



Low Load Responses – Distributed Photovoltaic Generation Management

Position Paper

The State Government is introducing Distributed Photovoltaic (DPV) Management capability as a last resort measure to assist the Australian Energy Market Operator (AEMO) maintain power system security during extreme low load events.

All new and upgraded installations of distribution-connected solar PV in the South West Interconnected System (SWIS),¹ from 14 February 2022, will need to be capable of being remotely turned down or off (known as DPV Management) in extreme operating conditions. Existing rooftop solar will not be impacted.

These extreme low load events are expected to be infrequent and to last for a short period of time. In South Australia, where the requirement was introduced in 2020, it has been used once for a period of about one hour.

The speed and scale of solar uptake is presenting challenges to the grid, particularly in the next few years. However, there is a long-term plan for managing this transition to greater renewables, which includes more batteries and household participation in virtual power plants for payment. DPV management is a stepping-stone to this long-term future.

DPV Management will help facilitate the connection of greater levels of low-cost, low-emissions renewable energy generation and allow more renewable energy generation overall, while managing emerging risks to the power system.

What is DPV Management

DPV Management is the capability to remotely reduce the generation from small-scale distributed rooftop solar PV systems as a last resort measure, assisting AEMO to protect the power system during extreme low load events.

It is being introduced to:

- **help manage the risks to the power system during times of extreme low load;**
- **avoid interrupting power supply to customers** – under DPV Management, the grid will continue to supply power to customers. Only rooftop solar generation is turned down or off for short durations;
- **provide a ‘backstop’ to help prevent customers losing power** – the alternative option available to AEMO to manage low load events is to disconnect a distribution feeder or substation – this would interrupt power supply to all customers connected to that part of the network, including those with and without rooftop solar.
- **progress the vision for the power system where customers participate** – the goal remains to fully integrate customer devices, which will see customers able to provide energy services for

¹ The SWIS is the main power system in the South West of Western Australia, covering the greater Perth Metropolitan area and north to Kalbarri, east to Kalgoorlie, and south to Albany.

payment, including services that help maintain power system security. The capability to remotely communicate with customer devices is strongly aligned with this future participation;

- **help support greater levels of rooftop solar and renewable generation;** – by managing infrequent periods of extreme risk, DPV Management will support greater levels of low-cost, low-emissions energy for use at all other times; and
- **avoid more severe measures, such as halting all solar installations or charging customers for solar exports, which has been contemplated elsewhere in Australia**– these initiatives are not currently being considered for the SWIS.

The transition to renewables

Moving quickly to renewables

Western Australians are embracing distributed energy resources (DER) at record rates. These small-scale devices include batteries, electric vehicles, and rooftop solar systems.

Already, about one in three homes have installed DPV, and in 2020 alone, installed DPV capacity increased by a record 300 megawatts (MW). In 2021, rooftop solar generation has supplied up to 64% of instantaneous energy output on the system.

This uptake presents significant opportunities for customers and the State to produce and use low-cost, low-emissions electricity generation, and we want this to continue.

However, the unprecedented speed and scale of DPV uptake is making the power system increasingly challenging to manage, particularly during times when customers' electricity demand from the grid (known as 'load') is very low.

This challenge is growing as more DPV is installed on the system.

Long-term vision

The State Government has a plan for the long-term integration of large-scale and small-scale renewable generation sources. The Energy Transformation Strategy (ETS), which commenced in May 2019, maps out a reform program with a focus on integrating rooftop solar and preparing the power system for a renewable energy future. Importantly, the ETS will provide opportunities for new technologies, including battery storage, to accommodate greater levels of low-cost, low-carbon generation while maintaining power system security and reliability.

Many of these changes are being implemented under the DER Roadmap. The DER Roadmap is the Australian-first plan for the safe integration of increasing levels of small-scale customer devices within the power system. It sets out a vision for the SWIS where DER devices play central role in the power system, providing opportunities and value for customers and the market. Crucially, this vision will see customer devices including rooftop solar participate in providing energy services for payment.

The full implementation of the DER Roadmap and this strategy remains a priority of the State Government.

Acceleration of the transformation and near-term risks

On 28 September 2021, AEMO released its *Renewable Energy Integration – SWIS Update* report, outlining the risks of declining levels of system operational demand, including heightened threats to power system security during times of extreme low operational load ('low load').

Low load events typically occur on mild, sunny days when total customer energy requirements are low, and output from DPV generation is high. These conditions usually occur on weekends in Autumn and Spring when demand from businesses is relatively low and air-conditioning is unnecessary for most customers.

To manage the power system, electricity supply and demand must be balanced. As demand from the grid decreases during low load periods, fewer of the large, controllable 'synchronous' generators are online and being dispatched to provide energy.

Currently, these generators play a critical role in supporting the power system, stabilising electrical frequency on the grid, helping the power system ride through disturbances and faults, and responding rapidly to sudden changes in demand.

AEMO, in its role as system operator, requires enough of this controllable generation to be online to maintain the stability of the power system. As a result, when there is a large amount of uncontrolled generation from DPV systems and low customer demand for energy from the grid, these controllable generators may not be able to continue operating (i.e. 'be online'). At these times, the power system becomes extremely vulnerable to unexpected events.

Since the commencement of work under the State Government's ETS in May 2019, the energy transition has accelerated.

A record amount of DPV was installed in 2020 (supported by COVID-19-related changes in homeowner spending behaviour), and forecasts from AEMO indicate this rate is likely to continue.²

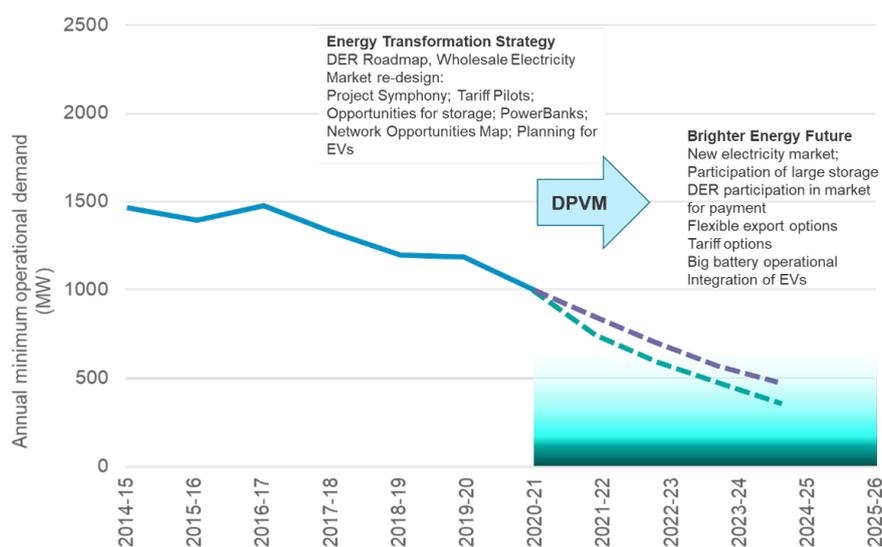
In its September 2021 report, AEMO made a priority recommendation to introduce the capability to remotely manage the generation from DPV systems (known as DPV Management) as soon as practically possible:

*"As soon as practically possible, enable the capability to manage newly installed and upgraded DPV (i.e., for output reduction and/or curtailment) on instruction from AEMO to a third party to assist in managing power system security and reliability in all emergency operational conditions, including during extreme low system load conditions and black start, as a measure of last resort (i.e., backstop capability)."*³

This recommendation is made by AEMO as an alternative to "disconnecting a distribution feeder or substation", which would interrupt power supply to all customers in suburbs attached to that part of the network.

The report identified that around 600MW of load was the critical amount that would keep the power system secure under most scenarios. This level is fast approaching; the Wholesale Electricity Market (WEM) recorded a new record low of 761MW on Sunday 14 November 2021, highlighting just how close the SWIS is to reaching AEMO's "zone of heightened security threat".

Figure 1: Energy transformation and managing the risks



Source: AEMO 2021 Update Report and Energy Policy WA

² AEMO 2021, [2021 Wholesale Electricity Market Electricity Statement of Opportunities](#)

³ AEMO 2021, [Renewable Energy Integration – SWIS Update](#), Executive Summary

DPV Management is being introduced to ensure that the power system continues to operate securely as we make the transition to a power system that integrates greater levels of renewable generation.

DPV Management can be used to avoid ensure the system avoids system security threats (shown in the shaded section indicating 600MW or lower levels of operational demand), which may occur until the long-term energy transformation vision is realised.

Alternatives to DPV Management were considered

DPV Management is part of a suite of solutions to manage low load risks, many of which are already being implemented. DPV Management has been selected as an option for responding to low load conditions following a process of public consultation and consideration of alternative options.

Consultation on proposed approach

A *Discussion Paper* was released for comment on 19 October 2021, outlining the proposed implementation model for DPV Management and related requirements for connecting and upgrading DPV systems. Energy Policy WA received 138 submissions from industry participants (including the Clean Energy Council, Smart Energy Council, and inverter and equipment manufacturers), consumer representatives (including Energy Consumers Australia) and over 120 members of the public.

Energy Policy WA has considered all feedback provided by stakeholders and has produced a *Consultation Summary Paper* outlining submissions and responses.

Key feedback from submissions related to the benefit of rooftop solar as a low-cost, low-emission energy source, and alternatives including greater use of batteries or electric vehicles.

Options considered

In considering AEMO's recommendation that DPV Management capability be implemented, several options to assist during times of extreme low load were evaluated:

Subsidies for customer-owned battery storage – Uncontrolled customer-owned batteries may assist, but will not reliably solve the problem of low load. Most household batteries will already be fully charged and unable to absorb more solar power during the early afternoon periods when low load events are likely to occur. In addition, installation rates would need to exceed that of DPV each year – this is considered unlikely to occur based on the current popularity of DPV systems, even with the presence of targeted subsidies.

Upgrading the power system infrastructure – Upgrading the power system to resolve low load events in the absence of DPV Management would require large amounts of energy storage. While large-scale storage is anticipated to play an important future role in managing power system security and decarbonisation, it represents a higher cost solution to resolving infrequent low load events and has long lead times for implementation. The State Government is supporting the transformation through investment in battery storage where appropriate, including Synergy's \$155 million investment in large-scale storage with the Kwinana Big Battery and 13 community-scale 'PowerBank' batteries for trials in the lower-voltage distribution system.

Market-based mechanisms – Large customers are already incentivised to increase their demand from the grid during periods of low load through the structure of their electricity tariffs. Other market-based mechanisms, such as the coordination of many rooftop solar and battery storage devices as a paid service, are still under development. Project Symphony, a large-scale 'Virtual Power Plant' (VPP) pilot being implemented by the State Government in partnership with Western Power, Synergy and AEMO, will demonstrate the technology required to make commercially-viable VPPs a reality.

Limiting exports – Limiting exports from rooftop solar is being implemented for larger systems without off-take arrangements. This will allow the connection of larger systems for self-generation where they would otherwise exacerbate local network issues.

Limiting installations of new rooftop solar – This option is not being contemplated for the SWIS.

DPV Management has been progressed because it presents a reliable solution to deal with the emerging low load risks, it can be implemented in a timely manner at low cost for consumers and is consistent with the regulatory framework and the long-term plan for DER participation.

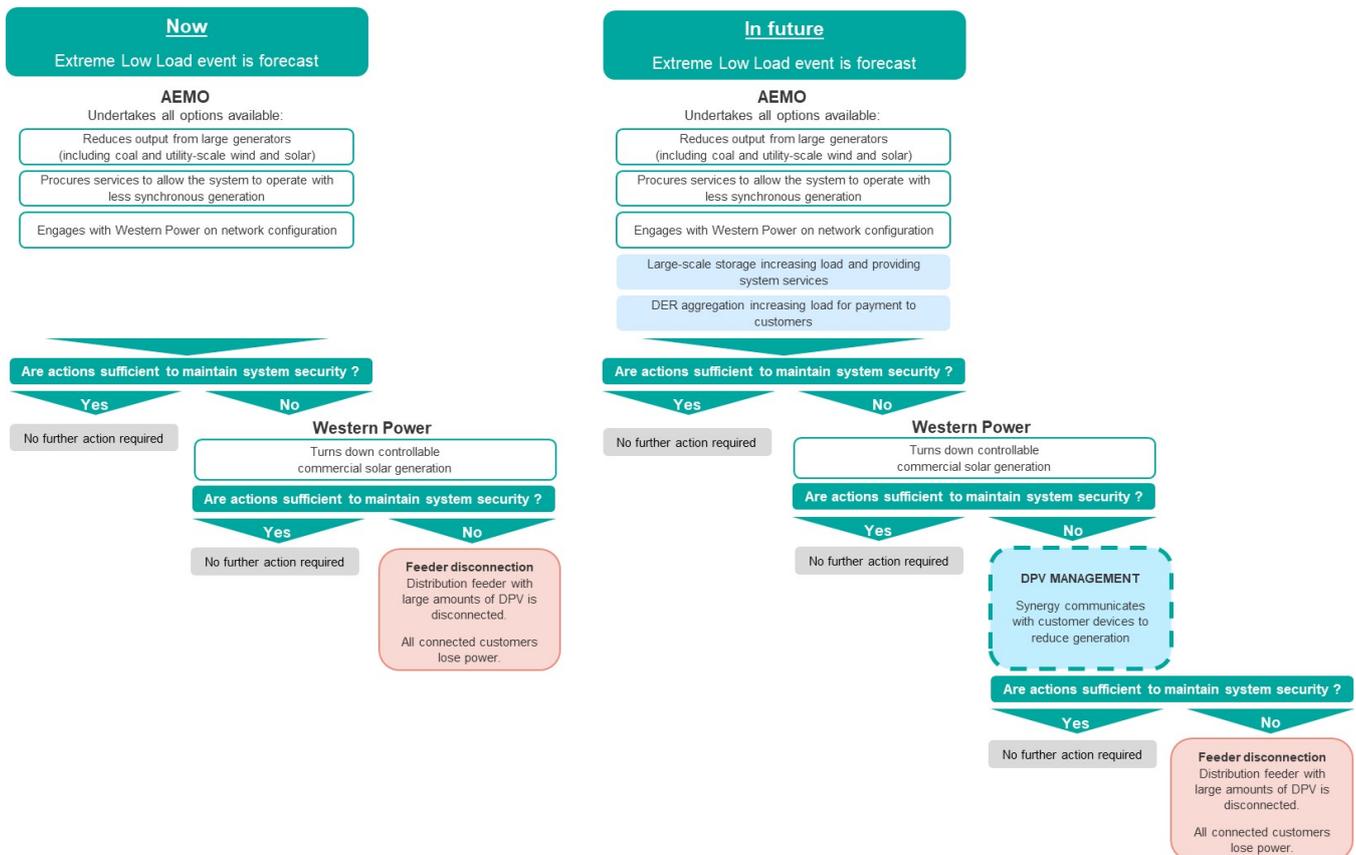
Implementation of DPVM

How it would be used

DPV Management is being introduced as a last resort, on the basis that AEMO will undertake all other options available to it *before* it requests a DPV Management response from customers.

As such, DPV Management will only happen in response to a formal request from AEMO, and will be used during extreme events to prevent the system entering an unsecure state.

Figure 2: Managing low load risks now and in the future



How often it would be used

Based on current estimates and forecasts, expected events requiring a DPV Management response will happen infrequently and only for short periods during the middle of the day. South Australia introduced DPV management capability in September 2020 and it has been deployed once, on 14 March 2021, for around one hour.⁴ However, South Australia has the added security of interconnections to other states which allow it to export energy surplus to local needs, which means that the Western Australian experience will be different.

⁴ AEMO, 2021, <https://aemo.com.au/en/newsroom/media-release/solar-pv-curtailment-initiative-by-sa-government-supports-the-nem>

Details

To ensure there is sufficient capacity available to provide a response if it is needed in coming years, DPV Management capabilities need to be implemented for all new and upgraded DPV systems as soon as possible. The soonest practical commencement date of 14 February 2022 has been selected.

Under the proposed changes, installers will have to ensure that systems meet new requirements from 14 February 2022 or Western Power will not approve the connection. Synergy will be providing support information for installers on its website.

Customers will be provided with the relevant information at the time of making an application, but are encouraged to find out more on Synergy's [website](#).

Information for customers

- If you already have rooftop solar installed, you will **not** be impacted by these proposed changes.
- If you install a new rooftop solar system or upgrade your existing system after 14 February 2022 and your system:
 - has a generating capacity of 5kW or less – it will need to meet DPV Management requirements for remote management; or
 - has a generating capacity greater than 5kW – the system will need to meet new Western Power requirements around system size and export limits.

Information for installers

- For installations from 14 February 2022, installers must ensure new and upgraded DPV systems meet the Western Power Basic Embedded Generator Technical Requirements (which replace the Network Integration Guidelines). (Western Power's portal will be closed from 14-15 February to update systems for the new requirements.)
- For installations of 5kW or below, installers must ensure DPV systems meet the new DPV Management requirements, including validation of an approved method for DPV Management in coordination with Synergy.
 - Information will be provided by Synergy in early 2022 on how installers can meet these requirements.
- For installations with generating capacity above 5kW, installers must ensure systems meet the approved system size and export limits.
 - DPV inverter systems with a capacity above 5kVA will be permitted with a 1.5kW export limit.

DPV Management technology solutions

Depending on the DPV installation, there may be multiple options for implementing DPV Management for a given customer.

Options for DPV Management include remote communication to an inverter or a gateway device (via customer wi-fi or telecommunications network), or a metering solution that disconnects the DPV system. Other options may become available in the future, if approved by Western Power.

Synergy is finalising technology options which will be available for customers, and a mix is expected to ensure all customers will be captured under the requirement.

Further information on DPV Management, including Frequently Asked Questions and a consumer fact sheet is available on the Energy Policy WA [website](#).

Information on the proposed guidelines will be available on the Western Power website from 2 December 2022.

Information to support customers and installers in meeting the requirements is available on the Synergy [website](#).