

March 2007

Final Report

Commercialisation of energy efficient and renewable energy in India

Prepared for
British High Commission, New Delhi



Project Report No. 2004 RS 21

www.teriin.org

The Energy and Resources Institute

Suggested format for citation

TERI. 2006
Commercialisation of energy efficient and renewable energy in
India
New Delhi: The Energy and Resources Institute.
[Project Report No. 2004 Rs 21]

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Chapter 1 Executive Summary

TERI implemented the project 'Commercialisation of Renewable Energy Technologies (RETs)' funded by 'The Renewable Energy and Energy Efficiency Partnership' (REEEP), New Delhi for the period from October 04 to August 06. The project was an extension of the India Canada Environment Facility (ICEF) funded project 'Dissemination of RETs in rural India through NGO' which lasted till 31 August 2003. The REEEP project was implemented in the rural areas of Bikaner, Rajasthan and subsequently taken to Gujarat, Punjab, Uttar Pradesh and Bihar.

Objectives of the project were as follows:

- To be a major private market player in solar photovoltaic technologies
- To create a decentralized, 'integrated model' for rural energy interventions
- To ensure a strong presence in the local market
- To consolidate and expand the business with special focus on Rajasthan.
- To concentrate on product portfolio and reduce the cost further

As part of the project, Energy Service Networks (ESNs) comprising - local entrepreneurs, retailers, dealers, manufacturers, vendors, trained technicians, NGOs and SHGs were established in Bikaner . This was done through a market-based approach for the provision of the need-based renewable energy systems to the households.

For large-scale dissemination and commercialisation of the product, the focus was on new product development, reducing the cost of systems, better after-sales service and affordable finance options. In order to meet energy requirements of rural households, the project team was able to develop and add low cost products to the Uttam Urja product range. These products were LED based systems such as LED torches, DLS (3 types), solar lanterns, garden lights etc. Products were also developed for institutional sale such as Solar Charkha for the purpose of spinning cotton and wool and Solar Milk Testing Center for the purpose of milk testing.

All these systems were assembled locally at Bikaner, which reduced the cost of systems considerably. Local assembly also reduced the delivery time of systems and promoted efficient

after-sales service. Supply chain was streamlined by establishing effective procurement system from the suppliers and vendors. For delivery of the products in the villages; network consisting of dealer, retailer, NGOs, SHGs was established.

Innovative awareness generation activities together with capacity building were the most important factors for broad dissemination and sustenance of the interventions. This led to establishment of a brand 'Uttam Urja' identified with the project to reinforce its attributes and made the project one of the most recognizable projects in the area.

The project started from a few villages in Bikaner and spread to neighbouring districts of Bikaner as well as other states: Gujarat, Punjab, UP and Bihar. This also encouraged Rajasthan Renewable Energy Development Agency (REDA), the government of Rajasthan body responsible for dissemination of RETs to follow suit and bring out more products as well as enhance reach throughout the above districts.

A network of 24 dealers (including 2 mobile dealers) and 25 service centres, 4 NGO's, and 78 self-help groups has been established at the project sites.

Importantly, franchisee model has been developed under the project. Franchisees were selected in Patna, Bihar, and Ahmedabad Gujarat. After completion of two years, Uttam Urja project met several of the milestones, as indicated above. There are several challenges ahead. These include.

- High initial investment on the solar systems
- High overhead cost incurred for marketing in the rural areas
- Problems in making market networks sustainable
- High investment and low returns
- Agriculture is main source of income so income level is limited
- Financing institutions are not motivated to finance the systems because of high transaction cost.
- Government subsidy on solar systems distorts the marketing system

After completion of the project, Uttam Urja network was functional on its own even after withdrawal of TERI from the project area. Two of the dealers selected from Uttam Urja network were running it.

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TERI has also proposed tying up Uttam Urja dealer network with Akshya Urja (Aditya Solar Shop) program of Ministry of Non Conventional Energy (MNES), which would enhance market penetration of Uttam Urja and make it more sustainable.

Chapter 2 Introduction

TERI implemented the project 'Commercialisation of renewable energy technologies' funded by The Renewable Energy and Energy Efficiency Partnership' (REEEP), New Delhi in the rural areas of Bikaner and its neighbouring districts and further expanded in the states: Gujarat, Punjab, Uttar Pradesh and Bihar. It continued for the period - October 04 to August 06. The project was an extension of the ICEF funded project 'Dissemination of RETs in rural India through NGO' and was completed on 31 August 2006. The purpose of the REEEP project was 'to create a commercially viable market for solar photovoltaic technologies by creating a network of vendors, dealers and trained technicians that was formed as an ESN (Energy Service Network) to serve the rural masses with need based energy efficient and renewable energy products and services beyond the project period'.

Regular activities undertaken in the project were: supply chain management, capacity building, awareness generation and brand building, customisation of the products, marketing and sale, after sales service, management information system, monitoring and reporting etc.

After completion of two years the project created a commercially viable market for solar photovoltaic technologies. A functional network of energy service network (ESN) was established.

Objectives of the current Project

- To be a major private market player in solar photovoltaic technologies
- To create a decentralized, 'integrated model' for rural energy interventions.
- To ensure a strong presence in local market
- To consolidate and expand the business with special focus on Rajasthan.
- To concentrate on product portfolio and reduce the cost further.

Background

TERI implemented India Canada Environment Facility (ICEF) funded project 'Dissemination of RETs in rural India through NGO' for the period from 1999 to 2003. It was implemented in

the rural areas of Rishikesh, Uttaranchal and Bikaner, Rajasthan. As part of the project, Energy Service Networks (ESNs) comprising local entrepreneurs, retailers, dealers, suppliers, vendors, NGOs, SHGs etc. were established through a market based approach for provision of need based renewable energy products and related services to the households.

The key achievements in the projects were as follows:

- Formation of a network of dealers and retailers constituting a supply chain for sale of energy efficient and renewable products such as Solar Home lighting Systems (SHS), Solar Lanterns (SL), Solar Churning Device (for milk skimming purpose) etc. This network was named - Energy Service Network (ESN) and comprises 3 NGOs and 52 dealers and retailers located in two different geographical village clusters (Bikaner and Rishikesh).
- Sale of over 2600 SPV based household energy systems through local NGOs, dealers and retailers.
- Involvement of local partners/ entrepreneurs for need based customisation of renewable energy products.
- Capacity enhancement (training of ESN members and users) for providing efficient 'after sales services'.

The ESN provided the institutional framework for the smooth delivery of renewable energy and energy efficient products to the rural market. ESN also undertook awareness generation programmes, provided after sales services and delivery of spare parts. The ESN had also been linked with innovative credit lending channels comprising financial institutions such as nationalised banks and rural cooperative banks.

The main lesson from the project was that a commercially viable market for RETs existed in the rural areas.

The present REEEP project took the TERI - ICEF initiative forward by developing and consolidating (through up-scaling and diversification) the ESN functioning in Bikaner and its neighbouring districts such as, Suratgarh, Ganganagar and Churu in the state of Rajasthan. The Bikaner ESN was responsible for more than 70% of the sale under the TERI - ICEF project.

Profile of the area of implementation

Bikaner

Implementation of the project started in the rural areas of Bikaner, and was subsequently expanded to neighbouring districts. Bikaner is one of the desert districts situated in the northwest of Rajasthan. It is bound in the north by districts of Sri Ganganagar, on the west by Jaisalmer and Pakistan,

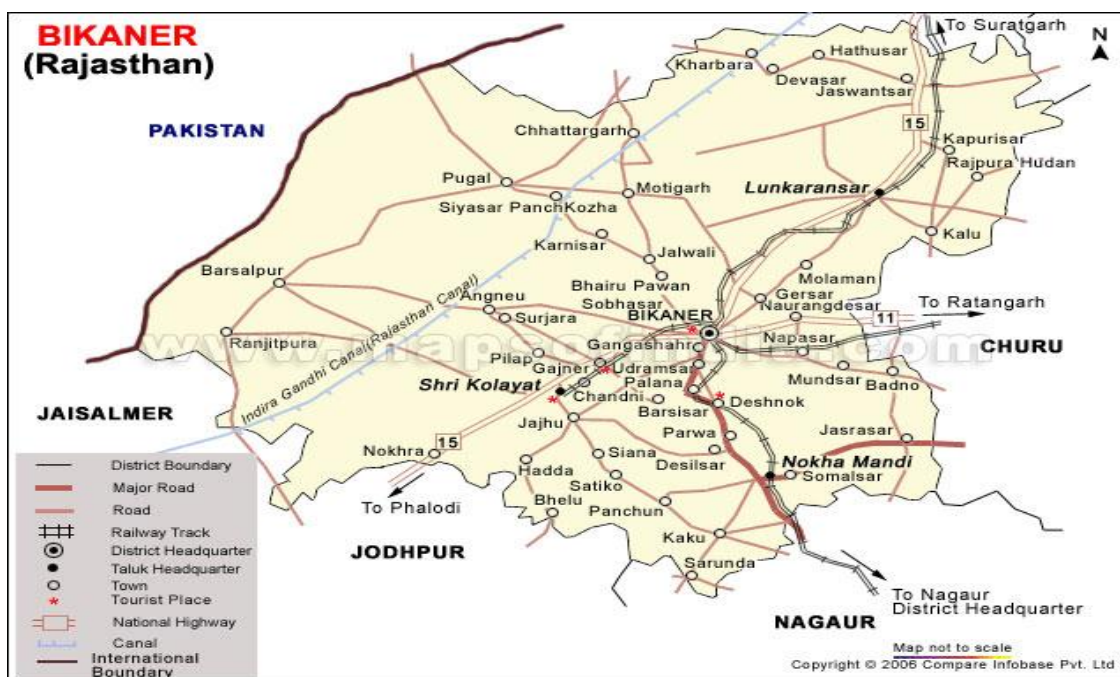


Figure 1 Map of Bikaner

Churu in the east, Nagaur and Jodhpur in the southeast (please refer to map of Bikaner, in (fig-1). Maximum temperature goes up to 48°C and minimum up to 1° C. The weather condition in the region is extreme with temperatures soaring in summers and dipping to 1°C in winters.

Total population is 16,73,562 and density of population is 62. Literacy rate is 57.54 percentages. Working population is 35.84 percentages. Capacity of grid supply in the district is 62 MW.

Status of electrification of Bikaner

The capacity of existing Grid sub-stations in Bikaner district is 62.0 MVA. Villages in the desert areas of Bikaner are widely spread. Cost of connecting the villages with grid supply is very high. Many villages near the border cannot be connected through

grid, as there is a government policy for border areas. As a result many of the villages are un-electrifiable. One of the best options is to connect these villages is with decentralised solar systems.

Income sources

The main source of income in the rural areas is agriculture, which is uncertain for want of rain. However, the condition has improved after the construction of India Gandhi Canal. It is currently a good source for drinking and irrigation. But access to water is limited to small parts of Bikaner. Not surprisingly then agriculture in the area is still largely rain fed.

Farmers cultivate two crops, first in the month of October and second in the month of May. The market for solar systems is at the peak during this period as farmers have sufficient purchasing power.

Chapter 3 Methodology

Implementation framework

An Energy Service Network was developed in the project incorporating local NGOs, dealers, retailers, manufacturers, suppliers, SHGs, Cooperatives, and Banks etc. The household lighting packages, and appliances for other energy services such as entertainment were sold through local enterprises under the brand name of 'Uttam Urja'. All the systems were assembled locally at Bikaner, which reduced the cost of the systems considerably. Furthermore, local assembly reduced the delivery time and also promoted efficient after sale service. Supply chain was streamlined which established effective procurement system from the national level manufacturers and also from local vendors. For delivery of products in the villages, the network consisting of dealer, retailer, NGOs, SHGs etc. was functional.

The project promoted individual and community ownership/management of energy services, technology transfer and capacity building of local entrepreneur and institutions, and improved access to credit. Directed at establishing a commercial approach towards dissemination of RETs, this was relevant for provisioning of energy efficient services.

Profile of the stakeholders and their role

TERI

The Energy and Resources Institute is an independent, non-government organisation. It is deeply committed to every aspect of sustainable development. From providing environment friendly solutions to rural energy problems to helping shape the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry, the emphasis has always been on finding innovative solutions to make the world a better place to live in. However, while Teri's vision is global, its roots are firmly entrenched in Indian soil. All activities in TERI move from formulating local- and national-level strategies to suggesting global solutions to critical energy and environment-related issues.

TERI was the implementing agency in the project. TERI's main role was to formulate strategies for implementation. Activities undertaken for implementation of the project are: marketing and sale, capacity building, institutional arrangements and awareness generation and promotion. And also developing marketing channel in one of the remotest areas in India, product development customised as per the local needs, entrepreneurship development along with reporting and monitoring of the project activities constituted the main activities for the project implementation.

REEEP

The Renewable Energy and Energy Efficiency Partnership (REEEP) is an active, global public-private partnership that structures policy and regulatory initiatives for clean energy, and facilitates financing for energy projects.

Backed by more than 200 national governments, businesses, development banks and NGOs, REEEP is uniquely placed to contribute to international, national and regional policy dialogues. Its aim is to accelerate the integration of renewable into the energy mix and to advocate energy efficiency as a path to improved energy security and reduced carbon emissions, ensuring socio-economic benefits.

With a network of 8 regional secretariats and more than 3,500 members, REEEP has the ability to affect change worldwide. The partnership has funded more than 50 high quality projects in 44 countries that address market barriers to clean energy in the developing world and economies in transition. These projects are beginning to deliver new business models, policy recommendations, risk mitigation instruments, handbooks and databases.

The partnership's goals are to:

- Reduce greenhouse gas emissions
- Deliver social improvements to developing countries and countries in transition, by improving the access to reliable clean energy services, and by making RETs more affordable
- Bring economic benefits to nations that use energy in a more efficient way and increase the share of indigenous renewable resources within their energy mix.
- REEEP was conceived at the Johannesburg World Summit on Sustainable Development in August 2002 and was developed via an intensive consultation process in

2003 covering a wide range of stakeholders at the national and regional levels. In June 2004, the REEEP was formally established as a legal entity in Austria with the status of an International NGO.

The partnership is funded by a number of governments including: Australia, Austria, Canada, Germany, Ireland, Italy, Spain, The Netherlands, New Zealand, The United Kingdom, The United States and the European Commission.

REEEP's regional secretariats provide access to best practice in policy and finance to promote renewable energy and energy efficiency. REEEP's International Secretariat engages political, financial and business support to reduce the risk inherent in implementing new policy and financing initiatives.

Shanti Maitri Mission

Shanti Maitri Mission is a non-governmental organization operating in Puggal block of Bikaner. It was established in the year 1993. The organization undertakes activities related to Panchayati Raj Institutions, environmental issues, livelihood, water related issues etc. Shanti Maitri Mission was a partner with TERI for the project. Shanti Maitri Mission had developed a network of around 64 SHGs. These SHGs worked as entrepreneurs for *Uttam Urja* in puggal block of Bikaner. Although the sale by the NGO was not significant, they played a very important role in the after-sale service, better participation of women in the project etc. Furthermore, Shanti Maitri Mission undertook activities related to promotion and capacity building. The organization, over the years, developed a good rapport with the local government offices that further helped in the implementation of the project.

Manav Sewa Ashram

Manav Sewa Ashram (MSA), an NGO based at Chhatargarh, Bikaner was established with the support of Khadi institutions in the year 1972. Manav Sewa Ashram worked as partner local NGO right from start of *Uttam Urja*. The project established a strong market network in Chhatargarh because of the support of the network of MSA in Chhatargarh. MSA activities were based at Chhatargarh block of Bikaner. *Uttam Urja* had undertaken activities related to sale, capacity building, promotion, and institutional arrangements in collaboration with MSA at Chhatargarh.

Uttam Urja Dealer

The dealers were an important component of the market delivery channels established by Uttam Urja. They were based primarily in the block markets of district. They delivered the products in the remotest of the villages and also worked as a centre for providing after sale services. Under Uttam Urja (REEEP project) network, 24 dealers were developed. In a particular area, Uttam Urja dealers were also representatives of Uttam Urja. They helped in the implementation of project related activities such as training programmes, promotion, institutional arrangements and getting feedback from the customers.

Uttam Urja Technical Persons

Uttam Urja technical persons provided after sale services to villagers and undertook assembling of the Uttam Urja systems. Technical persons were a very important part of the Uttam Urja network. Before UttamUrja there was no solution even for a small problem in the system. Customer had to go all the way to the block market and even at times go to the nearest town. Today there are many solar shops in the block market and in the town with facilities of after sales service. They have employed technical persons developed by the training programmes conducted under Uttam Urja.

Uttam Urja Suppliers/ Vendors

Under Uttam Urja a network of suppliers/ vendors who supplied products and components to its assembling centre was developed. They got technical specifications from Uttam Urja technical team and developed products based on those specifications. This process helped to bring down the cost of the systems to the extent of 45% and also improved the quality. This paved the way for adding to the brand value of Uttam Urja. These suppliers/vendors were based locally as well as in Delhi, Bangalore, Hyderabad etc.

Chapter 4 Market Development

a. Brief Overview of the project activities

The project activities undertaken in the project were as under:

- Expansion of operations to cover the states: Gujarat, Punjab, Bihar and UP.
- Appointment of new dealers/sub dealers at the sub divisions, blocks and the villages in the selected areas.
- Development of new products based on local needs such as Light Emitting Diodes (LED) based lighting devices; Solar Photovoltaic (SPV) based drinking water schemes and energy efficient DG (Diesel Generation) sets for irrigation.
- Identification of market segments for energy efficient and renewable technologies, and creation of marketing channels and sales teams for catering to their needs.
- Identification of the entrepreneurs ready for investment in the process of procurement, designing and manufacturing of the components.
- Networking with financial institutions for incubating above said enterprises.
- To get the design of the components, manufacture and procurement, especially CCU and associated electronics, from these enterprises.
- To design quality standards for products, components and processes.
- Quality certification for products marketed under Uttam Urja (the brand created under the TERI-ICEF project)
- Implementation of the quality control measures and adoption of processes through which defects were identified, and eliminated.
- Designing and adoption of risk sharing measures like mandatory inventory carrying levels for each member of the ESN and risk mitigation through higher margins for slow moving products.
- Implementation of the capacity building programs for the stakeholders in the project.
- Research, design, and launch of promotional campaigns and an umbrella branding exercise to enhance out-reach of Uttam Urja.
- Carry forward the activities in the project by the dealers, selected and groomed for this purpose.

Uttam Urja Products

Commercialisation of all kinds of renewable energy systems including photovoltaic, solar thermal, biogas plants, improved chullahs and solar pumps was undertaken. Other products, except solar photovoltaics, were introduced in the field at a later stage in the project. However, due to adverse geographical conditions the implementation of improved gas chulhas, biogas plants did not succeed.

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At the time of completion of the ICEF project, a wide range of products were available for marketing. Yet it was felt that product development should be an on going process in the project. These products were unique because of the following aspects:

- Need based
- Developed based on feedback received from the field - dealers, customers, retailers, technicians etc.
- Cost reduction by the process of customisation
- Quality and reliable products
- Assurance of 'after sale' service
- Technologies suiting tough geographical/climatic conditions e.g. high temperature
- Source for income generation for local suppliers/vendors
- Also, assisted in brand building of Uttam Urja

In the beginning of the project, a total of 24 products/components were available; a list in this regard is as under.

Table 1 Products under Uttam Urja

SN	Product
1	UUDLS 30W
2	UUDLS 35W
3	UUDLS 50W
4	Panel 2.5W
5	Panel 10W
6	Panel 8W
7	Panel 5w
8	Panel 3W
9	Battery 4Ah
10	Battery 7.2 Ah
11	Battery 40Ah
12	Battery 80 Ah
13	Battery 20Ah
14	CCU 10 Amp
15	CCU 4Amp
16	Luminary
17	Lantern Lilly
18	Uttam Solar Lantern (three types)
19	Battery Box 40Ah
20	Battery Box 40Ah
21	Battery Box 80Ah
22	DLS 25W w/o Panel & Luminary
23	DLS 50 W w/o Panel & Luminary
24	Water Heater

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Before Uttam Urja, the customers had to necessarily purchase the subsidized product (DLS 35W) supplied in the area through government channels. Uttam Urja changed the face of the market in the project area.

In the following table a SWOT analysis of products and services is given

SWOT analysis of Uttam Urja products

Strength <ul style="list-style-type: none">▪ Backing of promotion▪ Standard product▪ Rich product portfolio▪ After sales services▪ Free maintenance facilities▪ Credit and instalment facility▪ Specific to the local needs	Weakness <ul style="list-style-type: none">▪ Price of the product is high▪ High investment in the beginning▪ Tough to access the customers▪ Not a strong delivery mechanism at
Opportunity <ul style="list-style-type: none">▪ Un-electrified areas▪ Limited coverage by government▪ No proper service is provided to the customer.▪ Lack of credit or instalment mechanism in the market	Threat <ul style="list-style-type: none">▪ Subsidy market▪ Price sensitive market▪ Cheap products in the market▪ IREDA's rules and regulation will affect the price in the future
<p>In the above table it is clear that certain customer-oriented steps need to be taken. Some possible steps are:</p> <ol style="list-style-type: none">1. Different mode of payment e.g. credit or instalment basis to offset the high initial investment.2. Proper after-sales service is needed in the market to assure the customers that "Uttam Urja" is going to be in the market forever.	

Customisation and innovation of new products

Project implementation team and other stakeholders of the project such as dealer, retailers, technicians etc. were involved in the process of product development.

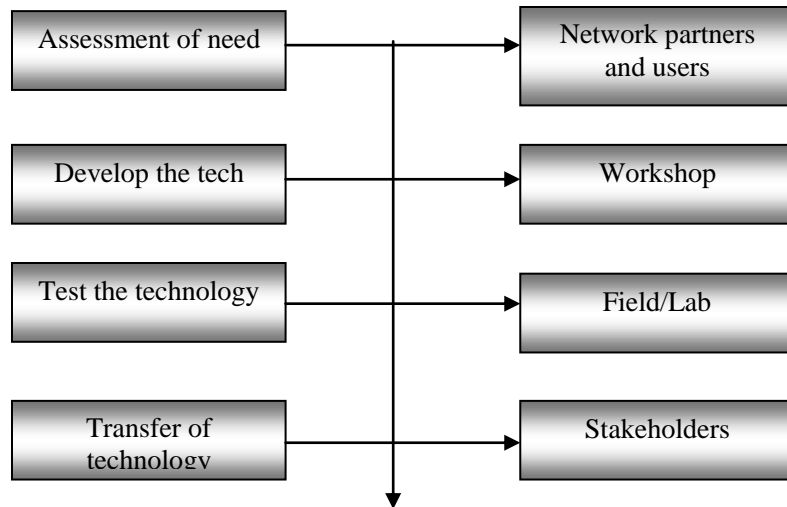


Figure 2 Innovation process

The project partners - dealers, NGOs, technicians etc initially identified the needs of people, and then the local vendors were assigned the job of manufacturing. They developed different components such as battery box, battery, electronics, mounting structure, cable etc. going through above process. (For details on the products developed under the project please see annexure-1).

LED based products such as torch, lantern, DLS, garden light and street light were also developed by the innovative process discussed above. These products were useful both for the rural and the urban area. LED based solar lantern was available at a cost less than the one based on CFL. It had also got better shelf-life. This product was also used as emergency light in the urban areas. So the product had good market potential.

These LED based products were significant to scale up sales under the project, which benefited all the stakeholders of the project. Moreover, LED products were developed targeting all the segments of the customers from low income to high-income group.

Simultaneously products like garden light, LED series light, LED emergency light, LED torch were catering to the need of urban customers.

Other important products developed by Uttam Urja team were Solar Charka and Milk Testing Centre. Solar Charka was newly

developed product of Uttam Urja. It was basically a spinning machine (charkha), which runs with solar power. For solar charkha Uttam Urja team got an order of more than thousand pieces from Uttaranchal Renewable Energy Development Agency (UREDA). However this order would be supplied in several phases. In the first phase, Uttam Urja team got an order of Rs.12 lakh. After installation of these systems successfully, UREDA was going to place another order, which would be of bigger quantity.

Some of the products were developed for the purpose of institutional sale such as Solar Milk Test Machine and Solar charkha. (For details on solar milk testing machine please see annexure-4)

By above additions, Uttam Urja Product Portfolio has become quite big and rich. Altogether there were 24 products in this portfolio; following is the details on this.

Table 2 Customised and innovated products developed under the project

SN	Product
1	LED based DLS (one light)
2	LED based DLS (two light)
3	LED based DLS (four light)
4	LED Garden light
5	LED Torch (3 model)
6	LED Street Light
7	LED Solar lantern (three types)
8	LED Solar emergency light
9	Solar Charkha
10	Inverter based LED system
11	Inverter cum Solar System
12	Salaried Automatic Milk Collection Station

Sale of Uttam Urja Products

Sale is one of the important criteria to decide success or failure of marketing related activity.

Uttam Urja had already got a good product portfolio. These products were classified under different income groups and their compatibility was determined after segmenting the customer base. Uttam Urja had got a product portfolio containing twenty-four different types of products. Prices of the products were quite important to decide market pull. Apart from DLS all other products were selling with margin and covering overheads. A process of cost reduction had already been started with having

own assembling facility in the project. So a better price could also be offered in near future to the customer so more sale could also be expected.

Segmenting customer base and classifying the products

Customer population in the area of intervention could be segmented based on income level of the people. Best criteria to decide income level was land holding size. There could be three categories of the households based on their income level such as High, Middle and Low-income levels. One product will fall in a particular segment based on its price and utility, however there would definitely be some overlapping features since many of the systems serve the common purpose. Details on classification of the products in to different segments of the user groups are as follows

Table 3 Classification of the product portfolio

Segment based on income level	Products
High Income Group	UDLS- 50Wp, UDLS-30Wp, Kissan Torch, Madhai, DC Fan, Luminary Middle-income group:
Middle Income Group	UDLS-30W, UDLS-15W, UDLS-20W, Kissan Torch, Panels (10W, 5W, 2.5W), Solar Lantern (small)
Low Income Group	Kissan Torch, Panels (10W, 5W, 2.5W), Solar Lantern (small)

After sales service

Solar photovoltaic systems needed a good service. It was difficult for the customers to handle electronics parts of the system. After sales, service was going to be the spine of the whole project, since this was one of the weapons to be used against subsidy. In order to provide a good after sales service the project adopted the following tools.

- Warranty on the product for one year
- Setting up of the service stations in the markets
- Training of radio and TV mechanics and electricians
- Three, free services to be provided by the project team within six months of the purchase

Warranty for one year from the date of purchase was provided on the systems. Apart from the dealers, TERI project team also provided three free 'after sales services' for one year from the date of purchase of the products.

The project also established service stations in the market to provide after sales service. These service stations had signage of the project name (Uttam Urja), to popularise the project and to make the customer aware of the service station. It had trained local technicians - radio & TV mechanics, electricians and the personnel of NGOs who provided service to the customers.

Market Delivery Channels

Placement of Uttam Urja products in the villages was very difficult due to the remoteness of the villages. Market delivery centres were developed in the block markets. Uttam Urja dealers selected by 'project implementation team' managed these marketing centres. These dealers worked as permanent channels to deliver the stock to the customers in the villages. They also provided after sale service to the customers and got feedback from the customers, based at the grass root. Dealers of Uttam Urja also helped undertaking activities like training programmes, promotional activities, finance the systems etc.

Retailers' were the delivery channels working for the dealer. A dealer set his own condition with the retailers as far as share of profit margin and cost was concerned.

Following is the list-containing name of the dealers with their date of joining. These dealers were functional in the beginning of the project.

Table 4 List of Uttam Urja dealers

UTTAM URJA BIKANER			
Dealer Network			
SL	Dealer	Address	Date of joining
1	Akash Ganga	Baja, Bikaner	2.9.02
2	Philips Radio	Khajuwala	15.5.2000
3	Shankhala	Nagaur	4.6.02
4	UU Showroom	Bikaner	21.7.02
5	Badu Solar	Chatargarh	28.3.02
6	Karni watch	Bajju, Bikaner	4.7.02
7	Tapadiya Solar	Nokha	28.12.03
8	Sharma Br.	Chatargarh	12.3.02
9	Subhas	Pilibhanga	13.12.03
10	Aneja	Bikaner	15.5.02
11	Usha	Bikaner	12.4.02
12	Khadi Mandir	Bikaner	22.5.02
13	Vishkarma	Chhtargarh	12.1.02
14	Hanuman	Lunkansar	2.2.03
15	Pramod Sharma	Sikar	2.12.02
16	V&J	Garsisar	3.2.02
17	Suresh Sharma	Salasar	10.5.02
18	Akash Radio	Mohan Garh	21.6.02
19	Gurunanak Solar	Rawala	12.1.03
20	Neha Enterprises	Pokharan	7.9.03
21	Pappu Radio	Bhikampur	8.8.03
22	Rajasthan Solar	Lunkaransar	5.5.03
23	Sunil Radio	Anupgarh	17.8.03
24	Alka Electronics	Ganganagar	18.10.03
25	J K enterprises	Ramgarh	4.9.03

REEEP Uttam Urja project continued for two years. A list of dealers at the time of closure of the project is as follows.

Table 5 List of dealers at the time of closure of the project

SN	Dealers	Address
1	Jaswinder Singh, Gurunank Solar	Rawala
2	Neha enterprises	Pokharan
3	Vishwakarma Electrics	Chatargarh, Bikaner
4	J. K. enterprises	Ramgarh, Jaisalmer
5	Bhawani Solar	Chhapar
6	Khet Singh, Neelam Agency	Jaisalmer

SN	Dealers	Address
7	Chaudhary Electronic	Pokharan
8	M. D. Watch and company	Nohar, Suratgarh
9	Shekhawat electronics	Raisingh Nagar
10	Rajkumar, Solanki Music	Kaichia
11	Kanchan Electronics	Nohar, Gaganagar
12	Sudhir ji, Pinki Electronics	Rajgarj, Jodhpur
13	Pareekh trading company	Sardar Sahar, Churu
14	Hasraj, Garg Radio	Raisingh Nagar
15	Vimal Radio	Ahmedabad
16	Arun Solar	Abohar
17	Singh Enterprises	Chandigarh
18	Biloo Solar	Bhatinda
19	Bhura Surya shakti	Rewari, Haryana
20	Manoj , Shakti Electronics	Patna, Bihar
21	Radheshayam,	Bijnor, Uttar Pradesh

Transportation of the materials

Transportation of the products to the customers ,located in remote villages was very costly and hence it was making the business unviable. To meet the challenges, new ways and means were explored. There were government buses plying to the block market daily. These buses were contacted and terms and conditions were set to carry the solar systems to the villages.

Expansion of operational areas:

The nature of renewable based market is such that it gains better scale by expanding the activities in different geographical areas. Therefore, expansion of the project activities in the new areas was an on going process. This covered states of Rajasthan, Gujarat, Punjab, Uttam Pradesh, Jharkhand and Bihar.

After visiting these areas, eight new dealers were selected. Marketing of Uttam Urja systems started from these dealer points. Capacity building programs, promotional campaigns, and developing systems for after sale service etc. have also been undertaken from these newly selected dealer points.

Franchisee system was also developed for delivery of the products in Patna, Bihar and Ahmedabad, Gujarat. Under the franchisee system, dealers were selling Uttam Urja products in new areas under set terms and conditions of Uttam Urja. Uttam Urja supported the dealers by building their capacities, promoting the

products, services and giving them the permission to use the Uttam Urja brand.

Supply of the systems to the government agencies:

State government nodal agencies were main buyers of the solar systems in Indian market. Uttam Urja had been getting the orders from these agencies. Uttaranchal Renewable Energy Development Agency (UREDA) had given order of value 12-lakh rupees to supply Solar Charkha *. Uttam Urja was also going to bid for the tenders to supply other systems such as solar lantern, DLS and LED based systems invited from nodal agencies in the states: Himachal Pradesh, Jharkhand and Rajasthan.

Vendor Network

Uttam Urja project had developed a strong vendor network in Bikaner. It had followed outsourcing model and had not invested anything in production infrastructure. In the last three years, there had been association of vendors for different components of the solar systems. A list in these regards is given below in the table-5.

Uttam Urja sourced critical components from its vendors in New Delhi, Dehradun, Hyderabad and Bikaner. For non-critical components, it had developed vendors from its nearby areas only in Bikaner. Proximity to supply network had helped the project to reduce its overheads and hence, cost of the systems.

Uttam Urja had more than one supplier for most of the components, which had helped it to increase its bargaining power and reduce dependence on given vendors.

In some cases, Uttam Urja had developed designs for its new products and vendors had invested in their infrastructure to produce it. This shows comfort level developed between Uttam Urja and its vendor network.

* Solar Charkha was newly developed product by Uttam Urja. It was basically a spinning machine (charkha), which runs with solar power.

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Table 6 Lists of the vendors of Uttam Urja

SL	Vender Name	Place	Items Supplies
1	Microsol Power Pvt Ltd	Plot No 19, IDA Balanagar	Solar Module
2	Swadesh Industries	C-II/ 73-74, New Kondli, Delhi	Electronics
3	Arsh Electronics	224, Surya Niketan, Delhi	Electronics
4	Balaji Trading	Kankhal, Haridwar	Cable
5	Surbhi Trading	Ranipokhari, Dehradun	Cable
6	Swastik Batteries	Bikaner	Batteries
7	Abdul Sattar	Bikaner	Mechanical Kit
8	Linear Acoustics	B-167, Freedom fighters Enclave, New Delhi	Batteries
9	RES	Hyderabad	Solar panels
10	Ritika Systems Pvt, Ltd	C-22/18, sector 37, Noida	Lantern

Chapter 5 Promotional Activities

In the REEEP project, promotional activities were undertaken. These activities were: publication, making wall paintings, banners, posters, handbills, music show, solar rally, nukkad natak. Promotional activities were used in most of the areas where project was implemented such as Bikaner, Barmer, Jaisalmer, Nagaur, Anupgarh, Suratgarh, Jodhpur, Amritsar Ahmedabad, Patna etc.

The project published a user manual detailing the use and maintenance of the various renewable energy and energy efficient products marketed in the ESN. Moreover, training manuals for the purpose of imparting training to the technicians, workforce of the NGOs, and entrepreneurs was also published. The project experience was also published in international journal (nos.1).

Other innovative promotional tools used in the project are: music show, nukkar natak, and solar rally. Details on the promotional tools used in the project are as under in the table-6.

Table 7 Details of the promotional tools

SN	Promotional tools	Number	Area Covered
1	Wall paintings	75	Nagaur, Barmer, Jodhpur, Jaisalmer, Bikaner, Sanchor, Ahmedabad, Patna, Abohar, Bhatinda
2	Banner	270	Nagaur, Barmer, Jodhpur, Jaisalmer, Bikaner, Sanchor, Ahmedabad, Patna, Abohar, Bhatinda
3	Posters	12000	Nagaur, Barmer, Jodhpur, Jaisalmer, Bikaner, Sanchor, Ahmedabad, Patna, Abohar, Bhatinda
4	Handbill	20000	Nagaur, Barmer, Jodhpur, Jaisalmer, Bikaner, Sanchor, Ahmedabad, Patna, Abohar, Bhatinda
5	Iron Boards	50	Nagaur, Bikaner, Jodhpur, Barmer, Jaisalmer
6	Music Show	35	Bikaner, Suratgarh, Barmer, Jaisalmer, anupgarh,
7	Solar Rally	15	Bikaner, Barmer, Jodhpur, Nagaur
8	Nukkar Natak	10	Bikaner, Barmer, Jodhpur, Jaisalmer
9	Newspaper	10	Bikaner, Barmer, Jodhpur

Nukkar Natak.

Nukkad Natak along with traditional programmes proved very effective medium as promotional tools. Local group named Gaavaniyar (a forum of folk artists) performed this program many times in the project. The group first worked on the script together with project implementation team. The script included messages on the quality energy systems, energy efficient systems, after sale services etc. All the messages disseminated in the Nukkad natak were in the form of entertainment., for which people had very high retention capacity. The tool was used for the mass audience and was performed in the market area, where people from the villages gather for their regular needs.

Music Show

This was another form of entertainment through which messages related to the project were communicated to the target audience in the form of entertainment. But difference here was that the program was full of songs. There were different types of songs such as film songs, folk songs, patriot songs and songs as demanded by the audiences. Hence messages disseminated by this medium were very effective.

Brand: TERI Uttam Urja

To differentiate services that the customers were availing under the project, it was necessary to give the project a specific name with which all the positive attributes could be associated i.e. branding. All RETs needed a good amount of maintenance work, government agencies had not been able to provide quality after-sales service to customers; hence, it was seen as a major opportunity for the project to compete with the subsidised systems.

A brand name ‘TERI Uttam Urja’ was developed as an umbrella brand under which all the products and services were delivered. To convince customers to buy the more expensive product, its advantages need to be projected through long-term sustained branding, synonymous with quality, reliability, and customer satisfaction. The name ‘Uttam Urja’ was chosen in May 2002. The sun and an illuminated house comprise the logo. The punch line is Ek rishta vishwas ka (‘A relationship based on trust’).



The brand was used in all promotional activities to familiarise people about the technology and to facilitate much needed differentiation. Differentiation helped in creating a market scenario where customers get satisfaction from the use of products and the seller makes a profit. The branding has won a place in the heart of the consumers who identified “TERI Uttam Urja” as a quality product and service provider.

Branding is unheard of in the solar photovoltaic market where the players still eye the short-term benefits. TERI's initiatives created a sustainable market, branding reaffirmed the intentions of TERI to be associated with it over the long-term as a short-term player will not find it prudent enough to invest money and energy in a brand building exercise.

Chapter 6 Capacity building programs

Training of various stakeholders in the project was one of the main focus of the project. This was extremely essential for long-term sustainability of the project. In this project, training at various levels was conducted. These were: training for the technical persons, training for the sale personal, training for development of entrepreneurial skills and training for the users. Training was an integral part of the project, essential to build an infrastructure for development of a market for SPV. Which in turn expedited the process of creating a commercially viable entity.

Training for the technical persons

For the development of a holistic and sustainable market in the project area, it was essential to provide after sales service for the solar energy products. When Uttam Urja project started in Bikaner there was hardly any facility of after sale service, hence in case of any small problem in the system customer had no one to consult. Similarly lack of knowledge on installation of the systems and the technical know-how of the systems abstained the customers from purchasing the systems.

Therefore technical training to develop technical personnel, who would provide solution for problems related to maintenance of the systems, was a must and it was taken as a priority under the project. After conducting regular training programs in the project, it was possible to generate a pool of technical personnel who would provide regular after sale service to the customers.

A number of training programs were conducted for development of the technical knowledge of technical persons who installed the systems and provided regular repair and maintenance of the same. Conducting these training programs had developed a technical bank of about 60 personnel who were committed for the customer care. Training manuals were developed for the technical persons. These were also quite useful to provide after sale service.

In case, the product was under guarantee and/or warrantee, the technicians were paid from the project otherwise they would charge reasonably from the customers. This created a source of income generation for them. They were also working on salary basis under Uttam Urja dealers. At dealer points, they were also

undertaking assembling work. The project had started a process of developing technical persons, which, with the gathered momentum would not stop even after withdrawal of TERI. It would continue, as trained technical persons would pass on the training to other personnel.

Training for salesmen

Selling newly developed products required the skills of a salesman. Therefore Uttam Urja had conducted training for salesmen. Around 35 training programs were conducted under the project. This had developed more than 50 salesman who were either working with dealers or had started their own business.

Training for entrepreneurship

At the time of withdrawal of the project 20 dealers were working under the dealer- retailers network developed by TERI Uttam Urja. These dealers were imparted training on undertaking renewable energy technologies as a regular business. Presently they are selling the products and getting a sustainable income out of the same. These dealers were linked with national level manufacturers at Delhi, Bangalore etc. It was from these places that they purchased the products and sold it to the end users after retaining certain margin money as profit. During the project period of more than two years, more than 50 dealers came into association with Uttam Urja. Many of them left the association and started independently when they established linkages with manufacturers, vendors and customers. A sustainable structure was already in place in which customers were getting the products and services from these trained entrepreneurs.

The emphasis of the project was on building capacities of the ESN members so that the project could be sustainable. The focus here was more on the commercial aspects of the business (market development). The different types of training envisaged were:

1. *Dealers and sub dealers*: training related to sales management, promotion related activities, financial management, after sales service, communication and market development.
2. *ESN management*: training in financial management (planning and management control), management information systems (MIS), brand development, product development and management, logistics and supply chain management, financial reporting, market development,

promotion management and human resource management.

3. *Manufacturers and assembly units*: training in quality control, systems management, product development, inventory management, costing and financial reporting.
4. *Brand reinforcement*: innovative marketing of the renewable energy and energy efficiency products and brand creation was one of the main contributing factors to the project's achievements so far. The project further established the brand through umbrella branding and aggressive promotion in an effort to enhance its visibility.

Training of people was conducted in the project regularly, targeting the people belonging to different groups.

Details of the training conducted during the project period given below in the table-8.

Table 8 Details on training programmes conducted in the project

Training	Number	Output
Technical training	66	Workforce of dealers/ NGOs/ Vendors, local technicians
Entrepreneurship development	44	Trained Dealers and NGO persons
Salesmanship and marketing of RETs	68	Trained Dealers and NGO persons
Technical training to women SHGs	45	SHGs formed by the NGOs
Saving and entrepreneurship development among SHGs	30	SHGs formed by the NGOs
User's training	715	Rural people including children and women

Following table is on details on the type of trainings and their contents.

Table 9 Details on type of training conducted in the project

Type of training	Duration	Course content
Technical training	2 days of first training and 1st day refresher	Installation, repair and maintenance, technical details of the components
Entrepreneurs hip development	1 day	Communication skills, sales speech, product display and demonstration, importance of after sales service, financial issues like loaning etc.
Salesmanship and marketing of RETs	1day	Communication skill, technical details about the product and services, follow-up techniques with the use of MIS, ways of conduction different promotion tools
Technical training to women SHGs	2 days of first round training and 1 day refresher	Installation, repair and maintenance, technical details of the components
Saving and entrepreneurs hip development among SHGs	2 days of first round training and 1 day refresher	Communication skills, sales speech, product display and demonstration, importance of after sales service, financial issues like loaning, thrift and saving etc.
User's training	3-4 hrs training during installation	Petty repair work, Dos and Don'ts, Installation

The training conducted at the field that contained both the classroom and on the spot schedule helped in contributing the following benefits:

- A trained technical team that could provide the required services to the customers efficiently
- A strong chain of service provider in the field that facilitated the customers to avail the benefits of repair and maintenance at their thresholds.

- The sales agent including the ESU workforce learnt the communication skills that helped in persuading the potential customers to purchase the technologies
- Users could take care of the petty Repair and Maintenance (R&M) on their own that saved their time and money in running to the dealers for servicing
- The training programs helped in offering opportunities for income generation to the trained technicians undertaking R&M work.

Quality control

To ensure quality technology dissemination following quality measures were adopted under the project:

- Performance test of the prototypes before finalizing the vendors
- Sample testing of the supplied materials at the project workshop
- Checking of the functionality of the systems before sending off to the dealers
- Measures when the replacement rate crosses 15% of the components supplied

Implementation of cost cutting measures

The TERI-ICEF project implemented cost cutting measures like local procurement of components and assembly through entrepreneurship development and capacity building. The project, continued on the same lines, encouraged local assembly and procurement for new products. The project, identified entrepreneurs, facilitated investments in component design and manufacturing, and facilitates access to loans from financial institutions.

Facilitate local procurement of components

In the past, a number of components like the charge controller unit (CCU), other electronic accessories and solar modules were being procured from Delhi and Hyderabad, which added to the cost of the products. The proposed project facilitated the local procurement of the CCU and other electronic accessories through entrepreneurship development and local capacity building in order to reduce costs.

Encourage quality improvements in existing procurement and assembly operations:

A quality standard was laid down for products, components and processes. Quality certification of all the above were undertaken at regular intervals. Quality control measures were enhanced at the manufacturing and assembling levels, wherein defects were identified at source and eliminated. To enhance quality levels, the project was also engaged in partnerships with organizations like the Solar Energy Centre (SEC) of the Ministry of Non Conventional Energy Sources (MNES), and battery manufacturers like EXIDE and the Indian Institute of Technology, Delhi (for CCUs).

Designing risk-sharing mechanisms

The project also put into place risk sharing measures. For example, the setting up of and maintaining a minimum stock of products for each member of the ESN was made mandatory. Other measures include putting high margins on slow moving products like the 50Wp Solar Domestic Lighting systems.

Putting in place monitoring mechanisms:

The project was continuously assessed and monitored by means of a detailed MIS that had already been developed. This included a comprehensive financial package that had been developed in the TALLY software to maintain a profit and loss account as well as details of flow of stocks and assets in the project.

Subsidy and Market development

Increase in subsidy by the government - this risk was managed through product customisation and providing quality services. The current government program offered subsidy on fixed product design. Further, many field based studies had shown that due to lack of after sales services many photovoltaic products lied in a state of disuse. The project with its much wider menu of options safeguarded against these drawbacks. Furthermore, the fact that government subsidy limited the number of products that could be provided in a particular financial year; access was a major issue. The project offered an advantage since the products were available throughout the year.

- Development of annual business plan with targets for sales and cost cutting. Monitoring of the same through a comprehensive MIS.
- Development of indicators for each activity and monitoring these on regular basis

- Development of MIS, financial reporting packages to provide information regarding the progress of the project.
- Central sales and marketing reports on a monthly, quarterly and annual basis.
- Formation of steering committee to review the project on a six monthly basis
- Field visits by external consultants, funders etc.

The project was evaluated by a steering committee on a quarterly basis. In this context, it was important to mention that the earlier steering committee (established under the TERI-ICEF project) was revived to provide macro-level direction and guidance to the project. The Steering Committee comprised of representatives from government agencies like the Head of Indian Renewable Energy Development Agency (IREDA), the CEO of Solar Electricity Light Company (SELCO), representatives from financial institutions like Indian Development Finance Corporation (IDFC), representatives from National Manufacturers (Central Electronics Limited, Renewable Energy Systems, Tata BP Solar, etc).

- Concurrent and mid-term review of the project by external evaluator
- Project evaluation at the end of the project by FCO and external evaluator
- Renewable energy technologies were pollution free and thus environment friendly. When a photovoltaic-based lighting device replaces a kerosene-based lantern it makes the environment free of toxic smoke consequently leading to hygienic and healthy living conditions. Further, the project also had carbon reduction benefits. It had been estimated that about 42 kg of carbon was saved per annum when a kerosene lamp was replaced by a SPV lighting device.

Chapter 7 Impact

The project literally brought light where there was darkness, hope where there was despair, and joy where there was mind-numbing drudgery. And based as it was on solar energy, Uttam Urja ('uttam' is Hindi for the best, and 'urja' is energy) achieved sustainability in economic, environmental, and social terms.

Main achievements of the project:

- Expansion of the project in new areas such as: Gujarat, Bihar, U P, and MP etc.
- Franchisee model developed and franchisees selected in Patna, Bihar and Ahmedabad, Gujarat. Franchisee in Patna also sold the products of worth Rs1.5 lakh.
- New products were developed under the project
 1. LED based products
 2. Solar Charkha
 3. Solar Milk Churning Machine
- Purchase orders from nodal agencies
- Good network with national level manufacturers and local vendors
- Sales Tax registration.
- Bid for Tender for LED based solar lantern
- MIS developed as per suggestion from the auditors
- Documentation of the activities
- Sustainability of the project - after withdrawal of TERI project is being run by selected dealers from Uttam Urja network.

Switching from kerosene to SPV

The impact of switching the source of light from a hurricane lantern, with its pale, sooty flame and acrid smell of kerosene to a solar-powered fluorescent lamp was impossible to capture in words—it had to be experienced first-hand just as the respite offered by a fan in the sweltering, fierce summers of Rajasthan or the security that came of knowledge that bright lights keep animals at bay. More generally, the short-term economic impacts of better-lit homes were of greater productivity and diversification of business; the long-term impacts were of better performance in schools by children, with all its attendant benefits, and improved health. The immediate impact was savings: kerosene had to be bought; sunlight was free.

Income generation

On dealers in solar equipments, the economic impact was more tangible: each of the 56 dealers earned about 2500 rupees a month. Then there were the vendors, 14 of them, who were trained in new solar photovoltaic technologies—the project opened up a new source of livelihood for them.

Addressing social concern

The most visible social impact of the project was again difficult to describe in words but obvious in the beaming faces of the beneficiaries, lit by a newly found sense of self-esteem derived from success in business made possible by improved lighting over longer hours at a fraction of what it would have cost otherwise (even if it had been possible: supply of electricity from a grid is unlikely to materialize in these remote villages). In Bikaner district of Rajasthan, for instance, a few women took up fine embroidery—now possible in the brighter and cleaner light. Uttam Urja also brought the outside world to the villages in the form of television, now that there was power to run the TV sets. And the Internet cannot be far behind.

Benefits to the environment

Impact on the environment was less direct: more than 3600 domestic lighting systems were now in use, which had eliminated the emissions of particulate matter as well as carbon dioxide because the systems had replaced kerosene-burning hurricane lamps.

Service of Energy Service Network (ESN)

The Uttam Urja project had led to the initiation of a process for converting the demand for RETs into a real business opportunity. Under this project TERI was currently working in three districts of India for market based promotion of RETs, with support from the REEEP, New Delhi. The project sites were – Bikaner, Jodhpur, Jaisalmer, Barmer, Anupgarh etc. in the state of Rajasthan. The project was initiated in 2004 and by August 2006 close to 1000 solar systems lanterns, home lighting systems and solar panels were disseminated without taking recourse and at full price. The response to this strategy was favourable, especially in Western Rajasthan. An institutional mechanism was also established at the grassroots for aggressive marketing of RE systems. A formal Energy Service Network-ESN comprising local NGOs, dealers and retailers, battery manufacturers, etc was established, to provide the institutional infrastructure for the smooth functioning of this operation.

Project experience

Market for RETs was commercially viable.

- Setting up local assembly and entrepreneurship based product dissemination could reduce the systems and service costs.
- Customers were willing to purchase at real market price (without subsidy) if the products and services were of high quality.
- Risk assessment and risk cover was very important to carry the business forward. Considering the high subsidy on grid electricity the transaction costs related to dissemination of RETs had to be met to make the business of RETs commercially viable. Hence, instead of upfront subsidy to the customers effort was on facilitating entrepreneurial ventures and provision of soft credit to the customers.
- Prices of the product and spares were well published to prevent the customers from being charged heavily and thus wrongly, especially by other sellers in the market.
- Decentralized and easily accessible financial arrangement could boost the sale. And this might be done either through nationalized or rural banks or through NBFCs (Non Banking Finance Companies) or SHGs (Self Help Groups).
- In a number of cases the sub-optimal performance of the system was largely due to the negligence of the customers (as high as 75%), in form of misuse or wrong connections of wires. Thus capacity building including user training was equally important.
- Brand equity played a major role in rural market and to create a good image it was imperative to provide an effective after sales service.
- Some of the factors that increased the price of the system were- transportation costs; overhead costs of larger manufacturing/assembly units; marketing and promotional costs and unnecessarily large size of the components. In order to reduce the costs of SPV systems and to develop local capacities, it was decided to start assembly of systems at local level. Such assembly workshops were being set up at both places – Bikaner and Rishikesh. Entrepreneurs already involved in similar activity (like radio or electronic repair/maintenance shops, NGO having service workshop, etc.) were identified for this activity. Detailed feedback was obtained from the customers on the operation and functioning of the systems. Once the customer

satisfaction was achieved then the large- scale assembly of units was being undertaken.

To summarise, the main benefits from the project till now could be divided into two groups, economic and non-economic.

Economically there were three beneficiaries. The first is the dealers who had over the last one-year earned a margin of close to 4.25 lakh. The second beneficiary was the customers and the government as the systems sold under the project had an over cost differential of 3 lakh vis-à-vis the unsubsidised products being sold by the government. The third was the retailers and service centres in all the major markets but it was not possible to estimate their exact economic benefits.

The **non-economic advantages** of the project were related to the improved environment, opportunities, quality of life and capacity building and awareness generation. Benefits on a household level include environmental improvements (especially of the home environment where kerosene based devices were the norm in rural area) due to reduction of Indoor Air Pollution. The other main benefit was the extended hours for undertaking income generating as well as other social activities, which used to come to an abrupt end after dark. The awareness regarding the environment and energy among the rural populace also went up and people were more aware. Possibilities for entertainment and time for educating children had increased and enhanced and the people no longer needed to go to the nearest town for charging their batteries.

The capacity building and training, like special training events had improved the ability of the people to take up economic activities. Because of the R&D and customisation, local sourcing of components had increased which in turn had generated employment. At the same time the setting up of the assembly, after sales, technical support and installation, marketing and selling functions in the two project areas had also given a small stimulus to employment generation.

Chapter 8 Way forward with recommendation on long-term strategy for sustaining the project

Creation of an ESN

The Bikaner ESN would be a sustainable energy service network with a dedicated management to carry forward and replicate the initiative. The project “commercialisation of energy efficient and renewable energy technologies in India”. Completed its period of two years from October 2004 to August 2006. The project had a mandate to create a commercially viable market for the solar photovoltaic technologies, by developing an efficient network comprising of dealers, vendors and trained technicians, serving the rural people with need based energy efficient technologies, development of new products and expansion of the market in the new geographical etc. In addition to the above the focus of the project was to foster an entity that would be able to carry forward the initiated activities beyond the project period. Two of the dealers from Uttam Urja network were selected one year before completion of the project to carry forward project activities beyond the project period. This was a process of grooming the entities, which continued for one year. For detailed report on sustainability of the project please refer to Annexure- 2)

Partnership between Uttam Urja and Akshya Urja

Uttam Urja TERI can have strategic partnership with MNES (Ministry of Non-Conventional Energy Sources). The Ministry has been promoting the establishment of ‘Aditya Solar Shops’ in major cities of the country since 1995 with a view to make solar energy products easily available and to provide easy after sales services. During the 9th plan period, shops were established by the State Nodal Agencies/Manufacturer’s Associations and reputed NGOs. During the 10th Plan, private entrepreneurs have also been allowed to establish these shops. Under the present scheme the shops have been renamed as “Akshay Urja Shops” with a view to cover wider sale and service of all renewable energy devices and systems including solar energy products. The network of the shops is to be expanded by encouraging private entrepreneurs and NGOs to set up and operate such shops in all districts of the country.

Uttam Urja TERI project has been successful in developing strong backward and forward linkages and in developing a brand name with high recall value in the rural markets.

The existing dealer network present with Uttam Urja offers such suitable private entrepreneurs that can be added on to the existing network of Akshay Urja shops. Uttam Urja offers a wide product range based on PV technologies. These include *Domestic Lighting Systems, Solar Lanterns* and even customized products such as *Madhani* that is used for churning milk. These products can also be sold from Akshya Urja network. There are also other services such as after sale service, promotion, capacity building etc. Which can be undertaken jointly. This is also keeping in terms with TERI's continued focus on sustainable development.

Strategic partnerships between Uttam Urja and Akshya Urja can exploit emerging synergies to increase the width and depth of dealer networks involved in Uttam Urja.

Concept paper for this partnership has been sent to MNES.
(Please refer annexure-3 for the concept paper)

Annexure 1 Details on different technologies developed under the project.

Name of the Innovation: Uttam Urja . Churning device (*Madhani*)

Rationale

To ease the operation of conventional churning devices and reduce the drudgery of women folk in rural areas.

Year of customisation January 2004

Technical details/Specifications

Solar module	NA
Motor	DC, Double valve bearing machine
Voltage	12V DC
RPM	1400

(Used a motor, which is well synchronized with the system to provide output with any type of solar-based system.)

- Application
- Motive power

The device is used for churning purposes in rural households. This operation was generally done manually in most of the rural households and thus with the intervention of this technology womenfolk in rural India are heaving a sigh of relief because it can be done mechanically now.

This has had a revolutionary effect in the field, as the women now do not need to devote hours to churning. They only need to switch on the device, which can do the operation automatically, and can utilize their time for other activities.

Name of the Innovation: Uttam Urja Lantern - 10 Wp

Rationale

To offer a portable lighting device for the rural masses. Subsidy had been withdrawn from this product category and as a result this lantern was cheaper than the substitute being sold by the state agencies.

Technical details

Solar module	10Wp
Battery	12V 7Ah, SMF lead acid battery
CFL	4 pin 7 W
Body	ABS
PCB	With overcharge/ deep discharge protection
Frame	Roof/pole mounting
Cable	1mm: 10m
Hardware	Nuts and bolts

Application

Used in rural areas where supply of electricity is erratic, for portable lighting purposes at the household level/community centres/clinics and commercial sectors. The lamp provides 5 hrs of lighting.

Name of the Innovation: Uttam Urja Lantern - 5 Wp

Rationale

To tap customers who are willing to pay half the price of the regular lanterns. With this product the project tried to increase the customer base in the category of solar lanterns. This lantern targets the very poor and has a very low price. Profit making product for the network. No competition in this segment.

Year of customisation October 2002

Technical details/Specifications

Solar module	5Wp
Battery	12V 7Ah, SMF lead acid battery
CFL	4 pin 5 W
Body	ABS
PCB	With overcharge deep discharge protection
Frame	Roof/pole mounting
Cable	1mm: 10m
Hardware	Nuts and bolts

Application
Lighting

Used for portable lighting purposes at the household level/community centers/clinics and commercial sectors. The lantern provides 3-4 hrs of lighting.

Results/Impact

The product filled the gap with the provision of providing two hours of lighting at half the price of the 10Wp lantern. This has created a niche market.

Name of the Innovation: Uttam Urja Lantern - 3 Wp

Rationale

The product was developed to cater to that segment of people who want to upgrade from kerosene-based lamps.

This product has been targeted at the very poor and the product has had a very high off take in the market.

Year of customisation January 2003

Technical details/Specifications (Customisation indicated in Italics)

Solar module	3Wp
Battery	6V 45Ah, SMF lead acid battery
CFL	4 pin 3 W
Body	ABS
PCB	With overcharge deep discharge protection
Frame	Roof/pole mounting
Cable	1mm: 10m
Hardware	Nuts and bolts

Application
Lighting

Used for portable lighting purposes at the household level/community centers/ clinics and commercial sectors. The lantern provides 2-3 hrs of lighting.

Results/Impact

Though the initial response of the product was lukewarm as it had some design problem, these were rectified and it was now selling well in the market.

Name of the Innovation: Uttam Urja. Solar Fan

Rationale

To meet the needs for greater air circulation especially in Rajasthan. A source/device to beat the heat was needed especially in the region of Rajasthan and this device fulfilled that need. *Profit making product for the network. No substitute available in the market*

Year of customisation March 2003

Technical details/Specifications (Customisation indicated in Italics)

	Model 1	Model 2	Model 3
Solar module	5Wp	10Wp	With DLS
Motor	DC	DC	DC
RPM	2600	3300	5600
Voltage/current	6VDC/0.53Amp	12VDC/0.5A mp	12VDC/1Amp

Use of new brushless DC motor to improve fan output and reduce battery discharge through better current consumption.

Application

Motive power

Models 1 and 2 are used during daytime only as battery is not provided with the system. In Rajasthan people need the fan only during daytime when it is hot but the same is not required at night as the temperature comes down.

Model 3 can be operated as and when required as it contains the battery that comes with the system.

Name of the Innovation: Uttam Urja. Kissan Torch

Rationale

To offer an alternate technology to the people who generally use general torch run on dry batteries that is very costly and also for those who have to travel long distances to get their batteries recharged. *This is a profit-making venture for the network and has no substitute in the branded market.*

Year of customisation September 2002

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Technical details/Specifications (Customisation indicated in Italics)

Solar module	2.5Wp
Battery	6V 3.5Ah, SMF lead acid battery
Lamp	Bulb 700 mAmp
Body	ABS

CCU functions in such a way as to avoid deep discharge and overcharge. The system is balanced and use of blocking diodes has been made to stop reverse flow of current.

Application Lighting

Mainly used for focus lighting purposes at household level. This is used especially for irrigation purposes in the state of Rajasthan where farmers get water from the canal generally at night. The torch provides 8-10 hrs of lighting.

Name of the Innovation: Uttam Urja. Emergency Light2

Rationale

To cater to the needs of areas that are electrified but face frequent power cuts. Targeted at low-end customers. Customisation includes improved CCU, CFLs & battery for longer life and better performance. Battery and CCU ensure protection against overcharge and deep discharge. Size of CFLs reduced to increase duration of operation. Profit-making product for the network.

Year of customisation January 2004

Technical details/Specifications (Customisation indicated in Italics)

Solar module	NA
Battery	12V 7Ah, Lead acid SMF battery
CFL	4 pin, 7W
Electronics	With overcharge and deep discharge protection
Body	ABS

Application Lighting

Used in rural areas where supply of electricity is erratic, for portable lighting purposes at the household level/community centers/clinics and commercial sectors. The lamp provides 6-8 hours of lighting.

Name of the Innovation: Uttam Urja Domestic Lighting Systems (DLS) - 50W Rationale

The system was developed keeping in mind the requirements of customers living in large houses and requiring more light points than the conventional systems presently available in the market offer. These systems are meant for people who need more light points and are willing to pay a little more.

Year of customisation June 2002

Technical details/Specifications (Customisation indicated in Italics)

Solar module	50Wp (<i>higher capacity module to cater to higher energy needs of high and medium income group rural households</i>)
Battery	12V 80Ah, positive tubular plate lead acid battery (<i>12V 80 Ah battery to prevent deep discharge due to higher capacity vis-à-vis other systems with a 12V 40Ah battery</i>)
CCU	10Amp (<i>only one in the product category to have a meter showing charge status of battery</i>).
Luminary	4 numbers (<i>vis a vis 2 in other products</i>)
CFL	7W (<i>for longer lighting compared to 9W CFLs used in other system</i>)
Frame	Roof/pole mounting
Cable	1mm: 16m, 1.5 mm: 10m
Hardware	Nuts and bolts

Application Lighting

Used for lighting purposes at the household level/community centers/clinics etc. *It provides 4 light points for 5-6 hrs of lighting.*

Entertainment

The system also operates a B&W portable TV for 4-5 hrs, a tape recorder (6V/12V) for 6-8 hrs. It also operates the colour television/DVD player for 1-1.5 hrs that has recently been launched by a few TV manufacturers targeting the rural upper class.

Motive power

Name of the Innovation: Uttam Urja. Domestic Lighting Systems (DLS)-35 W Rationale

This product was developed to meet the lighting demand in rural households while at the same time concentrating on bringing the cost down without providing direct subsidy. *This product shares no common specifications with the system being disseminated*

under subsidy and has been developed based on market feedback.

Year of customisation June 2002

Technical details/Specifications (Customisation indicated in Italics)	
Solar module	35Wp
Battery	12V 40Ah, positive tubular plate lead acid battery
CCU	4 Amp
Luminary	2 nos.
CFL	7W (To increase duration of lighting and provide adequate light compare to 9W ones being provided in other systems)
Frame	Roof/pole mounting
Cable	1mm: 16m, 1.5 mm: 10m
Hardware	Nuts and bolts

Application Lighting

Used for lighting purposes at the household level/community centers/clinics etc. It provides 2 light points for 4-5 hrs of lighting.

Entertainment

The system also operates a B&W portable TV for 2-3 hrs, a tape recorder (6V/12V) for 4-5 hrs.

Motive power

The system operates a DC fan for 2-3 hrs. A *madhani* is also operated in a typical rural household for churning purposes.

Results/Impact

The product is already commercialised and has been sold by a number of network partners in the states of Uttaranchal and Rajasthan.

Name of the Innovation: Uttam Urja Domestic Lighting Systems (DLS)- 15W

Rationale

To cater to the lighting needs of different segments of rural people who cannot pay for 35 Wp or bigger lighting devices. It targets poor people whose needs mainly centre on lighting. This is a small system and has Cols of 5W to increase duration of lighting. This has been a profit-making product for the network.

Year of customisation January 2004

Technical details/Specifications/(customisation indicated in Italics)

Solar module	15Wp
Battery	12V 20Ah, positive tubular plate lead acid battery
CCU	4 Amp
Luminary	2 nos.
CFL	5W (Low capacity CFLs which provide adequate lighting for general household usage.)
Frame	Roof/pole mounting
Cable	1mm: 16m, 1.5 mm: 10m
Hardware	Nuts and bolts

Application
Lighting

Used for lighting purposes at the household level/community centers/clinics etc. It provides 2 light points for 4 hrs of lighting.

Entertainment

The system operates a tape recorder (6V/12V) for 2-4 hrs.

Motive power

The system operates a DC fan for 5-6 hrs. A *madhani* is also operated in a typical rural household for churning purposes.

Results/Impact

This 15Wp system is popular among the rural masses with lesser purchasing power. With this the network is having a range of options now targeting different strata of customers.

ANNEXURE 2 Sustainability of the project: Commercialisation of energy efficient and renewable energy technologies in India

Background

The project “commercialisation of energy efficient and renewable energy technologies in India”. completed its period of two years from October 2004 to August 2006. The project had a mandate to create a commercially viable market for the solar photovoltaic technologies, by developing an efficient network comprising of dealers, vendors and trained technicians, serving the rural people with need based energy efficient technologies, development of new products and expansion of the market in the new geographical etc. In addition to the above the focus of the project was to foster an entity that would be able to carry forward the initiated activities beyond the project period.

Sustainability of the project has been its main focus. From the start of the project, activities undertaken were focused towards developing a market network, which would cater to the local needs for long terms even after withdrawal of the TERI from the project area. Activities undertaken for these purposes are as under.

Capacity building program:

Different types of training programs undertaken in the project, which were: [a] training for the technical persons, [b] training for the sale personal and, [c] training for development of entrepreneurial skills of the local community. Training programs were an important and integral part of the project, essential to build an infrastructure for development of a market for SPV. Which in turn expedited the process of creating a commercially viable entity.

Training for the technical persons

For the development of a holistic and sustainable market in the project area, it was essential to provide after sales service for the solar energy products. When Uttam Urja project started in Bikaner there was hardly any facility of after sale service, hence in the case of any small problem in the system customer had no one to consult with. Similarly lack of knowledge on installation of the systems and the technical know-how of the systems abstained the customers from purchasing the systems.

Therefore technical training to develop technical personnel who would provide solution for above problems was a must and it was taken as a priority under the project.. After conducting regular training programs in the project, it has now been possible to generate a pool of technical personnel who would provide regular after sale service to the customers.

A total of 28 training programs have been conducted for development of the technical persons who would install the systems and provide for the regular repair and maintenance of the same. Conducting these training programs has developed a technical bank of about 60 personnel who are committed for customer care.

Incase the product is under the guarantee and warrantee periods, the technicians get the service charge from the project and when this period is over they would charge for after sale service from the customers making it a source of income generation. They are also working as a permanent employee and getting service charges from the project by Uttam Urja dealers or the Uttam Urja office. Along with this they also undertake assembling work at the dealer points. The project has started a process of developing technical persons, which, with the gathered momentum will not stop after withdrawal of TERI. It would continue, as trained technical persons would pass on the training to other personnel.

Training for the salesmanship

Selling of newly developed products requires the skills of a salesman. Therefore Uttam Urja has conducted training for salesmanship. Around 35 training programs have been conducted under the project. This has developed more than 50 salesman who are either working with dealers or have started their own business.

Training for entrepreneurship

Presently 15 dealers are working under the dealer- retailers network developed by TERI under Uttam Urja. These dealers have been imparted training on undertaking renewable energy technologies as a regular business. Presently they are selling the products and getting a sustainable income out of the same. These dealers are linked with national level manufacturers at Delhi, Bangalore etc. It is from these places that they purchase the products and sell it to the end users after retaining certain margin money as profit. During the project period of more than two years more than 50 dealers came into association with Uttam Urja. Many of them left the association and started independently

when they established linkages with manufacturers, vendors and customers. A sustainable structure is already in place in which customers are getting the products and services from these trained entrepreneurs.

Promotion for awareness generation

In the beginning of the project acceptance of the products by end users was very low. There was a need to undertake awareness generation program. For this different type of promotional campaigns were undertaken such as music show, solar rally, wall paintings, posters, banners, handbills etc. Results were very positive and as a result the “Uttam Urja” brand was developed. People started recognizing Uttam Urja products and accepting these products gradually. Today Uttam Urja is established brand and products in this name are selling quite well. Moreover, people are able to recognize the new products. This is good effort toward sustaining the project.

Product development

In Bikaner and neighbouring districts most of the sold products are developed locally, suited to local needs. Initially, dealers were purchasing the products from Uttam Urja Which they gradually started assembling themselves. At present they procure the individual components from the manufacturers and subsequently assemble and sell them in the local market.

Expansion of the project in the new area

For gaining scale in the business it was also required to expand the marketing activities in new project areas. This was done in the project right from the beginning. Starting from one district Bikaner in Rajasthan. Presently market areas covers the entire western Rajasthan and also business has been expanded in out of state such as Gujarat, Punjab, Haryana, Bihar, Jharkhand etc. In Bihar and Punjab the franchisee model has been adopted. In Patna local entrepreneurs have sold Uttam Urja products of value more than Rs1,15,000. In Gujarat and Punjab also a similar phenomenon has been noticed. This process has in turn supported in making the project sustainable.

Selection of the dealers to carry forward Uttam Urja activities

The project “commercialisation of energy efficient and renewable energy technologies in India” completed its period of two years from October 2004 to August 2006. The project had mandate to create a commercially viable market for the solar photovoltaic technologies. This means Uttam Urja network would continue on its own even after the withdrawal of TERI from the project area.

For this there was a need to select an entity, which was involved in marketing of solar systems and was interested to carry forward the Uttam Urja network. It was decided that entrepreneurs who were working under Uttam Urja network were the right choice. Selection process started a year back, where the Uttam Urja team decided the criteria to select the entities, which are listed as under.

Criteria decided for selection of dealer:

- Are well aware of Uttam Urja activities
- Have experience of working under UttamUrja association minimum for 2 years
- Financially capable of running the business
- Ready to undertake responsibilities of Uttam Urja
- Has good backward and forward linkages
- Would be dealing in solar systems for long terms
- Good image in the market

Profile of the dealers

Two dealers were selected to work under the project; both were working under Uttam Urja network since last three years. They had acquired a good knowledge of solar systems. There was no complain against them regarding payment to Uttam Urja, provisioning of after sale service to the customers, selling at the suggested selling prices, and supporting Uttam Urja activities such as promotion and capacity building programs etc. Profiles of both of the dealers are as under.

(1) First dealer is Mukesh kumar. His address is, Mukesh Kumar, Shakti Electornics, Bhati tyres, Thirtham Road ,Bikaner. Mukesh Kumar is a graduate. He is 30 years old. He is in the business of solar and electronics goods since past five years. He has got a shop in Bikaner, where he has got staff strength of 6. After coming in contact with Uttam Urja he started dealing in solar systems since the past three years. Now he has developed lot of interest in dealing in solar systems. He is an honest person and has good image in the society. His father was in government service and since retirement, he has also been engaged in the business. Mukesh has good connection with villages since he also has agricultural land in Jamsar village. He is also financially sound to invest in the business.

(2) Sanjay Kumar, S I electronics, Maharani Church, Jodhpur. Sanjay is dynamic young person. He is soft spoken and well behaved. He has been dealing in the electronics goods since last 4 years. He has also got source of income from the agriculture

therefore his financial conditions are sound. After coming in association of Uttam Urja he started dealing in solar systems. Presently after getting training he is now a trained entrepreneur and is also sound as far as technical knowledge regarding solar is concerned. He has got staff strength of 5 persons. At his office he has got assembling facilities from where he assembles the products and supplies to other dealers and his retailers. He has been interested in carrying forward the Uttam Urja activities as will give him recognition in the market. Now after authorizing him, he is undertaken the responsibilities successfully.

Selected dealers would be undertaking following responsibilities.

- Installation of the systems.
- Repair and maintenance
- Assembling of the products
- Procurement of the products from national level manufacturers and suppliers and local vendors
- Undertaking promotional campaigns
- Undertaking capacity building programs
- Product development
- Developing marketing channels

Benefits to Uttam Urja dealer

Selected dealers would get benefit of the Uttam Urja brand. He would be dealing in all the products in Uttam Urja. Moreover, he would be an authorized person to cater to the needs of established big market. But simultaneously, he would also take responsibilities of providing after sale service to Uttam Urja customers. For which they would charge a reasonable amount from the customers. Thus this will also help him to earn from this market. As a result the users would get an after sale service. Also the products would be available off the shelf at any given point of time.

Annexure 3 Joining hands to achieve common goals

(TERI – Uttam Urja and MNES – Akshay Urja)

Uttam Urja is a TERI initiative to create a self-sustainable and decentralized model for renewable energy intervention in rural India. RETs (renewable energy technologies) hold the promise of, and potential for, bridging rural India's demand–supply gap in energy in general, and electricity in particular. RETs are particularly relevant for remote areas where extending the grid may not be economically viable. Besides being environmentally benign, the decentralized and modular nature of RETs makes it convenient for local entrepreneurs to disseminate and manage them at the local level.

Background

Uttam Urja was initiated in 1999, with support from ICEF (India-Canada Environment Facility) and is now being consolidated and expanded under the REEEP (Renewable Energy and Energy Efficiency Partnership) programme, which is being coordinated by the British High Commission. This initiative provides energy services through entrepreneurs in Tehri–Garhwal and Dehra Dun districts of Uttamanchal and Bikaner district of Rajasthan.

Current Scenario

Currently, Uttam Urja aims to break away from a project mode of operations and establish itself as a commercial entity wherein revenues from sale of products will provide necessary funds for operations. This is in keeping with TERI's continued focus on sustainable development. Strategic partnerships need to be formed to exploit emerging synergies and to increase the width and depth of dealer networks involved in Uttam Urja. The project has been successful in developing strong backward and forward linkages and in developing a brand name with high recall value in the rural markets.

Uttam Urja and Kasha Urja

One such strategic partnership could be with MNES (Ministry of Non-Conventional Energy Sources). The Ministry has been promoting the establishment of 'Adyta Solar Shops' in major cities of the country since 1995 with a view to make solar energy products easily available and to provide easy after sales repair

services. During the 9th Plan period, shops were established by the State Nodal Agencies/Manufacturer's Associations and reputed NGOs. During the 10th Plan, private entrepreneurs have also been allowed to establish these shops. Under the present scheme the shops have been renamed as "Kasha Urja Shops" with a view to cover wider sale and service of all renewable energy devices and systems including solar energy products. The network of the shops is to be expanded by encouraging private entrepreneurs and NGOs to set up and operate such shops in all districts of the country. The existing dealer network present with Uttam Urja offers such suitable private entrepreneurs that can be added on to the existing network of Kasha Urja shops. Uttam Urja offers a wide product range based on PV technologies. These include *Domestic Lighting Systems, Solar Lanterns* and even customized products such as *Madhani* that is used for churning milk.

The facilities available at Kasha Urja shops include:

- Sale of Non-conventional and energy saving devices.
- Repair of all non-conventional energy devices.
- Information on renewable energy technologies, new technologies and energy conservation.
- Loan assistance for non-conventional energy devices
- Display of various non-conventional energy devices
- Subsidy on selected items as per Govt. of India/State Govt. instructions.
- Round the year availability of products.

Advantages to Akshya Urja after tie-up with Uttam Urja
Uttam Urja dealers also provide many of these facilities and hence their readiness to be included in the Kasha Urja program is very high.

Additionally, Uttam Urja has developed great expertise in the areas of Awareness Generation and Capacity Building and can pass on these benefits to the entire network of Kasha Urja Shops.

Awareness generation

To reach potential users, simple slogans explaining RETs and their usage have been coined and promoted through wall paintings, banners, newspaper articles, outlets and service station signage, customer handbooks, maintenance manuals, and product brochures. These efforts have been substantiated by demonstrations in schools, government offices, marketplaces, service centers, and civic meetings; direct selling, training

sessions for customers and service providers, video and music shows, solar rallies, and door-to-door promotions. Local NGOs play a crucial role in promotion by facilitating meetings between panchayat bodies, health workers, farmers, primary teachers, and women's SHGs. Product popularity through mass events – such as *haats* (weekly/fortnightly markets), *melas* (fairs), and festivals – along with consistent innovations helps to form a positive image of RETs amongst rural people.

Capacity building

Capacity building is achieved through training programs during field visits, workshops, meetings, and also through customer booklets. Technical know-how is transferred to technical persons attached with dealers, who, in turn, are trained in entrepreneurship development of RETs. A special programme for schoolchildren has also been developed. Milk cooperatives have been involved in technology dissemination. They facilitate outreach to their members and, at times, extend credit to enable members to procure the solar lighting devices.

Women form an important interest group in RET dissemination. The project training modules encourage women to understand the working of the various RET-based household products. Often, financial and knowledge limitations hold women back from starting such activities on their own. To help them break the shackles of their routine rural life, the project has developed entrepreneurship for solar systems and initiated a revolving fund.

Specific Activities that will be undertaken (upon formalization of Uttam Urja – Kasha Urja partnership):

- Aligning Uttam Urja dealers with the Kasha Urja network thereby adding a ready pool of incremental dealers to this network.
- Making available all Uttam Urja products to dealers in the Kasha Urja network thereby increasing their product range.
- Identifying and defining four clusters and ensuring that all dealers in the Kasha Urja network are mapped to a particular cluster. This would be followed by seminar/training program in each cluster wherein all dealers in a cluster would attend and receive training on new RETs. This would ensure effective capacity building for these dealers.

- Appoint suitable cluster heads for each cluster that will be responsible for revenue generation within these clusters.
- Develop sales engagement programs and customer benefit schemes to encourage channel partners and promote the solar products available at Kasha Urja shops.
- All dealers within the best performing cluster to be given an award (monetary or non-monetary).
- Synergy with tie-up between Akshya Urja and Uttam Urja
- List of the products will be sold under Uttam Urja Network
- Assembling of the products started in the year 2002. And during the period of 4 years a product portfolio of nineteen products and components has been developed. Product innovation has been a regular process by which it has been possible to reduce the cost to the large extent. Moreover product development suiting to local needs of the people has proved very effective to increase sales proceeds. These products in latest style would be available at the Akshya Urja shop on demand.

Sl No.	Products
1	Uttam Urja Home Light System, 30 Wp
2	Uttam Urja Home Light System,50Wp
3	Uttam Urja Home Light System,18 Wp
4	Uttam Urja Solar Lantern ,10Wp
5	Uttam Urja Solar Lantern, 8Wp
6	Uttam Urja Emergency Light, 7W
7	Uttam Urja Kissan Torch
8	Uttam Urja Deck module 10 Wp
9	Uttam Urja Tape Module 5Wp
10	Uttam Urja Kissan Torch Module 3Wp
11	Uttam Urja Street Light 75Wp
12	Uttam Urja Luminary
13	Uttam Urja Charge Control Unit
14	Uttam Urja LED Torch
15	Uttam Urja LED Solar Lantern
16	Uttam Urja LED Home Lighting System
17	Uttam Urja LED Garden Light
18	Uttam Urja LED Street Light
19	Uttam Urja Solar Water Heater

Annexure 4 Strengthening the solar photovoltaic market: customer behaviour

Following is the report presented by Mr. Mirko Serkovic, Yale University on 'strengthening the solar photovoltaic market: customer behaviour and perception of 'Uttam Urja' solar systems'

Mirko Serkovic, Yale University

Part I –Background Information India Rural Energy Scenario

Energy is the basis of all activities. From it flow activities in agricultural, economic and social areas. Without adequate energy, the development of a country is jeopardized resulting in economic stagnation and tremendous internal upheavals. Since all industrial and other economic activities rely on electricity or other means of power, the primary energy production can be considered as an indicator of a country's economic strength. India's per capita energy consumption stands well below the rest of Asia and is one of the lowest in the world. Data shows that per capita energy consumption in India for 1997 was 12.3 million BTU, compared to 351.9 million BTU in the United States and a world average of 64.8 million BTU.¹ This low level of per capita consumption is not due to overall low energy consumption level, as India ranks sixth in the world in terms of energy consumption.² Rather, this figure reflects India's large population and the inequity in energy supply within them. While economic activities and standards of living boom in India's most vibrant cities, over 700 million rural poor have either limited access or no access to electricity, liquefied petroleum gas (LPG), or other non-traditional fuels.³

Because of this, electrification of the whole country should be taken as the top most priority as India continues to develop. By the year 2010, per capita energy usage in India is expected to increase around 40 million BTU.⁴ As population and industrial

¹ Kumar, Amit. *Energy scenario in South Asia*. Energy Technology News, Issue 1, October 2000. Available online at: <http://www.teriin.org/opet/articles/art1.htm>

² TERI Energy Data Directory & Yearbook – TEDDY 2002/2003, TERI Press, New Delhi

³ Friesendorf, Christian. *A Commercial Approach to Dissemination of Renewable Energy Technologies*.

⁴ *Anthropogenic Emissions from energy activities in India: Generation and Source Characterization*. Ohio

growth boom in India, the power generation would have to increase dramatically to serve these needs. India's rapidly growing economy will drive energy demand growth at a projected annual rate of 4.6 percent through 2010. This is the highest incremental energy demand rate of any major country.¹ Nevertheless, it needs to be considered that growth in the energy sector should be especially focused on rural areas, which are often neglected by the government. Here, electrification can bring considerable benefits in the improvement of agrarian practices, growth of commercial and industrial activities, and a much better lifestyle. In the last decade alone, a growth of 75% in commercial energy consumption has taken place. Despite all this, 65% of all rural households in India still have no electricity² and depend on inefficient fuels such as wood, biomass and kerosene. These groups are therefore forced to spend a higher percentage of their income for inferior-quality fuel, which considerably limits their economic development. Apart from being considerably inefficient, the use of these sources has other numerous disadvantages. Burning these types of fuels in an enclosed, poorly ventilated space presents a major health hazard. According to some estimates, smoke from kerosene lamps and fuel wood or biomass cook stoves contribute to acute respiratory infections that affect 4 million infants and children a year. Studies have shown that non-smoking women in India and Nepal who have cooked on biomass stoves for many years have a higher incidence of chronic respiratory disease. Household members attempting to read or work while using a kerosene lamp have to do so really close to it due to its dim light, which only causes them to inhale the fumes more acutely. The use of wood fuels has also taken a serious toll on the environment in many regions, leading to deforestation, soil erosion, and reduced soil fertility. Finally, many children and adults must spend up to several hours per day gathering fuel, leaving them with less time for schooling and productive activities and thus perpetuating poverty.³ To meet rural energy demands in India, a higher dependency on alternative sources would be needed. Although grid electrification is the traditional means of providing reliable electricity supplies, connection to distant grids is too expensive to

Supercomputer Centre. Available online:

<http://www.osc.edu/research/pcrm/emissions/background.shtml>

¹ *India: Energy Situation.* Energy Information Administration. Available online at: <http://www.eia.doe.gov/emeu/cabs/archives/india/indiach2.htm>

² Rajvanshi, **Anil K.** *Sustainable Development of India – A Gandhian Approach.* Nimbkar Agricultural Research Institute (NARI). Available online: <http://education.vsnl.com/nimbkar/gandhibook.html>

³ Barnes et al. *Tackling the Rural Energy Problem in Developing Countries.* The World Bank. Available online at:

<http://www.worldbank.org/fandd/english/0697/articles/020697.htm>

be cost effective for many rural areas. Rural settlements are really dispersed from one another and the households within them as well. 18 000 villages in rural India have been identified as ‘un-electrifiable’, meaning that reaching grid-based power supply to them is not viable.¹ Moreover, even if grid-connection was available, a large number of households are unable to afford the connection to electricity. Fortunately, there are a number of promising alternatives for increasing energy supplies even in very remote areas, ranging from more efficient use of traditional fuels to advanced technologies based on renewable energy sources. A decentralised approach introducing renewable energy sources seems the most efficient way to bridge rural India’s demand-supply gap in energy and electricity. Apart from decreasing dependence on the grid, renewable energy technologies (RETs) provide an environmentally benign and decentralised way for people to disseminate and manage them at the local level. Solar power is a particularly attractive option for India, since it has abundant sunlight and a poorly developed rural grid electrification system. Over the past decades, India’s approach to RET dissemination and popularisation has been highly centralised, target-oriented, and subsidy-based. This has led to numerous failures in planning, implementation, capacity building, publicity, allocation of and access to financial resources, and technology adaptation to local needs. The current status of policies regarding RETs and solar photovoltaic (SPV) is discussed in the following section.

Current Status of RETs and SPV in India Policies

The Indian energy sector has been regulated and owned by government agencies and organizations, with a nodal ministry in the center, which is the primary agency for policy formulation, support in decision-making, and implementation by state governments for each energy supply sector.

The electric supply industry has been under public ownership and public management ever since India’s independence in 1947. Existing utilities were integrated into 19 State Electricity Boards (SEBs) under the Electric Supply Act of 1948, where they remain part of individual state governments that are responsible for generating, transmitting, and distributing electricity in coordination with private and government owned generating companies or any other relevant agencies.

¹ Lighting up the lives of rural poor – TERI ICEF brochure.

Within the Government of India, the Ministry of Non-conventional Energy Sources (MNES) created in 1992 covers the entire renewable energy sector, namely solar, wind, hydro, biomass, geothermal, and tidal energy sources. The MNES is responsible for policy formulation, resource assessment, research and development, demonstration, commercialisation, awareness generation, and information dissemination for the popularisation and large-scale utilization of these non-conventional renewable energy devices. The MNES also aims to foster cooperation for financial and technical assistance from multilateral and bilateral agencies. The programs of the MNES are implemented through state nodal agencies, SEBs, R&D institutions, industries, and non-governmental organizations with the financial assistance of the Indian Renewable Energy Development Agency (IREDA). Since 1996, these programs have been made more market-oriented, with a greater role for the private sector. Even though private utilities form the smallest part of the power sector, the structure of SEBs is changing to corporatize and involve more private sector participation.¹ This is important especially with respect to RETs, as private dissemination of these technologies can supplement subsidy-based Government programs that often run short at the national level and fail to meet their true potential.²

The village electrification program of the Government of India has opened a significant market segment for SPVs. There are about 80,000 villages in the country, which are yet to be electrified, of which about 18,000 are in remote and inaccessible areas. All these villages are proposed to be electrified using RETs and executed by the MNES. The Tenth Five-year plan (2002-2007) targets to electrify 5,000 of these villages using mainly PV, biomass and small hydro power technologies, of which 4,000 will use PV technology. The MNES provides a capital subsidy of up to 50% of the ex-works cost of certain systems covered under the demonstration and utilization programme. An interest subsidy scheme for solar PV market development (up to 85% of the cost at 5% per annum) is also being implemented through IREDA and other commercial banks. A time frame has also been set to

¹ TERI Energy Data Directory & Yearbook – TEDDY 2003/2004, TERI Press, New Delhi

² *Final project report on "Implementation of Renewable Energy Technologies in Rural India through NGOs"*, The Energy and Resources Institute 2004.

complete the electrification of all the remote villages by the end of the Eleventh Plan in 2012.¹

Despite these attempts, knowledge of RETs and their advantages are still not very widespread in rural India. In areas with pilot projects, people are aware of such technologies, but because of their limited success people are still not open to the option. Finance is a constraint to the penetration of SPVs because of their one-time installation price, which compares quite highly to other subsidised fuels. In addition, there is a high-perceived risk associated with financing new technologies. The unavailability of loans and micro-credit schemes set back rural dwellers from purchasing SPVs. Financing organizations such as banks and rural moneylenders remain unconvinced of the success of SPVs and the potential benefits of implementing micro-credit schemes for these kinds of technologies. The fact that many of these projects are highly subsidised is also a barrier to the dissemination of SPVs, as they are not self-sustaining without governmental help. For most of the PV programmes, the MNES covers approximately 50% of the costs. Being offered in a subsidy basis, apart from representing an unsustainable burden on the state, the governmental projects limit a commercial and sustainable dissemination. This has caused a lack of market players in PV technologies, which does not allow for much brand competition that might lead to lower product price, better product quality, and the existence of after-sale services. Because the projects are target-oriented, once the target is achieved and the project comes to an end, there is no network for ongoing processes established and no maintenance or technical support programmes. By moving away from subsidy dependence, 'Uttam Urja' is being implemented by TERI to try to create a sustainable market for PV technologies in rural India. This market liberalisation is usually a far more effective strategy than the government programmes.

'Uttam Urja' Project

The Government of India's approach to RETs dissemination and popularisation has been highly centralised, target-oriented, and subsidy-based. It has had limited success due to various barriers in planning, implementation, capacity building, publicity, allocation of resources, and technology adaptation to local needs. By introducing alternative and supplemental approaches of a

¹ TERI Energy Data Directory & Yearbook – TEDDY 2002/2003, TERI Press, New Delhi

decentralised nature, TERI's 'Uttam Urja' project is attempting to overcome these barriers.

The project promotes individual and community ownership and management of energy services, technology transfer to and capability building of local entrepreneur and institutions, and improved access to credit. Directed at semi-commercial dissemination of RETs, this approach is particularly relevant as the government moves towards subsidy removal and reduction.

The basic objective of the project is to free the consumer from problems of high upfront costs, maintenance, and replacement, which have been so far responsible for limited penetration and impact of RETs in rural areas. In the 'Uttam Urja' scheme, the customer pays a basic upfront cost and then equated instalments for a specified period after which the ownership of the device is transferred to him/her. During the loan period, major maintenance costs such as battery and printed circuit board replacement are borne by the service provider.

The project funded by the India-Canada Environment Facility, initiated in 1999. It focuses on developing a grass root Energy Service Network (ESN), comprising local NGOs, dealers, and retailers of electronic systems. The project has consolidated a network of dealers and retailers, service stations, NGOs, financing institutions, government agencies, Self-help groups, cooperative organisations, technicians and costumers.

Without the subsidies that government-sponsored counterparts enjoy, 'Uttam Urja' has had to compete for the costumers' preference. A lot of effort has been put into awareness generation in order to reach potential costumers. Simple slogans explaining RETs and their usage have been coined and promoted around villages. These efforts have been sustained by demonstrations in schools, government offices, market places and other public places or mass events. This has helped in overcoming the low awareness levels and to create a sense of trust towards the 'Uttam Urja' brand. Moreover, this has allowed for capacity building in sales, repairs and maintenance of solar systems, thus involving the community more actively with the project.

Current financial options available include only banks, as it is too risky for NGOs and dealers to become involved, and other moneylenders have the negative image of charging high interest rates. Kissan credit cards allocate credit to farmers in proportion to the amount of land they have mortgaged. The interest rate is

the same as the bank rate, but 'Uttam Urja' offers a rebate on the interest.

Questionnaire Analysis

At the end of June 2005, a questionnaire concerning the customer behaviour and perception of 'Uttam Urja' solar systems was carried out in order to identify the weaknesses and strengths of the project. 100 users of solar systems were surveyed. The results will be discussed in this section.

Introduction to the Market

'Uttam Urja' has been introduced into the market quite successfully and actively through different means. This has been important in achieving competitive advantage, as different audiences and different groups within the market segment have been targeted, and awareness about the 'Uttam Urja' brand has been successfully created. Figure 1 below shows how respondents have found out about 'Uttam Urja' products.

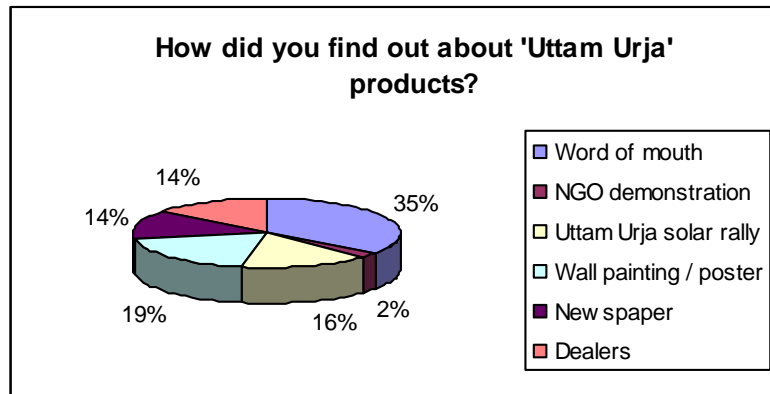


Figure 3 How did you find out about "Uttam Urja: products?"

Most respondents have heard about 'Uttam Urja' through word of mouth (35 percent). A relatively large number of respondents found out about the brand through traditional forms of advertisement such as wall paintings / posters (19 percent) and newspapers (14 percent). Wall paintings / posters are particularly a strong way of advertising in rural areas since they target groups that would not have access to newspapers and because they can remain exposed for longer periods of time. Solar rallies, despite being infrequent in occurrence, have also been quite powerful in generating awareness about the brand. These provide an animated setting that builds up a positive image of the brand. 16 percent of respondents claimed that they found out about 'Uttam Urja' through a solar rally. However, the promotional activities of NGOs have been lacking or not very successful as only 2 percent of respondents have been reached through this mean. Because 'Uttam Urja' has been providing training to NGO personnel in various aspects including promotion and technical training of solar systems, it should re-evaluate its linkages with its current network of NGOs and assess their activity in the dissemination of these systems.

Going back to advertisement efforts, while solar rallies, wall paintings, posters, and newspapers have created awareness about the brand, the study shows that their success varies from village to village. A close analysis of the questionnaire results reveals that solar rallies have been more successful in the village of Khajuwala, where most respondents of this village claim that they found out about 'Uttam Urja' through this mean. Interestingly, people from Khajuwala also seem to have had an increased exposure to the brand through wall paintings and posters than the rest of the villages in the Bikaner district. Exposure to the brand through these means was rare in other villages and the way in which respondents found out about 'Uttam Urja' was mostly through word of mouth. Implementation and penetration of these types of advertisement might have been limited in these areas because have socio-economic, topographic or accessibility factors specific to these villages. Further study could be carried out regarding the reasons determining the success of these means of advertisement in specific locations, and ways in which they could be further implemented where their success has been limited.

Attention should therefore be brought to the amount of awareness created through word of mouth. This means of exposure was equally strong throughout all villages surveyed, and reflects a sociological aspect of Indian culture, which needs to be

taken into account for marketing strategies. Especially in rural areas, storytelling is still a strong means in which tradition, experiences and knowledge is passed down from generation to generation and shared from household to household. Trust towards a product can easily be generated through the experiences and recommendations of others, especially those that are valued as being wiser or having an important presence in a community. Word of mouth can also be successful in motivating people to purchase a product that stands out as a status symbol. As more people in villages purchase solar systems and as a good reputation builds up through customer satisfaction, more village members will be motivated to purchase these systems in order to keep up with the rest of their community. For these reasons and because traditional means of advertisement have varying results from village to village, we can see that one of Uttam Urja core competences is customer satisfaction, public relations and community involvement. Since word of mouth is the main mechanism of awareness generation about 'Uttam Urja' products, active community involvement in the dissemination of these products – either in awareness generation or in entrepreneurial opportunities – will ensure a rapid increase in the popularity of solar systems. While local entrepreneurs such as dealers and retailers serve this purpose, local NGOs currently seem not to be very successful. Enhancing the linkages between NGOs and individual dealers and promoting a more active and direct cooperation between these two will establish a much more solid Energy Service Network at the grass-root level. These co-operations could be mediated and facilitated by involving local Panchayats that could oversee the role of these two stakeholders in the promotion and the maintenance of solar systems. Local Panchayats could also be involved in the repairs, maintenance and distribution of electricity within different villages. Primarily concerned by the well being of the villages and not with the generation of income, this will reduce maintenance costs relative to those conducted by local entrepreneurs.

What Customers Value

Now that Uttam Urja introduction to the market has been identified, it is important to analyse what customers value about solar technologies and the 'Uttam Urja' brand. When asked why they chose to purchase solar photovoltaic technologies, most respondents (39 percent) claimed it was because of long-term economic savings. Again, this emphasizes the importance of economics in the customers' decision making and the importance of having loan options to cushion the high upfront costs. Most

respondents also chose solar technologies because of their effectiveness (25 percent) and reliability (10 percent). This reflects Uttam Urja efforts in raising awareness about solar systems and helping create a positive image about them.

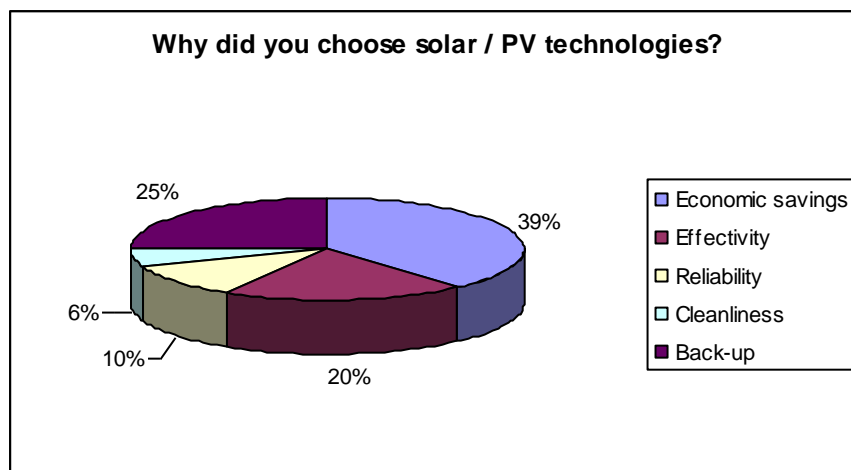


Figure 4 Why did you choose solar/PV technologies

When asked about the benefits of solar technologies, respondents ranked them in following manner in order of importance:

Figure 5 What do you find to be the most important benefits of solar technologies?

1. Economic savings
2. Makes chores easier for women
3. Household entertainment
4. Opportunity for social gatherings at night
5. Extended lighting hours allow my children more time for homework / reading
6. Environmental and Health Benefits
7. Extended lighting hours allow economic activities during the night to be possible (i.e. sowing)

Economic savings and cost effectiveness is what respondents believe to be the main benefit of purchasing solar systems. This perception might be rather skewed due to government subsidies altering the price of solar systems, but it is still encouraging to know that, despite its relatively high initial price, people are looking at the broader picture and making long-term decisions and investments about their energy needs. The understanding of

this issue by the customer considerably helps to overcome several product perception barriers, and allows the continuous purchase of solar systems.

Going on with the list, respondents perceive making chores easier for women as the second top benefit. This is interesting to note, especially since most of the times it is the male head of the household the one responsible for making the decisions to purchase the solar systems, and the one who most often answered the questionnaire. The high ranking of this benefit suggests that people are concerned with facilitating and simplifying daily household chores through the use of solar systems, as well as creating a more comfortable household atmosphere. This concern for daily chores and improving the quality of living, especially for women, could be taken into account for some serious marketing strategies. Now that the brand has been established and that trust has been created, promotion could step away from the idea of 'Uttam Urja' providing a reliable source of lighting, to exploiting other advantages of solar systems that might appeal to larger numbers of village dwellers. Advertisements could focus on improved quality of living and try to push solar systems as a strong status symbol, all while emphasizing the simplicity of these technologies and how household chores are facilitated for women.

Following on this idea, it can also be seen that people value quite highly the benefits of household entertainment (through the use of radio players, TVs, and other electronic appliances run by solar systems) and the possibility of social gatherings during the night. This ranked 3rd and 4th respectively on the benefits list (Figure 3). Again, we can see the importance of solar systems in providing comfort and a means of relaxation to its users. This is important to take into account for defining customer behaviour and future marketing strategies, since it seems people are mainly turning towards solar systems to enjoy the benefits of their simplicity and their easy of use rather than to use the extra lighting hours to engage in income-generating activities.

Extended lighting hours could allow children and other household members more time for homework or reading, and it could also allow economic activities to be undertaken during the night (like sowing). These two benefits, however, ranked 5th and 7th on the benefits list in Figure 3. One could expect that people would embrace these advantages, but going back to the discussion about comfort and the enjoyment of simplicity, it

seems that with the introduction of solar systems rural people are not ready to change their behaviour or their lifestyle to a more busy one. On the contrary, people are turning towards solar systems in order to make their lives as simple as possible. Now that the complications of collecting fuel wood and purchasing kerosene are gone, household members just want to take advantage of the extra time to relax. This tendency in customer behaviour is very important for the long-term success of the 'Uttam Urja' project. Customers do not want complications and 'Uttam Urja' needs to ensure that both the purchasing process and the maintenance / repair options are run as smoothly as possible. This means ensuring that the external linkages with NGOs, Banks and dealers / retailers are well established. As mentioned in the previous section, these major weakness. However, close proximity of dealers and service stations, cheap and effective after-sale services, good accessibility to loans and a solid product line are factors that will ensure long-term customer satisfaction. A study concerning how solar systems and the new increased availability of light is changing patterns of behaviour in the household could be carried out in order to analyse the impact of these systems in the lives of rural people, and to determine future trends regarding desires and needs for new solar technologies. However, 'Uttam Urja' should also aim to alter their customers' perception so that they adopt a more entrepreneurial perspective. Making users aware of the income-generating activities they could pursue using their solar technologies will create more demand for 'Uttam Urja' products, as well as facilitate micro-finance schemes and loan access for rural dwellers. The latter will be commented on in more detail when discussing the financial constraints of the 'Uttam Urja' project.

The project's weaknesses in external linkages with NGOs, dealers and financial institutions can also be seen when customers were asked to rate a number of characteristics of 'Uttam Urja' products. The average rating scores for all respondents are compiled in the following table:

Table 10 Rating of different features of 'Uttam Urja' products

Feature	Average Score
Ease of Use	7.48
Costumer Service	7.08
After-sale service plan	6.13
Cost-effectiveness	6.10
General product quality	5.56
Price	5.51
User training	5.02
Meeting daily household requirements	3.94
Loan facility	2.60
Proximity of service stations	2.38

While people appreciated the products' easy of use and were content with its costumer service, respondents rated the features of loan facility and the proximity of dealers / service stations extremely low, with average scores of 2.60 and 2.38 out of 10, respectively. It needs to be considered that the average distance customers are from the closest dealer or retailer is 75 Kilometres. Respondents in some villages, like Puggal - Gulamwala, claim to be 200 Kilometres away from the nearest 'Uttam Urja' dealer. This imposes a major barrier in the after-sale services and maintenance of products since most rural dwellers do not own motorized vehicles and, in the best of cases, it would take customers most of the day to reach their closest dealer or service station. Ways to improve on these issues would be discussed later on when talking about financing options in more detail.

Branding and Competition

It is also considerably important to discuss the brand's position with respect to its competitors, its critical success factors, and the resources and competences that allow these factors to exist. When asked why they chose to purchase 'Uttam Urja' over other brands, 40 percent of respondents identified the superior quality of their products and the reliance in the brand name as the main factors affecting their decision-making. This reflects Uttam Urja successful introduction and establishment in the solar photovoltaic market, but it needs to be noted that not a single respondent chose 'Uttam Urja' over another brand because of its loan facilities. If available, this could be the major factor influencing potential customers to choose 'Uttam Urja' over other options, and therefore slowly eliminating the rest of the competition.

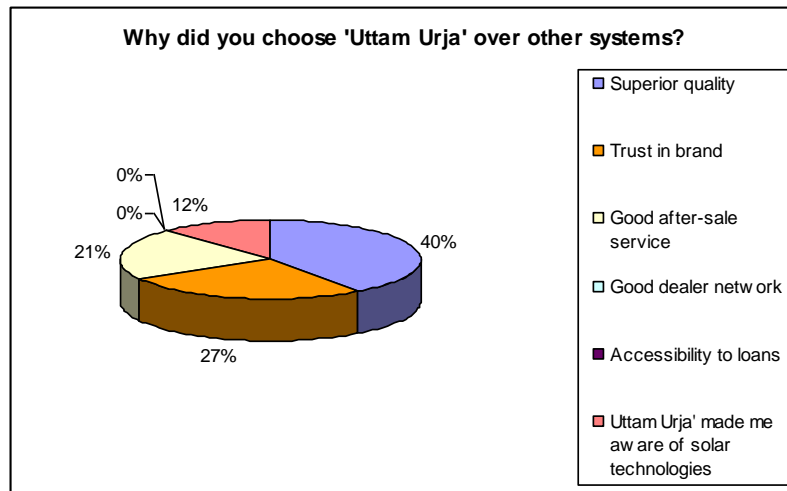


Figure 6 Selecting Uttam Urja over other system

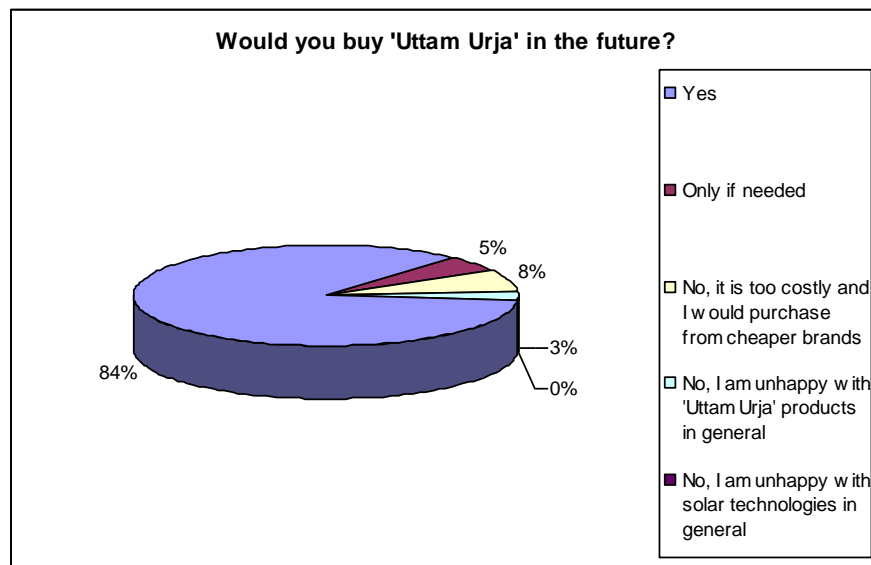


Figure 7 Purchasing Uttam Urja product over other products

'Uttam Urja' claims as one of its basic objectives to "free the consumer from problems of high upfront costs, maintenance, and

replacement, which have so far been responsible for limited penetration and impact of RETs in rural areas.”¹ Figure 6 shows that ‘Uttam Urja’ brand has been well established by building up a positive image only 3 percent of respondents were unhappy with ‘Uttam Urja’ products in general. Solar technologies have also been widely accepted; none of the respondents are unhappy with type of technology. While there is a strong willingness to buy ‘Uttam Urja’ products in the future, 84 percent of respondents would, the financial constraints do not seem to have been removed to a great extent since there is a major lack in sustainable financial options.

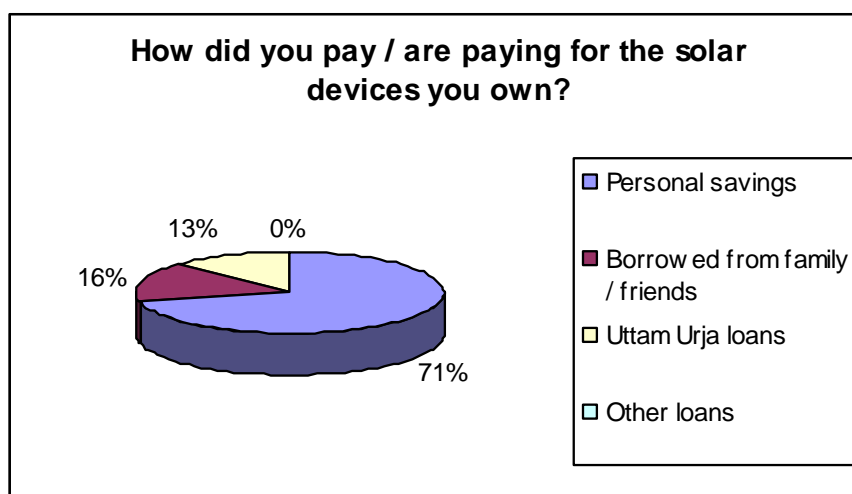


Figure 8 Accessibility to Loans and Financial Issues

87 percent of all respondents had purchased ‘Uttam Urja’ products by paying with personal savings or by borrowing from family or friends. The questionnaire results show that very few people (13 percent of all respondents) have gotten loans through ‘Uttam Urja’ or any other type of financial mechanism. This presents a huge barrier to purchasing solar systems because of their high initial price, which requires a considerable amount of savings and a big financial burden. A large Domestic Lighting System (DLS) is Rest 12,500 while the average respondent’s monthly salary is Rs3, 500. Some salaries even go as low as Rs1, 400 for people already owning ‘Uttam Urja’ products, and Rs800 for people owning other brands. A Kissan torch and its

¹ Lighting up lives of rural poor

complementary 2.5Wp solar panel, one of the cheapest available products, are Rs1, 600 combined, which accounts for almost half of the average's respondent salary. More micro-credit options should definitely be available and implemented more successfully in order for people to continue buying more 'Uttam Urja' products, as well as to expand the market to lower socio-economic groups.

If 'Uttam Urja' does not overcome this barrier, then people would continue purchasing the government-subsidised products. When asking owners of other solar system brands to explain why they purchased another brand instead of 'Uttam Urja', more than 50 percent of respondents mentioned financial reasons (Figure 8). They claimed that either 'Uttam Urja' was too expensive (19 percent), or that they did not have access to loans (28 percent) or that they had purchased another brand prior to Uttam Urja's introduction to the market and cannot afford to switch (3 percent). A considerably small number of respondents claimed that other products were of a higher quality (3 percent) or that the 'Uttam Urja' plan was not convincing enough. As we can see, there is a willingness to purchase Uttam Urja products, but a considerable lack of financial options to do so.

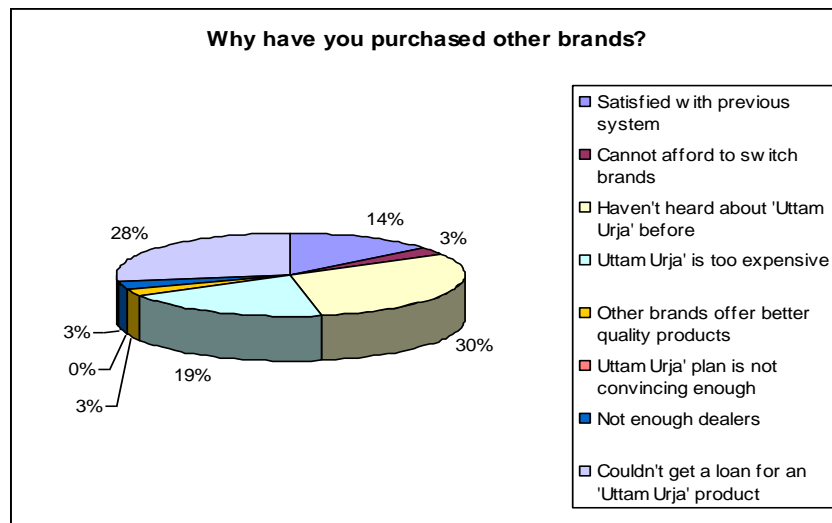


Figure 9 Reason to purchase other brands

41 percent of all respondents who do not own any 'Uttam Urja' products would buy them in the future if they had lower prices (Figure 9). Although this would be hard to achieve as the project moves away from government subsidies, 'Uttam Urja' could

overcome this barrier by developing sustainable financial options.

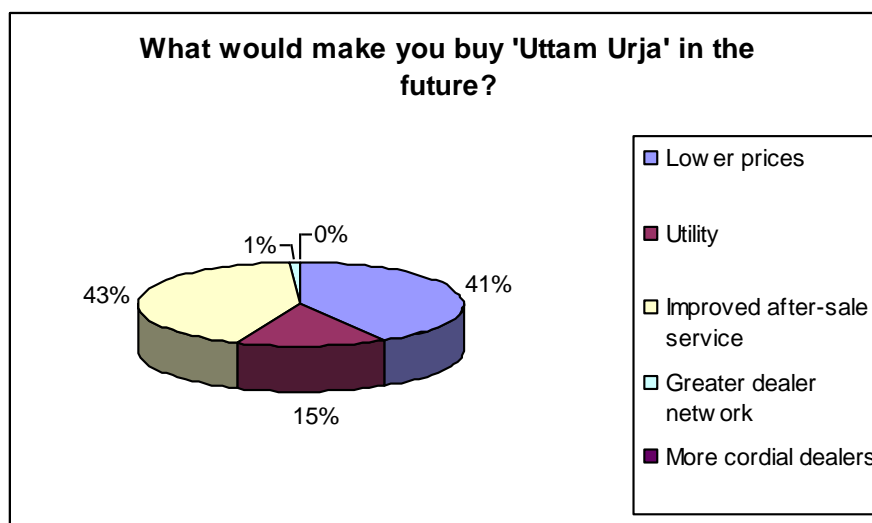


Figure 10 Reasons to buy Uttam Urja products

The project's current soft loan option, although a good start, is extremely limited and does not provide what it takes for most villagers to enter the market in a large scale. Under this scheme loanees only pay 3 percent of interest rate per annum (since, from the total of 11.5 percent extended by the Bikaner District Primary Co-operative Land Development Bank, TERI takes care of 8.5 percent). Even though the loan scheme is decent, it still remains extremely hard for a village dweller to have access to such a bank loan. The main problem does not lie on the loan scheme itself, but on the fact that villagers have very little credit worthiness. Therefore, when the bank is considering potential costumers, most village dwellers do not fit the loan requirements. For this reason, 'Uttam Urja' needs to start considering alternative options to finance their solar systems and ways in which the cost of the after-sale services could be reduced.

Since loans are hard to get for an individual due to lack of reliability, 'Uttam Urja' could develop its own micro-finance scheme. As a recognised and well-established brand, 'Uttam Urja' could provide loans for people to purchase their own systems. To guarantee loan recovery, an agreement could be formed between 'Uttam Urja' and the loanee where the latter is subjected to use the purchased solar technology for some income-generating activity. A monthly portion of this generated income could then go into loan repayment. This is an option that 'Uttam

Urja' should strongly consider because it's a win-win situation for both 'Uttam Urja' and its costumers. While positively engaging in rural development and empowerment, 'Uttam Urja' would strongly market its own solar technologies. People will be made more aware of the business possibilities that exist through the use of these systems and these would lead to greater demand for the products as they are used for a wider range of purposes. By providing the best loan option available, 'Uttam Urja' would slowly assure that if someone buys a solar system, it would be an 'Uttam Urja' one since it would be the one with the least economic burden for the buyer.

An example of micro-finance schemes empowering rural dwellers in business activities is Sarvodaya – SEEDS in Sri Lanka. This institution has the distinction of being the largest nongovernmental micro-finance organisation in the country. In 1998, SEEDS became a Company Limited by Guarantee – an autonomous body yet linked to its parent organisation, the Sarcomata Movement. In order to promote human development that is truly grassroots centred, SEEDS has empowered a little over 3,000 Sarvodaya Shramadana Societies island wide, to play a more meaningful role. Innovative financial, business development and capacity building interventions are channelled through an integrated program structure, viz. the Banking, Enterprise Services and Training Divisions. What's unique about SEEDS' loan scheme is that its loan clients, primarily village-based micro and small entrepreneurs, are provided with a range of Business Development Services. These include business counselling, timely and appropriate market information, new products and processes, technical skills training, business linkages and technology transfer. To foster a market presence for rural small producers, SEEDS' Enterprise Services Division organises mini trade fairs at district level and an annual mega trade fair and exhibition at national level. 'Uttam Urja' could take a similar approach to involve its customer in business activities using solar systems to repay the loan provided by 'Uttam Urja'.

After-sale services

Figure 9 also shows that 43 percent of respondents would buy 'Uttam Urja' in the future if the after-sale services were improved. According to Figure 4, the main weakness of the after-sale service is the proximity to the service stations. The average distance customers are from the closest dealer or retailer is 75 kilometres. Respondents in some villages, like Puggal - Gulamwala, claim to be 200 kilometres away from the nearest 'Uttam Urja' dealer.

This imposes a major barrier in the after-sale services and maintenance of products since most rural dwellers do not own motorized vehicles and, in the best of cases, it would take customers most of the day to reach their closest dealer or service station. If people are spending a higher price for a product whose one of its main competitive advantage is its after-sale service, then they want to be sure these options are readily available and easily accessible. The Energy Service Network for 'Uttam Urja' still remains weak at the grass-root level. It has already been discussed how involving local Panchatyas could involve the community more actively and strengthen the cooperation between dealers and NGOs and increase the access to service stations. People could find out about the closest dealer or service station through the local Panchatyats. Furthermore, a system in which customers take their solar systems to the local Panchatyats and, from there, these could be taken to the closest dealer or service station could be created. This would cut down travelling time and expenses for the customers and would be much more effective since many systems could be taken care of at once. Moreover, Panchayats could monitor closely the dealers' activities and make sure they are not overcharging. This sort of mechanism could also considerably reduced after-sale service fees. A way in which after-sale service costs could be reduced would be by involving local Panchayats in the repair of and maintenance of systems. By not doing it for profit and by being a respected an authoritative figure in the villages, the after-sale service to costumer network could considerably be improved.

Another option to strengthen the after-sale service could be cooperating with other brands in the networking of dealers and the creation of service stations. Since the maintenance of the different solar products is similar, all brands could benefit from this joint effort.

It is important for the future of 'Uttam Urja' to improve its maintenance and after-sale service. Many components and accessories such as luminaries, cables and batteries of a poorer quality are locally available but at a much cheaper rate. Local electricians probably also offer maintenance services at a much cheaper rate than dealers or 'Uttam Urja' service stations. Improving the after-sale services will increase Uttam Urja robustness of its resources and competences.

Conclusion

‘Uttam’ Urja’ has been successful in introducing itself into the market quite powerfully and creating a positive image of solar photovoltaic technologies. Rural dwellers perceive ‘Uttam Urja’ as an efficient, cost-effective and high-quality solution to their energy situation and regard it as the top brand in the solar market. Nevertheless, most people only have access to these technologies through personal savings, which creates a great burden as a customer assumes the upfront cost of a system. Another weakness of ‘Uttam Urja’ is its weak network of cooperation between dealers and NGOs, and their respective relationship with solar system users. ‘Uttam Urja’ should improve its external linkages with NGOs, dealers, and banks, and try to expand it to include local Panchayats. A stronger network between these entities will not only increase awareness about solar products, but also lead to a cheaper and more effective after-sale service provided that all these entities cooperate with one another and are closely monitored by an authoritative figure such as the Panchayat. Such a strong network will increase Uttam Urja robustness to imitation.

However, all of this could only be achieved once there are solid financial options available for potential customers. For this, it would be ideal for ‘Uttam Urja’ to develop its own micro-credit loan system, in which it would encourage customers to use their solar systems for an income-generating activity that would help them pay back the loan. This is a win-win situation for both ends, and ‘Uttam Urja’ would highly benefit from this as it promotes its products not only for lighting purposes but also for business activities. As the other brands only competitive advantage is their reduced price, demand for ‘Uttam Urja’ would boost while at the same time reducing the competitors’ popularity.

‘Uttam Urja’ also needs to expand its marketing activities and go into more exciting and adventurous paths, in order to make people more aware of all the potential benefits of solar systems. Such initiative would increase the status symbol of solar products and reach different groups of people with different needs and concerns. For example, ‘Uttam Urja’ could do more to raise environmental awareness about its products.

Appendix

1. Questionnaire (Users of solar power)

PERSONAL INFORMATION

Name of respondent: _____

Village name: _____

Household income: _____ (per year / month / week / day)

Household members

	Male	Female	Children (<15)
Total Number			
Literate (read / write)			
Completed Primary			
Completed Secondary			
Completed Superior Ed.			

purchasing factors

Why did you choose solar / PV technologies?

Economic savings (Cheaper in the long-run)

More effective / intense than previous source

More reliable

Cleaner than previous source

For back-up support

What systems do you run with your solar power product(s)?

Light

Radio / music

TV

Other: _____

Please indicate what you find to be the most important benefits of solar technologies (1 being the most important and 7 being the least)

- ____ Economic savings in energy
- ____ Environmental and health benefits
- ____ Household entertainment

- ___ Opportunity for social gatherings at night
- ___ Makes chores easier for women
- ___ extended lighting hours allow my children more time for
 - homework / reading
- ___ Extended lighting hours allow economic activities (like sowing)
- during the night to be possible

Who influenced in the decision-making about purchasing solar technologies?

- Head of household
- Women
- Youth (Male or Female)
- Children
- It was discussed with the entire family

Environmental concerns

5. (Only if previously using kerosene or fuel wood) Is / has any member of your household suffered from the following:

- Influenza
- Pneumonia
- Breathing difficulties
- Eye irritation
- Unusually regular headaches

6. Are you aware that these symptoms can be caused by indoor fuel wood / kerosene burning?

Yes No

7. How willing are you to stand these threats (from 1 to 10, 10 being very willing and 1 being not willing at all).

8. What environmental / health changes do you sense inside your household:

- Less smoke
- Less symptoms / Better health
- None

Branding and product competition

Do you currently own any 'Uttam Urja' products?

Yes No

10. How did you pay / are you paying for the solar devices you own?

- Personal savings
- Borrowed from family / friends
- Loans (through 'Uttam Urja')
- Other loans

(If answer to question 5 is yes, please answer questions 11 – 13. If answer is no, please continue from question 10)

11. Which (please circle)?

- Standard DLS (35 Wp)
- Large DLS (50 Wp)
- Small DLS (30 W)
- LED Solar Torch
- 2.5-Wp Solar Panel
- 5-Wp Solar Panel
- 10-Wp Solar Panel
- Kissan Torch
- Luminary
- Lily (3-W lantern)
- Sampurna
- Solar hot water system
- Pyrolyser

12. Why did you choose the 'Uttam Urja' brand over other systems?
- a. Superior Quality
 - b. Reliance / Trust in brand
 - c. Good after-sale / Customer Service
 - d. Good dealer network / Cordiality of dealers
 - e. Accessibility to loans
 - f. 'Uttam Urja' made me aware of solar technologies
13. How did you find out about 'Uttam Urja' products?
- a. Word of mouth
 - b. NGO demonstration
 - c. 'Uttam Urja' solar rally
 - d. Wall painting / poster
 - e. Newspaper
 - f. Dealers
14. (If answer to question 9 was No) Why have you purchased other brands?
- a. I am satisfied with the solar products I bought before 'Uttam Urja' was in the market
 - b. I cannot afford to switch brands
 - c. I haven't heard about 'Uttam Urja' before
 - d. 'Uttam Urja' is too expensive
 - e. Other brands offer better quality products
 - f. 'Uttam Urja' service plan is not convincing enough
 - g. Not enough dealers
 - h. I couldn't get a loan for an 'Uttam Urja' product
15. (If answer to question 9 was No) What would make you buy 'Uttam Urja' in the future?
- a. Lower prices of products
 - b. Utility / Demand for product(s)
 - c. Improved after-sale service
 - d. Greater dealer network
 - e. More cordial dealers
16. Did you own any solar products before 'Uttam Urja'? Yes No

If yes, which brand: _____

If no, why not?

- i. I was unaware of them
- ii. I didn't believe in the advantages of solar systems
- iii. They were of low quality
- iv. They lacked a good dealer network
- v. Didn't offer any after-sale maintenance plan
- vi. Too costly / No access to loans

Customisation

17. Please rate on a scale from 1 to 10 (ten being great and 1 being poor) the 'Uttam Urja' product(s) you own on the following:

Price: _____
 Cost-effectiveness: _____
 Meeting daily household requirements: _____
 General quality: _____
 Ease of use: _____
 Customer service: _____
 After-sale service plan: _____
 User training: _____
 Proximity of service stations: _____
 Loan facility: _____

18. Would you buy 'Uttam Urja' technologies in the future?

Yes. Why?

Only if needed

No, it is too costly and I would purchase from cheaper brands

No, I am unhappy with 'Uttam Urja' products in general

No, I am unhappy with solar technologies in general

Dealer services

19. Did the dealer provide you with customer-related information and user training about the 'Uttam Urja' product(s) you purchased?

Yes

No

20. Did the dealer install the product in your house correctly and free of charge?

Yes

No

17. Do the dealers provide you with regular free of charge maintenance service?

Yes

No

18. How fast do they respond to your queries?

24 hours

48 hours

A week

A month

No response

After-sale services

19. From 1-10, how satisfied are you with the 'Uttam Urja' after-service plan?

20. Please tell us the main difficulties you encounter with 'Uttam Urja' products / services?

Annexure 5 Solarised Automatic Milk Collection Stations

Background

Recognizing the importance of the sector, the notable programmes taken up by GOI are key village schemes, intensive cattle development projects, crossbreeding projects through bilateral assistance, operation flood programme and technology mission on Dairy Development. In 1970 under the aegis of National Dairy Development Board, "Operation Flood" programme was launched to modernize the dairy sector and flood the 4 metro cities with milk from dairy cooperatives. By the end of September 1999, 82000 village milk producers' cooperatives were organised through 102 lakh farmers and with an average rural milk procurement of 13.13 million liters per day.

Having made a significant stride in production and processing, our country is topping the Globe as the highest milk producer. Now it is the time to upgrade the quality of milk by increasing the efficiency of procurement as well as the testing of milk for quality. In India the milk pricing is based on the fat percentage and to some extent Solid Not Fat (SNF) in milk. The determination of fat is based on the butyrometer method, which is one of the oldest technologies adopted by the Milk Collection Centres/Milk Cooperative Societies. Since 1980's many of the societies have been using Milko testers for testing the fat percentage in milk as this is a rapid method compared to former one. Of late Milk Collection Centres/Cooperative Societies are installing automatic milk collection stations (PC based milk collection stations, smart automatic milk collection stations and automatic milk collection stations) which measure the weight of milk, fat contents and gives a print out of payment slip to farmers in each shift. The systems also facilitate storing 10 days/monthly/yearly data and printing of cumulative summary of shift as and when needed. The state of art equipment is able to perform 120 to 150 operations in an hour. But there are many societies, which are located in remote villages where no grid electricity is available. It is not possible for these societies to use the Automatic Milk Collection Station. And they are compelled to depend on traditional one. For them Solarised Automatic Milk Collection Machine can prove boon. Solarised Automatic Collection Machine is Solar PV energy run automatic collection center.

Objectives:

Solarised Automatic Milk Collection Station developed to meet following objectives.

1. To take use of Milk Collection Centre where grid power is not available.

To increase the efficiency and accuracy of fat testing in milk

To reduce the overhead cost by the process of automation. .

Beneficiaries

Milk Cooperative Societies of the Cooperative Milk Union or Milk Collection Centre of private dairies.

Project Details:

1. **Components:** Solarised Automatic Milk Collection Station is a specially designed integrated unit which is a combination of several units i.e. solar PV, Milk Weighing System, Electronic Milk Testing, Personal Computer with printer and battery.

2. **Capacity:** The capacity of Automatic Milk Collection Stations is to analyse 120 to 150 samples per hour.

3. **Specifications:** The broad specifications are as under:

- a) Fat measurements : 0 - 13%
- b) Measuring capacity : 120 to 150 operations per hour.
- c) Power supply : AC 220 to 240 watts 50 HZ

Advantages:

1. Saving in quantity of sample milk
2. Saving of chemicals and detergents
3. Saving of expenditure on glassware
4. Saving in stationery and time
5. Saving in expenditure on staff.