Four ways to stop Australia's surge in rooftop solar from destabilising electricity prices

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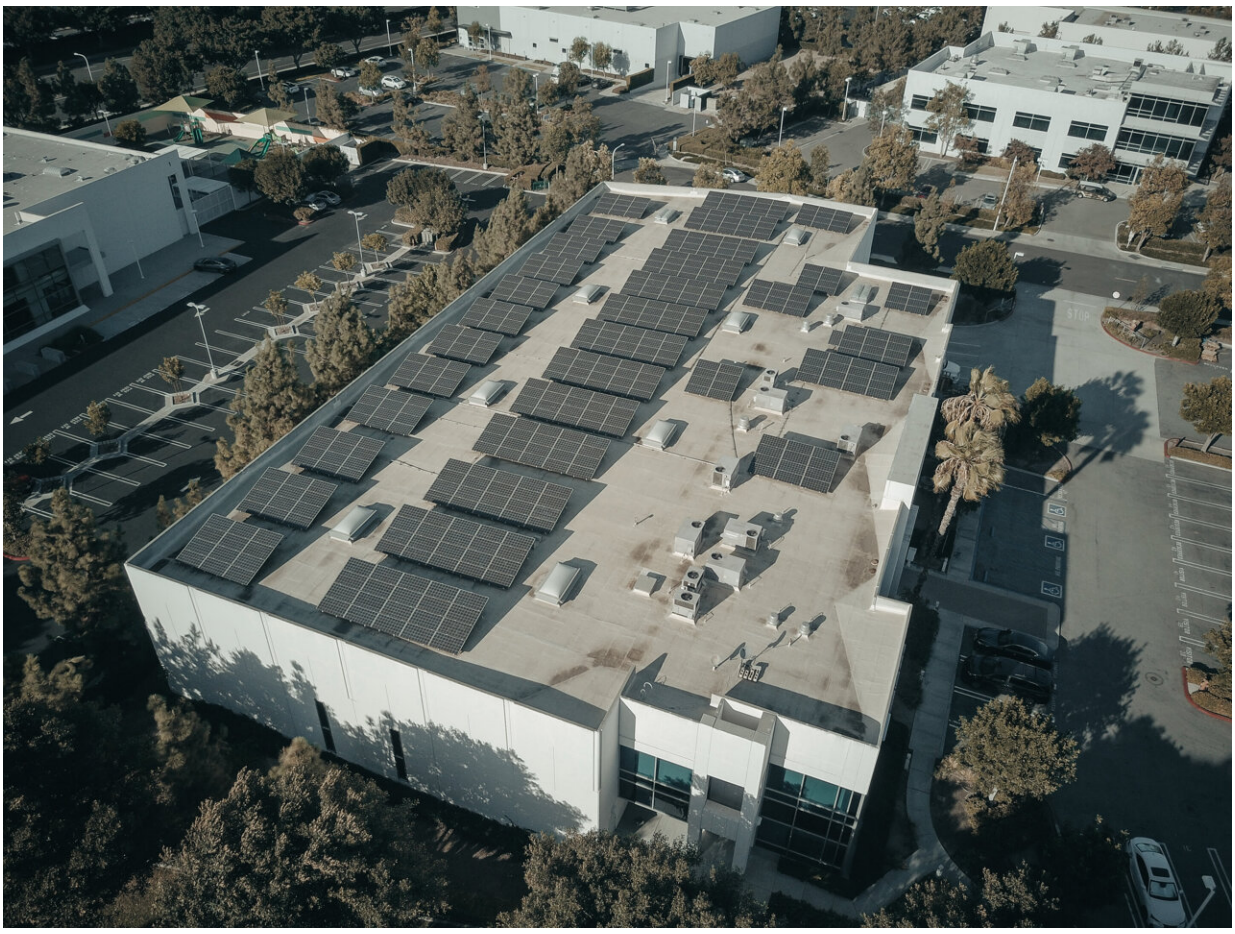

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Last year saw Australians install rooftop solar like never before, with 40% more installed in 2021 than in 2020. Solar system installations now make up 7% of the energy going into the national electricity grid.

Alongside the greater uptake of utility-scale solar (such as solar farms), this means cheaper and cleaner electricity is fast becoming a reality, putting the country on track to meet international climate targets.

But such a dramatic surge in solar output also poses challenges for Australia's power system for two main reasons.

It results in increased periods of large oversupply when weather conditions favor solar energy. This leads to energy being wasted due to the need for solar curtailment—when a solar system shuts down or stops exporting energy to the grid to counter the energy spike.

On the other hand, there is little solar generation during peak demand hours in the morning and evening. This requires more expensive generators to run.

These are huge problems from a market operations perspective, as the pressure on the system may result in blackouts and disruptions. It also creates large price swings for retailers, which then can increase costs for consumers. As a result, we may see it become more expensive to decarbonise the national energy market.

We propose four ways to combat this growing, volatile issue, according to findings from our recent research.

Renewables investment is exploding

Investment in solar has increased significantly since 2018 as it became the cheapest form of new power-generation technology.

In fact, the Australian Energy Market Operator's latest Integrated System Plan, released last month, predicts coal plants to close three times faster than industries had expected.

Australia has one of the highest per-capita rooftop solar installation rates in the world, with rooftop and utility-scale solar already meeting over 100% of demand in South Australia.

By 2050, we expect to see five times more rooftop solar capacity.

How does this challenge price stability?

As solar generation is so cheap, traditional coal and gas generators are getting pushed out as a source of base-load electricity supply.

This is especially acute in the middle of the day, when solar generation is greatest as the sun is shining at its peak. This results in low prices, or even in negative prices, which financially penalizes any generators making power at those times. Curtailment is then used to offset any oversupply or negative prices.

Electricity demand, however, tends to peak during the morning and evening when most people are home. Prices skyrocket during these periods as gas and coal-fired power stations benefit from the reduced competition from solar energy.

For retailers, these huge price swings are extremely inefficient. And this inefficiency in the market may eventually be reflected in consumer prices. What's more, too much solar curtailment can hurt the rooftop solar owner because it reduces the amount of generation coming from their systems.

This price variability can also undermine the stability of the power

system. This is because solar systems, both large and small, do not inherently provide certain services needed to keep the lights on, such as "system strength" and "inertia".

Such services are currently largely provided by coal and other thermal plants, whose very existence is under threat by additional solar.

Utility-scale solar output looks very different to rooftop PV output over the course of a day, as the utility-scale solar panels rotate to track the sun. On the other hand, rooftop solar systems are generally fixed in orientation.

We found this difference in output leads to different price impacts. Utility-scale solar output reduces price variability, while rooftop solar output increases it. This means we have a greater need for managing rooftop solar.

Our research proposes four ways we can better align solar output with electricity demand. This can reduce both the level and volatility of electricity prices, benefiting consumers without undermining the stability of the power system.

1. More battery storage

Australians with rooftop solar should be eligible for government grants, rebates, and loans to support their systems with batteries. This will enable owners to store extra power generation during the day and export it to the national grid later in the evening to meet the peak demand.

2. Flexible management of energy exported to the grid

The Australian Energy Market Operator should design dynamic and

flexible export management measures to absorb excess rooftop generation. This will efficiently control the generated energy going into the grid by taking into account demand and supply conditions in real time, improving the system security.

The operator has recently developed such measures for South Australia, but they'll also be useful to other regions.

3. Paying rooftop solar owners dynamic tariffs

Currently, people who own rooftop solar are paid a fixed or "flat-rate" tariff for the electricity they provide to the grid, regardless of time of the day.

Instead, we need to transition from fixed to dynamic tariffs. These dynamic "feed-in" tariffs would be lower during the day and higher in the morning and evening peaks to incentivise rooftop owners to inject their electricity into the grid when it's more valuable.

4. We need a two-sided market

Australia's energy market is heavily one-sided, with suppliers having the flexibility to, for example, set prices and dispatch energy.

A two-sided market will allow both supply and demand sides to participate in the dispatch and price setting process. This will enable electricity demand to be more flexible, and better align energy usage with solar and wind generation.

Such a market will allow increased output of renewables to be translated to lower electricity prices.

We rely on solar energy as a key technology to help Australia decarbonise the energy market by 2050. To maximize the benefits of solar generation, Australia urgently needs a coordinated response from policymakers, energy providers and consumers. And crucially, it will enable Australia to achieve net-zero emissions by 2050.

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