# ROLLING OUT AUSTRALIA'S LARGEST VPP

AUSTRALIA'S LARGEST VIRTUAL POWER PLANT (VPP) IS PROVIDING ENERGY SAVINGS FOR SOCIAL HOUSING TENANTS IN SOUTH AUSTRALIA. BY **ZENO ATHERTON**, ASSOCIATE DIRECTOR, CLEAN FUTURES TEAM, **CLEAN ENERGY FINANCE CORPORATION (CEFC)**.

Australia's abundant solar resource, high retail electricity prices and solar feed-in tariffs provide a compelling financial incentive for homeowners to install solar panels – and they have been doing so in record numbers. Australia has more than 12GW of small-scale rooftop solar installed, representing about one in three households. There is also growing interest in home battery systems, which offer these homeowners access to clean energy when the sun is not shining, as well as the opportunity to share it with households that cannot install rooftop solar. This combination of distributed energy resources (DERs), known as a virtual power plant (VPP), can also provide wider electricity system services to help support the grid.

## What is a VPP?

A VPP is a networked collection of electricity generators that can be operated and managed centrally but that are distributed throughout the electricity grid. It can consist of a range of DERs including technologies such as generation sources, solar panels, storage devices, batteries, and controllable loads – hot water, air conditioning, pool pumps and EV charging. VPPs can be aggregated from equipment located in homes, businesses and industry, leveraging scale and diversity in generation and loads.

## The Tesla SA VPP

In recognition of the significance of VPPs to Australia's clean energy transition, this year the CEFC committed up to A$30m debt capital, alongside an A$8.2m grant from the Australian Renewable Energy Agency (ARENA), A$10m from the SA Government and A$18m of Tesla equity to help roll out Phase 3A of the SA VPP. The investment aligns strongly with the CEFC mandate to increase the flow of private sector capital into new generation, storage, transmission and infrastructure, which are critical to support the security and reliability of Australia's energy grid.

The SA VPP underpins a low retail electricity offer made by the scheme's retailer Energy Locals to SA Housing Authority (SAHA) tenants. For a single flat electricity tariff the VPP serves customers with electricity sourced primarily behind the meter, with the solar PV and battery providing a physical and financial hedge to potential NEM1 wholesale electricity market exposure. The VPP can earn additional revenue by trading into the east coast National Electricity Market (NEM) energy spot market and ancillary services markets. Tesla's market bidding and dispatch software, Autobidder, continually assesses the value of market dispatch opportunities against serving their customers' expected load and will bid in and dispatch the fleet when suitable.

## A commercial scale project

SA VPP project sponsor Tesla commenced the project in 2018 with the SA Government. When the Australian Energy Market Operator (AEMO) launched its VPP Demonstration project in 2019, the SA VPP was the first VPP to join the trial, designed to help establish how to manage and incorporate distributed batteries into the running of the NEM, and in particular how VPPs could participate in the wholesale energy and contingency Frequency Control Ancillary Services (FCAS) markets. FCAS markets provide a balancing service for the grid's operating frequency during periods of disturbance due to generation, load or network outages, or technical failure.

Phase 1 of Tesla's SA VPP project saw 100 systems deployed as a pilot on SAHA properties funded through a A$2m grant from the SA Government, allowing Tesla to establish some broad success factors around installation and operation and to demonstrate technical capability to provide frequency services. These early systems were not networked together but helped Tesla build its deployment model. The systems deployed included 5kW of solar PV and a Tesla Powerwall with a rated storage capacity of 13.5kWh, and an internal inverter rated at 5kW. These systems are expected to provide, on average, about 80 per cent of the annual electricity needs of SAHA tenants, with the balance sourced from the grid.

Phase 2 established the key contracts and contracting structure of the VPP. A A$20m SA Government loan financed the deployment of 1,000 network connected systems in 2019–20. This phase demonstrated core capabilities of the SA VPP, including its ability to provide contingency FCAS balancing services as well as the first VPP deployment globally of Tesla's Autobidder software. This software was first used by Tesla for Neoen's big battery at Hornsdale Power Reserve, South Australia. In 2019, the CEFC committed up to A$50m in debt funding for the 50 per cent expansion of the battery, which was completed earlier this year. These 1,000 systems were deployed through the retail electricity

offering made by Energy Locals, a Melbourne-based electricity retailer specialising in wholesale pass-through retailing, which also provides retailing services for VPPs.

The SA VPP is now in Phase 3A, during which a further 3,000 systems will be deployed for social housing tenants. Phase 3A will take the demonstration of technical services from networked batteries further by providing a range of services that are currently not rewarded by markets in the NEM, including voltage support, inertia and fast frequency response. The SA Government has agreed to pay up to A$10m for these network security services for an initial five-year term.

### Benefits of the SA VPP

In addition to time-shifting excess solar generation, batteries are an excellent technology for providing short duration balancing services in the power system because they can respond quickly to inject or absorb power rapidly.

The SA VPP has been providing these rapid services in the NEM since September 2019 and has twice helped avert acute energy supply and generation issues in the state.

On October 9 2019, after only a month of being enrolled in AEMO's VPP Demonstration trial, the SA VPP immediately responded when Australia's largest single generator – Queensland's Kogan Creek coal-fired power station – tripped, instantly removing 748MW from the market and causing the frequency in the NEM to rapidly drop. The SA VPP immediately began discharging batteries, helping restore the frequency. It stepped in a second time during the recovery phase until frequency was fully restored in combination with other service providers.

On January 31 2020 a storm took down high voltage transmission lines in Western Victoria, prompting a series of cascading events that shut down the SA-Victoria Heywood interconnector, effectively islanding South Australia and causing the frequency of the power system in the state to rise outside of safe levels. Again, the SA VPP responded instantly, this time by charging the batteries, effectively providing additional load to help absorb energy and lower the frequency.

Tesla will also be demonstrating that the battery technology can provide inertia services that act to dampen the need for FCAS services, as well as fast frequency response services that act as a very rapid response to frequency deviations and help reduce the need for FCAS services. Currently there are no markets for these capabilities since thermal generators have historically delivered inertia as part of their physical operation and large spinning mass.

In addition, Tesla will demonstrate the capability of local voltage control – a service that could be procured by a distribution network operator as a non-network alternative to making a network investment in equipment to manage voltage.

A challenge for distribution providers such as SA Power Networks (SAPN), is managing increasing levels of rooftop solar and other behind the meter exports that cause power to flow in a reverse direction and voltage to rise in the distribution network during peak generation times. These effects can cause safety issues, with high voltages potentially damaging consumer appliances as well as network management challenges. To help integrate higher levels of DERs including solar and batteries without curtailing exports, SAPN has trialled dynamic export limits for inverters that will allow greater export. Tesla provide SAPN with data from the SA VPP to help test these dynamic limits and the SA Government has now mandated that inverters installed in the state comply with dynamic export limits, to help improve the investment case for batteries.

### Financing and credit

The CEFC and Tesla first engaged on the SA VPP before the Phase 1 pilot had commenced. This is not an unusual approach for the CEFC since it is interested in working with strong counterparties to help accelerate clean energy project concepts into bankable commercial propositions. The CEFC provided the project with a A$30m limited recourse senior secured debt facility for the phase three deployment.

The SA VPP business model was a unique financing challenge, given that the security pool consisted of a geographically diverse portfolio of small assets located on tenanted residential premises, with the solar and batteries used to provide those customers with electricity as well as hedge the electricity retail exposure of the owner. Our credit assessment considered and modelled the retail risk position as against the wholesale market exposure, as well as the risks relating to retail customer enrolment and attrition.

Another important credit consideration (for any VPP) was the asset performance at the individual asset level, at the fleet level and the warranty position of the asset owner in relation to that fleet. This covers the solar panel and battery hardware, the communication gateway device and the software used to optimise and orchestrate the individual systems and manage the fleet in the wholesale markets.

The SA VPP project also revealed that getting property insurance for a fleet of assets on residential properties was not without challenge. Unlike the US market, in Australia there is not a strong established market in financing small-scale residential rooftop solar PPAs (power purchase agreements), or lease agreements.

### Advisers

Advisers on the financing were Planum Partners as commercial and financial adviser to Tesla, Pinsent Masons as legal adviser to Tesla, Johnson Winter & Slattery as legal adviser to the state government, and King & Wood Mallesons as legal adviser to CEFC. RINA provided technical advice to the project, Professional Risk Solutions provided Tesla with insurance advice and Ernst & Young advised Tesla on tax matters. Seed Advisory assisted Tesla on its wholesale risk framework and Aurora Energy Research provided Tesla with market price forecasts. JPA Financial Modelling conducted the financial model audit. ■