



## Sustainable Power Market Products: RE and Conventional

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## Introduction to The Lantau Group (TLG)

The Lantau Group  
is an Asia Pacific strategy  
and economic consultancy  
focusing on energy and  
sustainability



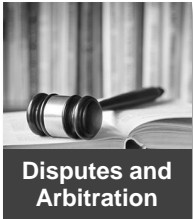
# Asia Pacific electricity and gas/LNG

## Decades of experience in commercial and regulatory matters

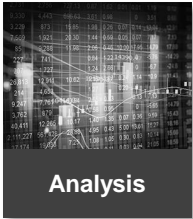
### Energy Sector Areas of Focus



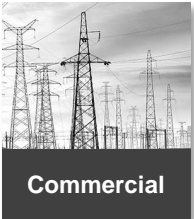
Strategy



Disputes and Arbitration



Analysis



Commercial



Regulation and Markets

#### Markets & Transactions

We focus on what can be measured and substantiated.

We provide objective, independent, well-grounded advice for decision-makers facing high stakes choices.

#### Industry Insights

We focus on what matters to energy stakeholders facing changes in markets, technologies, regulations, and policies.

This is what we do.

#### Impact

We advise on key projects throughout the Asia Pacific region and the rest of the world.

We influence the evolution of the energy sector through our work and expertise.

#### Economic Regulation

We apply economics and analysis to address challenges facing regulators, commercial stakeholders, and policy makers.

#### Client Service

Our senior team members are actively involved in the execution of mandates and assignments.

We own our company, so when we say we are dedicated to our clients we mean it.



Economic, commercial, and strategy advisory for energy sector stakeholders throughout the region

# Working with the region's leaders on energy matters (sample)



C&I End Users • Development Agencies • Financial Institutions • Government Ministries • Independent Power Producers  
• Leading Utilities • Market and System Operators • Oil & Gas Companies • Regulatory Agencies

# We draw from a diverse range of experience and expertise

## Vietnam

Extensive due diligence support for new RE and traditional power supply resources across the country  
LNG market entry studies  
Market modelling / development

## Thailand

Demand response pricing  
Grid solar evaluation  
Gas to power economics  
Market development  
Renewable energy

## Uzbekistan

CNG vehicle market evaluation

## Singapore

Market design and regulatory support  
Demand forecasting  
Commercial transactions  
Tariff benchmarking  
Corporate PPA support  
LNG and gas strategy  
Disputes / expert witness  
Capacity market

## Mainland China

Curtailment study in Gansu, Jilin and West Inner Mongolia  
Multiple studies on small-hydro power investment opportunity  
Coal-fired power generation and carbon policy in Zhejiang  
Coal-fired power investment opportunity in Chongqing  
Assessment of gas-fired CHP opportunities in Guangdong  
Strategic assessment of opportunities in multiple provinces  
Green procurement options / end user market support

## Malaysia

MESI 2.0 reforms  
PPA (Green and Other)  
Electricity/gas markets  
Tariff benchmarking  
Third party access  
Demand forecasting  
Commercial transactions  
Disputes / expert witness

## Philippines

Market design and development  
Due diligence support  
Business strategy  
Natural Gas Masterplan and LNG entry strategy  
Distribution sector structure and regulation  
Power price forecasting

## Indonesia

Gas to power (small and large scale)  
Evaluation of market entry opportunities  
Market development

## Japan

Customer Solar Entry Strategy  
End user pricing of gas and electricity

## Taiwan

Offshore wind  
Transaction support  
Corporate energy pricing  
Market development

## Australia

Capacity market design  
Contract disputes / expert witness  
Market design and policy / reviews  
Corporate green procurement  
Demand response  
Market modelling / transaction support  
Market design and regulation  
Network regulation and cost recovery  
Storage

## Korea

Renewable energy study for solar and wind  
Due diligence on CCGT and renewable power plants  
Capacity/ancillary market design and evaluation  
SMP/REC modelling and implications to IPP business  
Gas and coal IPP opportunities  
LNG/Coal competitive procurement

## Oman

Performance regulation  
Direct sales and corporate PPAs  
Market readiness and scarcity pricing  
Retail competition

## India

Wholesale market modelling  
Fuel switching  
End user pricing/invoice tracking

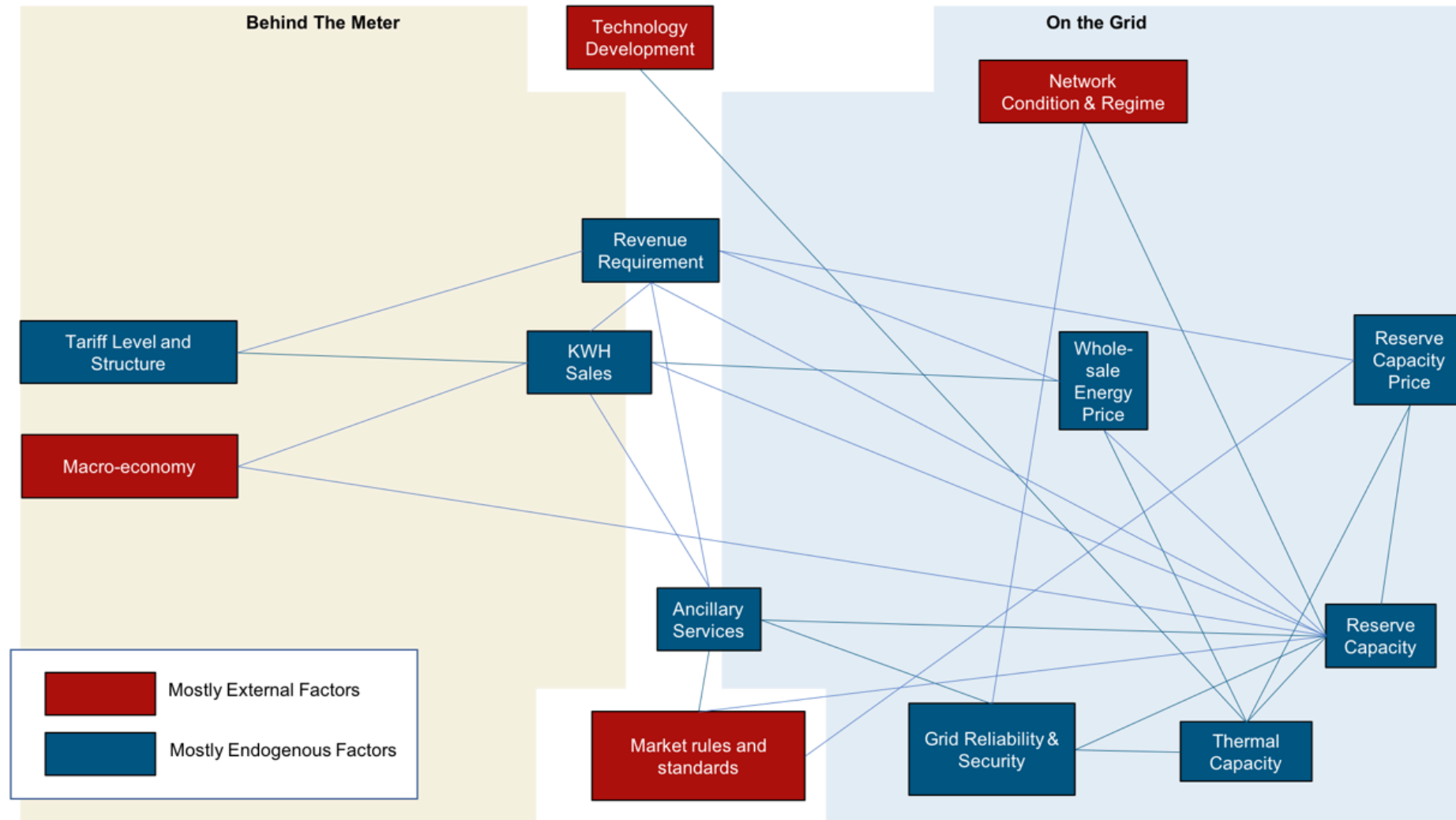
## New Zealand

Market development / regulation / pricing  
Retail sector development  
Gas pipeline access policy  
Market trading and market making  
Disputes / expert witness



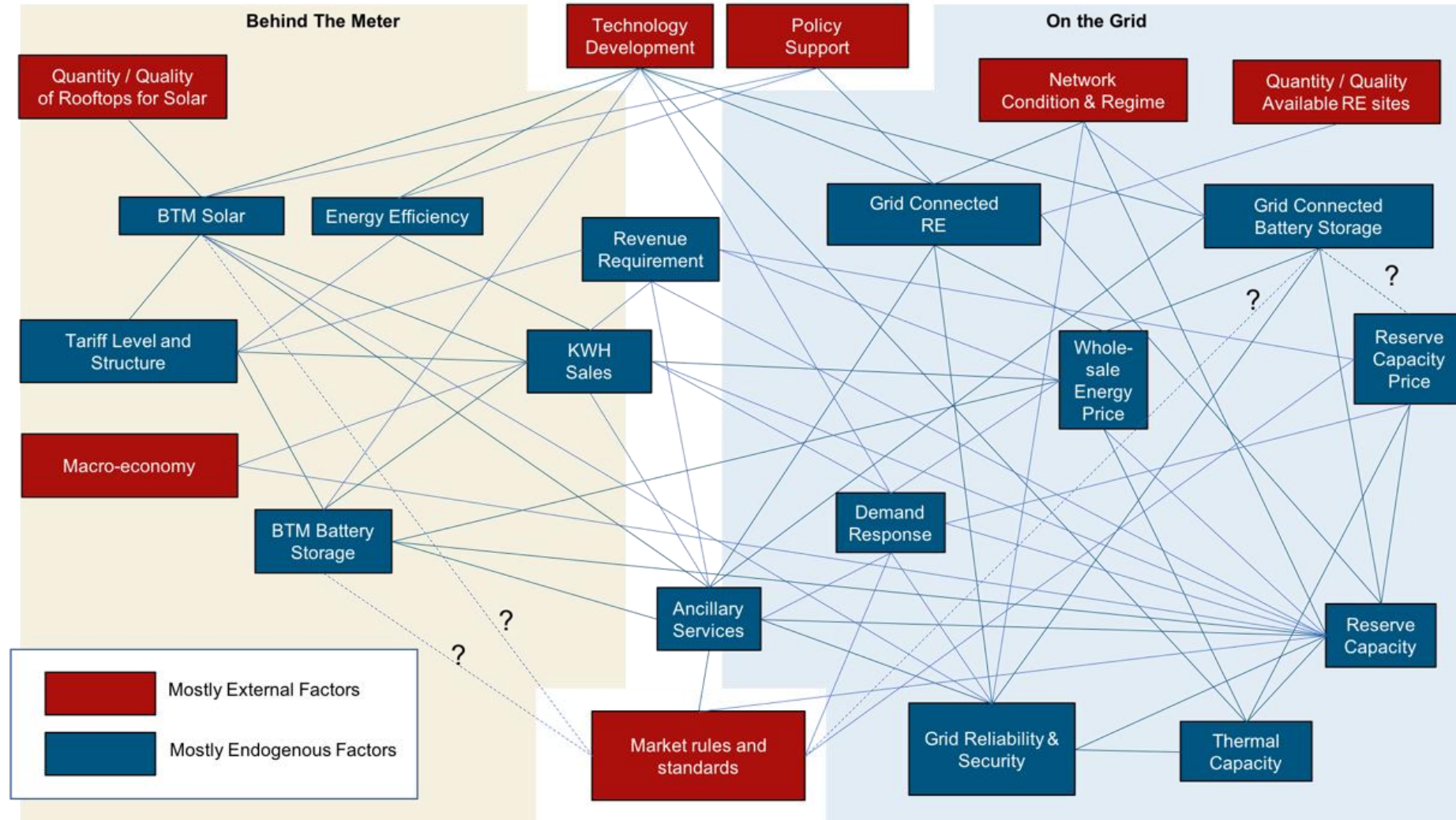


## The Traditional (Simple) Energy World

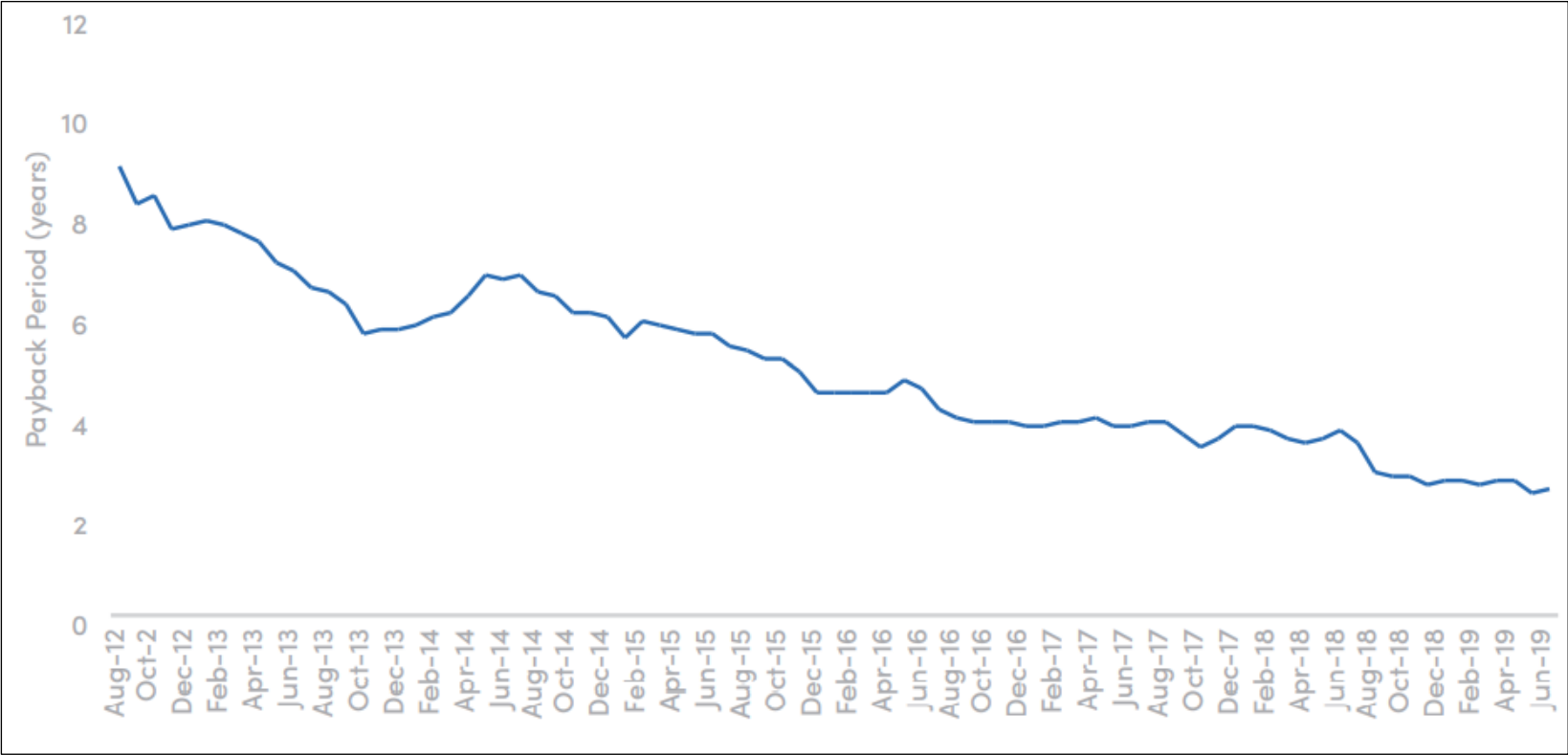


Such a simple world no longer exists. The introduction of demand response was an initial complication, as that established a stronger linkage between demand and capacity and between demand and prices. But system complexity increased dramatically mainly because of the emergence of renewable energy and battery storage technologies on both sides of the meter. The result is a much more complex set of interactions

# Current and Emerging (Complex) Energy World



Changes initially driven by subsidies, and more recently due to technological advancement and declining costs (and increasing savings for customers)

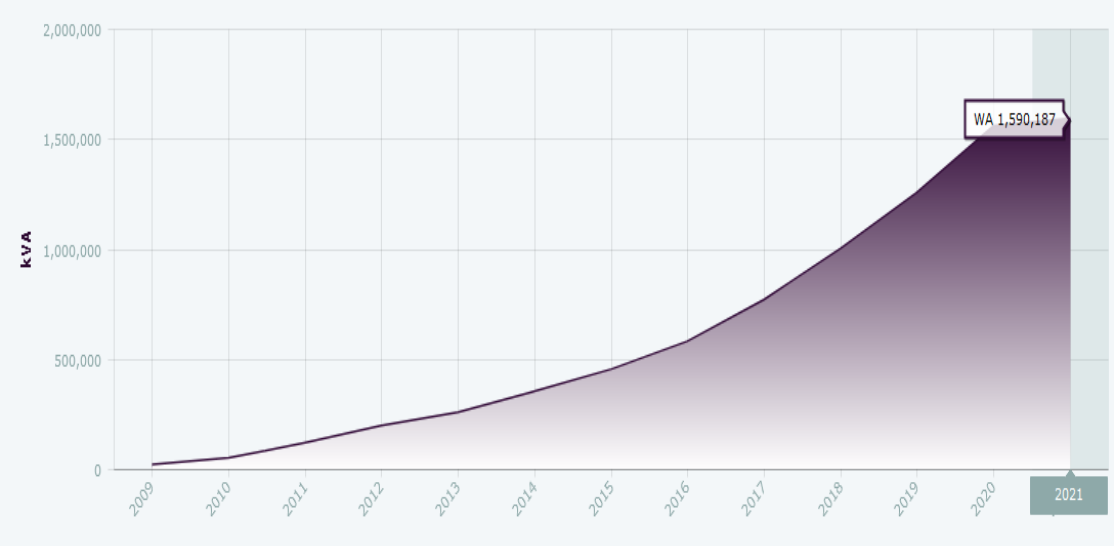


Source: Energy Policy WA – Distributed Energy Resources Roadmap

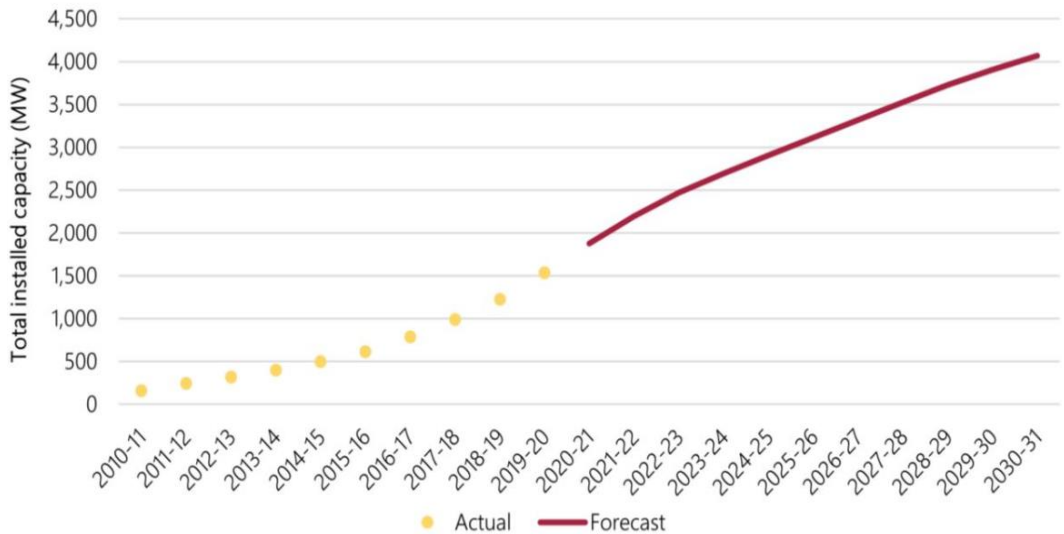


# The Economics (and to some extent, environmental considerations) has been driving up the PV uptake in Australia

...such that, in Western Australia, rooftop PV can be considered the largest single generator with approximately 1.59 GW of grid-connected installed capacity [as at Mar 2021], almost as much as the combined coal-fired capacity in the SWIS (1.65 GW).

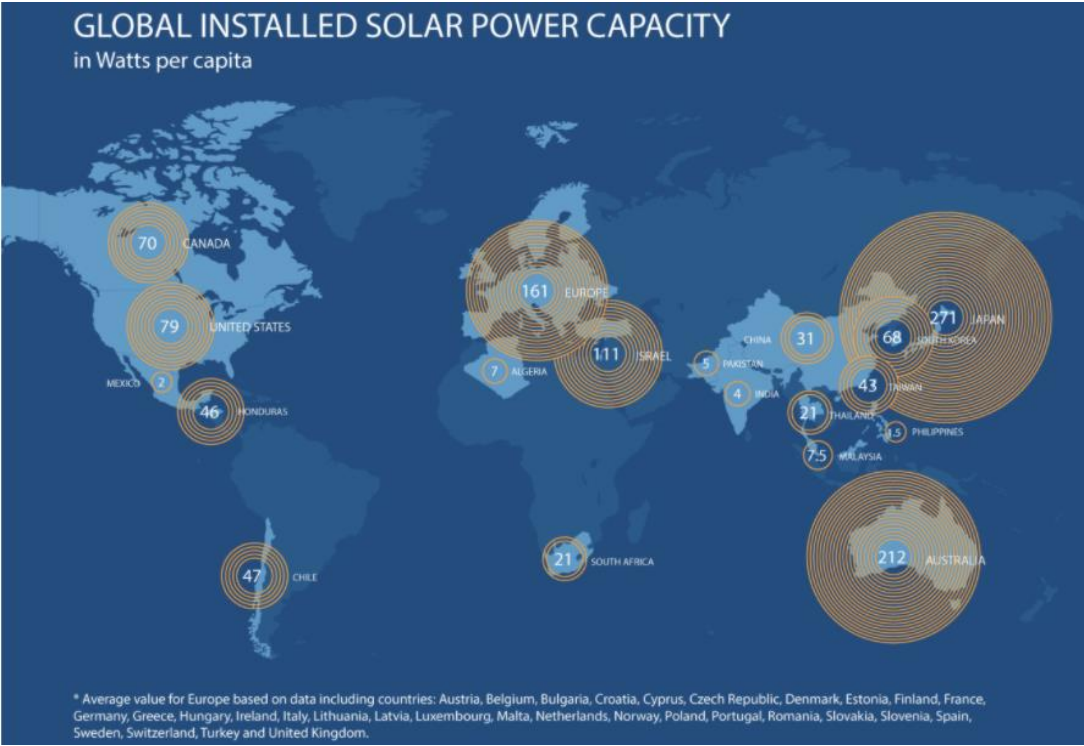


...and forecast to keep increasing to become the largest grid-connected installed capacity.

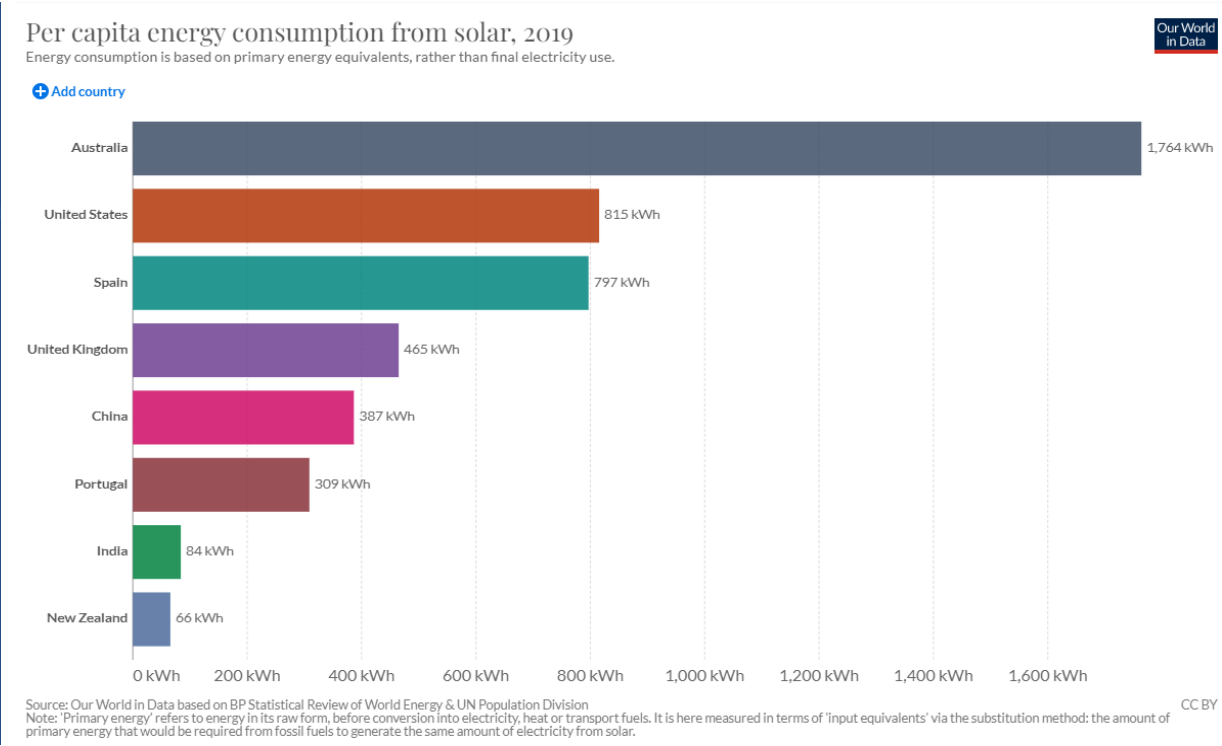


Source: CER, CSIRO and GEM.

# On per capita basis, Australia leads the world in Solar power, primarily driven by rooftop solar



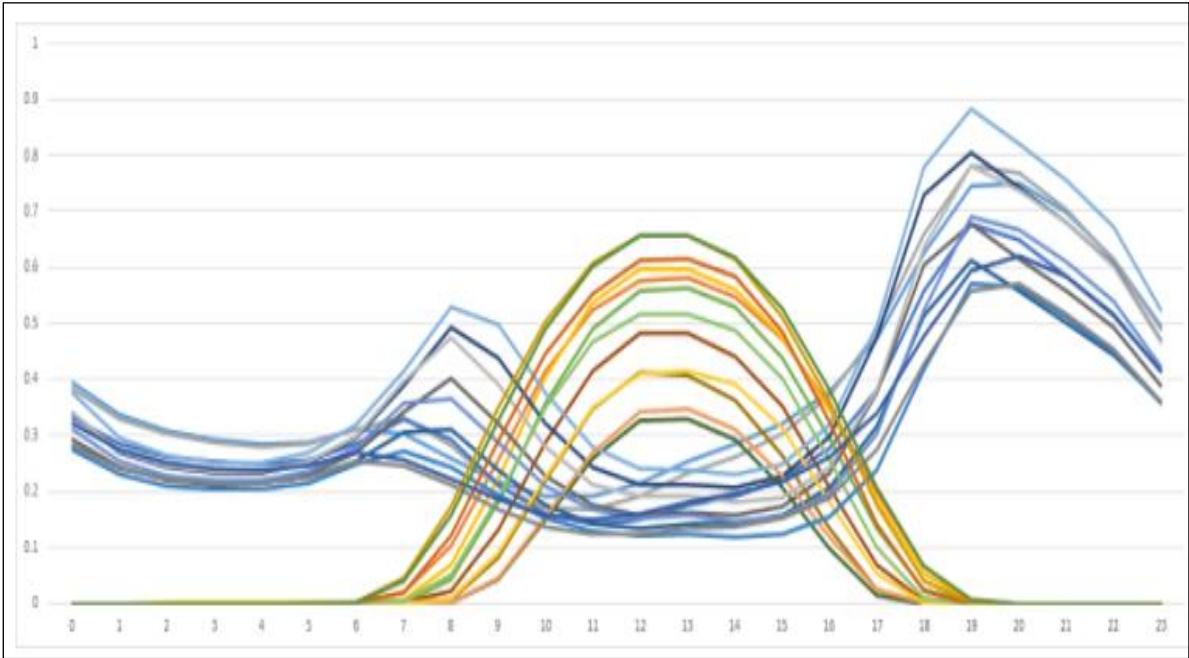
Source: International Energy Agency



Source: Visual Capitalist

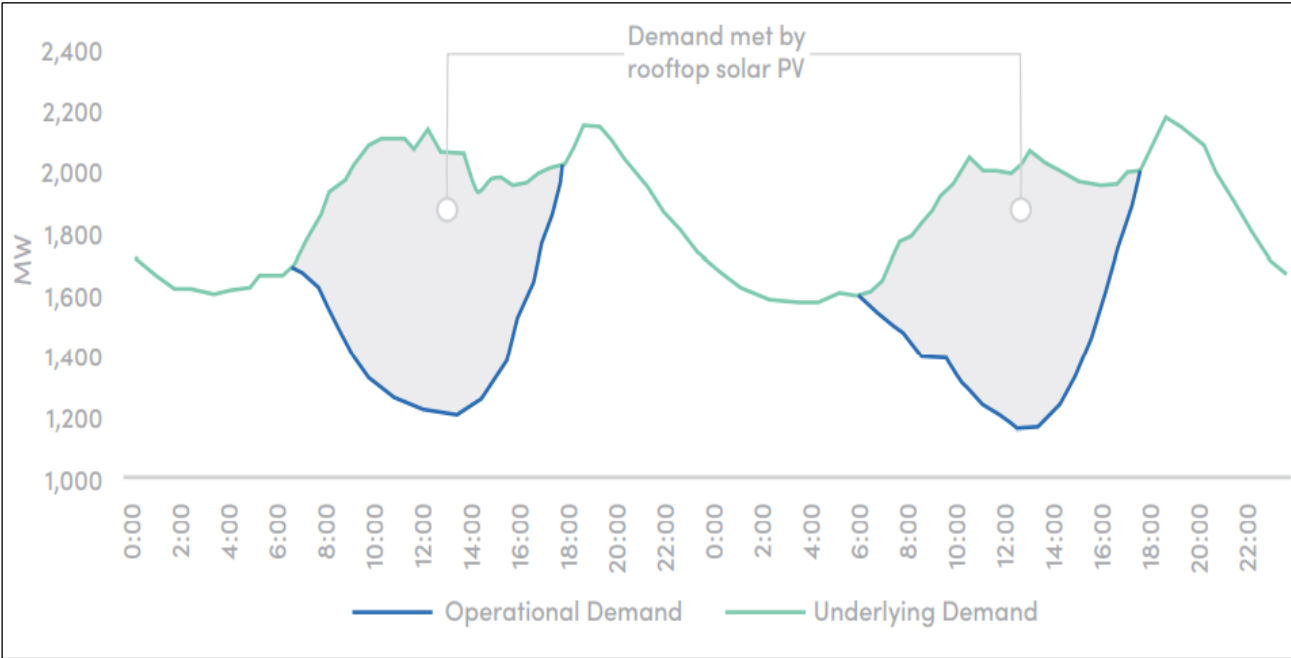
# Increased rooftop solar gives rise to the “duck curve”

The ‘duck curve’ with reference to WA’s residential customers’ average demand on any given day.



Source: Western Power

Operational vs underlying demand 12-13 October 2019

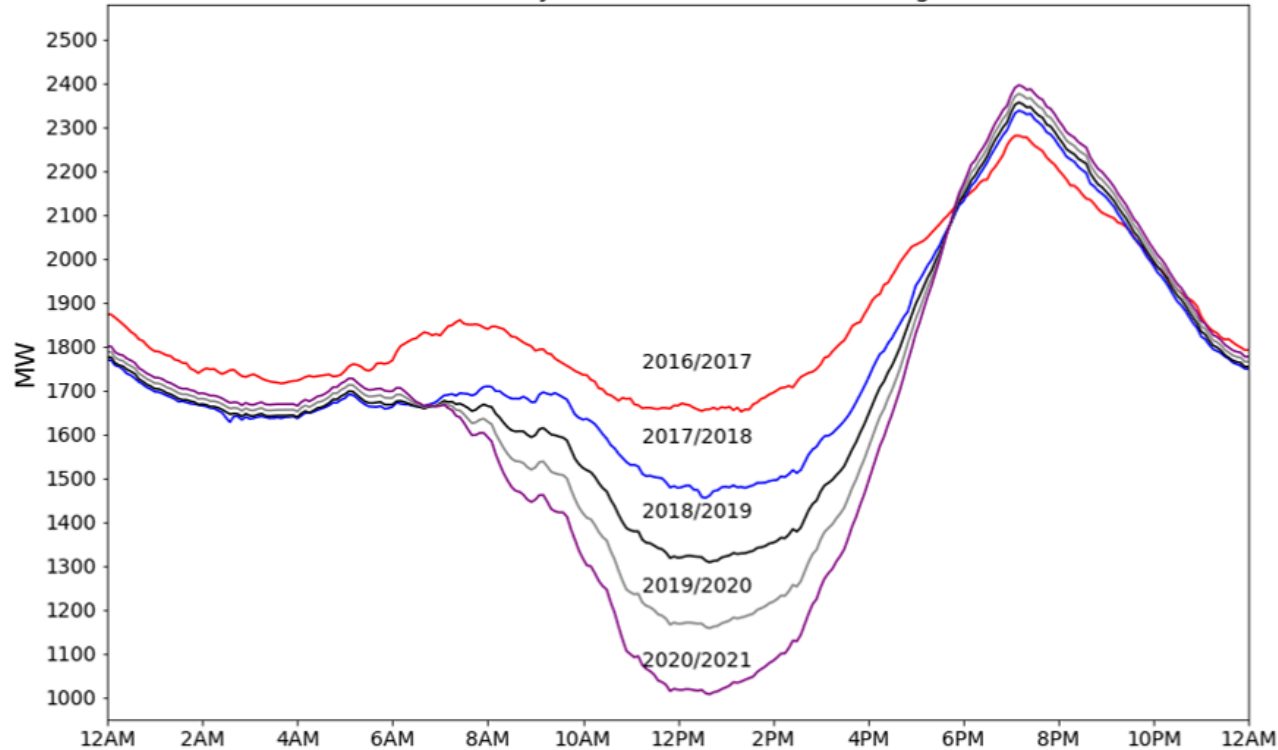


Source: Energy Policy WA – Distributed Energy Resources Roadmap



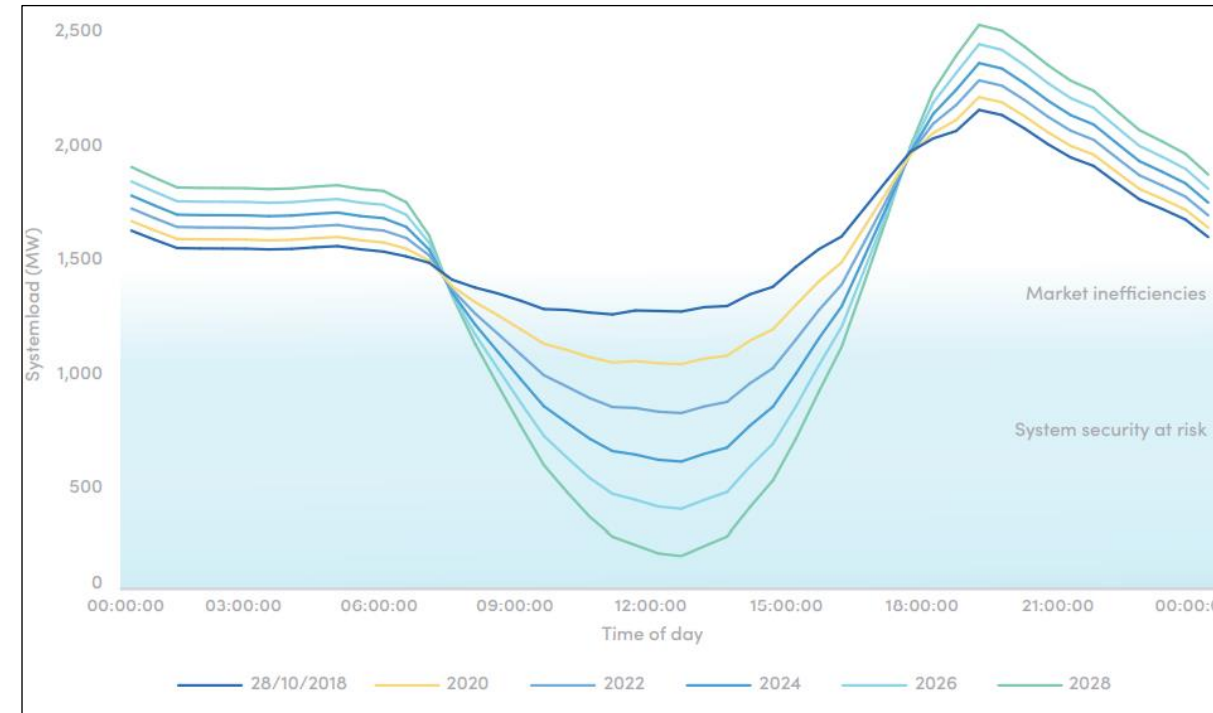
...And the duck is getting 'fatter' causing inefficiencies and system security risk

Grid Demand Minimum Day on the SWIS with Increasing Solar Penetration



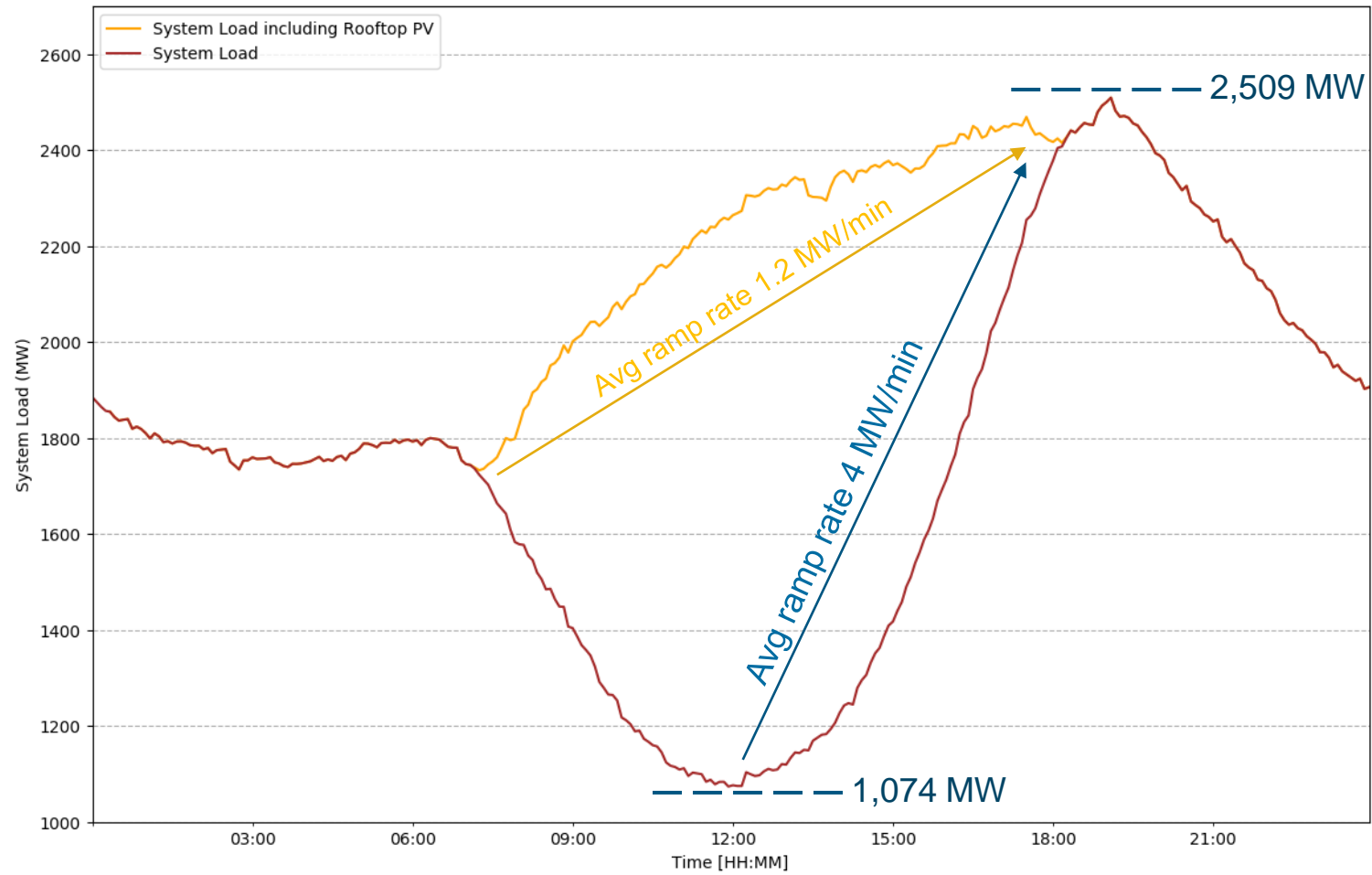
Source: AEMO

Shape of the Load Curve on the Minimum Demand Day



Source: Energy Policy WA – Distributed Energy Resources Roadmap

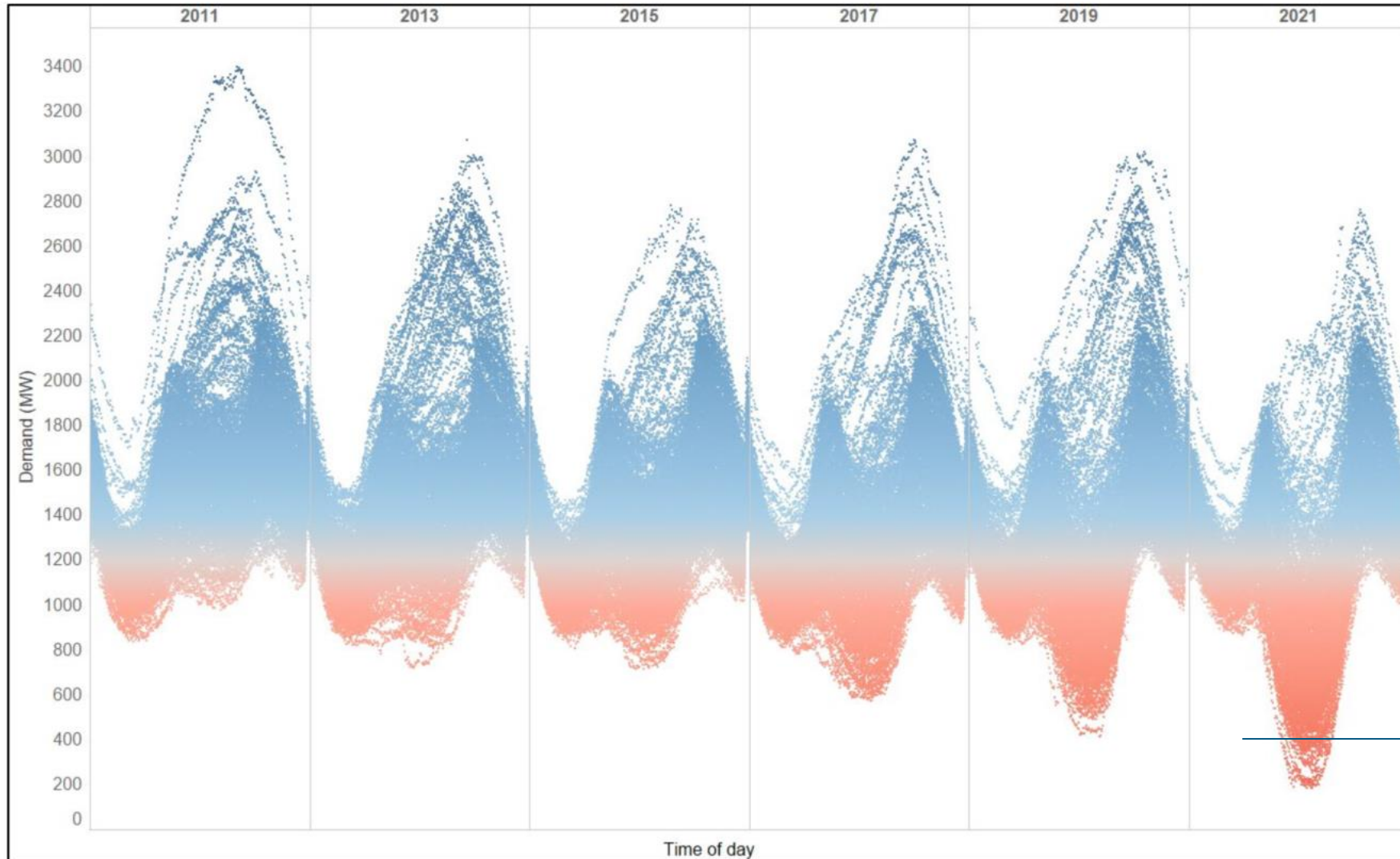
# Impacting system stability



14 March 2021

## Similar problems exist in other Australian States with high rooftop penetration

The shape of demand in South Australia has changed profoundly over the last decade



System  
Security  
at risk



# From Subsidies to Curtailment

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## Solar panels switched off by energy authorities to stabilise South Australian electricity grid

By Daniel Keane, Nick Harmsen and Sara Tomevska

Posted Wed 17 Mar 2021 at 2:34pm, updated Wed 17 Mar 2021 at 4:00pm

Energy authorities in South Australia have used their new power to remotely switch off thousands of household solar panels for the first time, making the intervention when electricity demand plunged over the weekend.

Last year, [transmission authorities were given permission to deliberately "trip" existing rooftop solar panels in rare circumstances](#) to prevent sudden dips in demand leading to widespread blackouts.

The Australian Energy Market Operator (AEMO) recommended the measure as a means of mitigating the threat to grid security posed by the rapid growth of rooftop solar, which has led to days of very low demand.

Low demand poses a major problem for operating the grid securely, particularly when South Australia's ability to export electricity to the eastern states is hampered.

AEMO said such a dip occurred on Sunday, with South Australia experiencing "near-record minimum demand levels for electricity from the grid" during a planned outage of circuits feeding the Heywood interconnector which links the state's grid with Victoria.

That planned outage meant a tighter-than-

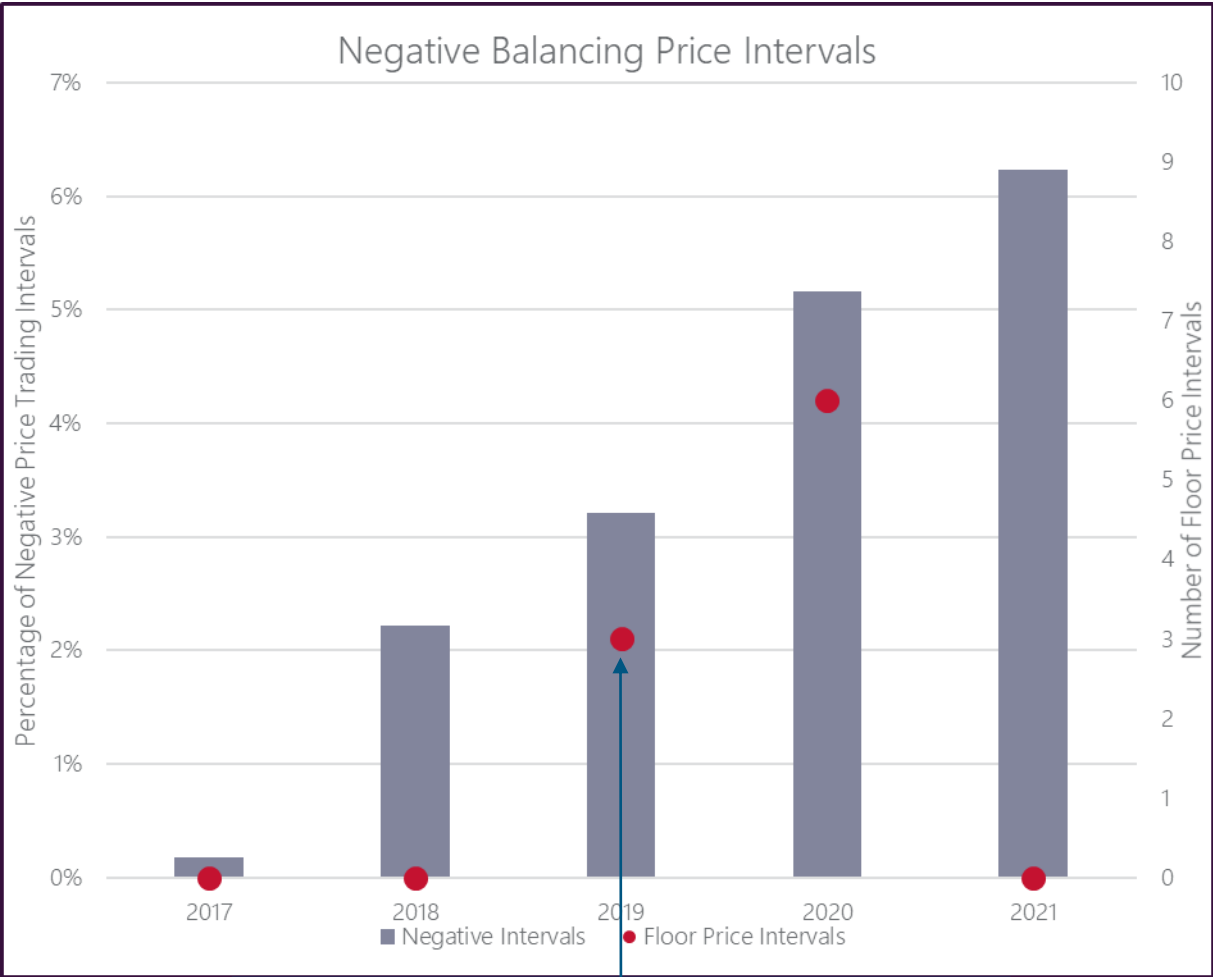
### Key points:

- SA's spot demand for electricity recently dipped to "near-record minimum levels"
- AEMO was forced to intervene, instructing ElectraNet to stabilise the grid
- That resulted in about 12,000 solar generation units being remotely switched off

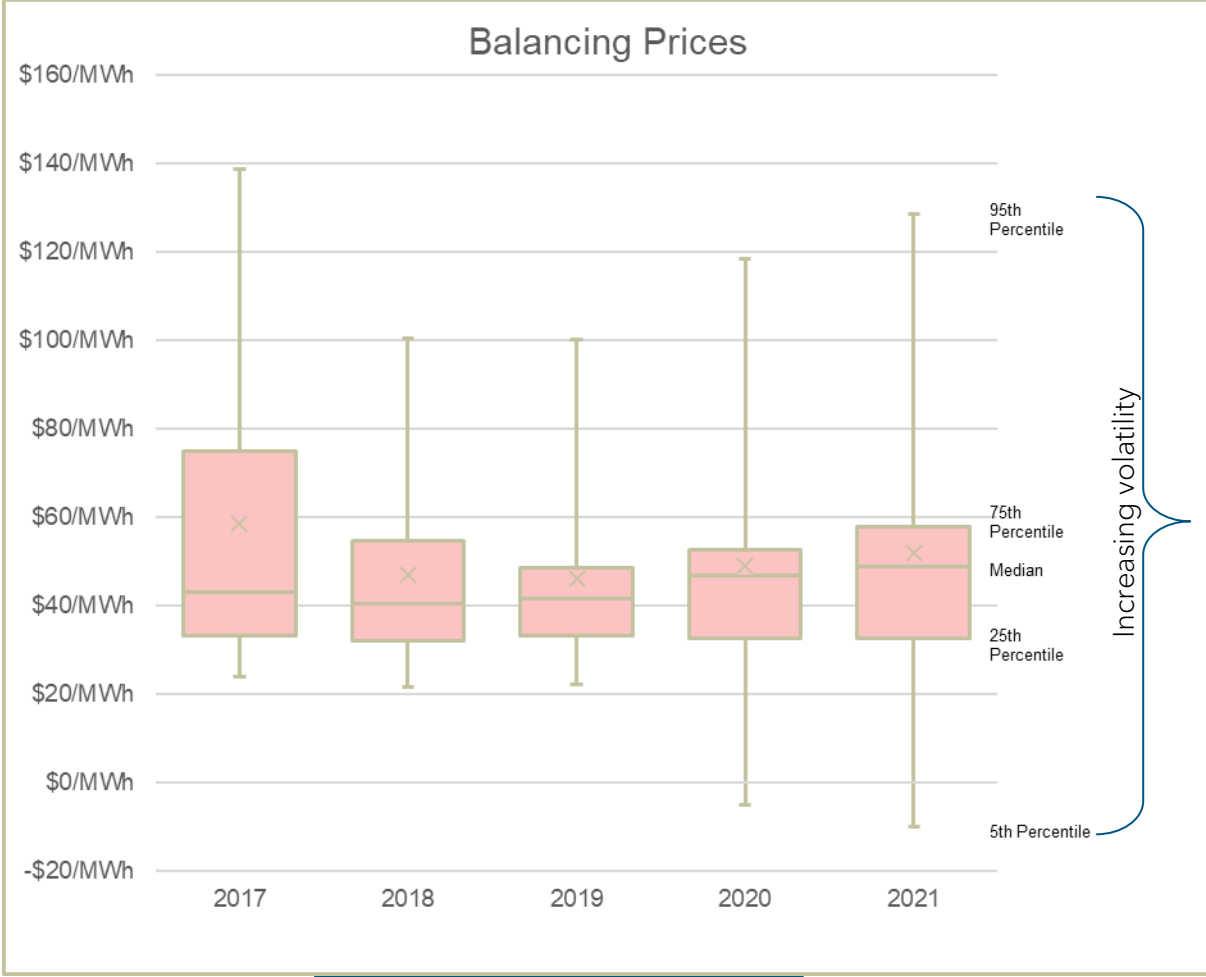
### Rush to renewables



# ...and Impacting Pricing



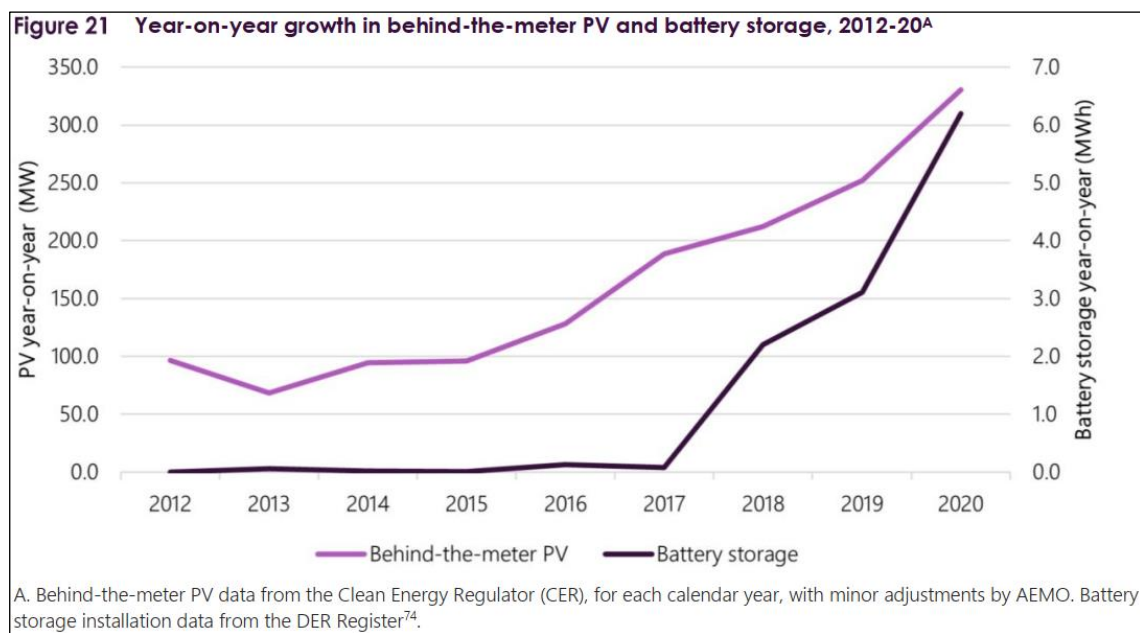
For the first time since the WEM commenced in 2006, the Balancing Price cleared at the Minimum STEM Price of  $-\$1,000/\text{MWh}$  during three Trading Intervals over 12-13 October 2019.



Balancing Prices are becoming increasingly negative, with a greater spread of pricing outcomes.

# Enter Batteries...the saviour (or is it?)

Year on year growth in behind the meter PV and battery storage, 2012 to (April) 2021

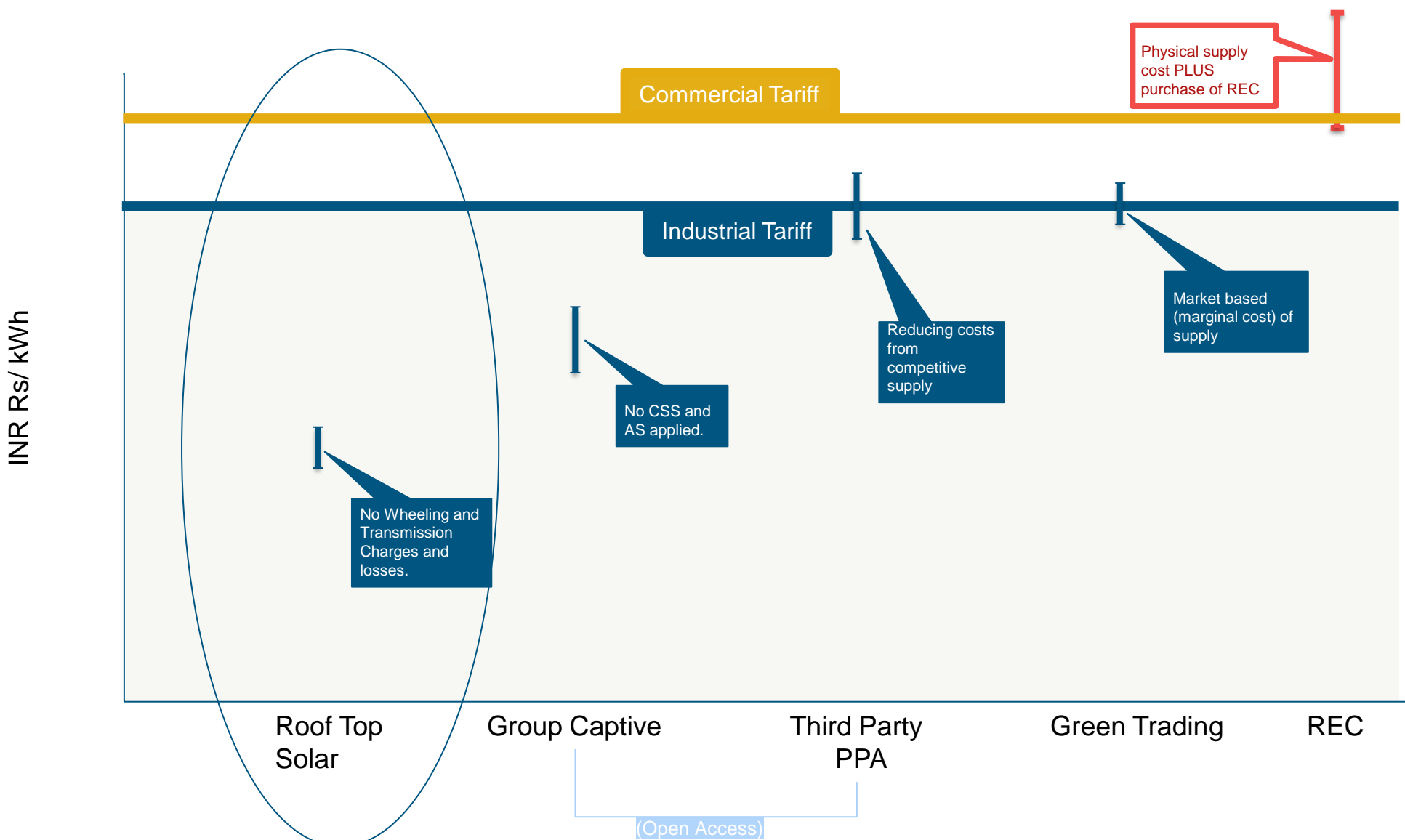


Proportion of installed battery storage, by system size, 2008 to (April) 2021





# Typical Economics of RE Supply Options



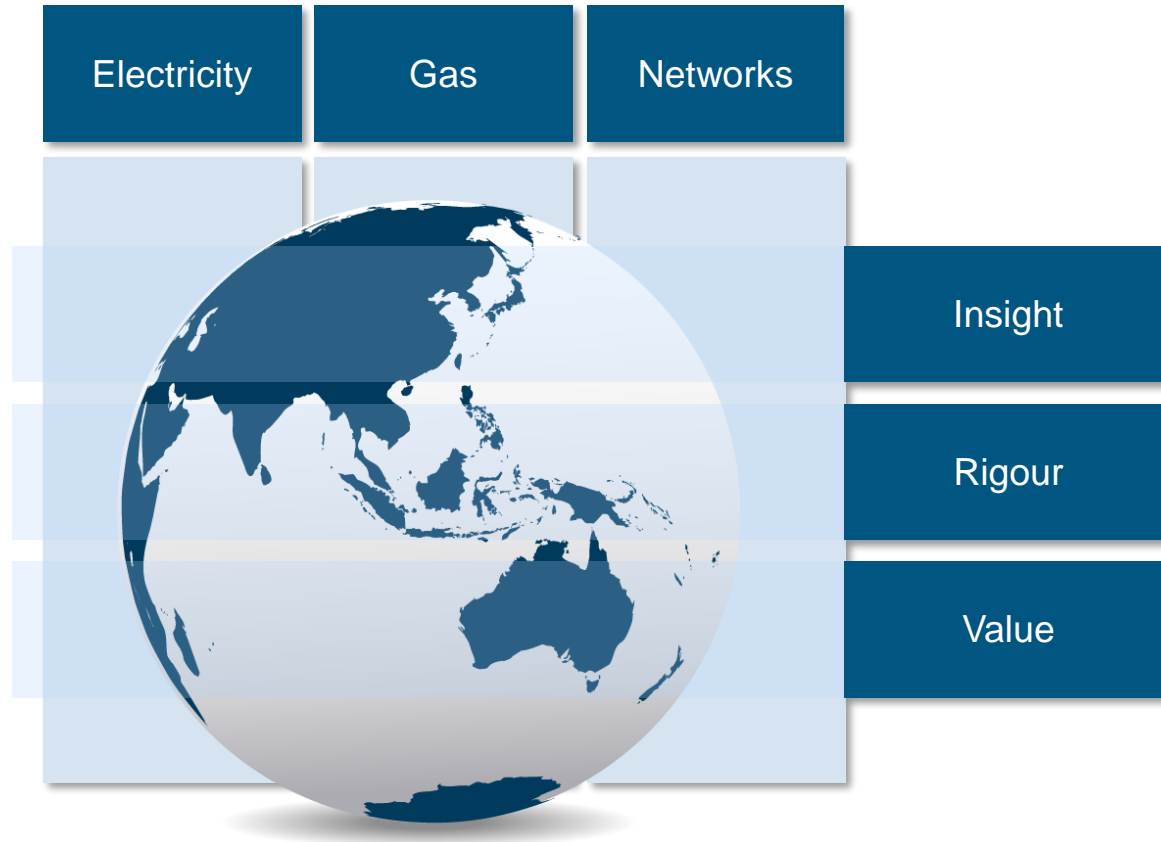
Illustrative only

## Key take away

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- BTM becomes an attractive option as tariff increase, solar and battery costs decline and technological innovations are made.
- At some point, India too will begin to face some of the system security and pricing and economic inefficiency problems that Australia is experiencing.
- Dealing with this will require a combination on technical solutions (e.g. inverter controls), tariff structure issues, and market design issues.
- Ancillary Services, 'Ancillary' no more. Need for enhanced ESSENTIAL system service (ESS)
- Power Exchange will deliver financial hedging instruments that will become more and more critical for the market with increasing price volatility. Eg:
  - ESS hedge products
  - weather insurance and weather caps
  - secondary settlement residue auctions
  - wind and solar firming products
  - load following hedges

## Contact Us



### By email

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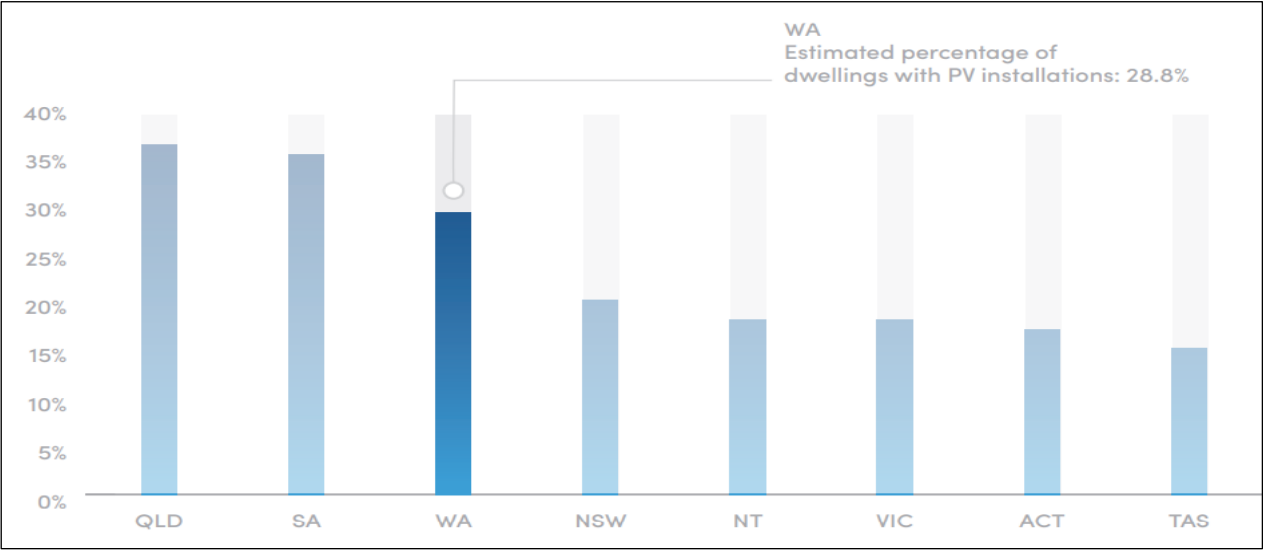
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# **ADDITIONAL SLIDES**

# Growing number of dwellings have rooftop solar installed



Its not just the number of Rooftop Solar, but its size is also increasing

