Solar for Education

Capacity Building of Education Institutions, Banks and other Stakeholders
August 10, 2018 | Jaipur

Report

CUTS International, with the support of Friedrich Ebert Stiftung (FES), India is steering an initiative called '**Green Growth and Energy Transformation**' in Rajasthan, with an aim of creating an implementable strategy on energy transformation at the state level.

In the first year of the project, **Solar for Education** was identified as the catalytic project, which could bring a transformative change in providing last mile access in rural Rajasthan and can have spill-over effect on other development areas like health and education.

It was observed that despite enabling policies, lack of awareness at the grassroots and practical challenges restrict the uptake of solar technology at the consumer level. Therefore, a need for capacitating beneficiaries, financial institutions and other stakeholders on processes involved in installation of solar solutions was felt, in order to improve the uptake of solar technology in rural Rajasthan as well as to promote adoption of quality components by consumers in order to ensure higher efficiency of the solar PV system. Financial institutions could make an informed decision while evaluating the loan proposals for solar projects. The civil society organisations, as grassroots mobilisers, would be better placed to create awareness among their target stakeholder groups on solar technologies.

CUTS International along with Bask Research Foundation organized a Capacity Building Workshop on Techno-Commercial aspects of Solar Rooftop Systems for schools, civil society organisations and banks from three districts of Rajasthan, namely Jaipur, Chittorgarh and Sawai Madhopur. The training was conducted on August 10, 2018 in Jaipur.

The workshop focused on the following:

- Key aspects involved in assessment of solar rooftop solutions
- Major components of a Solar PV System along with parameters to establish quality of respective components
- Sources of finance available for Solar PV Systems
- Key aspects of a fair contract between a project developer and a consumer

The Capacity Building Workshop also highlighted the risks associated with installation of rooftop solar and ways for mitigation and also discussed the myths pertaining to installation of Rooftop Solar.

Key points discussed:

I) Assessment of the site and technical feasibility

Assessment of the site is crucial in order to determine the size of the solar system, which is determined based on the following assessments:

1. **Energy Gap Analysis and Electrical Assessment**: Energy Gap Analysis is an assessment of the highest peak load requirement of the household in one year.
   Electrical assessment involves understanding the pattern of electricity consumption by the establishment, electrical equipment installed, quality of electricity and the wiring in order to reduce transmission losses.
   Electrical assessment also includes Load Assessment. Electrical load of a household is the total power consumed by all the appliances and electronic equipment of a household. During load assessment, Critical and Non-Critical loads of the establishment are identified, which further enables to prioritize critical loads in case of power cut.

2. **Rooftop Assessment:**

- **Assessment of the rooftop provides an estimate the feasibility of installation of solar PV systems and the maximum electricity generation possible from the installed system.** Rooftop assessment comprises of the following:

- Layout of the roof (location of objects or structures on the roof)
- Structure of roof
- Height of the building
- Presence of neighboring objects

  Based on the assessment of the roof, location of the equipment (Panels, Inverter, and Lightening Arrestors, amongst others) is determined.

3. **Risk Assessment**:

- **Efficiency of Solar PV systems is impacted by the following associated risks:**

  Off-loading and lifting material to the roof, Storage of Material, Hazardous Material, Presence of Overhead High Tension (HT) Cables, Integrity of Roof, Integrity of Electrical Infrastructure, Availability of Water and Electrical Power, Pests and Animals and Safety and Security

4. **Shadow Analysis and Insolation:**

- Analysis of shadow effect on the solar modules is essential to optimize energy generation and maximize yield. Shadow analysis is crucial for determination of location of the panel.
- Shadow analysis entails analysis of shadow effect during summer and winter solstice. It could be done manually or using stimulation tools and is performed during peak sunshine hours.
- Customers should demand for a Shadow Analysis Simulation model from the project developers
- **Insolation** is the amount of solar radiation received by a particular area.

5. **Direction of the Solar Panel (Module Tilt):**

- India is located in the northern hemisphere. In order to ensure maximum generation of energy, the solar panels must point in the direction that captures maximum sunshine or insolation. It is suggested that the panels in India should face southwards with a maximum tilt of 25 degrees.

6. **Deliverables of Feasibility Study:**

- Consumers must demand for the key deliverables of a site assessment and technical feasibility study, namely Site Plan, Shadow Analysis, Module Layout, Risk Mapping, Single Line Diagram, Yield Estimation and Commercial Offer, amongst others.

II) Capacity Estimation:

The capacity of the Solar Rooftop System is contingent upon availability of shadow-free space, regulations pertaining to net metering for grid interactive solar rooftop and the investment capacity of the customer. Determination of the size of the solar PV system varies in the case of off-grid and grid connected systems.

In the case of an Off-grid solar PV system, the capacity of the system is dependent on the analysis of Energy Gap and Maximum Shadow free space available. Whereas, for Grid-connected Solar PV Rooftop, the capacity of the system is based on the sanctioned load, which is as per Net Metering Policy of the state, Transformer Capacity and the Maximum Shadow free space available.

Impact of Efficiency: Usage of energy efficient appliances reduces the energy requirement and hence reduces the capacity of the solar PV system to be installed.

III) Key Components and Quality Parameters:

- **Key Components**: The key components of a solar PV system comprises of Solar Modules, Grid Tied Inverters, Module Mounting Structures, Cables, Protection Systems and Remote Monitoring System.
- **Defects:** Defects and degradation in solar modules could adversely impact the efficiency of the system and could lead to a drop in energy generation as well. Defects in solar cells could be in the form of micro cracks, discoloration, delamination and hotspots.
- **Deliverables:** Customers must demand for a **Solar Panel Structure Analysis Report.**

IV) Project Finance:

Financing of a Rooftop Solar PV project is available through two models, namely **CAPEX Model**, where the project is owned by the customer and is financed through owner's capital and debt and through **OPEX Model (RESCO Model)**, where the project is financed by developer and the ownership of the project lies with the developer. Under the OPEX model, a power purchase agreement is signed between the developer and customer for a period of 15-25 years. The OPEX Model is considered ideal for systems of size 25 KW and above, which are suitable for commercial establishments, urban schools and universities with greater creditworthiness.

V) Strategy to be adopted by government schools in order to obtain funds for Solarisation:

- **Need for Collective Action**: Lack of availability of sufficient funds is a major challenge faced by the government schools, which could also restrict adoption of Rooftop solar systems. The Education Department in Rajasthan provides a fixed sum of INR 50,000 as annual operational budget to the schools, whereas the total annual operational budget of a school is nearly three times the grants received from the Education Department. Hence, the balance amount is arranged by the schools through crowd funding.

  The Education Secretary approves the disbursement of funds to the schools. Given the lack of availability of funds, the government run schools of a block could collectively approach the Education Department to demand for an aggregated corpus of funds for installation of PV systems.

- **Assessment of Critical Load and Cost Estimation**: In order to estimate the total funds required, the schools could firstly assess the critical load of their buildings which could be shifted to Solar. The size of the system could be assessed based on the critical load that could be connected to the system and hence, the cost of the entire system could be estimated.

- **Assessment of Sources of Funds**: The Schools could then assess the funds available through both public as well as private sources, which could be utilized for installation of Solar PV Systems. Funds could be further by acquired from Schemes like *Jan Sahabhagita Yojana*[1].

- **Manner of Disbursement of Funds**: The budgetary support provided by the Education Department is an aggregated amount. As the total funds required by schools for installation of the PV system could be high, the Education Department may not be able to grant a huge sum at one time. The schools could acquire funds in a modular manner. Initially, the schools could install a system for only half of the capacity required. The load could then be further optimized and funds for the same could be acquired later.

VI) Myths pertaining to Rooftop Solar PV Systems:

- **Performance of a Solar PV system is highest in May and June**: Generation of energy from a Solar PV System is contingent upon temperature and insolation. High temperature could reduce the efficiency of the system as the solar panels get heated up. Hence, performance of the system is best during the winters. Similarly, installation of more solar modules than required may not translate into higher generation of electricity.
- **Partial shadow on solar panels does not affect the efficiency of the system**: Availability of shadow-free roof is critical for installation of solar PV systems. Even a partial shadow on the solar panels could negatively impact the efficiency of the system.
- **Warranty of the module is of 25 years**: It is believed that warranty of the module is of 25 years. However the efficiency or performance of the system is guaranteed for 25 years and not for the module, given the system is maintained for the entire life span. But, under any circumstance, the output of the system decreases by 10% after the first 10 years and decreases by 20% afterwards.
- **Battery backup is required only for night**: During the winters or monsoons, when sunshine is inadequate even during the day-time, battery back-up is essential.

[1] Under the scheme, fund contribution follows a 40:60 Ratio**.** Under the scheme, 40% is arranged through community participation and a proportional 60% amount is then contributed by the State Government. The fund could only be used for development of infrastructure of the schools in Rajasthan.