Solar ENGINEERING
INVEST
Consulting Through Innovation

Profkon Building

Case Study on Shading

Profkon brokers recently moved into their new offices on McDougall Street in Kimberley. The new offices also boast a 19.5kWp Grid Tied solar system to reduce electricity costs. The solar system also serves as a roof for the staff parking area.

The system consists of 19.5kWp Canadian Solar Modules optimised by SolarEdge. This is coupled to a 17kW SolarEdge inverter which feeds into the main Distribution Board. The system is designed for zero export, and all electricity generated will be for self-consumption. A pragmatic approach was needed to get the best solar yield.

Introduction

No Solar System design is ever the same, and the new Profkon building was just as any other design, unique. Because the sole purpose of a Solar INVEST (or grid tied) system is to give the best return on investment, getting the best yield out of the system is crucial. Therefore various locations for the modules need to be assessed. Shadows, roof strength and safety all played a role in choosing the best location.

Ordinary Roof Mount

In order to maximise solar yield in Kimberley, the modules should be mounted facing north, at a pitch of 29°. This is however an ideal situation. In most cases this is not possible. Roofs aren't necessarily designed for solar yield. If modules were to be mounted on the roof at the Profkon building, they would face south. Initially this sounds terrible, however, because Kimberley receives so much sunshine, and because our electricity is worth so much (due to high prices) it could still be a good investment. Initial simulations showed that the system would generate 29,110kWh of electricity a year if the modules were mounted on the roof. With a flat rate tariff of R1.81/kWh, this means the client would save R52,690 on the electricity bill in the first year.

Tilted Roof Mount

One potential option was to mount the modules on the roof, and raise them using a separate mounting structure. This would bring the modules to a north facing pitch, Figure 1 is an example of such a system. Structure Engineers on the building project were quick to dismiss such an option. Modules raised like this act as a sail. A wind from behind would create forces on the roof which the structure is not designed for.

Figure 1: Tilt mounting system (Image from Rubicon SA)

Parking Structure

The third option was to build a parking structure. This would give the added benefit of providing a covered parking area. The challenge in this option was that the structure would be on the southern side of the building, and therefore in its shadow. Working with architect drawings and models, Solar Engineering could construct a virtual model of the entire building with the modules on the structure. Using simulations, engineers were able to predict exactly where shadows would fall, and what effect it would have on the yield. Figures 2 and 3 show what the simulation predicted and how the shadows really looked at 10h43 on June 7.

Figure 2: Shadows at 10h43, June 7

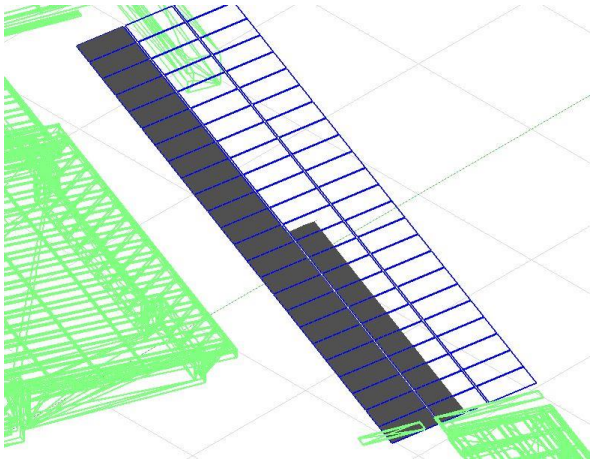

Figure 3: Predicted Shadows at the same time

Using these simulations, a shadow diagram was obtained, which was used to calculate

exactly what effect the shadows would have on the system. This was used to calculate exactly how much energy the system should generate in a year: 32,602kWh. This is worth R59,010 per year.

SolarEdge Inverter

A SolarEdge inverter (Figure 4) was used for this project. A SolarEdge system makes use of individual optimisers for each solar module. This mitigates the losses that shading would have on a solar system.

Figure 4: SolarEdge inverter with WiFi module for monitoring

Conclusion

A project such as this shows how it is possible to design a Solar System which will provide a good return, even though conditions are far from ideal. There are always various options for installing a solar system. It is however essential that the system is chosen which will deliver the best returns. Without a detailed design it is not possible to make an informed decision. Solar Systems are usually large capital investments. Clients should know exactly what returns to expect from the system.

Solar Engineering is a group of engineers who specialise in the design and installation of solar systems. As registered professional engineers we are one of few companies who are qualified to sign off solar systems according to municipal regulations.

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