WHY **TRANSGRID'S iDEMAND PROJECT** IS UNLIKE ANYTHING BEFORE IT

It's no mean feat to design an electricity demand management system that incorporates battery storage, solar panels, energy efficient lighting and research capabilities. *EcoGeneration* profiles the hybrid iDemand project and speaks with the various players that made the cutting-edge demand demonstration project possible.

iDEMAND PROJECT SPECIFICATIONS

Solar panel capacity: 98 kW in total (53 kW of polycrystalline silicon, 45 kW of cadmium telluride thin film)
Storage capacity: 100 kW, 400 kWh
LED lighting capacity: 4.7 kW DC LED lighting and 5 kW AC LED lighting
Capital cost: $3 million
Developer and operator: TransGrid
Construction contractor: Solgen
Battery manufacturer: Kokam
Battery inverter: Magellan Power
Thin film solar panel manufacturer: First Solar
Polycrystalline silicon solar panel manufacturer: Suntech
Thin film solar panel inverter: ABB Aurora
Polycrystalline silicon panel

TransGrid is one of Australia's largest high-voltage transmission networks. Its hybrid energy project, named iDemand, was designed to facilitate research into the commercial development of demand management opportunities in NSW. Further, the system will act to reduce the power consumption of TransGrid's Wallgrove Regional Centre.

The project is expected to shave off almost 50 per cent of the electricity usage of the facility during peak demand times, achieving substantial financial savings and saving 486,000 t/a of greenhouse gas emissions.

Launched in November 2014, iDemand is a culmination of two years of scoping and commissioning work by the TransGrid team and consultants WorleyParsons.

WHAT IS iDEMAND?

TransGrid's Sydney West site has over 300 employees and encompasses six buildings with an expected energy usage of 800-1,000 GWh/a.

The iDemand system generates 98 kW of renewable energy via its solar panels. The site is connected to the local 11 kV feeder Endeavour Energy supply via a transformer, and the grid supply is utilised in charging the battery at night.

The batteries are discharged on a pre-programmed discharge algorithm, which has been based on the dual objectives of reducing site peak usage as well as reducing bills. They are used to maximise site load reduction capability, which is equivalent to taking 60 large home air-conditioners off the grid (assuming 4 kW input).

Two types of solar PV were installed as part of the project - thin film and polycrystalline silicon panels that were supplied by Australian PV suppliers Yellowdot Power and Solgen Power.

The 400 kWh lithium polymer batteries from South Korean manufacturer Kokam are connected to the grid via the 100 kW Magellan Power supplied bi-directional inverters, which are capable of injecting both active and reactive power to the grid. Magellan is a →

Below: Solar panels provide much needed shading for the TransGrid facility's carpark. Image courtesy of Solgen.

A: Aerial footage of the TransGrid iDemand 50 kW PV system. Image courtesy of Solgen.

B: Solgen's carport framing solution with a 2.2 m clearance level. Image courtesy of Solgen.

C: External inverter station for the carpark arrays. Image courtesy of Solgen.

Perth-based company, which has been assisting TransGrid with ongoing operations and maintenance of the battery system, including the inverters.

iDemand is likely to be in operation for over a decade, with the solar panels expected to last for 25 years and the batteries up to 16 years.

THE NUTS AND BOLTS OF iDEMAND

The iDemand installation comprises:

A. **400 kWh of lithium polymer batteries**
The batteries have an available charge/discharge rate of 100 kW. They have high energy density (they fit inside a 20-foot shipping container), greater than 95 per cent energy storage efficiency, no moving parts and no risk of chemical spillage as there are no liquid electrolytes.

B. **53 kW of polycrystalline silicon solar panels**
Suntech manufactured the polycrystalline solar panels, which have an efficiency of 15.4 per cent. They are the same technology as many of the rooftop solar panels across NSW and Australia, but with a marginally higher efficiency. The polycrystalline silicon panels are connected to SMA inverters.

C. **45 kW of thin film solar panels**
The thin film solar cells at iDemand are made using cadmium telluride (CdTe). Thin film solar panels are typically cheaper than traditional forms of solar panels due to lower manufacturing costs and recent technological developments that give thin film panels similar efficiency levels to polycrystalline panels. The thin film panels are connected to ABB Aurora inverters.

D. **Energy efficient LED lights**
The new 4.7 kW DC LED lighting in the site's workshop is fed directly from lithium polymer batteries, through a DC/DC converter to provide power at the necessary voltage for the LED lights. The previous lights in the workshop consumed 16 kW when in use.

The new 5 kW lighting in the site's warehouse is fed from the site's main AC switchboard which, in turn, takes power from the iDemand batteries when they are discharging.

The addition of lighting controls delivered further savings. All 88 LED lights were fitted with enLighten-designed radio frequency controls and photo electric sensors.

SOLGEN'S CONTRIBUTION TO iDEMAND

TransGrid's solar project – of which Solgen Energy was at the helm of – is a crucial part of the iDemand renewable energy system. Solgen designed an innovative carport framing solution that allows for easy access for vehicles and pedestrians, while providing the perfect tilt and ventilation for iDemand's solar panels to perform at a high efficiency.

The Solgen team came across a few challenges with this project, including:

- The mounting framework of the solar array needed to be designed not to obstruct vehicle and pedestrian traffic
- Extensive civil works were required, consisting of the design and installation of the underground electrical works and steel carport framing.

To overcome these problems, Solgen Energy designed an underground framework that could support the solar power array on the surface, and allow for carpark spaces and pedestrian traffic.

A carport framing solution was designed with a 2.2 m clearance level above the ground. Five equally spaced supporting foundations were also constructed with car spaces in between.

To eliminate any potential dangers to passers-by, the cables were placed underground using existing pits and conduits. A security cage, complete with colorbond roof, was constructed to house the external inverter station and restrict public access to the vital electrical equipment.

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>
> GARRIE CHUBB

Solgen completed the civil works component of the project by collaborating with all parties involved and developing a consolidated solution to install the underground cable and carport framing network for the entire iDemand system.

As a result, Solgen Energy was able to develop a grand schematic for the cable network, and implement this to enable the electrical and data connection of the TransGrid iDemand system.

Solgen's PV system for TransGrid will:

- Generate an estimated output of 73.1 MWh annually
- Offset 78.2 tonnes of CO2 each year
- Provide shading for the centre carpark.

The project was completed in September 2014.

BENEFITS AND CHALLENGES OF iDEMAND

TransGrid Investment Support Manager Garrie Chubb says the lack of prior experience with larger-scale batteries – i.e. not secondary equipment batteries – translated to greater time spent in selection, installation, and development of operations and maintenance procedures. This was in contrast to the installation of other equipment, such as transformers.

"The 400 kWh iDemand batteries are one of the largest in capacity in Australia. Lithium polymer has not been used in Australia previously at this scale, to our knowledge," Mr Chubb says.

LESSONS TO LEARN FROM TRANSGRID

TransGrid is looking to formalise research agreements with universities and industry training groups to educate on demand management innovation activities and derive further value from the installation.

A key feature of iDemand that renders it unique is the open availability of on-site generation and consumption data to public and research bodies.

"The facilitation of research opportunities on the iDemand system by TransGrid is unusual for an Australian utility," Mr Chubb says.

The iDemand system is able to be monitored via the iDemand website, which provides live, five second updates of the solar panel output, battery usage and site usage, as well as downloadable spreadsheets with one-minute interval data of the system, the site and the corresponding weather.

"The iDemand system is expected to be utilised on an ongoing basis by various research and industry bodies to learn more about energy storage and other technologies related to demand management and peak reduction," Mr Chubb says.

"Six research proposals have been submitted so far. Numerous parties have expressed interest in real-time dispatch of batteries in response to parameters such as cloud cover, weather forecasts, real-time site load and market spot prices," he adds.

Mr Chubb says TransGrid will heavily utilise learnings from iDemand in exploring the feasibility of installing a grid-connected energy storage device in the near future. eee

TransGrid welcomes universities, industry bodies and other interested organisations to contact it for information on how to be involved in using the iDemand installation for research into energy storage, renewable energy and demand reduction on the network. Email **demandmanagement@transgrid.com.au**

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