

Australia's power systems are rapidly transforming

Australia's electricity grids were originally designed to handle one-way distribution of power from large-scale generators to homes and businesses.

Today, unused electricity from millions of rooftop solar systems flow back into the power system.

This will provide a growing opportunity for consumers to participate in the energy market with their solar, batteries and electric vehicles, to improve electricity reliability and grid security.

However, in certain conditions high volumes of rooftop solar can reduce the need for electricity from grid-scale generation, known as minimum system demand or load events, which can pose risks to grid security.



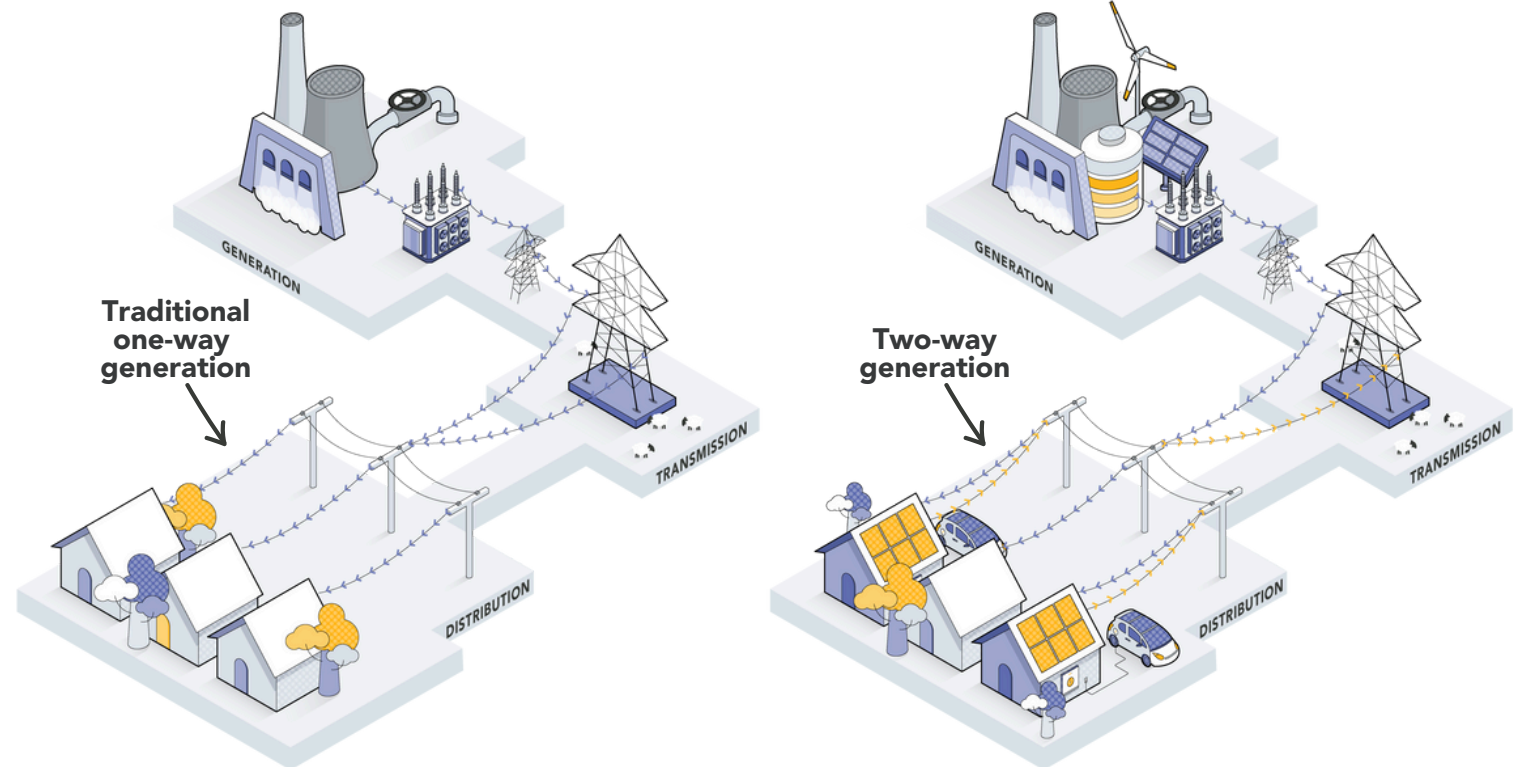
Changing role of the grid

Until a decade ago, electricity was predominantly generated by burning black or brown coal, which was then transported from these large power stations through the transmission and distribution networks (powerlines) to energy users.

However, along with the grid-scale investment in wind, solar and, more recently, batteries, Australia's world-leading uptake of rooftop solar has changed the way the system operates, with electricity now flowing from homes into the grid for use by other homes and businesses.

In fact, the excess electricity from millions of rooftop solar systems has, at times, met more than 70% of total demand in Western Australia's Wholesale Electricity Market (WEM) and half of total demand across the east coast's National Electricity Market (NEM).

At certain times, if high rooftop solar contributions coincide with issues on the power system, like unplanned generation and transmission outages, actions must be taken to keep the grid secure and mitigate the risk of damage to the system and potential blackouts to consumers.



About us: AEMO is the independent energy market and system operator and system planner for the National Electricity Market (NEM) and Western Australia's Wholesale Electricity Market (WEM). We are a not-for-profit company, with a membership of state and federal governments (60%) and energy industry members (40%).

More info: aemo.com.au/about/who-we-are

Challenges of rooftop solar

While there is no doubt rooftop solar provides immense benefits in generating clean and affordable electricity, power systems also require critical system security services provided by large power stations with spinning turbines (also known as synchronous generators) to maintain a safe and resilient electricity system.

These system services help safely manage electricity supply and demand during normal operating conditions, but also respond to issues that can impact grid security.

Currently, AEMO can operate the energy system with high levels of rooftop solar generation.

However, there are two main risks to power system security during periods of high rooftop solar contributions, also known as minimum system demand or load events:



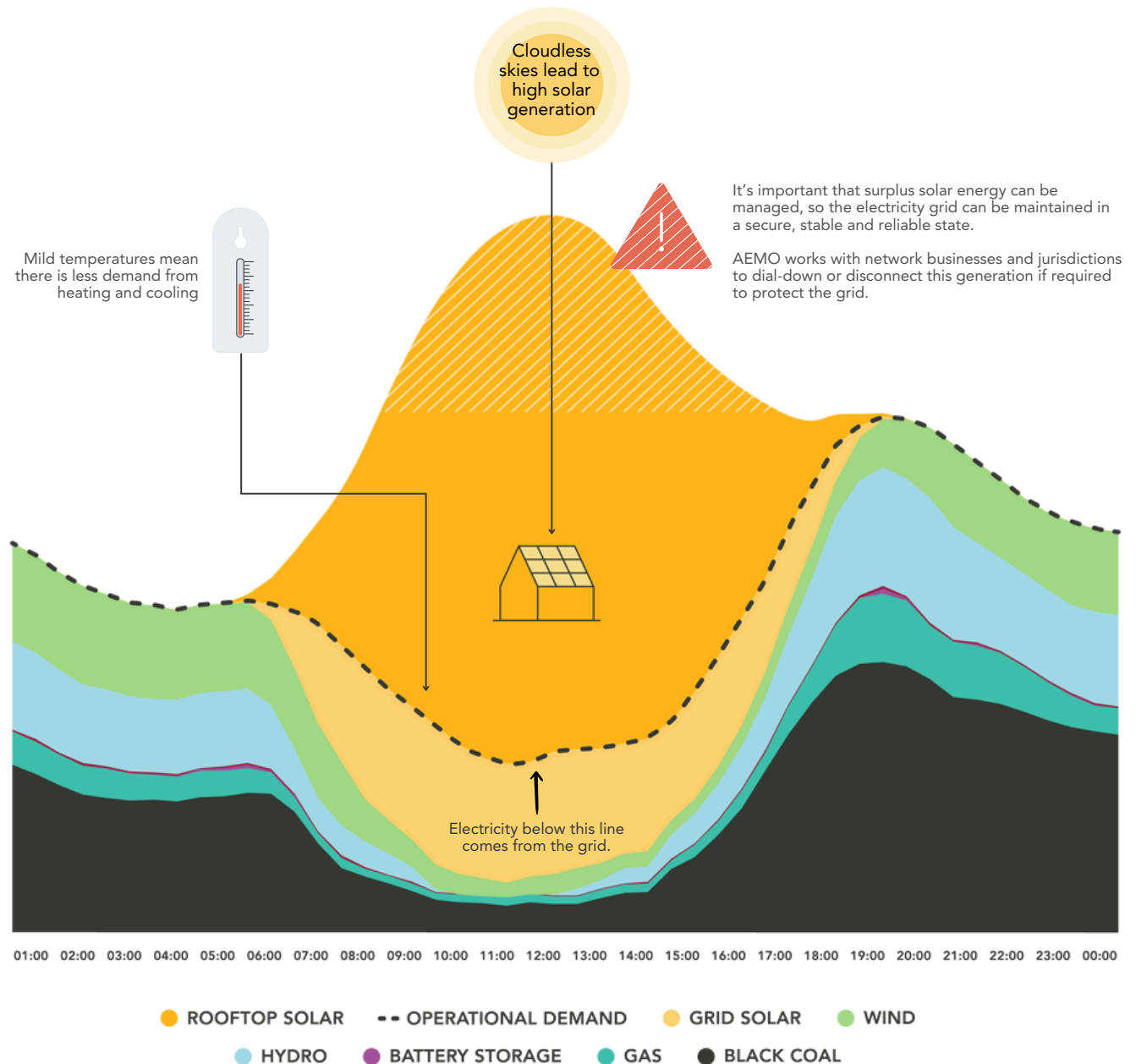
Rooftop solar generation removes large synchronous generation from the power system, which limits access to critical system security services.



Rooftop solar output is high, and, at the same time, a power system issue occurs that coincidentally disconnects a large power station and large volumes of rooftop solar systems.

These risks, and how AEMO works with industry, state governments and network service providers, are explained in further detail over the next pages under 'Frequently Asked Questions'.

The ingredients for a high rooftop solar/minimum system demand day



Frequently asked questions



Q: What is being done to manage risks associated with high rooftop solar contributions on minimum system demand days?

For several years, AEMO has flagged this emerging risk with industry. As a result, state governments and distribution network owners are developing appropriate emergency solutions or 'backstop' mechanisms.

This includes the capability to temporarily dial down or disconnect rooftop solar as a last resort in emergency situations.

Concurrently, AEMO is also undertaking a range of activities to support the continued uptake of consumer energy resources (CER), such as rooftop solar, residential batteries and electric vehicles, while maintaining reliable electricity support through a secure grid.

We're doing this by contributing to new market designs, trials and research, which will continue through the recently announced National CER Roadmap.



Q: What can AEMO do to manage these risks?

AEMO undertakes a range of grid-level actions to maintain security when rooftop solar contributions are deemed a risk.

These actions include:



Issuing market notifications on the forecast level of risk to secure a market response.



Recalling planned transmission outages.



Constraining and directing non-essential grid-scale generation.



Increasing electricity demand by directing large consumers into service to absorb excess energy, such as pumped hydro or batteries.

AEMO alerts market participants through minimum system load (MSL) notifications detailing the risks and associated actions it can take before rooftop solar management programs are used. This process is similar to when AEMO communicates lack of reserve notifications.



Q: What is rooftop solar management and how does it work?

If actions taken by AEMO with industry have not sufficiently reduced the risk, AEMO would issue a MSL 3 notification, notifying the relevant state transmission network service provider (TNSP) to maintain demand at the required threshold.

This may trigger the need to dial down or disconnect rooftop solar systems temporarily through solar management programs run by state governments and distribution network service providers (DNSPs, the owners and operators of pole and wires).

DNSPs would be responsible for determining what actions are taken to reduce rooftop solar generations to maintain demand in their networks.



Q: What actions can distribution businesses take?

To maintain demand at safe levels, emergency rooftop solar management options include:

- Temporarily dialling down or disconnecting rooftop solar systems.
- Temporarily disconnecting reverse flow feeders.



Q: What are reverse flow feeders and what part do they play in rooftop solar management?

A feeder is essentially a powerline that supplies electricity to suburbs and towns.

Under certain conditions, when electricity supplied from large generators is low and electricity into the grid from rooftop solar systems is high (known as minimum system load events), the excess electricity from people's rooftops flows into the street powerlines and up into the 'feeders' out of the local area.

These powerlines are known as reverse flow feeders due to the two-way, or bi-directional, electricity flow.

If rooftop solar management alone is unable to reduce risk to the system, then as an absolute last resort, these feeders can be temporarily disconnected.



Q: How often will solar management or feeder disconnection occur?

To date, dialling down or disconnecting rooftop solar systems has occurred temporarily on very rare occasions in South Australia.

Challenging operating conditions that could lead to emergency rooftop solar interventions are more likely to arise on mild sunny days during spring and autumn and weekends and public holidays.

However, they are very unlikely to be needed under normal power system operating conditions.

Disconnection of reverse flow feeders has not yet been required, and will only temporarily be used if all other options have been exhausted.



Q: Will I be notified when my system is being curtailed?

Communication details are outlined in each state government program.

Please refer to your particular state's rooftop solar management policy and electricity retailer for further information.

State rooftop solar management programs: [Queensland](#), [South Australia](#), [Western Australia](#) and [Victoria](#).



Q: How will solar management affect small consumers?

Rooftop solar management will generally not impact consumers' power supply. However, it may mean some consumers need to draw from their storage systems or the grid for short periods of time.

Some retailers provide financial incentives for customers to sign-up to be part of emergency rooftop solar management. Please contact your retailer for further details.

As a last resort, if reverse flow feeders require disconnection, this may temporarily interrupt consumers' power supply.