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Optimising solar: Residential Housing Development in Gauteng

An Overshadow case study

Introduction

Residential Estate A for an influential developer provides living space for people in the Gauteng province of South Africa. In the face of the South African electricity landscape, this estate must ensure that every one of its 84 apartment units receives electricity and hot water when needed. The complex runs on pre-paid electricity and water, so precision in energy monitoring and management is pivotal to ensuring adequate services are delivered to its residents.

Overshadow installed 88 carbonTRACK units to monitor and manage the solar and hot water systems at the apartment complex. The carbonTRACK units are an enhanced energy monitoring system that remotely capture energy data of the solar panels and grid, as well as alerting for faults in the system as a whole.



Project Goals

Overarching goal:

Deliver a positive internal rate of return

Other goals:

1. De-risk the future cost of utilities & electricity for the developer through the management of their solar investment.
2. Deliver a load shifting service: shift a small amount of electricity usage per apartment so that more solar energy is consumed and less grid energy is consumed.
3. Give the developer flexibility so they can decide how to use the savings from their solar investment: either pass on to the tenant, or increase the internal rate of return.
4. Ensure the tenants are serviced, and happy – no loss to current living standard.
5. Ensure the developer is meeting Green criteria/standards – and aim of 50% of energy used for hot water production from renewable.
6. Deliver a powerful management tool to property managers: tenant occupation, geyser & water management.

Project Implementation

Installation

On behalf of the developer, Overshadow installed a carbonTRACK system to every apartment unit, connected to the electric hot water system and PV solar systems in the complex. 88 units in total were installed in July, 2017 to monitor and manage the complex's energy.

Project Implementation

Results of the project against stated goals

Goals:

- Deliver a load shifting service: shift a small amount of electricity usage per apartment so that more solar energy is consumed and less grid energy is consumed.
- Ensure the developer is meeting Green criteria/standards – and aim of 50% of energy used for hot water production from renewable.

1st Priority

The developer is in the process of working towards meeting Green Building Standards. In order to achieve this, a goal of meeting 50% of water heating energy requirements with renewable energy has been set.

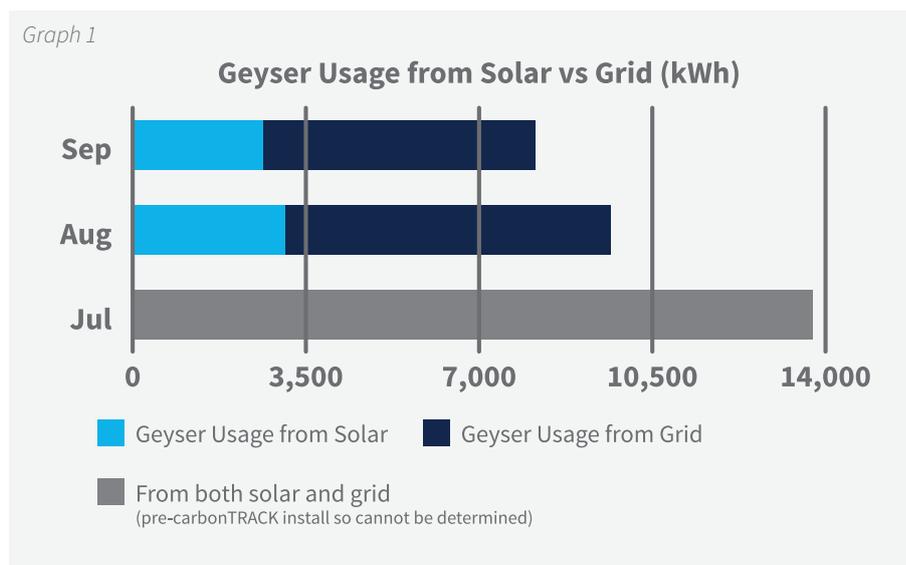
However, the apartment complex has a large demand from water heating. To reduce cost of electricity and meet its Green standards, the developer installed a solar system. They then needed to ensure the energy produced by this system is optimised, as generally residential usage times are outside of the solar day.

The Outcome

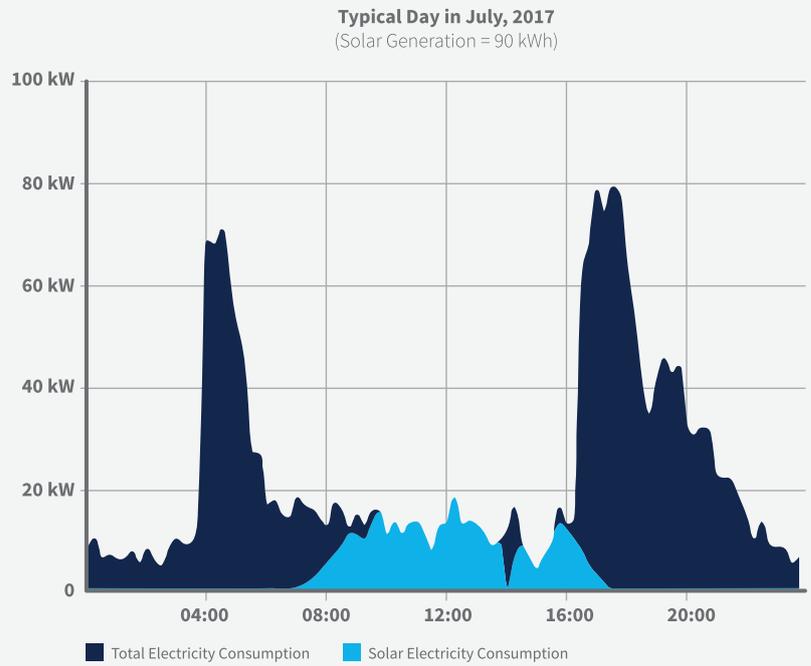
Overshadow powered by carbonTRACK's technology gives full transparency on solar generation, consumption at mains level and usage at apartment level. With the data captured and visible in real time on the platform, the full fleet is displayed, allowing management to optimise solar production and drive positive IRR on the investment. Overshadow's service ensures that from month to month targets are met in terms of solar yield, mains usage reductions and general efficiency.

After the solar and monitoring system was installed in July, geysers were optimised to use solar generation during the day with switching and load shifting (see Graph 2 to 4). Analysis showed that in August, 32% of total geyser consumption was provided by solar while September exhibited 31% geyser consumption from solar. Total geyser consumption still dropped after a 10% increase in occupancy from August to September (see Graph 1). Please note seasonal differences between months.

Graph 1

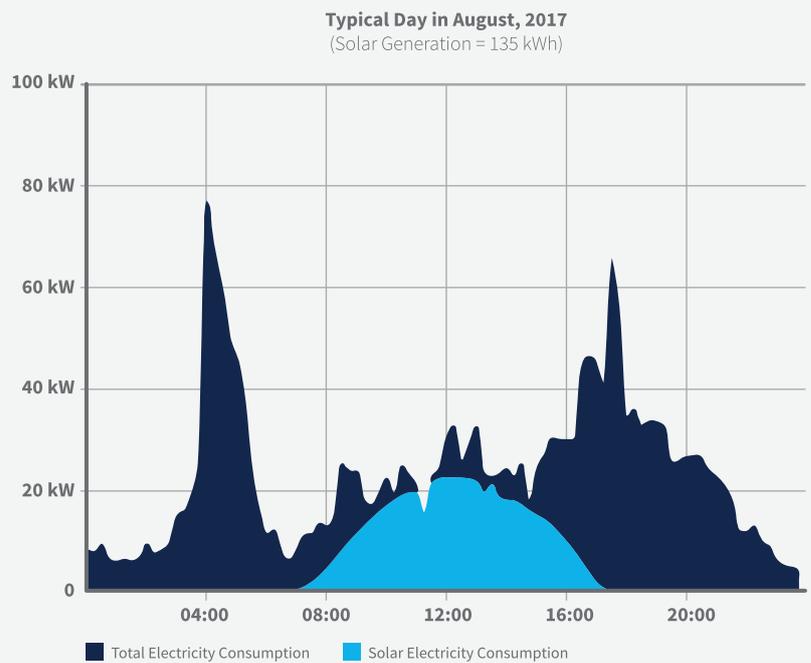


Graph 2



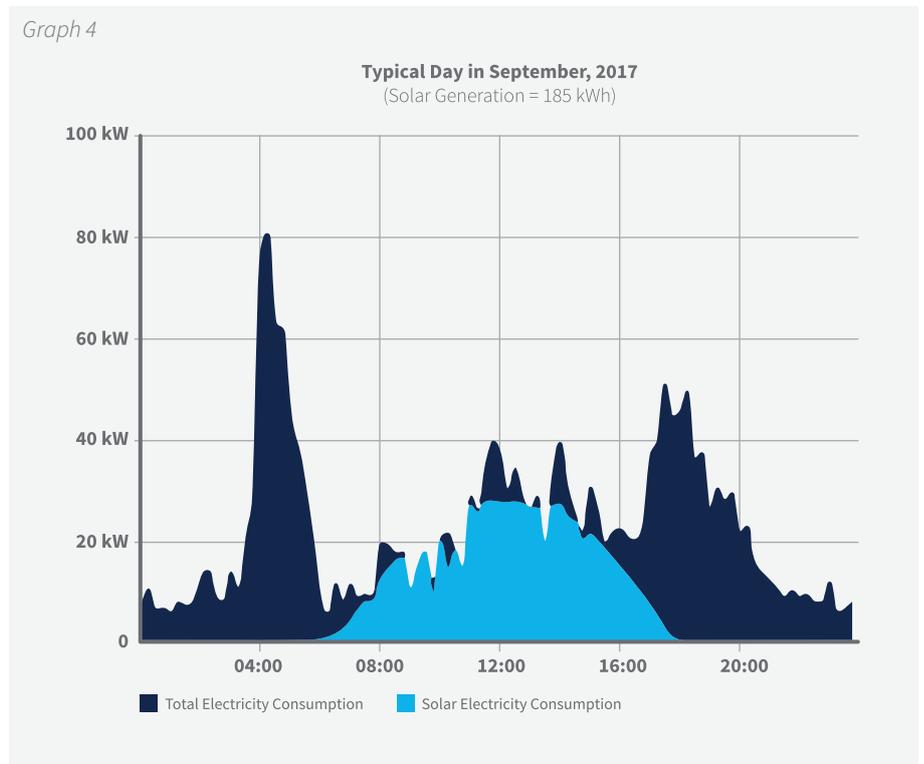
Note that electricity usage was not optimised to take advantage of day-time solar. Electricity generation is wasted and exported back to the grid.

Graph 3



Electricity usage optimised after switching and load shifting. Day-time solar generation is used to its full potential.

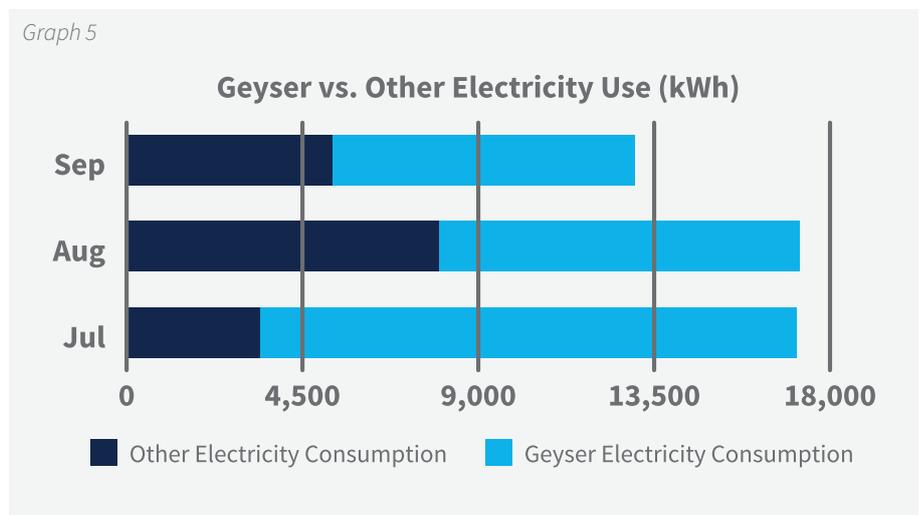
Graph 4



Electricity usage optimised after switching and load shifting. Day-time solar generation is used to its full potential.

Further analysis of energy data over the July to September period showed more positive results. In spite of a 20% increase in the complex's residency from July to September, electricity consumption from geysers decreased while still delivering hot water to all residents. Furthermore, total mains consumption overall also reduced (see Graph 5).

Graph 5



Main causes for these results could be attributed to slight seasonal changes between the 2 months. However, these causes require more investigation for verification.

Goals:

- De-risk the future cost of utilities & electricity for the developer through the management of their solar investment.
- Give the developer flexibility so they can decide how to use the savings from their solar investment: either pass on to the tenant, or increase the internal rate of return.

2nd Priority

Solar is a considerable investment for property developers. For this investment to prove worthwhile, the return on the investment must be shortened as much as possible. Without tracking, developers are left in the dark about their solar generation and usage. Furthermore, developers require assurance that their investment is working well, and know when maintenance is required.

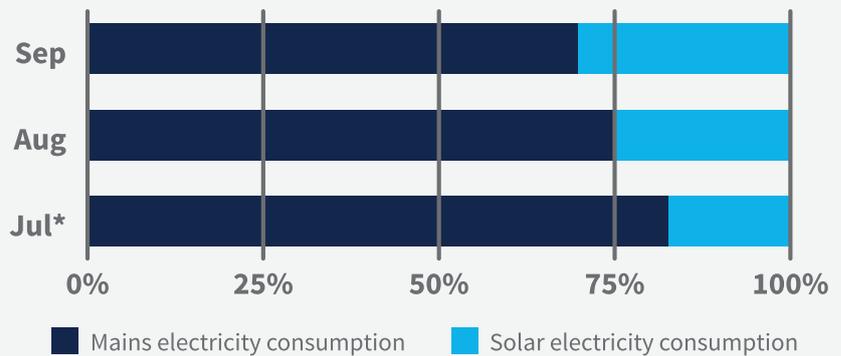
The Outcome

The installed carbonTRACK units permitted the facility managers to see the energy usage patterns, geyser usage patterns, and solar production of the panels. With this information, the property developers were able to verify their investments in solar as well as de-risk futures costs of electricity and utilities.

Early energy statistical results from the project show an improved optimisation of solar power usage. Solar energy usage increased from 17% to 30% at the end of September, compared to pre-management baseline during July (see Graphs 6 and 7 for consumption breakdowns over this period). The system was able to detect (no) faults within the solar panels during this period.

Graph 6

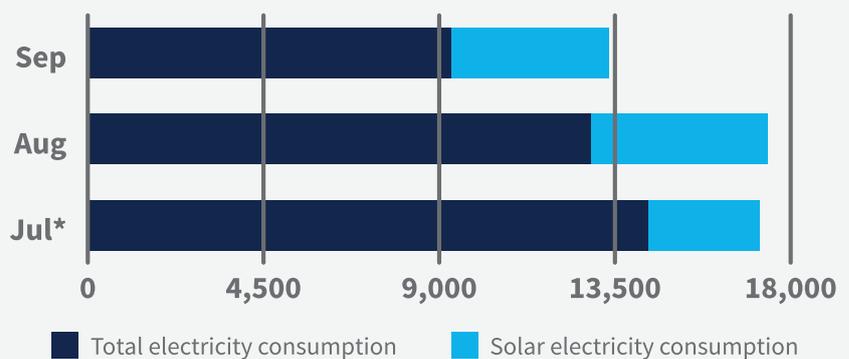
Electricity Usage - Percentage Breakdown



* July estimates based on actual readings from July 19-31

Graph 7

Electricity Usage - kWh Breakdown



* July estimates based on actual readings from July 19-31

Goals:

- Deliver a powerful management tool to property managers.
- Ensure the tenants are serviced, and happy – no loss to current living standard.

3rd Priority

Property managers are tasked with maintaining living quarters to a high standard while also ensuring that the asset is sustainable and profitable. Any changes they make to improve the performance of their investment must be carefully monitored to prevent a fall in the quality of the services they provide and the value of the asset.

The Outcome

With energy management, facility managers have the insights and tools they need to improve the management of the solar and hot water systems on their sites. They can see the electricity consumption patterns of each site. This allows them to adjust the times water is heated so that solar assets have an improved return on investment.

During colder months, water heating can become the biggest source of energy consumption. Geysers must be strategically switched on at specific time of the day to manage demand placed on grid.

Through the carbonTRACK interface, facility managers remotely manage which elements turn on at specific times to reduce peak load, as well as fully utilise the solar system during the day. Leak sensors installed as part of the system to allow facility managers to detect geyser leaks very early on and fix the problem before it can cause real and expensive damage.

The savings generated from the carbonTRACK system can be directed into other areas by the developer, such as other maintenance costs and facility improvements. Alternatively, they can pass these savings directly to tenants, which should result in improved tenant retention and satisfaction rates.

Conclusion

The apartment complex has made clear steps towards reducing their overall energy consumption for the complex, optimizing the use of their solar and, in doing so, shortening the payback period for their solar investment. Such improvements were greatly facilitated by the insights provided by carbonTRACK technology and the accordingly informed decision making of their energy efficiency consultant – Overshadow.

The results achieved indicated successful load shifting to better utilize solar power generated and reduced cost of running geysers (through increased use of solar power). Results also show increased geyser electricity consumption to one third. This shows the complex is moving in the right direction to achieve their goal of geysers powered 50% by renewable energy sources to meet Green Building standards. Furthermore, no complaints from apartment tenants were received during the three months when significant shifts of geyser loads occurred.

The overarching goal of delivering a positive internal rate of return, while not met yet, is on track to be reached if the current implemented changes are continually adjusted to respond to future changing patterns of energy consumption.