South Australia's clean energy transformation

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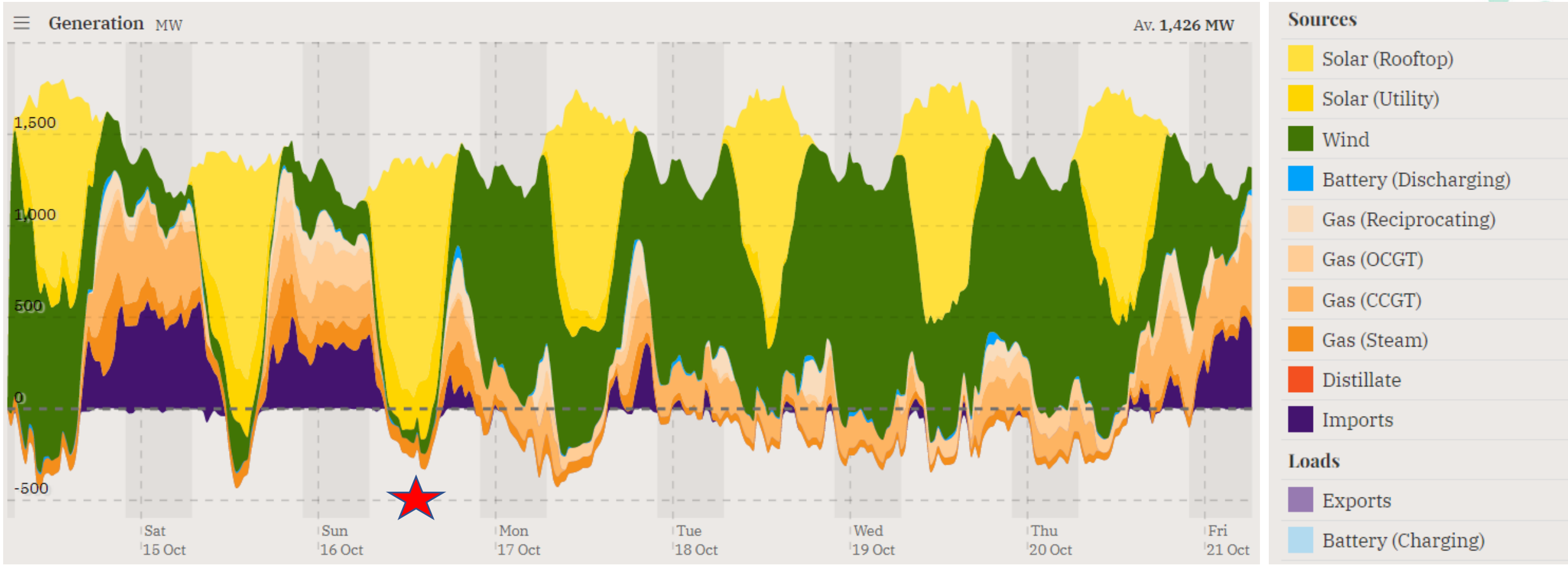
South Australia – a fitting choice for the 9th International Conference on the Integration of Renewable and Distributed Energy Resources

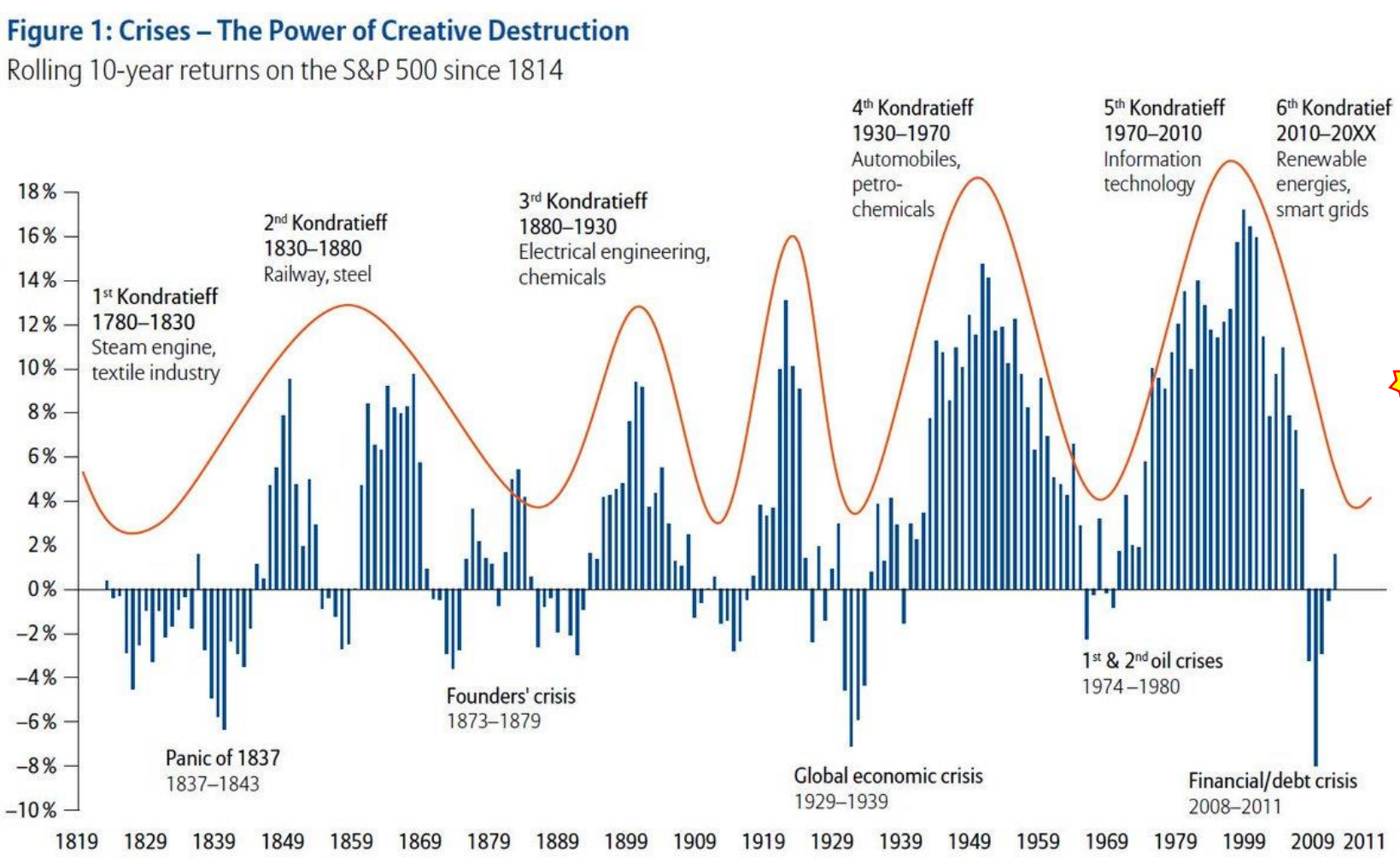


Sunday 16 Oct 2022
– new minimum operational state demand record of 100MW (after rooftop solar), lowering last year's record by 4MW
– new solar PV generation record of 116.7% of state demand, beating last year's record of 110%
– 76.2% renewable energy generation for the week (note the record of 88.3%, 17 – 23 January 2022)

Source: www.opennem.org.au

The global energy transformation is accelerating – renewables are powering the 6th Kondratieff cycle

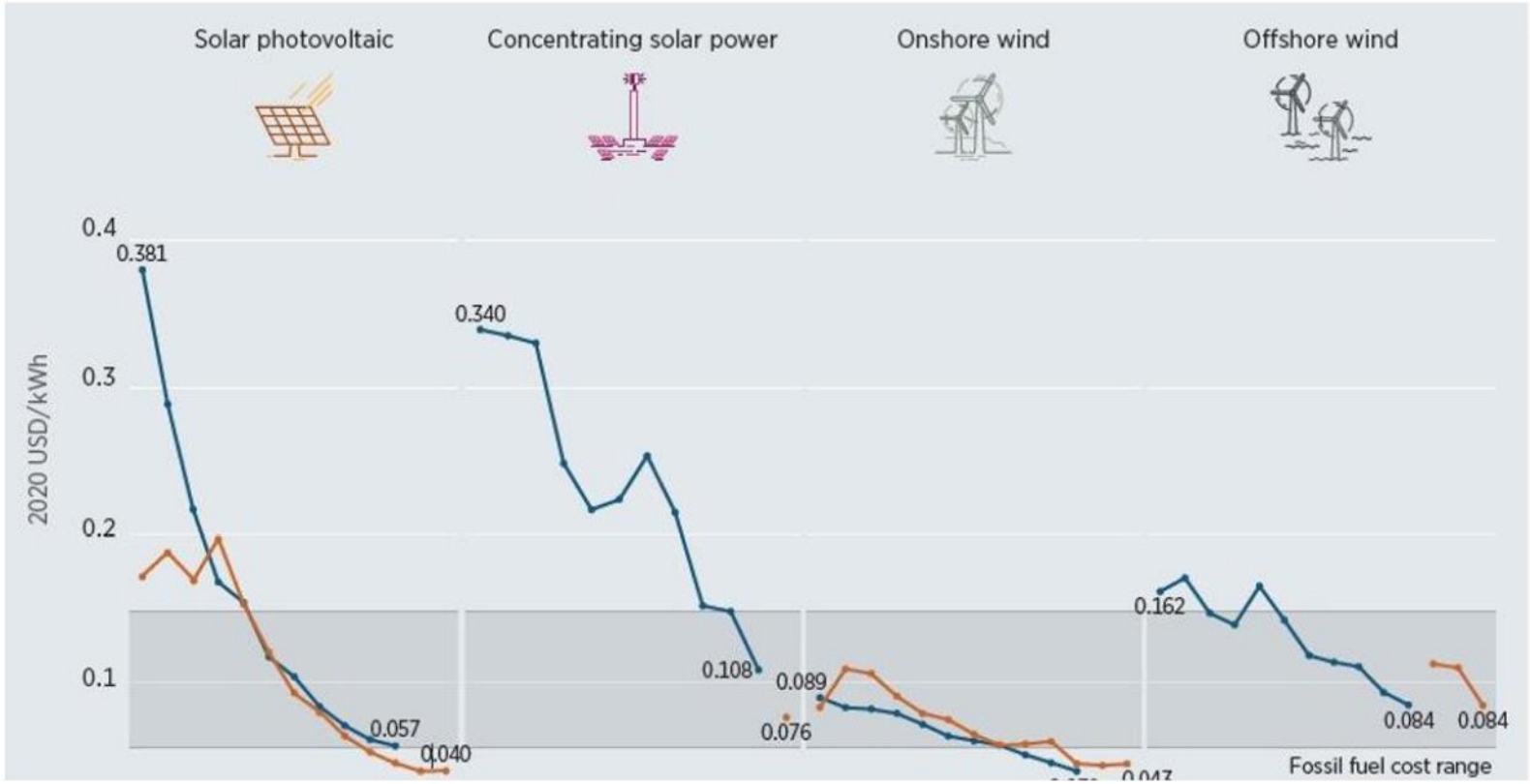
- Decarbonisation
- ESG
- Sovereign capability



Source: Allianz Global Investors 2010 Report "The Sixth Kondratieff – long waves of prosperity" updated 20 12

Wind and solar are now the cheapest forms of generating electricity

Figure ES.3 The global weighted-average LCOE and PPA/auction prices for solar PV, onshore wind, offshore wind and CSP, 2010-2023



Source: SA's Climate Change Challenge and Opportunity, Garnaut, 2020

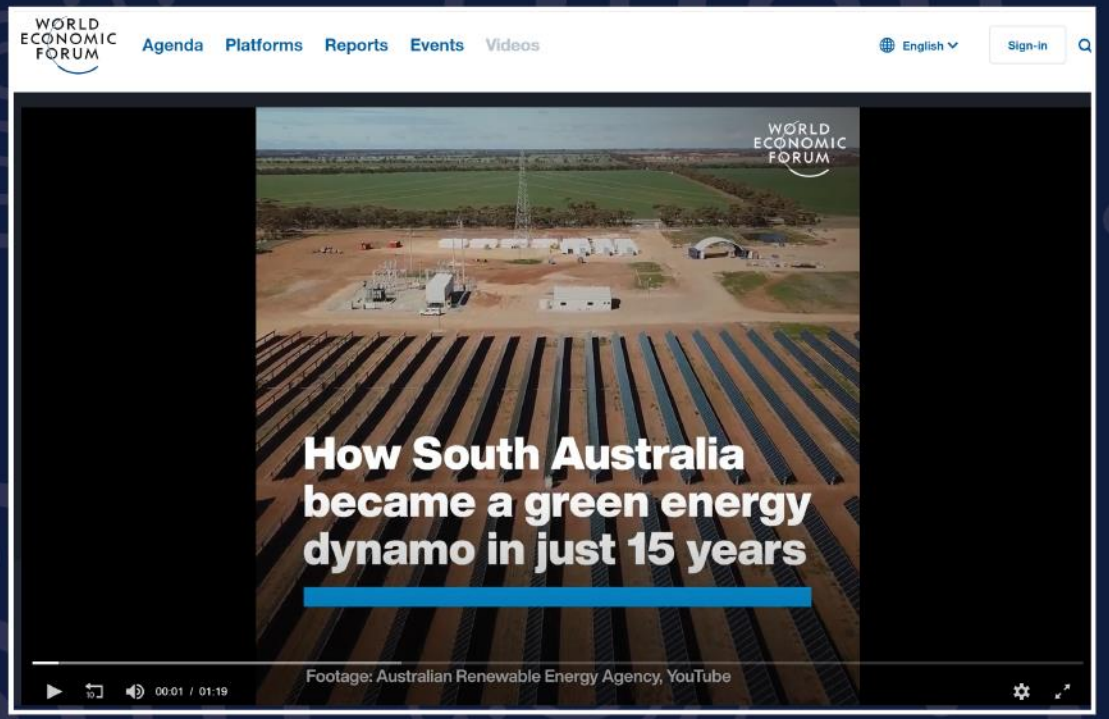
INCREASING GLOBAL RECOGNITION

For the scale and pace of SA's Clean Energy Transformation

BBC (May 2021)

https://www.bbc.co.uk/programmes/m000vp3w

World Economic Forum (June 2021)



https://www.weforum.org/videos/22826-how-south-australia-became-a-renewable-energy-powerhouse-in-just-15-years-1

INCREASING GLOBAL RECOGNITION

For the scale and pace of SA's Clean Energy Transformation

Channel 10's The Project (30 Oct 2021)

The South Australian Energy Edge

News

Air Date: Sun 31 Oct 2021
Expires: in 2 months

In the space of five years, South Australia has gone from being a blackout prone laughingstock, to a world leader in renewable energy. And doing a bit of myth busting along the way.

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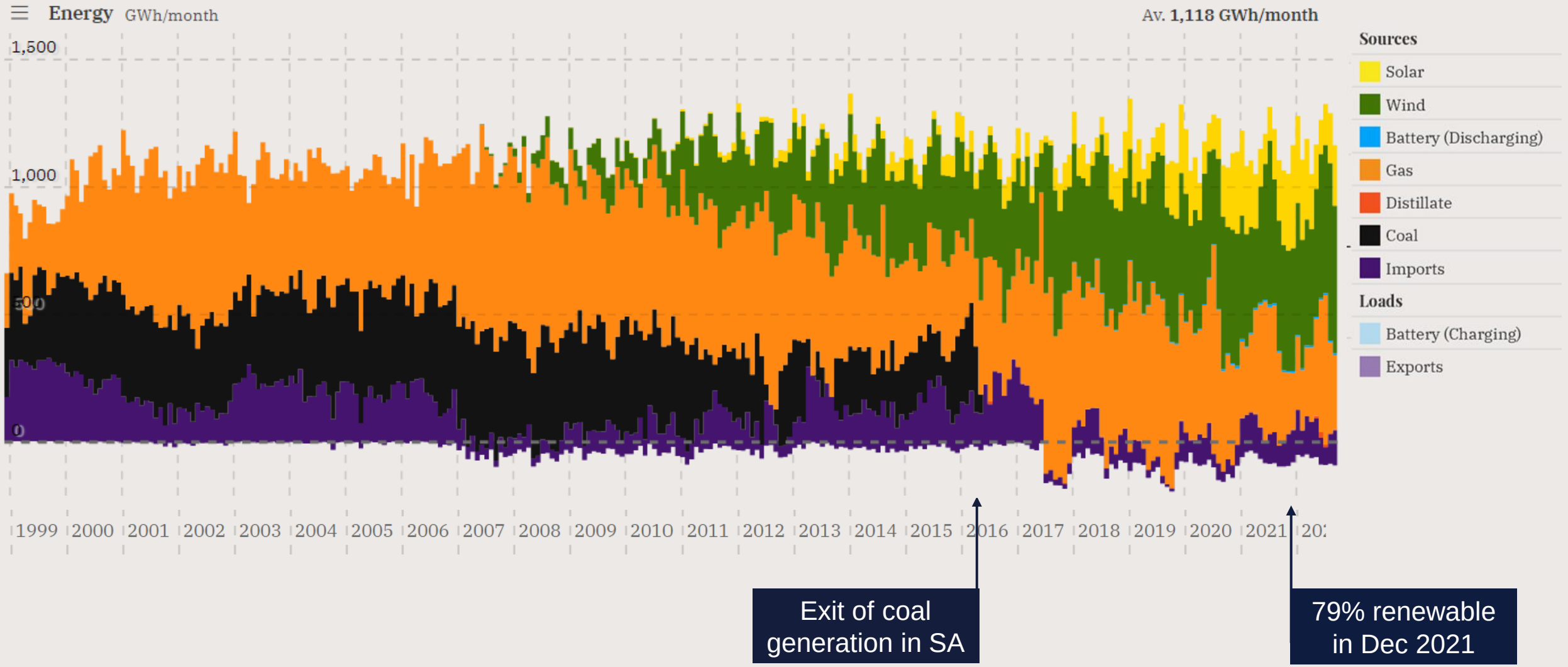
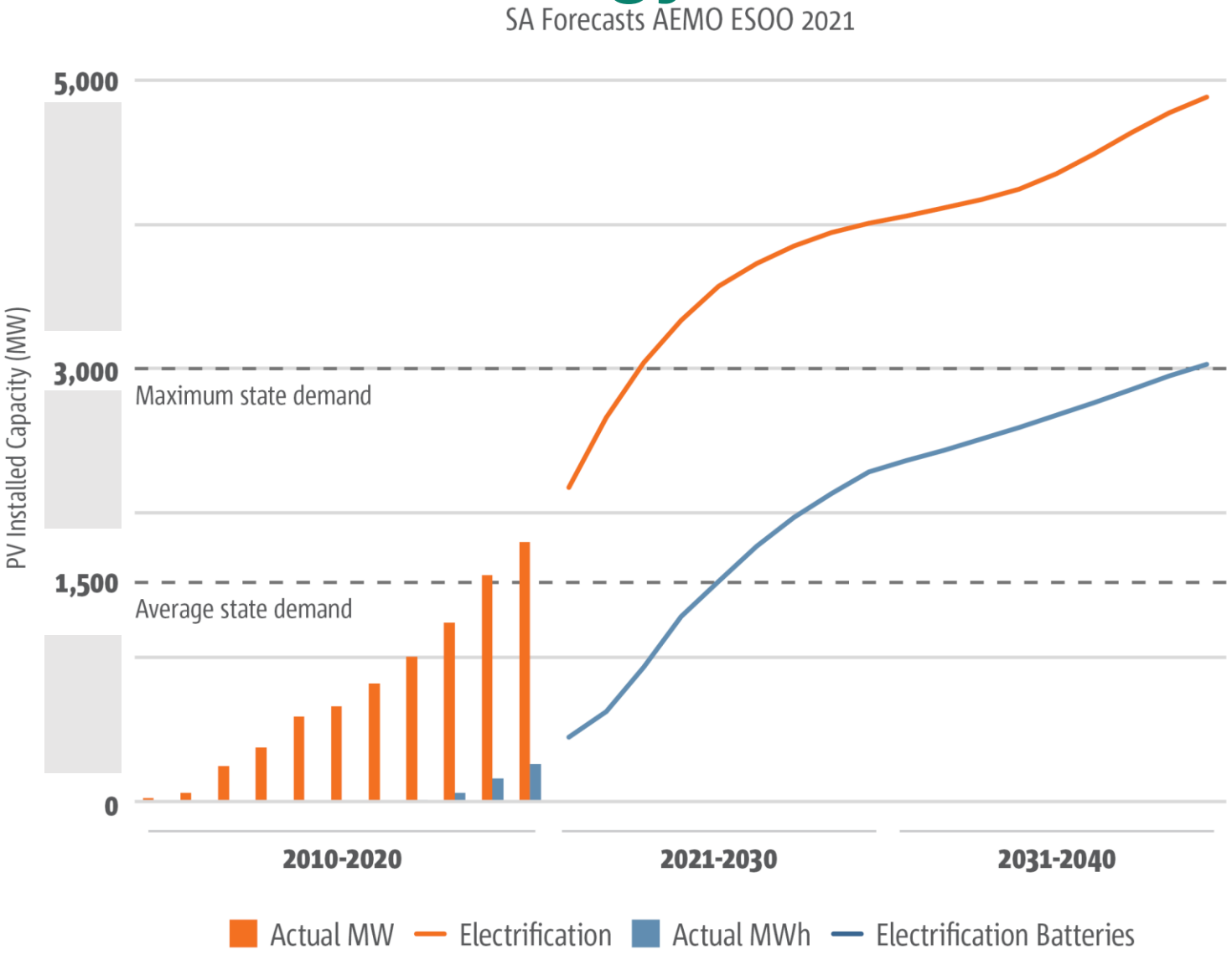
Claim to fame #1 – one the world's most rapid transformations to renewable electricity

Exited coal generation and <1% ➡ 68% RE p/a in 15 years



Source: www.opennem.org.au

Claim to fame #2 - SA a world leader in distributed energy



~300,000 Rooftop solar systems

>1 in 3 customers, world's highest

State's largest generator

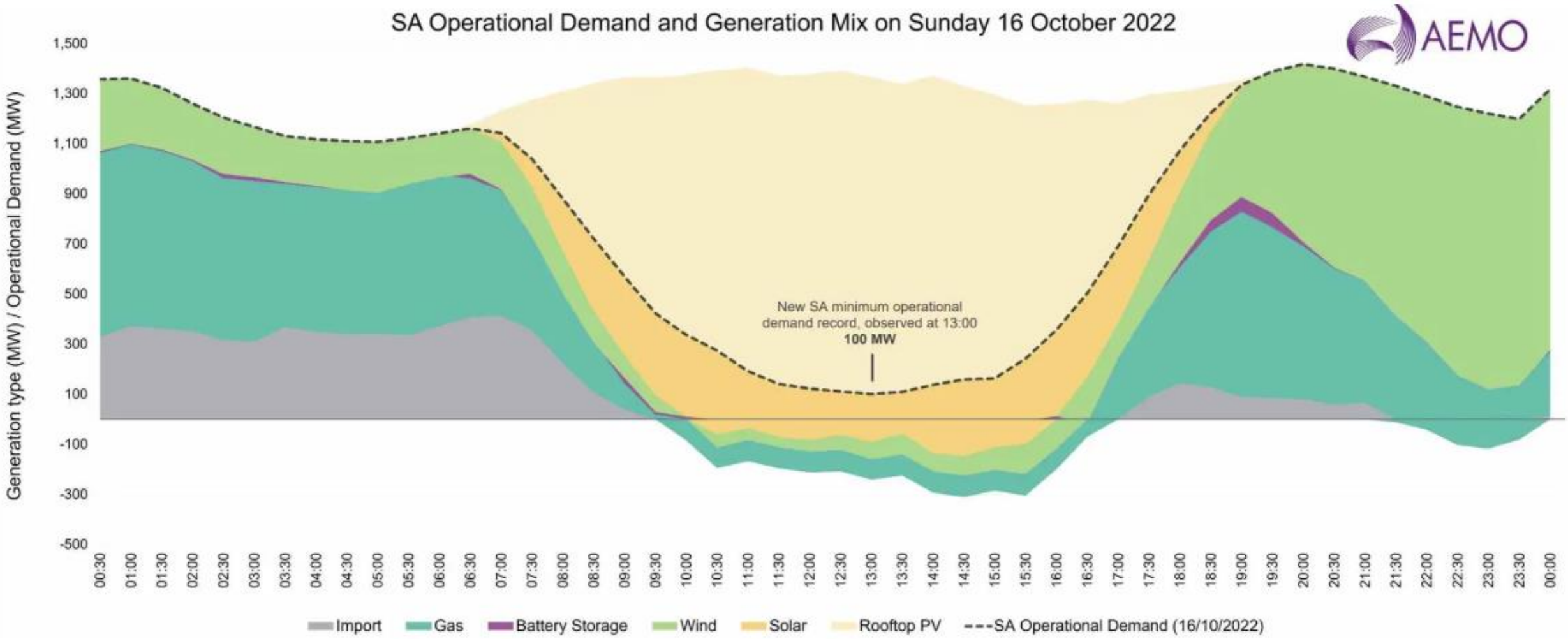
Record growth continues

~30,000 Home batteries

9 Virtual Power Plants operating in SA

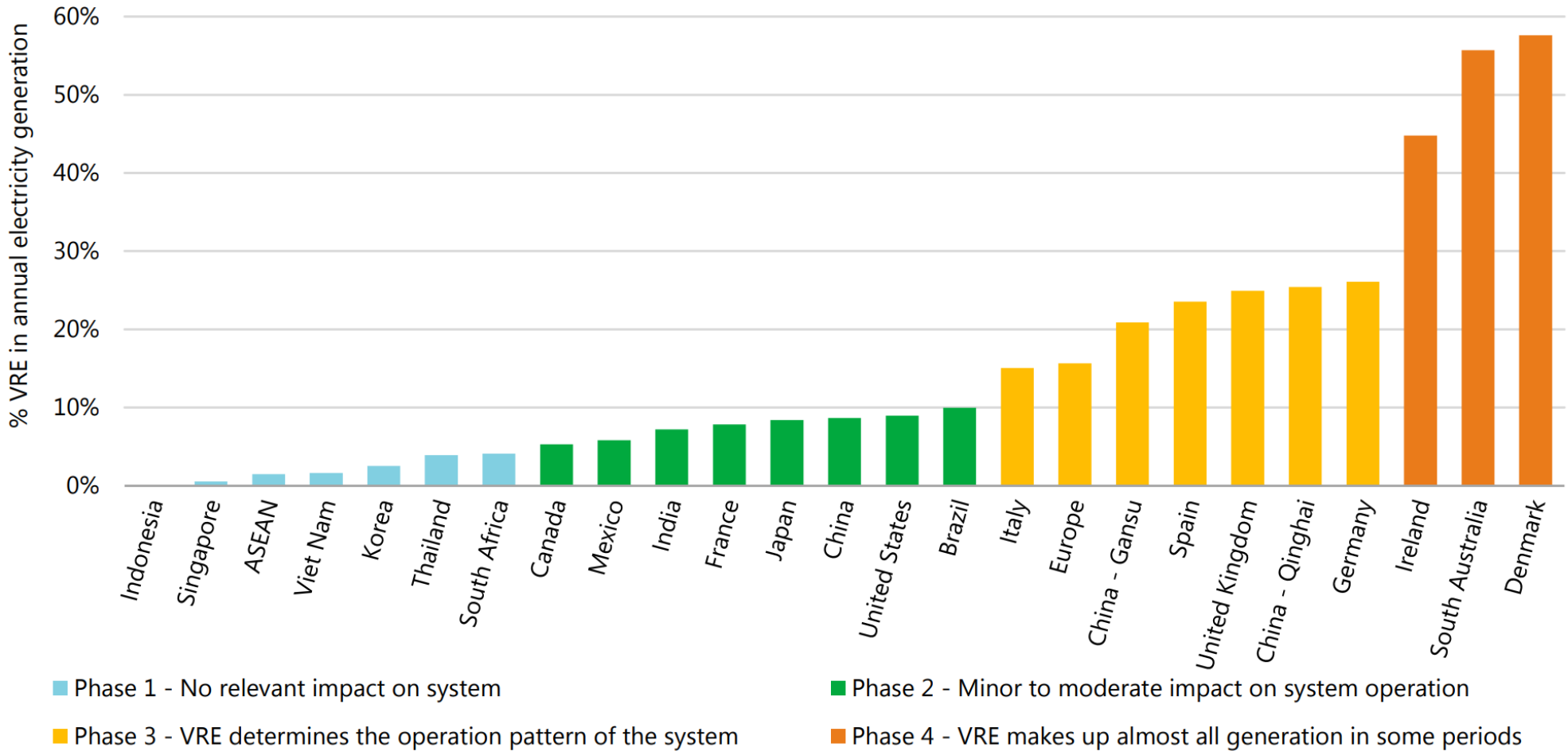
Source: SAPN

Minimum demand record set last Sunday



Source: AEMO

Neck and neck with Denmark for annual VRE%
- 2019 data



Source: IEA, Secure Energy Transitions in the Power Sector, 2021. Note China = The People's Republic of China

Technology has been key… SA has become a test bed

- Grid scale batteries
- Home batteries & VPPs
- Synchronous condensers
- Fast gas

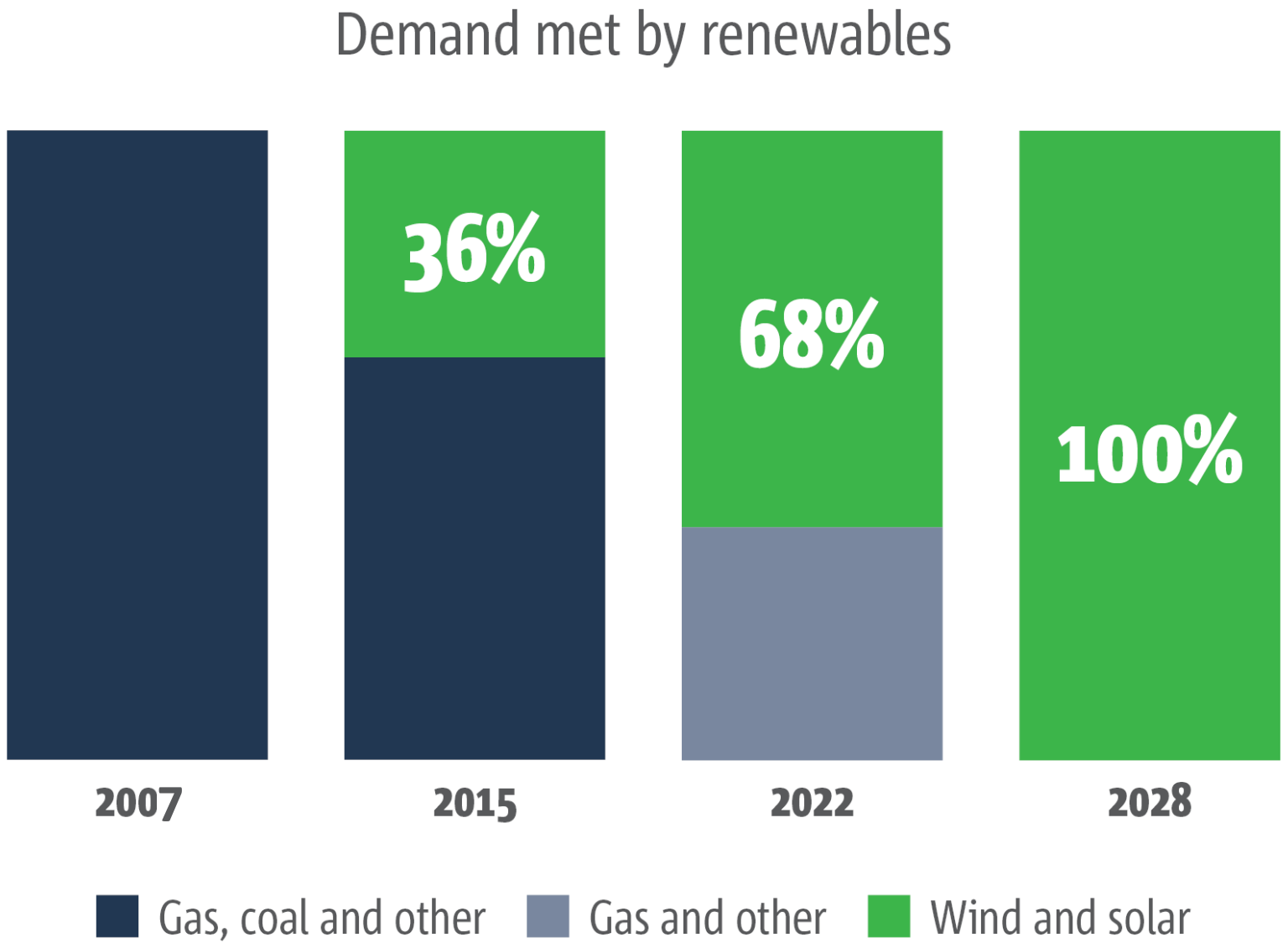

Source: Neoen


Source: SMA


Source: ElectraNet

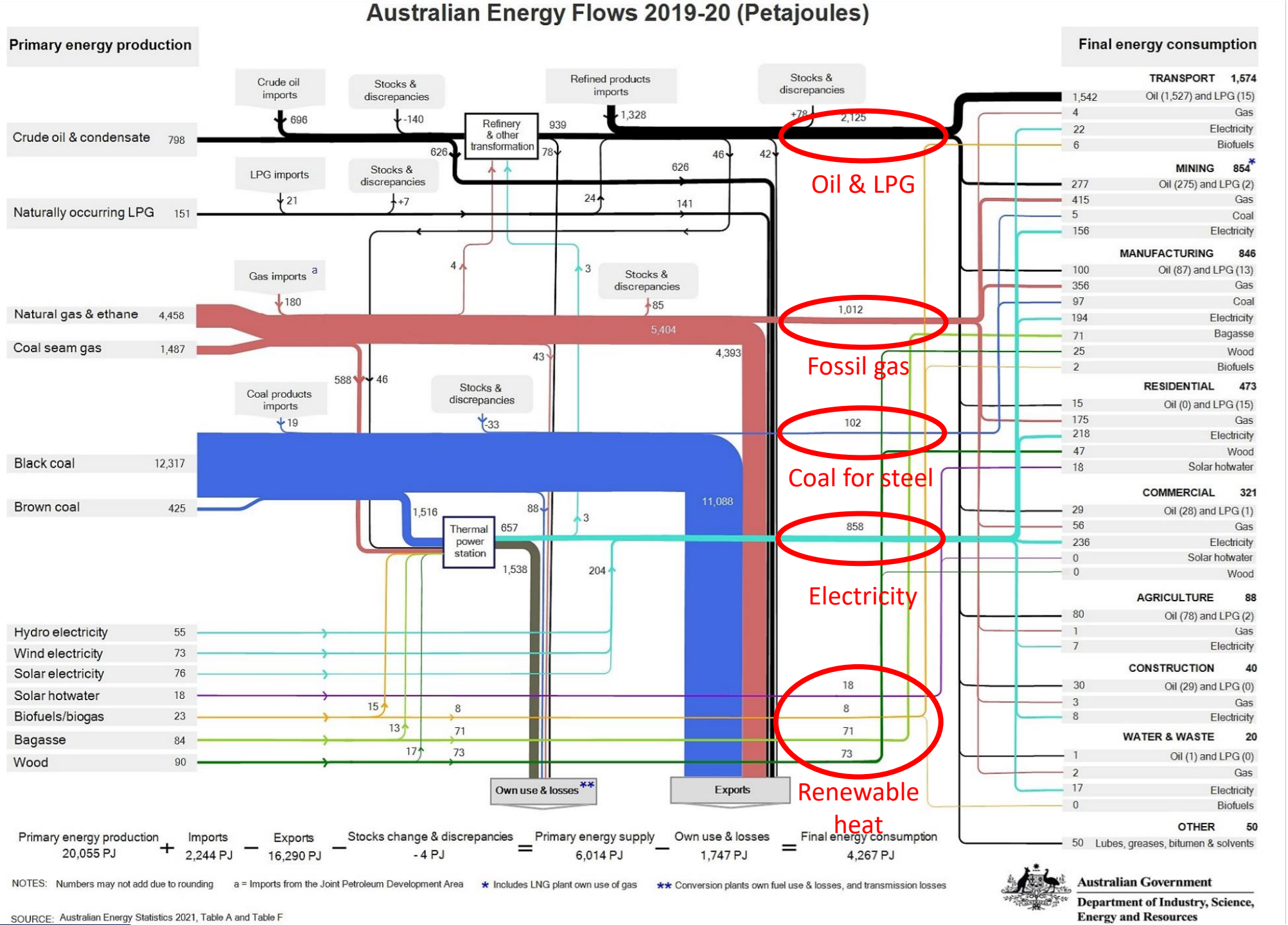

Source: Wärtsilä

On track for net 100% renewables by 2030



Source: SAPN

Domestic electricity is only part of the energy puzzle, so where to from here?



Electrification and hydrogenification can underpin the decarbonisation of the SA economy & low CO_2 exports

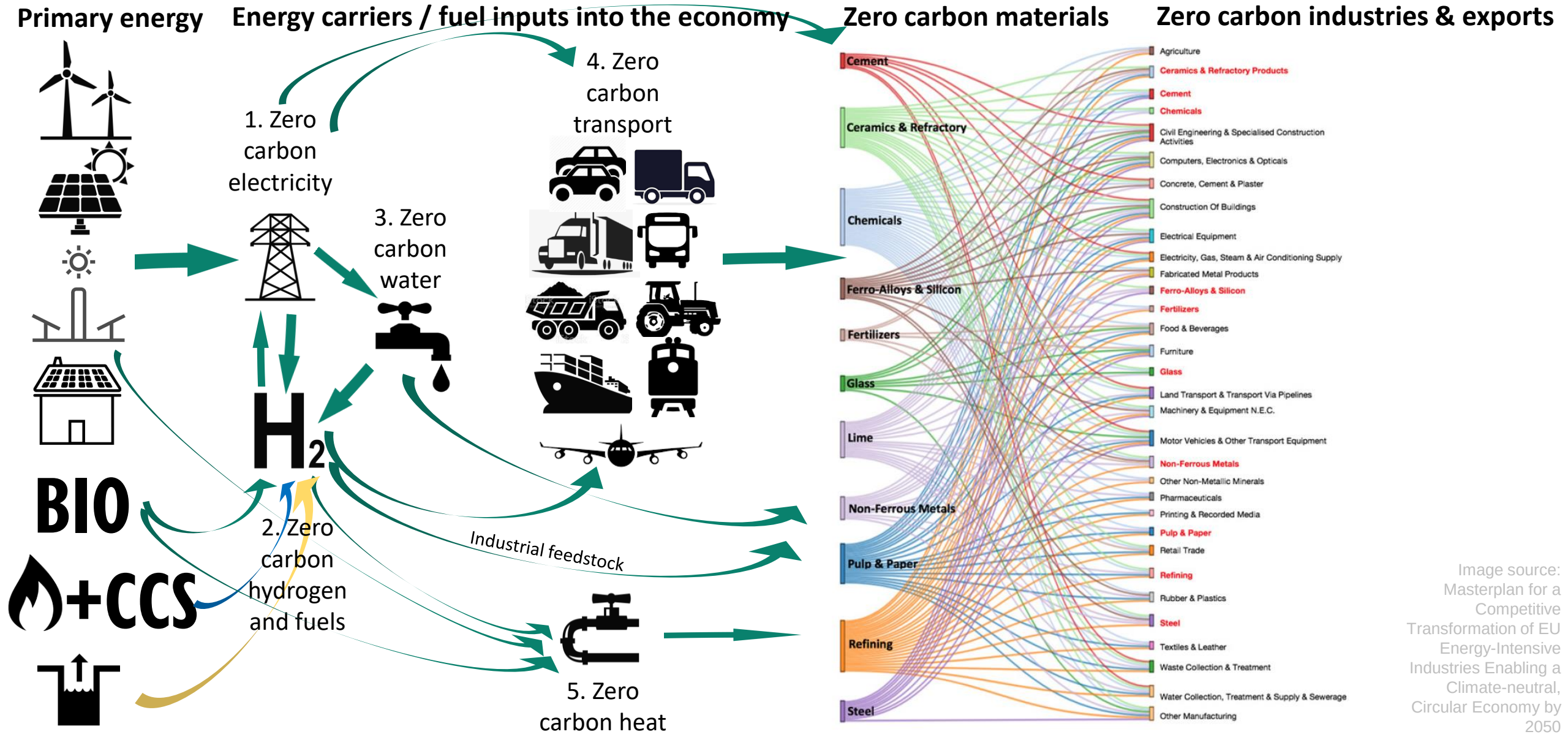
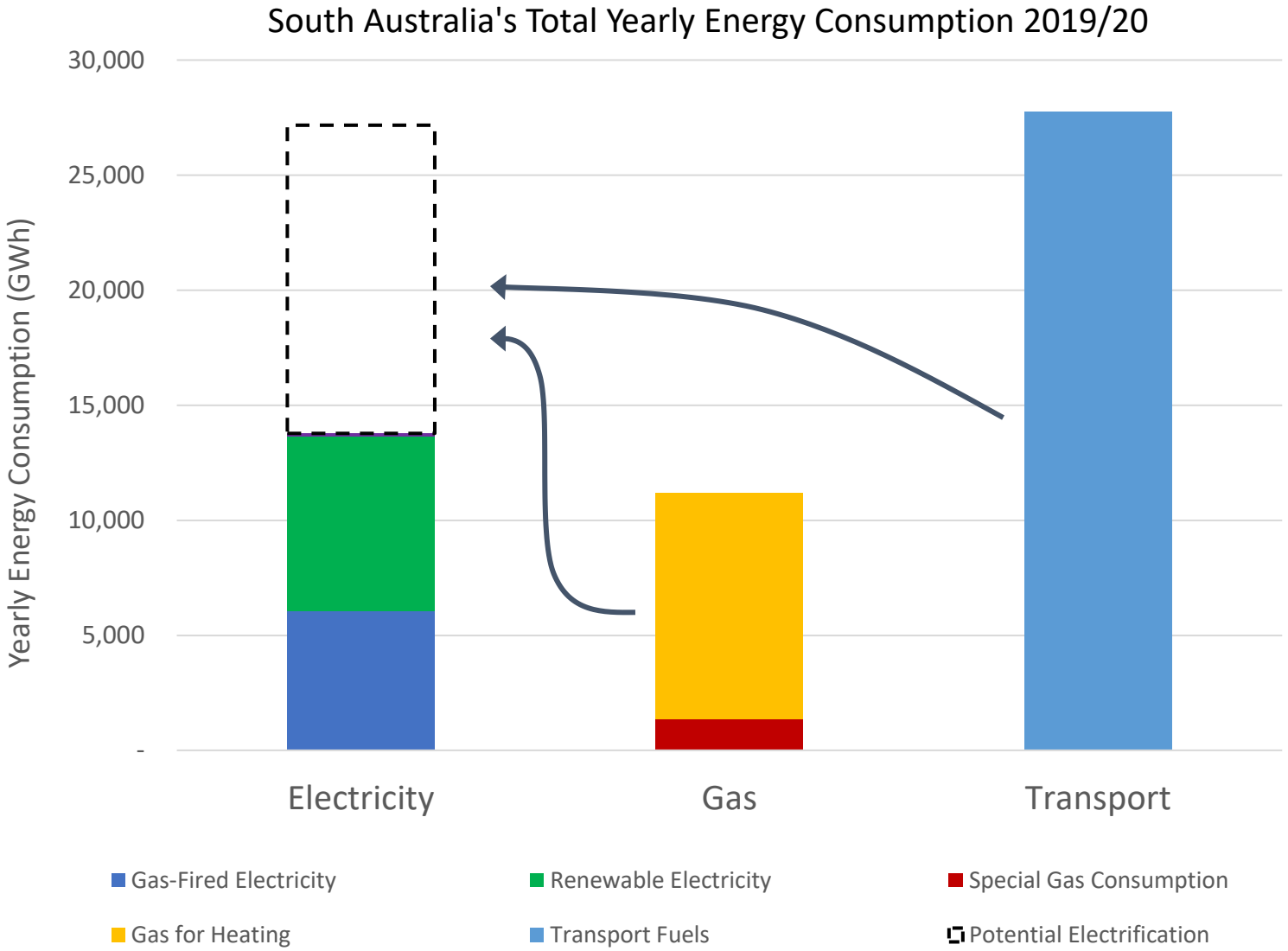


Image source: Masterplan for a Competitive Transformation of EU Energy-Intensive Industries Enabling a Climate-neutral, Circular Economy by 2050

Electrification of domestic transport and heat offer lower energy costs, emissions & fuel imports



The electricity network currently delivers ~22% of state end-use energy

As we decarbonise, electricity could ultimately supply 80%+ of the state's energy needs

Source: Australian Energy Statistics + SAPN

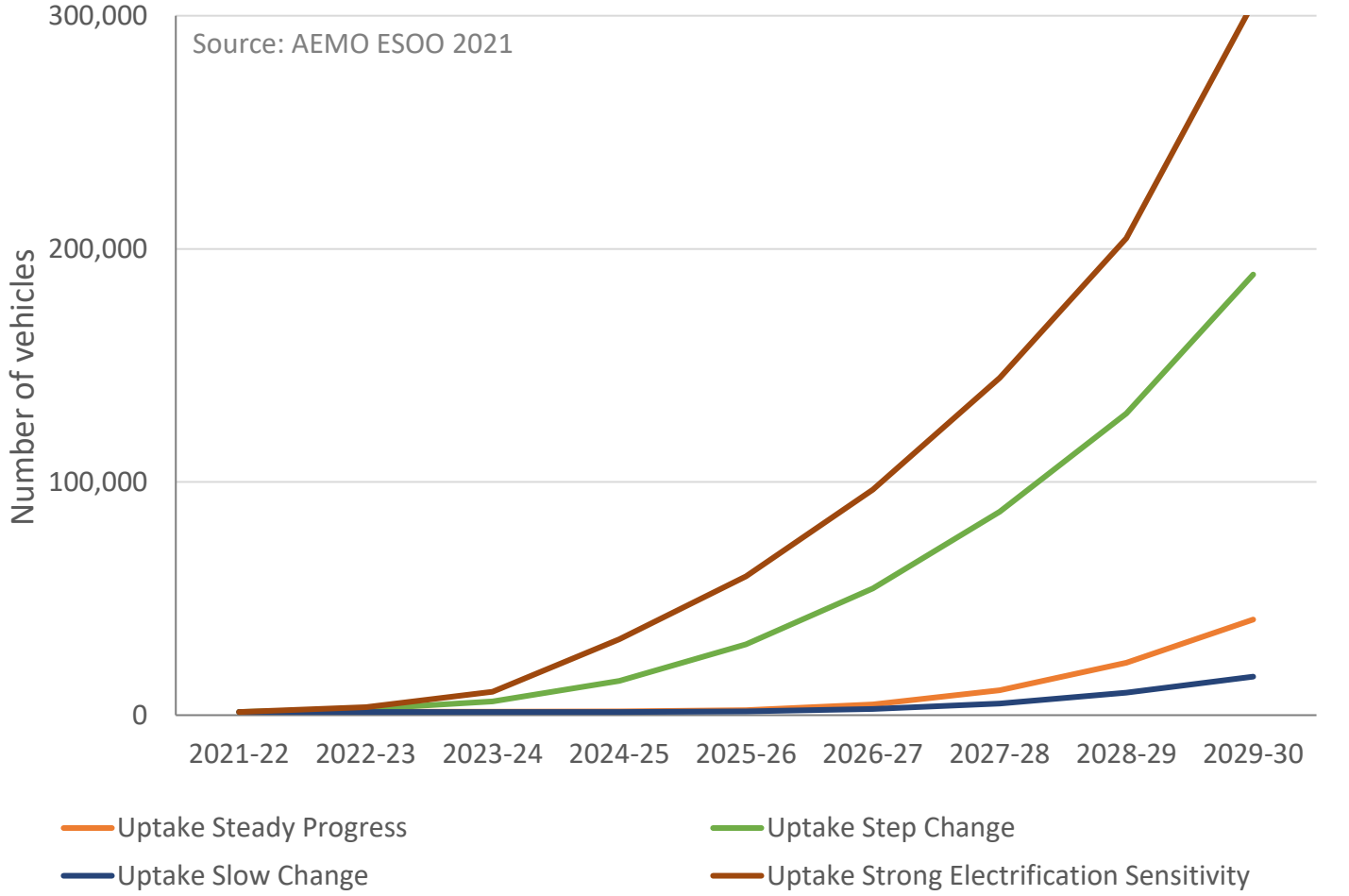
Industry examples of where to next

- BHP purchasing renewable electricity
- OzMinerals trialing battery electric haul truck
- Hallett Concrete low carbon concrete project
- GFG green steel vision for Whyalla
- Trafigura green hydrogen Port Pirie
- Santos CCUS and blue hydrogen projects
- Multiple gigawatt-scale green hydrogen projects
- Multiple crypto-mining data centre projects
- Developers prospecting for offshore wind
- Developers prospecting for gigawatt-scale wind and solar projects in the pastoral zone

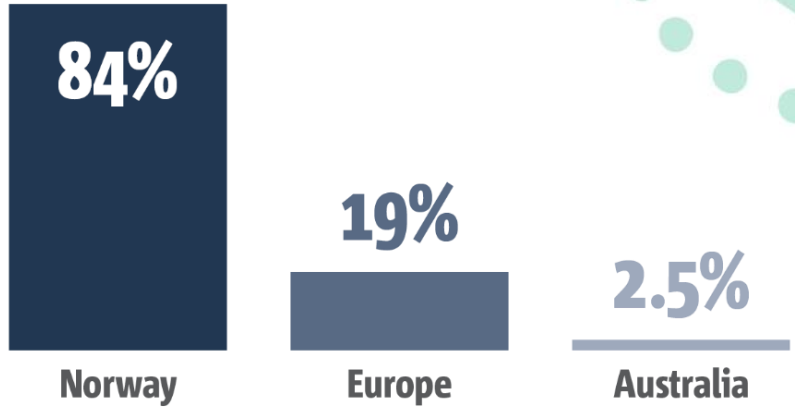
EVs are on the up

Up to 300,000 EVs by 2030

20% more energy (1,400 GWh)



EV new vehicle sales Q1 2022



>20 countries have announced plans to phase-out of internal combustion engine (ICE) car sales between 2025-35

e.g. Scandinavian countries, UK, China, Japan, EU

Many major automakers are also planning to cease making ICE vehicles between 2025–35

e.g. Jaguar, Volvo, Audi, VW, GM, Ford, Lexus

Source: SAPN

Pillars of SA's EV program

- SA border to border EV charging network
- 9 smart charging trials
- Repeal of road user charge legislation
- Purchase rebate for EVs
- Registration discount for EV owners
- State Government fleet policy
- Fleet pledge program

Hydrogen is coming, and offers a pathway to decarbonise industry & fuels, & to RE export

Liebreich Associates

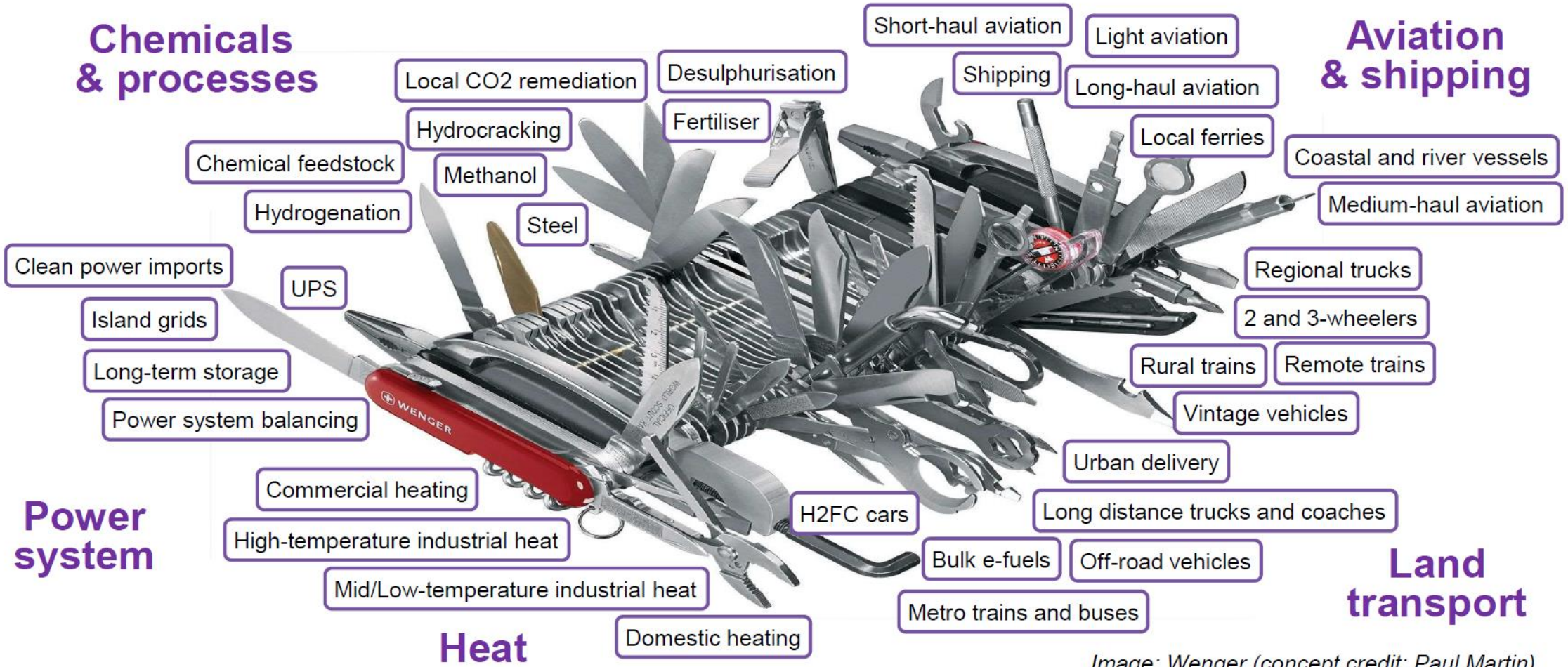


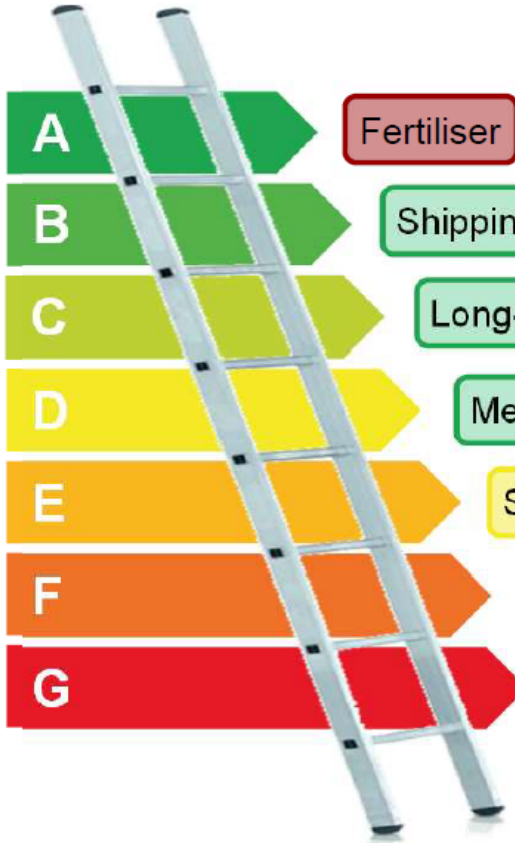
Image: Wenger (concept credit: Paul Martin)

Clean Hydrogen Ladder: Competing technologies

Liebreich Associates

Unavoidable

Key: No real alternative | Electricity/batteries | Biomass/biogas | Other



A	Fertiliser	Hydrogenation	Methanol	Hydrocracking	Desulphurisation						
B	Shipping*	Off-road vehicles	Steel	Chemical feedstock	Long-term storage						
C	Long-haul aviation*	Remote trains	Coastal and river vessels	Vintage vehicles*	Local CO2 remediation						
D	Medium-haul aviation*	Long distance trucks and coaches	High-temperature industrial heat								
E	Short-haul aviation	Local ferries	Commercial heating	Island grids	Clean power imports	UPS					
F	Light aviation	Rural trains	Regional trucks	Mid/Low-temperature industrial heat	Domestic heating						
G	Metro trains and buses	H2FC cars	Urban delivery	2 and 3-wheelers	Bulk e-fuels	Power system balancing					

Uncompetitive

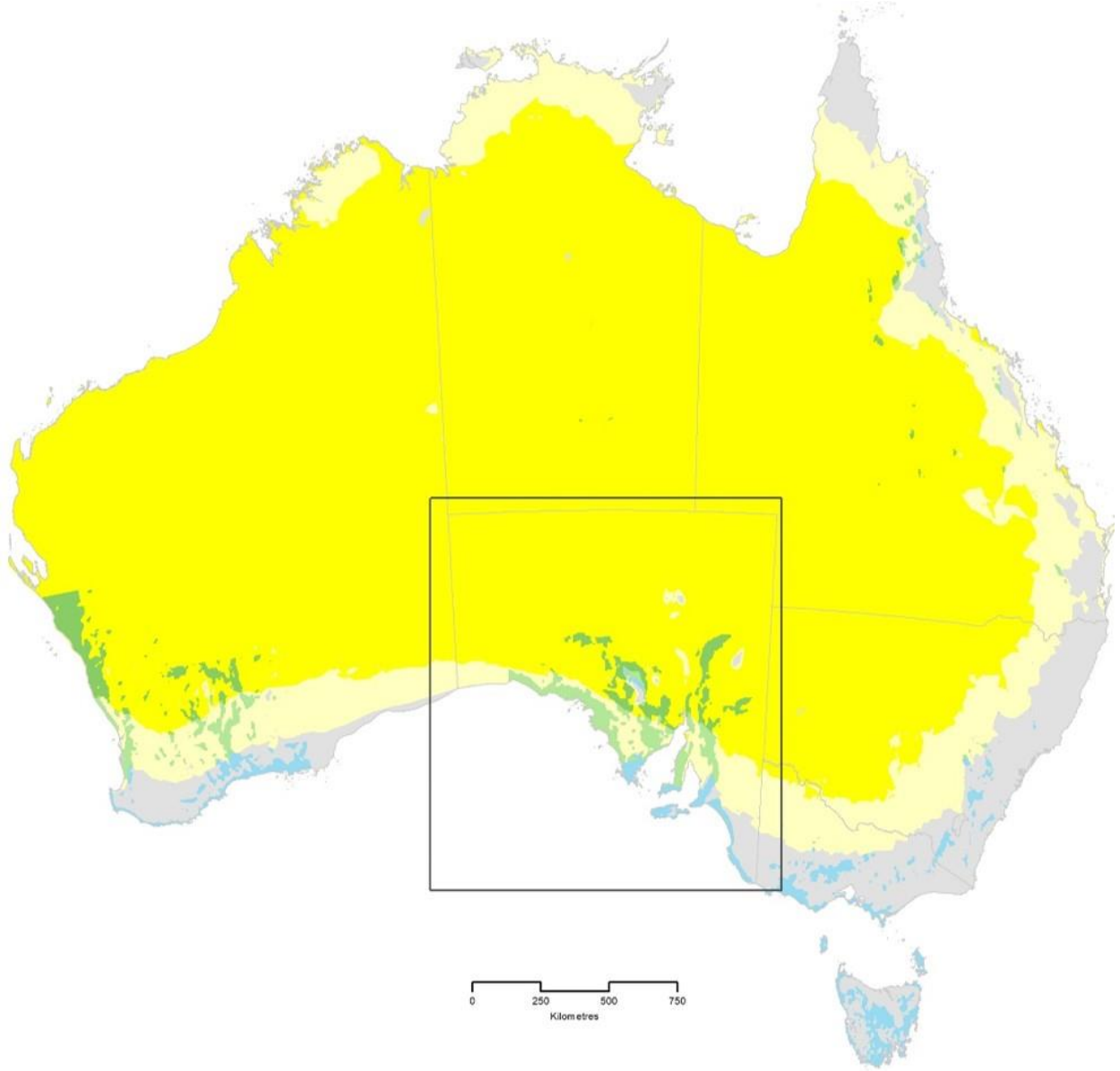
** Via ammonia or e-fuel rather than H2 gas or liquid*

Source: Liebreich Associates (concept credits: Adrian Hiel/Energy Cities & Paul Martin)

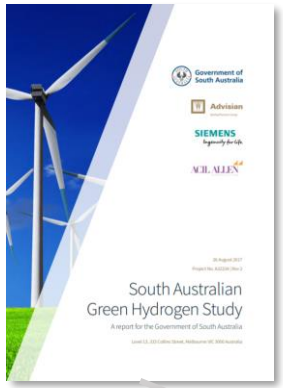
SA has a competitive advantage in green hydrogen production

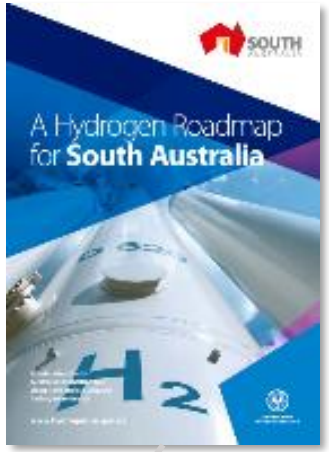
Optimal location for:

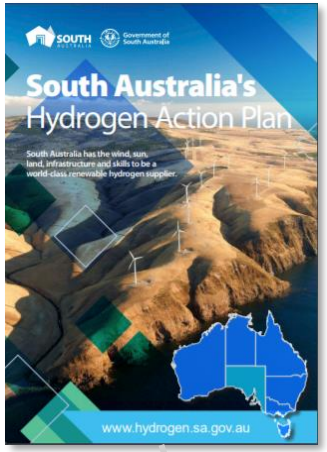
- SOLAR FARM
  DNI greater than 23.5 MJ/m2
- SOLAR FARM
  DNI greater than 20.5 MJ/m2
- WIND FARM
  Predicted ave. wind speed above 7.31 m/sec
- WIND FARM AND/OR SOLAR FARM
  Predicted ave. wind speed above 7.31 m/sec
  DNI greater than 23.5 MJ/m2
- WIND FARM AND/OR SOLAR FARM
  Predicted ave. wind speed above 7.31 m/sec
  DNI greater than 20.5 MJ/m2

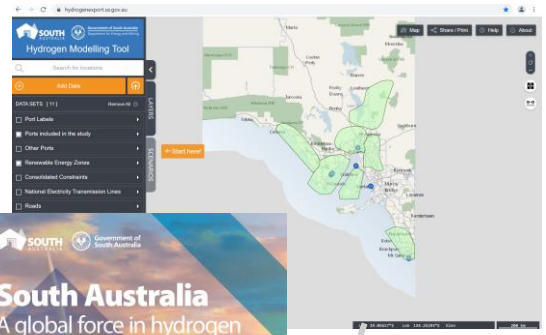


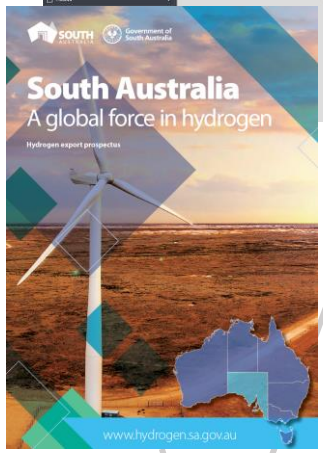
SA's hydrogen journey - Key studies and strategies

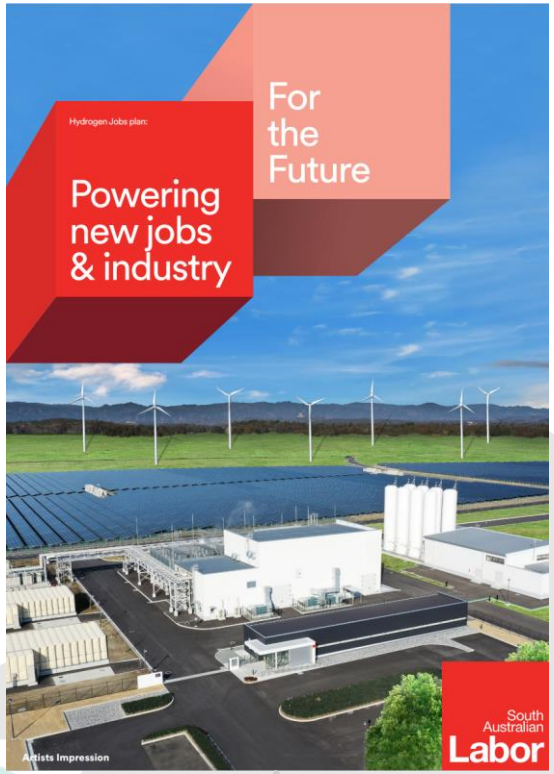












2017

2019

2020

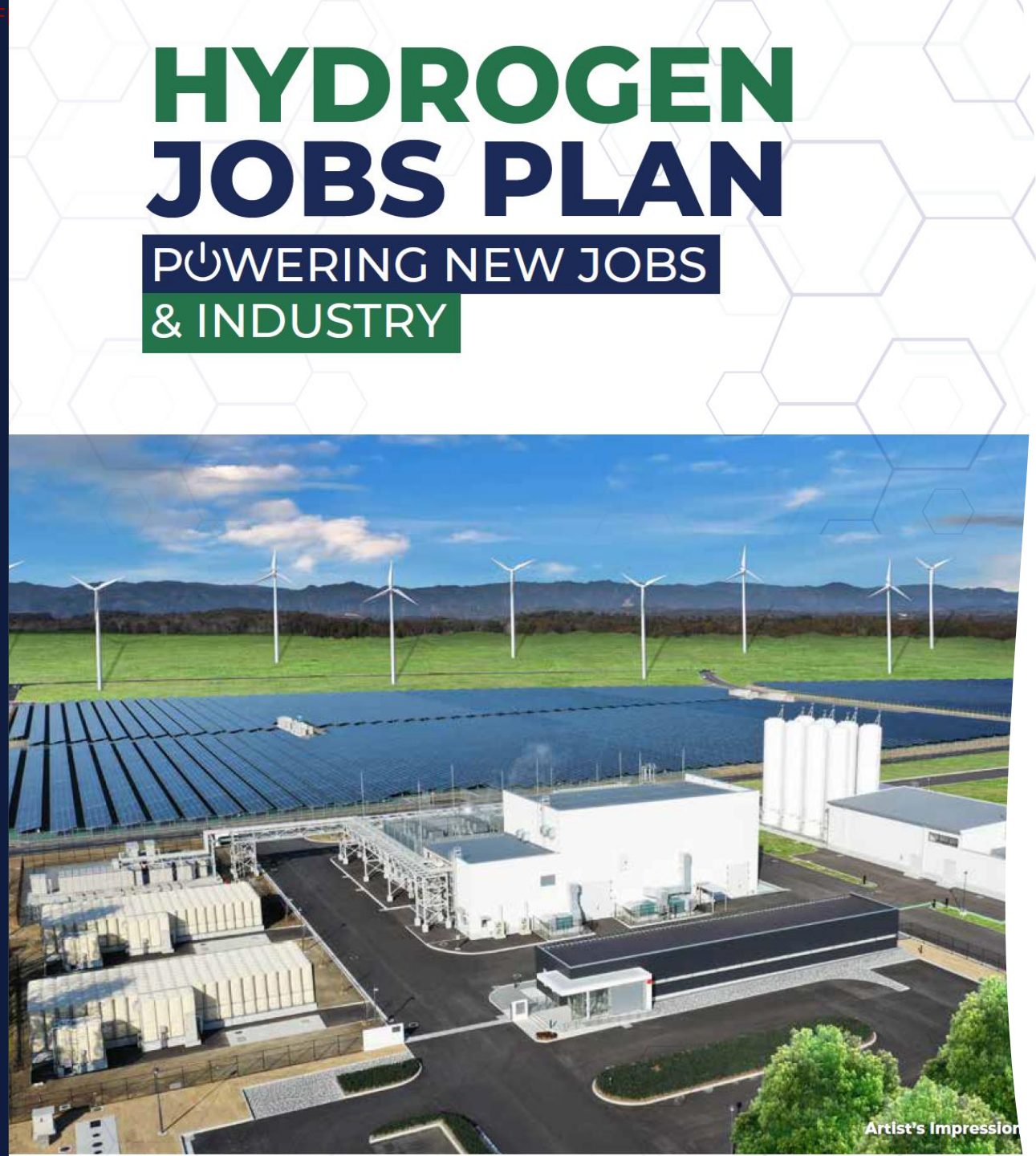
2021

2022

Hydrogen jobs plan

What

- $593 million targeting:
  - 250 Mwe electrolyser
  - 200 MW power generation fueled by hydrogen
  - hydrogen storage facility
- Provide energy system security and lower energy prices for industrial customers.



Port Bonython Hydrogen Hub

- State owned site: over 2,000 hectares of available land and 2.4km jetty
- EOI for land closed 1 July 2021
- 7 hydrogen projects shortlisted
- AMP Energy, Fortescue Future Industries, H2U, Neoen/Eneos, Neoen/Chiyoda/Mitsubishi, Origin Energy, Santos
- State awarded $70m Commonwealth Funding, matched by State and industry for common user infrastructure

South Australia's transformation to a net zero emissions economy and a national and international exporter of clean energy could mean achieving a level of renewable energy that is more than 500% of current local grid demand by 2050.

SA's Climate Change Action Plan, December 2020

Learn more

energymining.sa.gov.au

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