Australia as a Sovereign Renewable Energy Superpower

David Lee
40094760

Overview

RE Superpower

Sovereign Manufacturing

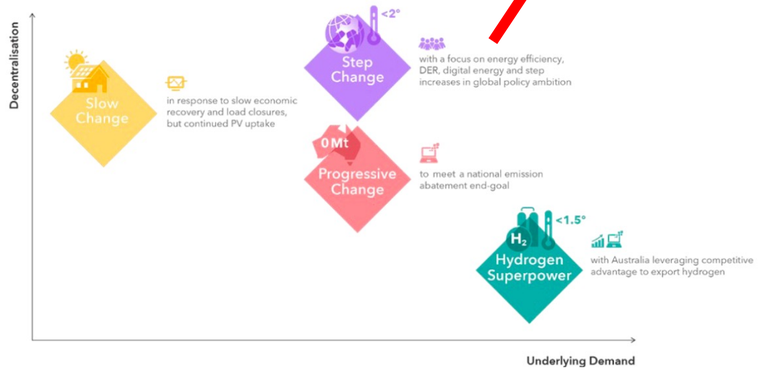
Recommendations

Where we are now

The Government has a plan to make Australia a renewable energy superpower, and has committed over $40 billion to this ambition:

- **Powering Australia with clean, cheap energy**, with $23 billion committed to growing and modernising our electricity grid and boosting energy performance, supporting electrification.
- **Powering net zero industries, jobs and communities,** with $17 billion committed to capturing opportunities in hydrogen, critical minerals and upstream industries, and realising low emissions industry growth opportunities in our regions.

Figure 6 Scenarios used for the 2022 ISP



Expected energy transition to 2050

('Step Change' scenario)

Storage capacity **to increase by a factor of 30**
(Batteries, virtual power plants, pumped hydro.)

NOW	2030	2050
2 GW	15 GW	61 GW

Grid-scale wind and solar **to increase 9-fold**

NOW	2030	2050
16 GW	44 GW	141 GW

Distributed solar PV **to increase 5-fold**

NOW	2030	2050
15 GW	35 GW	69 GW

Electricity usage from the grid **to nearly double**

NOW	2030	2050
180 TWh	184 TWh	320 TWh

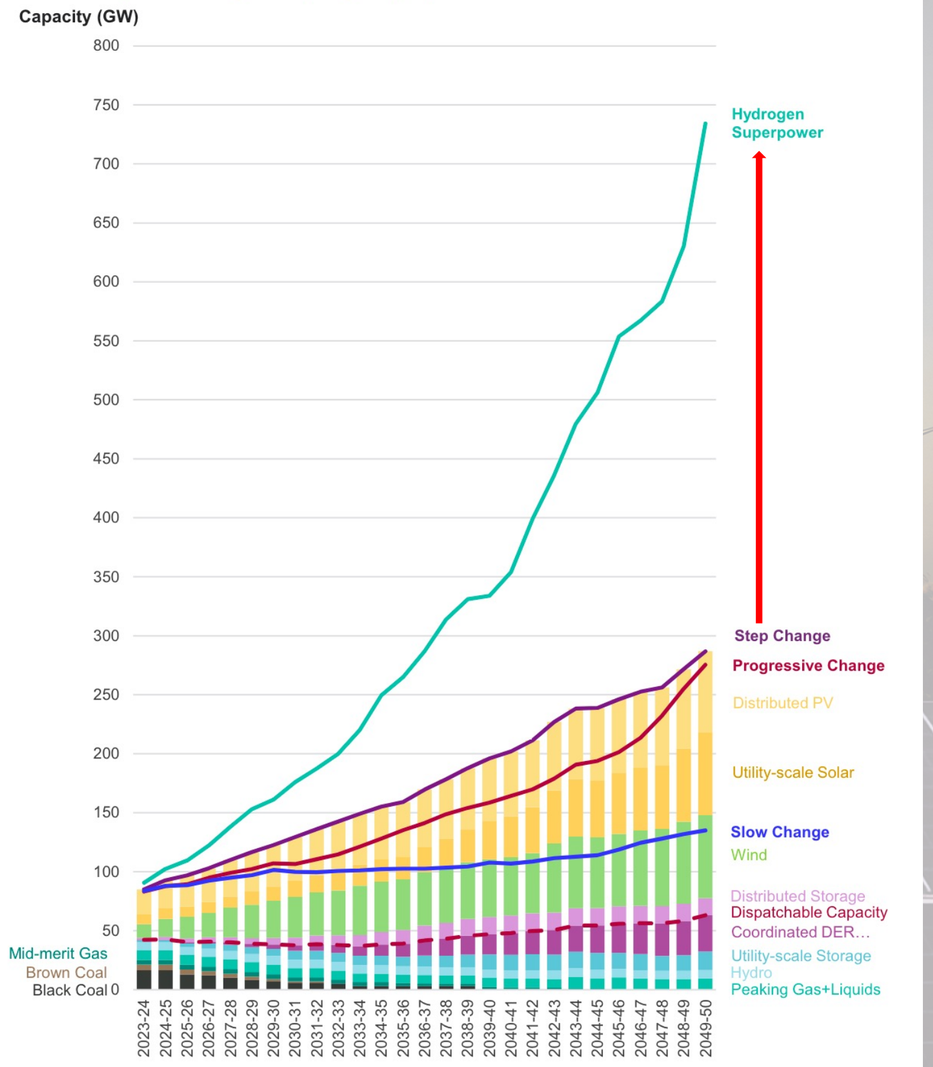
Gas-fired peaking plants **to increase**
While current mid-merit plants will all retire within that period.

NOW	2050
7 GW	10 GW

Coal generation **to be withdrawn**
Capacity to be retired by:

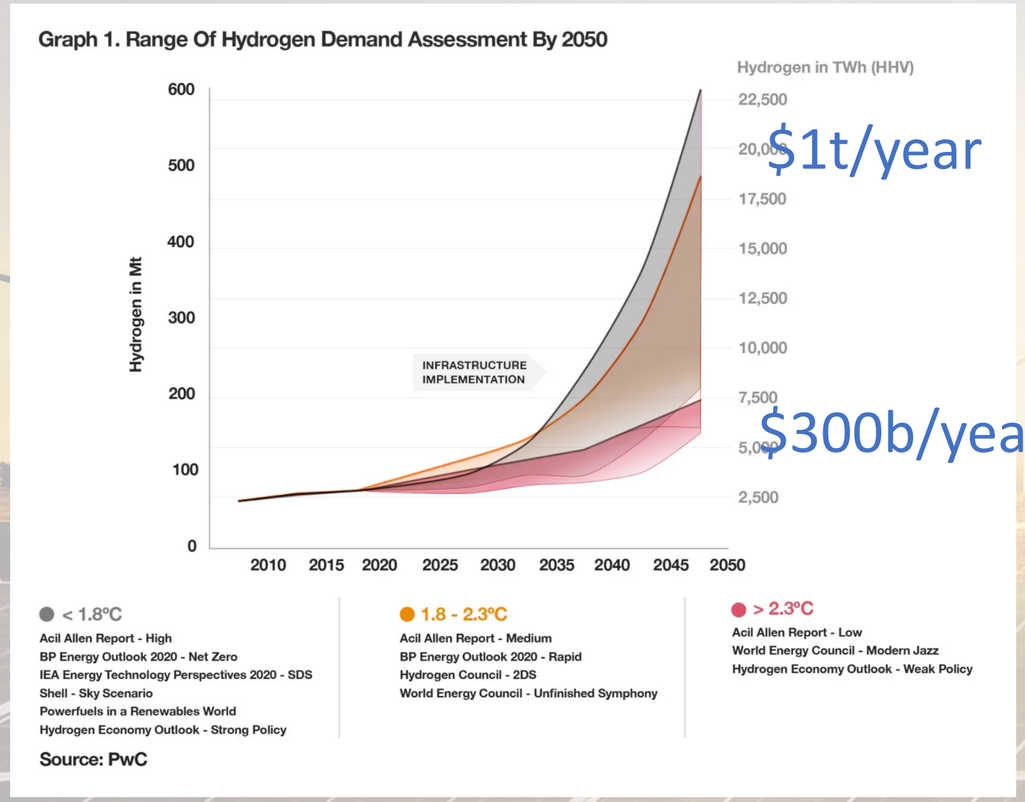
2030	2043
60%	100%

Figure 11 Development opportunities to 2050 in *Step Change*, and compared to total capacity required in *Progressive Change* and *Hydrogen Superpower*



Commonwealth of Australia, "Building a clean energy future," 2023. [Online]
AEMO, "2022 Integrated System Plan," 2022. [Online]

Hydrogen Demand

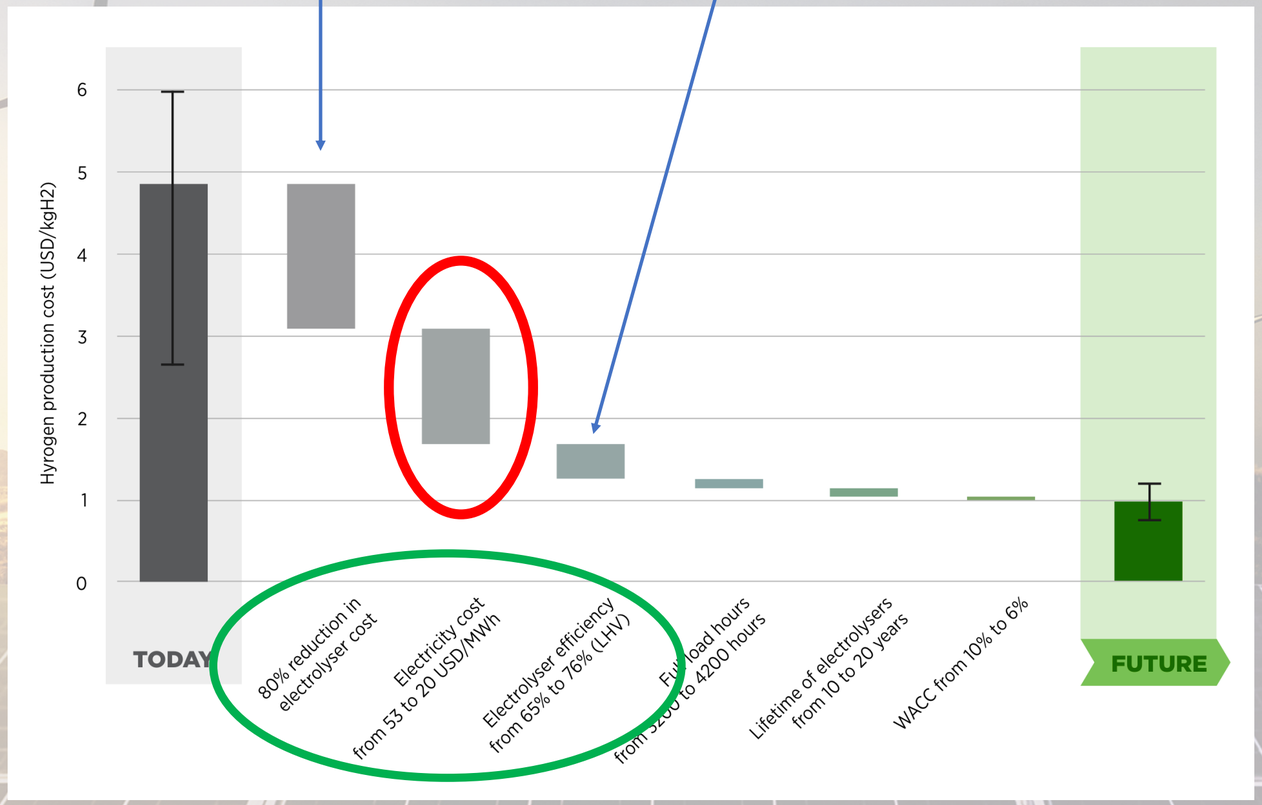


$1t/year

$300b/year

$2b Hydrogen Headstart

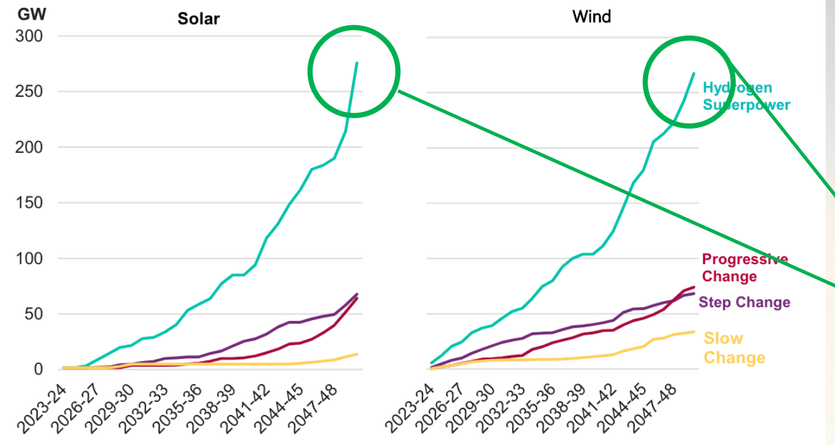
ARENA R&D



PWC, "The green hydrogen economy," 2023. [Online]
IRENA, "Green Hydrogen Cost Reduction," 2020. [Online]

Becoming a Renewable Energy Superpower

Figure 12 Growth and share of utility-scale solar and wind capacity, all scenarios



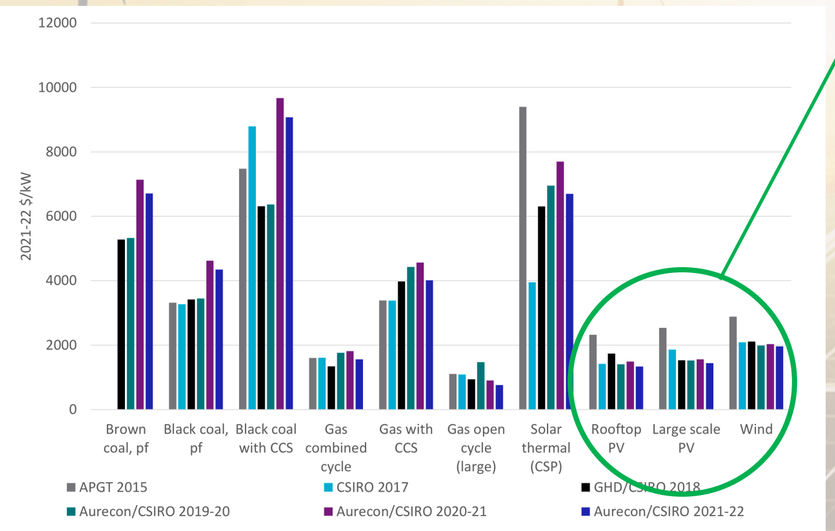


Figure 2-1 Comparison of current cost estimates with previous work

Table 2 – Capital required to produce capacity needed for a Hydrogen Superpower

Generation Type	CSIRO's 2022 Estimated Capital Cost ($AUD/kW)	AEMO's required capacity for superpower (GW)	Cumulative capital Required by 2050 $AUD b
Large Scale PV	1300	278	361.4
Onshore Wind	1915	269	515
Offshore Wind	4085 [11]	Not discussed	n/a
Battery (8hrs)	3000	43	129
Total	n/a	590	1005

$42.8b
Lifetime transaction value

$11.7b
Lifetime commitments

$4.6b
Capital available for ongoing activity

$2.62:$1
Lifetime private sector leverage (all figures to 31 December 2022)

Renewable Energy Superpower requires
$276b over 27 years for 590GW

CSIRO, "GenCost 2020-21: Final report," 01 June 2021. [Online]
CEFC, "Clean Energy Finance Corporation," 2023. [Online]

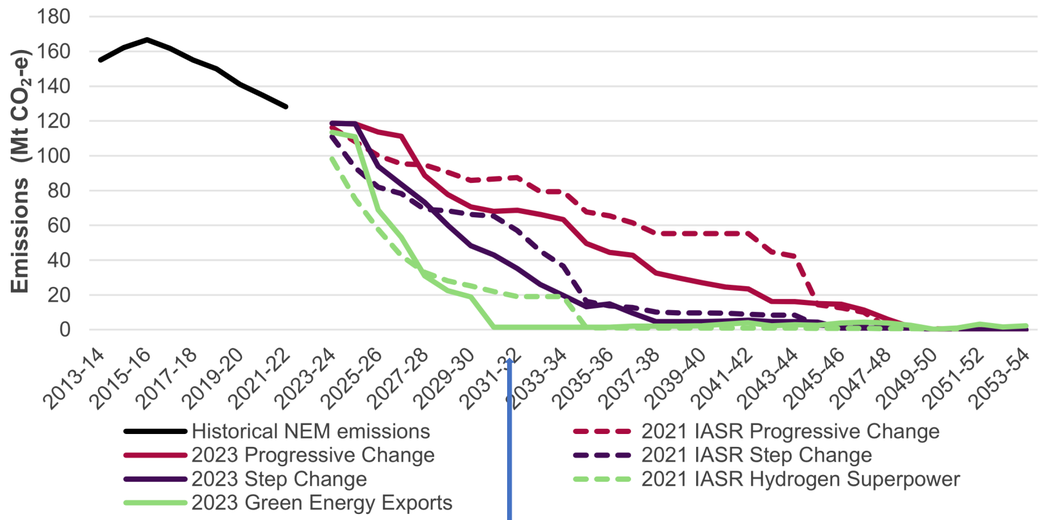
Impact on emissions

Table 1 Scenario comparison at 2040

	Reference value for scenarios	*Green Energy Exports*	*Step Change*	*Progressive Change*
Electrification and energy efficiency savings				
% of road transport that is EV	2022-23: <1	72	60	32
% of residential EVs still relying on convenience charging	2022-23: ~75	38	46	56
Business electrification (TWh)	Max. potential: 41 [A]	36	25	20
% increase from current business consumption	n/a	26	18	15
Residential electrification (TWh)	Max. potential: 12 [A]	9	9	6
% increase from current residential consumption	n/a	16	15	11
Energy efficiency savings (TWh)	n/a	41	36	26
Underlying consumption				
NEM underlying consumption (TWh)	2022-23: 193	345	299	230
Hydrogen consumption (domestic) (TWh)	2022-23: 0	50	28	15
Hydrogen consumption (export, including green steel) (TWh)	2022-23: 0	183	7	0
Total underlying consumption (TWh)	2022-23: 193	578	335	246
Supply				
Distributed PV generation (TWh)	2022-23: 24	92	77	45
% of household daily consumption potential stored in batteries	2022-23: 1%	22%	21%	3%
% of underlying consumption met by CER	2022-23: 12%	16%	23%	18%
Share of electricity emissions in economy-wide emissions (NEM states only)	CY2021: 36%	1%	1%	9%
Estimate of NEM emissions production (MT CO_2-e)	CY2021: 132	2	1	22

Note: Totals tabulated above may not tally due to rounding.
A. For the purposes of this table, the 'maximum potential electrification' reflects the 2050 electrification forecast for the *Green Energy Exports* scenario. This scenario assumes that residential buildings are able to fully electrify by 2050 and that industries that are theoretically able to electrify have adopted those electrification technologies by 2050. In this way, the 2040 electrification values for each scenario can be put into context by comparing to this 'maximum potential electrification' value.

Figure 3 Actual and forecast NEM emission trajectories from multi-sector modelling, all scenarios



NEM could be zero emissions between 2031-36

Table 10 Mapping of scenarios between studies

2023 IASR scenario	2021 WEO scenario	RCP Framework
Green Energy Exports	NZE	RCP1.9
Step Change	SDS	RCP2.6
Progressive Change	STEPS	RCP4.5

AEMO, "2023 Inputs Assumptions and Scenarios Consultation," July 2023. [Online]

Sovereign Manufacturing

Risks	Mitigations	Benefits
Insecure supply chain	• Progressively ramp up requirement for **solar PV, wind turbines, batteries and electronic chips to be be manufactured in Australia**	✓ More jobs ✓ Secure supply chain ✓ Energy security ✓ Reduced carbon footprint
Lack of demand	• Progressively increase the requirement for **usage of green materials domestically** (steel, aluminium, cement, fertilizers); • Reducing iron ore exports while **increasing green steel and aluminium exports** (by diverting the flow of natural resources back to Australia and adding value here); and • Progressively **increase fuel efficiency standards** for private, commercial, industrial, military vehicles, maritime shipping and aviation	✓ Lower emissions ✓ Higher GDP by exporting value-added products instead of ore ✓ Increased adoption of low emissions technology
Insufficient workforce	• In consultation with TAFEs, VETs, universities and professional peak bodies, **conduct appropriate workforce planning** to develop education, upskilling and transition programs for workers from all industries	✓ Full employment

Sovereign Manufacturing

Risks	Mitigations	Benefits
Lack of social license	• Create codes of conduct for **communication and consultation** with land owners, local communities and native title holders	✓ Better opinion polls
Patchwork implementation	• **Ensure that AEMO is sufficiently funded** and staffed to coordinate the delivery of Renewable Energy projects and approve grid connections in a timely manner	✓ Coordinated implementation ✓ Better energy security

Sovereign Manufacturing

Opportunities	Actions	Benefits
Investment returns	• Reinvest in other existing Government programs such as ARENA, the $100m Australian-made Battery Plan, the National Reconstruction Fund, the Hydrogen Headstart Program etc	Turbocharge the economy by: ✓ Increasing research, development and deployment of solar, wind, batteries, hydrogen electrolysers ✓ Lower cost green steel, green aluminium, green cement, fertilizers ✓ New technology such as virtual power plants, micro-grids ✓ Cheaper energy →cheaper hydrogen and therefore ammonia and sustainable aviation fuels (SAF) ✓ Ensuring a circular economy of renewable energy (refurbishing, remanufacturing and recycling of solar PV, wind turbines and batteries as they reach their end-of-life)
Savings from economies of scale		

Policy Recommendations

Ensure that Australia becomes a renewable energy superpower able to participate in the forecasted $1 trillion per year hydrogen industry by 2050.

1. **Fund the CEFC with $276 billion over the next 27 years to co-invest in renewable energy generation capacity**
2. **Progressively increase the requirement for the renewable energy supply chain to be based in Australia**
3. **Stimulate demand for green hydrogen through green building standards, green exports and better fuel efficiency standards**
4. **Conduct appropriate workforce planning**
5. **Ensure high levels of consultation with land owners, local communities and native title holders to secure social license for new projects**
6. **Ensure AEMO is sufficiently funded and staffed; and**
7. **Reinvest returns into other existing Government programs**

Together, these actions will turbocharge Australia's jobs and economy whilst adapting to climate change and rapidly reducing our carbon footprint.