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Decentralized Rural Household Energy Solution in Madurai

I. Introduction

“Crude oil price touches USD 137 per barrel” the newspaper headline screams for attention. As Muthu Velayutham, Secretary of The Covenant Centre for Development, Madurai turns the pages of the newspaper his mind drifts a year back when crude was trading at USD 57 per barrel. Annual inflation has steadily crept up to more than 8% fuelled first by the commodities price increase and then crude oil. And despite a looming recession in the US and signs of global slowdown, prices have shown no signs of tapering off. The Government of India recently has hiked up the price of petroleum products making cooking gas and transportation fuel dearer which in turn will have a cascading effect in driving up the prices of essential commodities.

Muthu reflects that the rural decentralised energy solution innovation his organisation initiated in partnership with a multinational company three years back is getting increasingly relevant now. The energy solution has been the introduction of clean, efficient low emission biomass stoves and pellets. His organisation and partner organisation Swayam Shikshan Prayog (SSP) in Maharashtra have worked with the MNC partner to identify the community household energy needs, developing and testing of a cooking solution, and then finally develop a commercial model for distribution. At present the biomass stove has reached about 11000 households in about 250 villages surrounding Madurai. The MNC partner is spearheading the distribution in other states of India and more than 200,000 biomass stoves have been sold altogether in over one and half years of commercial operation.

CCD has pioneered and tested the model of distribution of stoves through Self Help Groups and manufacturing of biomass pellets from the agricultural residue. Along with its partner organisation SSP in Maharashtra it has created entrepreneurial opportunities for more than 600 women who belong to Self Help Groups to work as sales agents for the biomass stoves and pellets in the villages and peri urban areas. It is distributing a cheaper and cleaner cooking fuel when compared to kerosene and LPG and thus delinking the community from the escalating price of petroleum products used for household energy needs. The initiative is contributing towards promoting renewable energy by converting agricultural residues like tamarind shell and groundnut shell into pellets to make it more efficient for burning as well as reducing the indoor air pollution. The list of potential impacts for the community and environment is quite impressive but for Muthu the challenges are also quite deep rooted ranging from making this initiative sustainable commercially to start a process where the community develops a greater understanding of the issues of energy crisis and climate change and hence adopt sustainable energy solutions for their household.

II. Consumer insights on energy needs at the Household level:

Why an intervention is required in rural energy

It was November 2004 when CCD was approached by one of the world's largest oil company. They shared their intention of working together with CCD in Madurai and SSP in Maharashtra in understanding the energy needs of the low income households in the rural and urban area and possibly co-create a solution to meet their needs. During his work with the community in the last ten years he has come to realise that almost all the households in the village use biomass and dung. The smoke emissions from the biomass are a major health hazard and creating negative environmental impact.

At that point about 75% of the households in India comprising 90% of the rural households and 33% of the urban households used biomass and cow dung as a household fuel. Approximately half a million premature deaths and nearly 500 million cases of illness are estimated to occur annually as a result of exposure to smoke emissions from biomass use by households in India, making indoor air pollution the third leading risk factor¹. Young children (under 5 years of age) and women are affected disproportionately. Traditional biomass use has other adverse social impacts: biomass fuel collection can take long hours and entail significant drudgery especially for women, consuming time that could be used for other important activities such as income generating activities, study or leisure.

An intense period of field research was conducted by CCD and MNC partner in the subsequent months. Market research, focus group discussion outputs and secondary research data were analysed and insights on low income consumers in the rural and urban households were developed.

In the rural areas households were spending close to 7-9% of their monthly expenditure on energy including electricity and the bulk is spent on cooking and lighting. The use of biomass fuel and dung usage is prevalent among all income levels. Close to 50 % of all households were using free biomass. In contrast LPG and Kerosene usage as primary cooking fuel was virtually non existent in the rural areas except for the richest segment.²

In the urban areas about one fifth of the households were still using biomass. The percentage of the households using free biomass in urban areas was significantly maller when compared in the rural areas. The occurrence of LPG as a cooking medium was observed over a range of income segments.³

¹ Source : World Bank Report on " Access of the Poor to Clean Household Fuels in India " , 2003

² Please refer Annexure C. Primary Energy Sources for Cooking and Lighting and Annexure D. Rural Household Spend towards various energy types as % share of total monthly expenditure

³ Please refer Annexure E. Urban Household Spend Towards various energy types as % share of total monthly expenditure

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One of the observations across income segments in rural and urban area was that consumers were using a portfolio of fuels for cooking like wood, dung, kerosene and LPG and they were optimising the use depending on the meal type, time of the day and fuel availability. For example LPG was most frequently used for making tea quickly but the same household may use biomass for cooking rice and vegetables. When consumers were asked about their aspirational fuels the answer was always LPG. The adoption of LPG was low in the rural villages because of lack of easy access, huge upfront initial payment for cylinder and stove and also lumpiness of payment for a refill cylinder when the consumer has to pay more than INR 300 at one time.

The MNC partner and CCD team came to the conclusion that cooking, lighting and water heating are the top three energy needs of the community. The intervention in the area of cooking was considered as most appropriate as bulk of the rural household expenditure for energy was for cooking energy. Moreover the harmful effects of emission from biomass were creating health hazards. Accepting the fact that biomass will continue to be preferred in the rural areas in the near future at this point the team's focus for the energy solution was steered towards on how to reduce the harmful effects of the biomass and make it a more clean and efficient fuel. Keeping in mind the aspirational fuel of consumers being LPG it was decided to include LPG cooking solution as part of the initial offer along with biomass to give consumers a choice.

III. Overview of the Intervention

A. The Journey: From product development to business in operation⁴

On successful completion of developing insights and needs of the consumers the team moved on to the phase of innovations around designing a biomass cooking solution. The MNC partner led the product development process at this stage.

Consumers were involved at every stage of the product development and their feedback was incorporated in the design. Intense product development iterations followed during the next few months and in September 2005 prototypes were ready to be tested in the consumers' house. The MNC Partner and CCD jointly conducted the prototype testing in 27 households in the villages in and around Madurai. Close monitoring of the prototype testing, listening to the improvement feedback from consumers and rapidly incorporating the changes in the stove design led to the development of the solution which was fit for the given purpose. As the prototype testing progressed all the partners were excited by the high acceptance level of the biomass stove by the consumers despite the teething problems that were present at that time.

The time was just right for CCD and its partner organisation SSP in Maharashtra to take the partnership with the MNC business to a new level. They decided to promote a social enterprise which will be spearheading the distribution of energy products and services for the community and in the medium term when it turns financially viable the ownership to be transferred to the community. So Adharam Energy Private Limited (AEPL) was promoted by CCD and SSP in January 2006.

⁴ Please refer Annexure B. Time line of the Initiative

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The prototype testing phase came to an end in March 2006 and Adharam entered into a business contract with the multinational partner as an exclusive distributor of the biomass stoves, pellets, LPG stoves and cylinders in the Madurai region in Tamilnadu and Marathwada region in Maharashtra.

14th April 2006 was a red letter day in the history of Adharam Madurai when the pilot commercial launch of the business took place in the village Pulwaikari near Madurai. The next 8 months was the commercial pilot phase where the business model was tested commercially and fine tuned. The LPG offer was supported by a microfinance option where the consumers could take a loan of Rs 2000 from a microfinance institution against a down payment of Rs 400. The pilot operations were launched in 27 villages near Madurai and 27 villages near Osmanabad/Solapur in Maharashtra. The total sales of biomass stoves in Madurai region during the commercial pilot touched nearly 2000.

Towards the end of commercial pilot in December 2006 it was decided to discontinue the LPG solution and only go ahead with biomass stove and pellets for business ramp up. The key driver leading to that decision was the change in government policy towards abolishing subsidies for LPG and price control. LPG pricing is regulated by the government and no subsidies are provided to private players. In 2004 when the decision to introduce LPG was considered as part of the solution the government was supporting a policy leading to abolishing of subsidies by April 2007. However with change in government, the subsidies were meant to stay till 2010 and so continuing with the LPG offer was unsustainable for MNC partner.

In the next 15 months Adharam Madurai launched its business in 250 villages and reached total sales of 10447 biomass stoves till May 2008. In 2007 CCD and Adharam Madurai also worked closely with the MNC partner to establish a biomass pellet production unit and stabilise the pellet manufacturing technology. It was spun off as a separate unit known as Kalasm Bio Fuels.

B. Business Model of the Social Enterprise Adharam Madurai

“The commercial pilot in 2006 and the ramp up in 2007 provided real time data and insights on how to improve the product, business model and supporting processes” recalls Mr Kumaresh Babu, General Manager of Adharam Madurai. He goes on describing the business model of Adharam as it stands now. The key actors in the business model are MNC Partner, Adharam Madurai, Kalasm Bio Fuels, Federation and SHGs, Jyothis.

i. Product Portfolio of Adharam Madurai

Currently the products that are marketed by Adharam are

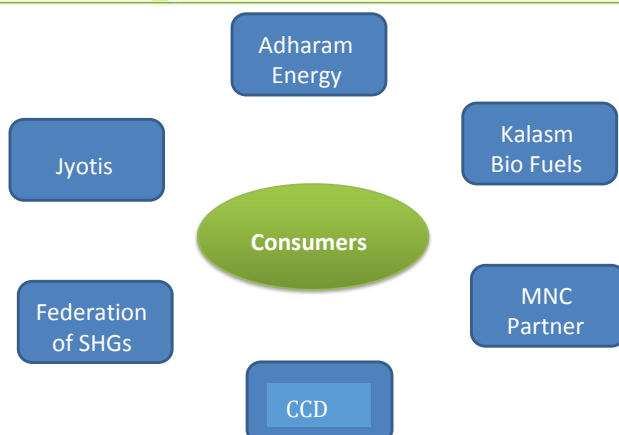
- “Oorja” Biomass Stove with retail price of INR 675 per stove
- “Oorja” Biomass Pellets in 5 kg bags with retail price of INR 5/kg

On the first purchase of the “Oorja” Biomass Stove the consumers receive free of cost 5kg bag of pellets as part of promotional offer.

Key Actors in the Business Model of Adharam Madurai



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ii. Adharam Energy Private Limited, Madurai

Adharam Energy currently is the exclusive distributor of the biomass products of the MNC partner. It has its operations in Tamilnadu based out of Madurai and in Maharashtra based out of Osmanabad.

The role and responsibilities of Adharam are:

- Selection of the village level entrepreneurs Jyothis
- Training of the Jyothis
- Business launch support for the Jyothis
- Sales Promotion at the village level
- Sale of biomass stove and pellets
- Distribution of the Pellets and Biomass Stove from warehouse to the Jyothis
- After Sales Service of the biomass stove

Currently Adharam Madurai gets commission of Rs 20 for sale of every biomass stove and Rs 0.40 per kg for sale of biomass pellets.

iii. Kalasm Bio Fuels Unit⁵

This unit is responsible for manufacturing of biomass pellets

- Procurement and Storage of agricultural residue (mainly tamarind shells) as raw material for pellets
- Production of pellets according to demand

This unit supplies pellets to Adharam which in turn distributes to Jyothi at the village. Apart from Adharam, Kalasm Bio Fuels unit supply to another distributor of MNC partner in Tanjore.

iv. MNC Partner

The MNC partner's current role as related to Adharam

⁵ Please refer Annexure M. Kalasm Bio Fuels

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- Ownership and Up gradation of technology for biomass stoves and pellet manufacturing unit
- New Product Development and introduction
- Building the “Oorja” Brand
- Setting guidelines and Supporting Adharam in terms of product marketing and sales promotion activities
- Ensure compliance to safety standards for distribution and manufacturing
- Training of Adharam Staff as Train the Trainers

v. The Covenant Centre for Development, Madurai (CCD)

CCD's role has evolved from co-creating a solution on household energy in 2005 to the current role of facilitating the business viability and sustainability of Adharam. CCD plays an active role in raising finances and its involvement in the governance of Adharam ensures that the social and business objectives are aligned.

vi. Jyothi

Jyothi is the village level entrepreneur appointed as an agent of Adharam for the sale of the biomass stove and pellets. She is a member of the Self Help Group in the village and is identified and recruited by Adharam team with the support of Federation representatives. Typically each Jyothi is responsible for sales in 400- 500 households in the village. If the village size is smaller, Jyothi may be in charge of sales for two or more villages provided the villages are within a distance of 3-4 kms.

Her role is

- Communication on increasing awareness of the biomass stove and pellets in the village through promotion
- Sale of Biomass stove and pellets in the village
- Basic after sales service of the stoves

A cash and carry system of distribution is followed where Jyothi places order worth at least INR 5000 of stoves and pellets on Adharam at one time. Adharam delivers the stoves and pellets to Jyothi's house in the village.

Jyothi receives a commission of Rs 35 for the sale of one stove and Rs 0.45 for the sale of one kg of pellets.

vii. Federation of SHGs⁶

“In 2004 about fifty Federation Representatives from three Federations completed the field work in 10 days interviewing 4000 households for the market research on energy usage pattern” recalls Partha, who was part of this project during that phase. Federations of SHGs have played a strong role in business development all through out. The Federation

⁶ Please refer Annexure N. Federation (Mahakalasm) Structure

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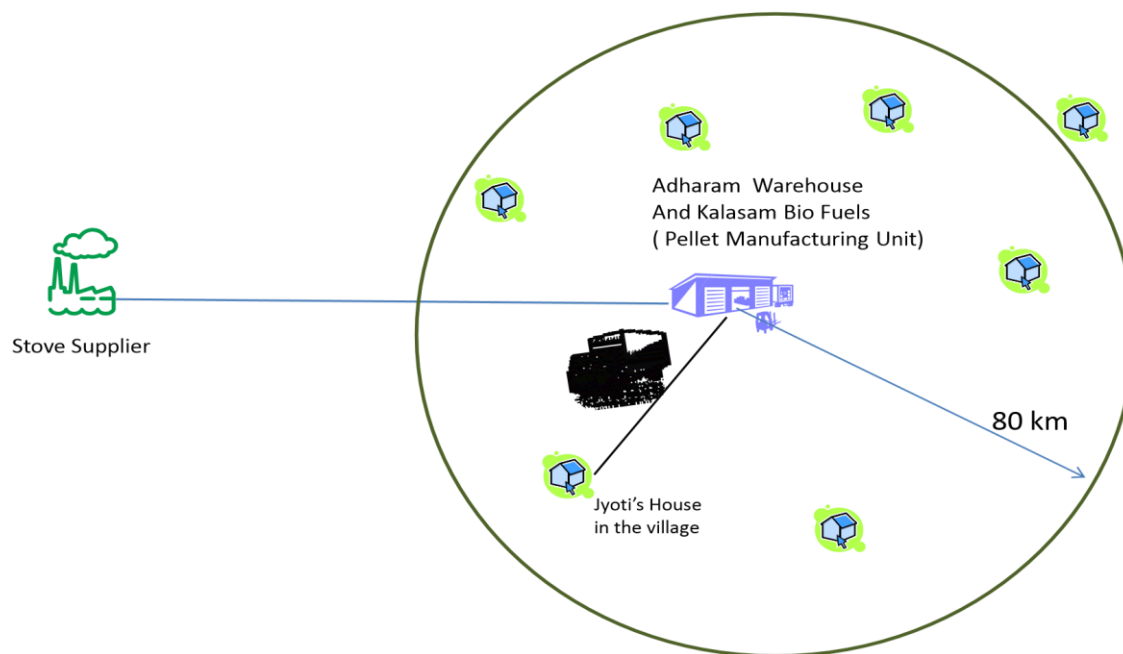
representatives and SHGs were involved in product concept testing, selection and monitoring of the Households for prototype testing.

Currently Federation representatives support Adharam in initial screening and selection of Jyothi. The Group leaders of SHG and the Federation representatives organise group meetings for Jyothi to demonstrate the product and support in sales promotion. Federation representatives invest significant time and energy to coach Jyothi so that she can establish her business successfully.

C. Supply Chain of Biomass Stove and Pellets

The distribution of biomass stove and pellets take place from the central warehouse in Madurai. The pellet production unit is adjacent to the warehouse. This warehouse covers about 250 villages majority of which is within a radius of 80 km. Jyothi places order worth a minimum of Rs. 5000 of pellets and stoves with the Network Co ordinator of Adharam. This order is processed in the central warehouse and the distribution route plan is prepared after optimising the lorry load. Adharam distributes the stoves and pellets to the house of Jyothi in the village. Depending on the case Jyothi may deliver at the house of consumers or consumers come and pick up from Jyothis house.

Adharam currently owns 3 trucks: one of 4 tonnes capacity and two of 1 tonne capacity each. The average transportation cost per kg of load within a radius of 80 km varies from INR 0.38- 0.46



D. Potential Benefits for the community and the environment

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This distributed energy solution for the households is on track to deliver the intended benefits for the community and environment. It is economical over paid biomass, kerosene and LPG, reduces indoor air pollution when compared to traditional biomass stove and saving non-replaceable biomass and providing an option to move away from non-renewable energy for cooking.

i. Savings for the consumer

The cost of cooking in Oorja stove using pellets comes to around Rs 162 per month for a family of five where as the corresponding figure for firewood paid for is Rs 315, LPG is Rs 330 and Kerosene is Rs 190.

ii. Reduction in indoor air pollution

The biomass stove has been designed as smokeless by making it operate with the optimum amount of forced air. Studies⁷ point out to a reduction in CO (Carbon mono oxide) and SPM (Suspended Particulate Matter) and RSPM (Respirable Suspended Particulate Matter) from existing levels by 71% ,75% and 34% respectively for Oorja Biomass stove when compared to fire wood burnt in traditional stove.

iii. Shift away from non-renewable energy and non-replaceable wood

This initiative is providing an option to the community to move away from nonrenewable energy like kerosene, coal, LPG for cooking and meet a significant portion of their cooking needs through this solution. Moreover by de-linking the community from the rising petroleum prices this solution is giving them an opportunity to control the expense on cooking energy.

The fire wood which is being obtained from cutting trees can be treated as nonreplaceable as it has a long duration for replenishment. The agricultural residues used to produce pellets have the replenishment duration of the crop cycle varying between six months to one year depending on the type of crop. The only net incremental carbon-dioxide emissions added to the atmosphere are that by the fossil fuels used for transportation of agricultural residue and processing of pellets.

The operational efficiency of the Oorja Biomass stove varies between 47%-50%⁸ and it represents a 300% increase in efficiency over the traditional cook stoves using fire wood. The implication of this is that for the same cooking using the combination of pellets and Oorja biomass stove the carbon di oxide emission reduces by 70-80%. compared to using fire wood in traditional stove.

⁷ According to Impact Assessment Study commissioned by MNC Partner

⁸ According to study conducted by MNC Partner

E. Business in Operation: Pilot to Scale up in the first two years**i. Sales Promotion in the village**

The sales promotion in the village takes place at two levels. After the completion of training of the Jyothi, the first sales promotion is organised during the launch of Jyothi in the village. This is supported by Adharam and the Federation. During launch in the village Adharam runs a sales promotion van complete with a TV and a public address system. This vehicle is deployed to organise road shows at four to five key locations in the village and create awareness through demonstration of the stove. Subsequent to the launch in the village Jyothi organises live demonstrations with groups of potential consumers. The federations also support in organising group meetings and Jyothi in demonstrations. Apart from the initial sales promotion during the business launch of Jyothi, regular sales promotions are organised at intervals in the village. These promotions are requested by Jyothi based on local dynamics of the village like festivals and occurrence of key events where people gather together. This ongoing sales promotion was supported by advertisement campaign in FM radio and in March 2008 local newspaper advertisements were introduced.

ii. Jyothi in Business

“If Jyothis’ are successful, then only Adharam will be successful. In the last two years 260 Jyothis have been trained and launched in the business and currently 174 of them are in business. Majority of the Jyothis are first time entrepreneurs and so require sustained support and coaching till the time they establish their business. The drop out usually occurs in the first 3-4 months after Jyothi launches her business. This is a crucial phase where Jyothi tries to establish her identity as an entrepreneur in the village, approaches potential consumers and works on closing the sale.

“Initially our target was that through this energy business opportunity, each Jyothi will have the opportunity to earn at least Rs 1000 per month “says Muthu.

However this is not happening for many of the Jyothis. The commission from biomass stove sales drop after 3-4 months of the business launch in the village and the sustained income is mainly from sale of pellets. The low consumer base for each Jyothi and lower than expected consumption of pellets from each consumer is restricting the average income of Jyothis to Rs 200-300 per month after the sales of stoves are over. Alternate earning opportunities like Government programs are also competing with this program to get Jyothis attention.

iii. New insights on consumer segments and pellets usage pattern

The two years of operations have brought in new insights regarding the consumers. The consumer segments in the village based on fuel used for cooking can be broadly classified into

- Households primarily using free biomass for cooking
- Households primarily using paid biomass for cooking
- Households primarily using free biomass but also have LPG

Most of the households also have access to Kerosene as supplied by Public Distribution System.

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The value proposition of this solution to households who are using free biomass for cooking is that this stove and pellets solution will reduce the indoor air pollution and the adverse effects on health. It will save the time spend for collecting free biomass which in turn can be used for income generating activities. Inspite of the communication and awareness creation the shift in the attitude of the consumers is taking time. Most of them still prefer continuing free biomass over pellets paid for. Households who are having kitchen outside of their house are not too bothered about smoke or harmful effects of emissions of using free biomass. Since this being the largest segment in the village these is adversely affecting the adaptation of the stoves in the village and achieve a critical mass.

The consumer segment which is seeing a lot of value in the product are households who pay for biomass. For them this solution not only reduces the smoke and soot but also is cheaper and convenient. In many villages where free biomass is scarce the sales of stoves have reached a critical mass. The consumers in peri-urban areas also fall under this category. Their migration to peri-urban areas from villages has resulted in that they do not have access to kerosene and LPG and lack of free biomass leading them to pay for biomass. So this category of consumers is emerging as a potential new customer base for Adharam.

The initial assumption for pellets consumption in a household was 1 kg per day for a family of five ie at least 30-32 kgs per month if the household cooks for 2 hours a day and uses only pellets. The average consumption observed is much less than that and varies between 5-6 kgs per month and has significant seasonal fluctuations. The consumption of pellets peak during monsoon season ie during the months of October- November in Madurai.

The consumers also need to adopt some changes in the cooking pattern while using pellets and the Oorja Stove.⁹

IV. Challenges for the General Manager

A. Economic Sustainability of Adharam Madurai, Pellets Production Unit, Jyothi

V C Nadarajan, Executive Director, CCD is clear on a basic tenet “ We have to steer Adharam and Pellets Production Unit to breakeven in the medium term and once we reach that level we can think of what we do with profits ”. It’s quite clear to V C Nadarajan and Muthu that unless this model is economically sustainable in the medium term then their dream of scaling up a distributed household energy system will come to a halt.

With the current cost structure Adharam needs at least a net margin contribution of Rs 50,000 per month to break even. In the last 4 months average monthly sales of stoves have been 420 per month. Adharam can expand beyond their current operating area for sales but that will only lead to higher distribution costs.

⁹ Please refer Annexure Q. Excerpts from the discussion with a Mother-daughter Jyothi and Annexure R. Excerpts from discussion with Federation Outlet Staff

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For Kalasm Bio fuels Business the breakeven will be achieved at a production of about 175-200 tonnes of pellets /month.

The economic sustainability of Jyothi is also crucial. Unless she earns Rs 1000 per month she will gradually drift away from this business. It is now time to assess what are the strategic options and recommended course of action on achieving economic sustainability for the following entities

- Jyothi
- Adharam
- Biomass Production Unit

The challenges in this case are what the interventions, redefinition of roles and responsibilities are necessary at the following levels to generate momentum

Consumer Level

- Which segments of consumers need to be targeted and how they will evolve over time?
- What will be the drivers to switch consumers from free biomass to pellet?

Jyothi level

- How can Jyothi's performance as an entrepreneur be improved?
- What should be the likely profile of Jyothi's?

Federation and SHG Level

- Is the current role of Federation and SHGs in this business adequate and appropriate?