressure regulation system	5326.01
Total capital cost	**32256.13**

Table 2. Annual Operational cost and revenue

Costs	Amount in USD
Dung - 4.5 Million tonne (MT) per day Dung = 1643 MT/year bought at USD 3.75/MT	6162.42
Labour Cost - 5 Employees	2062.14
Maintenance - Painting Gas Tank, oil, diesel etc.	120.02
Total annual operational cost	**8344.59**
Revenue	
Bio Gas Distribution 121 Connection X USD 2.25 X 12 Month	3267.62
Vermicompost from Slurry Input dung - 1643 MT of which 60% is obtained as dry slurry which produces 592 MT vermicompost which is sold @ USD 45.01 per MT	26645.06
Total annual revenue	**29912.68**
TOTAL ANNUAL PROFIT	**21569.10**

Table 3. Other benefits in monetary terms	
Particulars	**Amount in USD**
Fuel saving 121 Family X 5 Person = 605 X 5 Kg of Woods for Cooking @ USD 0.03 per kg	33130.04
After using vermicompost 25% more income from crops due to improved quality and production i.e. 121 families get USD 300.06 more per Annum.	36306.90
Revenue Generation from Carbon Credit Yearly (Expected)	3991.90
Total Other benefits in the terms of rupees	**73428.84**

Replication

Many agencies have come forward to replicate the concept of the CBP considering its tremendous success. AMUL has decided to implement this concept in 50 more villages under its co-operative network. The tribal development department of Gujrat has also followed AMUL and plans to establish 20 such plants (Nasery, 2011).

Specific outcomes/learnings

- Health: Biogas is a smoke free fuel. The health hazards due to the smoke emitted by previous cooking fuels like wood and cow dung is eliminated. Thereby cutting the medical bills in the long term.
- Cleanliness and hygiene: The main vision behind the establishment of CBP was to have a proper cow dung disposal system. Accordingly, the CBP has contributed in increasing the cleanliness in the village. Also, the spread of diseases due to the accumulation of cow dung is no longer an issue.
- Money: Each beneficiary earns around USD 2.48 per month from this scheme (Nasery, 2011).
- Village co-operative: it strengthens the community level institutions. Which can be used for further development of the community.
- Revenue: The village co-operative generates huge revenue from the CBP which can be used for many development activities in the village.
- Employment generation: The CBP requires one supervisor, four workers and 10-15 daily wage labourers for its entire operation. All the staff at the plant is local. Thus, the CBP provides employment for the villagers (Nasery, 2011).
- Environment: Use of clean fuel, a proper waste disposal system for cow dung and the prevention of deforestation for firewood are the main benefits to the environment from the plant. It is estimated that the plant can generate carbon credits worth INR 266,000 annually (Nasery, 2011).

How learnings can be taken further

Mahatma Gandhi advocated for self-dependency of rural communities. Biogas provides an opportunity for rural communities to achieve self-dependency in terms of energy, WASH services, local employment and entrepreneurship. Based on the project, discussed above, we can take learnings further. Which is discussed as follows:

Application of biogas in sustainable faecal sludge management and water treatment

Integrated model for urban slums and rural communities

A community size toilet for slums or villages, where people are incentivized in terms of biogas, clean water or monetary incentives to use toilet. The septic tank of the toilet is attached to a CBP, which produces biogas and electricity. Biogas is supplied to houses for cooking purpose and electricity is supplied to RO plants to provide clean drinking water to slums or villages. **S**lurry from the CBP is converted to vermi-compost, which is the major source of revenue for plant. This can be implemented with complete community participation as an entrepreneurship model. This integrated model provides sustainable WASH services leading to enhancement in cleanliness and improved faecal sludge management.

Feasibility and sustainability of clean drinking water in an integrated model

Biogas can be converted to electricity using a biogas engine, with an alternator and control panel. A biogas engine, three phase 220/240 VAC with electronic ignition system and electronic governing, consumes 10 cubic meter gas per kilo watt hour (m^3/kWh) and costs around USD 7,801. A CBP of 160 m^3 capacity can produce 15 kWh of electricity per day with the help of this engine Usually 3 - 5 kWh of electricity are required to clean 1000 litres of water through RO (Al-Zubaidy, 2012). With 15 kWh of electricity 3000 - 5000 litres of clean drinking water can be provided to the community each day.

With revenue of USD 21458.32 per year from biogas, it is possible to provide clean water at nominal rates or free of cost.

Source: http://www.biotech-india.org/Projects_Waste_Electricity.aspx

Feasibility and sustainability of open defecation free community thorough an integrated model

Profits from CBP can be used to build community toilets, where the sceptic tank is attached to a CBP. Those who use the community toilet daily can be incentivised in terms of concession in gas or drinking water charges. The enhanced capacity of community institutions and entrepreneurship among community members, due to CBP operations, will support the aim of achieving an open defecation free (ODF) community and larger goals of community development.

Construction of community level toilets solves the issue of resistance among many people to investing in building toilets. Since faecal matter or dung is required to run a CBP, incentives to use the toilets becomes sustainable. Incentives may include subsidised gas or monetary benefits for using the toilet, which is attached to CBP. It will also reduce operational cost of plant which is incurred due to supply of dung on daily basis.

Hygiene from an integrated model

As per our experience, we have seen resistance on the part of community to change their habits and surroundings leading to continuity of the status quo. A special subsidy by the Indian government has not shown a tremendous increase in toilet usage. Clean drinking water and cleanliness on streets is yet to achieve the priority status in rural and suburban communities, where we need to do away with cow dung on the streets. In the integrated model, due to the high demand and monetary value of cow dung, there will be enough incentive to clean the dung from the streets.

Water conservation from an integrated model

An integrated model needs a considerable amount of water on a daily basis. However, that water need not be pure water. We can use grey water to meet demand. Therefore, an integrated model can play a vital role in water conservation.

Women's empowerment from an integrated model

Since community members own the plant, a specific percentage of woman can be included in the decision making committee and the job of supervisor can be given to a woman. Biogas plants lead to women's empowerment, as they no longer have to collect firewood and suffer from smoke inhalation while cooking.

Conclusion

Ensuring community participation and cooperation becomes a major task for WASH professionals, in providing WASH services. The integrated model, which is a combination of a CBP, a RO plant and community toilets, run by the community only, which brings in revenue of around USD 21,458 per year makes WASH services and faecal management sustainable and inclusive. In rural areas, women are forced to carry water on their heads for long distances. A community RO plant powered by biogas will not only provide clean drinking water but also lead to women's empowerment. Women will no longer have to carry water on their heads. Cow dung and waste water (grey water) will shift to the CBP, leading to cleanliness in the community. Since the community owns and operates the plant, in the long run confidence and cooperation among community members will increase leading to capacity development of the community. The integrated model discussed above (CBP + RO plant + community toilet) leads to sustainable and inclusive wash services, augments the income of the community and individuals, boost entrepreneurship, creates employment at local level, leads to women's empowerment, conserves water and preserves the environment.

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Contact details

Guruprasad Sahu is a project associate at HCL Foundation, India working with marginalised rural communities. He has specific interest in community development, gender and technology as a solution for inclusive growth.

Guruprasad Sahu,
VPO Ranila, District Bhiwani, Haryana, India.
Tel: +919541473010
Email: guruprasad5543@gmail.com