Renewable Energy for Rural Livelihoods in MNRE-UNDP-FRG Project Villages in Rajasthan and Uttarakhand: A Report

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Renewable Energy for Rural Livelihoods in MNRE-UNDP-FRG Project Villages in Rajasthan and Uttarakhand: Executive Summary

The MNRE-UNDP-FRG Renewable Energy for Livelihoods Project implemented in remote villages in Rajasthan, Uttarakhand and Jharkhand demonstrates how renewable sources of energy can reduce poverty through improved quality of life and increased livelihood opportunities in remote, non-electrified villages of India that are not likely to get electricity from the grid. Per capita consumption of electricity in India is low. Around half the country's population does not have access to electricity. As is well known, most villages that are un-electrified are also home to people who are poverty stricken and multi-dimensionally deprived. According to Planning Commission estimates, around 57 percent of the rural households and 12 percent of the urban households in India did not have electricity in 2000. Power outages and voltage fluctuations of grid based electricity in rural areas need rectification even in villages that are electrified.

Indian Institute of Public Administration (IIPA) was the facilitating/monitoring institution for 14 villages in 6 districts in Rajasthan and Uttarakhand. The agencies implementing the project in these 14 villages and their location are as follows: SWRC-Manthan in Ajmer (Rajasthan); SWRC-Prayatna in Jaipur (Rajasthan); SWRC-Sankalp in Baran (Rajasthan); CII-Lupin in Bharatpur (Rajasthan); AHEC IIT Roorkee in Bageshwar (Uttarakhand) and Jansamarth in Tehri (Uttarakhand).

The villages identified for implementing the MNRE-UNDP-FRG project are remote and multi-dimensionally deprived - lacking not just electricity and roads but also employment opportunities, health facilities, sanitation and safe drinking water. Instead of choosing "low hanging fruit" each of the Implementing Agencies selected locations that were difficult and inaccessible, off the grid and the highway and where most of the community had lived in poverty for decades. Most of the villages selected for implementation of this project exhibit characteristics that lead to persistence of poverty, such as remoteness, low agricultural productivity, dependence on rainfed agriculture and illiteracy. Several interventions that have been initiated in this project such as provision of livelihood generating equipment, value addition as in the case of wool carding, access to assured water such as from lift irrigation or

water tankas, access to assets such as community or group owned livelihood generation equipment etc will enable people to move out of poverty if the project is sustained over time. Night schools enable young children to study and may protect them from inheriting their parents' poverty. Hence, the choice of project location meets the overarching goal of the project, i.e., to use renewable sources of energy to reduce poverty and improve the quality of life and livelihoods.

There are a total of 836 households in the 14 villages. Between two and four field visits were undertaken to each of these villages, to facilitate progress of the project through discussions with the Implementing Agencies, meetings with the community to motivate them as well as determine project impact on livelihoods and quality of life in the village. Focus Group Discussions were held with the community in all the 14 villages. Efforts were made to interview as many households as possible in each village.

IIPA's task was to facilitate successful completion of the project and enable achievement of the project objectives within existing constraints and emerging challenges. Despite challenges, the MNRE-UNDP-FRG project has successfully demonstrated the functioning and usefulness of village-based, new and renewable energy solutions being delivered with the support of grassroots technicians, whose capacity has been built through the project. Village communities have benefited from the use of solar lanterns in the villages selected by SWRC-Manthan and SWRC-Prayatna; solar home lighting and street lighting in the villages selected by CII-Lupin; micro-hydro power based lighting and initiation of livelihood generation in the villages selected by AHEC-IIT Roorkee and Jansamarth; livelihood generation in the biomass gasifier based villages selected by CII-Lupin and SWRC-Sankalp and biogas for drudgery reduction in the villages selected by CII-Lupin.

The gasifier has worked successfully in CII-Lupin's Nagla Ramoli and less effectively in neighbouring Shri Nagar. It worked very effectively in SWRC-Sankalp's Sanwara for one agricultural season but ran into an unforeseen ban by Government on lifting of water from natural bodies due to drought. The details regarding performance or functionality status of each

of the project initatives at the time of the Impact Assessment field visit, difficulties in functioning if any and whether or not these have been resolved, are presented in the report.

Gasifier sheds, powerhouses, solar repairing workshop, livelihood equipment sheds, water tanks, roads and schools have been constructed as needed and quality of life improved in all 14 villages, as Implementing Agencies have built capacity, raised awareness, conducted training and skill provisioning, organised health camps and schools and facilitated access to income earning opportunities available through implementation of NREGS.

In all the project villages, the gasifier shed, gasifier, powershed, and other major infrastructure constructed through the project is owned by the community. However, in the case of livelihood generation machinery, CII-Lupin and AHEC, IIT Roorkee supported individual entrepreneurship and ownership. SWRC-Sankalp facilitated group ownership of livelihood generating equipment (eg. motors for pumping water) while Jansamarth encouraged it's ownership by the village community (eg. wool carding machinery and flour mill etc). Each of the approaches has advantages and challenges that are discussed in the report.

Various interventions initiated through the project constitute efforts to improve the lives of the people in each of these communities through providing renewable energy for lighting, cooking and motive power and to build capacity, facilitate livelihood generation and, in many cases, enable access to education and health facilities. Despite severe challenges due to inclement weather conditions and difficult terrain, accidents and ill health, the implementing agencies have succeeded in providing light in all the project villages, set up Urja Samitis or Gasifier Sanchalan Samitis, train barefoot technicians, initiate livelihood generation activities in several others, develop infrastructure such as gasifier shed, powerhouses, schools, run night schools, construct community owned and individually owned water tanks, dig deep bore wells, and support and encourage non-energy based livelihood generating activities through providing livestock or facilitating NREGS activities, and generate awareness regarding health related issues.

The regular visits and follow-up work of the Implementing Agencies with the communities in the selected villages have led not only to provision of light and motive power but additionally built skills and capacity, enabled convergence with NREGS, improvement in access to education and health facilities, plantations for biomass, access to water, construction of roads and therefore an improvement in the quality of life of each of these communities. However, additional resources and time are needed for the investment to take firm root and transform the selected villages into best practice cases so that they reflect the impact of using new and renewable energy in sustainable generation of livelihoods, increase in cash income, poverty reduction, drudgery reduction and improvement in the quality of life. Additionally, there is need for convergence and linkages with other government departments and schemes. This is especially required with departments of drinking water, health, education, agriculture, horticulture, animal husbandry, textiles and rural development.

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1. Introduction

The Renewable Energy for Rural Livelihoods (RERL) project tries to demonstrate the use of renewable sources of energy in reducing poverty through improved quality of life and increased livelihood opportunities in remote, non-electrified villages of India that are not likely to get electricity from the grid.

The objectives of the Project are to:

- raise economic levels of households through the delivery of a comprehensive package of energy services for meeting the needs of cooking, lighting and motive power from renewable sources.
- use the energy for economic activity, such that as many households as possible benefit from the project and are able to sustainably cross the poverty line.
- achieve investment efficiency.
- reduce drudgery and loss of time in fetching fuel-wood and water, etc.

1.1 Project Implementing Agencies and Project Villages

The agencies implementing the project, project villages and their location are listed in Table 1.1.

Table 1.1: Location of Project Villages and Name of the Implementing Agency

States	Implementing Agency	Districts	Project Villages		
Rajasthan	SWRC-Manthan	Ajmer	Balaji ki Dhani	Gudda	
Rajasthan	SWRC-Prayatna	Jaipur	Kalia	Singla	Doi Ki Dhani
Rajasthan	SWRC-Sankalp	Baran	Sanwara	Ledra	
Rajasthan	CII-Lupin	Bharatpur	Nagla Ramoli	Shri Nagar	
Uttarakhand	AHEC IIT Roorkee	Bageshwar	Dobar	Miri	Topania
Uttarakhand	Jansamarth	Tehri	Agunda	Pangethi/Ghenwali	

1.2 Partnership Models Used

Different types of partnerships are envisaged for implementing the project with the objective of identifying potential best practice:

1) Partnership with an Industry Association, Confederation of Indian Industry (CII) based on Public- Private Partnership. As an industry association, CII should be able to use its industry networks to the advantage of successful income generation in the villages.
2) Partnership with an NGO, Social Works Research Centre (SWRC), Tilonia with a track record in community based innovative grassroots work and through it with NGOs, Sankalp, Manthan and Prayatna in remote villages in Rajasthan.
3) Partnership with AHEC-IIT Roorkee, with a track record in micro hydel and in innovative, engineering solutions in difficult locations.
4) Partnership with an NGO, Jansamarth, New Delhi with a track record in micro hydel and in community based, innovative, low cost engineering solutions in difficult locations.

Each of the Implementing Agencies has taken a mix of approaches in implementing the project. The major infrastructure, such as Gasifier or Micro-Hydro, is owned by the community in all the villages. CII-Lupin and AHEC, IIT Roorkee supported individual entrepreneurship and ownership of machinery for livelihood generation. SWRC-Sankalp facilitated group ownership of livelihood generating equipment (eg. motors for pumping water) while Jansamarth encouraged ownership of livelihood generating equipment by the village community (eg. wool carding machinery and flour mill etc). Each of the approaches has advantages and challenges as will be discussed later in the report.

1.3 The Overall Poverty Context

Poverty in India declined from 54.9% in 1973-74 to 27.5% in 2004-05 (see Table 1.2). Despite the recently experienced high rates of growth that exceeded expectations, the pace of poverty reduction in India has been much lower than anticipated. 301.7 million persons live below the poverty line, 220.92 million of them in rural and 80.79 million in urban areas.

Table 1.2: Poverty: Percentage of Population and Number of People Below the Poverty Line 1973-74 to 2004-05

Year	% Population below poverty line	Number of people below poverty (in millions)
1973-74	54.9	321.3
1977-78	51.3	328.9
1983	44.5	322.9
1987-88	38.9	307.1
1993-94	36	320.3
1999-2000	26.1 (different method)	260.2 (different method)
2004-05	**27.5**	**301.7**

Source: Planning Commission Draft Ninth Five Year Plan (1997-2002) and Government of India, Poverty Estimates for 1999-2000, Press Information Bureau, 22nd February, 2001 and March 2007.

Poverty is unevenly distributed across the country with concentration of poverty in certain states, districts and socio-economic groups (Mehta and Shah 2003). Further, poverty is not static and although some poor households manage to escape poverty, others are stuck in poverty while some non-poor households descend into poverty. Evidence from panel data studies shows that there is both substantial persistence and substantial mobility into and out of poverty and that important determinants of poverty are caste, tribe and household demographic composition. The probability of being chronically poor is greater for casual agricultural labour, landless households, illiterate households and larger households with more children (Mehta and Bhide 2003; Bhide and Mehta 2004).

There are a large number of factors that drive people into poverty, that keep people poor or maintain them in poverty, and that enable escape from it or interrupt persistent poverty. Panel data based research shows that factors enabling escape from poverty are literacy, ownership of or access to income from physical assets, increased incomes from physical assets, irrigation and crop intensification, infrastructure and having a large urban population in the neighbourhood. Most households undergo a variety of shocks and uncertainties over time, such as due to crop failure or losses due to price volatility or the onset of ill health. Their ability to go through these periods

without significant reduction in income levels depends on their initial levels of assets and other conditions affecting income which may be related directly to themselves or embedded in the physical, social or political environment (Bhide and Mehta, 2004; Mehta and Shepherd 2006).

Per capita consumption of electricity in India is low and is just 4% of consumption in the US, 7% in Japan, 40% in China and 23% of the world average (Table 1.3).

Table 1.3: Selected Energy Indicators

Region/Country	Electricity Consumption Per Capita (kWh)
China	1379
Australia	10640
Brazil	1934
Denmark	6599
Germany	6898
India*	**553**
Indonesia	440
Netherlands	6748
Saudi Arabia	6481
Sweden	15397
United Kingdom	6231
United States	13066
Japan	7816
World	**2429**

Source: Planning Commission 2006 based on IEA (2005), Key World Energy Statistics 2005, International Energy Agency (IEA), Paris, http://www.iea.org
*Note: *Data for India are corrected for actual consumption and the difference in actual and IEA assumed calorie content of Indian coal*

Around half the country's population does not have access to electricity. "Even though 85 percent of villages are considered electrified, around 57 percent of the rural households and 12 percent of the urban households i.e. 84 million households (over 44.2% of the total) in the country did not have electricity in 2000. Improvement in human development is also strongly associated with access to electricity" (Planning Commission 2006).

Most villages that are unelectrified are also home to people who are poverty stricken and multi-dimensionally deprived.

1.4 Project Villages: Poor and Remote

The relatively greater vulnerability to poverty of scheduled castes and tribes, especially in remote locations is well documented (Mehta and Shah 2001; Thorat and Mahamalick 2006). Scheduled Castes (SCs), Primitive Tribal Groups (PTGs) and Other Backward Castes (OBCs) predominate in

the Project villages in Rajasthan. The villages identified for implementing the MNRE-UNDP-FRG project are remote and multi-dimensionally deprived – lacking not just electricity and roads but also employment opportunities, health facilities, sanitation and safe drinking water. Some of the characteristics of the Project Villages are depicted in Table 1.4.

Table 1.4: Project Villages: Characteristics and Accessibility

Project Villages	Implementing Agency	Caste/Tribe	Terrain and Difficulty in accessing the village
Rajasthan			
Shri Nagar	CII-Lupin	Jatav (SC)	Newly constructed kachcha link road through the M.P LADS. Vehicle gets stuck in the mud during rains
Nagla Ramoli	CII-Lupin	Jatav (SC)	Kachcha road that becomes very slippery in the rainy season. Vehicle gets stuck in the mud during rains
Sanwara	SWRC-Sankalp	Sahariya Tribes (PTG)	Rocky and broken road; difficult to reach. Remote primitive tribal village. Infested with insects during the rain. Accessible by jeep.
Ledra	SWRC-Sankalp	Sahariya Tribes (PTG)	
Balaji ki Dhani	SWRC-Manthan	Meghwals (SC) and Gujjars (OBC)	Remote and poor village in the desert. Sandy soil but accessible by jeep
Gudda	SWRC-Manthan	Gujjars (OBC)	Recent construction of road under PMGSY
Kalia	SWRC-Prayatna	Gujjars (OBC)	Accessible
Singla	SWRC-Prayatna	Gujjars (OBC)	
Doi ki Dhani	SWRC-Prayatna	Gujjars (OBC)	Remote but accessible by jeep
Uttarakhand			
Agunda	Jansamarth	Rajput (General)	Bad and broken roads to village. Most jeeps are unwilling to ply on the stones and broken road. Landslides.
Ghenwali - Pangethi	Jansamarth	Rajput (General)	Only a pagdandi (footpath) up the mountain. Very inaccessible. The most remote of all the villages. Landslides.
Miri	AHEC IIT Roorkee	Rajput (General)	Bad and broken roads to foothill and then stones on footpath up the mountain. Landslides.
Dobar	AHEC IIT Roorkee	Rajput (General)	Bad and broken roads to foothill and then only a pagdandi (footpath) up the mountain. Landslides.
Topania	AHEC IIT Roorkee	Rajput (General)	

Source: Observations during Field Visits
Note: SC: Scheduled Caste , OBC: Other Backward Classes, PTG: Primitive Tribal Group

The communities living in most of the 14 villages selected for implementation of the project are largely multi-dimensionally deprived with low levels of adult literacy, poor quality of water, lack of connectivity, poor health and education facilities and dearth of livelihood opportunities.

Since "the poor are poor only because they have no assets – no land, no livestock, no houses and often no education" and "their only assets are time and labour…the challenge lies in enhancing the economic value of the time and labour of the poor" (Swaminathan 2004: 49). The MNRE-UNDP-FRG project tries to improve the quality of life in un-electrified villages through renewable energy (in Ajmer, Baran, Bharatpur, Jaipur, Bageshwar and Tehri) and also use motive power to facilitate access to income from livelihood generating machinery (in Bharatpur, Tehri, Baran and Bageshwar); irrigation increased crop intensification and yields (in Baran, Bageshwar and Tehri villages and for a few individuals in Bharatpur), as well as development of infrastructure, such as water tanks, night schools, education, roads, schools, health camps and implementation of NREGS (in all the project villages).

Instead of choosing "low hanging fruit" the Implementing Agencies selected locations that were difficult and inaccessible, off the grid and the highway and where most of the community had lived in poverty for decades. Hence, the choice of project location meets the overarching goal of the project, i.e., to use renewable sources of energy to reduce poverty and improve the quality of life and livelihoods.

1.5 Process, Method and Tasks

As the Monitoring and Facilitating Agency for the villages listed in Tables 1.1 and 1.3 above, IIPA's task was to facilitate successful completion of the project and enable the achievement of project objectives within existing constraints and emerging challenges. The following methods were used:

i) village visits and discussions with the community through focus group discussions to determine project progress;
ii) interviews with individuals within each community;
iii) primary data collection and analysis to assess the extent to which the community in each project village had benefited from the project;
iv) meetings and discussions with the many stakeholders of the project (MNRE, UNDP, Implementing Agencies, District Officials, Village Elders, women and men in each community) to facilitate and support completion of the project.

The tasks conducted for the project include:

1) Visits to all the Implementing Agencies and all the project villages.

Rajasthan

SWRC-Manthan: 2 villages - Balaji ki Dhani and Gudda in Ajmer district (three visits)
SWRC-Prayatna: 3 villages - Doi ki Dhani, Kalya and Singla in Jaipur district (three visits)
SWRC-Sankalp: 2 villages - Sanwara and Baran District (three visits)
CII-Lupin: 2 villages - Nagla Ramoli and Shri Nagar in Bharatpur district (two visits)

Uttarakhand

AHEC IIT Roorkee: 3 villages - Dobar, Miri and Topania in Bageshwar district (two visits).
Jansamarth: 2 villages - Agunda and Pangethi-Ghenwali in Tehri district (three visits).

2) Provided comments on Baseline formats prepared by TERI for energy related activities.
3) Prepared the Baseline formats for village and household questionnaires to capture economic status, education and health related parameters.
4) Resolved queries of Implementing Agencies on the formats.
5) Attended all Standing Committee and Subcommittee meetings.
6) Raised the issues facing Implementing Agencies at Standing Committee Meetings to resolve emerging problems.
7) Reviewed the status of Income Generating Projects for AHEC and pointed out errors in product profiles that were prepared.
8) Facilitated the work of Implementing Agencies through email communications, interaction and discussion during Standing Committee Meetings.
9) Conducted field visits to determine project progress, provide motivation to complete pending tasks; check the status of completion of the civil works such as construction of the shed, completion of the channel, delivery of penstock, plans for income generation, etc.
10) Discussed the project with the community and stakeholders through Focus Group Discussions and meetings with individuals during field visits.
11) Resolved problems where possible; met concerned government agencies for some of the projects.
12) Finalised the Baseline data collection.
13) Analysed the data and information collected.
14) Identified achievements and challenges facing the project in each of the project locations and presented the findings at Standing Committee Meetings.
15) Provided comments on draft formats of Impact Assessment Questionnaires and helped finalise the Quality of Life and Livelihood questionnaires for Impact Assessment.
16) Presented the status of project implementation, achievements and challenges at the MNRE-UNDP-FRG Seminar on 7th May, 2008.
17) Conducted Impact Assessment field visits in all the villages, analysed the data and prepared the draft report.
18) Presented the draft report to the Secretary MNRE at a meeting at MNRE on 1st December 2008.
19) Shared the findings of the report with the UNDP Terminal Evaluation Team.
20) Submitted the draft report to MNRE, UNDP and Terminal Evaluation Team on 6th March 2009.

2. District Bharatpur (Rajasthan): Shri Nagar and Nagla Ramoli

Location and Demographics

CII and Lupin are implementing the MNRE-UNDP-FRG project in two villages, Shri Nagar and Nagla Ramoli, in Bharatpur District of Rajasthan. Shri Nagar and Nagla Ramoli are in Farso Gram Panchayat located in Bayana block of the district. This is a poor village that lacks road connectivity. Solar light reached these villages just before Diwali in October 2006 through the MNRE-UNDP-FRG project. There are 70 households in Shri Nagar and 25 households in Nagla Ramoli. The population size of the two villages is 575 and 153 persons respectively and all of them belong to the Jatav caste or Scheduled Caste. Most of the people are poor but only 14.29% households in Shri Nagar and 4% households in Nagla Ramoli have BPL cards (Table 2.1).

Table 2.1: Caste/Tribe and Poverty Status in Shri Nagar and Nagla Ramoli

(percent households)

Caste and Poverty Status/ Name of Village	Shri Nagar	Nagla Ramoli
Scheduled Caste	100	100
BPL Card Holders	14.29	4.00

Source: Compiled from Impact Assessment survey data

Strong gender disparities exist and women do not speak in the presence of men. The majority of households in both the villages are engaged in agriculture, raise livestock or work as casual labour. Access to both these villages is difficult during the rainy season as the road becomes slushy and the mud is very slippery. At the time of the Baseline field visit the vehicle got stuck in the mud several times. The internal path in the village becomes very slithery during the rain and people often slip and fall. During the first few days of the Impact Assessment field visit, the vehicle could not reach the village and reaching the village required walking through the slush.

Household Level Analysis

The size-wise distribution of the 70 households in Shri Nagar and 25 households in Nagla Ramoli at the time of the Impact Assessment survey is shown in Table 2.2. Around 44% of households in both villages have between 6 and 8 members. However, while, 34% households in Shri Nagar have more than 9 members only 16% of households in Nagla Ramoli are large.

Table 2.2: Household Size in Shri Nagar and Nagla Ramoli (percent)

Name of Village/ Household Size	1 to 5	6 to 8	9 to 12	13 to 23	All
Shri Nagar	21.43	44.29	20.00	14.29	100
Nagla Ramoli	40	44	12	4	100

Source: Compiled from Impact Assessment survey data

At the time of the Baseline survey the sex ratio was 894 in Shri Nagar and 914 in neighbouring Nagla Ramoli. The child sex ratio at 855 in Shri Nagar needs attention. In contrast the child sex ratio in neighbouring Nagla Ramoli was 1000 (Table 2.3). However these estimates have not been adjusted for migration.

Table 2.3: Population and Sex Ratio in Shri Nagar and Nagla Ramoli

Name of Village	Shri Nagar		Nagla Ramoli	
	Child (0-6 years)	Total Population	Child (0-6 years)	Total Population
Males	55	274	18	81
Females	47	245	18	74
Sex Ratio (FMR)	855	894	1000	914

Source: Compiled from Baseline survey data

Lighting and Energy: Project Impact

Solar light reached these villages just two years ago (Diwali 2006), a few days before our first field visit. The community in both villages was ecstatic. Information regarding the solar home lights, streetlights, biogas and gasifier systems installed in the two villages is presented in Table 2.4. All the households were provided with solar home lighting systems and all 70 households in Shri Nagar and 25 households in Nagla Ramoli stated that they valued the solar home lighting system through which 2 light points have been provided in each house. 27.14% households in Shri Nagar and 12% households in Nagla Ramoli reported getting electricity from the Gasifier as well (Table 2.5). However, all households in Shri Nagar also use a kerosene lamp. Three streetlights installed through the project were functional in each of the villages. During the Focus Group Discussion with the community it was mentioned that among the many benefits of the streetlight were fewer accidents and reduction in theft. Cost and capacity of solar lighting systems are presented in Tables 2.6 and 2.7.

Table 2.4: Renewable Energy Interventions in Shri Nagar and Nagla Ramoli (Numbers)

Name of Village/ Source of Lighting	Solar Home Light	Solar Street Light	Bio Gas	Gasifier
Shri Nagar	70	3	6 (Benefited 18 households)	One
Nagla Ramoli	25	3	6 (Benefited 16 households)	One

Source: Compiled from Impact Assessment survey data

Table 2.5: Primary Sources of Lighting in Shri Nagar and Nagla Ramoli

(percent households)

Name of Village/ Source of Lighting	Percent of HHs using Gasifier	Percent of HHs using Solar Home lighting	Percent of HHs using Kerosene Lamp
Shri Nagar	27.14	100	100
Nagla Ramoli	12	100	4

Source: Compiled from Impact Assessment survey data

Table 2.6: Cost and Capacity of Solar Lighting Systems

Name of Village	Panel Capacity (*in Wp per unit*)	Cost per unit (*in Rs.*)	Battery size (in *Volts*)	No. of units disseminated
Shri Nagar	12 Volt + 37 watt	13200	12 Volt. 40 Ah	70
Nagla Ramoli	12 Volt = 37 Watt	13200	12 Volt. 40 Ah	25
Shri Nagar	170 Watts	24200	12 Volt	3
Nagla Ramoli	170 Watts	24200	12 Volt	3

Source: Lupin Human Welfare and Research Foundation, Bharatpur

Six Gobar gas plants of 4 cubic metre capacity have been constructed in Shri Nagar and five Gobar gas plants of 4 cubic metre capacity and one of 2 cubic metre capacity have been constructed in Nagla Ramoli. 34 households derive the benefit from Gobar gas for cooking purposes. 18 households own the six Gobar gas plants constructed in Shri Nagar while 16 households own the six Gobar gas plants in Nagla Ramoli. The slurry is used as fertilizer. During the survey, some of the beneficiary households mentioned several advantages such as ease of use, smoke-free environment, eyes not hurting and the house not getting blackened. Other benefits are saving of time spent by women in collecting firewood and reduction of drudgery as the inefficient burning and the inhaling of the pollutants from use of fuel wood for cooking leads to illness and premature death. The limitation of biogas is that if less than the optimal amount of dung is put into the unit, functioning is inefficient. More importantly, only houses with animals can avail of this. Since a subsidy is provided by the project, questions of equitable use of the subsidy need attention.

Table 2.7: Renewable Energy Interventions in Shri Nagar and Nagla Ramoli: Capacity per unit

Type of Interventions	Capacity per unit		Total no. of units installed in the cluster
	Capacity	Unit	
Biomass Gasifier	10	kW	2
Solar home lighting system	37	Wp	95
Solar Street Light	170	Wp	06
Biogas plant	4 2	M^3 M^3	11 01
Total			12

Source: Lupin Human Welfare and Research Foundation, Bharatpur

Dependence on fuel wood and dung cake for cooking purpose has halved in Nagla Ramoli and decreased in Shri Nagar after the project was initiated. 38.57% households used fuel wood and 55.71% households additionally used dung cake for cooking in Shri Nagar before the project was initiated. Now 34% households use fuel wood and 57.14% households also use dungcake for cooking. The reduction in dependence on fuel wood is significant in Nagla Ramoli where use of fuel wood declined from 76% to 32% households before the project was initiated to half after the project was implemented (Table 2.8).

Table 2.8: Use of Energy for Domestic Consumption in Shri Nagar and Nagla Ramoli

(percent households)

Percentage of HHs Using different Energy sources for Household Consumption						
Energy use in		Fuel wood	Fuel wood and Dung Cake	Kerosene, Fuel wood	Solar energy, Kerosene	Biomas Gasifier, Gobar gas
Cooking						
Shri Nagar	Before	38.57	55.71	1.43	0.00	0.00
	After	34	57.14	0.00	1.43	17.14
Nagla Ramoli	Before	100.00	0.00	0.00	0.00	0.00
	After	52.00	0.00	0.00	0.00	48.00
Heating Water						
Shri Nagar	Before		2.86		0	0
	After		2.86		1.43	4.29
Space Heating						
Shri Nagar	Before				0	0
	After				1.43	1.43

Source: Compiled from Impact Assessment survey data

Women generally collect fuel wood and crop residue in both the villages and it is collected from a distance of 1 k.m.

Health and Education: Project Impact

There is no Primary Health Centre (PHC) in the village; the nearest PHC is located at a distance of 7 kms from the village at Khedali Gadaria. A Doctor and ANM are reportedly available at the PHC. 40% households in Shri Nagar have access to medical care and institutional delivery in a hospital. 36% households in Nagla Ramoli have benefited through the Janani Surakshya Yojana (maternity benefits), 24% households have access to medical care and institutional delivery at the hospital. None of the households reported benefits from the Special Nutrition Programme (SNP). The community reported that mobile medical vans do not visit the village. The most common forms of illness in the village are fever, common cold and cough. Some households reported asthma, jaundice (pilia) and typhoid as common diseases.

A Health Camp was organized by the Implementing Agency on 9th September, 2008 in the Middle School, Shri Nagar for the residents of both villages. 85 persons, including men, women and children from Shri Nagar and 48 from Nagla Ramoli received treatment and advice. Treatment/advice was given for Malaria (4 positive cases), 2 women for Pregnancy, 21 women for UTI, 16 persons for ENT and 82 for general diseases. Two women were referred to the CHC, Bayana. A Health Camp was also organized for animals at Shrinagar on 4th September, 2008 and 105 animals were treated.

Therefore, 37.14% households in Shri Nagar and 60% in Nagla Ramoli reported that health facilities have improved in the village after the project was started (Table 2.9).

Table 2.9: Improvement in Access to Education and Health in Shri Nagar and Nagla Ramoli (percent households)

Name of Village	Education	Health
Shri Nagar	64.29	37.14
Nagla Ramoli	88	60

Source: Compiled from Impact Assessment survey data

Shri Nagar has a Middle school. Regular mid-day meals and books are provided to the students in the school. Uniform is not provided in the school. For analyzing the status of education among the households surveyed in Shri Nagar, the total population in each of the villages was divided into two groups based on age, i.e., children aged 5 to 17 years, and adults i.e., aged 18 years and above. 87.98% of children in Shri Nagar and 92.35% children in Nagla Ramoli in the age group 5 to 17

years were studying at the time of the Baseline survey. The proportion was 92.94% for boys and 83.67% for girls in Shri Nagar and 93.55% for boys and 90.91% for girls in Nagla Ramoli (Table 2.10).

Table 2.10: Gender-wise proportion of children studying in Shri Nagar and Nagla Ramoli

Name of Village	Children aged 5 to 17 years studying in	
	Shri Nagar	Nagla Ramoli
Males	92.94	93.55
Females	83.67	90.91
Total	87.98	92.45

Source: Compiled from Baseline survey data

The adult (18 and above) literacy rate is 49.24% in Shri Nagar and 59.65 in Nagla Ramoli (Table 2.11). Shri Nagar has very low female literacy at 18.18% while male literacy rate is 75.52%. Nagla Ramoli has significantly higher male and female literacy at 88.89% and 46.15% respectively.

Table 2.11: Adult Literacy in Shri Nagar and Nagla Ramoli (percent)

Name of Village	Shri Nagar	Nagla Ramoli
Males	75.52	88.89
Females	18.18	46.15
Total	49.24	59.65

Source: Compiled from Baseline survey data

In an effort to build capacity and raise awareness, the Implementing Agency had initiated a large number of social development activities. These include the following:

In Shri Nagar

- Accident Insurance cover provided to all 70 families (100%).
- Jhonpadi Bima Yojana to 11 families.
- Four Womens Self Help Groups established.
- Two Youth Self Help Groups established.
- Two Solar Light Sustainability Groups established that have deposited Rs.24500/-.
- 15 women taken on Exposure Visit for Tulsi Mala making.
- One Workshop Organized with Line Department.
- 100% children in School.
- One Health Camp organised in which 99 patients were treated.
- Five households benefited from Beti Ek Anmol Rattan Campaign.
- A Village Development Committee established.

In Nagla Ramoli

- Accidental Insurance to all 25 families (100%).

- Jhonpadi Bima Yojana to 11 families.
- Two Women Self Help Groups established.
- 100% Children at School.
- Exposure Visit at CIRG Makhdoom.
- Five households benefited from Beti Ek Anmol Rattan Campaign.

Basic Infrastructure: Project Impact

At the time of the Baseline survey, there was no road connectivity to these villages. The Implementing Agency helped procure funds from the M.P.L.A.D. for construction of a link road in Shri Nagar and that has been constructed. Under NREGA the community is now constructing additional access roads. The number of pucca houses increased from 34.29% to 38.57%, and the number of semi-pucca houses from 22.86% to 27.14% (Table 2.12). Solar streetlights have been provided for the community through the project. A Gasifier shed has been constructed for housing the Gasifier that is owned by the community.

Table 2.12: Access to Basic Infrastructure in Shri Nagar and Nagla Ramoli

(percent households)

Name of Village	Electricity		Water	Road	Other development work in Village
	Gasifier	Solar Home Lighting	Handpump	MPLADS	NREGA
Shri Nagar	12	100	100	100	96
Nagla Ramoli	27.14	100	98.57	100	100

Source: Compiled from Impact Assessment survey data

61 out of 70 households (87.14%) reported that they do not have a kitchen for cooking purposes and they cook food in the open. Only one household has a bathroom in the village. No household has a toilet facility in the village. There is no tap water facility or source of drinking water in the household premise. Women generally fetch water in 94% households in Shri Nagar and 96% households in Nagla Ramoli. All households reported that they fetch water from the well and the quality of water is poor.

Of the few households that have taken loans, most have done so from a bank or money lender or SHG for agricultural activity, purchasing livestock, tractor, income earning opportunities, children's study purpose and marriage.

The following works for **Community Infrastructure Development have been undertaken by Lupin in Shri Nagar:**

- Construction of 2 School Rooms under DPEP.
- Construction of a 200 metre CC Road under Zila Parishad.
- One Deep Bore Well for Drinking Water through PHED.
- Construction of one Drinking Water Supply Tank.
- Digging of New Ponds Under NREGA.
- Additionally, construction of 600 Meter Road from Nagla Ramoli to Shri Nagar is in progress.
- A Milk Collection Centre is being established.

The following **Community Development Works have been undertaken by Lupin in Nagla Ramoli:**

- Construction of Link Road from Farso to Nagla Ramoli for 2 km under MP LAD Scheme

- One Deep Bore Well for Drinking Water under PHED.
- Digging of a New Pond .
- Construction of internal brick pavement road (Kharanja).

Work and Livelihoods: Project Impact

The people of both the villages are largely dependent on agriculture, wage labour and raising livestock for their livelihood. The majority of them grow wheat and bajra while some households also grow mustard. The primary occupation for 63% households in Shri Nagar and 36% households in Nagla Ramoli is agriculture. 17.14% households primarily work as wage labor and 11.43% are in the service sector in Shri Nagar (Table 2.13). Occupational diversification has taken place in Nagla Ramoli where the project has led to a reduction in wage labour and an increase in livestock rearing, services and joining the army.

Table 2.13: Livelihoods and Work (Primary Occupation) in Shri Nagar and Nagla Ramoli (percent households)

Name of Village		Agriculture	Livestock	Agriculture/Livestock/Service	Wage labour	Contractor	Business	Service	Army
Shri Nagar	Before	62.86		2.86	17.14	1.43	1.43	11.43	
	After	62.86		2.86	17.14	1.43	1.43	11.43	
Nagla Ramoli	Before	36	0		32		8	24	0
	After	36	8		24		0	28	4

Source: Compiled from Impact Assessment survey data

In order to provide income earning opportunities for households, the following machinery has been installed for livelihood generation/enterprise development in the two villages (Table 2.14).

Table 2.14: Motive Power based Machinery for Income Generation in Shri Nagar and Nagla Ramoli

Type of Interventions		Capacity per unit		Total no. of units installed in the cluster
		Capacity	Unit	
a.	Flour Mill	7.5	H.P.	02
b.	Masala Grinding Machine	5	H.P.	01
c.	Electric Motor and Starter Etc. for lift irrigation	7.5	H.P.	01
d.	Garment making (Sewing Machine)	-	-	05

Source Lupin Human Welfare and Research Foundation, Bharatpur

Support for income generating activities has been provided through the project to the following:

In Shri Nagar

- Shri Dalchand: Flour Mill
- Shri Shivcharan: Masala Grinding Machine
- Shri Nirbhay: Bandbaja
- Shri Sunder Singh: Grocery Shop/ General Store
- Shri Ram Swarup: Grocery Shop/ General Store
- Dress Making and Tulsi Mala Training to 13 women
- Four Sewing Machines for women who received training.
- Murrah Buffaloes to 14 Households in Shri Nagar
- Ber fruit plants were given to 8 people in Shri Nagar.

In Nagla Ramoli

- Shri Morarjilal: Flour Mill
- Shri Uday Singh: Camel Cart
- Shri Man Singh: Interlock Machine
- Shri Sohan Lal: General Store
- Shri Babulal - Agriculture, Tubewell
- 9 households were supported in starting goats units
- 8 households were supported in getting Murrah Buffaloes
- One Tube well
- 2 sewing machines

At the time of the Baseline survey, households did not report benefits from any work related government scheme. However at the time of the Impact Assessment, 85% of households reported benefits from the NREGS and creation of community infrastructure.

Gender Empowerment

There has never been a women sarpanch in the Gram Panchayat either before or after the project was initiated (Table 2.15). At the time of the Baseline survey a Village Development Committee comprising 9 members existed in Nagla Ramoli. 8 of the members were men while the VDC formed

in Shri Nagar had 15 members, all of whom were men. The solar and biogas committees have a large number of women members. There is a functional Women Self Help Group in the village, which was set up in 2006. Women members were trained by the Implementing Agency for making tulsi mala etc through the MNRE-UNDP-FRG project.

Women members do not attend Panchayat meetings and they do not have a right to land/property in the family. Women do not speak in the presence of men nor do they sit on a chair in their presence. The gender development and empowerment related indicators of these villages clearly reflect the disempowerment of women and the lack of development of these villages. A woman social worker is engaged in development and capacity building of the SHG so implementation of the project has led to initial levels of awareness of gender issues and building of capacity.

Table 2.15: Involvement of Women in Decision Making in Shri Nagar and Nagla Ramoli (percent households)

Name of Village		Presence of Woman Sarpanch	Are Women in Committees	Women participate in Decision making
Nagla Ramoli	Before	0	0	0
	After	0	100	44
Shri Nagar	Before	0	0	0
	After	0	97.14	14.29

Source: Compiled from Impact Assessment survey data

Quality of Life

The very poor quality of water is a cause of distress in both the villages. Most households reported that the quality of water from the hand pumps is salty and is not fit to drink. 88.57% households in Shri Nagar and all households in Nagla Ramoli stated that the village is poor and does not have access to safe drinking water or sanitation.

Lack of employment opportunities is causing considerable concern in both the villages and 78.57% households in Shri Nagar raised this issue. 44% households in Nagla Ramoli reported that family members were in search of employment. A few educated youth were demanding jobs at the time of the survey.

Health facilities are dissatisfactory. 47.14% households were dissatisfied with the health facilities in Shri Nagar and found them poor (Table 2.16).

Table 2.16: Community Perception regarding Improvement in Quality of Life after Implementation of the Project in Shri Nagar and Nagla Ramoli (percent households)

Name of Village		Health	Education	Food Security	Water	Sanitation	Cooking needs	Lighting needs	Road	Employment and Livelihood
Shri Nagar	HS	0.00	7.14	1.43	0.00	0.00	1.43	1.43	0.00	0.00
	S	52.86	80.00	87.14	32.86	10.00	88.57	97.14	14.29	21.43
	P	47.14	12.86	11.43	67.14	88.57	10.00	1.43	85.71	78.57
Nagla Ramoli	HS	0	8	0	0	0	16	28	0	8
	S	96	84	96	20	0	84	72	96	48
	P	4	8	4	80	100	0	0	4	44

Source: Compiled from Impact Assessment survey data
Note: HS: Highly Satisfactory, S: Satisfactory, P: Not satisfactory/poor

There was considerable satisfaction with the lighting facility in the village and 97.14% households in Shri Nagar reported that there is better lighting facility in the village while 84% households in Nagla Ramoli felt that the educational status of the children had improved due to better lighting facility and schooling. Households that have been provided biogas are satisfied with it.

While there is satisfaction with the roads that have been constructed, the access to the village remains poor and pucca roads need to be constructed.

All the households have reported that they get adequate food throughout the year.

Overall Project Achievements in Bharatpur

- All the households have been provided fixed solar units for lighting purpose.
- The solar light has enabled children to study at night and improved access to education.
- Six Solar Street Lights have been fixed in the two villages.
- Gasifier sheds have been constructed in both the villages.
- Two Gasifiers (10 kW) have been installed (one in each of the two villages) for providing motive power for income generation activities such as lift irrigation, masala grinding, flour mill etc
- One household is using electricity from the gasifier for running a flour mill and thereby earning money from grinding the flour.
- One household is using electricity from the gasifier for running a Masala Grinding Unit.
- Subsidy has been provided to two Flour Mills, two General Store Shops; one Masala Grinding enterprise; one Band Baja enterprise; one Dress Making enterprise; an Interlock Machine; lift irrigation for agriculture; and Murrah Buffaloes to 22 households.
- Tulsi Mala Training was provided to 13 women;
- Expenditure on purchasing kerosene for lighting and cooking purpose has declined after the project was initiated.

- Eleven group owned/and one individually owned biogas plants have been provided to 34 households for cooking. This has reduced drudgery and saved women from problems due to inhaling smoke and irritation to the eyes as also saved time required for cooking.
- Fewer accidents and theft occur as 6 solar streetlights have been fixed in the villages and solar lights at home.

Non-Energy Based Activities

- Livestock raising: 22 households have been provided with a buffalo. This yields milk and ghee and the household income has increased through the livestock rearing.
- Goat rearing: 13 households have been provided with four goats each for generation of income.
- The nutritional status of the children and family members has been enhanced due to availability of milk for household consumption.
- Some households have benefited through the Janani Surakshya Yojana (JNM).
- Some households have benefited from livestock insurance.
- Accident Insurance cover to all the 95 families in the two villages
- Jhonpadi Bima Yojana to 22 families
- Ten households benefited from Beti Ek Anmol Rattan Campaign
- One Health Camp organised in which 133 patients were treated.
- Construction of 2 School Rooms under DPEP.
- Construction of a 200 metre CC Road.
- Two Deep Bore Wells for Drinking Water through PHED.
- Construction of one Drinking Water Supply Tank.
- Digging of two New Ponds Under NREGA.
- Construction of internal brick pavement (Road).

Capacity Building Measures:

- Training for running the Gasifier was provided to one person in the village
- Nine Women Self Help Groups established (WSHG)
- 15 women taken on Exposure Visit for Tulsi Mala making
- Two Youth Self Help Groups established
- Two Solar Light Sustainability Groups established have a deposit of Rs.24500/-
- Awareness of the community was raised through exposure training at Jind, Haryana, for learning how to rear buffalos and goats etc.
- One Workshop Organized with Line Department.
- All children in School

Overall Challenges faced by the Project in Bharatpur

- Risk averse nature of the community and difficulty in risking money in investments that may not yield even the amount equivalent to the casual wage rate. For this reason and for additional reasons, such as difficulty in trusting others, the project could not be implemented in the Dholpur villages, where professional dacoits who have been rehabilitated, reside.

- The major issue in the village is related to water. Water is salty and not fit for drinking.
- Poor sanitation facilities.
- Water borne diseases are to be found in both the Bharatpur villages.
- Regular livestock insurance for all.
- It is difficult to get biomass for running the gasifier and technical problems occur due to overload and wet wood.
- The Gasifier in Shri Nagar was not working when we visited the village for the Impact Assessment. The community blamed the technology. However during our visit to neighbouring Nagla Ramoli, the Gasifier purchased from the same company had worked without any problems since the day it was installed. One reason for problems faced in running the Gasifier in Shri Nagar is that the person who had received the training has been ill. An additional reason is the lack of understanding of the importance of feeding small size of wood pieces with low moisture content.
- Villagers have to collectively contribute to run the gasifier for getting water for lift irrigation.
- Only houses owning animals can avail of the community biogas plant. Since a subsidy is provided by the project, questions of equitable use of the subsidy need attention.
- There have been problems with the functioning of the Gasifier such as tripping because of overload.
- The Biogas plant has the best technology and construction but villagers have to get used to providing adequate cowdung for optimal output. It requires an input of 100 kg of cowdung. If instead of 100 kg. only 60 or 70 kg are supplied, the biogas plant will work below optimum.
- Issues of payment by the village to the technician need to be decided by the community to ensure sustainability.
- Ensuring sustainable and equitable use of the motive power from the Gasifier for generating livelihoods.

Photo 2.1: Focus Group Discussion with the Community at Shri Nagar village

Photo 2.2: Solar Street Light, Shri Nagar village

Photo 2.3: Gobargas Plant at Shri Nagar

Photo 2.4: Dried Chillies to be processed through the Grinding Machine based on motive power from the Gasifier at Shri Nagar village

Photo 2.5: Gobargas Stove in a house at Shri Nagar

Photo 2.6: Biomass Gasifier installed at Shri Nagar

Photo 2.7: Biomass collected by village community for Gasifier, Shri Nagar

Photo 2.8: Digging a pond through NREGA at Shri Nagar

Photo 2.9: Solar home lighting system fixed in one of the houses in Shri Nagar

Photo 2.10: Facilitating the generation of livelihoods through a Kirana shop in Shri Nagar

Photo 2.11: A Kirana shop in Shri Nagar village supported for income generation

Photo 2.12: Running Atta Chakki in Shri Nagar

Photo 2.13: Focus Group Discussion with the village community at Nagla Ramoli

Photo 2.14: Gasifier Shed with fully functional Gasifier at Nagla Ramoli

Photo 2.15: Atta Chakki using motive power from the Gasifier, Nagla Ramoli

Photo 2.16: Atta Chakki converting Wheat into Flour at Nagla Ramoli

Photo 2.17: Filling household questionnaires at Nagla Ramoli village

Photo 2.18: Meeting with women at Nagla Ramoli

3. District Baran (Rajasthan): Ledra and Sanwara

Location and Demographics

SWRC-Sankalp is the Implementing Agency for the MNRE-UNDP-FRG project in two villages, Sanwara and Ledra in Shahbad block of Baran district, Rajasthan. Sanwara is at a distance of about 40 km from Shahbad and 55 km from Mamoni. Ledra is 37 km from Shahbad. The first field visit to the two villages was conducted a few months after a Gasifier was installed in Sanwara in 2006. The road to the village comprised of stones and even with the jeep being driven at a speed of 5 to 10 km per hour, the drive was difficult. Transporting the Gasifier machinery to the village on this road must have been a severe challenge for the Implementing Agency as well as an achievement for it.

Migration is a coping strategy in these villages and it is therefore difficult to accurately determine the number of households at any time. The number of households in Sanwara has varied between 136 and 149 at different times, and was around 74 for Ledra. At the time of the Baseline survey, 126 households in Sanwara were Sahariyas, a Primitive Tribal Group. Most of the remaining households were OBCs and 2 households belonged to the general category. All the households in Ledra belong to the Sahariya Tribe.

Table 3.1: Caste/Tribe, Population and Poverty Status in Sanwara and Ledra

Name of Village	Sanwara	Ledra
Total Households	149	74
Population	734	426
Men	357	377
Women	204	222
Female Male Ratio	0.95	0.92
Scheduled Tribes (Sahariya PTG)	126	74
BPL / AAY	126	74
Debt per household	Rs 4144	Rs 3769

Source: SWRC-Sankalp Survey

These are remote, poverty stricken, multi-dimensionally deprived and inhospitable villages. 88 households in Sanwara and 51 households in Ledra were interviewed during the Impact Assessment. Almost all the households in both the villages are poor (Table 3.1). During the Impact Assessment it was found that the Implementing Agency has facilitated almost all the households in getting Antyodaya cards.

Table 3.2: Household Size in Sanwara and Ledra (percent)

Name of Village/Household Size	1 to 5	6 to 8	9 to 12	13 to 23	All
Sanwara	43.18	47.73	7.95	1.14	100
Ledra	56.86	39.22	3.92	0	100

Source: Compiled from Impact Assessment survey data

Table 3.2 shows the size-wise distribution of the surveyed households based on information available at the time of the Impact Assessment survey. Around 39.22% and 47.73% households in Ledra and Sanwara respectively, have between 6 to 8 members while 9% households in Sanwara and 4% in Ledra have more than 9 members.

Lighting and Energy: Project Status, Interventions and Impact

A Gasifier of 46 kW was installed at Sanwara in March 2006 and then at Ledra in October 2007, with the objective of providing light and enhancing incomes and livelihood opportunities. A shed was constructed in Sanwara and a Gasifier plant was installed on 2.5 bighas of land donated by Manthu Sahariya. The Gasifier was inaugurated on 13th April 2006. For each day from 1st August 2006 up to 30th September, 2006 electricity from the Gasifier was supplied to 143 households in Sanwara village for four hours from 7 pm. to 11 p.m. so that they could have power for lighting (Table 3.3). The understanding was that each household would pay Rs.60 per month and provide 50 kg wood per month. However, the community was unwilling to pay this amount so the supply of electricity to households was stopped in October 2006. An exception was made for Diwali. Grid connections also exist in some of the houses but none of the houses are presently electrified either by grid or by the Gasifier as they are not willing to pay for either. Almost all the households in both villages still use a kerosene lamp for lighting. A few households own a solar lantern.

Table 3.3: Renewable Energy Interventions in Sanwara and Ledra

Source of Lighting	Gasifier	Lighting	Motive Power	Home Light through Gasifier
Sanwara	1	√	√	117 in basti + 26 in new colony = 143
Ledra	1	√	√	35

Source: SWRC-Sankalp

Table 3.4: Use of Energy for Cooking in Sanwara and Ledra (percent households)

Name of Village/Energy use in	Fuel wood	Fuel wood and Dung Cake	Kerosene, Dung cake	Kerosene, Fuel wood	Nirdhan Chulha

Sanwara	12.50	20.45	52.27	9.09	26
Ledra	17.65	25.49	19.61	25.49	-

Source: Compiled from Impact Assessment survey data

The surveyed households use primarily fuel wood, dung cake and kerosene for cooking purposes (Table 3.4). Both men and women of the households collect fuel wood and crop residue in Ledra and Sanwara. In Ledra, the villagers have to travel for an average 3 km and spend 4-5 hours to collect fuel wood. In Sanwara, the villagers travel less, around 2 km and spend less time i.e. around 2 hours for fire wood collection.

Work, Livelihoods and Energy: Project Impact

The primary occupation of the people in both villages is agriculture, casual labour and collection of NTFP. For 85.23% households in Sanwara and 86.27% households in Ledra, agriculture is the primary occupation, while wage labour is the main source of livelihood for 11.36% households in Sanwara and 9.8% households in Ledra (Table 3.5).

Table 3.5: Primary Occupation in Sanwara and Ledra (percent households)

Name of Village	Agriculture	Wage labour	Business or Service
Sanwara	85.23	11.36	2.28
Ledra	86.27	9.8	3.92

Source: Compiled from Impact Assessment survey data

Agricutural income is supplemented (secondary occupation) by mainly wage labour, NTFP and for some, raising livestock.

During the Kharif season the farmers grow soyabean, bajra and groundnut. While the crop is primarily rainfall dependent, it needs one or two irrigations if rains stop before 2nd September. During May and June, farmers grow ladyfinger, gourd and fodder. During the Rabi season they grow wheat, gram, mustard. The crop needs 4 to 5 irrigations. Kolughat river flows nearby. It is 8 feet deep and 25 metres wide.

The community in these villages is primarily dependent on agriculture for their livelihood. Based on discussions with the community, the Implementing Agency took the decision to give priority to using the motive power generated by the Gasifier to providing irrigation. The objective was to benefit as many farmers as possible through raising agricultural yields.

Table 3.6: Motive Power based Machinery for Livelihood Generation in Sanwara and Ledra

Name of Village	Type of Interventions	Capacity per unit		Total no. of units installed in the cluster
		Capacity	Unit	
Sanwara	Biomass Gasifier	46	kW	1
Ledra	Biomass Gasifier	46	kW	1
Ledra	Motor pumps for irrigation	10	HP	2
Sanwara	Motor pumps for irrigation	5	HP	3
Sanwara	Motor pumps for irrigation	3	HP	3
Sanwara	Flour mill	7.5	HP	1

Source: Discussions during field visits

From March 2006 till the date of the field visit for Impact Assessment, i.e., 11th October, 2008, the Gasifier had run for a total of 806 hours, and had irrigated 107 bigha of land. On 21st October 2006 the community in Sanwara started using the Gasifier for running the motors for agriculture from 7 am to 6 pm. 6 motors used electricity from the Gasifier for irrigating 107 bigha of land on 32 farms.

i) In October 2006, the Gasifier was used for the last irrigation for Kharif soyabean.

ii) In November 2006, it was used for the first irrigation, pre-sowing, for wheat and then as needed for subsequent irrigation. The Gasifier ran every 20 days for 8 days each time up to March 2007.

iii) However in the 2007-08 agricultural season there was problem and it was run only for a few hours for a few days due to low supply of water and the ban imposed by government on lifting water from natural bodies. The ban meant that the Gasifier could not be used to lift water for irrigation. As a result, yields were low. This was a huge setback to the implementation of the project.

Six motor pumps (Table 3.6) were shared by 32 farmers for irrigating their fields. Badri Lal Sahariya was given charge of a 5 hp motor which irrigates 4 bighas owned by him, 4 bighas owned by Bara Lal, 3 by Ram Dayal, 2 by Ram Swarop and 4 by Gulab Singh. Similarly, Mohan Singh Yadav had responsibility for using a 3 hp motor for irrigating land owned by a group of people; responsibility for a 3 hp motor pump was with Birju Ram Sahariya; a 5 hp motor pump with Diwan Yadav; a 5 hp motor pump with Ram Charan Sahariya and Ghamandi Sahariya with a 5 hp motor pump. Each of them was for group use. Water for irrigation was taken from the river and from a deep open well.

Similarly, in Ledra, the Gasifier plant was established on 2 bighas of land donated by the Gram Panchayat. The Gasifier stated functioning in October 2007 just before State Government imposed a

ban on lifting water from natural water bodies. Two motor pumps of 10 hp each were given to Udham Singh Sahariya for use of a group of farmers for irrigating 80 bighas of land and to Munshi Sahariya for irrigating between 80 to 100 bighas of land.

In each of the two villages a Gram Urja Samiti was formed at the level of the community to look after the maintenance and repair of the Gasifier and a bank account was opened in the name of the Samiti. The total amount collected was Rs 58,400 in Sanwara and Rs 41,243 in Ledra. Most of this has now been spent. In the process of constructing the Gasifier Shed and installing the Gasifier, local employment of 1,515 man-days was generated at an average wage rate of Rs 73.

Based on discussions with the staff and community during a Focus Group Discussion at Sanwara it is estimated that 20 kg of wood/ biomass (besharam) and 2.5 litres of diesel are required to run the Gasifier for 1 hour. In 2006-07, the Gasifier irrigated 107 bighas of land. The average cost of irrigation including cost of wood, diesel, salary of the technician, administrative costs and maintenance was Rs 616.

The alternative is to use diesel for irrigation. The average cost of irrigating one Bigha of land through use of a diesel engine is Rs 1,140 based on the assumption that a diesel engine runs for 4 hours for one irrigation and requires 1.5 litres of diesel per hour. If diesel costs say Rs 38 per litre this works out to Rs 228 per irrigation and therefore Rs 1,140 per bigha for 5 irrigations not including rental and maintenance.

The Gasifier was used to irrigate 107 bighas of land in 2006-07. The land allocation to different crops is shown in Table 3.7 below:

Table 3.7: Land irrigated through Motor Pumps connected to the Gasifier

Crop	**Bigha**
Wheat	94
Mustard	9
Gram	3
Peas	1
Total land irrigated through Gasifier	107

Source: Interviews conducted at the Gasifier Plant during the Impact Assessment survey

During the Focus Group Discussion, farmers reported that when they used diesel engines to irrigate their farms, wheat yields were around 3 to 4 quintals per bigha. Among the reasons cited for low yields were delays in installing the diesel engine, or attempts at cutting costs by reducing the number of irrigations or technical fault with the engine. In the year 2006-07, since there was adequate supply of water at the right time for irrigation, therefore yield of wheat was reportedly an average of 8 quintal per bigha.

Table 3.8: Gasifier and Diesel Engine: Comparing Costs and Returns

Cost and Returns	Diesel	Gasifier
Cost of diesel based irrigation for 107 bighas @ Rs 1140 each	121980	
Cost of diesel engines repair @ Rs 2000 per year for 20 engines	40000	
Cost of using Diesel Engine	161980	
Cost of Gasifier based irrigation for 107 bighas @ Rs 616 per bigha		65912
Cost Difference between Gasifier and Diesel		96068
Increased yield of wheat due to Gasifier is 2 quintals per bigha		
Conservative estimate of increase in yield of wheat (in quintals) for 94 bigha		188
Price of wheat per quintal in Rs		1000
Increase in income from wheat due to use of Gasifier		188000
Increase in Income and Cost Saving due to use of relative to Diesel		284068
Average gain for 32 households from One Rabi Wheat		8877

Source: Discussions with Farmers who Benefited from Use of the Gasifier at Sanwara and with Shri Gajraj, Shri Moti Lal and technicians at the Gasifier Plant during the Impact Assessment survey

The farmers in Sanwara are fully aware of the advantages of using the Gasifier for irrigation. Those owning farms that were irrigated by the 6 motors that are available through the Project, have benefited from their use. Farmers are also aware that 32 households have received an average benefit of more than Rs 8,877 each from wheat (as a conservative estimate) for one rabi crop through use of the Gasifier (Table 3.8).

However, the impact of the project on income and livelihoods suffered a severe setback in 2007-08 as the State Government imposed a ban on the use of river water due to drought. As a result the gasifier could not be used for irrigation. Hence in 2007-08 only 67.5 bighas of land received partial irrigation through the Gasifier in Sanwara.

A Flour Mill was also set up for income generation but is not functioning at present.

The situation was harder for the community in Ledra where the Gasifier has run for only 32 days in its first year of operation and only 56 bigha land received one or two irrigations due to the ban that was imposed.

In the course of installing the gasifier, 1330 days of work were generated at a wage rate of Rs 73 per day. The community was provided home light for only 18 days before the ban was imposed. Hence the community has not understood the value of the Gasifier in the way that the Sahariyas in Sanwara have.

Nursery and Plantation Activity for Enhancing Incomes and Livelihoods

To enable income generation and provide bio-mass for the gasifier units, the Gram Panchayats of Sanwara and Bamangaon have allocated lands for plantation of trees. Plantation activity was initiated in 2006 on 40 bighas of community land in Sanwara and in 2007 on 60 bighas in Ledra.

Table 3.9: Plantation Activity in Sanwara

Plantation Type	Alive	Yield	Gestation	Expected Income in 2011
Amla	400 in 2 hect.	50 kg./plant	5 years	20000xRs.5 =100000
Bamboo	1000 in 2 hect.	5/plant	5 years	5000xRs.25=75000
Khair	1000 in 4 hect.	250gm gum/plant	Current	250xRs.100=25000
Sitaphal	100 in 1 hect.	30 kg./plant	5 years	3500xRs.5=16500
Total				Rs 216500

Source: SWRC-Sankalp

The expected income to the community from the plantation even without value addition is Rs 2,16,500/- (Table 3.9). If value addition activities are undertaken, the returns will increase.

The Implementing Agency has reported that till now, 64,000 plants covering a wide variety of fruit plants, medicinal plants, shady trees and plants for biomass for the Gasifier have been planted. Within 10 hectares, cultivation of medicinal plants has been done for conservation and income generation and also for medication. Many of these medicinal plant species need to be conserved. Some of these plants were developed in the Sanwara nursery.

Nursery and Plantation: Within the Gasifier Plant campus, a women's SHG has been supported in preparing 15,000 plants in a nursery. Fruit plants, medicinal plants and plants needed as biomass for the Gasifier are grown here (Table 3.10). Some of these plants were used for plantation in the pasture land. A group of women has been trained in nursery development, budding and grafting. There is scope for developing grafted plants of amla, guava, pomegranate, etc. There is also scope for generating biomass for Gasifier, which can be purchased by the community contribution.

Table 3.10: Plants Prepared in the Nursery in 2006 for Sanwara Pasture Land Enclosure

S.No:-	Local Name of plants	Area (in acre)
Medicinal Plantation		
1	Guggal	½
2	Sinduri	1
3	Shatawar	1
4	Giloy	1
5	Ashwagandha	2
6	Ratanjot	2
7	Amla	5
Fruit Plants		
1	Karaunda	300 Plants
2	Achar	170 Plants
3	Mahua	300 Plants
4	Sitaphal	1000 Plants
5	Tamarind	5 Plants
Other useful plants		
1	Bamboo	4300 Plants
2	Subabool	2000 Plants
3	Ipomia	4000 Plants
4	Castor	20 Kgs.
5	Karanj	100 Plants
6	Neem	50 Plants

Source: SWRC-Sankalp

NREGS was being implemented in Baran district at the time of the Impact Assessment survey. All the households had been facilitated in getting job cards. 93% of households in Sanwara and 94% households in Ledra reported that they had benefited from NREGS and had worked in various activities such as digging ponds, road construction etc.

Rajas Sangh agents are given the responsibility of buying the minor forest produce collected by the community in return for 6% as commission. Recently a woman from Sanwara has been made an agent. Apart from the income it will generate for her, the village community will be able to sell their produce in the village and will be encouraged to protect and collect NTFP. Government made the payment for the plantation activity and the community in Sanwara earned Rs 1,02,619 and in Ledra Rs 2,02,512, in 2007-08. Under the Demonstration of Soyabean Crop, seeds were distributed to 9 households in Sanwara. Department of Agriculture distributed 36 kits of hybrid seeds in Sanwara and 23 kits in Ledra. Under the Horticulture Mission, 1,080 amla plants were provided to 18 households in Sanwara and 450 amla plants, 18 mango plants and 18 pomegranate plants to 9 households in Ledra. These will yield fruit and income in the future.

Health and Education: Project Impact

SWRC-Sankalp has continuous presence in Sanwara as Lakshman, who is the barefoot technician for the Gasifier, Hari Om and Ramkali live in the Sanwara village, which is the base for work in 5 villages, i.e., Sanwara, Madi Kachar, Patari, Madia Khania and Sandri. They track issues affecting different age groups within the community, such as malnutrition, to facilitate development of the village and provide access to different government schemes such as the ICDS. Through discussions, community awareness is raised regarding a large number of health and education related issues, such as the importance of institutional delivery, immunization programmes, anaemia etc.

85.23% of households surveyed in Sanwara and 78.43% households in Ledra reported that access to health facilities has improved in the village after the project was initiated (Table 3.11). The households of both villages are aware of the importance of immunization and hence all children of the sampled households have been immunized. Similarly in Ledra, 25.49% of the sample households have benefited through the Janani Surakshya Yojana (JSY); 47.06% of the sample households stated that the ANM visits the village.

The PHC is at Kasbathana. The health sub centre has 2 staff, a compounder and a nurse. The Anganwadi center at Sanwara has an Anganwadi worker and helper to track children for malnutrition and immunization. Similarly, at Basheli, near Ledra there is an AWC which provides nutritious food to the village children. 15 children between the ages of 0 to 5 were admitted to Shahbad Nutrition Remedy Centre for nourishment and treatment. A training programme was conducted at Mamoni to explain what is child development? Why is immunization important? What facilities are available? A disability camp was held for which doctors came from Shahbad. They identified 5 persons as disabled, of which 2 get pension @ Rs. 400/- per person.

Table 3.11: Improvement in Access to Education and Health in Sanwara and Ledra

(percent households)

Name of Village	Education	Health
Sanwara	86.36	85.23
Ledra	76.47	78.43

Source: Compiled from Impact Assessment survey data

In both the villages there is a primary school for children. In Ledra, the primary school has 4 teachers. In schools, books are provided to the students under Sarva Shiksha Abhiyan (SSA). There is one Maa Badi in Sanwara. Mid-day meals are also provided to the students of the primary school.

For analyzing the status of education among the households surveyed in Baran villages, the total population in each of the villages was divided into two groups based on age, i.e., children aged 5 to 17 years, and adults i.e., aged 18 years above. 64.86% children in Sanwara and 68.38% of children in Ledra in the age group 5 to 17 years were studying in school. In Sanwara, the proportion was 68.27% for boys and 60.49% for girls and in Ledra, it was 73.33% for boys and 63.16% for girls (Table 3.12).

Table 3.12: Gender-wise proportion of children studying in school in Sanwara and Ledra

	Children aged 15 to 17 studying in	
Name of Village	**Sanwara**	**Ledra**
Males	68.27	73.33
Females	60.49	63.16
Total	64.86	68.38

Source: Compiled from Baseline survey data

The adult (18 years and above) literacy rate was only 14.79 in Sanwara and 31.87 in Ledra (Table 3.13). Female literacy rates were very low in both the villages and are a cause of concern. However, there is a dramatic improvement in the levels of literacy and education of children.

Table 3.13: Adult Literacy in Sanwara and Ledra (percent)

Name of Village	Sanwara	Ledra
Males	18.97	51.09
Females	9.49	12.22
Total	14.79	31.87

Source: Compiled from Baseline survey data

86.36% households surveyed in Sanwara and 76.47% in Ledra have stated that access to education has improved after the project was initiated (Table 3.11). 61.36% households surveyed in Sanwara during the Impact Assessment Survey stated that they are getting benefit from various educational schemes. 89.77% households send all their children to school. 54.55% households stated that the improvement in education is due to the existence of the primary school in the village and SSA. 2.27% households stated that all the members from their family are educated. 62.50% households

stated that children spend more time at school then they did prior to the start of the project. In Ledra, 92.16% of households surveyed at the time of the Impact Assessment stated that they have benefited from the educational programmes and 90.20% benefited from the Sarva Shiksha Abhiyan.

Basic Infrastructure: Project Impact

At the time of the Baseline survey, there was no road connectivity to these villages. During the implementation of the project, construction of roads to these villages was started through PMGSY. While part of the road from Shahbad to Sanwara and Ledra is newly metalled, the 15 km access to the village remains covered with rocky, kachcha road and connectivity remains poor. Villagers have started digging ponds in the villages under NREGA.

The number of kachcha houses has decreased and pucca houses increased because some households got pucca houses under a housing scheme - *Sahariya Awas Nirman Karya Scheme.* A residential colony was constructed for the tribal in both Ledra and Sanwara under the same housing scheme. Streetlights and electricity connections were given from the gasifier. However, the entire investment has been wasted as people are unwilling to live in those houses as a few deaths occurred in the new houses shortly after they started living there the community is not willing to live in the new houses.

The majority of houses i.e., 94.12% households in Ledra and 79.55% households in Sanwara do not have a separate kitchen and food is prepared in the open. None of the households have latrines or bathrooms in these villages.

All the households surveyed in Sanwara and 92.16% in Ledra reported that they do not have a water source in their house. All households in Ledra fetch water from the well and in Sanwara, 97.73% households take water from a hand pump and 1.14% from a well for drinking purposes. In both the villages, women generally fetch water from nearby sources (Table 3.14).

Table 3.14: Access to Basic Infrastructure in Sanwara and Ledra (percent households)

Name of Village	Water		Road	Other development work in Village
	Handpump	Well		NREGA
Sanwara	97.73	1.14	Poor	100
Ledra		100	Poor	100

Source: Compiled from Impact Assessment survey data

In Sanwara, 5.68% households have borrowed money from the local money lender and bank to meet expenditure due to illness, marriage, to purchase a tractor or for agricultural activities. The rate of interest varies from 1% to 5% per month. In Ledra, 7.84% of the sample households have borrowed from various sources like local money lender, bank and from the SHG for purchasing a tractor or for agricultural activities at an average 1% to 2% of monthly interest rate. This is a major achievement for these villages as they suffered starvation just a few years ago.

Food Security

Around 1 percent of households surveyed in Sanwara and none of the households in Ledra have reported food insecurity.

Gender Empowerment

A women is the Sarpanch in both the villages. Women do hold administrative positions and are members of different village development committees like the Jagrat Mahila Sangathan (JMS), Yuva Shakti Sangathan (YSS), Women Self Help Group Committee and Gasifier Committee etc. In both the villages, Women Self Help Groups were set up in 2006 and women members are trained by the Implementing Agency. The School Development and Management Committee has 11 members, which include the Anganwadi worker, ASHA worker, ANM worker, Mid-day meal cook. The remaining Committee members are male. Efforts are made to ensure that all those eligible for Old Age Pension and Widow Pension receive it. On the 6th of each month a meeting is held at Shahbad to follow up all pending cases. If an atrocity is committed against a woman, the Jagrat Mahila Sangthan and Yuva Shakti Sangthan take follow up action. Further, in all such cases, Sankalp facilitates the lodging of an FIR. If an issue cannot be solved locally or if this is a block level problem then the Karya Karta and villagers go to the Manav Adhikar Kendra and they in turn raise the issue with the administrative authorities. The issues raised generally pertain to PDS, Pension, AWW etc.

Quality of Life

The installation of a Gasifier in each of the villages has provided access to light and enhanced the scope for livelihood generation through lift irrigation. Moreover, NREGS has not only created wage

employment in the villages but also helped in creation of infrastructure and assets. Despite all the improvements in access to health, education, livelihood and income generation, and access to government schemes for convergence, the major concerns in both Sanwara and Ledra villages remain water, livelihood and connectivity. All the households in both the villages reported that they were dissatisfied with the state of access to water and roads. Most of the houses in Sanwara use hand pump and well water for drinking and household work and in Ledra households use well water. There is high concentration of salt in the water in this area. 60.23% households in Sanwara and 94.12% households in Ledra were dissatisfied with access to sanitation. 95.45% households in Sanwara and 70.59% households of Ledra think that access to health facilities is poor. The communities were relatively satisfied with access to education and food security. While the households in Sanwara were relatively satisfied with access to employment and livelihood opportunities, those in Ledra were not (Table 3.15).

Table 3.15: Community Perception regarding Improvement in Quality of Life after the Implementation of the Project in Sanwara and Ledra (percent households)

Name of Village		Health	Education	Food Security	Water	Sanitation	Cooking needs	Lighting needs	Road	Employment and Livelihood
Sanwara	HS	2.27	21.59	30.68	0.00	7.95	34.09	3.41	0.00	45.45
	S	2.27	51.14	63.64	0.00	30.68	40.91	22.73	0.00	30.68
	P	95.45	26.14	4.55	98.86	60.23	23.86	71.59	100.00	22.73
Ledra	HS	0.00	1.96	0.00	0.00	0.00	0.00	0.00	0.00	1.96
	S	70.59	49.02	88.24	0.00	5.88	92.16	23.53	0.00	21.57
	P	27.45	49.02	11.76	100.00	94.12	7.84	76.47	100.00	76.47

Source: Compiled from Impact Assessment survey data
Note: HS: Highly Satisfactory, S: Satisfactory, P: Not satisfactory/poor

Unique Features of the Project in Baran

- The conception of the project in Baran is very closely aligned with the overall objectives of the project and this would have been the most successful of all the projects if it had not faced two serious setbacks: the prolonged illness and death of Charu and other persons partnering the project; and the ban imposed by government on lifting water from streams and rivers due to drought in 2007-08.
- A Gasifier was transported to and installed in extremely adverse conditions. Despite this, it has successfully generated an additional income of Rs 8,877 per household for 32 primarily Sahariya primitive tribal households just through use of motive power for irrigating wheat for one rabi crop.
- Trained grassroots engineers were involved in all the construction activities and only local labour (from in and around the village) was used.

- Through discussions with the community in Sanwara, one of the Sahariyas was motivated to give 2.5 bigha of his own land (Malthu Sahariya) for community use for building the Gasifier shed, Nursery, Flour Mill, Vermi-Composting etc.
- The project has sought convergence with a large number of government schemes including plantation of medicinal plants such as Guggal, Sinduri, Shatawar, Giloy, Ashwagandha, Ratanjot, Amla, and also fruit bearing and other useful plants such as Karaunda, Sitaphal, Tamarind, Bamboo, Subabool and Neem. These will yield recurring income for the community.
- Several species are being identified and conserved.
- The community owns the subsidised income generating equipment. The motors are being used to irrigate 107 hectares of land owned by 32 households in Sanwara. Similarly, the benefit was to accrue to a large number of households in Ledra.
- A well of 30-40 feet depth has been dug and the water from this well is used for the nursery and running the Gasifier. The well has been recharged with rainwater.
- With the participation of the community, 10 wells were deepened in Sanwara and 11 in Ledra.
- The project has tried to improve the health situation in the village by monitoring the grades of malnutrition.
- 15 children between the ages of 0 to 5 were admitted to Shahbad Nutrition Remedy Centre for nourishment and treatment.
- Old age pension is given to 30 people @ Rs.400/- per person.
- 10 widows get pension @ 400/- per person.
- A disability camp was held for which doctors came from Shahbad and identified 5 persons as disabled of which 2 get pension @ Rs. 400/- per person.
- Under the Antyodaya scheme the poor are given 35 kg of grain at Rs. 2/- per kg.
- A Cluster Review and Planning Meeting is held on the 4th of each month by the Jagrat Mahila Sangthan and Yuva Shakti Sangthan. If the issue cannot be solved locally or if this is a block level problem then the Karya Karta and villagers go to the Manav Adhikar Kendra (where Reba works) and they in turn raise the issue with the administrative authorities. The issues raised generally pertain to PDS, Pension, AWW.
- 217 job cards were issued under NREGA and employment has been generated and infrastructure and assets created for the community. Joint families split so that children could get separate jobcards from parents.

Achievements

- Income has been increased through use of the Gasifier for irrigation.
- A Gasifier Sanchalan Committee was set up in each of the villages to manage the project. The Gasifier is owned by the community, operated and managed by local Samiti and the grassroots engineers. The operator is paid daily wages. However this has not been sustainable due to exogenous factors due to which the Gasifier could not be used for income generation.
- 40 bigha land was given by Sanwara Gram Panchayat for the Plantation, Medicinal plant cultivation and biomass generation.
- People have paid the cost of diesel, as well as the salary of the local youth who are running the Gasifier and waste biomass required for running the Gasifier.

- 60 bigha pasture land has been given by Gram Panchayat in Ledra for plantation so as to increase income through land development. The community has made the boundary wall for protection and plantation has been completed.
- 64,000 plants including a wide variety of fruit plants, medicinal plants, shady trees, as well as plants used for biomass for the Gasifier have been planted. Many plants were developed in the Sanwara nursery.
- Medicinal Plants have been cultivated for conservation and income generation as well as for use by the community as medicines
- 20 Barefoot Women Ayurvedic Workers from villages of Shahbad and Kishanganj have been trained in recognizing herbs, shrubs and plants and preparing herbal medicines from them. They also participate in immunization programmes, formation of SHGs, Women Groups and other awareness building activities.
- A woman from Sanwara has been made a Rajas Sangh agent thereby enabling her to get 6% of the value of NTFP as commission and the community to sell their produce in the village.
- Homes have been electrified through the Gasifier. However, this is not being used at present as the community is not contributing the required amount.
- Payment was made by Government for the plantation activity and Rs 1,02,619 was earned by the community in Sanwara and Rs 2,02512 in Ledra, in 2007-08.
- Under the Demonstration of Soyabean Crop, seeds were distributed to 9 households in Sanwara.
- The Department of Agriculture distributed 36 kits of hybrid seeds in Sanwara and 23 kits in Ledra.
- Under the Horticulture Mission, 1,080 amla plants were provided to 18 households in Sanwara and 450 amla plants, 18 mango plants and 18 pomegranate plants to 9 households in Ledra.

Preparation of village community for the Project and Capacity Building:

- SWRC-Sankalp organized an exposure visit of the community to Taragram, District Orcha where Development Alternatives, New Delhi has already established two units of 50 kW in their premises to build capacity and understand how the Gasifier could be used in Sanwara.
- Two local youth, Laxman and Feran from village Sanwara were sent to Bangalore to NETPRO Renewable Energy Systems Pvt. Ltd (from whom the Gasifier was purchased) for one month to learn how to run and maintain it.
- A health sensitisation training programme was conducted at Mamoni.
- A Women SHG was set up and has been supported in preparing 15000 plants in a nursery and have been trained in nursery development, budding and grafting.
- Training has been provided to women in vermi-composting.
- A two day science fair was organized in which 400 hundred children of 8 villages participated.
- Training programmes have been conducted for raising awareness regarding health and education.

Challenges

- If water is not needed for agriculture (for irrigation), the cost of running the Gasifier just for electricity is too high and so people are not willing to pay for this.
- More pumps are needed in order to make optimal use of the Gasifier. The power generated by the Gasifier can be used to irrigate 200 bighas of land but due to shortage of pumps or motors it is being used to irrigate only 107 bighas of land.
- At present, 6 water pumps, electrified through Gasifier, are operating at a time, irrigating 107 agricultural land. These pumps have been provided by SWRC-Sankalp through the MNRE-UNDP-FRG project. The total agricultural land is nearly 400 bighas. More pumps are needed as presently the pumps have to be shifted from one place to another, which is difficult and time consuming.
- Further, the Gasifier has the capacity to run 12 pumps at a time, hence the electricity is being under-utilized and the cost of irrigation can be reduced. If 12 pumps can irrigate at a time, more people will be benefited.
- Streetlights and electricity connections in each home were provided in pucca homes built by the Government for Sahariyas. However two or three Sahariyas died and now none of them are willing to live in those homes and have shifted to kuccha huts.
- The Sahariyas are unwilling to pay for use of electricity
- The persons supplying diesel engines for agriculture try to create problems since running 10 motors through a gasifier costs the same as 1 diesel engine.

Lessons and Suggestions

- Instead of one large Gasifier plant if this could have been divided into two plants of 20 kW and 10 kW that would have been more useful. The 10 kW plant could then be used just to provide electricity to the houses and run the flour etc mills while the 20 kW plant could be used during peak agricultural/irrigation needs. This would also serve as a backup in case one plant needed repair.
- Alternatively, solar should be provided for light and gasifier for livelihood activities such as agriculture.
- Since this technology is completely new to the village, there is need for funds for managing and running the plant for atleast 2 to 3 years till local capacity is built.
- While the Community should run the Gasifier and pay for running costs, yet initially funds for outside management are needed till the systems are established.
- The SWRC-Sankalp Gasifiers have been set up in villages that are very remote and where very poor, primitive, tribal community called Sahariyas, live. Many of them migrate in search of work and are indebted. Moving these communities out of poverty needs time and concerted action.
- Funds are also needed to train local village youth in tasks such as diesel engine repair, motor winding, electricity distribution etc so that livelihoods are generated and dependence for minor repairs gets reduced.
- NTFP processing technology and IGPs need to be started for women
- The project requires 3 persons for checking and maintaining the machinery or management and technical guidance for at least 2 years for the following tasks: (a) when the gasifier is run one person is needed to check each of the motors to ensure that they are connected properly and (b) two operators are needed to feed wood properly into the gasifier

- The MNRE-UNDP-FRG project villages should be treated as special villages and linked with other existing programmes and schemes for convergence. Orchards can be developed in the village for which support of the Horticulture Department will be valuable. Technical expertise is needed for conservation of soil and water and watershed development. Support is required for planting medicinal herbs, adding value and marketing the product. Linkages need to be developed with the PTG schemes of the Rajasthan Government. Finance for small income generation activities, building community assets etc (like pond, forest development, pastureland development) will enable generation of additional income.

Photo 3.1: Gasifier Shed at Sanwara

Photo 3.2: Gasifier Installed at SanwaraVillage

Photo 3.3: Filling questionnaires outside the Gasifier Shed at Sanwara

Photo 3.4: Discussion with the village community at Sanwara

Photo 3.5: Manthu Sahariya who donated land for constructing the Gasifier Shed at Sanwara

Photo 3.6: Discussion with the village community in Ledra

4. District Ajmer (Rajasthan): Balaji ki Dhani and Gudda

Location, and Demographics

The MNRE-UNDP-FRG project has been implemented in two villages in Ajmer district, Balaji ki Dhani and Gudda. The Implementing Agency is SWRC-Manthan. Both the villages are in Sinodiya Gram Panchayat in Silora block of Ajmer district of Rajasthan. Balaji ki Dhani is located at the border of Nagaur and Ajmer districts. The village is about 12 kms from the nearest town of Mithidi. The majority of the households belong to the Meghwal or Scheduled Caste. There were a total of 32 households in the village at the time of the Baseline survey. The second village where the project is being implemented is Gudda, located about 15 kms away from the nearest town of Badhun. Most of the households belong to the Gujjar community. There are 143 households in the village out of which 101 were present during the Baseline survey; the rest had out-migrated. 13% of households in Balaji ki Dhani and 9% of households in Gudda have BPL cards (Table 4.1).

These are non-electrified, poor and multi-dimensionally deprived villages located in the desert of Rajasthan. People are dependent on rain-fed agriculture, livestock and casual labour for their livelihood. Given the lack of biomass and water resources in the area, neither gasifier based livelihood generation nor livelihoods based on motive power from small hydro power stations are an option. Solar provides light and improves the quality of life but livelihood generation in remote, deprived, poor, un-electrified desert villages remains a challenge.

Table 4.1: Caste/Tribe and Poverty Status in Balaji ki Dhani and Gudda

(percent households)

Caste and Poverty Status	Balaji ki Dhani	Gudda
Scheduled Caste	47.83	0
Gujjar/OBC	30.43	100
Jat/OBC	21.74	0
Below the Poverty Line	13.04	8.82
Without card	0	1.47

Source: Compiled from Impact Assessment survey data

Household Level Analysis

Table 4.2 shows the size-wise distribution of the households surveyed based on information collected during the Impact Assessment survey for the 23 households in Balaji ki Dhani and 68 households in Gudda. Around 30% of households in Balaji ki Dhani and 47% of households in

Gudda have between 6 and 8 members. 30% households in Balaji ki Dhani and 25% in Gudda have more than 9 members.

Table 4.2: Household Size in Balaji ki Dhani and Gudda (percent)

Name of Village/Household Size	1 to 5	6 to 8	9 to 12	13 to 23	All
Balaji ki Dhani	39.13	30.43	26.09	4.35	100
Gudda	27.94	47.06	20.59	4.41	100

Source: Compiled from Impact Assessment survey data

The Baseline survey showed that the sex ratio in Balaji ki Dhani was extremely low at 798 and this needs attention. The sex ratio in Gudda is 938. The child sex ratio is 900 in Balaji ki Dhani and 942 in Gudda (Table 4.3). However these estimates have not been adjusted for migration.

Table 4.3: Population and Sex Ratio in Balaji ki Dhani and Gudda

Name of Village	Balaji ki Dhani		Gudda	
	Child (0-6 years)	Total Population	Child (0-6 years)	Total Population
Males	20	109	52	338
Females	18	87	49	317
Sex Ratio (FMR)	900	798	942	938

Source: Compiled from Baseline survey data

Lighting and Energy: Project Impact

Through the MNRE-UNDP-FRG project, SWRC-Manthan distributed solar lanterns to 23 households in Balaji ki Dhani and 77 households in Gudda in 2005 (Table 4.4). 22 out of the 23 households in Balaji ki Dhani and 52 of the 77 households in Gudda that had received solar lanterns were interviewed at the time of the Baseline survey in 2007. 19 of the 23 households who received solar lanterns in Balaji ki Dhani and 62 out of the 77 households who received solar lanterns in Gudda were interviewed during the Impact Assessment survey in 2008. However, all these households were still using the solar lanterns though some reported that they needed to replace the battery or fuse. Replacement is based on voluntary contribution. Some households contributed Rs.1000/- at one time while others have contributed Rs. 25 per month towards maintainance and repair. The battery costs Rs.650/- (earlier Rs.400/-). 10 other households have asked for a solar lantern.

Table 4.4: Renewable Energy Interventions in Balaji ki Dhani and Gudda

Name of Village	**Panel Capacity** (*in Wp per unit*)	**Cost per unit** (*in Rs.*)	**Battery size** (in *Volts*)	**No. of units disseminated**	**Total cost** (*cost per unit * no. of units*)
Balaji ki Dhani				23	4000/- x 100 = 4 lakhs
Gudda	10 WP	4000/-	7 AH	77	
RO Plant	2.5 kWP	16 lakhs			16 lakhs
Total				100	20 lakhs

Source: SWRC-Manthan

In Balaji ki Dhani and Gudda, around 82% and 91% (respectively) households interviewed during the Impact Assessment survey are using a solar lantern as the primary source of lighting (Table 4.5). A large number of households are still dependent on a kerosene lamp for lighting purposes. Being remotely located, there is almost no grid electricity supply or connectivity in Balaji ki Dhani. The grid has reached Gudda since it is now on a newly constructed road but only one household has an electricity connection.

Table 4.5: Primary Sources of Lighting in Balaji ki Dhani and Gudda

(percent households)

Name of Village/ Source of Lighting	**Solar Lantern**	**Kerosene lamp**
Balaji ki Dhani	82.61	69.57
Gudda	91.18	26.47

Source: Compiled from Impact Assessment survey data

During a Focus Group Discussion with the community at Balaji ki Dhani, the following were reported as benefits to the community through use of the solar lantern:

- Reduction in accidents due to light.
- Increase in ability of children to study after dark.
- Very helpful in delivering pregnant animals especially at night.
- Income earning opportunities have increased, as it is possible to earn additional income through working at night. For instance, Rs.100 can be earned from filling a trolley and with the solar lantern it is possible to fill the trolley after dinner.
- Earlier cattle would eat and destroy the crop. Now it is possible to take the solar lantern and go to the field at night.
- The lantern is very useful while cooking and in domestic work.
- The solar lantern has made it possible for the community to sit together and take joint decisions eg. payment for the replacement of the solar battery.
- Petromax lighting used at weddings costs Rs.50 to 80/night. Now with the solar lantern that expenditure has been saved.
- A kerosene chimney gets blown out by the wind and has to be re-lighted, while a solar lantern does not.

- If the tractor has a problem the light from the solar lantern can be used to fix it.
- It is possible to see snakes and insects (keeda) and avoid stepping on them at night.

In Kotri village, Ajmer and Solavata, Jaipur district, a 2.5 kW solar photovoltaic plant has been installed for running a Reverse Osmosis (RO) Plant for providing safe drinking water and for wool shearing. An RO plant does not directly augment income. However, poor quality of water has serious health related ramifications. Those who live in poverty or marginally above the poverty line cannot afford to take time off from work in case of ill health. The food that they and their families eat depends on the money earned from working that day (Mehta and Menon, 2001). It is estimated that in India 21 per cent of all communicable diseases (11.5 per cent of all diseases) are water related and every year 1.5 million children under 5 years die in India of water related diseases and the country loses 1800 million person hours (over 200 million person days) each year due to water borne diseases (Parikh, 1999-2000).

The water available in about 100 villages around Sambhar lake is unfit for drinking. The potable sources have dried up and the water supplied is brackish. According to SWRC reports, on testing the water contained total dissolved solids in concentrations ranging from 4000 to 6000 milligrams per litre. “This poor quality of water has led to stunted growth of children, various skin ailments, physiological problems and no agricultural produce since the salinity is not conducive for taking even a rainfed crop.”

Kotri, where SWRC-Manthan is located is 10 miles from the Sambhar Lake. The RO plant has been installed with the help of scientists from the Central Salt and Marine Chemical Research Institute (CSMCRI) at Kotri. The brackish water coming to the village through the government pipelines pumped through the RO plant and stored in a 5,000 litre tank. The community collects the safe drinking water from Kotri at a nominal charge per month. However, safe drinking water is yet to be provided to Balaji ki Dhani and Gudda. Kotri is too far from these villages for the RO plant to be accessible on a daily basis.

Both the Ajmer villages use fuel wood, dung cake and kerosene for cooking purposes. There has been no change in the use of energy for household consumption before and after the project was implemented. In Balaji ki Dhani, 17% households were using fuel wood and 22% and 35%

households additionally used dung cake or kerosene with it for cooking purposes. The rest of the households used kerosene and dung cake. In Gudda, for cooking food, 54% households were using kerosene and fuel wood while 38% households were using just fuel wood. The remaining households used dung cake with either fuel wood or kerosene (Table 4.6).

Table 4.6: Use of Energy in Cooking in Balaji ki Dhani and Gudda (percent households)

Name of Village/ Households using	Fuel wood	Fuel wood and Dung cake	Kerosene and Dung cake	Kerosene and Fuel wood
Balaji ki Dhani	17.39	21.74	26.09	34.78
Gudda	38.24	5.88	1.47	54.41

Source: Compiled from Impact Assessment survey data

In both Balaji ki Dhani and Gudda, women collect fuel wood and other crop residue from an average 1 to 2 km distance and it takes around 1 to 2 hours average time. In both the villages, the use of energy sources in household consumption has not changed after the initiation of the project.

Health and Education: Project Impact

There is no Primary Health Centre (PHC) in either Balaji ki Dhani or Gudda. The nearest PHC is located at a distance of 20 kms from the Balaji ki Dhani at Naba and is at Bhadun for Gudda. There is a health sub-centre at Mithidi, which is 12 kms from Balaji ki Dhani. The PHC has medicines but no testing facilities. 2 doctors and 1 Auxiliary Nurse Midwife (ANM) are present at the PHC at Naba and 1 doctor and 1 ANM at Badhun. Doctors do not visit the village. However, the ANM visits the village on the 6 health days, and distributes medicines according to requirements to the villagers. Under conditions of emergency, the patients from Balaji ki Dhani are referred to a bigger city hospital at Ajmer and from Gudda to private hospitals in Parbatsar, which is nearly 30 kms from the village.

All the households in Balaji ki Dhani are aware of the importance of immunization, and hence all children have reportedly been immunized. Each month a Mahila Samuha meeting is held and the community is told about health related issues and the importance of inoculation or teeka karan, infant care, pregnancy etc. During the Impact Assessment survey, around 39% households acknowledged that the health facilities have improved in the village after the project was initiated (Table 4.7). 9% households stated that the ANM visits the village and 30% families have benefitted

from pulse polio programme in the village. However, none of the households have reported benefits from the Special Nutrition Programme (SNP). Respondents reported the occurrence of skin disease, boils, tuberculosis and malaria. While none of the households reported access to institutional health delivery at the time of the Baseline survey or even awareness of other health related programmes such as RCHR, TB Eradication Program etc, there was a significant improvement in this village at the time of the Impact Assessment survey. Four households had benefited from the Janani Suraksha Yojana.

In contrast, some of the children in Gudda have not been immunized. However, benefit from the Special Nutrition Programme (SNP) has been reported. The most common diseases in the village are common cold, fever, skin disease and boils. Respondents also reported tuberculosis and malaria as common diseases. Only 4 (5.88%) of 68 households accepted that health facilities had improved after the project was initiated while 94.12 percent households reported no improvement in the health facilities. Only 3% of sample households stated that they had benefited from Pulse Polio Programme (Table 4.7).

Table 4.7: Improvement in Access to Education and Health in Balaji ki Dhani and Gudda
(percent households)

Name of Village	Education	Health
Balaji ki Dhani	73.91	39.13
Gudda	58.82	5.88

Source: Compiled from Impact Assessment survey data

There was no school in the village. A school was started in the open by SWRC-Manthan before the start of the project. After the MNRE-UNDP-FRG project started a Shiksha Committee was made. Today, both the villages have a primary school, a night school and a Balwadi. In the primary school, books are provided to the students. There is no provision for mid-day meals in the school in Balaji ki Dhani but mid-day meal is served in the primary school in Gudda.

For analyzing the status of education among the households surveyed in Ajmer villages, the total population in each of the villages was divided into two groups based on age, i.e., children aged 5 to 17 years, and adults i.e., aged 18 years and above. 54.10% of children in Balaji ki Dhani and 37.45% of children in Gudda in the age group 5 to 17 years were studying at the time of the Baseline survey.

The proportion was 60% for boys and 46.15% for girls in Balaji ki Dhani and 57.03% for boys and only 17.07% for girls in Gudda (Table 4.8).

Table 4.8: Gender-wise proportion of children studying in School in Balaji ki Dhani and Gudda

Name of Village	Children aged 5 to 17 years studying in	
	Balaji ki Dhani	Gudda
Males	60.00	57.03
Females	46.15	17.07
Total	54.10	37.45

Source: Compiled from Baseline survey data

In Balaji ki Dhani, the adult (18 and above) literacy rate was 32.73% and in Gudda it was only 15.20% at the time of Baseline survey (Table 4.9). The female literacy rate in both the villages is very low and needs attention. In Balaji Ki Dhani, the female literacy rate was as low as 13.04% and in Gudda it is an abysmal 6.67%. The male literacy rate in Balaji ki Dhani and Gudda was 46.88% and 23.16% respectively. There are more frequent conflicts in Gudda related to gender and other issues.

Table 4.9: Adult Literacy in Balaji ki Dhani and Gudda (percent)

Name of Village	Balaji ki Dhani	Gudda
Males	46.88	23.16
Females	13.04	6.67
Total	32.73	15.20

Source: Compiled from Baseline survey data

The Impact Assessment survey data shows that all the children of around 48% households in Balaji ki Dhani and 28% in Gudda go to school. 74% of sample households in Balaji ki Dhani and and 59% in Gudda have reported improvement in access to education after the project was initiated (Table 4.7).

Balaji ki Dhani, Ajmer: Chote Ram's Struggle in Getting an Education

Young Chote Ram lives in Balaji ki Dhani and is 15 years old. He started his education by studying in the school, in the open, on top of the tanka. Today a new school building has been constructed there with the help of SWRC-Manthan. Chote Ram is presently studying in the 10^{th} class and is the first child in this village to reach this level of education. He managed to get 78% marks in the 8^{th} class but got only 55% in the 9^{th} because there was no teacher. Two boys and a girl were studying

with him till the 8th class and then dropped out. He walks for several kilometers and then takes a bus to attend the Royal Academy Secondary School located 13 kilometres from his village. He has to walk 4 km each way and then wait for a bus to take him to school. He leaves home at 5 a.m. and returns from school at 4 p.m. and then has to attend to the tasks required of him such as feeding the livestock. By the time he completes these tasks it is dark. Earlier he used to try and study with the chimney but the light was not adequate and there was smoke. Now with the help of the solar lantern he can study till 11 p.m. or 12 p.m. each night.

However, two young girls who were interviewed had stopped studying after the 5th standard and 8th standard respectively as they were not allowed to travel the distance required to reach school. The Shiksha Samiti meets once a month. During these meetings they decide how many teachers are needed, depending on the number of children attending school; they encourage young children who drop out to attend school and talk to their parents as well; and the salary of the teacher is paid by the Samiti.

Around 31% households of both the villages are benefitting from the schools being run by the Implementing Agency. Further, due to solar lighting provided by the MNRE-UNDP-FRG project, children of 48 % families of Balaji ki Dhani and 29% families of Gudda are able to study at night.

At the time of the first field visit to Balaji ki Dhani, small children were studying on a tanka under the sky and a night school was functioning under a tree. During meetings with the community, one of the elders of the village specially requested that a school be built. During the Impact Assessment survey it was gratifying to see that the Implementing Agency had taken cognizance of this and construction of a school building was close to complete.

In Gudda, a night school or Ratri Shala is being run in the village by SWRC-Manthan for those children who are not able to get education in day schools because of their involvement in agricultural or other household activities. A Tanka was constructed in the school. A school for girls was started in the temple and is now being run opposite the flour mill. If there is a shortage of teachers under the Yojana any educated villager can be appointed as a teacher. A retired teacher now works as Shiksha Mitra in a Shiksha Mitra Yojana School. Around 35 children are studying there. The Panchayat pays

the school teacher @ Rs.3000/- p.m. Around 31% households have benefitted from the night school in the village.

Basic Infrastructure: Project Impact

At the time of the Baseline survey, there was no road connectivity to either of the villages. At the time of the Impact Assessment survey Gudda was well connected with a road constructed under PMGSY. However, Balaji ki Dhani remains remote and inaccessible. There is neither a pucca nor kachcha link road to the village (Table 10) and a motorable road is at a distance of about 3 kms from the village.

The condition of dwellings in both the villages has improved after the project was initiated. The number of pucca houses increased from 60.87% to 73.91% in Balaji ki Dhani and from 63.24% to 66.18% in Gudda.

Table 4.10: Access to Basic Infrastructure in Balaji ki Dhani and Gudda

(percent households)

Name of Village	Electricity		Water		Road	Other development work in Village
	Grid Connection	Solar Lantern	Underground water tank	Handpump	PMGSY	NREGS
Balaji ki Dhani		82.61	100		0	39.13
Gudda	1.47	91.18	29.41	69.12	100	51.47

Source: Compiled from Impact Assessment survey data

Most households in the two villages do not have a separate kitchen for cooking and they cook food in the open. In neither of the villages do any of the houses have a toilet.

There is no tap water facility in any of the households and there is no piped water supply. Water is critical for survival and the Implementing Agency created awareness among the households about the benefit of a Tanka. One community Tanka was constructed for collecting water before the start of this project. At the time of the Baseline field visit, access to water was a major problem especially in Balaji ki Dhani. However, at the time of the Impact Assessment all the households in Balaji ki Dhani had individual underground water tanks or tankas within the household premises. In Gudda, 20 households had an underground water tank, one household a tubewell and 3 had wells.

Also around 70% of households in Gudda use handpump water for drinking and household consumption. When needed, women generally fetch water.

Thrift and credit societies and Self Help Groups have been set up. In Balaji ki Dhani, 47.83% households have taken loans. Most of the households depend on the moneylender for loans. Loans are also taken from the SHG at an average 2% monthly interest rate. The reasons for taking the loan include illness, marriage, buying a house or land and also repaying loans taken in the past. In Gudda, only 17.65% of households have taken loan for agricultural activity, purchasing livestock, tractor, jeep, marriage, illness, other household consumption and also for repaying loans. Loans have been taken from the Bank and from the moneylender. The interest rate varies from less than 1% to 3%.

Work and Livelihoods: Project Impact

All the households surveyed in Balaji ki Dhani, except one, are engaged in agriculture on their own land. Most households grow Bajra while some of them also grow moong, moth and gunwar. The majority of households are engaged in wage labour work.

At the time of the Baseline survey, the National Rural Employment Guarantee Scheme (NREGS) had not started in Ajmer district. However, at the time of the Impact Assessment, 39.13% households in Balaji ki Dhani and 51.47% households in Gudda reported receipt of income from the NREGS as also creation of community infrastructure (Table 4.10). 19 households in Balaji ki Dhani and 66 households in Gudda have job cards. The Implementing Agency has facilitated this as also smart cards for 35 households in Gudda.

A large number of households migrate seasonally in order to find fodder for their livestock. They return in summer at the onset of the monsoon, in the hope of getting an agricultural crop if it rains. They head home with their sheep but turn back if the rains fail as the animals need to be fed and in the absence of rain not even a blade of grass is visible in the desert.

Agriculture is the primary occupation for 78% households in Balaji ki Dhani and 47% households in Gudda; livestock rearing was reported as the primary occupation for 31% households in Gudda while for 13% households, both agriculture and livestock were reported as their primary occupation.

9% households in Balaji ki Dhani and 4% in Gudda respectively primarily work as wage labor. For 5 % households in Gudda, service is the primary occupation (Table 4.11).

Table 4.11: Livelihood and Work (Primary Occupation) in Balaji ki Dhani and Gudda

(percent households)

Name of Village	Agriculture	Livestock	Agriculture/Livestock	Wage labour	Business	Service
Balaji ki Dhani	78.20	0	0	8.70	13.4	0
Gudda	47	30.88	13	4	0	5

Source: Compiled from Impact Assessment survey data

Interviews with households in Balaji ki Dhani showed that the following changes had occurred between the Baseline and Impact Assessment field visits:

- 7 persons who were working as casual labour became thekedars or contractors;
- 3 persons who were working as casual labour are now driving a tractor;
- 2 persons who were rearing sheep are now working in the salt mines;
- 3 persons were working as casual labour are now working in the salt mines;
- 1 person who was working in agriculture is now driving a tractor and running a shop.
- In Gudda, one disabled person is running a PCO/STD booth through use of solar energy.

Gudda Village, Ajmer: Solar Energy based PCO

Ram Swarup Singh is a 35 years old disabled person who lives in Gudda village. He has 7 members in his family. He got a solar lantern under RERL activity and deposited a base charge of Rs.1000 in the joint account at Nossal Grameen Bank for future maintenance. He runs a telephone booth with the help of solar energy. Gradually he transformed the booth to a petty shop. He then bought a tailoring machine and started stitching clothes at night with the help of the solar lantern. He bought a black and white TV and a loudspeaker system for entertainment. He has also purchased a Jeep and runs a shuttle service for the villagers. His monthly income is around Rs.8,000 per month.

Gudda Village, Ajmer: Barefoot Solar Engineer

Hanuman Ram is a 35 years old resident of Gudda village and belongs to a Below Poverty Line family. He has 5 members in his family. He works for the Manthan Sansthan, Kotri and earns a monthly salary of Rs. 2,190. He received training for six months in repairing the solar lantern at Barefoot College, Tilonia. A solar lantern workshop has been established by SWRC-Manthan at

Gudda village and he is in-charge of it. Along with this he has started a petty shop and a tailoring shop. After the project intervention, his income has increased to Rs. 29,000 per annum.

In both Balaji ki Dhani and Gudda households that were rearing livestock or in agriculture as a secondary occupation now combine this with wage labour through the NREGS. This is a significant development in both the villages and the Implementing Agency has been instrumental in facilitating access to job cards and NREGS works.

SWRC was planning to use solar powered sheep shearing machines to:

- protect the sheep from cuts and infections caused by the manual blade;
- enable even shearing of wool to fetch higher rates;
- leave less wool on the sheep; and
- get longer fibre at lower cost.

However, the activity had not begun at the time of the Impact Assessment visit.

Food Security

17 out of 32 households in Balaji ki Dhani and 50 out of 101 households in Gudda had reported food shortage at the time of the Baseline survey. None of the households in Balaji ki Dhani and only 25% of the sampled households in Gudda reported food insecurity during the Impact Assessment. This could be due to good rainfall this year.

Gender Empowerment

While women have been the sarpanch of the village, few women were traditionally members of any village development committees. After the project was initiated, there was an increase in representation of women in committees, in decision making and in SHGs. Women were especially represented on the Solar Lantern Committee and the Education Committee. The Implementing Agency has generated awareness among the community through Mahila Divas, Swasthya Divas and NREGA Padyatra. Women travel to Tilonia to attend meetings and this creates self-confidence and increases their ability to raise issues.

Quality of Life

Despite the night schools, improvement in access to health and education facilities, construction of Tankas, creation of SHGs, provision of solar lanterns, generation of awareness and capacity building and improvement in livelihoods for some households, job cards, smart cards and access to work under NREGS, these villages are still deprived and have been left behind by the growth and development taking place in the rest of India. While most households expressed satisfaction with lighting, the very poor quality of water and sanitation remains a cause of distress in both the villages. Most households reported that the quality of water from the hand pumps and underground tanks is salty and is not fit to drink. Therefore, all the households spend Rs. 300 to 500 for buying one tanker of water. None of the households have access to toilets in the household premises. Access to health facilities is also very poor in both the Ajmer villages. Additionally, road connectivity is very poor in Balaji ki Dhani.

All households in Balaji ki Dhani and 84% households in Gudda were concerned about the lack of employment opportunities in the villages (Table 4.12).

Table 4.12: Community Perception regarding Improvement in Quality of Life after Implementation of the Project in Balaji ki Dhani and Gudda (percent households)

Name of Village		Health	Education	Food Security	Water	Sanitation	Cooking needs	Lighting needs	Road	Employment and Livelihood
Balaji ki Dhani	HS	0	13.04	0	0	0	0	13.04	0	0
	S	0	56.52	100	0	0	100	73.91	0	0
	P	100	30.43	0	100	100	0	0	100	100
Gudda	HS	0	0	0	0	0	2.94	8.82	0	0
	S	0	17.65	100	0	0	97.06	82.35	100	16.18
	P	100	82.35	0	100	100	0	8.82	0	83.82

Source: Compiled from Impact Assessment survey data
Note: HS = Highly Satisfactory; S = Satisfactory; P = Poor

Overall Project Achievements

- Providing functional solar lanterns to unelectified villages where survival is dependent on flickering kerosene chimneys is a major achievement.
- Reduction in accidents, enabling children to study at night, enabling persons to work in the field at night to harvest crops, work in salt mines, cook and do domestic chores, hold meetings, save expenditure on petromax at weddings, charge cell phones, etc. with the help of the lantern.
- Creation of awareness about the benefit of collecting and storing water in a Tanka in water scarce desert areas. Construction of a Community Tanka that led to construction of individual tankas in most households.

- There is a significant difference in the level of literacy and education between adults and that of children. The night schools, day schools, construction of school buildings, motivation of teachers and students and raising awareness among the community are among the larger benefits of the implementation of the project.
- Generation of awareness among the community through development of SHGs, Mahila Divas, Swasthya Divas and NREGA Padyatra.
- Facilitating access to job cards, smart cards, janani suraksha, etc
- Generation of awareness among women about the benefits of inoculation, infant care, pregnancy etc.
- There is reduction in time, drudgery and expenditure related to the purchase of kerosene, as the majority of the households are using lanterns for lighting purpose.

Building capacity of:

- youths in water testing
- Barefoot technicians
- in running Solar Reverse Osmosis plant
- women through increasing self-confidence and ability to raise issues
- women in fabrication and installation parabolic solar cookers
- Barefoot Solar Engineers
- women artisan groups through skills
- teachers and health workers as community trainers.

Challenges

- Enabling households to move out of poverty in multi-dimensionally deprived, resource poor, desert villages;
- Providing skills and building capacity to enable the community to earn a decent livelihood through renewable energy;
- Providing access to safe water for drinking and water for crop production;
- Most of the hand pumps in the village are either dysfunctional or if they are working then the water is brackish. Households who are not able to purchase tank water use the water from the hand pump for drinking purpose.
- Improving access to health facilities;
- Very low levels of female literacy and gender empowerment
- Providing access to sanitation and toilets.

Immediate Actions Needed

- Funds to provide access to atleast one solar lantern per household in remote villages that are not on the grid.
- While 100 Solar Lanterns have been distributed in these two villages, several households have not yet been provided with this facility and are demanding it.
- In order to scale up the use of solar energy in remote villages where grid electricity has limited reach, mini solar workshops can be established at the village level.

- Provide training and skills to young men and women so that they can earn a livelihood as Barefoot technicians/ engineers. Barefoot College, Tilonia needs to continue to play a vital role in this regard.
- Regular visits by extension workers from the Department of Agriculture and Animal Husbandry to enable increase in yields and income.
- Access to safe drinking water and sanitation.

Photo 4.1: Discussion with the village community at Balaji Ki Dhani

Photo 4.2: Chote Ram with Bhagawat Nandan at Balaji ki Dhani

Photo 4.3: School building under construction at Balaji ki Dhani

Photo 4.4: Reverse Osmosis Plant at Kotri

Photo 4.5: Filling questionnaires at Balaji Ki Dhani

Photo 4.6: Discussion with the village community at Gudda

5. District Jaipur (Rajasthan): Doi ki Dhani, Kalia and Singla

Location and Demographics

SWRC-Prayatna Sansthan, Sholawata is implementing the MNRE-UNDP-FRG project in three villages of Jaipur district, Doi ki Dhani, Kalia and Singla. These three villages come under the Habaspura Gram Panchayat of Dudu Block in Jaipur district of Rajasthan. The nearest town from Doi ki Dhani, Singla and Kalia is Marwa, located around 20-22 km from the villages. There are 54 households in Doi ki Dhani, 75 households in Kalia and 64 households in Singla. A large number of households in each of the villages had migrated at the time of the Baseline and Impact Assessment surveys.

38 households in Doi ki Dhani, 65 in Kalia and 53 in Singla were interviewed at the time of the Impact Assessment survey. Most of the households belong to the Gujjar community, though there are a few Jats in Doi ki Dhani and additionally a few Scheduled Castes and Rajputs in Kalia. Most of the people in these villages are poor but only 18.42% households in Doi ki Dhani, 1.54% in Kalia and 3.77% households in Singla have BPL cards (Table 5.1). Whereas Doi ki Dhani lacks road connectivity, Kalia and Singla are comparatively well connected with all season roads.

Table 5.1: Caste/Tribe and Poverty Status in Doi ki Dhani, Kalia and Singla

(percent households)

Caste and Poverty Status/ Name of Village	Doi ki Dhani	Kalia	Singla
Scheduled Caste	0	23.08	0
Gujjar/OBC	94.74	70.77	100
Jat/OBC	5.26	3.08	0
Rajput/General	0	3.08	0
Below the Poverty Line	18.42	1.54	3.77

Source: Compiled from Impact Assessment survey data

Household Level Analysis

Table 5.2 shows the size-wise distribution of the households surveyed at the time of the Impact Assessment survey. In Doi ki Dhani, Kalia and Singla, approximately 40%, 31% and 32% households have between 6 and 8 members. Around 31.57% households in Doi ki Dhani and 36.93% in Kalia and 13.21% in Singla have more than 9 members.

Table 5.2: Household Size in Doi ki Dhani, Kalia and Singla (percent)

Name of Village/ Household Size	1 to 5	6 to 8	9 to 12	13 to 23	All

Doi ki Dhani	28.95	39.47	23.68	7.89	100
Kalia	32.31	30.77	24.62	12.31	100
Singla	54.72	32.08	13.21	00	100

Source: Compiled from Impact Assessment survey data

At the time of the Baseline survey the sex ratio was 959 in Doi ki Dhani, 822 in Kalia and 909 in Singla. The child sex ratio in Kalia was 957 in contrast to 1038 in Doi ki Dhani and 1030 in Singla (Table 5.3). However, these estimates have not been adjusted for migration.

Table 5.3: Population and Sex Ratio in Doi ki Dhani, Kalia and Singla

Name of Village	Doi ki Dhani		Kalia		Singla	
	Child (0-6 years)	**Total Population**	**Child (0-6 years)**	**Total Population**	**Child (0-6 years)**	**Total Population**
Males	26	169	47	276	33	175
Females	27	162	45	227	34	159
Sex Ratio (FMR)	1038	959	957	822	1030	909

Source: Compiled from Baseline survey data

Lighting and Energy: Project Impact

Through the MNRE-UNDP-FRG project, 100 solar lanterns were given to households in Doi ki Dhani, Kalia and Singla in October-November 2006 (Table 5.4). Each household receiving a solar lantern contributed Rs 25 per month towards maintainance and repair. 27 out of 100 solar lanterns were distributed to households in Singla, 16 in Doi ki Dhani and the remaining in Kalia. At the time of the Impact Assessment survey, interviews were conducted with 14 out of the 16 households that had received solar lanterns in Doi ki Dhani, 49 (of 57) beneficiary households in Kalia and 24 (out of 27) beneficiary households in Singla.

Table 5.4: Renewable Energy Interventions in Doi ki Dhani, Kalia and Singla

Name of Village	**Panel Capacity** (*in Wp per unit*)	**Cost per unit** (*in Rs.*)	**Battery size** (in *Volts*)	**No. of units disseminated**	**Total cost** (*cost per unit * no. of units*)
Doi ki Dhani	10 WP	4000/-	7 AH	100 units	4000/- x 100 = 4 lakhs
Kalia					
Singla					
Total				100	4 lakhs

Source: SWRC

All these households were using the solar lanterns at the time of the Impact Assessment field visit. During the Focus Group Discussion at the time of the Impact Assessment survey, one person complained that the solar lanterns were not working. Therefore each of the persons present was

individually asked whether or not they owned a solar lantern and whether it was functioning. The person who had made the complaint had not received a solar lantern. A few people reported the need for replacement of battery, charger, wire, sockets or fuse. In each case the problem had been rectified. The exception was in cases where the stock of dependable batteries at the workshop at Solawata had depleted and the supplier had taken time to provide it. Time taken to resolve the complaint and charges for replacement and repair varied according to the nature of the complaint. 36.84% households in Doi ki Dhani, 75.38% households in Kalia and 45.28% households in Singla use a solar lantern (Table 5.5). Most households additionally use a kerosene lamp since one solar lantern is not enough to meet all household and livelihood needs.

Table 5.5: Primary Sources of Lighting in Doi ki Dhani, Kalia and Singla

(percent households)

Name of Village	Solar Lantern	Kerosene Lamp	Both
Doi ki Dhani	36.84	97.37	36.84
Kalia	75.38	84.62	61.54
Singla	45.28	92.45	37.74

Source: Compiled from Impact Assessment survey data

During a Focus Group Discussion with the community in Doi ki Dhani, Kalia and Singla the following were reported as benefits of using a Solar Lantern:

- Prevents getting bitten by scorpions, insects and snakes in the dark.
- Is helpful in tending to animals at night and handling goats, cows and buffalos.
- Children can study after dark.
- Increases mobility as the solar lantern can be taken by the person while moving in or outside the house. It is useful in the field at night and also in the kitchen.
- Prevents loss of livelihood and drudgery caused by having to walk 10 kms to get kerosene. The dealer opens the shop only for 2 hours each day.
- Can go to the field at night and the light prevents animals from destroying the crop.
- Earlier when jaggery was distributed during a celebration (shagun) people would easily claim they had not received their share. With the lantern, when the jaggery is distributed, it is possible to clearly identify the person receiving the jaggery and they cannot say that they have not received it.
- Useful in social functions and community meetings.
- The villagers take the solar lantern with them when they go on migration.
- The battery charging unit is used for charging the mobile. The mobile in turn is used to check on prices in the wholesale market that is 9 kms away.
- If a pregnant woman has a problem Dai Maa can be located with the help of the lantern.
- Very helpful in delivering pregnant animals especially at night.
- Useful in counting livestock.

Kalia Village, Jaipur: Solar Lantern Prevents Snakebite

Chauthi is the wife of Kana Ram, Gujjjar and lives in Kalia village. She was married 30 years ago and had never seen light in the village. When the representatives of the NGO Prayatna would visit her village, they would carry a solar lantern with them. After her family received the lantern through the project, they realised the many benefits of solar lighting but in addition found that it can save lives as happened when a snake entered her hut at night. Her daughter-in-law had just delivered a baby and she was sleeping next to her. She woke up at night and put on the solar lantern to go and get water and saw a snake below the bed. She was stunned and after recovering, called for help and got the snake killed. If she did not have a solar lantern, she would have had to get down from the bed to light the chimney and would not have seen the snake and could have stepped on it. She therefore believes that the solar lantern saved her own and her daughter-in-law's life.

Use of Energy in Household Consumption

There is a complete dependence on fuel wood and dung cake for cooking in Doi ki Dhani, Kalia and Singla. 65.79% households surveyed in Doi ki Dhani, 75.38% in Kalia and 88.68% in Singla use both fuel wood and dung cake for cooking. Most of the remaining households use fuel wood and/or kerosene for cooking purposes while 1.54% households use solar energy in Kalia (Table 5.6).

Table 5.6: Use of Energy for Cooking in Doi ki Dhani, Kalia and Singla

(percent households)

Name of Village	Fuel wood	Fuel wood and Dung cake	Kerosene	Kerosene and Dung cake	Kerosene and Fuel wood	Solar Energy, Kerosene
Doi ki Dhani	34.21	65.79				
Kalia	13.85	75.38	4.62	6.15	1.54	1.54
Singla	11.32	88.68				

Source: Compiled from Impact Assessment survey data

Women generally collect fuel wood and crop residue in these villages and it is collected from a distance of 1 to 2 km and requires 1 to 2 hours time on average.

Health and Education: Project Impact

There is no Primary Health Centre (PHC) in the village; the nearest PHC is located at a distance of about 20-22 km from the village at Marwa. A Doctor and ANM are reportedly available at the PHC. 15.38% households in Kalia have said that there is an improvement in access to medical care and institutional delivery whereas the corresponding estimate is 5.66% in Singla. The Implementing Agency has reported that 7 households benefited from the *Janani Surakhsa Yojana*. However, households in Doi ki Dhani did not report improvement in access to institutional health delivery. 12.31% households in Kalia have benefited through the Reproductive Child Health - Rajasthan (RCHR) and 4.62% from Tuberculosis Abhiyan. None of the households reported benefits from the Special Nutrition Programme (SNP). The community reported that mobile medical vans do not visit the village. The most common forms of illness in the village are fever, common cold and cough. Some households reported asthma, jaundice (pilia) and typhoid as common diseases (Table 5.7).

Table 5.7: Improvement in Access to Education and Health in Doi ki Dhani, Kalia and Singla (percent households)

Name of Village	Education	Health
Doi ki Dhani	10.53	0
Kalia	47.69	15.38
Singla	15.09	5.66

Source: Compiled from Impact Assessment survey data

Doi ki Dhani does not have a primary school in the village while Kalia and Singla have a primary school as well as a night school. The night schools in Kalia and Singla are run by SWRC-Prayatna Sansthan for those children who are not been able to get education in day schools because they are required to undertake agricultural and other household activities. Children living in Doi ki Dhani go to school in a neighbouring village. Books are provided to primary school students. In both Kalia and Singla mid-day meal is served in the primary school. The use of solar lantern in these villages also helps in running the schools at night. An Anganwadi Center (AWC) is also functioning in Kalia. 47.69% households in Kalia, 15.09% in Singla and 10.53% in Doi ki Dhani have acknowledged the improvement in the access to education in the village and have mentioned that better lighting at night has helped children to study at night.

Table 5.8: Gender-wise proportion of children studying in school in Doi ki Dhani, Kalia and Singla

Name of Village	Children aged 5 to 17 years studying in		
	Doi ki Dhani	Kalia	Singla

Males	88.24	61.39	81.97
Females	47.14	53.33	43.48
Total	67.39	57.95	65.42

Source: Compiled from Baseline survey data

The total population in each of the villages was divided into two groups based on age, i.e., children aged 5 to 17 years, and adults i.e., aged 18 years and above. 67.39% of children in Doi ki Dhani, 57.95% children in Kalia and 65.42% in Singla in the age group 5 to 17 years were studying at the time of the Baseline survey. The proportion was 88.24% for boys and 47.14% for girls in Doi ki Dhani, 61.39% for boys and 53.33% for girls in Kalia and 81.97% for boys and 43.48% for girls in Singla (Table 5.8).

Table 5.9: Adult Literacy in Doi ki Dhani, Kalia and Singla (percent)

Name of Village	Doi ki Dhani	Kalia	Singla
Males	53.09	42.36	54.95
Females	6.49	8.20	9.09
Total	30.38	26.69	32.40

Source: Compiled from Baseline survey data

The adult (18 and above) literacy rate was 30.38% in Doi ki Dhani, 26.69% in Kalia and 32.40% in Singla (Table 5.9). Female literacy was low in all three villages and this needs attention. Doi ki Dhani had the lowest female literacy among the three villages (6.49%) while male literacy is lowest in Kalia (42.36%).

Children from about 12.31% households surveyed in Kalia were attending the night school and 21.54% households have stated that children are able to study at night due to solar light. Around 34.21% households surveyed in Doi ki Dhani, 27.69% in Kalia and 5.6% in Singla were getting benefit from the Sarva Siksha Abhiyan (SSA).

Basic Infrastructure: Project Impact

At the time of Baseline Survey, there was no road connectivity to Doi ki Dhani while both Kalia and Singla had better road connectivity. Under National Rural Employment Guarantee Scheme (NREGS) the community in Doi ki Dhani has started constructing a link road but the task was incomplete at the time of the Impact Assessment survey.

No significant change has been noticed in the type of dwellings in these villages except in Doi ki Dhani where the percentage of pucca houses increased from 31.58% to 39.47 %.

Table 5.10: Access to Basic Infrastructure in Doi ki Dhani, Kalia and Singla

(percent households)

Name of Village	Electricity	Water			Road Connectivity	Other development work in Village			
	Solar Lantern	Underground water tank	Handpump	Well		NREGS	AWC	SSA	RCHR
Doi ki Dhani	36.84	63.16		36.84	Poor	84.21	2.63	34.21	
Kalia	75.38	73.85	4.62	21.54	Satisfactory	95.38	4.62	27.69	6.51
Singla	45.28	24.53	50.94	24.53	Satisfactory	88.68	5.66	5.66	

Source: Compiled from Impact Assessment survey data

Of the households surveyed, 73.9% in Doi ki Dhani, 37% in Kalia and 62.3% in Singla have a separate kachcha kitchen. There were no latrine and bathroom facilities in any of the households surveyed in the three villages.

There is no tap water or piped water supply facility in any of the three villages. Most of households surveyed collect water from an underground water tank or well for drinking and household consumption. In Kalia and Singla some households also use a hand pump for the same purposes. Because of high concentration of salt in water in this area, the quality of water is poor and unfit for drinking. Women generally fetch drinking water and water for other domestic needs from a distance of around 0.5 km.

There are no thrift and credit societies or any Self Help Groups working in these three villages. Around 63.16% of households surveyed in Doi ki Dhani, 43.08% in Kalia and 28.30% in Singla have taken loans. Dependence for loans is primarily on the money lender or Bhumi Vikas Bank and the interest rates varies from 1 to 2% or sometimes the bank rate. The reasons for taking loans include agricultural activities, illness, marriage, purchasing a tractor, livestock, land etc.

Work and Livelihoods: Project Impact

Agriculture is the primary occupation in all the households and the majority of households grow bajra, chanwala and moth. Other primary occupations of households are raising livestock and wage labour. 65.79% households in Doi ki Dhani, 55.38% in Kalia and 67.92% in Singla, earn their livelihood primarily from agriculture. Livestock rearing is the primary occupation for between 20

and 30% households while around 7 to 10% households are mainly dependent on wage labour (Table 5.11).

Table 5.11: Livelihoods and Work (Primary Occupation) in Doi ki Dhani, Kalia and Singla (percent households)

Name of Village	Agriculture	Livestock	Agriculture/Livestock	Wage labour	Service/ Business
Doi ki Dhani	65.79	23.68		10.53	
Kalia	55.38	29.23	4.62	9.23	1.54
Singla	67.92	20.72		7.55	1.87

Source: Compiled from Impact Assessment survey data

Around 36.84% households surveyed in Doi ki Dhani, 55.38% in Kalia and 26.42% in Singla seasonally out-migrate due to lack of fodder for their livestock or for wage labour due to lack of employment opportunities in the village. They return in summer at the onset of the monsoon in the hope of being able to getting an agricultural crop if it rains. But very often due to failure of rainfall they return with their livestock, due to lack of availability of fodder in the villages.

Livestock and wage labour were the secondary occupation for 34.21% households in Doi ki Dhani, 12.31% in Kalia and 20.75% households in Singla pre-project. During the Impact Assessment survey, this was reported as the secondary occupation by 39.47% households in Doi ki Dhani, while there was a three-fold increase to 40 % in Kalia and 64.15% in Singla. One explanation for this is that at the time of Baseline survey, the National Rural Employment Guarantee Scheme (NREGS) had not been implemented in these villages. The impact of implementation of NREGS in all the three villages is clear and most households reported benefits from work and wages. Hence, during the Impact Assessment survey, 84.24% households in Doi ki Dhani, 95.38% households in Kalia and 88.68% in Singla reported benefits under NREGS (Table 5.10).

Doi ki Dhani Village, Jaipur: Solar Lantern saves Crop from Destruction by Pests

Gopalji, son of Nanda Ram listened to a Krishi related programme on the radio regarding using a solar lantern to reduce the threat of flying insects ruining the crop and decided to try it. The crop is susceptible to:

i. Tiddi flies
ii. Gingli flies most dangerous for bajra

iii. Jijula
iv. Mola (in moong and gawar)
v. Green Lat (moong)
vi. White Fitkali (moth) in moong

He put water and a few drops of oil in a large flat vessel. He placed a bucket in it upside down and put the solar lantern on it. Insects were attracted to the light and hit the lantern and fell into the water and died. As a result, he was able to save Rs 140/- per bigha of land on insecticides. This was the amount that the neighbouring farms had to spend on insecticide. While he needed to use 25 kg of insecticide per bigha earlier, only 5 kg of insecticide were now required. Therefore, the solar lantern reduced the drudgery of having to get the insecticide and also having to take care of the field. Additionally it led to increase in productivity due to reduction in insect attack.

Food Security

At the time of the Baseline and Impact Assessment surveys, all households surveyed in Doi ki Dhani and Kalia and 94.34% households surveyed in Singla reported food security or availability of food throughout the year. No major change in diet was reported by any of the households.

Gender Empowerment

Although women have been the Sarpanch of the Gram Panchayat before and after the project was initiated, in all the three villages, there has been an increase in the number of women who have become members of village development committees after the project was initiated. However, except 5.26% households surveyed in Doi ki Dhani, all other households reported that women do not have much role in decision making in the family. There is a working Women Self Help Group in Doi ki Dhani, which was set up in 2006. Women members do not attend Panchayat meetings and they do not have a right to land/property in the family. They do not speak in the presence of men nor do they sit on a chair in the presence of male members or any elders of the village. However, awareness is being generated and capacity building measures are being implemented.

Quality of Life

Initially SWRC-Prayatna made tankas for storing water for the community in the village, school, community hall. With the help of the Implementing Agency a large number of households have constructed their own tankas. Specifically, 10 households in Doi ki Dhani, 53 households in Kalia and 14 households in Singla have recently constructed their own tankas (Table 5.12). Therefore the

kind of desperation due to lack of water that was visible during the field visit in 2006, was not there at the time of the Impact Assessment.

Prayatna started ratri shalas or night schools to increase the access to education of young boys and especially girls, since the village elders do not allow girls to travel long distances to school. A Balwadi and subsequently an Anganwadi were established. The government set up a school in Singla ten years later. So as to reduce the mortality rate, Prayatna has facilitated immunization of all the children with smallpox vaccine, BCG, DPT etc; enabled access to an RCH revolving fund for institutional delivery. It has facilitated access to the IAY, widow pension, smart cards and other government schemes. In order to provide access to work Prayatna has helped get job cards for NREGA for a large number of households in these villages. It has also started computer training and handicraft and patchwork training.

Despite all these initiatives the villages remain backward. The very poor quality of water and sanitation is a cause of distress in all villages. All the households of Doi ki Dhani, Kalia and Singla reported that the drinking water was salty and not fit for drinking.

Table 5.12: Benefits from Schemes facilitated by the Implementing Agency in Doi ki Dhani, Kalia and Singla (Number of households)

Name of Village	Janni Surksha	Study in school	Job Card	Tanka	Smart card
Doi ki Dhani			46	10	2
Kalia		57	68	53	15
Singla	7	32	59	14	8

Source: SWRC

Even though the NREGS has been implemented in all three villages, 100% households surveyed in Singla, 96.92% households in Kalia and 94.74% in Doi ki Dhani have reported lack of adequate employment opportunities in or around the village. A few educated youth were demanding jobs at the time of our survey. There was considerable satisfaction with the solar lantern facility in all the villages and the grievance of those who have not received it is that they too should get a solar lantern. A few people reported problems with the switch or battery but these have been resolved by the Implementing Agency. The solar lantern has had considerable impact on enabling children to study at night as also facilitating agricultural and domestic work at night. However, sanitation facilities are non existent in all the villages and road connectivity is poor in Doi ki Dhani.

Project Achievements

- Providing functional solar lanterns to unelectified villages where survival is dependent on flickering kerosene chimneys is a major achievement.
- Use of the solar lantern in preventing accidents, snake bite, enabling persons to work in the field at night to harvest crops, cook and do domestic chores, hold meetings, save expenditure on petromax at weddings, charge cell phones, etc. with the help of the lantern.
- The solar lantern is used to tend to livestock at night and prevent theft.
- Night schools are running by Prayatna Sansthan and solar lantern is used at night for studying. There is a significant difference in the level of literacy and education between adults and that of children. Motivation of teachers and students and raising awareness among the community are among the larger benefits of the implementation of the project.
- Creation of awareness about the benefit of collecting and storing water in a Tanka in water scarce desert areas. Construction of a Community Tanka that led to construction of individual tankas in most households.
- Generation of awareness among the community through SHGs, Mahila Divas, Swasthya Divas and NREGA Padyatra. Facilitating access to job cards, smart cards, janani suraksha, etc.
- Raising self-confidence and ability to raise issues among women in the village.
- Generation of awareness about the benefits of inoculation, infant care, pregnancy etc.
- There is reduction in time, drudgery and expenditure related to the purchase of kerosene, among households that are using lanterns for lighting purpose.

Building capacity:

- Solar repair workshop has been set up at Solawata and Barefoot Solar Engineers/Technicians maintain and repair the solar lanterns as needed.
- Barefoot Solar Engineers
- Skills to women artisan groups
- Teachers and health workers as community trainers.
- Women in enabling partipation in collectives and in raising issues.

Challenges

- Scarcity of water and poor (saline) water quality leading to low crop yields.
- Most of the hand pumps in the village are either dysfunctional or provide salty water that is unfit for drinking. Households unable to purchase tank water use the water from the hand pump for drinking.
- High incidence of waterborne diseases, skin diseases, tuberculosis etc.
- Villagers are mostly dependent upon the moneylender for loans for consumption needs, purchasing fodder for the livestock, or for family functions like marriage.
- Lack of infrastructure
- Enabling households to move out of poverty in multi-dimensionally deprived, resource poor, desert villages;
- Providing skills and building capacity to enable the community to earn a decent livelihood through renewable energy;

- Very low levels of female literacy and gender empowerment
- Providing access to sanitation and toilets.

Immediate Actions Needed

- Funds to provide access to at least one solar lantern per household in remote villages that are not on the grid.
- While 100 Solar Lanterns have been distributed in these three villages, several households have not yet been provided with this facility and are demanding it.
- In order to scale up the use of solar energy in remote villages where grid electricity has limited reach, mini solar workshops can be established at the village level.
- Provide training and skills to young men and women so that they can earn a livelihood as Barefoot technicians/ engineers. Barefoot College, Tilonia needs to continue to play a vital role in this regard.
- Regular visits by extension workers from the Department of Agriculture and Animal Husbandry to enable increase in yields and income.
- Access to safe drinking water and sanitation.
- Access to health facilitites
- Road connectivity
- The village elders in Doi ki Dhani want this village to have a separate Gram Panchayat so that the children do not have to travel to other villages to attend school and it gets access to other development opportunitites. A letter was sent to the Resident Commissioner but follow up action is needed.

Photo 5.1: Discussion with villagers in Doi Ki Dhani

Photo 5.2: Discussion at Gopalji's house in Doi Ki Dhani

Photo 5.3: Gopalji's son studying with Solar lantern in Doi ki Dhani

Photo 5.4: Discussion with the community at Kalia

Photo 5.5: Discussion with the women in Kalia village

Photo 5.6: Lunch at Prayatna Sanstha

Photo 5.7: Discussion with the community at Singla

6. District Bageshwar (Uttarakhand): Dobar, Miri and Topania

Location, Size and Demographics

Fieldwork for Impact Assessment was conducted in three villages in Bageshwar district, Dobar, Miri and Topania, in which the MNRE-UNDP-FRG project is being implemented by AHEC-IIT Roorkee. The three hamlets are located in Dobar Gram Panchayat in Kapkote block in Bageshwar district of Uttarakhand and can only be reached by walking up the mountain on a narrow path. The villages are located about 16 to 20 kms from the nearest town of Kapkote. There is a road till Saran, which is at the foothill of the mountain but this was blocked due to landslide at the time of our Impact Assessment field visit. Miri is at a height of about 2 kms from the foothill while Dobar is around 1.5 kms further up the mountain from Miri. Topania is the furthest and remotest of the three villages and is an additional 1.5 kms from Dobar.

At the time of Baseline survey and Impact Assessment survey, 15 households were present in Dobar and 10 households were there in Miri. In Topania, 23 households were present at the time of the Baseline survey and 21 households at the time of Impact Assessment survey. All the households in all three villages belong to the Rajput community. 80% households surveyed in Dobar, 50% households in Miri and 38.10% in Topania have BPL cards (Table 6.1).

Table: 6.1 Caste/Tribe and Poverty Status in Dobar, Miri and Topania

(percent households)

Caste and Poverty Status/ Name of Village	Dobar	Miri	Topania
Rajput/General	100	100	100
Below the Poverty Line	80	50	38.10

Source: Compiled from Impact Assessment survey data

Household Level Analysis

Table 6.2 shows the size-wise distribution of the households surveyed at the time of the Impact Assessment. Around 33% of households in both Dobar and Topania and 50% households in Miri have between 6 and 8 members. However, 20% households in Dobar, 10% in Miri and 28.57% in Topania have more than 9 members.

Table: 6.2 Household Size in Dobar, Miri and Topania (percent)

Name of Village/Household Size	1 to 5	6 to 8	9 to 12	13 to 23	All

Dobar	46.67	33.33	20		100
Miri	40	50	10		100
Topania	38.10	33.33	19.05	9.52	100

Source: Compiled from Impact Assessment survey data

At the time of Baseline survey, the sex ratio was 941 in Dobar, 968 in Miri and 940 in Topania. The child sex ratio was 714 in Dobar and 1100 in Topania (Table 6.3).

Table 6.3: Population and Sex Ratio in Dobar, Miri and Topania

Name of Village	Dobar		Miri		Topania	
	0-6 years	Population	0-6 years	Population	0-6 years	Population
Sex Ratio (FMR)	714	941	-	968	1100	940

Source: Compiled from Baseline survey data

Lighting and Energy: Project Status, Interventions and Impact

AHEC, IIT Roorkee in partnership with UREDA and the Village Energy Committee have set up a small hydro power station at Karmi III, which was commissioned in the first week of March 2008. The power station is located at a distance of 36 km from Bageshwar (all weather road) and 8 km by foot from Godiyadhar. The stream is called Karmi Gad and is a tributary of the river Saryu.

Table 6.4: Capacity of the Karmi III Micro Hydro Plant in Bageshwar

Type of Interventions	Capacity per unit		Total no. of units in the cluster
	Capacity	Unit	
Micro hydel	25kW	2	1

Source: AHEC IIT Roorkee

The total electrical power generation capacity of the micro hydro plant at Karmi is 50 kW (Table 6.4). The power station has been set up to provide both light and motive power for generation of livelihoods to the households in all three hamlets (Table 6.5).

Table 6.5: Services Offered by the Karmi III Micro Hydro Plant in Bageshwar

Name of Village	Number of households covered by the Micro hydro	Services offered	
		Lighting	Motive

Name of Village	Number of households covered by the Micro hydro	Services offered	
		Lighting	Motive
Dobar	14	√	√
Miri	12	√	√
Topania	25	√	√
Thalidhar	15	√	√
Khalidhar	20	√	√
Saran	45	√	
Munar	18	√	√

Source: AHEC IIT Roorkee

A two-phase electricity connection from this power house has been supplied to the three Bageshwar villages. Households in all the 3 villages were given electricity connections and reported that they had been getting light except when there was a disruption. For instance, at the time of the Impact Assessment field work, the channel was blocked due to heavy rains that had led to landslides. Gravel in the water channel was being cleared so that the powerhouse could function. A provision has been made for a three-phase connection for those who plan to use motive power based for livelihood generating enterprises such as a flour mill (*Attachakki)*. The village energy committee has fixed a base security charge for an electricity connection at Rs. 600 for BPL households and Rs 1500 for APL families.

One household in Miri additionally uses solar home lighting system as a source of lighting. Further, all the households also use a kerosene lamp (Table 6.6).

Table 6.6: Primary Sources of Lighting in Dobar, Miri and Topania (percent households)

Name of Village/ Source of Lighting	Microhydel power	Kerosene Lamp	Both	Total
Dobar	100	100	100	100
Miri*	100	100	100	100
Topania	100	100	100	100

Source: Compiled from Impact Assessment survey data

* In addition one household has solar home lighting system.

Generation of Electricity and Livelihoods

Livelihoods are dependent on rainfed agriculture, terrace farming and casual wage labour supplemented by animal husbandry. Landholdings are small and fragmented and agricultural productivity is very low. All the three villages receive plenty of rainfall during the monsoon season but agriculture remains rainfall dependent. Since the area is extremely backward, inhospitable and

inaccessible, the MNRE-UNDP-FRG project seeks to provide electricity and use motive power to generate livelihoods and enhance incomes. During discussions with the community, applications were received for the following livelihood generating equipment: grinding mill, rice dehusker, madua dehusker, oil expeller, masala grinding, flour mill, carpentry, fruit processing, sewing machine and Public Calling Office for Telephone (PCO).

If there is assured irrigation, the villagers can grow dhan, jau, wheat, motwa, cholai, rajma, madua, gehat, soyabean, potato, many vegetables, many fruits, lasan, ginger, haldi and many herbal products/jadi bootis. In the absence of irrigation, if it does not rain, yields will be very low. Therefore, they produce only the basic minimum.

Based on discussions with shopkeepers in the market at Bharadia, the community in the Project villages and with the objective of enabling most or all households to benefit from the Project, rather than just the few households who can contribute towards purchase of livelihood generating equipment, it was suggested that lift irrigation be provided to ensure assured water supply for agriculture for all households. An NGO in the area has successfully used green poly houses and based on discussions at their marketing outlet it was suggested that this option be explored.

Transporting supplies is both difficult and expensive. There is no road. Stones have been placed by the village community on the mountain side through the only scheme that has been implemented in these villages, that too only after Dobar became a separate Gram Panchayat. Therefore, it was suggested that to reduce the drudgery of carrying supplies up and down the mountain, a rope-way trolley be provided to transport output.

In view of the above, the Implementing Agency has planned the following livelihood generation cum drudgery reducing activities that use motive power to generate livelihood opportunities and thereby enhance incomes. These are:

- Grinding mill
- Oil expeller.
- Welding machine
- Computer and Photocopy
- Ropeway Unit (order placed)
- Lift Irrigation (under process)

The electrical capacity required for each of the above is listed in Table 6.7.

Table 6.7: Electricity required for Livelihood Generation in Dobar, Miri and Topania

Equipment for livelihood/ enterprise development	Capacity	Name of Village
a. Grinding Mill	3 kW	Dobar, Topania
b. Oil Expeller	4 kW	Miri
c. Welding Machine	3 kW	Topania
d. Computer and Photography	3 kW	Miri
e. Ropeway Unit (order placed)	10 kW	Dobar
f. Lift Irrigation (under process)	22 kW	Miri

Source: AHEC IIT Roorkee

The order has been placed for the ropeway and the lift irrigation is under process (Table 6.7). However, livelihood generation was yet to begin in these villages at the time of the Impact Assessment field visit, as the rains were extremely heavy and landslides caused disruption and diversions on an unprecedented scale this year. The cost of some of the machines procured for livelihood generation in Dobar, Miri and Topania is given in Table 6.8 below.

Table 6.8: Cost of Machines for Livelihood Generation in Dobar, Miri and Topania

(Amount in Rs.)

Machine	Name of Village/Hamlet	Cost of Machine			Beneficiary other contribution **	Total cost
		AHEC Paid	Beneficiary Cash contribution	Total cost *		
Grinding Mill	Dobar	25,322	3,000	28,322	23,500	51,822
Computer	Miri	82,716	30,000	1,12,716	6,000	1,18,716
Grinding Mill	Topania	27,048	3,000	28,322	23,500	51,822

Source: AHEC IIT Roorkee
*Note: * including transportation cost upto road head*
*** includes head road charges, cost of civil works, installation charges borne directly by beneficiary*

All the households surveyed in Dobar, Miri and Topania are solely dependent on fuel wood for cooking and other household work and there is no change in this after the implementation of the project (Table 6.9).

Table 6.9: Use of Energy for Cooking in Dobar, Miri and Topania (percent hoseholds)

Name of Village/ hamlet	Before Project Implementation			After Project Implementation			Total
	Cooking	Heating	Space Heating	Cooking	Heating	Space Heating	
	Fuel wood			Fuel wood			
Dobar	100	100	100	100	100	100	100

Miri	100	100	100	100	100	100	100
Topania	100	100	100	100	100	100	100

Source: Compiled from Impact Assessment survey data

Health and Education: Project Impact

No significant improvement has been observed with regard to the health status of the villagers. There is no Primary Health Centre (PHC) in the village; the nearest PHC is located at a distance of 6 kms in Karmi village. The PHC has medicines and minor testing facilities. A Doctor and ANM are available at the PHC. In situations of emergency, the patients are referred either to Kapkote or to the district hospital in Bageshwar or to hospitals at Haldwani or Almora. All the households are aware of the importance of immunization, and take their children to the Karmi PHC for immunization. However, none of the households have reported benefits from the Special Nutrition Programme (SNP). An Anganwadi Center exists in Dobar. There is no possibility of a mobile medical van visiting these villages due to their inaccessibility. The most common forms of illness in the village are stomach pain, common cold, fever and skin diseases. Respondents have also reported that jaundice is common. Accidents are frequent due to slipping on stones and falling and in all such cases the person has to be carried down the mountain and taken to the doctor. There has been no improvement in access to health facilities over time (Table 6.10).

Table 6.10: Improvement in Access to Education and Health in Dobar, Miri and Topania

(percent households)

Name of Village/ hamlet	Education	Health
Dobar	86.67	0
Miri	90	0
Topania	100	4.76

Source: Compiled from Impact Assessment survey data

A primary school was observed in the village during the Baseline survey. An Upper Primary school has recently been established at Dobar. The children from Miri and Topania also study in this school. Regular mid-day meals and books are provided to the students in the school. For higher studies (High School and Secondary School), the children go to Karmi, Bagher and Kapkote. Improvement in education has been noticed in all three villages and better lighting enables children to study at night. All the households from Topania and most of the households in Miri and Dobar stated that there is improvement in access to education due to the existence of a school in the village and due to better light (Table 6.10).

For analyzing the status of education among the households surveyed in Dobar, Miri and Topania the total population in each of the villages was divided into two groups based on age, i.e., children aged 5 to 17 years, and adults i.e., aged 18 years and above. 92.31% of children in Dobar, 94.12% children in Miri and 85.71% children in Topania in the age group 5 to 17 years were studying at the time of the Baseline survey. The proportion was 92.31% for both boys and girls in Dobar; 100% for boys and 85.71% for girls in Miri; and 100% for boys and 70% for girls in Topania (Table 6.11).

Table 6.11: Gender-wise proportion of children studying in School in Dobar, Miri and Topania

Name of Village/ hamlet	Children aged 5 to 17 years studying in		
	Dobar	Miri	Topania
Males	92.31	100.00	100.00
Females	92.31	85.71	70.00
Total	92.31	94.12	85.71

Source: Compiled from Baseline survey data

The adult literacy rate (18 and above) is 60.61% in Dobar and 73.17% in Miri and 73.02% in Topania (Table 6.12). A comparison of the literacy rate among the three villages shows that Dobar has the lowest female literacy (47.06%) and Miri the highest (63.64%). Male literacy is highest in Topania (96.67%).

Table 6.12: Adult Literacy in Dobar, Miri and Topania (percent)

Name of Village/ hamlet	Dobar	Miri	Topania
Males	75.00	84.21	96.67
Females	47.06	63.64	51.52
Total	60.61	73.17	73.02

Source: Compiled from Baseline survey data

Data collected during the Impact Assessment survey shows that around 93.33% households in Dobar, 90.48% in Topania and 90% in Miri send their children to school. All the households surveyed in Topania, 90% in Miri and 86.67% households in Dobar have reported an improvement in access to education. 40% households in Dobar, 90% households in Miri and 61.90% households in Topania have reported an improvement in education due to better lighting facilities while 46.67% households in Dobar have reported that children are now able to study at night. Under the Sarva Shikshya Abhiyan (SSA) free text books and mid-day meals are distributed to the children. During the Impact Assessment, 93.33% of households surveyed in Dobar and 100% in both Miri and Topania reported that they had benefited from the SSA.

Basic Infrastructure: Project Impact

The motorable road is only up to Saran at the foothill of the project villages. The condition of even this road is very poor and it is often blocked due to frequent landslides in this area. These three villages are situated at a height of around 5000 meters from the foothills, at Saran. One can only access these three villages through walking up narrow, rocky, slippery paths up the mountainside.

Pucca houses in Topania increased from 47.62% to 61.90% during the period of project implementation. There was no change in the condition of dwellings in Miri during this period. However, there was a decrease in the number of pucca houses in Dobar because four houses were demolished by landslide.

Whereas, 66.67% most of the households surveyed in Dobar have a separate kachcha kitchen, 90% households have a separate pucca kitchen in Miri. In Topania, the percentage of households having a separate pucca kitchen increased from 19.05% before the start of the project to 33.33% after the implementation of the project. Access to sanitation and toilet facilities is relatively better in these villages. 6.67% of the households in Dobar had a bathroom while 30% households in Miri had both a latrine and a bathroom. While there was no toilet or bathroom in any house in Topania before the start of the project, 4.76% households had a bathroom and 9.52% households had a latrine at the time of the Impact Assessment.

At the time of the Baseline survey, piped water was being supplied to all the households of the villages for drinking and household consumption under the Swajaldhara Scheme. The exception is one household in Miri.

Table 6.13: Access to Basic Infrastructure in Dobar, Miri and Topania

(percent households)

Name of Village/ hamlet	Electricity	Water		Road Connectivity	Other development work in Village		
	Microhydel	Tap Water	Natural Spring		NREGP	SSA	Swajal Dhara
Dobar	100	100		Poor	90	90	100
Miri	100	90	10	Poor	100	100	100
Topania	100	100		Poor	100	100	100

Source: Compiled from Impact Assessment survey data

The major impact of the MNRE-UNDP-FRG project is that all three villages are now electrified through the Microhydel power house installed at Karmi III (Table 6.13). The community has worked on constructing water channels through NREGA activities and received wage employment. Sarva Shikshya Abhiyan (SSA) is being implemented and free text books distributed to the children. Teachers have been appointed to teach at the Primary school at Dobar Gram Panchayat. A Panchayat Bhawan and an Anganwadi Centre have been established at Dobar.

Self Help Groups have been set up in these three villages. The Impact Assessment survey data shows that only one household in Topania has taken loan from a bank to buy a jeep which has become a source of livelihood.

Work and Livelihoods: Project Impact

Agriculture is the primary occupation for all the households in Miri, 95.24% in Topania and 86.67% in Dobar village. Most households grow wheat, millets, barley, cholai, rajma etc. A few households also grow garlic, turmeric and chilly. However, atleast one member from 6.67% households in Dobar is in the army and another 6.67% have undertaken business as their primary occupation. Similarly, in Topania 4.76% households have atleast one person in the army (Table 6.14).

Table 6.14: Livelihoods and Work (Primary Occupation) in Dobar, Miri and Topania

(percent households)

Name of Village/ hamlet	Agriculture	Business	Army
Dobar	86.67	6.67	6.67
Miri	100		
Topania	95.24		4.76

Source: Compiled from Impact Assessment survey data

Additionally, raising livestock was a secondary occupation for 46.67% households in Dobar and 80% households in Miri before the project was initiated. However, due to introduction of the NREGS, 66.67% households in Dobar, 70% households in Miri and 47.62% households in Topania now raise livestock and also work as wage labour to supplement their income.

Food Security

Food shortage has been reported by a majority of the households. Due to lack of irrigation, agriculture is completely dependent on rain. Therefore, yields are low and this leads to food insecurity. Most of the households in the village are BPL and have reported access to PDS. Three households have reported that they purchase wheat from a grain bank, although the rest have reported non-existence of any grain bank in the village. Through the MNRE-UNDP-FRG project the Implementing Agency is providing a lift irrigation facility to these villages so that agricultural yields can be increased and the community can become self sufficient in food.

Gender Empowerment

A woman was the Sarpanch of Dobar Gram Panchayat during the time the project was being implemented and was very keen that the implementation occurs at the earliest. However, in the recently held local election a male Sarpanch was elected. Women of all three villages are members of different village committees such as the Urja Samiti (Microhydel Energy Committee). A women's SHGs existed in the village before the project was initiated and women from all the households surveyed in Dobar and Miri and 47.62% from Topania became members of WSHG after the project began. Women actively participate in the Panchayat meetings (Table 6.15).

Table 6.15: Involvement of Women in Decision Making in Dobar, Miri and Topania

(percent households)

Name of Village/ hamlet		Presence of Woman Sarpanch	Are Women in Committees	Women participate in Decision making	Do Women SHGs exist in the Village	Set up of Women SHGs in Village	Are women members of SHGs	Do women attend Panchayat Meetings	Do women raise issues wrt village development needs	Do women raise issues wrt village development needs in Panchayat meetings
Dobar	Before	100	0	0	0	0	0	0	0	0
	After	0	100	0	100	100	100	100	0	0
Miri	Before	100	0	0	0	0	0	0	0	0
	After	0	100	0	100	100	100	0	0	0
Topania	Before	100	0	100	100	100	47.62	100	100	100
	After	0	100	100	100	100	47.62	100	100	100

Source: Compiled from Impact Assessment survey data

Quality of Life

The quality of lighting has improved after the implementation of the Microhydel project in this area and all the households of the three villages have benefited from the project. In addition to getting light, access to education has also improved in these three villages. In Dobar, 26.67% households were highly satisfied and 66.67% were satisfied with the educational facilities. The corresponding

estimates were 10% and 80% for Miri (Table 6.16). A Computer Centre with two computers was being established at Miri to impart computer education to the children through the MNRE-UNDP-FRG project. All the households in Topania stated that they were satisfied with the education facilities.

Table 6.16: Community Perception regarding Improvement in Quality of Life after Implementation of the Project in Dobar, Miri and Topania (percent households)

Name of Village/ hamlet		Health	Education	Food Security	Water	Sanitation	Cooking needs	Lighting needs	Road	Employment and Livelihood
	HS	0.00	26.67	6.67	93.33	0.00	0.00	13.33	0.00	0.00
	S	0.00	66.67	80.00	6.67	0.00	66.67	86.67	0.00	20.00
Dobar	P	100.00	0.00	13.33	0.00	100.00	33.33	0.00	100.00	80.00
	HS	0.00	10.00	40.00	20.00	0.00	0.00	80.00	0.00	0.00
	S	50.00	80.00	60.00	70.00	40.00	100.00	20.00	0.00	20.00
Miri	P	50.00	0.00	0.00	10.00	60.00	0.00	0.00	100.00	80.00
	HS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	S	4.76	100.00	100.00	100.00	0.00	100.00	100.00	0.00	57.14
Topania	P	95.24	0.00	0.00	0.00	100.00	0.00	0.00	100.00	42.86

Source: Compiled from Impact Assessment survey data
Note: HS: Highly Satisfactory, S: Satisfactory, P: Not satisfactory/poor

However, there was considerable dissatisfaction with the state of health facilities. 95.24% households from Topania and 100% households from Dobar reported they are dissatisfied with the health facilities. Since these villages are situated in remote locations health workers hardly visit. However, 50% households in Miri noted that health facilities were available a few kilometers away.

Electricity connection to these remote villages is a major achievement and has certainly benefited the village community. Most of the households expressed satisfaction with access to water for domestic purposes.

The lack of employment opportunities in these villages is a major issue and 80% households in Dobar and Miri expressed concern in this regard. Similarly, 42.86% households were concerned about unemployment in Topania village.

Road connectivity to these villages is very poor and the Implementing Agency is working towards providing a ropeway from Dobar to Saran.

Overall Project Achievements and Challenges in Bageshwar

Project Achievements

- Despite landslides, broken roads and stones for a path as well as inclement weather conditions, electrification of all three villages have been accomplished.
- Village Energy Samitis have been set up with community representation for management and decision making.
- Grinding mills and oil expeller are being installed and will reduce drudgery as the villagers will not need to carry wheat and mustard down the mountain to get them ground or processed. There will also be lower risk of losses due to dropping the material or getting it wet due to rain.
- The lack of assured supply of water for agriculture is one of the main reasons for low yields. Provision of lift irrigation is in process and should make a significant difference to agricultural productivity and income.
- Transporting supplies is arduous as villagers carry ration, food grains etc. on their backs or on a mule, which is expensive. A ropeway has been ordered and should provide relief in this regard.
- A Computer Centre has been established at Miri for imparting education to school children.
- The project has significantly improved the quality of life and education by providing light and also enabling children to study at night.
- District Authorities have been made aware of the lack of agricultural extension support but much more effort is required.
- Training Programmes were conducted to build capacity in Bageshwar for running a Grinding mill for 20 trainees; Computer literacy and Photography Center for 6 trainees; Electronics/Electrical for 1 trainee; Wool carding for 1 trainee; Fabrication /welding unit for 3 trainees; and Carpentry for 3 trainees.

Challenges

- The project villages are situated in very remote areas. Instead of a road there are stones that have been placed by the community to form a path up the mountain.
- In the absence of road connectivity, the Implementing Agency has faced considerable difficulty in transporting the materials to the project villages.
- Due to landslide the gravel needs to be cleared from the water channel. Capacity of village community must be built so that they can manage these tasks.
- No agricultural extension worker, or horticulturist, or soil testing extension worker, or medical team has ever visited the village. This was brought to the notice of the District Collector, Line Departments and Block Officials who were apprised of the lack of agricultural extension and horticulture support at the time of the Baseline field visit. At the time of the Impact Assessment visit we were informed that a horticulturist had subsequently visited the village.
- The communities in these villages suffer from jaundice, skin diseases, tuberculosis, etc. Health workers and ANM rarely visit them.

- In case of serious illness, villagers carry their family members on their shoulder or on a chair down the mountain and from there to the nearest hospital. It was mentioned that in several cases the person dies on the way to the doctor.
- Even for immunisation etc the villagers have to go to Bharadia/Kapkote.
- The community has concerns regarding capacity/ability to successfully run the machines and it will take time and some successes before more people will come forward to use motive power for income generation.

Immediate Actions Needed:

- Funds and time to handhold community through the teething problems in the initial year after commissioning of the project
- Development of additional livelihood generating opportunities.
- Agricultural extension is needed to increase yield of crops and vegetables.
- Green houses or low cost poly houses have been successful elsewhere in the region and would increase yields.
- Serious efforts at convergence with the different line departments are needed to estimate potential and convergence.
- Safe Drinking Water needs to be provided to each home to reduce drudgery, jaundice and other water borne diseases.
- Deprivation of the villages with regard to health services needs to be rectified on priority. Access to health care is urgently needed as accidents and broken bones are frequent due to slipping and falling.

Photo 6.1: The IIPA Team with AHEC IIT Roorkee: On way to Dobar, Miri and Topania

Photo 6.2: Climbing to Miri in Bageshwar

Photo 6.3: Villages in Dobar Gram Panchayat

Photo 6.4: In Dobar Gram Panchayat just a few minutes before Miri – the best buttermilk ever

Photo 6.5: Focus Group Discussion with the members of Dobar Gram Panchayat at Miri

Photo 6.6: Discussion with the village community at Miri

Photo 6.7: Filling questionnaires at Miri

Photo 6.8: Computer Center being set up at Miri

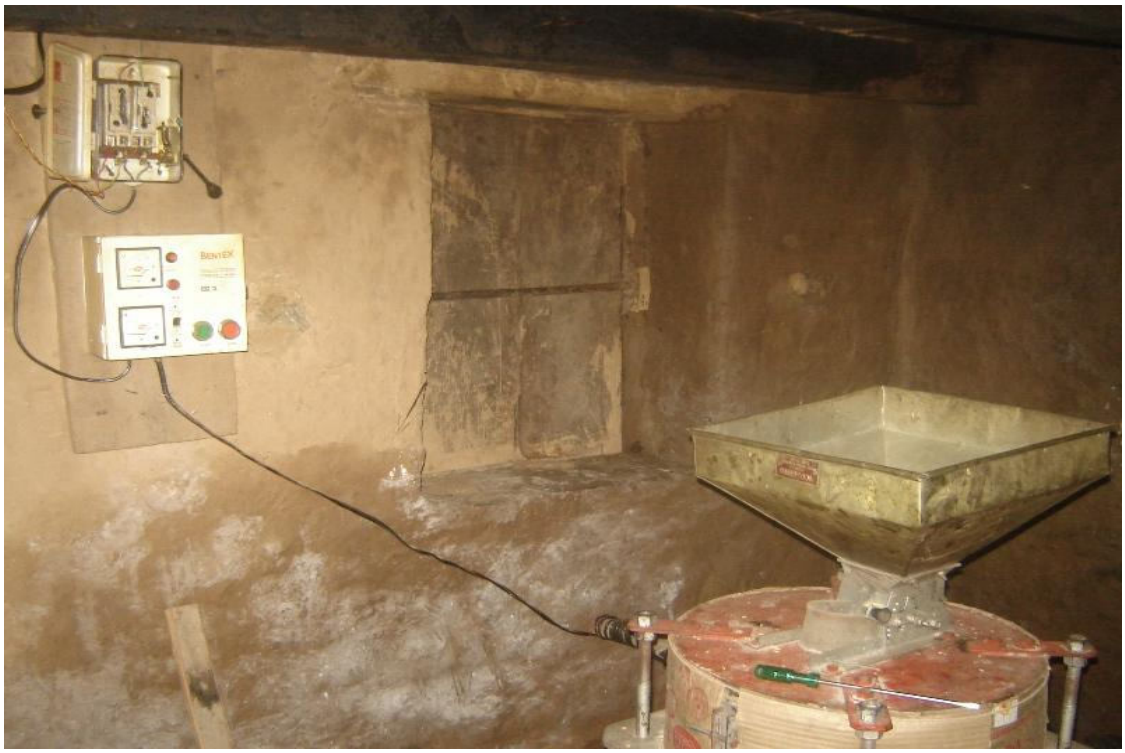

Photo 6.9: Atta Chakki in Topania based on Hydropower from Karmi III

Photo 6.10: Leaving Bageshwar after completing the Impact Assessment

7. District Tehri (Uttarakhand): Agunda and Genwali-Pangethi

Location and Demographics

Fieldwork for Impact Assessment was conducted in two villages, Agunda and Pangethi, in which the MNRE-UNDP-FRG project is being implemented by Jansamarth. Agunda and Genwali-Pangethi are located in Bhilangna block in Tehri Garhwal district of Uttarakhand. Jansamarth initiated work under this project in 2006, i.e., a few years after the other Implementing Agencies. Information was collected on 37 out of 42 households in Agunda that were present at the time of the Baseline survey and all 60 households in Genwali-Pangethi. Additionally, 30 households in each of the two villages were interviewed during the Impact Assessment survey. Several households in Agunda have now split and the number is now 61.

Agunda, earlier a major hamlet of Titrona village, became a separate revenue village in September 2008 and is about 5 kms from the nearest town of Budhakedar. All the households are Rajputs. Genwali-Pangethi village is the remotest of all the villages in the MNRE-UNDP-FRG project and is located in the hills at a distance of about 14 kms from the nearest town of Binakhal. There is a kachcha (fair-weather) road only upto Kot which is 10 kms from Budhakedar. From Kot, the village can be accessed by trekking for a distance of 12 kms through the forests and treacherous hilly tracts. There are a total of 60 households in the village, 10% of whom belong to the scheduled caste. Almost all the households are BPL (Table 7.1).

Table 7.1: Caste/Tribe and Poverty Status in Agunda and Genwali-Pangethi

(percent households)

Caste and Poverty Status/ Name of Village	Agunda	Genwali-Pangethi
Scheduled Caste		10
Rajput / General	100	90
Below the Poverty Line	96.67	100

Source: Compiled from Impact Assessment survey data

Household Level Analysis

Table 7.2 shows the size-wise distribution of households in Agunda and Genwali-Pangethi villages at the time of the Impact Assessment survey. Around 30% of households in Agunda and 47% in Genwali-Pangethi, have between 6 to 8 members while about 33% households in Agunda and 23% in Genwali-Pangethi have more than 9 members.

Table 7.2: Household Size in Agunda and Genwali-Pangethi (percent)

Name of Village	1 to 5	6 to 8	9 to 12	13 to 23	All
Agunda	36.67	30.00	26.67	6.67	100
Genwali-Pangethi	30.00	46.67	16.67	6.67	100

Source: Compiled from Impact Assessment survey data

The sex ratio was 1000 in Agunda and 1052 in Genwali-Pangethi. The child sex ratio was high at 1105 in Agunda and even higher at 1362 in Genwali-Pangethi (Table 7.3).

Table 7.3: Population and Sex Ratio in Agunda and Genwali-Pangethi

Name of Village	Agunda		Genwali-Pangethi	
	Child (0-6 years)	Total Population	Child (0-6 years)	Total Population
Males	19	139	30	192
Females	21	139	41	202
Sex Ratio (FMR)	1105	1000	1367	1052

Source: Compiled from Baseline survey data

Lighting and Energy: Project Status, Interventions and Impact

The Impact Assessment Survey was conducted in the last week of October, 2008. The Implementing Agency has reported that the power station and all the machinery/ equipment related to livelihood activities at Agunda village were commissioned on the 5th of December 2008. The people of Agunda, Koti and Titrona villages are using milling and wool processing facilities established at Agunda. Further, 22 large size 'Namdas' (felt) made by the village community have been sold by them at the rate of Rs 450 -Rs 700 per piece depending on the design content. Additionally, there is considerable local demand for 'Namdas'.

The following tasks required for generation of hydro power had been completed at the time of the Impact Assessment Survey:

In Agunda

- Civil works completed.
- Transmission and Distribution works completed.
- Electro mechanical works installed except for coupling machines.
- Penstock installed except for one point needing some cutting and welding which is delayed due to exhaustion of the oxygen gas. This had to be procured from Rishikesh, at a distance of about 200 kms.
- 2 turbines installed.
- Pipeline installed except for 1 pipe of 3 metres.
- Panel box was in the power house and was being installed.
- Alternator was lying on the base and had to be coupled.

- Shafts for energising the machines were in place and had to be coupled to machines for operationalisation.
- Transmission and Distribution lines were complete.
- 41 metres had been installed in the houses; 15 more had been requested as some of the persons were not in the village at the time of installation and some households had split since the Baseline.
- Load Controller was in place in the Agunda workshed.
- Water Tank and Heater were already in place.

In Genwali-Pangethi

1) Civil works completed.
2) Material for Transmission and Distribution works had reached but had to be installed.
3) Material for Electro mechanical works had reached but had to be installed.
4) Penstock - Pipes were in the village but had to be installed.

Generation of Electricity and Livelihoods

Solar lights have been installed in Agunda and pre-date the project and most households have a solar lighting system or solar lantern. There is a small power station of 10-15 kW in Genwali and almost all the households get electricity for lighting from this throughout the year except for the summer months (Table 7.4). This small power plant was built at Genwali 9 years ago and it serves almost all the households at Genwali hamlet seasonally (for 6-8 months a year).

Table 7.4: Primary Source of Lighting in Agunda and Genwali-Pangethi

(percent households)

Name of Village	Solar Home Lighting	Hydel power	Solar Lantern	Kerosene Lamp	More than one Source
Agunda	70	0	43.33	56.67	60
Genwali-Pangethi*	0	96.67	0	3.33	96.67

Source: Compiled from Impact Assessment survey data
*Note: * all the households use kerosene lamp only in summer*

In winter, people migrate to hamlets such as Pangethi, Kharkhurali and nearby areas that are lower down the mountain, where they maintain houses and cowsheds. The community is constructing more houses in Pangethi as there is scarcity of land in Genwali village.

Water supply to Genwali (and to the powerhouse) is inadequate from January to June due to massive landslides in the upper catchment thereby disrupting power generation. Since the Genwali power station does not generate electricity throughout the year, it was decided to set up a new larger hydel

powerhouse at Pangethi where water is available throughout the year. Pangethi power supply will supplement power in Genwali village also.

Pangethi also offers a better place for livelihood activities as it is not affected by snow during winter and is also approachable to people of other villages who would like to use wool carding and milling facilities.

The electrical power generation capacity of the micro hydel plant at Agunda is 30 to 35 kW. In addition, purely mechanical capacity (in which water runs turbines which turns other machines) of 15 kW has been provided. Therefore, the total power generation capacity is approximately 50 kW if the electrical and mechanical power generation capacity is added. Both the power stations will provide both light and motive power for generation of livelihoods (See Tables 7.5, 7.6 and 7.7).

Table 7.5: Capacity of the Micro Hydro Plants in Agunda and Genwali-Pangethi

Type of Interventions	Capacity per unit		Total no. of units Assessed in the cluster
	Capacity	Unit	
Microhydro Mechanical Power (Agunda and Pangethi)	15 + 10	kW	2
Micro hydel or Electrical Power (Agunda and Pangethi)	35 + 20	kW	2

Source: Discussions during the field visits

Table 7.6: Coverage and Services Offered by the Micro Hydro Plants in Agunda and Genwali-Pangethi

Name of Village	Number of households covered by the Micro hydro	Distribution of load (kW)		Services offered	
		Enterprise load	Household purposes	Lighting	Motive
Agunda	61	8+7+15	20	√	√
Genwali-Pangethi	62	8+10	12	√	√

Source: Jansamarth

The following livelihood generation cum drudgery reducing activities have been planned, each of which is based on processing local produce and adding value to it to ensure significantly higher returns. These are:

- Wool washing, wool carding, wool drawing, wool spinning and namda making
- Flour mill
- Rice huller
- Oil expeller.

- Welding and steel works.
- Cream Separator in Genwali-Pangethi.

The capacity of the machines installed for each of these is in Table 7.7.

Table 7.7: Motive Power based Machinery for Livelihood Generation in Agunda and Genwali-Pangethi

Equipment for livelihood/ enterprise development	Capacity (Agunda + Pangethi)	Agunda and Genwali-Pangethi
a. Wool Carding	4 + 4 kW	2 (both villages)
b. Wool Drawing/Condensing	2 +2 kW	2 (both villages)
c. Power Spinning	0.5 *6 kW	6 (both villages)
d. Oil Expeller	10 +5 kW	2 (both villages)
e. Rice Huller	5+5 kW	2 (both villages)
f. Flour Mill	5 +5 kW	2 (both villages)
g. Cream Separator	0.5 kW	1 (only in Genwali-Pangethi)
h. Welding Set	7 kW	1 (only in Genwali-Pangethi)

Source: Jansamarth

Except for the last two machines, the same machines are being installed in both villages. Genwali-Pangethi will additionally have a cream separator and welding machine. The village community has access to a large quantity of milk during summer when Ban Gujjars seasonally migrate to the area. Nearly 500 liters of milk is produced per day during the period from May to September. The purpose is to enable them to add value to the milk and to reduce spoilage by making paneer and ghee, and get higher returns.

Trained persons are required to run each of the machines installed for livelihood generation and Table 7.8 lists the direct employment creation associated with each machine.

Table 7.8: Cost of Machines for Livelihood Generation and Generation of Direct Employment by each Machine in Agunda and Genwali-Pangethi

Machine	Employment Generated	Cost of Machine
Wool carding	2 persons needed on shift basis depending on demand	Rs 3 lakhs in Agunda and Rs 3 lakhs in Pangethi
Drawing machine	2 persons	
Three Motorised Ambar Charkhas	3 persons	
Washing cum dyeing wool	1 person	
Namda making	3 trained. Several interested	
Flour Mill	2 persons for rice mill, Oil and flour mill	Rs 20,000 each
Rice Huller		Rs 5,000 each
Oil Expeller		Rs 65000 for Agunda and Rs 35000 for Pangethi

Source: Discussions with Shri Yogeshwar Kumar

Additionally there is need for one person to maintain the Channel, another to read the meters and two persons to work in the powerhouse for generating electricity.

Most households in Genwali-Pangethi own sheep. Shearing a sheep yields 1 to 1.75 kg of wool depending on the size of the sheep. Around 50 quintals of wool are available in the village. Wool prices fluctuate between Rs 35 to Rs 45 per kg depending on the quality of wool. In Uttarkashi, Rs 35 per kg is charged for washing and carding raw wool. Raw wool is processed by washing, carding, drawing and felting into a simple namda. The selling price of a 1.9 kg namda is Rs 400/-. Production of a designed namda (felt) requires that 2 persons work for 10 hours to process raw wool, wash, card, draw and make it. The selling price of a 1.9 kg designed namda is Rs 800/-. The power capacity required and process of adding value to the wool are presented in Tables 7.9 and 7.10.

Table 7.9: Machines for Processing Wool: Production Capacity and Electrical Power

Machine	Quantity Processed per hour	Power required
Wool carding	6 kgs	5 kW
Drawing machine	12 kgs	1 kW
Motorised Ambar Charkha (three) for making yarn	1 kg of wool per charkha per day for fine count	0.5 kW
Washing cum dyeing wool		2 kW

Source: Discussions with Shri Yogeshwar Kumar

Table 7.10: Value Addition and Price of Wool

Material	Process	Price
Raw Wool		Rs 45 per kg
	Scouring (removing grease with chemical) and Washing	Rs 65 but weight reduced to 0.8 per kg. Therefore price is Rs 82 per kg
	Wool Carding	Rs 35 per kg
Carded Wool		Rs 117 per kg
Spun Wool		Rs 250 to Rs 400 per kg depending on count of yarn
Felted Wool (Namda)		Rs 400 for 1.9 kg Namda
Namda with colour design		Rs 800 per 2 kg Namda

Source: Discussions with Shri Yogeshwar Kumar

A large number of young boys drop out of intermediate college and they can get livelihood through this work. There are livelihood opportunities for women through washing and dyeing wool, spinning wool and designing and making namdas. The community uses and is very interested in making Namdas for blankets, woollen clothes, 'cummer bunds', jackets and pyjamas.

Wool is collected in Agunda from a 15 km x 15 km radius covering around 6 villages. Agunda has a Government owned sheep breeding farm where a large quantity of wool is available for processing.

In Pinswar, which is 11 kms from Agunda, some households have 400 to 500 sheep. Pinswar has a total of 4,000 to 5,000 sheep. The community in Pinswar are keen to have a powerhouse and wool carding machine in their village and they mentioned this while travelling in a jeep on way to field work in Agunda.

There are 3 machines for processing agricultural produce and seasonally there will be work on different machines. Each machine needs one to two persons to run it.

Impact of Project Activities on Reducing Drudgery and Saving Time

The impact of the project on reducing drudgery and saving time is shown in Table 7. 11 below.

Table 7.11: Impact of Project Activities on Reducing Drudgery and Saving Time in Agunda and Genwali-Pangethi

	Wheat for conversion to Flour	**Mustard for oil**	**Wool for Carding**
From Agunda			
Location and Distance	4 km to Budhakedar	4 km to Budhakedar	150 km to Uttarkashi
Time Spent	1 hour and 15 minutes walking one way with headload and waiting in queue	1 hour and 15 minutes walking one way with headload and waiting in queue	3 or 4 days
From Genwali-Pangethi			
Location and Distance	15 km to Budhakedar	10 km downhill to Kot or 15 km to Budhakedar	160 km to Uttarkashi
Time Spent	5 hours walking one way with headload and waiting in queue	5 hours walking one way with headload and waiting in queue	4 days

Source: Discussions during the field visit

Atta Chakki: Women carry wheat for 5 or 6 kms from Genwali-Pangethi to Toli or Jakhana. The gharat is of very slow speed so people keep some grain to preserve their place in the queue. As a result conflicts arise. Hence, there is keen demand for an atta chakki in the village. Similarly, from Agunda men and women come to Budhakedar to get the wheat ground into flour. Sometimes it starts raining and if the flour gets wet and the entire effort goes waste. It costs Rs 1.5 to 2 per kg for converting wheat to flour and for pounding rice.

Oil Mill: Genwali-Pangethi is 14 kilometers from Budhakedar and people come from there to buy mustard oil. A few months ago a machine was installed in Kot so some people get the processing done at Kot. If a farmer takes 3 kg mustard to the oil mill, the mill owner gives him 1 kg oil and keeps the khali (mustard cake). Khali sells at Rs 5-6 per kg. If 2 kg of khali is left with the oil mill, since the khali has some oil left in it, the loss to the farmer from getting the mustard processed is Rs 20. Oil sells at Rs.80 per kg. Setting up of an oil mill has also encouraged the people of Agunda and other neighbouring villages to plant mustard crop on fallow land.

Rice Mill: 13 households in Genwali-Pangethi grow paddy. The lack of a huller in the village means that women go through the drudgery of pounding paddy at home. A large amount of paddy is also taken to Budhakedar for processing whenever needed for marriages and festivities.

The community was still dependent on fuel wood and kerosene for cooking as the power station was yet to be commissioned at the time of the Impact Assessment field visit. Hence there was no reduction in use of fuel wood between the Baseline and Impact Assessment surveys. A few households occasionally use LPG for cooking.

Health and Education: Project Impact

All the households in both villages reported that access to health facilities is very poor. Health workers and ANMs never visit these villages due to their remote nature. This is reflected in Table 7.12, which shows that all respondents stated that there was no improvement in access to health facilities. Accidents and wounds are frequent in the area due to the slippery mountain slopes even within the village. Even for basic first aid the patient has to be taken to Budhakedar.

Table 7.12: Improvement in Access to Education and Health in Agunda and Genwali-Pangethi (percent households)

Name of Village	Education	Health
Agunda	36.67	0
Genwali-Pangethi	76.67	0

Source: Compiled from Impact Assessment survey data

For analyzing the status of education among the households surveyed the 278 persons in the 37 households in Agunda and 394 persons in the 60 households in Genwali-Pangethi have been divided

into two groups based on age, i.e., children aged 5 to 17 years and adults i.e., aged 18 years and above.

In Agunda, 87.50% of children in the age group 5 to 17 years were attending school (Table 7.13). 83.78% of boys and 91.43% of girls were in school. The corresponding estimates for Genwali-Pangethi are 80% of children, 83.12% of boys and 77.42% of girls were studying in school.

Table 7.13: Gender-wise proportion of children studying in School in Agunda and Genwali-Pangethi

Name of Village	Children aged 5 to 17 years studying in	
	Agunda	Genwali-Pangethi
Males	83.78	83.12
Females	91.43	77.42
Total	87.50	80.00

Source: Compiled from Baseline survey data

The adult literacy rate was 52.52% in Agunda and 46.11% in Genwali-Pangethi (Table 7.14). The gender gap in adult literacy was large in both the villages. Male literacy was 75.56% and female literacy was 28.89% in Agunda while the corresponding estimates are 77.89% and 10.59% for Genwali-Pangethi.

Table 7.14: Adult Literacy in Agunda and Genwali-Pangethi (percent)

Name of Village	Agunda	Genwali-Pangethi
Males	75.56	77.89
Females	28.89	10.59
Total	52.22	46.11

Source: Compiled from Baseline survey data

During the Focus Group Discussion conducted with the village community at the time of the Impact Assessment, it was mentioned that the primary school teacher had not been coming to the school for a long time and the community requested that we inform the District authorities regarding this. A letter was sent to the District Collector enclosing the request given by the community. The Implementing Agency has informed us that Government of Uttarakhand has posted a teacher in the school and the person joined the primary school in the last week of November.

Basic Infrastructure: Project Impact

At the time of the Baseline survey, there was a road to Agunda. However, the road is now badly broken and only a few jeeps are willing to ply on the road at considerable expense as driving on the broken road becomes very risky. Access to Genwali-Pangethi requires walking up a pagdandi.

Table 7.15: Access to Basic Infrastructure in Agunda and Genwali-Pangethi
(percent households)

Name of Village	Electricity			Water		Road	Other development work in Village		
	Solar Lantern	Solar Home Lighting	Micro-hydel	Tap in house	Spring		NREGA	IAY	SSA
Agunda	43.33	70	100 after commissioning	13.33		Very Poor and broken	70	26.7	
Genwali-Pangethi			96.67		100	Pagdandi	100		100

Source: Compiled from Impact Assessment survey data

The micro-hydel power station has been constructed very close to Agunda, for supplying electricity to all the households. Nahars/water canals have been constructed by the Irrigation Department and these have been partially strengthened by Jansamarth. All the households in Agunda reported that development work has been initiated in the village through the construction of the microhydel power house. Wool carding and other machines have been installed and villagers received training in wool carding etc.

Genwali-Pangethi are among the remotest villages in Tehri district, where neither government officers nor health workers have visited so far and the construction of micro-hydel power stations in such conditions is valued by the village community. All the households in Genwali-Pangethi also reported that development works like construction of a bridge over a river by PWD, has been a major development. All the 60 households in Genwali-Pangethi get electricity from a small 10 kW micro-hydel power project (Table 7.15). A spring serves as the main source of water (including drinking water) for all the households. Time taken to collect water from the stream varies from 5 to 30 minutes depending on the distance of the household from the stream.

Accessing this village is both time consuming and difficult due to lack of connectivity and the climb up a steep and narrow path along the mountain.

Work and Livelihoods: Project Impact

All the households surveyed in Agunda are engaged in agriculture on their own lands, but it is entirely for self-consumption. The able-bodied male inhabitants of the village undertake wage labour work for which the daily wage rate varied from Rs. 60 to 120. Women mostly work on their own lands and also take up wage labour work like grass cutting for which the daily wage rate varies from Rs. 50 to 70. Migration is a coping strategy in Agunda with 66.67% of the sample households reporting that a member of the family had migrated to work as wage labor, work in a hotel; for service or to study. The level of migration is much lower, at 20% in Genwali-Pangethi.

In Genwali-Pangethi most households are engaged in agriculture on their own lands. However, the able-bodied people of the village prefer to work as wage labourers for private contractors since they get upto Rs. 150 per day. Most of the households migrate to Pangheti and to a nearby hamlet Kharkhurali in winter as these are located at a considerably lower altitude as compared to Genwali, which becomes very cold from late October. Rearing of livestock is an important income generating activity amongst almost all the households in the village and a significant part of the total household income is generated through this as also from selling ghee, milk and wool from the sheep.

The villagers have benefited from the Jawahar Rozgar Yojana (JRY) and National Rural Employment Guarantee Scheme (NREGS). Almost all the households have received wage employment through NREGS and most households have benefited from Sarva Shiksha Abhiyan (SSA) and send their children to school.

There is a significant difference in awareness of (and benefit from) NREGS between the Baseline and Impact Assessment surveys. Although employment generating government schemes like the National Rural Employment Guarantee Scheme (NREGS) were in place at the time of the Baseline survey, very few people were aware of it at that time and the number of beneficiaries of the scheme were therefore close to nil. Similarly, other State Government schemes under the Department of Social Welfare, like the old age, handicapped and widow pensions were also in existence, but awareness of such schemes was low. However this had changed by the time of the Impact Assessment. In Agunda, 70% of the sample households have received wage employment through NREGA; 36.67% of the sample households have got houses under Indira Awas Yojana (IAY); 1 of

the sample households got tap water through Swajal Dhara scheme. In comparison, in Genwali-Pangethi, all households have received wage employment through NREGS and villagers have constructed water canals and roads under the scheme. Similarly, all eligible households have received educational benefits.

Gender Empowerment

A woman Sarpanch has been elected this September in Agunda. However, there are no other women in other administrative positions. Womens SHGs exist in the village since 2003, or before the project was initiated. However, women do not have a greater say with regard to development needs of the village. Women members generally do not have a share in land/property in the family.

Women are members of committees like the Gram Vikas Panchayat Samiti, Microhydel committee, Women's SHG committee etc in Genwali-Pangethi. Women SHGs exists in the village since the year 2000. However, women members of the family do not raise issues regarding village development needs (Table 7.16). Further, women do not have a share in land/property.

Table 7.16: Involvement of Women in Decision Making in Agunda and Genwali-Pangethi
(percent households)

Name of Village		Presence of Woman Sarpanch	Are Women in Committees	Do Women participate in Decision making	Women SHGs exist	Are women members of SHGs	Women attending Panchayat Meetings	Women raising issues in Panchayat
Agunda	Before	100	0	6.67	100	10	26.67	6.67
	After	100	0	100	96.67	6.67	6.67	0
Genwali-Pangethi	Before	0	100	100	100	100	0	0
	After	100	100	100	100	100	0	0

Source: Compiled from Impact Assessment survey data

Quality of Life

There is considerable dissatisfaction in Agunda with regard to the state of health and education facilities, water, sanitation, road connectivity, public transport and employment opportunities. Between 43% to 100% of respondents stated that these services were poor. The extent of dissatisfaction with these services is significantly higher for all these basic needs except education (Table 7.17).

Table 7.17: Community Perception Regarding Improvement in Quality of Life after Implementation of the project in Agunda and Genwali-Pangethi (percent households)

Name of Village		Health	Education	Food Security	Water	Sanitation	Cooking needs	Lighting needs	Road	Employment and Livelihood
Agunda	HS	0.00	20.00	0.00	0.00	0.00	46.67	0.00	0.00	23.33
	S	6.67	36.67	86.67	50.00	50.00	50.00	80.00	0.00	30.00
	P	86.67	43.33	10.00	46.67	46.67	0.00	16.67	100.00	43.33
Genwali-Pangethi	HS	0.00	16.67	3.33	0.00	0.00	0.00	70.00	0.00	0.00
	S	23.33	53.33	80.00	50.00	16.67	46.67	26.67	0.00	40.00
	P	76.67	30.00	16.67	50.00	83.33	53.33	3.33	100.00	60.00

Source: Compiled from Impact Assessment survey data
Note: HS: Highly Satisfactory, S: Satisfactory, P: Not Satisfactory/poor

Unique Features of the Project in Tehri

- A unique feature of the Tehri project is that Jansamarth has constructed the powerhouse without any contracts and with the direct involvement of the community. This is important for facilitating withdrawal of the Implementing Agency. The basis for sustainable running of the powerhouse is the extensive training given to local people for maintenance and operation.
- Trained grassroots engineers were involved in all the fabrication and construction activities and only local labour (in and around the village) was used.
- Two sheds have been constructed, one for electrical power generation and the other for mechanical power generation so that machinery for daily use is independent and does not require electricity. In case of electrical faults, running of machinery is not affected. There is a separate turbine for electricity generation for lighting and heating purposes and for wool works that need constant speed for processing.
- The second turbine is for motive power application when no electricity generation is required. This can be upgraded later if required.
- Machines for livelihood activity have been installed in a shed just above the village at the confluence point of four villages, i.e., Agunda, Koti, Pinswar and Titrona
- In order to forge community ownership of the powerhouse, it was mandatory for each household to contribute 15 days of labour as voluntary contribution for building the powerhouse.
- Village Samitis were formed to manage the scheme. The power station is owned by the community and operated and managed by the local Samiti and the grassroots engineers. The Samiti owns the powerhouse and the livelihood generating equipment. The operator is paid the daily wages and the rest goes to the Samiti.
- Only trained operators have been employed.

Achievements of the Project in Agunda:

Despite extremely difficult terrain, broken roads and no roads, difficult and adverse weather conditions due to unseasonally heavy rains and landslides, remote and inaccessible villages the project has achieved the following:

- An initial contribution of ten to fifteen person days per household was ensured with the objective of raising community awareness and ownership of the project based on contribution of voluntary labour in constructing the powerhouse etc. Local contribution of unskilled labour includes preparation of site, collection of sand, preparation of chips, unskilled labour for construction of cement blocks, construction of power shed, channels and head-load transportation of materials.
- Record of the contribution from each house is maintained by the Urja Samiti.
- Gridlines have reached but villagers have declined to use this and formally informed the concerned department.
- Local Village Samitis have been set up for management and decision making.
- Metres have been installed in all homes, in the intermediate college, schools and shops and in the shed where the wool is being processed.
- The Power House and Work Sheds are complete; the Water Channel is clear; the Penstock is installed. Power generation began on 5th December 2008 (after the Impact Assessment visit).
- The Implementing Agency has designed and scaled down large machinery for livelihoods generation. Wool Carding machines and 3 spinning units of low capacity have been built, costing Rs 3 lakhs. These are in the workshed and are functional.
- Until the carding machine was installed at Agunda, villagers were selling surplus wool at Rs 35-40 per kg and for their own use they had to go to Uttarkashi to get the wool carded. Wool is now being collected and processed.
- A Six week Training Programme was conducted for wool carding and namda making.
- There is potential for developing skills among the local youth especially those dropping out of the education system with few other employment opportunities.
- Involving youth in income generation activities could reduce social problems due to unrest among unemployed youth.
- The project has the capacity to generate livelihoods and income earning opportunities for a large number of men and women through wool washing, wool carding, spinning, oil milling, flour milling and rice threshing for all those willing to learn to run the machine.
- The project will reduce drudgery for all households using the flour mill, oil expeller and rice huller in the village as in the absence of these they will have to carry the material for 4 to 5 kms to Budhakedar on broken roads with the risk of conflict in the queues and loss of flour while carrying it due to rain.
- Convergence was initiated with Ministry of Textiles through conducting a six week training programme.
- Capacity of the project was enhanced at the request of the community. Originally only 15 kW of power was to be generated. At the request of the villagers the capacity was raised so that benefits can be provided to both the neighbouring villages, Koti and Titrona.

Challenges in Agunda:

- Remoteness, broken roads and landslides prevented access to the villages and are a continuing challenge as is the extremely difficult climate and terrain.
- There is no public transport; occasional jeeps ply to the Agunda but the charges for hiring a jeep for even a short distance are very high.
- There is conflict within the village due to Panchayat Elections creating fractured communities. The earlier Pradhan of the larger Titrona village (of which Agunda was a

hamlet) was Smt Sudha Devi, wife of Shri Bhagwan Singh and the MNRE-UNDP-FRG project is seen as their project. The new Pradhan is a woman. The village is divided due to elections. Through Focus Group Discussions efforts have been made to make the community aware of the fact that this is a Government of India project that belongs to the community and they should take all possible benefits from it.

- The community has concerns regarding capacity/ability to run the machines and the powerhouse and manage the project after withdrawal of the Implementing Agency. Withdrawal mechanisms are being put in place by the Implementing Agency to ensure no dependence of the community on it.
- There is lack of availability of labour in Agunda and labour had to be requested from Genwali-Pangethi and other neighbouring villages.
- There is lack of/ low level of skills in the villages.
- A private operator wants to generate 12 MW of power on this stream, upstream of this village. The villagers are averse to this, as the channel would pass through the village. Agunda had major floods in the past due to blockage of the stream by landslides.

Challenges in Genwali-Pangethi

- Capacity of Pangethi power station was raised to 20 kW for power generation and 10 kW for motive power instead of the planned capacity of 10 kW only. It would not have been possible to run the machines simultaneously if just 10 kW was generated. The machines for processing wool require more than 8 kW of power. Realising that wool is available in large quantities and continuous work would take place using wool machinery, the capacity of the power house was increased.
- Despite extremely difficult terrain, difficult and adverse weather conditions due to unseasonally heavy rains and landslides, remote and inaccessible villages and the fact that reaching Genwali-Pangethi requires trekking through the forests and treacherous, steep mountain tracts, the project is under finalisation in Genwali-Pangethi. The achievements and challenges in Genwali-Pangethi are similar to those in Agunda with the additional difficulty that access to this village is harder than that to any of the other project villages.
- There is a forest between Pangethi and Genwali. A wire has to connect the two. No tree has to be cut. Yet the forest authorities have caused delays in granting permission.
- Land is irrigated in Pangethi but the upper mountain plots are neither irrigated nor properly terraced. Yield is low because production is organic and they are using traditional seeds. This year crop yields are low due to heavy rains. There has been spoilage of even Amaranthus (ram dana). Flowering and fruiting has been affected by the rain.

Capacity Building Measures:

- Nine local grassroots engineers trained for four months at Budhakedarnath and learnt the theory of hydropower stations, hydrology, measurement methods, estimation of power generating capacity, alignment of canal, hands on experience of operating machinery; use of tools and implements, power plant wiring, metre reading, household wiring.
- With a view to convergence a six weeks Training Program was conducted at Panipat with the support of the Ministry of Textiles for wool carding, processing and Namda making. Rs 150/-

per person was allocated to meet the cost of room and food. However people were not willing to attend as the opportunity cost was the income they could earn through work during that time. Hence it was decided to pay them Rs 100/- each for the duration of the training. The three people from Agunda and three from Genwali-Pangethi who have been trained in processing wool are:

Agunda

1) Nagendra Singh Rawat
2) Vikram Singh
3) Kuwar Singh

Genwali-Pangethi

1) Mukesh
2) Shur Vir
3) Veer Singh

- A skilled person from Srinagar, Jammu and Kashmir has been requested to further train local people on Namda making. Another worker from Delhi was requested to work on fitting and assembling the carding machine at Agunda and running the wool processing works during November (for atleast one month) so that any initial problems faced by the local trainees were resolved, their capacity enhanced and the system was fully functional.
- Women want to learn tailoring.
- A Samiti was formed and included Bhagwan Singh, Bishan Sigh and Narendra Singh. As mentioned in the Focus Group Discussion, Rs.3.5 lakhs was given to them in stages for constructing a 5 meter x 5 meter shed; a 5 meter x 6 meter shed; silting chamber of 14 meters; and a 2 meter x 2 meter forebay. In addition, the community provided a voluntary contribution of 10 days labour per household or shramdaan.
- Makaan Singh, Nagendra, Ravi, Raju and Uttam are learning how to operate the machines at present.
- The Implementing Agency has informed us that a second round of wool training has also been completed at Agunda village. The villagers have already sold 22 large size 'Namdas' (felt) at the rate of Rs 450 to Rs 700 per piece depending on the design content. These 'namdas' were made by the villagers. There is a considerable local demand for 'Namdas'.

Immediate Actions Needed:

- Funds and time to handhold the community through the teething problems in the initial year after commissioning of the project
- Funds for building the capacity of local youth who will run the machines and for further development.
- Development of management systems for collection of raw material, payment to machine operators, distribution of profits, etc.
- Wool is available with all those who own sheep in and around these villages. There is local need for felt. Making felt is easy and does not require much skill. Since there is a provision for making yarn, local weaving would improve. It requires initial support in terms of training and marketing.
- Agricultural extension is needed to increase yield of crops and vegetables. Green houses or low cost poly houses would increase yields.

- Convergence and trouble shooting has occurred for instance with making District Authorities aware of the lack of a school teacher in the primary school for two years.
- Smokeless chulhas are needed, as firewood is used for cooking and heating.
- Safe Drinking Water needs to be provided to each home to reduce drudgery and illness.
- Deprivation of the villages with regard to health services needs to be rectified urgently. Access to health care is urgently needed as accidents and broken bones are frequent due to slipping and falling while cutting grass etc.

Photo 7.1: Agunda Village

Photo 7.2: Focus Group Discussion in Agunda

Photo 7.3: Wool Carding in Agunda

Photo 7.4: Wool Carding Machine in Agunda

Photo 7.5:Machinery for carding wool in Agunda

Photo 7.6: Demand for Income Generating Activities by the Community at Agunda

Photo 7.7: Filling household questionnaires in Agunda

8. Findings, Issues and Recommendations

The MNRE-UNDP-FRG Renewable Energy for Livelihoods Project has been implemented in remote villages in Rajasthan, Uttarakhand and Jharkhand. IIPA was the facilitating/monitoring institution for 14 villages selected from Bharatpur, Ajmer, Jaipur and Baran districts of Rajasthan and Bageshwar and Tehri districts of Uttarakhand. There are a total of 836 households in the 14 villages where the project was implemented (Table 8.1). Between two and four field visits were undertaken to each of these villages, to facilitate progress of the project through discussions with the Implementing Agencies, meetings with the community to motivate them as well as determine project impact on livelihoods and quality of life in the village. Focus Group Discussions were held with the community in all the 14 villages. Efforts were made to interview as many households as possible in each village. 587 households (70.22%) were interviewed individually during the Impact Assessment Survey. While all the households in Nagla Ramoli, Shri Nagar, Dobar and Miri were interviewed during the Impact Assessment Survey, around 70 to 90 percent households were covered in Doi ki Dhani, Kalia, Singla, Balaji ki Dhani, Topania and Agunda and between 47 to 70 percent of households in the remaining villages.

Table 8.1: Total Households in the Project Villages in Rajasthan and Uttarakhand

District	Project Villages	Total Households	Households interviewed during the Impact Assessment	% Households interviewed
Ajmer	Balaji ki Dhani	32	23	71.88
	Gudda	143	68	47.55
Jaipur	Doi ki Dhani	54	38	70.37
	Kalia	75	65	86.67
	Singla	64	53	82.81
Bharatpur	Nagla Ramoli	25	25	100.00
	Shri Nagar	70	70	100.00
Baran	Ledra	74	51	68.92
	Sanwara	149	88	59.06
Bageshwar	Dobar	15	15	100.00
	Miri	10	10	100.00
	Topania	23	21	91.30
New Tehri	Agunda	42	30	71.43
	Genwali-Pangethi	60	30	50.00
Total		**836**	**587**	**70.22**

As pointed out in Chapter 1, the objectives of the MNRE-UNDP-FRG Project are to raise economic levels of households through meeting the needs of cooking, lighting and motive power from renewable sources; use the energy for economic activity to enable reduction in poverty; achieve

investment efficiency and reduce the drudgery and loss of time in fetching fuel-wood and water. More than half of India's population does not have access to electricity or any other form of commercial energy. All the villages selected for the project were un-electrified.

Access to infrastructure is a critical enabler for achieving poverty reduction (Bhalla 2006) and inclusive growth. In view of continuing power shortages, the development of new and renewable energy is critical for decreasing dependence on energy imports, diversifying the energy basket and meeting clean emission norms. Despite challenges, most of which have been resolved, the MNRE-UNDP-FRG project has successfully demonstrated the functioning and usefulness of village-based, new and renewable energy solutions being delivered with the support of grassroot technicians whose capacity has been built through the project.

Provision of Renewable Energy for Cooking, Lighting and Motive Power: Status and Performance

Renewable energy in the form of solar, biomass or micro-hydro based energy has been provided in the 14 villages. The performance or functionality status at the time of the Impact Assessment field visit, difficulties in functioning if any and whether or not these have been resolved, are presented in Tables 8.2, 8.3 and 8.4.

Table 8.2 Renewable Energy for Lighting: Status and Performance

Project Village/ Implementing Agency	Power Source	Performance	Problem faced and Solution
Rajasthan			
Balaji ki Dhani, SWRC-Manthan	Solar lantern	Functioning well and used for working night shift; tending to livestock at night; in agriculture; at home; during migration; for studying	Occasional replacement of battery or fuse
Gudda, SWRC-Manthan	Solar lantern		
Kaliyan, SWRC-Prayatna	Solar lantern		
Singla, SWRC-Prayatna	Solar lantern		
Doi ki Dhani, SWRC-Prayatna	Solar lantern		
Sanwara, SWRC-Sankalp	Street light and solar home lighting	Was functioning. Not functioning at present	The community is not willing to live in the new pucca houses where light connections were provided as a few deaths occurred. Unwilling to pay the monthly charge of Rs 50 per household

			for power from the Gasifier
Ledra, SWRC-Sankalp	Street light and solar home lighting	Was functioning. Not functioning at present	Community unwilling to pay the monthly charge of Rs 50 per household
Shri Nagar, CII-Lupin	Solar lantern and Street light	Functional. Gasifier often not functional	Increase in number of households due to splitting of joint families. Demand for solar home lighting systems by the new households
Nagla Ramoli, CII-Lupin	Solar lantern and Street light	Functional. Gasifier has worked every single day since it was installed	
Uttarakhand			
Agunda, Jansamarth	Micro-Hydro	Commissioned on 5th December 2008	Now functional
Ghenwali – Pangethi, Jansamarth	Micro-Hydro	To be commissioned	
Miri, AHEC IIT Roorkee	Micro-Hydro	Started August 2008. Not functioning at time of Impact Assessment visit due to gravel in channel caused by landslide but was functional prior to the visit	Water channel was being cleared of gravel caused by landslide
Dobar, AHEC IIT Roorkee	Micro-Hydro		
Topania, AHEC IIT Roorkee	Micro-Hydro		

Table 8.3: Renewable Energy for Cooking: Status and Performance

Project Village/ Implementing Agency	Power Source	Performance	Problem faced and Solution
Rajasthan			
Shri Nagar, CII-Lupin	Biogas	Generally functional	Equity issues arise since biogas units have been constructed only for households that own livestock. Problems in functioning occur if cowdung fed is below optimal quantity
Nagla Ramoli, CII-Lupin	Biogas		

Table 8.4: Renewable Energy for Livelihood Generation: Status and Performance

Project Village/ Implementing Agency	Power Source	Machine	Performance Status, Problem faced and Solution
Rajasthan			
Balaji ki Dhani, SWRC-Manthan	Solar	Wool shearing machine Solar lantern for night shift; tending to fields; scaring away animals; preventing pests; tending to animals etc	Wool shearing machine was used after Impact Assessment visit Solar lanterns functioning well except for occasional maintainance and repair.
Gudda, SWRC-Manthan	Solar		
Kaliyan, SWRC-Prayatna	Solar		
Singla, SWRC-Prayatna	Solar		
Doi ki Dhani, SWRC-Prayatna	Solar		
Sanwara, SWRC-Sankalp	Gasifier	Pumps for Lift irrigation for agriculture. Plantation for NTFP and value addition	i) Worked very well for the first year. More pumps needed. ii) Problem in the second year Drought year. Government ban on

			lifting water iii) NTFP yield begins two years from now
Ledra, SWRC-Sankalp	Gasifier	Pumps for Lift irrigation for agriculture. Plantation for NTFP and value addition	First year was the drought year with the ban Community has given land on lease to outsiders for fear of poor weather
Shri Nagar, CII-Lupin	Gasifier	Flour Mill, Lift irrigation, Masala unit, goats, buffalos etc	Worked well initially but erratic. Feed wet fuel wood. Trained youth is ill. Need a trained substitute
Nagla Ramoli, CII-Lupin	Gasifier	lour Mill, Lift irrigation, Masala unit, goats, buffalos etc	Working well. Not a single day's down time
Uttarakhand			
Agunda, Jansamarth	Micro-Hydro	Wool carding, namda making, oil mill and atta chakki	Electricity generated 5th December 2008 after Impact Assessment visit. Wool carding initiated through use of diesel prior to functioning of micro- hydro to test community interest, which was substantial
Ghenwali – Pangethi, Jansamarth	Micro-Hydro	Wool carding, namda making, oil mill and atta chakki	To be initiated
Miri, AHEC IIT Roorkee	Micro-Hydro	Oil Expeller, Computer, Photography, Rope way Lift Irrigation	Mostly under implementation; Computer was being installed; Grinding mill just initiated in Topania
Dobar, AHEC IIT Roorkee	Micro-Hydro	Grinding Mill	
Topania, AHEC IIT Roorkee	Micro-Hydro	Grinding Mill Welding Machine	

As can be seen from the details in Tables 8.2, 8.3 and 8.4, village communities have benefited from the use of solar lanterns in the villages selected by SWRC-Manthan, SWRC-Prayatna; solar home lighting and street lighting in the villages selected by CII-Lupin; micro-hydro power based lighting and start of livelihood generation in the villages selected by AHEC-IIT Roorkee and Jansamarth; livelihood generation in the biomass gasifier based villages selected by CII-Lupin and SWRC-Sankalp and biogas for drudgery reduction in the villages selected by CII-Lupin. The gasifier has worked successfully in CII-Lupin's Nagla Ramoli and less effectively in neighbouring Shri Nagar. It worked very effectively in SWRC-Sankalp's Sanwara for one agricultural season but ran into an unforeseen ban by Government on lifting of water from natural bodies due to drought.

In view of the absence of electricity through the grid, lack of biomass and water and abundance of sunlight, the choice of solar home-lighting systems, lanterns and streetlights is appropriate especially for the villages in the Rajasthan desert. The technology is robust since there are few complaints even though the solar lanterns and streetlights have now been functioning in these areas for a few years.

The lantern has the additional advantage of providing light both within the home and in the fields, pastures and workplace with minimum need for maintenance. Capacity of a large number of grassroots engineers has been built by Barefoot College over several years.

Micro hydro is appropriate for the villages in Uttarakhand since rivers provide adequate supply of water. Maintenance cost is low. The power is locally generated and does not require long transmission lines. While channels do need to be kept free of gravel etc especially during rains and landslides, there are instances of these power stations being run effectively by the community for several years. Both AHEC, IIT Roorkee and Jansamarth have installed and delivered micro-hydro in a large number of villages that are performing successfully for the last several years.

In comparison, the Gasifier is primarily dependent upon availability of biomass and ensuring the wood pieces that are of the appropriate length and moisture content. The experience has differed across villages depending on the care taken by the community.

Poverty Reduction and Quality of Life

An important goal of the Project is to use the energy for economic activity to enable generation of cash income, reduction of poverty and reduce the drudgery and loss of time in fetching fuel-wood and water. The purpose is to help improve the lives of the poorest women and men and those who are marginalized and disadvantaged in India. All the villages selected for implementation of the project in Rajasthan are inhabited by marginalised and disadvantaged communities. Similarly the villages selected for implementation of the project in Uttarakhand are extremely remote and the communities suffer from poverty and deprivation in multiple ways. The many innovative interventions initiated through this project constitute meaningful efforts to improve the lives of the people in these communities through providing renewable energy for lighting, cooking and motive power and to build capacity, facilitate livelihood generation and, in many cases, enable access to education and health facilities. Night schools enable young children to study and may protect them from inheriting their parents' poverty. Most of the villages selected for implementation of this project exhibit characteristics that lead to persistence of poverty, such as remoteness, low agricultural productivity, dependence on rainfed agriculture and illiteracy. Several interventions that have been initiated in this project such as provision of livelihood generating equipment, value

addition as in the case of wool carding, access to assured water such as from lift irrigation, access to assets such as community or group owned livelihood generation equipment etc will enable people to move out of poverty if these efforts are sustained over time.

A tentative framework for working towards reducing poverty in the project villages is given below. Convergence with other line Ministries, such as the Department of Drinking Water Supply, Department of Agriculture, Horticulture, Animal Husbandry, Textiles and Rural Development is needed to safeguard against factors causing persistence of poverty or entry into it and strengthen factors that can enable escape from poverty and this needs follow – up action.

Table 8.1: 'Drivers, Maintainers and Interrupters' of Poverty in the Project Villages

Drivers	**Maintainers**	**Interrupters**
Loss of productive assets (eg Landslide leading to loss of houses in Dobar; Flood caused by cloud burst leading to death and destruction in Agunda Death of income earner (Doi ki Dhani) Crop failure, drought, pest attack (Dobar, Miri and Topania; Balaji ki Dhani, Gudda, Kalia, Singla, Doi ki Dhani) Policy change (ban on lifting of water from natural water bodies in Sanwara and Ledra) Lack of employment opportunities, unemployment and educated youth in search of jobs in Nagla Ramoli and Shri Nagar Ill health including due to very poor quality of drinking water unfit for drinking Unproductive spending, i.e. family functions, giving dowry for marriage Barren or infertile land especially in Rajasthan villages; small size of plots	Social exclusion (eg PTGs in Sanwara and Ledra; SCs in Shri Nagar and Nagla Ramoli; Gujjars and OBCs in Balaji ki Dhani, Gudda, Doi ki Dhani, Kalia and Singla). Illiteracy/ very low female literacy; lack of education/skills Remote location (Sanwara and Ledra; Shri Nagar and Nagla Ramoli; Balaji ki Dhani, Doi ki Dhani, Agunda, Genwali-Pangethi, Miri, Dobar and Topania) Low agricultural productivity, Subsistence farming; Low wages and casual labour Households unable to purchase tank water and thus drinking the salty water Indebtedness Lack of market linkages; sale of unprocessed products such as wool. No agricultural extension	Growth, increased productivity and higher wages (all the villages after the livelihood generation stabilizes) Transfer of skills and capacity building (all the project villages); value addition and linkages with market (eg for wool carding and making namdas) Access to water for irrigation, (SWRC-Sankalp lift irrigation at Sanwara and Ledra; planned lift irrigation at Bageshwar and irrigation at Agunda and Genwali-Pangethi) Asset transfer (livelihood equipment both individual and group/community in all the project villages) Access to credit at reasonable rates of interest, IGPs, Non farm employment (Self Help Groups) Infrastructure development in the village (all the villages in the MNRE-UNDP-FRG Project) Literacy and Education (long run impact and prevention of inter-generational transfer of poverty through SWRC night schools, computer based education in Bageshwar) Reduction in illness and loss of work

in Uttarkhand villages Exploitation by middlemen /traders/sahukars/ moneylenders		days due to access to clean drinking water (RO plant at Ajmer) Access to off-farm work and jobs based on livelihood generation Regular visits of agricultural extension workers and horticulturists etc to the villages to test the soil and provide agriculture related inputs

Source: Adapted from Bhide and Mehta CPRC-IIPA Working Paper 15, 2004

Community Participation and Ownership of the Project

Community participation in the project was ensured in all the villages through formation of Urja Samitis, community participation in site selection, donation of land either by an individual as in the case of Manthu Sahariya at Sanwara village in Baran district for installing gasifier shed or by the Gram Panchayat in most of the other villages; and additionally, pasture land by Gram Panchayat in Sanwara and Ledra for the plantation in the Closure, medicinal plant cultivation and biomass generation. The plantations will yield cash income for each of the Sahariya households in before the end of this decade.

Community involvement has also been ensured through labour participation in building the boundary walls, gasifier and power sheds. In Tehri, the community was required to make an initial contribution of ten to fifteen person days per household as voluntary labor for constructing the power house. This included preparation of site, collection of sand, preparation of chips, and unskilled labor for construction of cement blocks, construction of power shed, water channels and head-load transportation of materials. In Baran, the community contributed wage labor and out of the minimum wage i.e. Rs.73 per day, Rs.23 per day of work was saved in the village Kosh to meet the maintenance cost of the gasifier. In Bharatpur and Bageshwar households using motive power for livelihood generation contributed to the cost of the flour mill, interlocking machine, welding machine and other equipment. In Ajmer and Jaipur some villagers paid Rs.1000 at one time to cover costs of maintainance of the solar lantern over the first few years while others contributed Rs. 25 per month. In Tehri, the livelihood generation cum drudgery reducing equipment has been provided by the project and is owned by the community.

Despite severe challenges due to extremely difficult climate and terrain, remoteness landslides, broken roads and stones for a path as well as inclement weather conditions, accidents and ill health,

the Implementing Agencies have succeeded in providing light in all the villages in the project and initiate livelihood generation activities in several others. In addition, the following are among the achievements of the project:

Creation of Infrastructure and linkages with other schemes

- Construction of infrastructure such as gasifier shed, powerhouse etc;
- Development of relatively low cost, innovative livelihood generation machinery of low capacity and its installation at Tehri
- Functional night schools, construction of rooms in schools in Shri Nagar and a school building in Balaji ki Dhani;
- construction of community owned underground water tanks and construction of individually owned underground water tank by a large number of households in the Ajmer and Jaipur villages;
- construction of deep bore wells in the Bharatpur and Baran villages; construction of roads in Bharatpur, Baran and other villages;
- wage employment through NREGS in all the project villages;
- health related programmes in all the Rajasthan villages; residential colony for Sahariya tribes in Baran;
- Encouraging non-energy based activities livelihood generating activities such as through providing livestock (goats, buffalo), supporting kirana shops etc in the selected villages in Bharatpur.
- plantation in the closure for income generation in the selected villages in Baran
- Insurance for the head of each household and for livestock in the selected villages in Bharatpur.
- Crop demonstrations, distribution of seeds in the Rajasthan villages.

Training and Awareness Raising

- Training programme for developing skills among the local youth especially those dropping out of the education system.
- Barefoot women Ayurvedic Workers from villages have been trained in recognizing medicinal plants and preparing medicine from them.
- Barefoot solar engineers and technicians.
- Training programmes for local grassroots engineers in the theory of hydropower stations, hydrology, measurement methods, estimation of power generating capacity, alignment of canal, hands on experience of operating machinery, use of tools and implements, power plant wiring, metre reading, household wiring.
- Training programme for computer learning, running photography centre etc.
- Training for running the gasifier.
- Gasifier Sanchalan Committees set up.
- Training for running RO plant, grinding mill and other machinery.
- Teachers and health workers working as community trainers.
- Training of women in fabrication and installation parabolic solar cooker.
- Creating awareness about the benefit of collecting and storing water in tanka.

- Facilitating access to job cards, smart cards.
- Creating awareness about the benefit of inoculation, infant care, pregnancy etc.
- Women and youth SHGs established.
- Training for tulsi mala making, vermi-composting, wool carding, namda making, tailoring, fabrication/welding unit, carpentry etc has been provided.
- Solar light sustainability groups established.
- Solar Repair workshop has been set up.
- Training for livestock rearing has been provided.
- Workshop, science fair and health camp organized for the villagers.
- Beti Ek Anmol Ratan Campaign.
- Health sensitization training programme and immunization programmes has been conducted.
- Women Rajas Sangh agents for selling NTFP as commission and enabling the community to sell their produce in the village.
- Local Village Committees, Village Energy Samities has been set up.

Policy Issues and Recommendations

Hence, the continued visits and links of the Implementing Agencies with the selected villages have led not only to provision of light and motive power but additionally built skills and capacity, enabled convergence with NREGS, led to improvement in access to education and health facilities, encouraged plantations for biomass, facilitated access to water, construction of roads and therefore an improvement in the quality of life of each of these communities. However, additional resources and time are needed for the investment to take firm root and transform the selected villages into best practice cases so that they reflect the impact of using new and renewable energy in sustainable generation of livelihoods, increase in cash income, poverty reduction, drudgery reduction and improvement in the quality of life.

In sum,

- A significant difference has been made to the quality of life of communities in the villages where the project has been implemented. However, most projects have just been commissioned and livelihood generating equipment has only recently been deployed. It is therefore too early to estimate the efficiency of the investments made as cash incomes have yet to be generated or stabilize in most villages.
- There are equity issues in sharing returns from project interventions in villages where livelihoods have been generated for those who have funds

- It must be recognised that there will be slippage of time lines when working with communities in remote villages with poor infrastructure, poor roads or no roads, no electricity and in several cases no telephones.
- Each of the Implementing Agencies has taken a mix of approaches in implementing the project. The major infrastructure, such as Gasifier or Micro-Hydro, is community owned in all the villages. CII-Lupin and AHEC, IIT Roorkee supported individual entrepreneurship and ownership of machinery for livelihood generation. SWRC-Sankalp facilitated group ownership of livelihood generating equipment (eg. motors for pumping water) while Jansamarth encouraged ownership of livelihood generating equipment by the village community (eg. wool carding machinery and flour mill etc). The individual entrepreneurship approach is propelled by the personal profit motive and is likely to succeed because of it. However, the livelihood generating equipment has a large element of subsidy in it and therefore community ownership and sharing of returns is more equitable. If conflicts do not arise and it works successfully for a few years this will lead to increased cash income and reduction in poverty for a large number of households. For instance 32 households in SWRC-Sankalp received a saving of almost Rs 9000 each from just one rabi crop due to shared benefits from lift irrigation.
- Below poverty line households are understandably reluctant to risk investment in Income Generating Projects. There will be a spread effect and increased demand for livelihood generating opportunities once the initial investments lead to increased cash income and returns sustain over time.
- If the initial investment made by MNRE, UNDP and FRG in the selected villages is to yield sustainable returns, funds and time will be needed to handhold the community through the teething problems in the initial years after commissioning of the project.
- Capacity of local youth has been built for running the machines but follow-up training will be needed at regular intervals.
- Management systems need to developed for collection of raw material, payment to machine operators, distribution of profits, etc.
- There is need for convergence and linkages with other government departments and schemes. This is especially required with departments of drinking water, health, education, agriculture, horticulture, animal husbandry, textiles and rural development.

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