National Energy
CORPORATION OF TRINIDAD AND TOBAGO

Understanding Commercial Solar Photovoltaics

Local Success Story – Preysal Service Station

Although National Energy continues to work with the Government for the future installation of rooftop solar photovoltaic (PV) systems at schools and community centres (that are used as emergency shelters), the Company also successfully oversaw the installation of a 100 KW rooftop commercial solar PV system at the new Preysal Service Station in 2021.

This project showcases the Government's commitment to including renewable energy technologies at the national level. The Preysal Service Station is a model for future projects and allows for the collection and analysis of critical solar data.

Emission Savings from Preysal Service Station

During the period January - April 2022, the solar PV system dispatched 31,484.2 kWh of power resulting in 5,788.99 kg of CO2 Emission Savings. It is therefore clear that distributive, rooftop or commercial solar PV installations can open another avenue for T&T to achieve its Paris Agreement targets.

February Blackout Vs Preysal Solar Panels

Figure 1: 320 South Facing Solar panels at the Preysal Service station which forms part of the PV System.

Security of supply and resilience of infrastructure were critical in the design of the Preysal Service Station. The solar PV system, inclusive of battery storage, as the primary source of power, was developed to improve business continuity for the station's operations.

There are 320 solar PV panels installed on a purpose-built canopy and a battery bank with a total voltage of 729.6VdC which provides 510.72kWh.

During the power outage on February 16th, 2022, the battery bank provided power for the:

· liquid fuel pumps
· internal and external lighting in the convenience store
· in-store cashier booths.

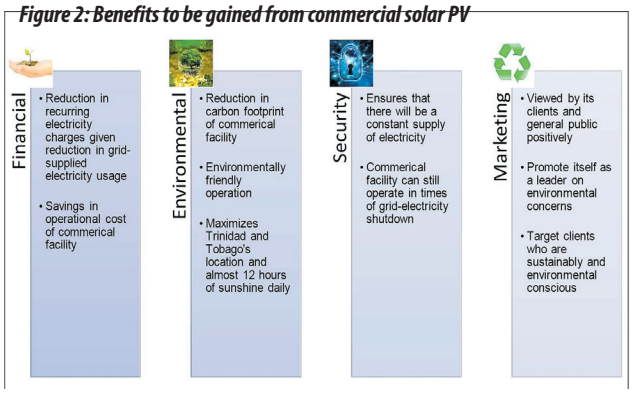
Combined, the abovementioned factors facilitated increased traffic in customer purchases at the pumps and the convenience store. The station was therefore able to remain online and continue providing full service to its customers. At the time of power restoration, the state of charge of the battery was 78%.

Considerations for Maximum Performance of a Solar PV Installation

Shading

In conducting the technical assessment of using a commercial solar PV system, issues of shading, roof orientation and the structural and space requirements are to be analysed and optimised. Conducting a shading analysis refers to looking at the effects of sunlight blockage on the solar array cell. Any form of blockage/shading reduces the power out of the solar PV system. Objects such as trees, other buildings and fixtures can cause shading issues on the solar array cell at different times during daylight hours.

Figure 2: Benefits to be gained from commercial solar PV



Roof orientation

Roof orientation deals with the slope of the roof on which the solar PV system will be mounted and how this will impact on the configuration of the system. Roofs are classified as either low-sloped or sloped, where a low-sloped roof range from flat (0 degrees) to 24 degrees of incline.

Azimuth & Tilt Angle

Two additional factors to be considered in the configuration of the solar array are the azimuth and tilt angle of the array. The azimuth refers to the angle in which the array is positioned. The azimuth angle is the clockwise angle from true north that describes the array's orientation. A south-facing array has an azimuth angle of 180 degrees, whereas a north-facing array has an azimuth angle of zero degrees. The default azimuth angle for locations in the northern hemisphere is 180° (south-facing) and 0° (north-facing) for locations in the southern hemisphere. However, the specific azimuth used at the location would be determined based on the orientation of the roof, to optimise spacing and layout.

The tilt angle refers to the angle of the PV modules in the array which is measured in degrees from the horizontal. The tilt angle of a fixed array is its angle from horizontal, where 0° equals horizontal and 90° equals vertical. Figure 3 shows the relationship between azimuth and tilt angle. To optimise the system's total electricity production across the year, a popular rule of thumb for fixed arrays is to adjust the tilt angle to the latitude of the system's position. However, on flat roofs the system may employ a tilt angle that is less than ideal for the given latitude. Flat or zero-tilt arrays are sometimes utilized on low-slope roofs because they provide a significant amount of energy per square foot of roof area and reduce wind loads. The recently completed solar PV system at the Preysal Service Station was executed well in line with industry standards for Trinidad's location (see Figure 3).

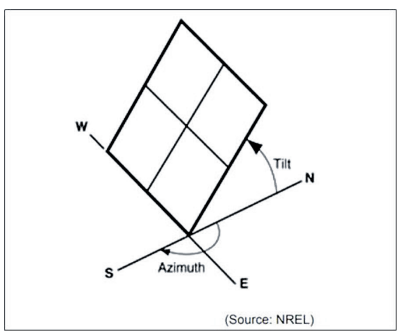


Figure 3: Preysal Service Station PV system configuration

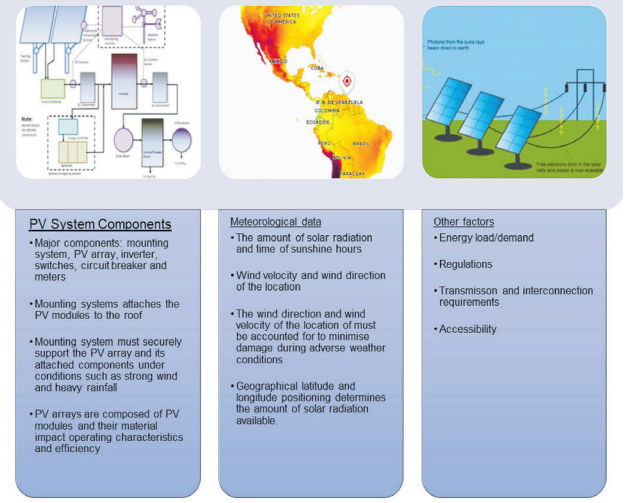
Preysal Service Station's PV System Configuration

PV System: Medium size commercial
Azimuth of PV panels: 186°
Tilt of PV panels: 11°
Installed capacity: 100kW

Structural and Spacing Requirement

The structural integrity of the commercial facility must be evaluated before the solar PV system is placed on the roof top. The roof must be able to support the weight of the solar PV system while still dealing with environmental conditions such as rain and debris as well as the weight of service personnel who will have to conduct routine maintenance and checks on the solar PV system. Understanding the pressures applied to the racking system and roof from static and dynamic loads are critical.

Figure 4: Considerations for Solar PV Installations



Depending on the type of solar PV module utilized and the system's architecture, the array's footprint will vary significantly. When evaluating potential roof space for solar PV system, it is important to consider the placement and size of current or future rooftop equipment such as heating, ventilation, and air conditioning (HVAC) systems.

References

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