



Smart Sun

Summary pilot report findings

Australia's first regional Virtual Power Plant



*Owned by the
people of WA*



Increasing grid stability, enabling regional development and lowering power bills. The success of the Smart Sun pilot, explained.

Demonstrating the energy and cost benefits of coordinating distributed energy resources as a fleet.

Globally, solar energy and home battery storage is becoming cheaper and more popular. Electricity networks are being transformed into decentralised and two-way systems. For small, regional micro grids this can have a huge impact on stability and can limit the amount of solar able to be installed on the network.

To monitor this kind of impact, Horizon Power and DevelopmentWA joined forces to create a project called Smart Sun in DevelopmentWA's Waranyjarri Estate, Broome North – a quality development planned to double the size of the existing township of Broome. A first-of-kind Virtual Power Plant (VPP) with real-time visibility and control of:

- **rooftop-solar generation**
- **battery energy storage**
- **hot water systems**
- **air-conditioning**

Located in the far north of Western Australia, the Kimberley region is one of the continent's hottest landscapes. Perched on the west coast of the region is the town of Broome - known as the gateway to the Kimberley.

Together, Broome's climate, growth and environmental considerations present a significant and unique challenge to housing development.

DevelopmentWA's Innovation Through Demonstration projects champion sustainable land and infrastructure development practices and cutting-edge technologies.

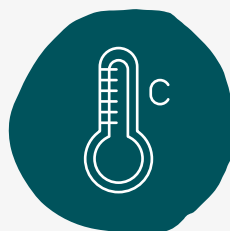
Our Smart Sun pilot is one such project, resulting in the creation of new energy solutions for regional Western Australia.



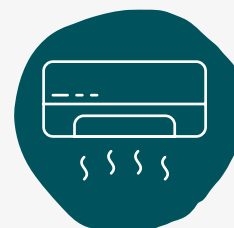
Rooftop-solar generation



Battery energy storage



Hot water systems



Air-conditioning



Why Broome?

Broome is a beautiful coastal town, with a community that is highly committed to cleaner, greener solutions. Currently operating on a small microgrid, there is only limited capacity to connect solar energy.

The remoteness and extreme climate of living in regional WA significantly increase the cost of living, from fuel, transport, food and power. Broome is no exception, with the tropical climate driving the need for homes to have an average of 3.5 air-conditioners installed. This high level of air-conditioning is required to maintain comfort in the 60+ days per year that reach over 35 degrees.

DevelopmentWA's Waranyjarri Estate provided Horizon Power and DevelopmentWA a great opportunity to join forces to test solutions that would lower energy costs for participants, help more of the community connect solar and do so in a clean, green way.

This innovative pilot program has allowed Horizon Power and DevelopmentWA to better understand how regional customers can connect their solar system into a microgrid, while keeping the grid stable for everyone. We've also been able to better understand how these new energy technologies can not only dramatically reduce household electricity bills, but also lower the expensive cost of infrastructure on new developments.



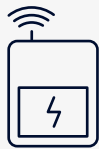
The Smart Sun Virtual Power Plant was made up of:



Waranyjarri Estate



15
Smart Sun participants



95kW
of inverter capacity



111kW
of rooftop solar panels



105kW
of battery storage



51
air-conditioners



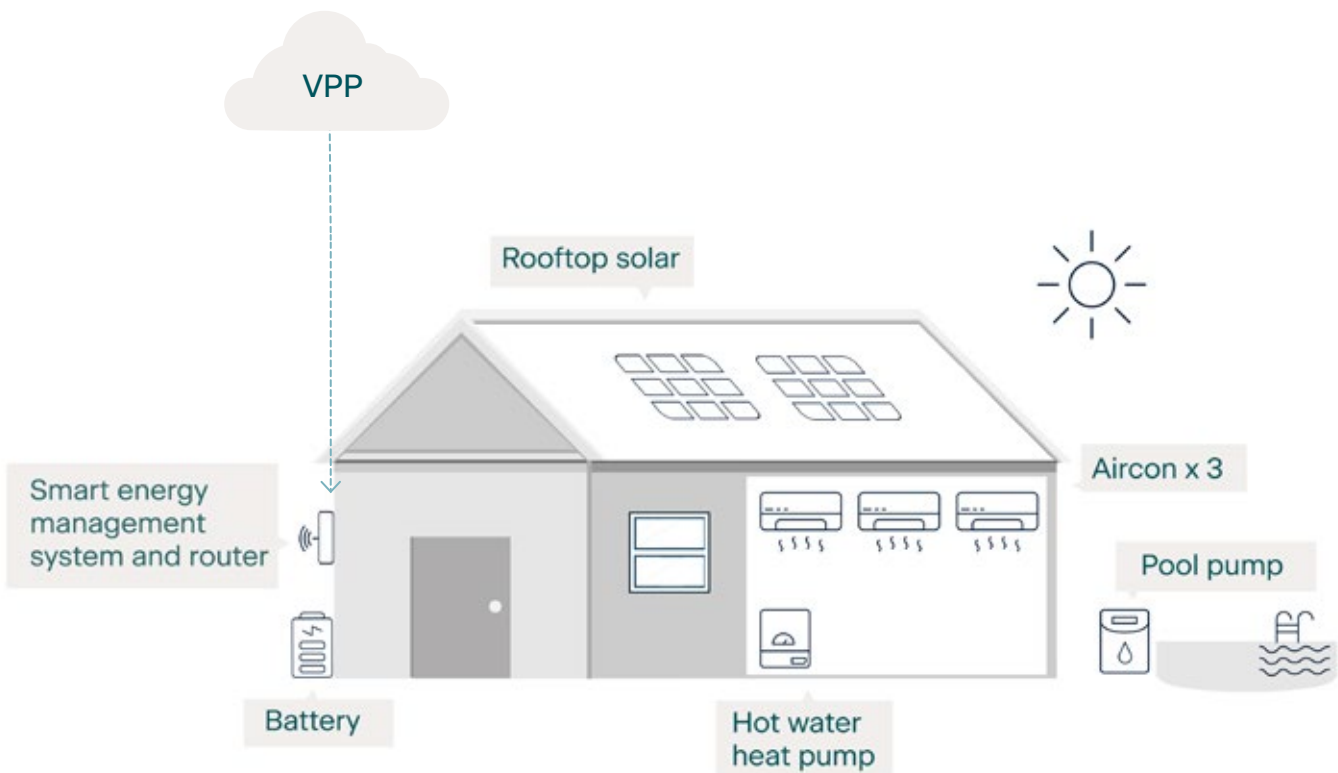
15
local household energy management systems



15
heat pumps

VPP orchestration





DevelopmentWA and Horizon Power subsidised the cost of each homes solar and battery package up to \$35,000.

For the heavily subsidised price of \$5,000, 15 customers purchased a renewable energy system, orchestrated by the VPP:

- **rooftop solar panels** – help to power the house by generating environmentally friendly electricity
- **a solar PV inverter** – which converts energy from the solar panels into electricity for the household
- **a battery** – which stores excess electricity generated by the solar panels (used when the solar panels can't produce electricity, such as cloudy periods)
- **a local energy management system** – which controls major appliances to maximise the use of electricity from the sun (and helps to keep down the amount of grid supplied power)
- **a hot water heat pump** – as an energy efficient way of heating water, designed for WA's harsh conditions.

The outcome from the pilot was to re-evaluate energy production and delivery in all regional WA.

The pilot aimed to demonstrate that numerous distributed energy resources may be coordinated as a fleet to:

1. Integrate high levels of solar, while reducing cost infrastructure of new developments
2. Keep our grid stable and stop intermittency issues which can occur when clouds cover the sun's rays that generate energy in the solar panels
3. Reduce customer electricity bills without impacting their comfort levels.

The Project Timeline

Phase 1

November 2017 – April 2019

The pilot was designed, participants enrolled, and DER packages and DER coordination technology selected.

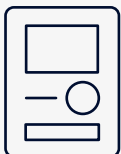


Technology was operationally tested at two showcase homes (not part of the pilot group and not in the Waranyjarri Estate) by the end of January 2019.



Ten customer homes had an installed, commissioned and fully tested DER package and orchestration equipment by the end of January 2019.

The transformer was fitted in February 2019 with a power quality meter and interfaced to a communications and management system, to measure various power quality parameters and 1-minute interval load data.



The orchestration technology underwent significant development and testing to enable the first of its kind fleet level coordination of DER to Horizon Power's requirements by March 2019.

Phase 2

May 2019 – December 2020

Thirty-two trials, and numerous functionality tests, were undertaken by Horizon Power as part of Phase 1 through to June 2019.

Lessons were captured as part of a post implementation review. Predictably, the testing and trials exposed challenges and issues with purchased equipment, most of which were resolved through the manufacturer/s.

Five additional homes on the same transformer were selected to participate through an EOI. Installed, commissioned system and orchestration technology by the end of December 2019.

Development of new **functionality** to automate dispatch of DER coordination to achieve consistent, reliable and repeatable management of transformer demand within prescribed limits.

Radio Frequency mesh network Demand Reduction Enabling Devices were installed at all 15 customer homes to test improvements in device communications.

596 trial events, comprising automated, scheduled, and manual, were undertaken by Horizon Power in Phase 2 of the pilot.



Comprehensive data analysis undertaken by Data Analysis Australia to establish findings.

The findings

Customer's electricity bills were reduced



\$37,500
saved in total



\$2,500
average saving per year
off electricity costs

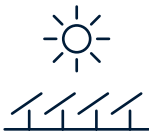


\$6.85
saved per day in
electricity costs



72 metric tonnes
reduction of greenhouse
gas emissions

The grid was more stable



27%
reduction in reverse
power flow from solar



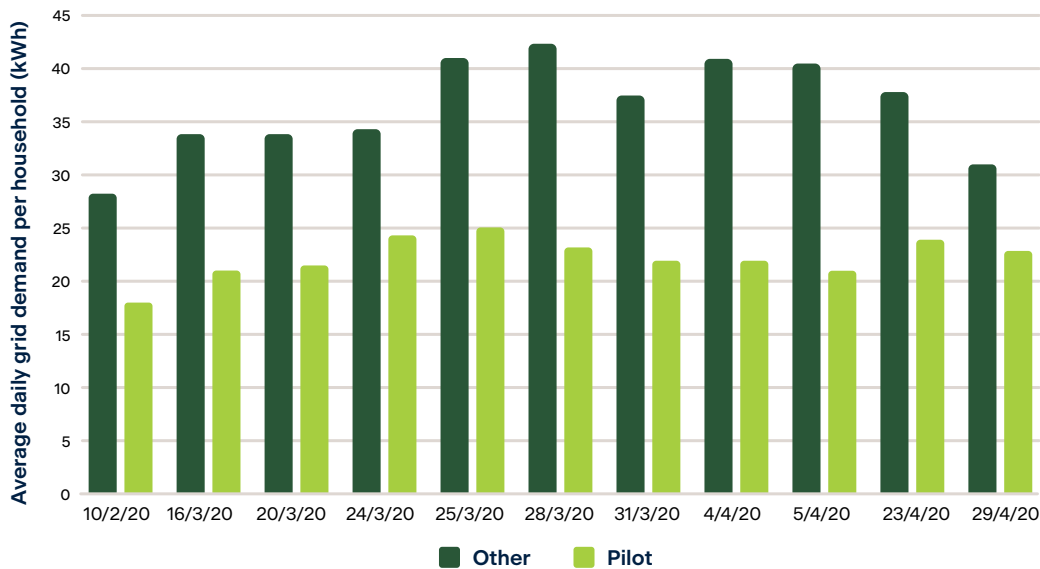
26%
reduction in peak
demand using battery



9%
average peak reduction from
controlling air conditioners



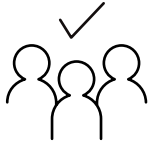
30%
reduction in upfront
electricity infrastructure
requirements



Customers used 40-70% less from the grid, with daily grid demand and average peak demand lower on the pilot homes.

The findings

What did the Smart Sun participants tell us?



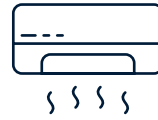
100%

of customers reported a positive or very positive experience



7/10

had savings that exceeded their expectations



7/10

never noticed impact to their air-conditioning



8/10

told family and friends about the electricity savings off their bill



7/10

increased their savings from lower electricity bills



50%

monitored their energy use through Horizon Power's app



8/10

would recommend a battery to their family and friends



55%

customers were able to use their airconditioners more often



“This trial was very exciting. It has been a very good lesson in how much electricity consumption we use, especially for our kids.”

- Horizon Power customer, Broome



Conclusions

The customer needs to be at centre of every decision

We carefully selected the appropriate in home appliances and timings in each customer's home to ensure that dynamic management events did not adversely impact the customer's comfort levels.

Curtailment of solar PV was effective

Scheduled dispatch to curtail solar PV limited the impact on the network and was simple to administer and operate.

Customer comfort was increased

Customers were able to increase the amount of time they used their air-conditioning systems by about 55% – all while still saving significantly off their electricity bill.

Plus, most customers didn't notice any dip in comfort levels when their air-conditioners were subject to dynamic management.

Battery storage was reliable and effective at reducing peak demand

Incentives to encourage evening discharge from storage systems may provide a cost-effective network support option.

New development property infrastructure costs could be reduced thereby promoting regional development.

Lower development costs through ADMD

- When developing new land there are connection costs involved in providing an adequate power supply – this is based on a measurement called "After Diversity Maximum Demand" (ADMD).
- The pilot households achieved our best-case target for ADMD, reducing development costs by 30%.
- The pilot data supports a case for a review of design ADMD in new housing estates where there are new homes built to current building codes which could incorporate energy efficient appliances and DER orchestration.





Frank Marra

DevelopmentWA CEO

Our Innovation through Demonstration, Smart Sun pilot project at Broome North has demonstrated an effective approach to reduce power infrastructure costs in regional land developments and given rise to industry-leading innovations that will help solve key grid and land development challenges for projects of the future across the globe.

Stephanie Unwin

Horizon Power CEO

Our Smart Sun pilot at Waranyjarri Estate, Broome, has demonstrated that through this commitment to innovation and co-creating with our customers, we're delivering new energy solutions for a vibrant regional WA.



To find out more about Smart Sun head to
horizonpower.com.au/SmartSun

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*Owned by the
people of WA*

