The 'Click Factor': What Makes Technology Dissemination Successful?

Analysing Biogas Dissemination Practices

Submitted in Partial fulfilment of requirements of
M. Tech. in Technology and Development

by

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Dedication

To see a world in a grain of sand,
And a heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour.

- William Blake

To all those who have helped me in my quest to knowledge and made me wiser…

Dissertation Approval

This is to certify that the seminar report titled "**The 'Click Factor': What Makes Technology Dissemination Successful? Analysing Biogas Dissemination Practices**" submitted in partial fulfilment of the course TD 695 is an original effort carried out by Yatin RS Diwakar (10335001).

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Declaration

I declare that this written submission represents my ideas in my own words and where other‘s ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honestly and integrity and have not misrepresented or fabricated or falsified any ideas, data, facts or sources in my submission. I understand that any violation of the above will be cause of disciplinary action by the institute and evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

This report is an attempt to answer the question ‘how dissemination efforts of an appropriate technology by a change agency can be improved?’ A brief overview of dissemination theory, stages in adoption, adopter classes and barriers to dissemination is taken in the literature review to better understand the process of technology dissemination. Biogas technology was chosen as the specific instance of technology and its dissemination by five agencies in Western Maharashtra is studied through interactions with their heads. Important factors from these discussions and literature review were identified that affect the dissemination efforts of biogas technology. A list of steps that must be included in biogas dissemination is given in the discussions. Though it is not exhaustive, it is a starting point. Key factors are highlighted in the conclusions as the “Click factors”. Problem of dissemination itself can be treated as a technological problem and needs to be tackled like any other challenge of designing, implementing and operating an appropriate technology. A generalised strategy of dissemination work is also outlined in the conclusions.

Key words

Appropriate technology, Biogas, Dissemination, Diffusion, Change agency.

Table of Contents

List of Figures

List of Tables

List of Graphs

List of Appendices

Nomenclature

ARTI	Appropriate Rural Technologies Institute, Pune
BAIF	Bharat Agro Industries Forum Research and Development Foundation
CDM	Clean Development Mechanism
JP	Jnana Prabodhini
KVIC	Khadi and Village Industries Commission
LPG	Liquefied Petroleum Gas
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
NABARD	National Bank for Agriculture and Rural Development
NBMMP	National Biogas and Manure Management Programme
NGO	Non-governmental organisation
NPBD	National Project on Biogas development
PRA	Participatory Rural Appraisal
R&D	Research and Development
SHG	Self Help Groups

1 Introduction

Technology dissemination refers to the outreach, application, transfer, etc. of fruits of technological developments. It is establishing a relation between the technology and its potential beneficiaries. (Woolgar, 1994). While technologies can be classified in various ways, appropriate technology defines the category which is the focus of this research. Appropriate technology has the characteristics that it is small scale, energy efficient, environmentally sound, labour-intensive and controlled by the local community. It must also be simple enough to be maintained by the people using it (Hazeltine & Bull, 1999).

Dissemination c be addressed as a specific instance of a much more general problem: namely, the production, transfer, uptake and consumption of cultural artefacts in general (Woolgar, 1994). Appropriate technology is one such cultural artefact, which is affected by social and cultural mores of the recipient society (Frenierre, 2008). The mechanisms by which market/commercial technologies and appropriate technologies spread are different. Beyond realising the general principles, further understanding is needed for successful dissemination.

In this report, an attempt is made to identify the various factors that affect the dissemination of appropriate technologies in a society. Biogas technology is taken as the specific technology and its dissemination by some development organisations in Maharashtra has been studied. From interviews, field observations and literature review, important factors or the "click factors" are identified that determine the success of dissemination. In this chapter, the philosophy behind this research, challenges in dissemination of appropriate technologies and why biogas has been selected is described.

1.1 Idea behind the Research

It was realised that many alternative technologies which are socially beneficial but not commercially viable for some reason, do not spread enough across the society. Many prototypes are developed successfully, with inputs from people in field, but aren't put to use on a large scale. Many attempts at doing so fail for some reason or the other. Apart from

drawbacks of the technology and the constraints of the society, the role played and interactions carried out by the development organisations (or agencies) seem to be major factors determining success or failure of the technology dissemination.

Jeff La Frenierre, in his article on social and cultural implications of appropriate technology concludes "When a technology fails, it is often due to one (or both) of these causes: the technology was inappropriate (technical failure or inability to meet user characteristics and requirements) or the recipients did not participate in its introduction." (Frenierre, 2008). He attributes this lack of participation to the development sector neglecting to give full consideration to the social and cultural mores of the people the development is meant to serve.

The author feels that while this is true, another aspect also needs attention. To ensure participation of the recipients, the development agency should engage them successfully. Many times, the same proven technology fails in the same region if the implementing agency or its agents are changed. This is due to the differences in approach and emphases on various steps of the process.

1.2 Hourglass Approach to the Research

This research aims to understand *modus operandi* of grass-roots level technology extension or dissemination, from the start to end (and beyond) for successful spread and sustainable use of the technology. Through this understanding, insights can be obtained for increasing efficacy of dissemination process.

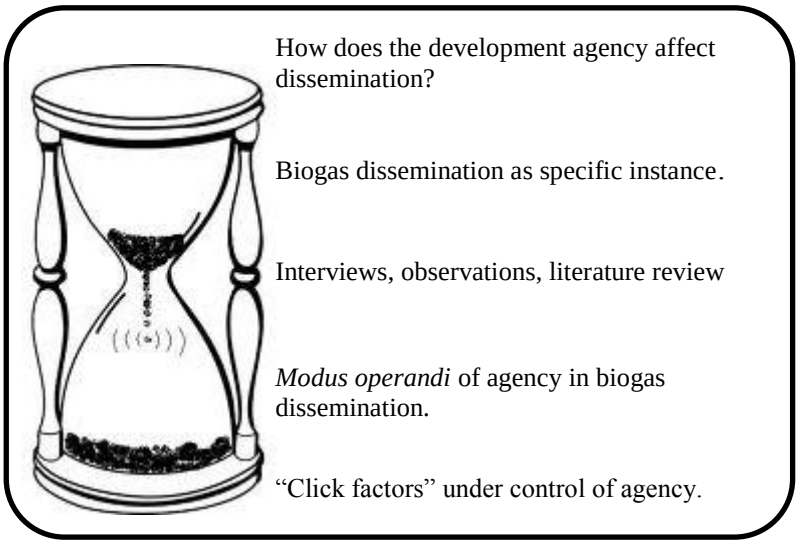


Figure 1.1: Hourglass approach

With this broad idea in mind, biogas technology dissemination in Western Maharashtra was studied. Through interviews and observations, the steps followed during biogas dissemination by some agencies have been identified. Using inputs from

literature, list of crucial steps can be made. This leads to a checklist of activities to be performed during on-field biogas dissemination.

Many points in this list can be generalised and corroborated from literature review. Thus, this research will lead to creation of a checklist usable by a development agency. It will include obvious and non-obvious factors that affect the dissemination of a technology which are under the control of the change agency with the aim to improve speed and efficiency of change. The important ones are the "click factors" that determine successful dissemination.

1.3 Dissemination of Appropriate Technologies

Appropriate technologies, are designed in the context of a society and their dissemination necessitates interaction with the society for adaptation to the local conditions. This means that 'one size fits all' approach is not effective here.

A. W. Date, in his writings, generalises the methodology for appropriate technology solutions as a series of steps (Date, 1981). These are:

i. Identify the felt need.
ii. Specify the surrounding conditions so as to determine the level of collectivity of people associated with the need and also determine other relevant limit situations.
iii. Convert the need into a solvable technological problem.
iv. Scan the spectrum of technical solutions available.
v. Choose from the spectrum or else innovate a new technical solution through research and experimental development.
vi. Practise micro-diffusion.
vii. Search for transfer mechanisms for wider diffusion.

Transfer or diffusion of a technology can be done by various mechanisms. As Amulya Reddy mentions in his writings (Reddy, 1989), there are four main approaches to dissemination of appropriate technologies:

i. The market
ii. Top-down approach
iii. Bottom-up approach
iv. Franchising approach

But a technology derives its appropriateness not only from correct identification of needs and from the strictness with which the choice criteria are observed but also from the manner in which it is transferred and used (Date, 1981). The market, which works within a legal and commercial framework, assumes people to be mere consumers. Though it is good for commercial and capital goods, it is not the appropriate solution for masses in developing countries whose needs and incomes can be seasonal (ibid.). The market is an excellent allocator of resources, but ignores important aspects: equity, environment and long-term. The rural poor are generally outside the market as they lack the requisite purchasing power to articulate their demands via the market (Reddy, 1989).

On the other hand, the top down approach presumes the trickle down paradigm of development. It uses central planning and control, underrating the role of popular participation in technology selection and finalization and of the strengthening of self-reliance (ibid.).

Within the human resource development paradigm, bottom-up approach and franchising approach should be used for dissemination of appropriate technologies. This necessitates wider dissemination through education and training and creation of people's movements led by development agencies and their change agents (Date, 2004). But, the non-market participatory and learning transfers at present appear to indicate voluntarism. This process of transfer does not replicate itself very easily. There is thus an urgent need to generate institutional and policy frameworks for bringing this about (Date, 1981).

This research tries to address a crucial step in this direction, by creating material which will assist in replication of the process of transfer of a technology.

1.4 Choice of Biogas Technology for the Study

For this study, the variable is the approach of the change agency. Technology, social characteristics need to be kept as similar as possible. Also, the dissemination should have been carried out widely, for a considerable amount of time. There should have been active attempts, both at policy level and field level through various agencies for the dissemination. Different agencies should have carried out the work, in different fashions. Also, enough literature should be available on this. The failures and successes should be attributable to reasons beyond the basic technology. Also, regional and social variation should not play a

major role in its spread and acceptance. Biogas fits all these parameters as does improved cook stoves. But as the author was to spend ten weeks of summer field-work with an NGO actively involved in dissemination of biogas technology, it was chosen.

Biogas dissemination in India is going on since 1960 by KVIC, then the National Project on Biogas Development (1981-82) and now the National Biogas and Manure Management Programme (2007-). Over 4 million household plants have been built against a potential of 20 million (MNRE, 2011). Multi-model, multi-agency approach has been adopted with constructive role of development agencies (Myles, 2001). There is a fair amount of documentation of the history over the past five decades.

Also, many established names in the field reside around Pune, close to Mumbai. This made visiting them easy for taking inputs. So it was pertinent that biogas technology was chosen.

1.5 Outline of Report

In the next chapter of this report, basics of dissemination theory, biogas technology and its history in India have been given. In the third chapter, a short comment on government programmes is made, followed by the case studies and wrapped up with discussions. The report concludes with the click factors of biogas dissemination and general factors affecting dissemination with a note about work to be carried out in the second phase.

2 Literature Review

2.1 Dissemination Theory

The origin of the word is in the Latin word *disseminatus,* the past participle of *disseminare.* This word comes from *dis-* + *seminare,* which means to sow, from *semin-, semen, i.e*., seed (Merriam-Webster, 2011).

Some scholars distinguish "diffusion" and "dissemination," so that the first term indicates unplanned or spontaneous spread of ideas while the latter is used for diffusion that is directed and planned (Rogers, 1995). Although Everett Rogers, the author of 'Diffusion of Innovations' (ibid.) subsumes both terms under the concept of diffusion, retaining the distinction may better serve the development of the science needed to speed the progression from the validation of a technology to its widespread deployment (Schoenwald & Hoagwood, 2001). The general principles for explaining diffusion and dissemination are the same though the forces in the two cases are different.

Diffusion has four elements (Rogers, 1995). Diffusion is the process by which

1. An *innovation*
2. Is *communicated* through *certain channels*
3. Over *time*
4. Among the members of a *social system.*

In dissemination, the change agency/agent that plans, directs and pushes forth the innovation is part of the communication channel and the social system. Here, it must be noted that an innovation is an idea, practice, technology, or object that is perceived as new by an individual or other unit of adoption.

2.1.1 Innovation

An innovation is spread if it has certain qualities.

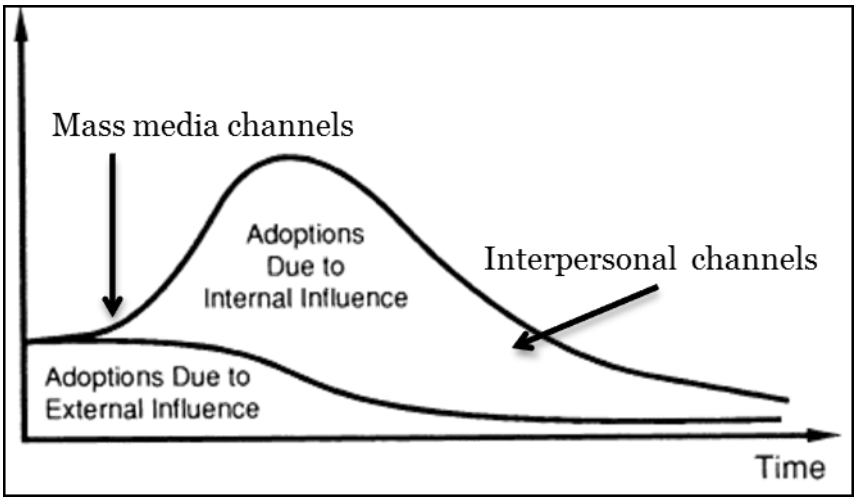
i. *Relative advantage* as perceived by the users. It can be economic advantage, social prestige, convenience or satisfaction.

ii. *Compatibility* with values, norms, past experiences, practices and needs of the adopters.
iii. *Simplicity* and ease of use.
iv. *Trialability* at low cost, limited basis.
v. *Observable results* stimulating peer discussions.

Reinvention is the key to success of an innovation as it keeps evolving to meet the needs of more demanding and risk-averse individuals.

2.1.2 Communication Channel

For the spread of any information, Communication channels are needed. The nature of relation between the source and receiver of the information decides how effective the information transfer is. The two types of channel are – *Mass media channels* and *Interpersonal channels*. Here, the concept of *heterophily* and *homophily* comes into play. More effective communication occurs when two or more individuals are homophilous. Homophily is the degree to which two interacting individuals are similar w.r.t. belief, education, social status, etc. One major problem with dissemination is that the participating individuals are heterophilous as the change agent is technically competent than the clients. Ideally, if they are homophilous in all aspects except for the innovation being disseminated, the chances of success are more.



Graph 2-1: Adoption due to external and internal influences
(Mahajan, Muller, & Bass, 1990)

As can be seen in Graph 2-1 based on Bass forecasting model, external influence which comes from the mass media is important in the initial phase. But later on, the spread is due to within community - interpersonal interaction. Thus any change agency should, in the

beginning phase, focus on reaching out to people through mass media, advertisements, meetings, etc. Over time though it is necessary to build relations with local people and recruit a few of them as they are homophilous with the society. These people should develop into opinion leaders and through peer networks, influence decisions.

2.1.3 Time

The third element, time, is involved in

A. The *innovation-decision* process – from first knowledge to adoption/rejection
B. *Innovativeness of adopter* – Relative earliness/lateness with which individuals adopt
C. *Rate of adoption* of innovation – members of system adopting in given time.

A. Innovation-decision process

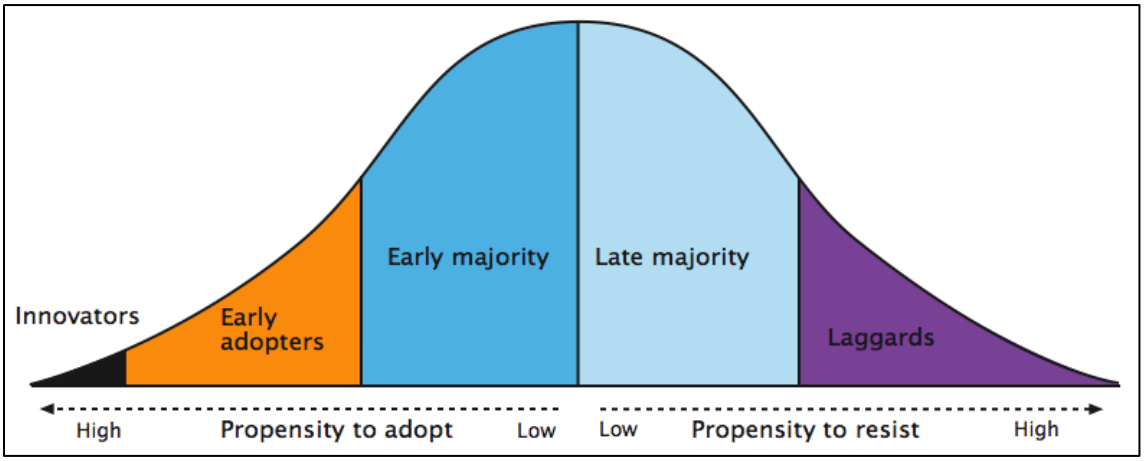
This is conceptualised in 5 steps:

i. *Knowledge* about the innovation and its functioning
ii. *Persuasion* into forming a favourable/unfavourable opinion
iii. *Decision* to adopt/reject
iv. *Implementation*
v. *Confirmation* to reinforce decision

B. Innovativeness and Adopter Categories

"*Innovativeness* is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system." Diffusion research shows that members of each of the adopter categories have a good deal in common. If the individual is like most others in the late majority category, he or she is of low social status, makes little use of mass media channels, and learns about most new ideas from peers via interpersonal channels (Rogers, 1995). Adopter categories, the classifications of members of a social system on the basis of innovativeness, include:

i. Innovators
ii. Early adopters
iii. Early majorities
iv. Late majorities
v. Laggards.



Graph 2-2: Adopter categories

(Robinson, 2009)

Each group has its own "personality", especially its attitude to a particular innovation. When dealing with these groups, shifting people from one group to another is difficult and doesn't work. It's best to think of the membership of each as static. Innovations spread when they evolve to meet the needs of the successive segments (Robinson, 2009). Approach to work with each category is different. Some points are highlighted in Table 2.1.

Table 2.1: Adopter Categories

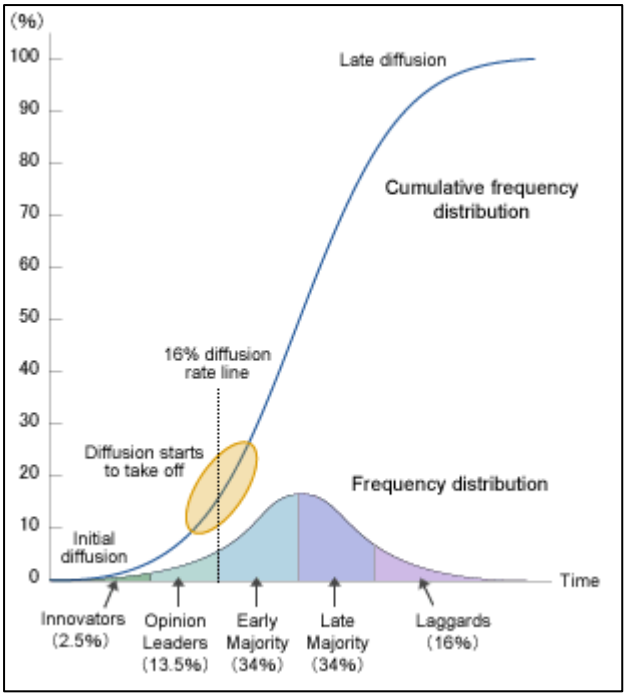
Category	**Description**	**How to work with**
Innovators	Develop/improve new idea, technology, gadget etc.	Invite keen innovators to be partners in designing your project
Early Adapters	Economically successful, well connected and well informed and socially respected. Don't need much persuasion.	Offer support to trial new idea, study trials to make the idea convenient, low cost and marketable. Reward their egos, promote as fashion leaders. Recruit and train some as peer educators. Maintain contact with regular feedback
Early Majority	Pragmatists, comfortable with moderately progressive ideas. Won't act without solid proof of benefits. Followers who are influenced by mainstream fashions. Cost sensitive and risk averse	Offer give-aways, competitions to create buzz. Use mainstream advertising and media stories featuring endorsements from credible, respected, similar folks. Lower entry cost, guarantee performance, redesign to maximise ease and simplicity. Cut the red tape: simplify application forms and instructions. Provide strong customer service and support

Late Majority	Conservative pragmatists, hate risk, uncomfortable of new ideas. Fear not fitting in, will follow mainstream fashions and established standards. Influenced by laggards.	Focus on promoting social norms rather than just product benefits: they'll want to hear that plenty of other conservative folks like themselves think it's normal or indispensable. Keep refining the product to increase convenience and reduce costs. Emphasise the risks of being left behind. Respond to criticisms from laggards
Laggards	Hold out till the end. See high risks in adopting. Might be correct or innovators of ideas that challenge your paradigm.	Give high levels of personal control over when, where, how and whether to adopt. Maximise familiarity with new products or behaviours. Let them see how others have successfully adopted the innovation

Based on (Robinson, 2009).

C. Rate of Adoption

The rate of adoption is the relative speed with which an innovation is adopted by the members of a social system. When the number of individuals adopting the innovation is plotted on a cumulative frequency basis over time, S-shaped curve is the result. The slope of the curve varies between innovations, as does the time period for the lag phase and exponential phase. Innovations that are perceived by individuals as possessing greater relative advantage, compatibility, and the like, have a more rapid rate of adoption. The same innovation can have different rates in different social systems. Many aspects of diffusion cannot be explained by individual behaviour. The system has a direct effect on diffusion through its norms and other system-level qualities, and an indirect influence through the individuals.



Graph 2-3: Rogers' innovation adoption curve

Source: http://www.sustain.co.uk/resources/insight-articles/the-value-chain.aspx

2.1.4 Social System

A social system is a set of inter-related units engaged in joint problem-solving to reach a common goal. The members/units may be individuals, informal groups, organisations, and/or subsystems. Each unit can be distinguished from the others. The linkages between them can be formal and informal, and the communication structure amongst them decides how information flows. Social structure and norms greatly affect diffusion as well as decision making. Here, the role of opinion leaders and change agents becomes important to mould the social system as per our requirement.

Opinion leaders are more exposed to external media, have a higher social status and are more innovative. They have their own interpersonal communication network, which can be effectively used by the change agent. Though, if they deviate too much from the social norms, they can lose their respect. If they are seen like peers of the change agent or their aides, they can lose their followers. So, their use should be with care.

Change agents are often professionals from a technical field. This knowledge, and the social status that goes with it, makes them heterophilous from their typical clients, posing problems for effective communication and dissemination. Thus, many change agencies employ aides. An *aide* is a less than a full professional change agent who intensively contacts

clients to influence their decisions. Aides are usually homophilous with the average client, and thus provide one means of bridging the heterophily gap.

2.2 Barriers to Dissemination

Amulya Reddy, in his paper 'Science and technology for rural India' (Reddy, 2004) goes into details about barriers to commercialisation of rural technologies. The same is applicable to dissemination of appropriate technologies.

Appropriate technology dissemination can fail at three levels:

- Technology generation level – failure in identifying needs or in R&D efforts
- Technology spread level – choice of dissemination method, order of priority of needs, operational failure, and failure to modify behaviour.
- Policy and infrastructural support level.

The dissemination of technologies in rural areas involves a number of actors at various levels. These are: technology users, technology manufacturers and providers, technology generators, technology champions, financial institutions, and local, state and national governments and their decision-makers. Thus, action is required at the lowest level of the user (individual, household or community) through the highest level of government.

There are two categories of barrier to the effective diffusion of rural technologies: (i) *Endogenous* barriers, which are internal to the process at the level of technology users and technology manufacturers-providers; and (ii) *exogenous* barriers, which arise out of non-supportive (or hostile) elements in the environment at the level of resource producers and distributors, financial institutions and government decision-makers.

2.2.1 Technology users

The unaware

It is necessary that the potential user understands the costs and benefits of the various technological options, knows about the improved technology and is aware of its relative advantages before they will accept the technology. But a large number of technology users are unaware of the advantages of the technology and of its cost-effectiveness. In rural areas, newspapers, radio and television play are major mass media channels. With these, demonstration of technology and training of users are also necessary. The supply of relevant

information to, and the education of, the technology user is the means of overcoming the barrier posed by the uninformed.

The poor and first cost sensitive

High initial cost can become a barrier to implementation. The user might not be ready to invest scarce capital resources now for future perceived benefits. The way to make appropriate technologies affordable even to the poor and/or to the first-cost sensitive is to convert the initial down payment into a payments stream that coincides in time with the benefits stream.

The helpless

There is the class of technology users who are knowledgeable, can afford the improved technology and are motivated, but are nevertheless completely helpless in the face of all the problems that must be tackled in identifying, procuring, installing, operating and maintaining the associated devices and equipment. This is a problem of institutionalisation of the alternative compared to conventional technology. Total packages of hardware plus software (the latter being all the instructions and knowledge to run the hardware) should be developed and disseminated together. In turn, this means that an efficiency-improvement agency must be established and developed to provide these packages.

2.2.2 Technology manufacturers

The manufacturer with incompletely engineered technology

The barriers of non-available specialists, non-existent facilities and no funds for the crucial task of product/process development need to be overcome. Training of engineers for manufacturing intermediate scales of units, establishing the needed setup and providing for funds through venture-capitalists and donors is thus necessary. Else, for many appropriate technologies, this problem can be solved by manufacturing at the village/household level with the proper training.

The Efficiency-blind

Decision of adoption depends far more on the initial capital cost, because poor customers are sensitive to this cost. Since cheaper equipment invariably means lower efficiency of resource use, the sales of improved technologies may actually be less than the sales of inefficient technologies. Enforcement of energy-stars or other such system to reflect

efficiency of devices is necessary. Also, tying finances to performance will make user more aware of the latter.

The supply obsessed resource producers/distributors

Resource supply agencies are worried about the supply so much that they rarely pay attention to resource use efficiency. With the setup, infrastructure, capital and manpower these agencies have (irrigation departments, the electricity boards, oil companies and gas utilities), they can be converted from resource-supply agencies to resource-service agencies. Even the billing systems of the suppliers of resources offer the opportunity for technology users to invest in improved devices with loans from the suppliers and to pay back these loans through their resource bills.

2.2.3 Financial institutions

The supply-biased

The best way of dismantling the barrier posed by the supply-biased financing is to shift the emphasis from resource consumption and supplies to the service provided by resources, to include improved technologies in the list of options for providing services and to pursue the least-cost planning process.

The unfair

This barrier of the unfair financial institution must be overcome by an emphasis on fair competition through the elimination of subsidies to resource supplies, correct pricing, same terms of credits, benefits, incentives, etc.

2.2.4 Government decision makers

The cost-blind price-fixer

The barrier of the cost-blind price-fixing government decision-maker can be surmounted by a move towards long-run marginal cost pricing and by ensuring that price increases are implemented along with improved technologies.

2.3 Participatory Dissemination

The social system and the communication channel can be used through individuals, the opinion leader and aides or through groups of people. A larger number of individuals could be engaged at the same time, their inputs used for understanding local scenario, priority of needs, norms, deciding strategies and enacting them.

Farmer groups have an important role in the technology dissemination process (Davis, Franzel, Hildebrand, & Place, 2004). There are certain factors that contribute to groups' success in such extension. These include leadership; group resources, type and size; number of activities; number of linkages; the wealth of the members; distance from the information sources; gender balance; member commitment and group unity; discipline and management.

This approach is also extendable to using Self-Help-Groups, the main benefit being these are women centric. Women in SHGs can work together to address issues that affect not only their own members, but others in the larger community.

SHGs have been involved in India in following group based enterprises or contracts:

i. Collective organisation of marketing for the produce of individual enterprises established using micro-credit, particularly milk collection centres/dairy cooperatives at village level.
ii. Collective activities by SHGs using group credit to access larger natural assets for production, e.g., leasing land and ponds for cultivation and pisciculture.
iii. Other collective economic activities based on group credit that combined labour and management: stone-cutting, processing rice, managing a tent house.
iv. Management of government contracts: running ration shops (Public Distribution System), cooking mid-day meal in schools, or managing a subsidised fodder depot.

Thus, it is completely possible to use SHGs for dissemination at village levels, by taking their help in production of the technology/items or using their strong network for spread and acceptance.

Participatory dissemination involving local groups reduces the efforts needed to be put in to gather people and reach out to each one of them. Once some members of a group are convinced and trained, they can go on spreading the idea.

2.4 Biogas Technology

Biogas is “a gas mixture comprising around 60% methane and 40% carbon dioxide that is formed when organic material, such as dung or vegetable matter are broken down by microbiological activity in the absence of air, at a slightly elevated temperature.” (Bates, 2007).

The main benefits of biogas are:

- Reduces the amount of wood fuel required and thus reduces desertification
- The waste is reduced to slurry with a high nutrient content making an ideal organic manure
- During the digestion process, dangerous bacteria in the dung are killed, which reduced the pathogens dangerous to human health
- Being a clean fuel, it reduces health complications from indoor air pollution (ibid.)

The digester provides a sealed vessel that allows input of feedstock and removal of gas, ideally being built of locally available materials. There are two basic classes in biogas digester models:

i. The floating drum model
ii. The fixed dome model.

2.4.1 Floating drum/Indian digester

Developed in 1956, the chamber is made of brick masonry and a steel/fibre drum placed on top to catch the biogas. The drum moves up as it fills. It requires high investment and maintenance (Buxton & Reed, 2010). It provides a constant gas pressure, a useful feature for big plants. Figure 2.1 shows a sketch of the floating drum digester as developed by KVIC.

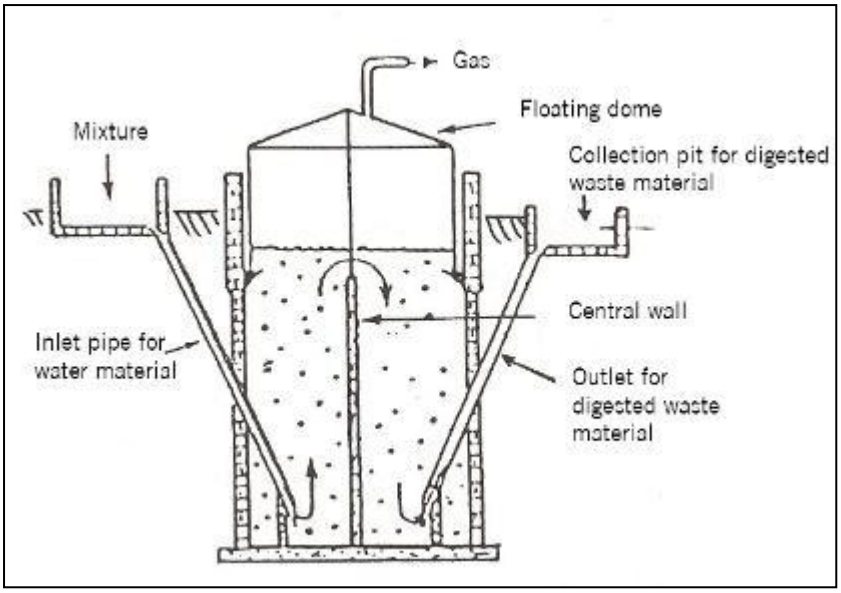


Figure 2.1: Floating drum biogas digester
(Buxton & Reed, 2010)

2.4.2 Fixed dome/Chinese digester

Dates back to 1936, consists of an underground masonry compartment known as the fermentation chamber and a fixed dome for gas storage. The single piece structure decreases complexity of maintenance whilst still having two drains to feed waste. The life span is longer at around 20 to 50 years, increasing economic feasibility (Buxton & Reed, 2010). The Deenbandhu model, shown in Figure 2.2, was originally developed by Action for Food Production in 1984 to bring down costs. Made entirely out of masonry with hemisphere gas storage at the top and concave base, it works under the same principles as a normal fixed dome digester (ibid.).

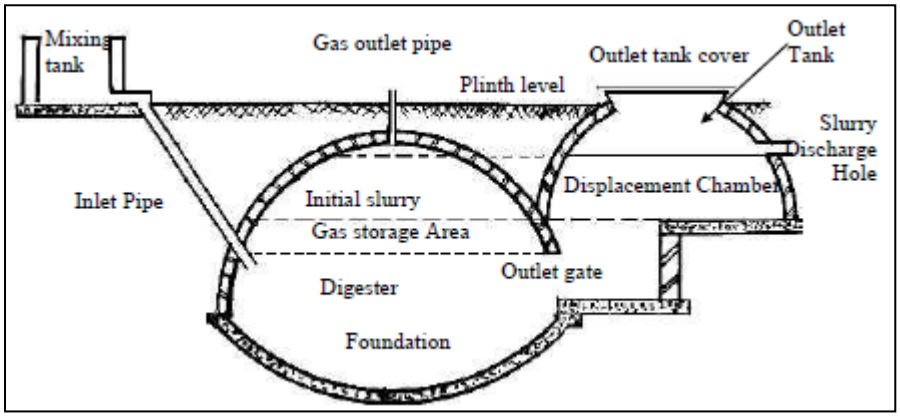


Figure 2.2: Fixed dome Deenbandhu model
(AFPRO, 2005)

In comparison to the floating gas holder type of biogas plant, the fixed dome type has a longer life span, lower maintenance cost, and lower capital investment. It also does not need a steel gas holder. As the unit is an underground structure, the space above the plant can be used for other purposes. However, the absence of a constant pressure reduces the efficiency of the gas appliances which are powered by the unit. In addition, locating and repairing defects in the fixed dome type are difficult (Joshi, 1988). Also, a small defect during construction can be hard to trace and correct, leading to leakage and in the end rendering the plant useless.

A number of other digesters have been developed over the years, including bag digesters. But the two listed here and their variants remain the most commonly used ones. Fixed dome model is used more for household level plants while floating dome model is used for community level and institutional plants.

2.5 History of Biogas Technology in India

In this section, we look at the history with a national perspective, without going into details of how much and where biogas technology has spread across the country. We overview the two main government programs, the National Project on Biogas Development (NPBD) and National Biogas and Manure Management Programme (NBMMP).

India is one of the pioneers in biogas movement. During the freedom struggle, Mahatama Gandhi gave the slogan ‘return to the villages’, and bade both planners and technologists to reconsider strategies of rural development with a view to utilizing locally available resources of energy. Cow dung, which is used by millions in their homes as fuel for purposes of cooking, was regarded by him as an important energy resource with multiple uses (Joshi, 1988).

In India, the work on dung based plants began in the 1930’s, and the patent for the first plant was obtained in 1946. The Agricultural Research Institute, the Khadi and Village Industrial Commission, and .several other non-governmental organizations have been working in this area (ibid.).

It was realised that biogas serves the dual purpose of cooking energy needs and manure for agriculture, using the same resource.

2.5.1 National Project on Biogas Development

In the years after independence, most work was done by KVIC till the Central Government started the National Project on Biogas Development (NPBD) to cater to the family type biogas plants. It was started in 1981-82 with following objectives:

- Provide fuel for cooking and manure to rural households through biogas plants
- Mitigate drudgery of rural women, reduce pressure on forest and accentuate social benefits
- Improve sanitation in villages by linking toilets with biogas plants.

Under this program, indigenously developed models of biogas plants were promoted. Each state had designated nodal departments and nodal agencies for implementation. Besides, Khadi and Village Industries Commission, Mumbai; National Dairy Development Board, Anand and national and regional level non-governmental organisations were also involved in implementation. NPBD provided different financial incentives including central subsidy to users, turnkey job fee to entrepreneurs, service charges to State Nodal Departments/Agencies and support for training and publicity (RDPRD, 2006).

Up to 31st March 2003, 35.23 lakh biogas plants were built, against an estimated potential of 120 lakh biogas plants. An evaluation survey study conducted in 18 States involving a sample of 5,165 biogas plants by National Council of Applied Economic Research, New Delhi in 1995 indicated that on an average 87.5 per cent of biogas plants were in working order (ibid.). The estimate was revised to 200 lakh household level biogas plants in 2000 (Myles, 2001).

Biogas Development and Training Centres, functioning in nine major States, provide technical and training back up to State Nodal Departments and Nodal Agencies. Commercial and co-operative banks provide loan for setting up of biogas plants under Agriculturally Priority Area. National Bank for Agriculture and Rural Development (NABARD) is providing the facility of automatic refinancing to banks.

2.5.2 National Biogas and Manure Management Programme

The National Biogas and Manure Management Programme (NBMMP) was launched during the 11^{th} five year plan by Ministry of New and Renewable Energy, (Bio - Energy Technology Development Group) (MNRE, 2009).

The Objectives of this programme are:

- Provide clean fuel for cooking purposes and for other applications to reduce use of LPG and other conventional fuels
- Meet ‘lifeline energy’ needs for cooking as envisaged in ‘Integrated Energy Policy’
- Provide bio-fertilizer/organic manure to reduce use of chemical fertilizers
- Mitigate drudgery of rural women, reduce pressure on forests and accentuate social benefits
- Improve sanitation in villages by linking sanitary toilets with biogas plants
- Mitigate Climate Change by preventing black carbon and methane emissions.

So, it can be seen that the objectives have remained much the same from NPBD to NBMMP.

Guidelines for Biogas Development and Training Centres, implementation procedures, finance provision, subsidy, bank loans, and field inspections have been given under this program. While this is one step ahead from the previous program, the approach is quite the same. Though the objectives state sanitation, at field level it has never been sold as a toilet which gives manure. Rather, it has always been a gas plant also giving manure.

3 Case studies and Discussions

To understand how the dissemination of biogas has been carried out at ground level, various people working in the field were visited and interviewed. First, it was necessary to understand what the approach of the government is. Since, across country, the policy, programmes and guidelines are the same, the working of change agencies needs to be looked with that context at the back of the mind.

3.1.1 Government Policy

In the recent years, as seen in the literature review, government policies have improved and focus is on manure as much as on biogas. On paper, it is also expected to reduce the drudgery of the women, but women have rarely been engaged directly. While reading the government regulation published in 2009, it was realised that the approach has been further diversified and CDM benefit is being looked into. Funds are to be released in advance; capacity building of various organisations is to be done. The Central financial Assistance is tied to the development status of the region, toilet connection has been incentivised. On average, the subsidy covers over 50% of the plant construction cost, payable on commissioning of the plant. A monitoring program has also been chalked out. As with governmental schemes, the implementation varies from state to state and region to region, but overall a strong framework is in place.

NABARD, the nodal agency in financing for rural development, analyses some field problems in implementation and operation. It notes that though India has a huge potential and need, our progress isn't satisfactory when compared to China's which is fossil-fuel sufficient. So India should have a greater urgency. The field problems and operational difficulties have been mostly identified and are known to implementing agencies and banks should take special note of it (NABARD, 2007).

The technical problems can be addressed through R&D and various publications on the topic. But the socio-economic problems are somewhat sensitive and need to be dealt with

care. While both these can be tackled at various levels, more pertinent to our discussion are the organisational lapses.

- Extension agencies often fail to communicate the true benefits to the users. Now, since each district nodal agency is provided with technical and other supporting staff, promotional work should improve.
- Target oriented approach has proved detrimental to the programme. Only potential areas where the programme can be successful should be adopted for implementation. It is necessary to assess the need for fuel and manure of the individual cases in a scheme area before a programme is envisaged.
- Another dispute is the release of subsidy by government and the time taken by banks to sanction loans. Understanding with agencies responsible for releasing subsidies for speedy clearance of schemes is necessary so that implementation is not delayed. The formulators of scheme should involve funding agencies from start to avoid miscommunication.
- The way banking sector is expected to participate goes away from conventional banking and will need some time. Banks have been instructed that mortgaging of land or asking for securities should not be insisted upon for bio-gas programme. This is a new challenge to the banking sector which may have to operate in circumstances where securities etc. have to be overlooked.

With this broad overview, agencies which have worked in the field of extension of biogas technology were approached, their heads interviewed. Here, a brief of the discussions and what emerged out of each one is described.

3.2 Case Studies

In this section, a short description of the organisation is followed by the context of their work in the field of biogas technology dissemination is given. This is followed by the major points that came out from the discussions. The details of the interviews are included in the Appendices. In the end, some comments on each are made.

3.2.1 ARTI, Pune

Appropriate Rural Technology Institute and Samuchit Envirotech are Pune based organisations run by **Dr Anand D Karve**. Their work is mostly in Research and development and spread of domestic urban biogas plants. Being a not-for profit organisation and lacking

funds for aggressively spreading the technology, they work on demand-pull basis. When someone requests their services, they give it, either for training, installation or consultation. Focus is not on dissemination, but development of technology hardware and software.

He attributed failure of biogas to spread to lack of advertising and participation of big companies which don't find this business lucrative or safe for investment as there are no patents involved. Another reason for large scale failure was attributed to use of cow-dung, which he says is energy inefficient. Direct burning of dung cakes gives more energy than converting it to biogas. But the slurry can later be used as manure, an equally important use of dung. He promotes use of dung directly for manure and other carbohydrate wastes for biogas production.

He stresses on educating the users to carry out basic repairs to keep the plant functional. For installations, his approach is to train local entrepreneurs to carry out the job in different cities as it isn't possible for ARTI to go and build just one or two plants every where. Also, all the material to be used has to be procured by the client as otherwise transport costs will be huge. CDM, though lucrative, becomes a costly affair if done on a scale smaller than a district.

Overall, his approach is closer to that of an inventor than a dissemination agent. A lot of material has been developed by them related to how to use, maintain, repair, construct, etc. of a biogas. The main takeaway points were lack of glamour and institutional structure for biogas; need of procuring material locally and possibility of spreading biogas movement to urban areas.

3.2.2 Ravindra Desai, Pune

Mr Ravindra Desai has worked in the field of biogas development and consultation with a peak in the 80's when NPBD was in full swing. He developed the technique of building fixed dome masonry structure without the need of centring material (sand filled up in the shape of the dome) and is wrote a book on biogas in Marathi (*Gyanabacha Biogas*).

He has worked with BAIF, Jnana Prabodhini and independently for biogas implementation and has closely observed the work of the government mechanism and NGOs. According to him, the main reason for failure was the delay in starting the works. In most of Maharashtra, water availability is low from February to June. Planning starts after the financial year starts in April and budgetary allocations come in July-August. But then the villagers are busy in farming activities. So, biogas work is kept aside till December. By the

time construction work starts and bank loans are arranged, it is February. After plant construction, 21 days for curing of cement are needed. Everyday watering should be done, which isn't due to scarcity of water. This leads to small cracks which develop over time and the plants become dysfunctional.

Also, attempts at cost reduction can be counterproductive. Plastic and rubber pipes, though cheaper, need a high care and maintenance. Anything causing a leak in the system results in decrease in the gas pressure. This prevents dung from overflowing out of the outlet and it accumulates in the dome, making the plant useless over a period of time.

Any failure is a problem for the woman and thus she should be empowered to maintain it or complain to the agency and repair personal. He talked about use of postcards, but in today's age, mobiles are a better option. Every government official and powerful person in the village should be included in the process of development; at no stage should we go against them. We work for development, not revolution. He forced that it should be easy for the end-user to get a plant installed and maintained. There should be setup for that. Training of local masons should be focused, but they should be trained rigorously on every small aspect. When working in a village, multiple plants should be built at a time to reduce costs of transport, managing etc. Having a person to overlook the work and manage is very important.

Main points that came out were training of women, attention to durability, setup for complaining, training of local masons, professionalism in the work and responsibility of agency to provide support post construction.

3.2.3 Bhagirath Gramvikas Pratishthan, Kudal

Bhagirath Gramvikas Pratishthan is an agency based in Zarap, Tal. Kudal, Dist. Sindhudurg. It is headed by **Dr Prasad Deodhar**. This is the NGO with which the author had stayed for ten weeks of summer field-work and observed work up-close. Their focus is on overall rural development, with biogas being the focal activity for the past 5-6 years. Active dissemination is being done and from this year onwards, they are working in close association with the district administrations in Sindhudurg and Ratnagiri. The work region is Konkan, where water is not a big issue; people are hardworking and financially strong.

Biogas is a part of a bigger picture, of a better village with sustainable and healthy lifestyle. It should not remain as a developmental agenda but become a routine. All backward and forward linkages needed must be made available to the people. A complete replacement

of the fuelwood based stoves is not desirable; women are very strongly attached to it. Society should be educated and scientifically moved to better alternatives. The norms should not be broken, but changed over time.

CDM, dairy, organic farming, sale of manure are few of the linkages which will make the whole process sustainable for the farmers. The Ecovillage policy of government of Maharashtra is going to give a further boost to their efforts as each Gram Panchayat is mandated to build biogas in 10% of the houses. They have made full use of the government mechanisms in their work. At no stage have they gone against the government or its representatives or interfered in their work.

Bhagirath initially invested in

- Demo plants built for one farmer in a village. Monetary assistance by Bhagirath.
- Training of local masons – technical and soft-skills
- Strategic networking before entering into an activity
- Approach of participation of people, giving social returns

The role of people was changed by changing nomenclature from beneficiaries to Biogas plant owners. This is not another attempt of being politically correct, but a route to social change. Use of organised sector like schools, SHGs, farmers' groups, youth groups is made.

A lot of effort is put in training masons, connecting with them, maintaining relations, teaching soft-skills etc. A yearly workshop is also held for all the masons working with Bhagirath. Ample expenditure on advertising through flex boards is done. Every now and then articles come in local dailies. Visits by district level officers are organised in the villages – this has a completely different effect on the government mechanism and people talk about it. Masons are given visiting cards to give them a corporate look and these they give in the houses. People are able to contact them easily.

Financial set-up through local banks has been provided for easy loans. There are trilateral agreements with the banks with inclusion of the Gram Panchayats. Do not work for over 3-4 years in the same village. Work spreads through active selection of clusters and spill-over effects.

As there is active work going on here, interaction with change agent, **Santosh Teli**, and villagers was also possible. Through observation, some further points were noticed about the work:

- Work is done through Gram Panchayat; detailed quotation is given to each household wishing to build a Biogas plant. Responsibility of the agency, Gram Panchayat and owner are clarified, finance arrangement, mason + helper system is defined – food is to be provided by the families – all these points are clarified before starting any work.
- List of interested people is prepared through government officials in the village – surveying. When roaming in the village initially, have some important person from the village accompany you, a Gram Panchayat member or so, this makes villagers respond.
- In the beginning – be hard and direct with people, overestimate costs, include smallest of things possible. Have a semi-trained villager to help in the process, if this is the one with a demo Biogas plant and/or influential in the village
- Identification of spot for building should be done by a specialist. Should take fees, will be taken seriously then. If recruited by the Gram Panchayat, take charge from Gram Panchayat – including travel costs. (These were taken from people by the Gram Panchayat member, also making the people serious about this investment and thus building the plant.)
- List of materials explained in each house – and where to buy from, disclaimer about payment, responsibilities, subsidy etc. was told.
- Earlier, had to run behind people, paid from donation to the organisation so that people would build plants. Now, people have heard of success and only approaching them is needed. Mostly, Gram Panchayats or groups of people have started approaching them.
- In every village, a few trips are needed before the work starts. A lag phase of 2-4 years in many villages, growth phase of another 2-4 years.
- Talking in local dialect makes people comfortable, check on masons is necessary. So visit to the worksite every day.
- The payment for masons is divided into three parts –wages, central fund and services cost. Service is provided by trained monitoring person. More such people need to be trained as the work is spreading outside the few talukas where it began.
- Lupin foundation, another agency working in the same area, doesn't train local masons, brings them in from Kerala – so villagers are not very comfortable with them. Lupin gives extra money to the masons, though overall costing is almost the same. They too have a person to take care of post installation services. Their approach is

more corporate as far more funds are available with them. More such agencies are expected to enter now, with the Ecovillage program being launched.

Local mason training at village level, Bank linkage for necessary cash flow, Using strengths of government machinery, Strategic planning and policy level decisions enforced, Indirect benefits – eco village program has helped in increasing spread, Cluster approach – focusing on a few villages and assuring cash inflow there are the important points which came out from this interview.

3.2.4 Jnana Prabodhini, Pune

Jnana Prabodhini (JP) is a school in Pune, with a social development wing attached to the institute. A lot of rural development activities are carried out by it. It was one of the nodal NGOs chosen by state agriculture department in the 80's to train masons across the stat and build biogas in a few districts. Their work in biogas is mostly halted currently. The last project they carried out was in a village just outside Pune city, where though initially successful, proximity to city and access to LPG cylinders has led to a gradual disuse of the plants. **Mr Shubhash Deshpande** and **Mr Madhav Deshpande**, two members who were in-charge of the dissemination of biogas were interviewed.

The role of JP was limited. When the government asked them to work in a region, the government machinery would prepare a list of interested house-owners and masons. Training of masons would be done by JP and then monitoring of the construction by them. Most problems leading to breakdown were technical during construction and lack of proper maintenance.

By its own, JP carried out work in Sanaswadi, a village outside Pune along NH-4. Here, JP already had a presence as other developmental activities had been done. People were engaged and convinced to build biogas plants; old ones were repaired to kindle interest of the people. It worked and people came forward. They were then convinced to connect toilets. This was also the time of the Nirmal Gram Yojana, under which all houses in a village were required to build toilets to get a monetary award for the village. Since a biogas costs similar to the soak pit chambers (considering subsidies), people had a financial incentive. Once the stigma attached to night-soil was removed, 40 such biogas plants were built in the village. Of course, demo plant had to be built and masons in the village were trained during the process.

The important aspects which came into focus are: target based work by NGOs without contact with the villages for a long time fails. The work shouldn't be just another government

scheme to which people don't feel attached. NGOs lack on management front, training of field workers is must. Training of NGOs is necessary before they undertake such projects. In rich and close to the city villages, keeping animals is becoming costly while LPG is cheaper putting biogas out of favour.

3.2.5 Nirmal Gram Nirman Kendra, Nashik

Started by Mr Bhau Navrekar, the work has mostly been in sanitation. Biogas was seen as an effective way of converting night-soil into useful manure and this aspect was focussed. Chinese fixed dome technology was adopted and reproduced in India by him in 79 which was later accepted and spread by KVIC and NPBD. Their main focus is training of government officials, extension officers, masons and agencies. Hundreds of plants were built around Nashik in the 80's but no work in biogas now, focus totally on toilets. His son and daughter now look after the work. Interaction with son, **Mr Shrikant Navrekar**, who has worked closely in association with the state government, was done.

Thus, most interaction was about aspects led to failures and success in general.

Major mistake was working through the agriculture department in Maharashtra. It should have been by rural development ministry directly as it involves sanitation, manure, energy, women health etc. In spite of all the benefits of government mechanism, the major flaw is its lack of monitoring. The people who had to implement, the agricultural extension officers lack technical knowledge in the field which an engineer would have. Training was done but was insufficient.

Though Fixed Dome design lowered cost, it increased failure as any crack in the cement can lead to leakage and masons aren't trained to do work with finesse. Beneficiary should be empowered to monitor the work – have a checklist to be referred to while construction is going on. Importance of repairing was not realised by people as the plants were virtually free for them.

Manure aspect, though important was always neglected. Though biogas is deeply connected with women, their participation in implementation and planning was missing for a long time. The younger generation feels LPG is a better alternative to biogas. Change of outlook towards self-sufficiency is needed.

Most of the small issues can be fixed with little R&D – mixing of dung can be done with a churner, in areas with water scarcity, water from slurry can be recycled, number of animals is reducing – benefits of keeping animals economically must be proven.

Village youth and women should be included in monitoring processes. As of today, biogas is still not a people's program. When this transition occurs, it will become sustainable. Village level sanitarian should be trained who takes care of multiple problems, is technically competent and is able to convince people. The profession should be of a waste manager, not a toilet/biogas maintenance guy.

Need for good training material, checklists in the hand of the villagers and masons for ready reckoning, simple local adaptations, and participation of women were a few points stressed upon.

Though not much work in biogas dissemination has been carried out, this agency has been working in a related field and inputs are valuable. As their major work has been in training, this knowledge can be made use of in creating various materials which can be used by a change agency in creating canvassing material, manuals, checklists etc.

3.3 Discussions

In this section, the author tries to list down desirable tasks that should be carried out by an agency involved in biogas dissemination to make it successful and sustainable. Though this list has been made by the author, details of many subtasks are given in various texts. Some useful ones are in the annexure of the reference- (Joshi, 1988).

- *Prioritise* according to need of people. Start in the villages with some easily acceptable, useful intervention which the people feel a direct need of, to *establish credibility* of the agency. These can be health camps, watershed development, afforestation, financial inclusion, etc.
- One *demo plant* must be built in the house of an average person in the village. Success of this plant is talked about and people are able to connect to it.
- *Survey* should be carried out, using various PRA tools. Data of how many houses own cattle, from where is cooking fuel obtained, general economic status of the village should be gathered. Use of government servants in the village to get data fast and accurately.

- *Advertising* and *capacity building* of villagers. Putting up big flex board at prime locations. The topic should remain in focus. People should become curious.
- Engaging school children and elderly in different forums. These can persuade the adults in the house, who can't be reached easily as they might be going out to work.
- Interacting with adults during Gram Sabhas and other organised platforms. Involving SHGs and farmers' groups from the very beginning. These are organised, homophilous groups.
- Answering all possible doubts and removing false notions. Educating people about benefits of the technology.
- Understanding women's needs, their drudgery. Making them see the benefits of biogas in term of health, time saved, drudgery saved, ease of operation, cleanliness of utensils, better sanitation. Involving them in decision making.
- Making men see the benefits of having animals, dairy connection, organic manure, status in terms of having a biogas plant, economic benefits and analysis.
- Local level technology *adaptations* to meet water availability, material availability, local customs. Main plant design should not be altered, though piping, distance from house etc. should be as per user convenience.
- Matching plant size, number of animals and people in the house. Too large or too small plant will soon be disused.
- Solving other related problems – water availability, dairy connection, fodder availability. Will need working on rainwater harvesting, road connectivity, improving agriculture. These can be taken up by the same agency or it can ensure that some other agency or government does these.
- Arranging for *finances* through local bank, in which most villagers have an account. Setting up agreement with them for easy release of loans. Sending subsidy to the loan accounts directly from the Gram Panchayat.
- Continuous *monitoring* of construction by a technically skilled manager.
- Providing *guarantee* and after installation *service*, free for at least one year. Taking nominal charges after that, so that people learn to maintain plants on their own, instead of paying for every small thing.
- Continuing *interaction* with village for years after the project as problems can arise any time.

- Understanding that it can take years before a majority of the villagers will build plants. Selection of villages for initial work. Some societies are more responsive and enthusiastic than others. Success with such can push others to accept. The adapter classes can be applied to entire villages.

3.4 Changing Scenario

Today, the India society is at a flux. Large numbers of people are migrating from villages to cities. Number of working hands in rural households is decreasing. People are finding it costly to maintain animals for farm work when farm mechanisation is cheap. In spite of all developmental activities going on, water scarcity remains a major problem. Households have been divided and in many villages, houses are very close to each other, leaving no open spaces. With urbanisation and road connectivity, LPG cylinder availability has gone up. All this makes running a biogas plant costly and difficult.

But on the other hand, there is a movement towards organic agriculture which needs organic manure. This is catching up in cities too, with organic terrace and kitchen gardens. The work under MGNREGS focuses on water resources development and programs such as Jal Swarajya aim at providing piped water at home level. There is an increase in fuel oil prices and LPG costs are going up in India. With climate change, there is also a focus on forest conservation and reducing methane emissions from various quarters. People are now educated and understand the global relevance of local measures, including biogas.

At such a moment, it is very necessary to push ahead with biogas and come up with innovative solutions to locally perceived problems. While on one hand, villagers in Western Maharashtra, with whom the author interacted are just highlighting the problems they face, such as reduced number of animals, costs involved, proximity of houses; on the other hand, villagers in Vidarbh are taking lead to build biogas at household level to reduce their LPG consumption. They are coming up with novel solutions to overcome the usual problems (Pallavi, 2011). The agencies involved in biogas dissemination should first target such areas where there is higher potential for success. Spill over effect, interpersonal communications through relatives and exposure in media will soon result in people from other areas demanding biogas. This will also need active persuasion and marketing. A more corporate approach, with better management, more funds, advertising and wider networks with government machinery inclusion is needed to push the movement further.

3.5 Improving Dissemination of Biogas

First the myth that the progression from research innovation to diffusion of occurs smoothly has to be removed. Mostly, the R&D and dissemination efforts are carried out by different agencies. Very little adaption at field level is done. These also are different than public agencies with roles in rural development sector (Sulaiman & Hall, 2005). The three of these should be brought together, in every region and then across regions to pass on innovations at one end to another. Solutions to some problems being faced here might have already been implemented somewhere. There is no need to reinvent the wheel.

Community mobilisation, conflict management, problem solving, education and human development are also important in extension work and the change agent must possess adequate social skills to perform these (ibid.). Instead of engaging people on one issue of biogas, they should be engaged on wider scale. Including climate change, deforestation, price rise, self-sufficiency, life-style changes, self-dignity, financial inclusion, health and nutrition, etc. All these are interconnected and each will help the other.

In spite of these, looking at the history of biogas dissemination, we see that the choice of technology and the design has had a major role in its wide scale acceptance. Based on the users, their requirements, their ability to maintain, geography of the region, socio-cultural norms, the choice of technology will be determine. Dissemination will happen after that.

4 Conclusions

4.1 'Click Factors' in Biogas Dissemination

In section 3.3 an outline of how a change agency should approach biogas dissemination work, created by author, is given. Building upon it and from the literature review, interaction with practitioners and discussions with various people, some of the factors which seem to be crucial for successful Biogas Dissemination are given below:

- *Advertising* and educating people
- *Training* of local masons for technical perfection in construction
- *Women empowerment* and participation
- *Institutional arrangements* for loans, installations and maintenance & repair service
- *Management* skills of the agency

Advertising and educating people can be done using flex-boards at important locations in villages, through success stories in local newspapers, campaign on local radio/television channels. Training of local masons is necessary to develop local skills and provide employment to local people. Also, they are more readily accepted due to similar language, culture and social norms in the households where they are to work for about 3-4 days and visit later as well. Biogas is a boon for the woman of the house. It reduces time spent on fetching firewood, cooking on traditional stove; reduces indoor health pollution; gives her more free time which was earlier spent in cleaning utensils but she has to now make sure that the plant remains functional. She has to put dung and water in it regularly. So, her participation is crucial. Making institutional arrangements assures villagers against the major perceived problems of finance arrangement, lack of quality control and disuse due to breakdown. The management skills of the agency are needed when the construction work is in progress in many houses across various villages.

Many innovative ideas can be used, in keeping with the times. Use of mobile phones for contacting masons, cook books with recipes for biogas, adding glamour quotient to biogas by putting up stickers on house with biogas and so on…

4.2 Generalised Conclusions

While studying biogas dissemination, the real intention was to understand the process of grass-roots level dissemination of any appropriate technology. It must be noted that technology choice and design determine technology dissemination. With this in mind, in this section, the learning from current biogas dissemination analysis is generalised. Understanding the process of dissemination of an innovation is necessary. Theoretical knowledge helps in practical understanding on field.

It is realised that dissemination of even a technology well acknowledged by academia and policy makers is a difficult task. Close interaction with potential users and being accepted by them is the first step towards influencing their decisions. Long contact periods will improve acceptance. Homophily with the society is necessary and all attempts to achieve it should be made by the change agents by living amongst the people, accepting their norms, trying to use local dialects, etc.

Demonstrations of success are necessary, but these demos should be in the right houses, i.e., people there should be able to influence their neighbours and act as opinion leaders Women should be involved in all activities since most interventions affect their daily life, drudgery, health, etc. Work should be done through local community groups, which are homophilous to the society, for a multiplying effect. These being organised sectors, less efforts on the part of the agency will be needed to get people together and ready to listen. This is a strong interpersonal channel.

Support should be given even after putting up the technology. Providing maintenance and repairing services is important to ensure functioning of the technology. If possible, users should be trained for the same. All aspects, including technical support, financial support, paperwork, raw material procurement should be assisted in. This is a step towards institutionalisation and makes the technology approachable for people. Since people are not eager for a change, their priorities being different, they need assistance at every step or they

give up. Local people must be trained in these to reduce load and allow one change agent to cover larger areas.

The further we break down each step and establish standards for it, the better it is. Just as an industry has detailed standard operating procedures, a dissemination agency should develop one for their work too. This will ensure better replication of their efforts even when the change agent is changed. The agency should also have a strong management of its projects and monitor all its activities at each stage. This is necessary to assess and respond to any risks, maintain quality and work within time, money, resource and manpower constraints..

4.3 Future Work

In the second stage of Master in Technology Project, based on the interaction with the practitioner, addressing one important gap before dissemination of biogas can spread will be done. This is training of village level biogas technicians and managers. For this, coursework will need to be made. They need to be taught not only the technical aspect of biogas plant installation but all other aspects discussed in this report. Social skills, management skills, interacting with villagers especially women, obtaining bank loans, subsidies, repair and maintenance of plant and stove, etc. should be taught. This person should be single window system for the villagers for building a biogas. This will be one step towards institutionalisation of biogas plants. This training syllabus will be supported with a policy brief about cooking energy projection for Maharashtra, need for such technicians and their relevance.

On another path, some work involving on-field biogas plant installations/repairs or training with some specific stakeholder is being explored.

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Appendix

Appendix I: Interview with Dr Karve

Samuchit Envirotech Pvt. LTd.
Ft. No.6, Ekta Park Co-op Hsng Soc., Behind Nirmitee Showroom
Law College road, Erandawane Pune 411007

Dr Anand D Karve
10-10-2011, 1140

Work in Domestic Urban Biogas
Yale Business School and Harvard say that there is great business potential in urban biogas, though it looks good on paper; it is not accepted by people.
Main reason is it has no glamour due to lack of funds for advertisements. No big companies are in the business. People don't relate to Biogas. If Shahrukh Khan advertised for it, they would accept it.
MNCs have approached ARTI in the past to sell this technology, but since there is no patent for it, they are not interested. They require exclusive rights on the product before putting in money.
The only novelty in the design is the plastic water tank being used and the benefits that come with it.
Because of the simplicity of the technology, no company sees it worth making into a business.
The same model is sold by Kirloskar at Rs 25,000 while ARTI sells it for Rs 10,000.
It is food waste based, especially for urban areas.
It has a payback period of 2 years for restaurants while for households it is about 4 years. These are mainly due to the subsidy involved which brings down the cost for the user.
The main obstacle in spreading of biogas is huge subsidies given to LPG cylinders, making it lucrative to households. LPG is also a user and environment friendly, standardised technique.
Government efforts to spread biogas have mostly failed.
ARTI has installed about 5000 plants across the country, mostly in major metros and Konkan region. In Pune they have installed about 3-4 hundred plants.

ARTI BGP spread is mostly demand driven. People approach through website, are given a quotation and things move forward once it is accepted.
Use of sugars as substrate for biogas was first tried in 2003 with good results. 1 kg of sugar produces gas equivalent to 40 kg of dung. Food waste which contains sugars, starch, fats, proteins gives similar results.

According to Mr Karve, Government program failed as it was dung based.

- If the farmer sells dung as dried cakes or manure directly, they earn Rs 15-20 per kg. While 1 kg of dung cakes give 3600 kCal, only 600 kCal are recovered in biogas. SO, there is a loss of both money and energy.
- The capital cost involved in biogas plants promoted by government is huge.
- Size of the plant is huge, many houses, being clustered together in rural areas, do not have space for a biogas plant close to the houses.
- Number of animals required to run a dung based biogas is large, making it unviable for the farmer to maintain them.
- Today, there are 30 lakh working biogas plants in the country, which is approximately 2 % of the families in our country.

While questioned about subsidy by government, he replied that ARTI technology doesn't get any subsidies, while Syntex, which uses the same technology and sells biogas plants at a higher rate, gets a subsidy.

Training of technicians is done through audio-visual aids, CDs have been prepared for the same.

When the time for operation and maintenance comes, if the plant has been built by ARTI, they maintain it for some time period. But the technicians who have been trained by ARTI and working independently many a times don't provide maintenance service. If such customers contact ARTI, service is provided at some charge.

Usage and Success – 2-3 % plants are non-functional.
Main problem – people are not handy with simple tools – many repairing activities can be done at home. There are people who have been using ARTI BGPs for over 5-7 years.
If there is a leak in the tank, simple M-seal can be used to treat it.

Transport cost is huge as it is a hollow tank. So, it is not economical for ARTI to deal in the materials required. Instead, they provide the customer with a list of hardware to be bought, and one personal from ARTI goes to do the job. If a local plumber accompanies during the installation, he can easily learn it and then start his own business as the installation is very simple.

Quality assurance – for any business, after sales service is very important.
Especially in biogas, where the gas is produced after one month of installation.
At least three visits are needed to the house –

- At the time of commissioning, i.e., when gas production starts
- After that to see if things are working right and to train the housewife about feedstock, water amount, daily operation. A CD for Do's and Don'ts and simple troubleshooting has been prepared for the same.
- If any problem arises.

Mass production is not possible. Local artisans should locally do a small scale business.
Then, customisation as per the customer's needs is possible – feed, size, placement, shape, etc.

ARTI also consults in large scale, institutional biogas plants.
The balcony model will be especially successful in urban areas in hot and humid climates, as in Mumbai.
Biogas can also be used for electricity generation in any spark plug engine like the Honda engine.

CDM or Clean Development Mechanism certification required for Carbon trading is a costly affair and needs intense work in 1-2 districts at a time. the main cost is of the Inspectors.

In rural areas, any fruit waste from orchids can be added to the dung based BGPs.

BGP technology needs glamour like other household appliances. Currently, even if 10 people are contacted every day of a month, only 2-3 turn up to get a plant installed.

New materials that are being tried out in Biogas plants –

- Chinese flexible bags instead of tanks – might allow mass production + marketing
- SRF, Gurgaon is producing rubberised fabric balloons
- Swastik Rubber Works produces balloons designed like a BGP with arrangement for attaching pipes etc.

Though life of these is still needs to be checked due to problem of depolymerisation of rubber/plastic.
Some big company like Duckback can go into this business.

While NGOs have ideas and commitment, they lack funds. On the other hand, those with capital are not interested in this technology.

Appendix II: Interview with Mr Desai

Mr Ravindra Desai, Pune
12/10/2011
14:30

Exact faults have to be found.

Current work pattern-
Project quota given to the NGO/agency
Gram Panchayat and Panchayat Samiti take care of subsidy being provided.
Motivation and information sharing about benefits are important parts of the process. Expenses involved for city based NGO are large due to the frequent visits pushing up transport costs.

Major problem with government and project quota approach-

- Though financial year starts in April, budgetary allocation for BGP comes in around July-August.
- Monsoon and agricultural activities during this period – BGP isn't a priority for farmers right now.
- So, BGP work starts around January
- Bank loans are available by February
- What was supposed to be done in a year, now has to be done in two months.
- Water shortage in many regions in March April – cement cracks during curing. In fixed dome model needs leak proof plastering otherwise it can't function.
- Since cracks don't develop immediately and might remain hidden, problems arise later.

Non-availability of water + late commissioning + reduced time span which makes supervision difficult, together lead to most problems.
If work is started earlier, or strict financial year is not followed, it can be more successful.

Attempts at cost reduction in construction can be counterproductive due to decrease in life of the plant. Plastic pipelines are put instead of MS. Also, since the contractor uses daily wage labourers to lay pipelines, they are not laid deep enough underground – the pipe soon gets exposed and due to animals or vehicles passing over it, it cracks and leaks.
Also, children play with the valve damaging it.
Due to leakage, dung rises within the dome as there is no gas pressure opposing it leading to less gas storage. Also, the gas pressure is responsible for pushing out dung into the outlet. This doesn't happen anymore, filling up the dome.

Failure of biogas is a loss to the woman of the house, not man. Though man is the beneficiary at government level, it is the woman who has the problems during cooking. If anything fails, the man has to run around to get it repaired, but he has no motivation for it and doesn't do it. If woman is empowered, she can get the things repaired for herself. For this, if woman supervisors are used during construction, it will help the woman of the house to establish a contact in case of any problem.

To solve follow up and maintenance issues, subsidy amount must be staggered, work should be done only through local people whose contact details are given to the household.

Some of the main things that need to be implemented for successful installation and operation are:

- Metal pipeline should be used
- Water availability for the curing period should be insured before construction is started
- Beneficiary should be made aware beforehand about the use of wetted bricks and need of watering the plaster.
- Since unskilled, skilled and superskilled workers need to work together in different parts of the biogas plant during construction, supervision capacity of contractor is very crucial.
- Teaching what needs to be watched at each stage is necessary

- Amount of water and cement in the mix, size of the depo needs to be monitored. A local village mason who generally works with soil doesn't realise that setting period for cement is 2-4 hours and mixes large quantities together.
- Awareness of women is a must.

Help of influential people in the village should be taken so that they do not stop your work. They have both utility and nuisance value and can make situations bad by gathering the village against you.

People in village follow city dwellers blindly – they do not have the right aesthetic sense – how to live a prosperous, developed and content life. They end up using money on frivolous things. Many a times they have a perceived inadequacy of money for constructing BGP. Women's needs have to be considered. Though this is a women-centric work, the man in the house still has the veto power, so they must be given the necessary importance while providing women with all the details, especially about operation, maintenance and repairing. Postcards with the address of the agency and household prewritten on it were introduced to provide post installation service.

Reality in village homes is very different, it is important to see the houses from inside to understand their demography. Any work with them will not be successful until then.

Initial entry points into a village-

- Talathis, Gramsevaks, Arogya Sevak, School Teacher, Milk Cooperative – first contact persons.
- Since they have some interest in this work, there are clashes of interest if they are not involved.
- Patil, Sarpanch, Savkar, Bhikshuk etc., who are important people in the village should atleast be met with, and project should be explained to them. Even if they don't get involved at the very beginning.
- Even while working with Harijans, don't start with them. First go to the Patil's house. Start from social top to bottom. We have to work successfully, not have a failed revolution.

Locality groups-

Depending on their capability, they can be made use of. If a group is homogenous, it allows for easier propagation of the work.

Finances-

- To reduce costs, house owner should do pit digging and work as unskilled labourer under the mason.
- Arrangement of loans should be made easy
- Subsidy money should be given directly to the agency
- Work should be done on turnkey basis to control amount and quality of raw material and reduce transport costs. Also, the supervisor should provide with the technical knowledge and trained masons
- For the end-user, it should be a single window job
- Motive of the agency should be work, not profits

Training of masons

Masons are trained and made to make first few BGPs under supervision

600 were trained during that time

Group training is needed so that they can work in a village in groups to reduce costs – training, supervision, raw materials, etc.

Backward and Forward linkages

Animals are there – value addition from dung for cleaner fuel, and still have manure to use.

LPGs shouldn't be given if enough animals are present in a household.

To reduce difficulty in operation involved in mixing water and dung, some mechanical device should be made.

Carbon credit – refer to biogas – a foolish flame.

Additional value of biogas must be looked into, overall cost benefit analysis should be done, not only financial.

Convenience to women, trees, saved, foreign currency saved should be looked at.

Political will should be exerted to reduce use of LPG which comes from outside

If community biogas plants are run properly, they can be a source of income.

Compression and bottling of gas must be looked into. Pressurisation and then distribution can be done as is done with LPG

If purification is also done, it will further improve the quality of the fuel.

But all this will happen only if there is a will to experiment.

No one has been really successful in MH. Currently, there are less than 4000 BGP/yr being built in MH.

New Approach

- Give guarantee that the plant will run.
- Animals to gas ration should be strictly adhered to. Since, if a BGP fail, neighbours also decline from building one.
- Site selection is crucial – soil type, avoiding water logging which reduces temperature leading to death of microbes. Tree roots that can break plaster should be avoided.

Community BGP

- Large size, proportionally less cost.
- Running is a problem – since it is everyone's, it is no ones to maintain
- Sulabh Shouchalay model should be used. Buy dung, sell manure – get salary and maintenance.
- Compressor can be used if plant is outside village.
- Political will + technical knowledge + sociological angel in work is needed.
- The problem is economical + technical + sociological

Currently things are cost centred rather than durability.

Appendix III: interview with Dr Deodhar

Bhagirath Gramvikas Pratishthan, Zarap, Kudal
Dr Prasad Deodhar
30/10//2011
09:45 onwards

1. **% households with biogas:**
   Pinguli – 170 new, 110 old – 100 families remaining with cattle
   Bhambed- 97/266 – said yes to BGP
   169 said no.
   Bhambed is taluka place in Lanja
   But in 4 years, 100 % BGPs will be built and people without animals will buy them
   In Hadi, Malvan, mangroves were used as firewood. It is an island. 60 HH built BGP last year and 60 more are being built this year. Though BGP on an island has added costs, people are building them because firewood is very limited.

2. **% households using biogas-sustainability**
   1200 – almost all are working. Very few of the dead ones are not reactivated. Masons go to the village once/ twice a year if needed. When people see that old biogas are working, there is a spill-over effect.
3. **% households satisfying entire cooking energy need through biogas:**
   - 75% of fuel consumption. Reduced cutting of trees. People love the taste of cookstoves, need ash as pesticide, need fuel to heat water. Forests have a decaying factor of about 10-12% p.a., so cookstove act as a recycling medium too.
   - Women have a strong relation with the stoves, they don't want to dissociate completely from it. There is no need to end it either. There shouldn't be an extremist approach, but a middle path. Women have a problem with firewood – breathing illnesses, drudgery in fetching, time spent in cooking and cleaning utensils. Direct, indirect and distant benefits need to be seen and explained.
   - For 50 Kg dung, 2 buckets of water is needed. not a problem in Konkan. Time for water fetching v/s firewood fetching is less.
   - Biogas + tap water connection will have far more benefits
   - Human + animal waste – integrated disposal in biogas. It was started for Bhangi mukti by Appasaheb Patwardhan, Kankavali in 1940s.
   - Cost of clearing septic tank is atleast 500 rs now, but human values and economics both must be seen. Sentimental to scientific bargain shift must occur over the years.
   - Coconut benefit – 100 – Rs 1500. Per year needed in an average household. For last four years, his family hasn't needed to buy coconuts from market, saving money. Soon they will be able to sell surplus and earn through it. They have been grown on compost, slurry manure from a single cow which runs their biogas.
   - Once indirect benefits dominate, BGP will not be agenda, but a routine. People have started to think where they can build a biogas. Reason – increased subsidy plus people unavailable to clear septic tanks.
4. **Spread to surrounding areas:**
   In 3 years, people start to approach. Exit policy – to start work in next village – avoids blocking of corpus in a single village.
5. **Attempts for optimal development:**
   - CDM
     - Lila trust – software consultancy – technical support.
     - ARTI – contacting German Partner – CDM buyers.
     - Door to door – online survey is planned. ADB proposal has been made for it.
     - One Rural Energy Technician behind every 100 BGPs is needed. The person who takes care of the tap water system can double up for the job.

    - Disrepair → underutilisation → neglecting → stops functioning → short circuit of methane → negative CDM.
- Dairy – Sindhubhumi – 850 people give milk. Linking them with BGP and BGP holders to dairy work is on.
- Organic certification – agrotourism+ marketing. Organic certification is needed for exporting. For domestic purposes, no need to spend extra on it. It can be trust based, if the buyer can once in a while come to visit the fields – tourism + buy produce.
    - Though things can move through Bhagirath cash flow system upto the end beneficiary for the purpose, it can be bypassed, and should be.
    - India – Bharat connection will lead to empowerment.
    - Biogas is not yet thought of in this angle.

6. **Local Entrepreneur development:**
   There should be one person per 20 BGP being built.
   - When work was started, only 2 masons were there. There are 60 today who work for Bhagirath. This should grow to 500 masons building BGPs in Ratnagiri and Sindhudurg, either with Bhagirath or independently.
   - Mason can build 30-40 BGP in 8 months while doing other works as well.
   - Target is to build 5000 BGP
   - Now that Paryavaran Santulit Gav Yojana has come, every GP needs to build 10% BGPs and government has already kept money for it. This will speed up BGP building in the coming few years.
   - When Bhagirath decides to work in a field, they hammer the same topic for 3 years to prepare people's mentality to accept it. A lot of Strategic planning goes into this.
7. **Support bygovt mechanism:**
   Have been able to affect the local government mechanism.
   - The target for Sindhudurg was 300 BGP per year. That is, 300 in 740 villages, which is very small.
   - There was a sum on effect of global warming + Paryavaran Santulit Gav Yojana + Jayant Patil being minister for Rural Development + availability of water being improved + Nirmal gram Yojana + Vyaktikendrit Gramvikas model that allowed to revise this target.
   - A lot of follow up, presentations convinced to make the target non-limiting – 1500 is the current target.
   - Though Bhagirath is accountable to achieve this target, it is not responsible for the accounts. It will work through the government mechanism.
   - Many people will now jump into the bandwagon, which will reduce the load on Bhagirath.
   - Government mechanism is being forced to look at it through all possible angles and it still remains the best way to effect on a large scale.
   - Loan system has been established through the district bank.
   - MH level targets will be diverted to these districts as they will be over-performing.
   - BGP still remains the prime agenda for Bhagirath.
   - Executive body must move from enemies to friends and the agency should strive for this to make its work more effective.
8. **Biogas inspite of other available sources, s.a.LPG:**
   Development is inversely related to biomass.
   Yes, people have shifted to BGP from LPG at places, to reduce their LPG consumption.

1. **What did the agency first try to do in the region?**
   Start of the work was water conservation – building check dams, repairing old wells, planting trees etc. mixing with people started this way.
2. **Why did it turn to biogas implementation?**
   Forest need to be conserved, they cant be created anew. So preservation is needed. Through readings, realised that support systems and providing sustainable livelihoods to people is necessary. So, as a solution to conserve forests, biogas was thought over.

3. **What was the approach?**

No one knew exactly what to do. Attempt to repair existing biogas plants was made. Would roam around himself to repair them. Availability of technology is not the problem, but approachability is. Pressure cookers, which have been available for years, are now being made approachable for the rural masses by providing them through Paryavaran Santulit Gav Yojana. Pinguli GP spent 16 lakhs on BGP activities.

4. **How was the first interaction?**

Bhagirath invested initially

- Demo plants built for one farmer in a village. Money put in by Bhagirath.
- Training of local masons
- Strategic networking before entering into an activity
- Approach of participation of people, giving social returns
- Changing role of people by changing nomenclature from beneficiaries to BGP owners. This is not another attempt of being politically correct, but a route to social change.

a. Interaction with local influential people:

Yes, powerful people are identified and a good dialogue is established. But staying away from each other's spheres is necessary – avoiding the grey zone. Powers are demarcated, only inputs should be taken or given. Do not meddle in any way.

The organisational structure is also multifaceted and mutlifactoral. There is a division of specialities. Even within it each one is given freedom, minimum interference in daily working. Also, new people are being trained to continue work.

b. Interaction with organised sectors:

Yes. Connecting people through various reasons is a social investment. Competitions are organised in schools etc, people are encouraged to visit BGPs, demonstrations are made.

c. Interaction with locality groups:

Didn't make any new groups. The existing ones were contacted and supported.

Smoke-free SHG competition was organised – reached to the government officials and they too supported.

Sarees,for them, t-shirts for masons are distributed.

Visiting cards given to masons gives a corporate touch – it tells more about the mason and the organisation.

Logo has its own power – touch of management is given through such small measures.

d. Interaction with government agencies:

Surveying involves use of all government workers in the village. Since they are free and there is a volunteer hidden in them who needs activation.

If apex body visit of chairman is arranged to the village, it continues to benefit the village for the next two years.

5.

a. Capacity building & training:

Yes.

b. Masons' training:

One and a half days every year before work starts - in November. Work period is Nov to June.

Technology revision + soft-skills- behaviour, addictions related training is given.

Since these masons are not just BGP builders, but representatives of Bhagirath in that village, connecting the villagers to Bhagirath and other developmental processes.

Masons are made to understand the global picture in simpler terms which spreads up to the people and rational discussions take place at the bottom levels on topics such as global warming and organic agriculture.

The teaching is very informal, both to the masons and through the masons.

c. Advertisements/people's training:

Flex – print media and visuals – size same as political boards – only then people pay attention.

Wording and art-work paid great attention. Rs 1200 per 8*6 sq ft board are spent.

On average, if every board fetches about 10 BGPs, so its economically viable.

Prime spots are chosen to put them up, where people come to wait, relax and mingle and have an open attitude.
This is the job of the NGO but banks should support them. Bank of India has given money for these flexboards.

d. Women's empowerment:
Direct impact of BGP on health of women, so they have to be targeted.
This also requires having good relations with Doctors and Arogyasevika in the village. Such people help indirectly, increasing scope of the work.
Women are also involved in the construction, either as helpers to the masons or by serving them food, water etc.

6.

a. Finances:
District bank, Grameen Bank, Bank of India

b. Government subsidy, low interest loans etc.:
Yes

c. Cost reduction attempts:
Bamboo model prototype has been made. Working for past 3 years. Will be spread now. Masons will be given incentives for spreading this.

d. Cost of operation and maintenance:
Mobile helpline is there, as all relevant numbers are printed on the visiting cards. If operation is okay, there is very less maintenance. Burner cleaning and moisture removal are the only things to be done. And farmers can be trained for such basic maintenance.

7. Quality Assurance:
Yes. The process is standardised. Size is controlled. Laminated pocket sized cards of measurements are given to the mason. Masons also do evaluation. Senior masons are referred if in any doubt.

a. **Turnkey basis work?** No
b. **Material quality control?** Parameters decided. No human error in cement or steel. Material is made available at local level or village society.
c. **Quality contrl of construction?** Yes
d. **Support till commissioning and later?** Yes. Money not taken till gas burns. Phase-wise payment model is being designed. Mason's contact details are given in the house.

8. **I/p and O/p** – water dung available, manure used in fields.

9. How the movement spread?
Started in 1-2 villages.

a. Nemala – 40 BGP 6 years ago.
Spread to 40 villages now.
Can easily spread to 100 villages in Vengurla, Sawantwadi and Kudal Taluka of Sindhudurg District.
Alternate system needed for distant areas to reduce transport costs.
To make an Adarsh Gram in next district, transport costs will go up. Rather, capacity building over there to carry out good and independent work.
b. **Support from local politicians?** Good. Reluctance initially, but get involved as the work progresses and spreads without their support, they see the social benefits attached to it and contribute then.
Support of ZP members is also necessary
During election "Acharsanhita" time, work of Bhagirath is stopped. Exposure visits to different regions are carried out in that time.
c. **Competition?** Lupin Foundation has just entered into the business, has built200 BGP this year,but without mobilising local resources.
d. **Appreciation by government agencies?** Yes
e. **CDM?** Yes, work started.

10. **What changes would youmake if you could go back?** None. Strategic planning is done to avoid such problems. Planning is done with next 20 years in mind.
11. **Organisation structure?** 9 trustees, 3 female 6 male. 3 Doctors, 5 are actively involved, only 1 is inactive who is very watchful.
12. **Unisectoral or multisectoral approach?** Multisectoral approach has been successful. Unisectoral work would have been possible, but would not be filling. Overall skill development is the goal. Unisectoral would also get boring and would have quit.
13. **Funding agencies affect on work?** Not at all, they tried, but not allowed to. Luckily, they accepted.
14. The few remaining people will build in next few years. They generally accept. 10% people will still remain. These are non-receptive in totality. There is gender inequality in these houses, women are troubled, animals are not cared for and many other issues.
    By 2nd 3rd year, most accept.
15.
16. **Time needed in next village for successful adoption by majority.** Equal time is needed in the next village. One village has spillover in 6-7 villages. Geographical proximity and family relations work to bring this about.
    No force is put to increase momentum, it goes on at its speed.
17. **Imp factors**
    a. Local mason training at village level
    b. Bank linkage for necessary cash flow
    c. Using strengths of government machinery
    d. Strategic planning and policy level decisions enforced
    e. Indirect benefits – eco village program has helped in increasing spread.
    f. Cluster approach – focusing on a few villages and assuring cash inflow there.

On field with Santosh Teli
Work through Gram Panchayat
Detailed quotation is given to each household wishing to build a BGP
Responsibility of the organisation, GP and owner are clarified
Finance arrangement is explained clearly
Mason + helper system is defined – food is to be provided by the families

List of interested people is prepared through government officials in the village

In the beginning – be hard and direct with people
Overestimate costs initially, include smallest of things possible
Have a semi-trained villager to help in the process, if this is the one with a demo BGP and/or influential in the village, it helps.
When roaming in the village initially, have some important person from the village accompany you, a GP member or so, this makes villagers respond.
Identification of spot for building should be done by a specialist. Should take fees, will be taken seriously then.
If recruited by the GP, take charge from GP – including travel costs. (this were taken from people by the GP member, also making the people serious about this investment and thus building the plant.)
List of materials explained in each house – and where to buy from.
Disclaimer told – about payment, responsibilities, subsidy etc.

Earlier, had to run behind people, paid from donation to the organisation so that people would build plants.
Now, people have heard of success and only approaching them is needed.
Mostly, GPs or groups of people have started approaching them.

Still, in every village, a few trips are needed before the work starts.
A lag phase of 2-4 years in many villages, growth phase of another 2-4 years.

Talking in local dialect helps.
Check on masons is necessary. So visit to the worksite everyday.
The payment for masons is divided into three parts – one is the wages, second goes into central fund and third is for services cost. Service is provided by the monitoring person, who has been trained in everything – burner cleaning, repairing, changing pipes, finding faults, etc. here, Santosh does this work. But more such people need to be trained as the work is spreading outside the few talukas where it began.

Lupin doesn't train local masons, brings them in from Kerala – so villagers are not very comfortable with them.
Lupin gives extra money to the masons, though overall costing is almost the same. They too have a person to take care of post installation services. Their approach is more corporate as far more funds are available with them. More such agencies are expected to enter now.

Appendix IV: Interview with Mr Deshpande

Jnana Prabodhini
9-11-2011
13:05
Mr Subhash Deshpande
Mr Madhav Deshpande

Have built biogas under government program as the nodal NGO in Kolhapur district in the 80's. then spread work to Dhule, Jalgaon, Satara, Sangli and Pune districts.

MH government gave importance to biogas in 82-83.
Mason's training was taken up to a great extent
It was channelized under the agriculture department.
When JP started work in Kolhapur villages, gramsevaks had already prepared lists of beneficiaries in the villages.
Z.P. had identified masons for training as well.
Thus, all the structure was readymade for the agency at that time.
Classes for masons were conducted, both theory and practical was taken.
Fixed dome model in bricks was propagated. Earlier, construction with centring was done, later without centring method was used once it was developed.

Selection of site was critical – there should be no water logging, slope should be less, trees should not be very close and should be close to the place where animals were kept.

Material selection was also taught to the masons.

Initial work was through masons' training.
1 day training of women about importance and how to use biogas plant. Practical experiments used to remove fear of explosion. Using and cleaning stoves also taught.

Water curing was emphasised.
16,000 masons were trained in Maharashtra while 5,500 BGPs were built.

To understand why plants became dysfunctional, listing of problems of origin is needed.
Material, technical, not curing cement are problems during construction
Not using water and dung in equal ratios, use of other material are problems in operations.
Not cleaning stove properly, moisture collection in pipe are maintenance issues.
Sunlight and heat are regional problems – maintenance of temperature is needed in biogas for microorganisms to grow.

Work in Sanaswadi was carried out during 1990-2004
Since firewood had become scarce and kerosene wasn't easily available, biogas was offered as an alternative to the people. In the 80's, when the subsidy was high, BGP were a source of corruption.
Initially, shut down plants were started, maintenance service was provided. It was realised that there is a mismatch between many plants' size and number of animals. Arrangements to fill them initially was made.
Initially, 30-40 people became ready. Training for masons was carried out.
People were convinced into connecting toilets. When one person became ready, his plant was built and served as demo – there was no foul smell, any filth or flies. Then others became ready.

As long as there is a contact with the villagers, plants kept running, but over the years, various factors led to their shutdown.

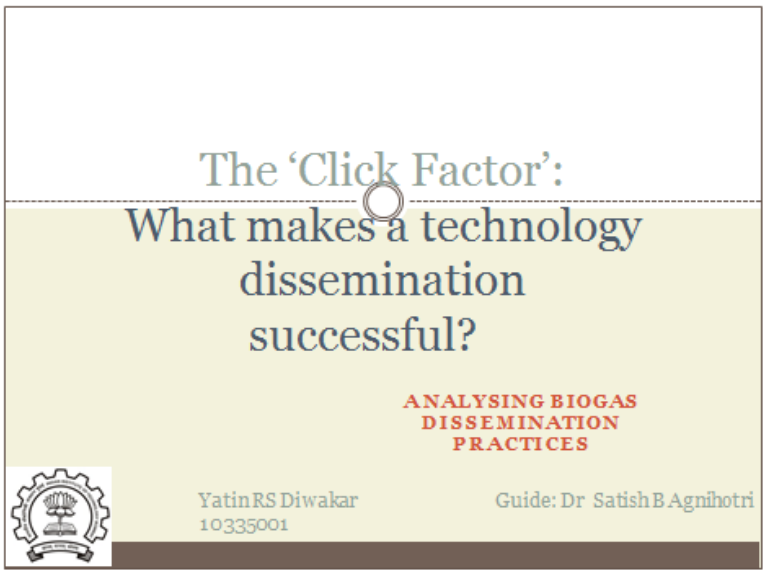
Cost of dung is huge as it involves maintaining the animals who need food and water. Food includes the fodder grasses and the supplements.

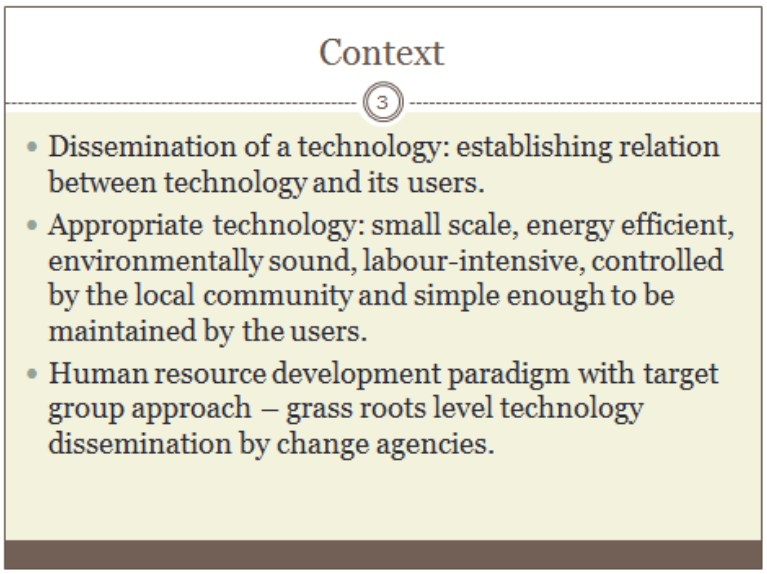
Appendix V: Interview with Mr Navrekar

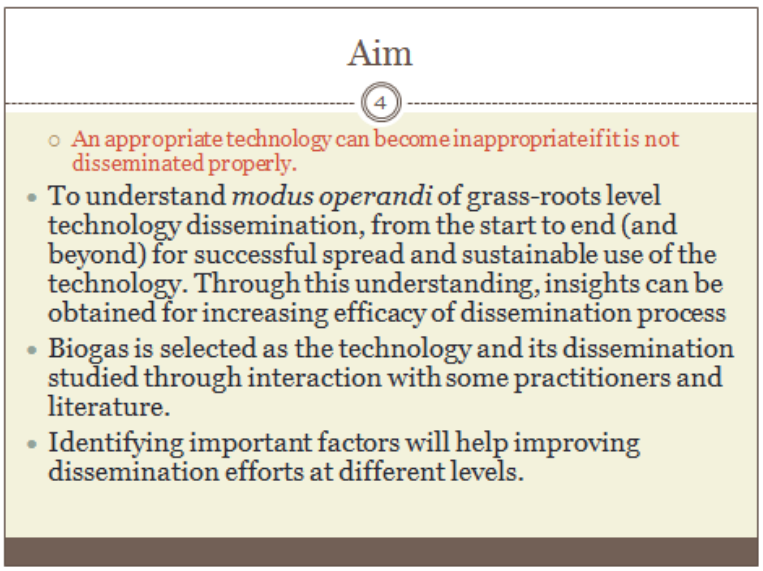
Nirmal Gram Nirman Kendra
Gangapur village, Nashik
1-12-2011
15:45
Mr Shrikant Navrekar

80's – 20 point program – great amount of work.
Government has the reach and setup. But government machinery vices worked in biogas programme.
No monitoring – target oriented program. subsidy was huge – people built BGP for subsidy
Hygiene, energy, fuel, etc. angles not forced.
Beneficiary outlook – no belongingness – people attachment lacking due to no orientation.
Low technical quality of constructions
KVIC v/s FDD – mason dependency
MH – mistake – agri dept – no civil construction background of agri extension officers – quality monitoring missing.
Manure aspect never focused upon.
Apathy – importance not realised leading to disuse.
Women participation taken up very late
New generation feels LPG is better.
R&D needed for small things- churner, water, animals
Sanitation need not realised
If corporate sector enters, it will hijack the program.

Appendix VI: Presentation

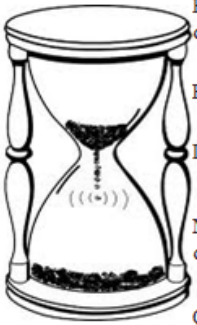






Hourglass of Research

5



How does the development agency affect dissemination?

Biogas dissemination as specific instance.

Interviews, observations, literature review

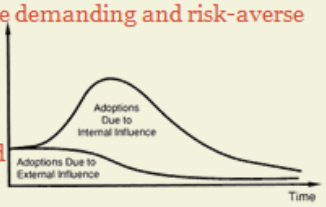
Modus operandi of agency in biogas dissemination.

Click factors under control of agency.

Dissemination Theory

6

- *Innovation* is disseminated through *communication channels* over *time* in a *social system*.
- Innovation:
  - Compatible, simple, trialable, observable results → Demos
  - Reinvention to meet needs of more demanding and risk-averse individuals.
- Communication channels:
  - Mass media and Interpersonal
  - Heterophily of change agent: need of long interaction periods.



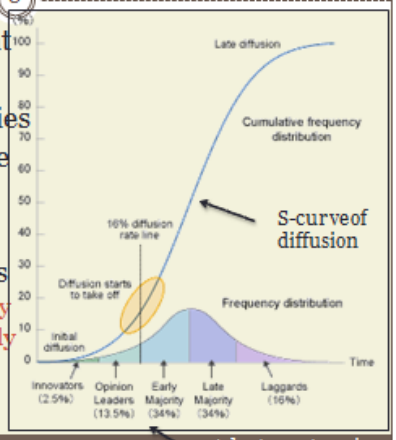
7

- Steps in Decision to Adopt:
  - Knowledge about innovation and functioning
  - Persuasion forming an opinion
  - Decision to adopt/reject
  - Implementation
  - Confirmation to reinforce decision
- Influenced by
  - Media
  - Success stories – demos
  - Constant touch – confidence building

Adopter categories

8

- Each group needs different approach
- People won't shift categories
- Deal with them one by one
- Special attention needed to each
- Understand social systems
  - Use opinion leaders effectively
  - Use aides to bridge heterophily gap



Barriers to Dissemination

9

- Users
  - Unaware – educate and advertise
  - First cost sensitive – financial aid
  - Helpless –technology + service package → institutionalise
- Resource producers and distributors
  - Supply obsessed – change paradigm to resource service
- Financial Institutions
  - Supply biased – change paradigm
  - Unfair – removal of subsidies, correct pricing, same terms of credits, benefits, incentives, etc.
- Decision makers
  - Cost blind price fixer – marginal costing, pricerises, efficiency improvements

History of Biogas in India

10

- KVIC Floating dome model were used 1960's to 80, then the FDD *Janata* model was introduced.
- National Project on Biogas Development was launched in 81. High subsidies and target based approach without monitoring led to mediocre success of the project.
- Estimated potential of biogas plants: 120 lakh
- Cumulative Biogas plants (2010) : 41.7 lakh(34%)
- National Biogas and Manure Management Programme launched in 11th Plan – modifications in earlier program.
- Target for 11th Plan: 6.47 lakh plant

Case Studies

	ARTI (post 2003)	Bhagirath (2006-)	JP (81-2002)
Dissemination	Passive – pull	Active – push	(Inactive)- push
Work area	Urban	Rural	Rural
Government participation	No	Yes, for scaling up	For government
Other interventions	cooking energy	Yes	Yes
Training	plumbers	Masons	Masons
Sophistication of change agents	No	Social skills, credit cards, etc.	No
Innovations	Sugar based, plastic tanks	use of bamboo, drip pipes	FDD without centring
Guarantee	Yes	Yes	?
Service	Limited	Special Person	No
Finance	No need	MoU with banks	No
Women participation	Yes	Actively sought	Need realised, not implemented
Belongingness	Yes	Yes	No

SWOT of Biogas Dissemination

12

Strengths
- Technological Developments
- Government programs & subsidies
- Localised approach
- Training of village masons

Weaknesses
- Not exploiting Dairy, Sanitation, Manure market connections
- Neglecting Women
- Target completion approach
- No institutional/follow up setup

Opportunity
- CDM
- SHGs and farmers' groups
- Mobiles for repair services
- Entrepreneurs

Threats
- Costs of animal rearing
- Previous failures
- Lack of monitoring in projects
- Cost reduction → affects durability
- Biogas is not a priority for users

"Click Factors"

13

- Advertising and educating people
- Women empowerment and participation
- Institutional arrangements for loans, installations and maintenance & repair service*
- Training of local masons for technical perfection in construction*
- Management skills of the agency*

Take-homes for Change Agencies

14

- Understanding Dissemination Theory
- Participatory dissemination – engaging groups
- Women's empowerment
- Training of local aides, use of opinion leaders
- Work for total development: help from others
- Education and training
- Single window setup for end-users
- R&D and Dissemination should go together
  - cooperation between agencies, government and people's organisations.
  - Provision of policy, infrastructural and financial suppport.

Future Work

15

- Biogas plant entrepreneur – Technical education syllabus – framework
- Policy brief – need of cooking energy in MH (some village case study) – projected need – how can biogas help to meet this.
- Developing syllabus through interaction with people in it, biogas trainers, government material, people working on field.
- Alternate – Making dysfunctional plants work – train youth for the same.

Relevance in CTARA

16

- Lot of appropriate technologies have been developed with participatory approach.
- Lying idle without being used on field.
- Need to actively disseminate these – real test is on field.
- Students comfortable with solving technical problems. Uncomfortable on field?
- Treat dissemination as a technical problem with socio-economic constraints.
- Innovations needed for this too!

Thank You

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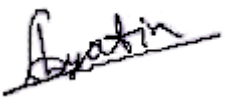

Yatin RS Diwakar