SOLAR DC MICRO OFF GRID FOR RURAL ELECTRIFICATION

(CHANGE PROJECT)


PROJECT BRIEF

For Villagers, who don't have access to grid electricity, this project means cheap quality power at home and relief from kerosene, which is pollutant and health hazard, for which, often they have to pay expensive price due to black marketing. The mobile charging station provides another relief from travelling long distance for the sake of charging phone and paying expensive price. For the villagers it is just more than light, it is an opportunity to do more after the dark. Many social enterprises sell products such as solar lanterns or wind-up chargers to meet their customers' lighting or charging needs. But in this region, where average family incomes are rarely higher than 800-1600 rupees per month, villagers would have to put themselves into debt to purchase such products.

OBJECTIVE

The objective is to improve the quality of life of the remotely located population through the sustainable provision of electric energy services and the associated social and economic benefits.

The project will ensure new sustainable mechanisms for the construction of a variety of decentralized energy systems which are based on renewable energy technologies, for the electrification of areas that are isolated from the grid.

The goal is to create a constant source of power that uses simple, local technology with maximum efficiency and can be replicated quickly in many un-electrified villages adopted by BHEL.

TARGET GROUP

Up to 70 micro-grid consumers who are located within a 200 meter radius of a single central power source in the Shantinagar village locality.

EXPECTED RESULTS

The arrival of electricity will significantly improve health conditions, especially for women and children, and will enable school children to study in the evenings. With the cooperation of BHEL, we would be try to mobilize the villagers to fully utilise the electricity to enhance economic activity and productivity (i.e. water pumping and distribution, sewing machines, cash crop drying).

Public Administration Uses	• Allows for more efficient public administration. • Increase working time and improves quality of service.
Health Uses	• Light for emergencies, childbirths; vaccine fridges ; HIV. Domestic light seems to be correlated with more whitewashed walls and less bugs (e.g. Chagas)
Educational Uses	• Studying at night; adult education; allows retention of qualified teachers. Schools can serve as anchor clients for service providers. Subsidizing public services is an efficient way of targeting subsidies with reduced free rider effects.
Productivity Uses (MSB)	• Raises productivity; increased profit and employment . E.g. light extends work time ; electricity allows applications such as water pumping (irrigation), soldering, motive applications (drilling, sawing, mills), cold chain (e.g. for small shops and restaurants, milk processing, beef storage), fish ponds, electric fences, video cinemas, etc. Permits use of ICT.
Household, Social and Community Uses	•Improved quality of life (light,TV, radio). •Light: children and women gain additional time at night (reading, homework).Improved light quality (200 times brighter) and cost per lumen. • Reduced cooking times and easier cleaning due to illuminated room. • Increased productivity for self consumption. • Safety: Street lighting allows children and women to socialize at night. Facilitates community activities (light, TV, radio, discotheques).Potential effect on birthrates?

POTENTIAL FOR ENTREPRENEURIAL ACTIVITY GROWTH

The provision of electricity creates opportunities for a number of entrepreneurial activities

- Water supply
- Sale of appliances and bulbs
- Ice machine
- Refrigeration services
- Battery charging
- Irrigation
- Movie showings
- Power tool rental
- Ice cream machine
- Welding shop
- Woodworking machine shop
- Electric Sewing machines

POWER SCENARIOS

	Scenario 1 Absolute minimum	Scenario 2 Low income household	Scenario 3 Medium income rural household	Scenario 4 Urban household
Lighting	✓	✓	✓	✓
Cell phone	✓	✓	✓	✓
Fan/Cooler		✓	✓	✓
Radio/TV		✓	✓	✓
Water pump			✓	✓
Other				✓
Peak demand per household	30 Wp	150 Wp	500 Wp	1 kWp
Annual energy demand per household	65 kWh	500 kWh	1,000 kWh	1,200 kWh

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	Public lighting	School	Health station	Administrative building
Lighting	✓	✓	✓	✓
Fan/Cooler		✓	✓	✓
Water pump		✓	✓	
Refrigerator			✓	

TECHNICAL SPECIFICATIONS

Many small scale renewables natively generate low voltage DC power. Most of these generators supply power to AC mains networks and require costly and inefficient power invertors; even where the power may ultimately be delivered to a DC device.

A possible solution is to install a DC network linking DC devices to DC power supplies. Such networks have higher electrical losses associated with transmitting a fixed amount of power as low voltage DC, rather than higher voltage AC. But with the proliferation of low power electronic devices, bringing the potential for LEDs to reduce lighting loads by a up to a factor of 10 and the potential for efficient distributed power generation, localised DC networks – or DC micro-grids is practical.

Aside from reducing resource and financial costs, a key advantage of DC micro-grids is that the low risk of dangerous electric shocks from low voltage DC makes plug-and-play grids a possibility. This greatly reduces the installation cost of micro-generation, and could empower end users to take responsibility for understanding and controlling their individual energy consumption.
A DC micro grid comprises:

- DC power generation (i.e. solar PV panels, or micro wind turbines);
- DC electrical storage (i.e. battery or super capacitor);
- DC power distribution (i.e. wiring and control);
- DC gadgets (i.e. DC fans, telephones, satellite TV controllers);
- DC lighting (i.e. LEDs).

1. DC Power Generation: Through Power generation.

2. Battery Bank: Power is generated during the day but consumed at night. To bridge this gap, a battery bank large enough to provide

two days back up is installed inside the same house that the panels are installed on. MGP's design only requires four batteries for an entire village thus reducing the footprint of the battery cabinet in the household.

3. Power Distribution: Power is distributed over a short distance from the battery banks to the village and then to households within the village. Low voltage electricity is distributed according to a set schedule agreed to by the village.
4. Light-Emitting Diodes (LED): By utilizing LED lights, Prabuddha's micro grid design is ultra energy efficient. This is the key to reducing power generation and storage equipment. Each household is provided with two or four LED lights. These lights provide better light through more light points and for longer duration each night than our customers are able to get through kerosene.

#	Item	SCENARIO I	SCENARIO II
1	No of Households	70	70
2	Load of each Household	1 DC fan (20 W), 1 LED light 3 W 1 Mobile charger 3 W	1 LED lights 4 W 1 LED light 2 W 1 Mobile Charger 3 W
3	PV module array	3 KW Array	1.4 KW Array
4	Solar Charge Controller Unit (SCCU)	Yes	Yes
5	Dusk to Dawn Operation	Yes	Yes
6	Remote Monitoring system	Yes	Yes
7	Battery Bank	1500 AH	600 AH
8	Wiring and Cabling and accessories (circuit breakers, fuses, MCBs, junction boxes)	Lump Sum	Lum Sum
9	Installation	Lump Sum	Lump Sum
10	Annual maintenance and service delivery	2 Year after which AMC needs to be signed	2 year after which AMC needs to be signed

KEY CRITICAL SUCCESS FACTORS FACTORS IN SUCCESS OF DEVELOPING MICROGRIDS

- Community level leadership and
- Organizing capability