DER FINAL PROJECTIONS

FRG meeting

April 2021

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Enlightening environmental markets

Green Energy Markets

Overview

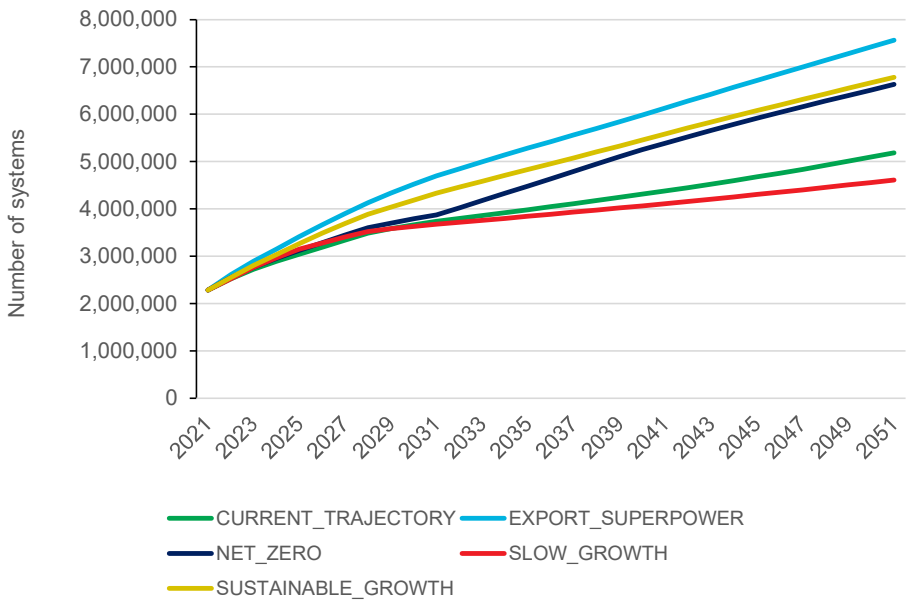
- **Cumulative results**
- **Changes to final results compared to draft results**
- **Explanation of results - why rapid growth of solar installs is expected to reverse and annual installations fall**
- **Explanation of results - why battery installs are expected to grow substantially**

NEM cumulative results - Solar

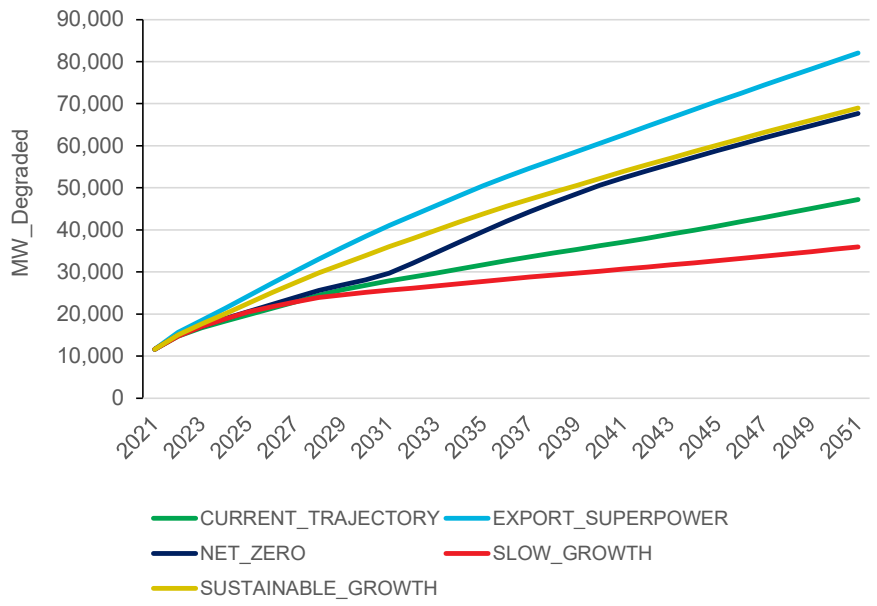
FINAL RESULTS – APRIL 2021

- **For the NEM the cumulative number of solar systems under Current Trajectory grows from the current level of 2.1m to just under 5.2m by 2051. The high point under Export Superpower is 7.5m and low under Slow Growth is 4.6m.**
- **The megawatts of degraded capacity in the NEM expands from 11.3GW to reach 47.2GW by 2051 under Current Trajectory. It peaks at 82GW under Export Superpower and is down to 36.0GW in Slow Growth.**
- **By 2051, under Current Trajectory 37% of residential connections would have a solar system while under Export Superpower it would be 52%.**

NEM cumulative number of solar systems by scenario



NEM cumulative degraded megawatts of sub-30MW solar by scenario

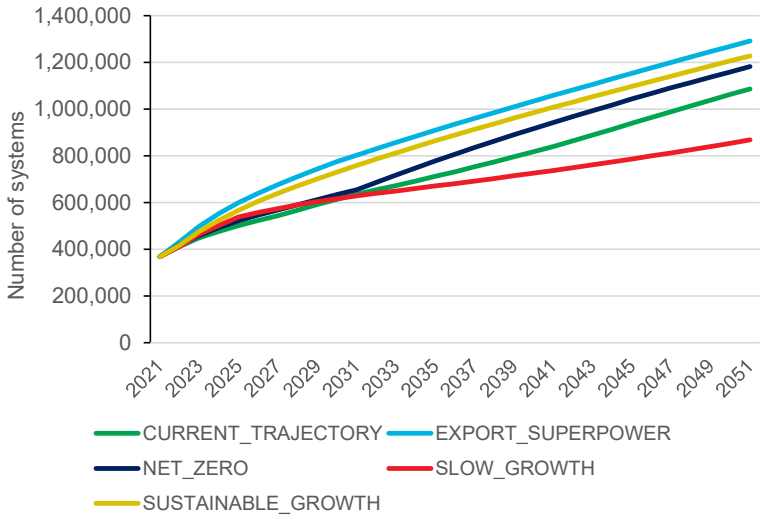


SWIS cumulative results - Solar

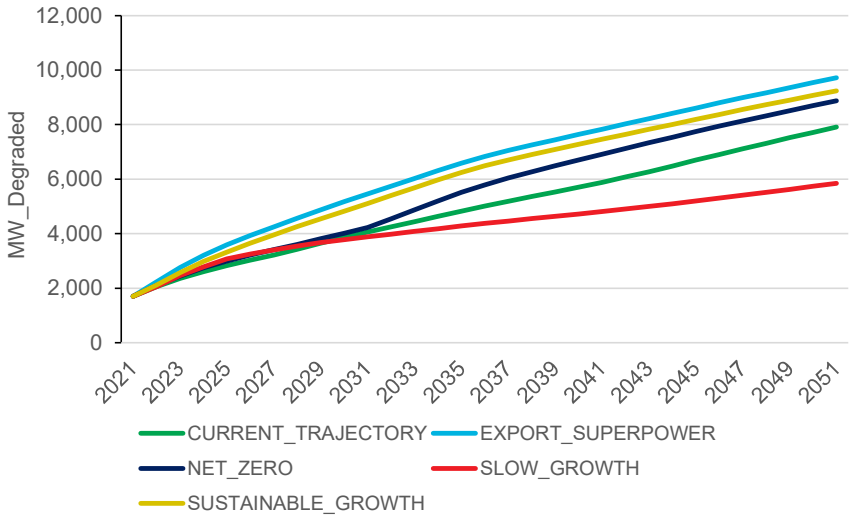
FINAL RESULTS – APRIL 2021

- **For the SWIS the cumulative number of solar systems under Current Trajectory grows from the current level of 348,000 to 1,086,500 by 2051. The high point under Export Superpower is 1.3m and low under Slow Growth is 868,100.**
- **The megawatts of degraded capacity in the SWIS expands from 1.6GW to reach 7.9GW by 2051 under Current Trajectory. It peaks at 9.7GW under Export Superpower and is down to 5.9GW in Slow Growth.**
- **By 2051, under Current Trajectory 62% of residential connections would have a solar system, and 67% under Export Superpower.**

SWIS cumulative number of solar systems by scenario



SWIS cumulative degraded megawatts of sub-30MW solar by scenario

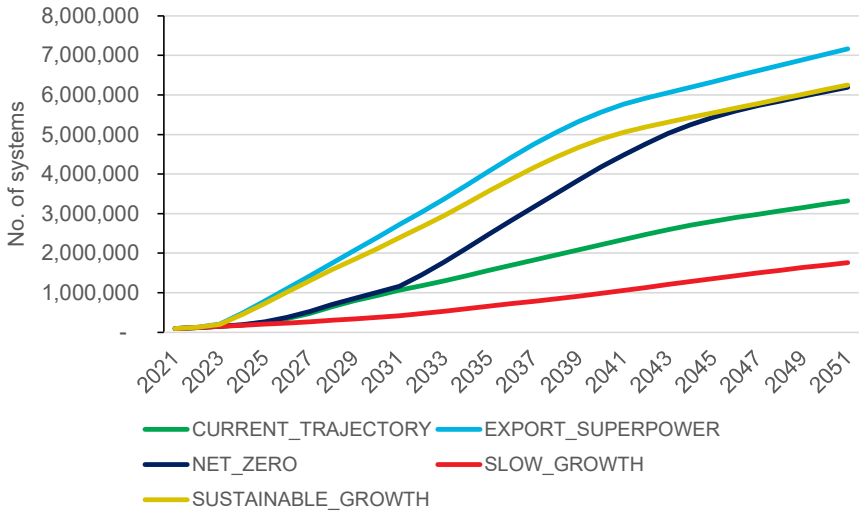


NEM cumulative results – Batteries

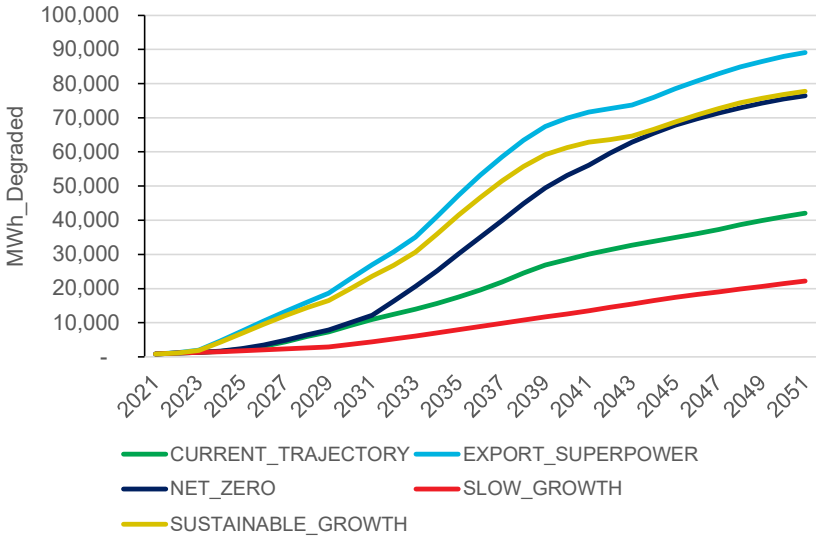
FINAL RESULTS – APRIL 2021

- **For the NEM the cumulative number of battery systems under Current Trajectory grows from the current level of close to 85,000 to reach over 3.3m by 2051. The high point under Export Superpower is 7.2m and low point under Slow Growth is 1.8m.**
- **The NEM megawatt-hours of degraded battery capacity expands from 790MWh to reach 42,000MWh by 2051 under Current Trajectory. It peaks at 89,000MWh under Export Superpower and is down to 22,200MWh in Slow Growth.**
- **The NEM megawatts of battery capacity reach 20,670MW in 2051 under Current Trajectory; 44,174MW under Export Superpower; and just under 11,000MW in Slow Change.**
- **Battery results have been revised up due mainly to a fix in a market saturation trigger in the model**

NEM cumulative number of behind-the-meter battery installations by scenario



NEM cumulative battery megawatt-hours by scenario

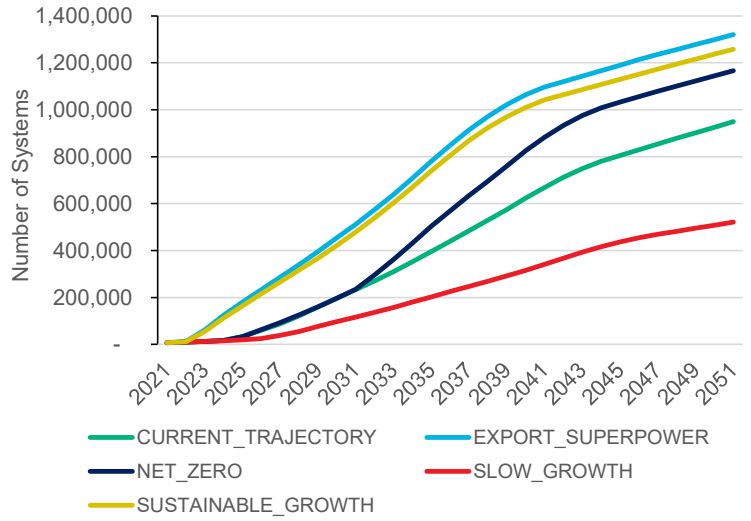


SWIS cumulative results - Batteries

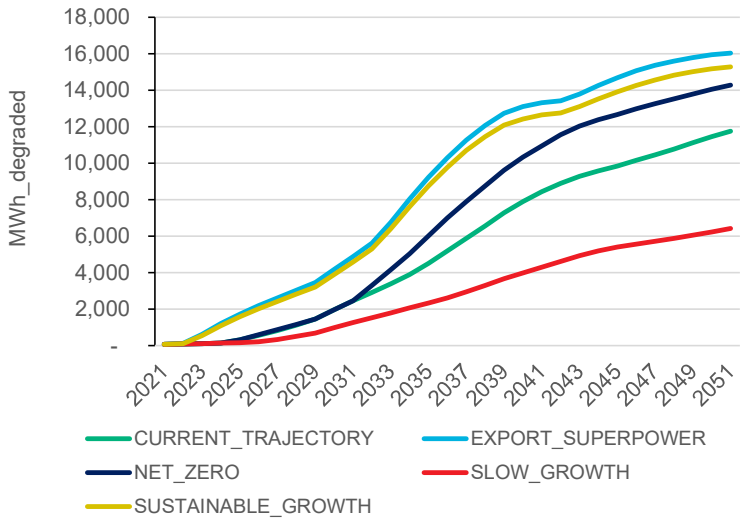
FINAL RESULTS – APRIL 2021

- **For the SWIS the cumulative number of battery systems under Current Trajectory grows from the current level of close to 6,000 to reach slightly over 949,000 by 2051. The high point under Export Superpower is 1,320,000 and low point under Slow Growth is a bit below 522,000.**
- **The SWIS megawatt-hours of degraded battery capacity expands from 56MWh to reach almost 11,800MWh by 2051 under Current Trajectory. It peaks at 16,000MWh under Export Superpower and is down to 6,418MWh in Slow Growth.**
- **The SWIS megawatts of battery capacity reach almost 5,800MW in 2051 under Current Trajectory; 8,000MW under Export Superpower; and just under 3,200MW in Slow Change.**

SWIS cumulative number of behind-the-meter battery systems by scenario



SWIS cumulative battery megawatt-hours by scenario



Final results compared to draft results

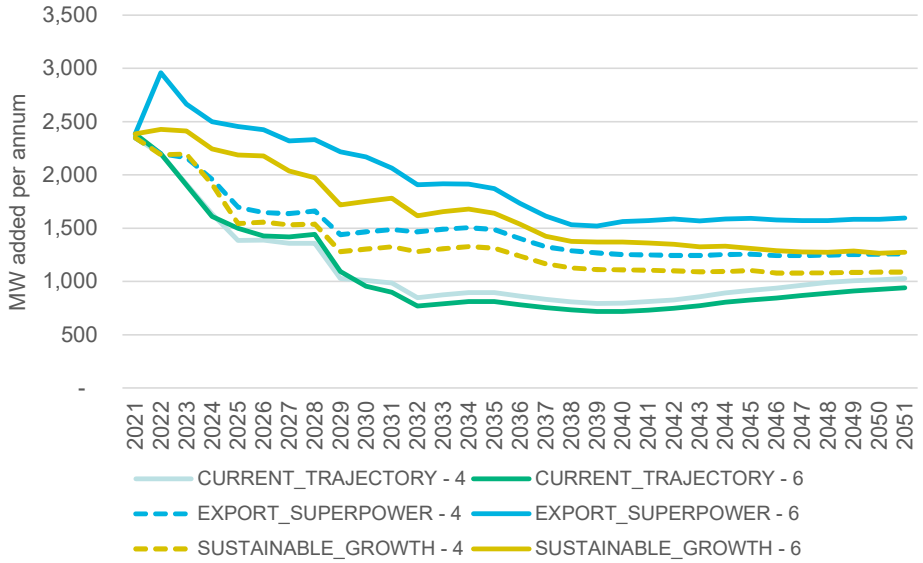
- **As a result of feedback on draft results we have adjusted upwards capacity installed under Export Superpower and Sustainable Growth to reflect the potential for system sales to remain elevated, particularly in the shorter term.**

Draft versus Final forecast

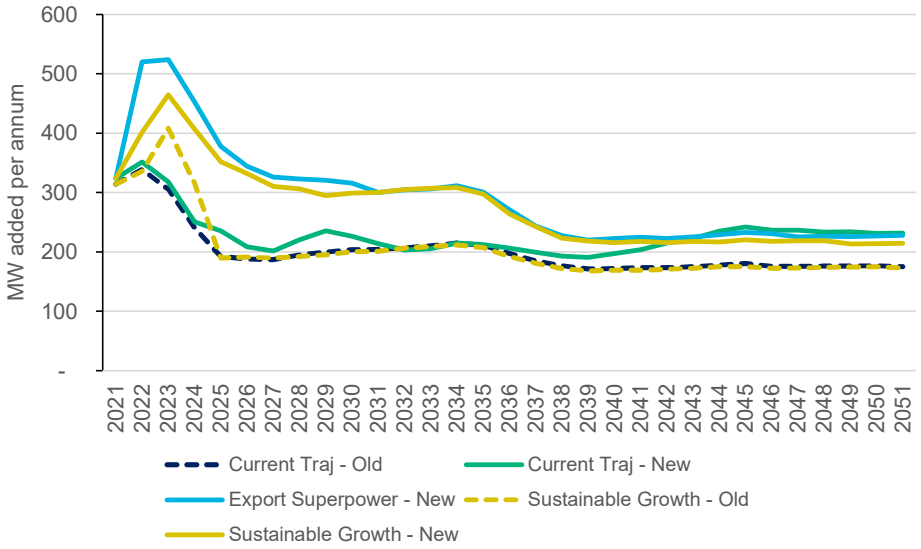
Annual solar MW additions to stock

NEM

Version 4 is the draft forecast and 6 is the final forecast



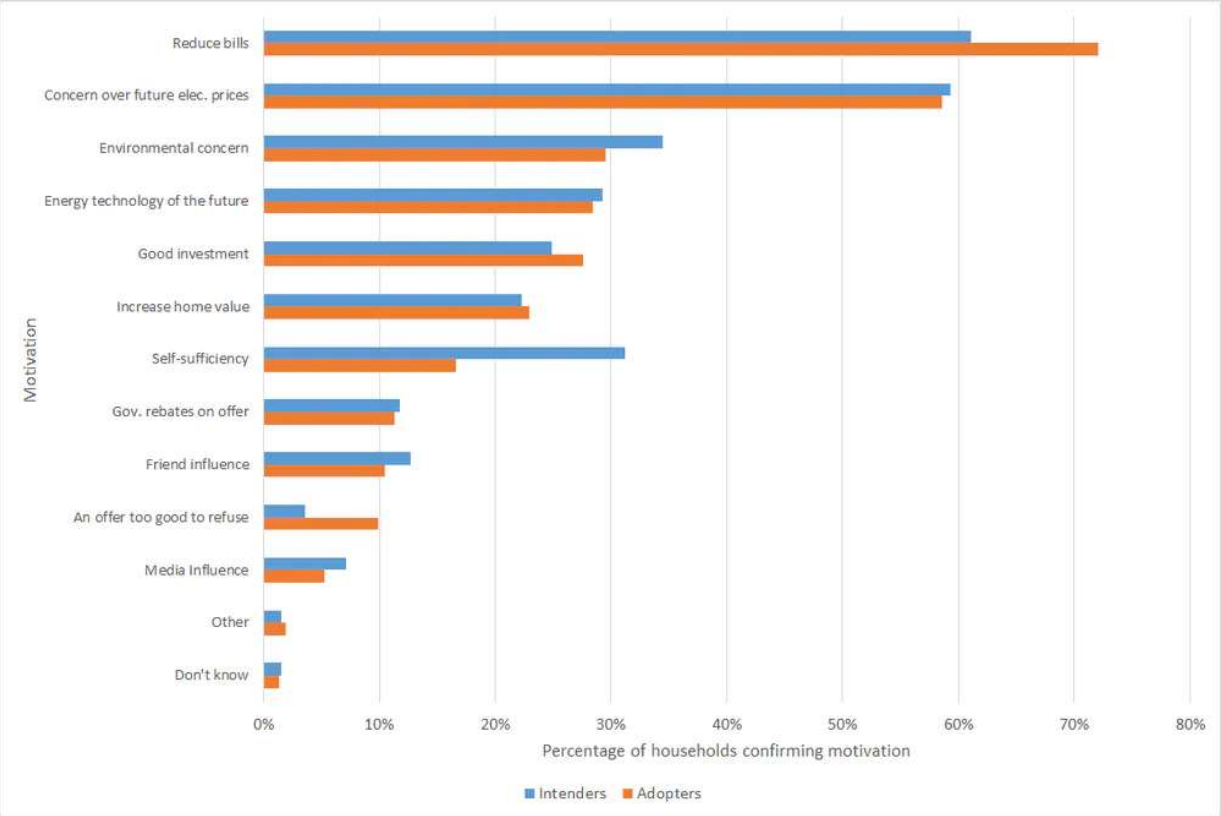
WA SWIS



Why do we expect annual solar installs to decline – economics

- **While we have increased our estimates of solar and battery capacity installations relative to draft results, we continue to project that rapid growth in past few years will reverse and annual installs will fall.**
- **This is because there are several factors that are leading to a deterioration in the financial attractiveness of solar systems.**
- **Surveys and feedback from industry participants indicate that the most important driver for adoption of solar systems (and intent to purchase batteries) is to reduce electricity bills in order to save money.**

Motivational factors for purchasing a solar system

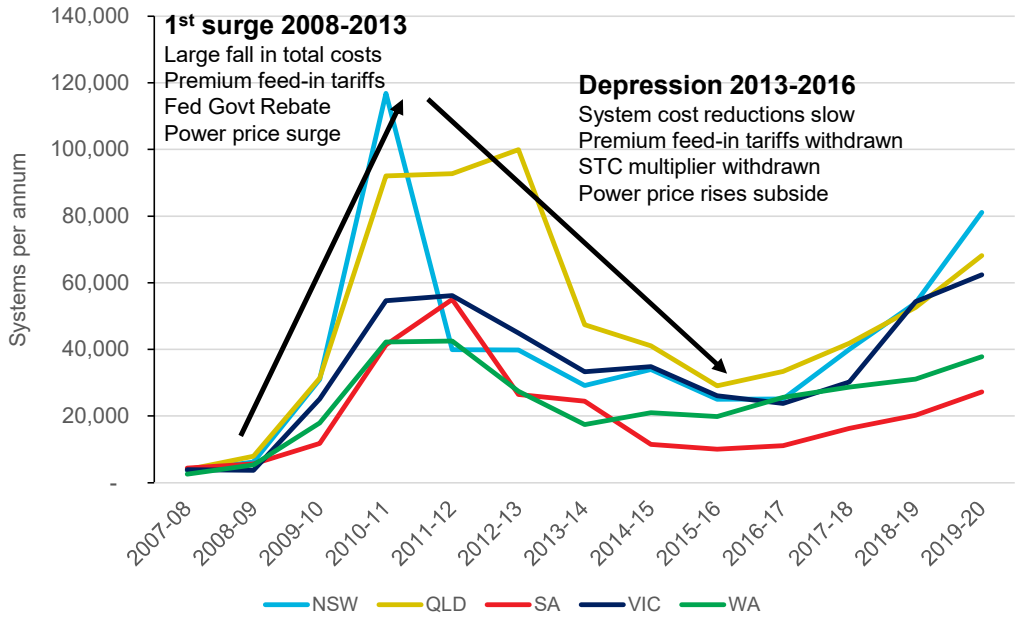


Source: Bondio, Shahnazari and McHugh (2018) The technology of the middle class: Understanding the fulfilment of adoption intentions in Queensland's rapid uptake residential solar photovoltaics market

Why do we expect annual solar installs to decline – economics

- **The story of the Australian residential solar market has not been one of continual growth but rather two booms and a depression – all driven by financial attractiveness of solar.**
- **The first surge unfolded between 2008 and 2012. This was driven by:**
  - A dramatic fall in underlying system costs per kilowatt from $10/watt fully installed to $3/Watt.
  - A rapid increase in retail electricity prices.
  - The Federal Government providing significant rebates (direct rebate followed by solar REC/STC multiplier).
  - States implementing very high premium feed-in tariffs of 45c-60c/kWh.
- **The drop in system sales can be clearly tied to the cancellation in premium feed-in tariffs in each state as well as wind back of the solar STC multiplier rebate. While system costs continued to decline they weren't large enough to outpace withdrawal of government support.**
- **At the same time the rapid rise in retail electricity prices began to reverse slightly after 2013.**

Number of residential solar systems installed per year by state

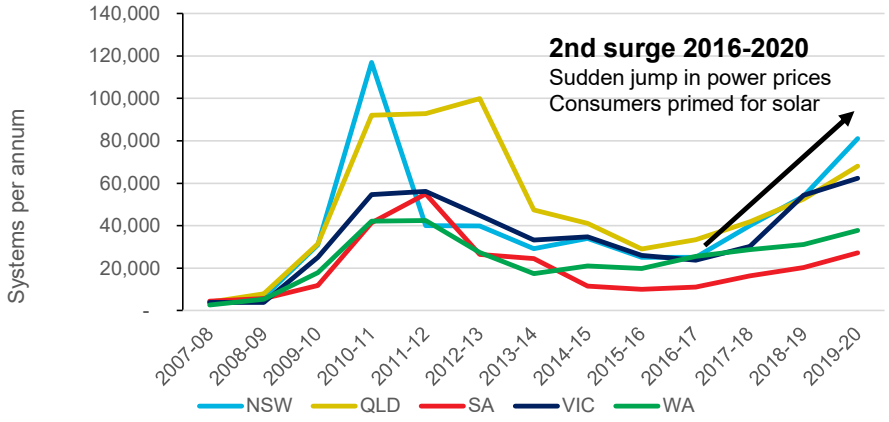


Source: Green Energy Markets

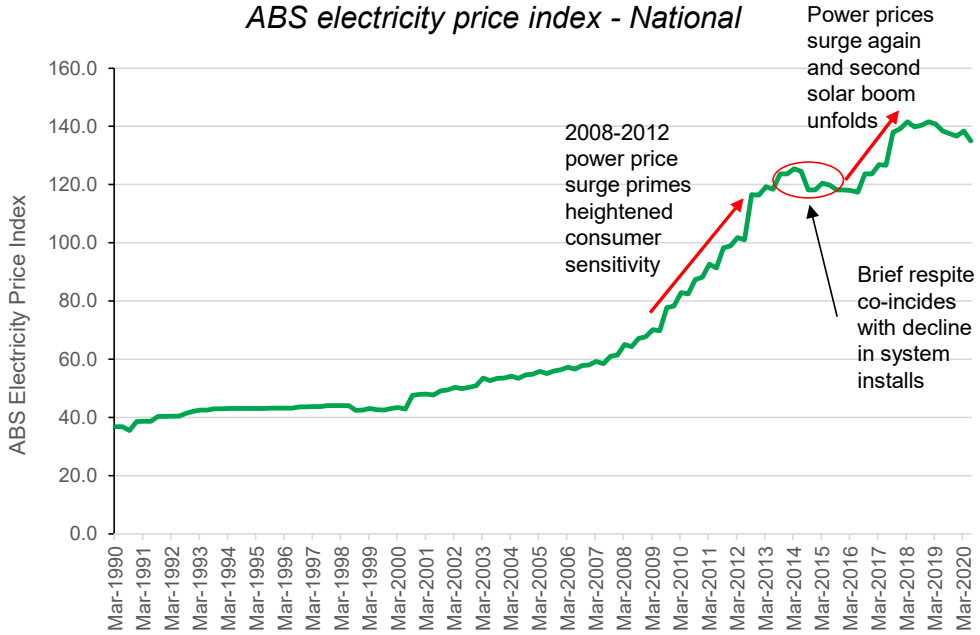
Why do we expect annual solar installs to decline – economics

- **The second solar surge began in the third quarter of 2016 and was driven by:**
  - A sudden jump in electricity prices but also the anticipation of this rise driven by blanket media coverage of electricity costs and reliability flowing from Hazelwood shut-down announcement and intense political focus on the topic.
  - While the improvement in economics was less dramatic than 1st surge, both consumers and the solar industry had been primed by experience from the 2008-2012 surge.
  - Consumers had heightened sensitivity to power price rises ("power prices just keep rising").
  - Solar industry knew how to take advantage of consumer concern and systems now very affordable.

Number of residential solar systems installed per year by state



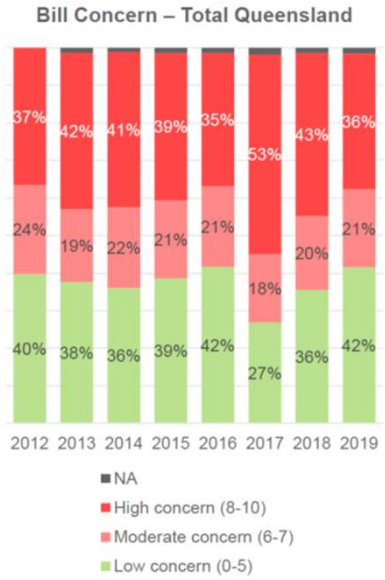
ABS electricity price index - National



Why do we expect annual solar installs to decline – economics

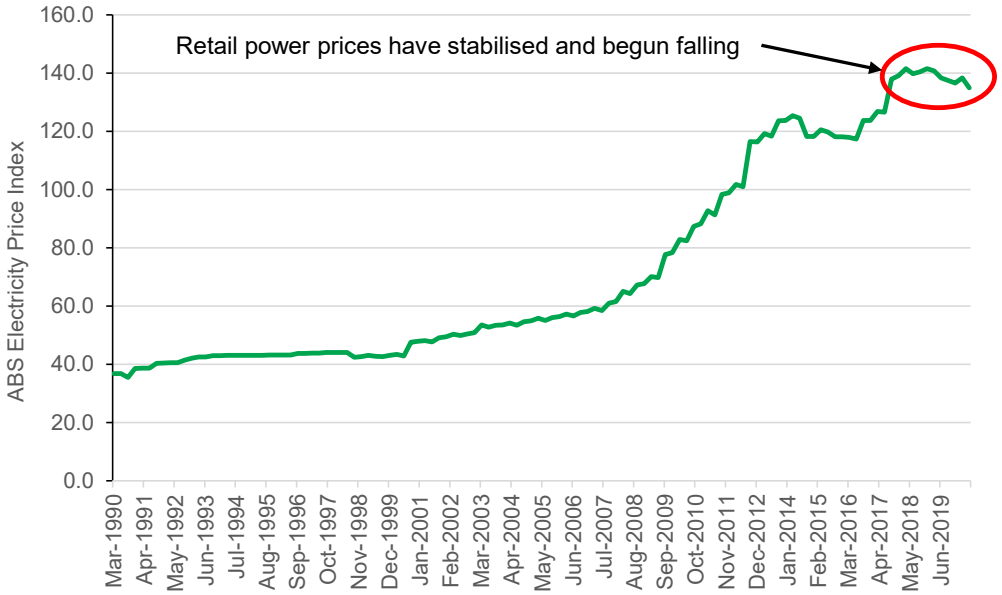
FINAL RESULTS – APRIL 2021

- **The end of the second boom**
  - Power prices are starting to fall although consumers will tend to respond with a lag to good news, given past experience.
  - COVID-induced boom in home-improvement expenditure extending beyond just solar clouds picture – is 2020 a sign of new normal or a short-term anomaly?
  - Concern around energy bills beginning to subside after 2017 peak based on QLD survey information, and front page media coverage of spiking power costs are no longer.



Source: Queensland Household Energy Survey 2019

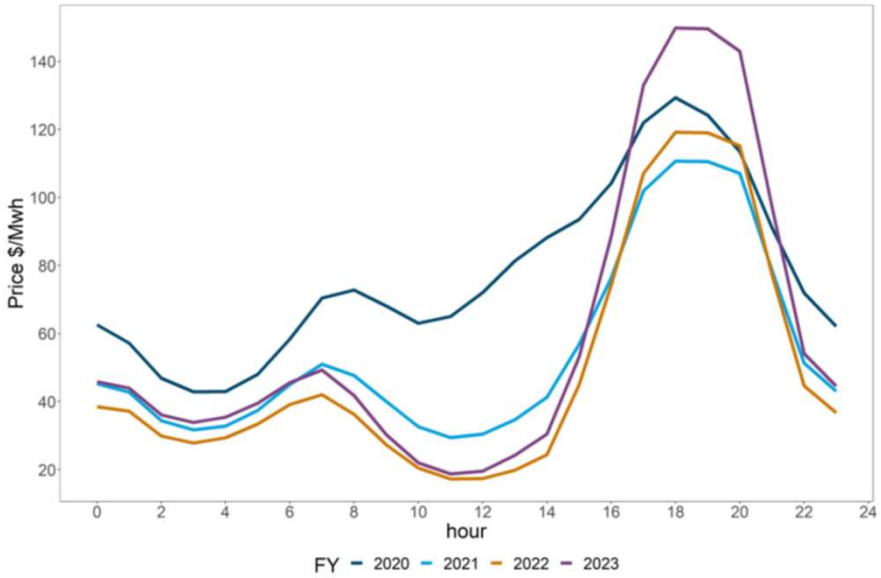
ABS electricity price index - National



Why do we expect annual solar installs to decline – economics

- **While the fall in overall residential power prices is slight, the fall in the value of exported solar power is plummeting across all states.**
- **Approximately 70% or more residential solar system output is exported based on current system size norms (6.6kW+).**
- **On top of this the ability to lower grid-import costs via substitution with solar is being undermined by move to time-of-use tariffs that concentrate supply costs into evening period.**

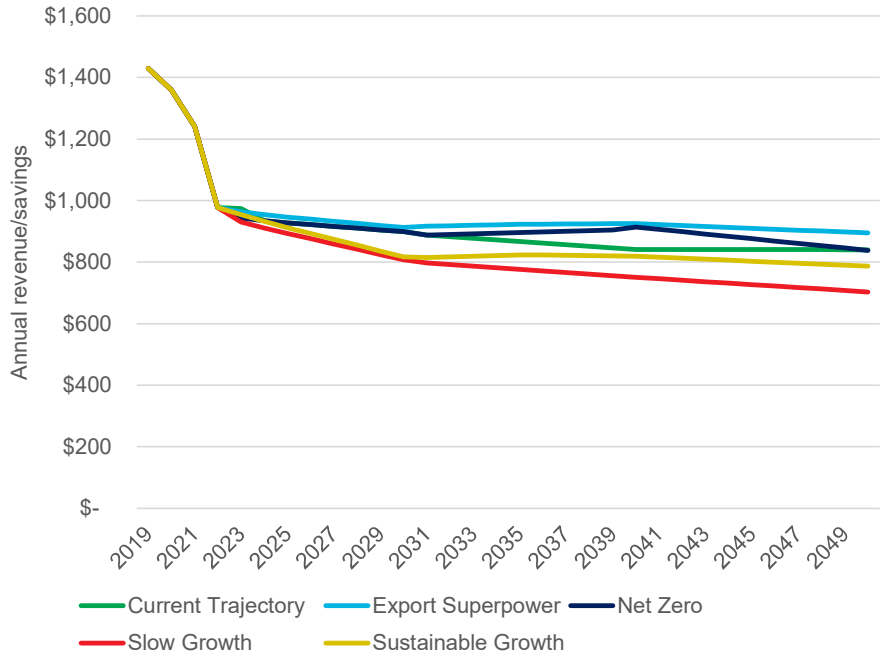
AEMC projection of NSW wholesale prices by hour of day 2020 to 2023



Why do we expect annual solar installs to decline – economics

- **Given the large fall in daytime wholesale power prices and therefore feed-in tariffs that comes with solar dominating daytime supply, as well as the switch to time-of-use tariffs, we envisage large falls in the revenue/bill savings delivered by a residential solar system across all scenarios and for all states.**

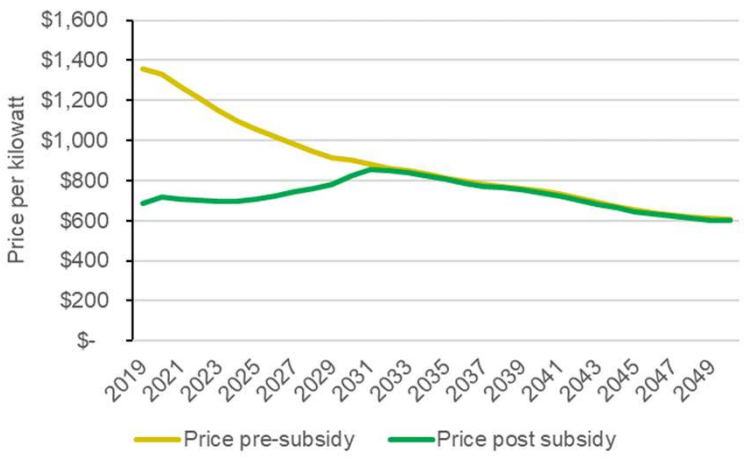
Projection of annual revenue/savings provided by 6.6kW residential system - NSW



Why do we expect annual solar installs to decline – economics

- **While we expect the pre-subsidy price of a solar system to continue to decline substantially, the loss of financial support from the fall away in the STC deeming rate manages to exceed the cost reductions over the next decade under Current Trajectory.**
- **Under Export Superpower the loss of revenue is partially offset by steeper system cost reductions and government support that, while it declines relative to current levels, remains significant.**

Current Trajectory- Purchase price per kilowatt for NSW residential solar system pre and post government support



Export Superpower - Purchase price per kilowatt for NSW residential solar system pre and post government support

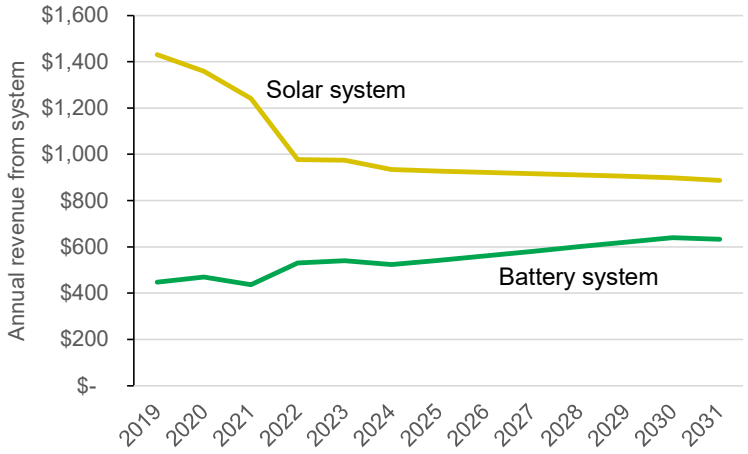
Why do we expect annual solar installs to decline – economics

- **Other constraints affecting the longer-term uptake:**
  - Curtailment to manage system-wide system stability;
  - Distribution network controls to manage local voltage;
  - Saturation of the residential market as availability of suitable roofspace/owner-occupied dwellings declines
- **There is a considerable amount of uncertainty surrounding when these constraints might bind:**
  - Greater deployment of energy storage (not just at DER level but also utility-scale) can help mitigate constraints, as could demand-management;
  - The degree to which there is room for adjustments in voltage settings and management at modest cost;
  - Rental housing standards could bypass the landlord-tenant split incentive plus turnover of housing stock from owner-occupiers to renters passes solar passively onto rental stock.
- **We do not model these constraints explicitly given considerable uncertainties but instead moderate uptake propensity to given paybacks once region-wide solar installations approach:**
  - Upper levels of household penetration seen currently in highest solar density postcodes;
  - A level of cumulative capacity in line with average electricity demand.
  - But the fact we also project batteries will become financially compelling to couple with solar will also mitigate constraints to a degree.
- **It is important to note that consumers are already electing to purchase solar systems that face some degree of spillage/curtailment. Systems with 10kW of panels and 5kW export limited inverters are increasingly common. While such systems lose some of their potential output, it is more likely to occur under conditions where the output is of lesser financial value. But in return the consumer receives significant savings on the installation cost of the incremental additional kilowatts installed above 5kW.**

The counter story – the rise of batteries

- **Solar's loss is battery's gain. The value of a battery to a consumer rises:**
  - As the feed-in tariff falls to low levels there is a larger gain from using the solar generation to offset consumption later in the day rather than export.
  - The roll-out of time of use tariffs further increases the arbitrage between the low feed-in tariff and import rates during the evening peak period.
- **Under Current Trajectory for NSW the net-additional revenue provided by a residential battery system when coupled with a solar system increases by 40% between 2019 and 2031. Meanwhile the revenue generated by a solar system alone falls by 38%**

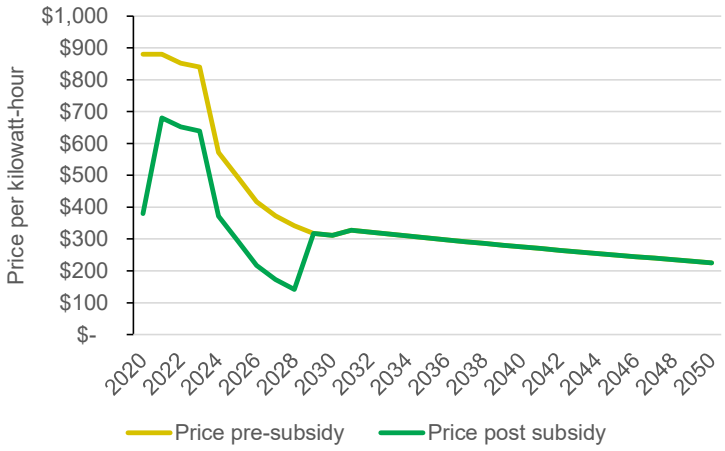
Annual revenue for a 6.6kW residential solar system without a battery and additional revenue provided by a 10kWh battery



The counter story – the rise of batteries

- **The other factor supporting the increasing uptake of batteries are large expected falls in their purchase price. In addition assumed government support makes an important impact on attractiveness.**
- **Capital cost for batteries for the initial few years are based on current market prices for a fully installed system informed by a combination of the SA Battery Rebate dataset, SolarChoice and feedback from industry participants.**
- **Prices then transition downwards towards CSIRO's GenCost estimates for a utility-scale 2 hour duration battery plus a premium that is aligned with the current cost premium for residential solar systems compared to utility-scale solar systems.**

Current Trajectory- Purchase price per kilowatt-hour for SA residential battery system (coupled with solar) pre and post government support

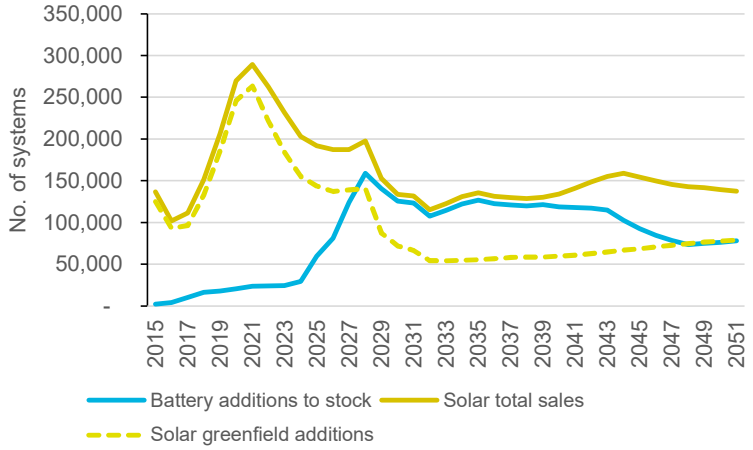


Export Superpower - Purchase price per kilowatt-hour for SA residential battery system (coupled with solar) pre and post government support

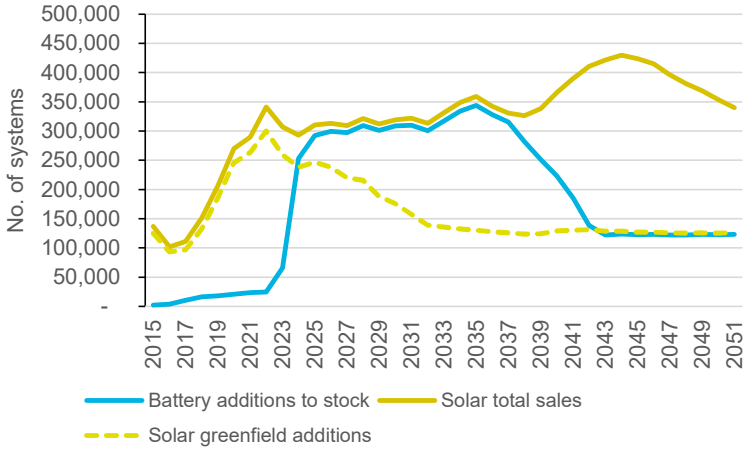
The counter story – the rise of batteries

- **Uptake of batteries is expected to remain modest for the next few years consistent with our assumptions that prices remain similar to recent market prices. However, after a competitive shake-out and large price declines battery installs rise rapidly such that by 2029 almost all solar systems sold are coupled with a battery in Current Trajectory.**
- **In Export Superpower this point occurs by 2025 due to assumed faster price reductions and greater government support for batteries.**
- **However battery additions to stock decline as we approach 2040 due to almost all existing solar systems being coupled to battery as they go through a replacement cycle. This leaves just greenfield sites for ongoing growth in the installed stock.**

Current Trajectory- Residential annual battery additions relative to solar system sales



Export Superpower - Residential annual battery additions relative to solar system sales



Questions?

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