



# INNOVATIVE SOLAR POWER MODEL

A Case Study of Village Rampura,  
District Jhansi, Uttar Pradesh

## At A Glance

### Location

Village Rampura, Panchayat Pahalguwan  
Block Baragaon, District Jhansi  
Uttar Pradesh, India

### Beneficiary Households

70

### Plant Operational Since

January 2009

### Power Plant Design

Polycrystalline Solar Plant 8.7 kWp; Mini-grid 0.75 km;  
Battery backup to secure 3 days of autonomy  
(days with no sun)

### Funding Agency

Scatec Solar

### Implementing Agency

Development Alternatives, India

## OVERVIEW

Rampura is a small village in the Bundelkhand region - a semi-arid region of district Jhansi, in Uttar Pradesh. Till the year 2008, there was no electricity in the village. But with the initiative of setting up of a Community Solar Power Plant (CSPP) by Development Alternatives along with Scatec Solar, Rampura is now reaping the fruits of increased economic activity which can be directly attributed to the electric supply.

The process of CSPP was started in 2008 and by January 2009 it started supplying electricity to the people of Rampura village. Prior to electrification, the villagers were using kerosene as the prime source of energy for household lighting, resulting in an annual kerosene consumption of approximately 2,400 litres. The main objective of the CSPP was to gain a first-hand experience about the design, construction and operation of stand-alone solar power plants and establish a community managed revenue model. The community solar power plant was commissioned as a pilot project and now, with its success at the community level, it can be replicated in other areas and context as well.

## Partners

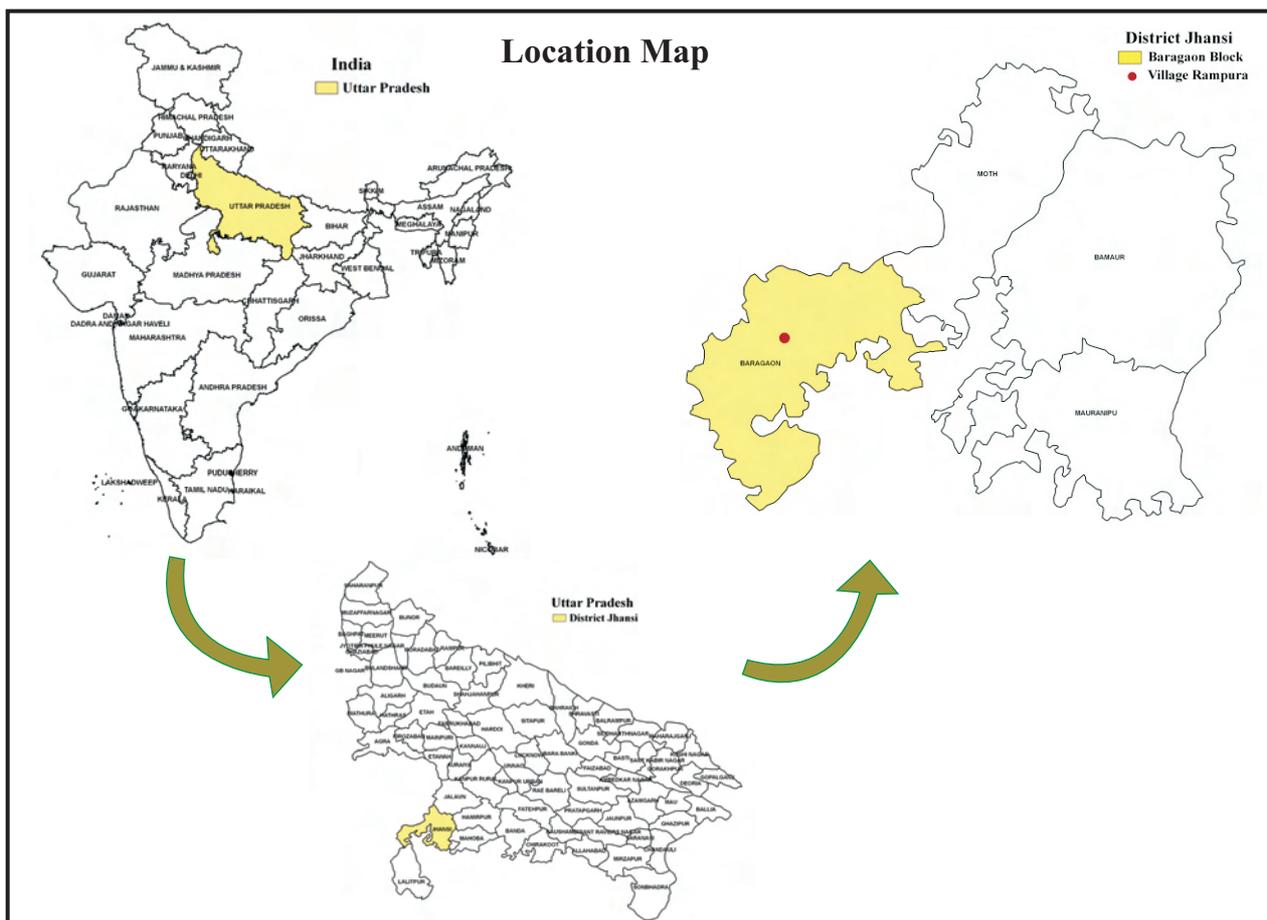
The Community Solar Power Plant at Rampura was initiated by Development Alternatives with technical and financial support from Scatec Solar. DD Solar 23 India (which works under the banner of Bergen Group) provided the technical support by donating one television and computer to Rampura. Along with this, Bergen Group is also paying for the salary of the computer teacher. Development Alternatives acted as a 'door-opener' for introducing the concept of solar power in the village and played a

catalytic role in facilitating the implementation of solar power plant. One of the focus areas of the pilot solar energy generation project was decentralized energy generation. This was attained through community participation, along with social mobilization & capacity building of grassroots stakeholders, which included the local communities and members of Panchayati Raj institutions. A Village Energy Committee (VEC) was formed and assigned the responsibility of load management, revenue recovery and operation-maintenance on its own for sustainability.

## Process and approach

The approach followed for setting up the solar power plant was 'Build-Own-Operate-Transfer' (BOOT), where the ultimate ownership of setting up and operating the plant rested with the village community itself. A work plan was developed by Scatec Solar for operation and maintenance of the solar plant for approximately 20 years. Development Alternatives took the role of engaging the village community and encouraged the villagers to utilize the electricity generated using solar power for new income generating activities. The concept of 'Pay for Energy' was introduced to the villagers to ensure financial sustainability of the plant.

Solar power generated from CSPP is now supplied for household lighting, fans and entertainment/educational purposes. Along with these facilities various other developmental activities have been carried out in the village, which include basic computer education, formation of self-help groups, land development and health and cleanliness activities. These developmental activities have helped in establishing a successful revenue model in the village.



**Business model**

A Community based solar power plant has polycrystalline solar panels with 3 strings that consist of 20 modules each. Each module consists of 50 cells. The total capacity of the solar power plant is about 8.7 kW. To secure 3 days of continuous power supply (days without sunlight), 24 batteries (2 Volt) of 2500 Amperes are used. The power station has two inverters of capacity 5 kW each supplying power of 42 Volt (DC) to 220 Volt (AC) and one 9 kW inverter charge controller.

For distribution of electricity, a mini-grid is supplying single phase 220 Volt (AC) power for household and community use and enterprise running. The project started with installation of 8 street lights and this number has now increased to 13 street lights for community use.

The plant has been oversized to meet the electricity demand for an enterprise load up to 2 horsepower (hp). The current tariff is structured in three slabs on the basis of monthly consumption of individual household. Consumption below 5 kW lies in Slab-1, between 5-10 kW in Slab-2 and more than 10 kW in Slab-3.

Current Tariff Structure			
	Slab-I	Slab-II	Slab-III
Types	0-5 kWh	5-10 kWh	10 kWh
Domestic			
Fixed Cost (INR)	20	90	160
Variable Cost (INR) per kWh	4.50	5.5	6.50
Enterprise			
Fixed Cost (INR)	200		
Variable Cost (INR)	6.5 per kWh		

**Revenue**

- Annual revenue from domestic load: INR 40, 843 (including Rs. 4800 from street lights)
- Annual revenue from commercial load: INR 4,819
- Total annual revenue: INR 45,662

**Expenditure**

- Annual operator salary: INR 14,400
- Annual salary of security guard: INR 14,400
- Estimated annual expensive on maintenance: INR 4,000
- Annual insurance premium: INR 3,500
- Total annual expense: INR 36,300
- Annual saving: INR 9,362

**OUTCOME**

The 8.7 kW plant generates an average energy of 950 kWh per month. The average energy consumption of the village is 840 units. Thus, the solar power plant is running at 90 per cent of its full utilization capacity. Out of the 69 households in this village, 44 households are connected to the solar power plant mini-grid supply. The solar power plant has not only provided assured energy supply to the people of Rampura, but has also made its impact in social, economical and environmental domains.

**Socio-economic changes**

**Education and skill development**

Presence of electricity in the village has enormously changed the lives of women and children. As per the field survey, 14 households have consented that electricity has made a positive impact on education.



Solar panels in village Rampura



School children engaged in learning computers

Children are enjoying the benefits of electricity which include using computer, watching TV, flexible studying hours, etc. They are now being able to study for 1.5-2.0 hours extra every day. Advent of electricity has improved the quality of life in Rampura and has placed it amongst the few advanced villages in India. The village has been able to hold a successful computer training programme in the village school campus itself. At present, 42 children of Rampura (and nearby villages) are getting an opportunity to learn the basic functions of computer. Out of 42 children, 28 children are below ten years of age.

**Gender concerns**

Presence of electricity in the village has brought a positive change in the lifestyle of women. In fact, it has brought a shift in cooking timings for dinner. Provision of electricity throughout the day has given more time to women for indulging into various income



Flour mill as a small enterprise is established to generate local employment

generating activities like sewing, stitching, rope-making and sweater-weaving.

To educate villagers, especially children on the importance of renewable energy a "Saarp-Seedi" (snakes and ladders) game was invented, with energy efficiency component in it. It proved to be an effective method of information dissemination.

**Renewable energy based enterprises**

Rural electrification has also opened new avenues for employment generation and enterprise development in the village. A flour mill of 3 horsepower is operating on electricity generated from the solar power plant.



Meters are connected to save the theft of electricity



Mini-grid established to distribute electricity

### Improved living standards

Provision of quality services (due to the continuous electricity supply) has raised the living standard of the villagers. This is visible from the quantity of electrical appliances purchased by them. Reportedly about 15 new TV sets, 9 coolers, 12 fans and a refrigerator has been purchased within the nine months of commencement of the plant, summing up to a total of Rs 64,000. Each household is paying an average of Rs 120 per month for electricity services.

Prior to the introduction of these electricity services, each household was spending Rs 60 per month on kerosene oil for lighting purposes only. This clearly demonstrates the willingness of rural people to pay extra money, provided they get quality services.

### Improved health and sanitation

As per the results of household survey conducted keeping women in center, women agreed that non-usage of kerosene lamps has made a positive impact on their individual and family health. Presence of street lights is helping the villagers to change their age old habit of defecating in the open. Survey revealed that 17 households have already constructed new toilets in the past one year, after the inception of the solar plant.

### Environmental changes

Reduction in the usage of kerosene oil by the villagers has reduced the environmental problems in the village.

### Emission reduction

Prior to the inception of the solar power plant, the average household consumption of kerosene was 3 litres per month. At present, the average monthly consumption of kerosene has fallen to half of the initial consumption.

With 44 households subscribing to electricity services, 110 litres of kerosene is saved per month. Hence, Rampura villagers are successful in keeping in check around 3900 kg of carbon dioxide (CO<sub>2</sub>) emissions annually.

### LESSONS LEARNT

The pilot phase of the solar energy power generation project has provided valuable lessons, which can be used in formulating a general catalogue for the future roll-out of such projects.

### Community needs and aspirations

While planning and designing any welfare and development activity, community needs and aspirations have to be considered. During the implementation of the solar energy generation project, the project team recognized the growing demand for extra energy by the villagers for irrigation purposes. For this, the project team introduced the concept of mobile irrigation in the village.

### Community awareness

Though the villagers felt that there was a need to utilize alternative methods of energy development to cater to their requirements, there were some apprehensions regarding the solar energy at the initial stage. The common perception amongst villagers was that solar energy can be used only for lighting and it cannot cater the demands of domestic activities such as irrigation and running of appliances.

Therefore, a change in the mindset of the villagers was required, so that the Community Solar Power Plant model would appeal everyone and be replicated and applied to other villages as well. The villagers were also encouraged to invest in energy-efficient appliances like the CFL.

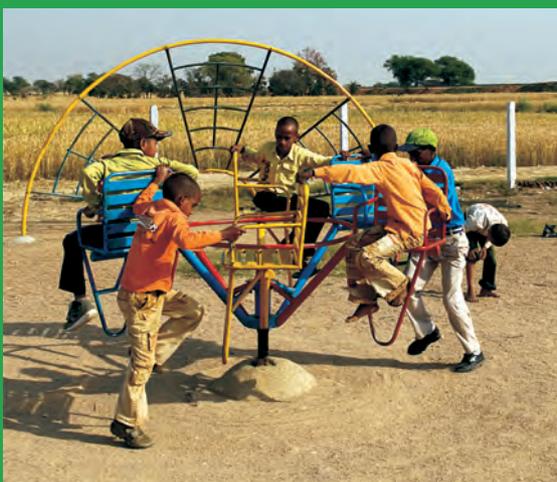
Various workshops were organised to educate and create awareness related to the environmental, economic and social benefits of decentralized energy generation in the village.

### Community mobilization to secure ownership

For the sustainability of any community-based project, it is essential that the community should be able to take the ownership of the project. For this, community participation was sought from day one by involving local people in activities such as plant construction. After eight months of continuous training in accounting and management, Village Energy Committee has now become the owner of the solar power plant. Other developmental activities in Rampura like basic computer education, self-help group formation, land development, health and cleanliness activities have helped in establishing a successful revenue model.

### Dialogue between local government and stakeholders

Development Alternatives not only initiated the dialogue process between local communities and the government but also influenced the local government to support the project. Support from the local Panchayat was required for procuring land for the solar power generation project. Permission from other Local



Availability of electricity at night has now allowed the kids to enjoy daytime activities



Community participation in action

District Administration departments (like Revenue Department and Sales Tax Department) was also sought for custom clearance and transportation of hardwares like solar panels, batteries and controls from one state to another state.

### Deciding realistic power plant capacity

Although the capacity of a power plant varies along different geographical locations, a large part of northern and central India experience similar seasonal cycles. Hence, the results this pilot solar plant projects can be taken as the baseline for similar context.

Another important component for deciding the realistic capacity of a power plant is its load estimation and response to the fluctuating demand and supply. With the experience of running the pilot solar plant for more than a year, Village Energy Committee in Rampura is now in a position to take prudent decisions to meet every day challenges of load management.

### Importance of explaining the tariff structure properly

To gain confidence of villagers it is important to explain each component of the project to the local communities. A locally acceptable tariff structure can certainly promote the usage of

electricity in more efficient ways. For the ease of villagers, a chart can be prepared to explain the monthly consumption of electricity units (kWH) versus monthly bills that can be charged (INR).

## HIGHLIGHTS

- Students are now able to study for 1.5-2 extra hours every day.
- The computer training programme in the village is attracting students from the nearby villages as well.
- Television has brought change in the living style of villagers with an upto date knowledge of the world.
- Rampura has become much safer and possess better sanitary conditions.
- The purchasing power of local communities has been enhanced and they are now better equipped with appliances like coolers, TVs, DVD players.
- The Pilot Solar Generation project at Rampura was implemented with the total cost of INR 29.5 lakh.

## About the Partners

Development Alternatives (DA) is a 26 years old research and implementation focused not-for-profit organisation. The activities of DA broadly cover the areas that underline sustainable development process.

Website: [www.devalt.org](http://www.devalt.org)

Scatec Solar is a global turn-key supplier of solar PV solutions, with headquarters in Oslo, Norway. Scatec Solar is the first turnkey PV supplier with triple ISO certification for quality, environment and health.

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