

Australia 's Electricity Generation update

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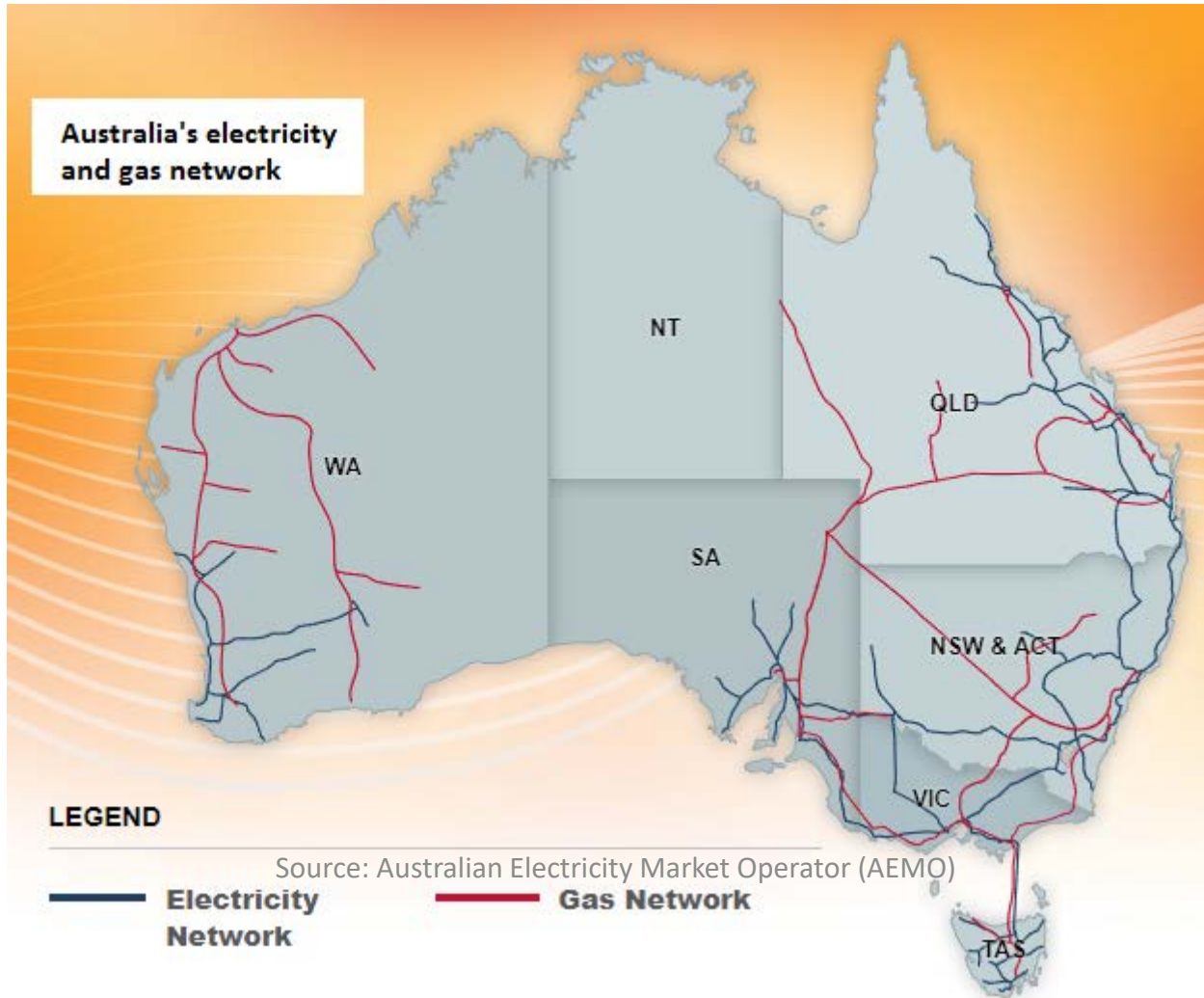
Australia

Quick Numbers

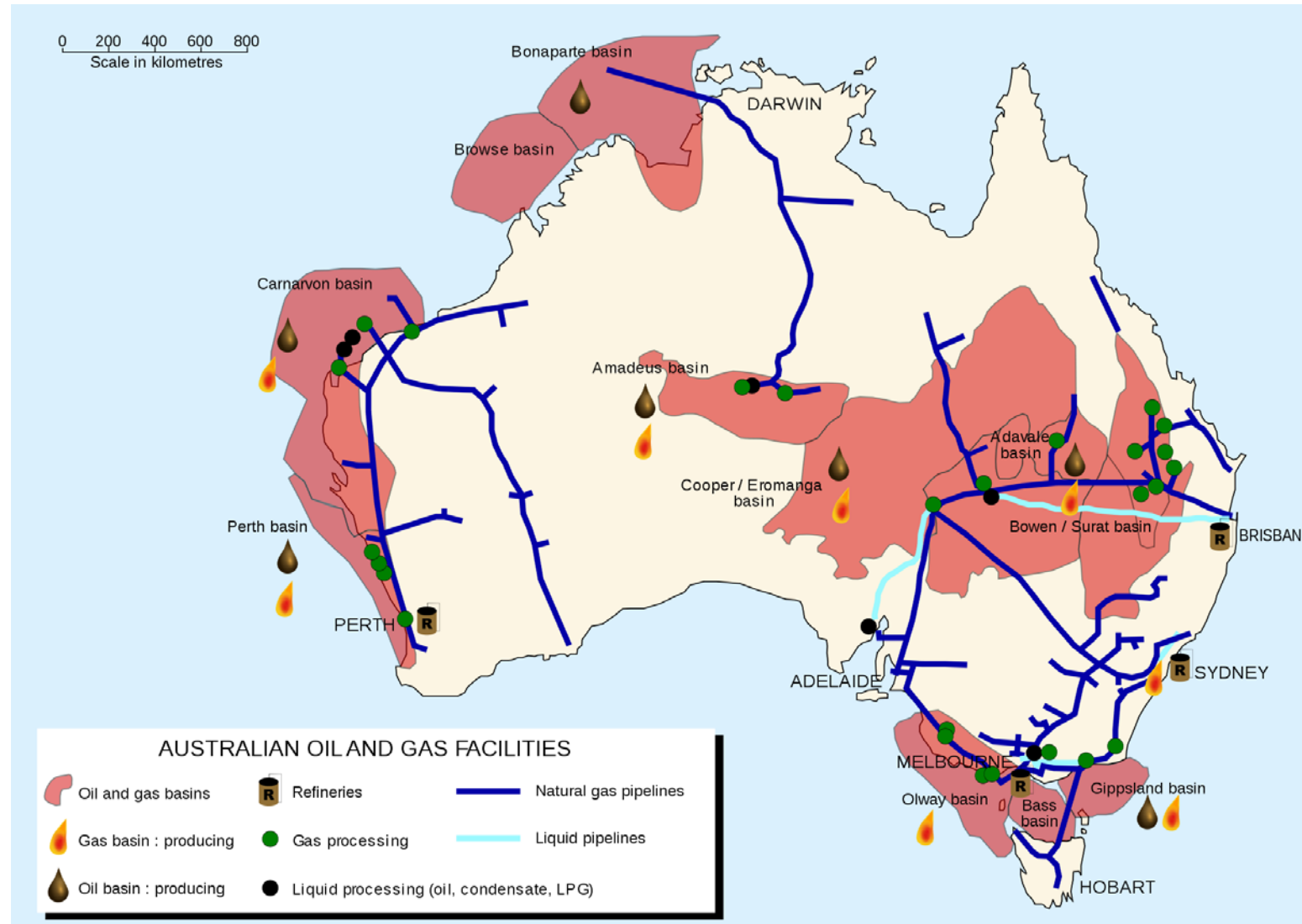
- **Pop:** 25 Million people
- **Land:** 7.68 million km²
- **GDP:** USD 1.3 Trillion
- **Electricity use:**
~10,000 kWh pp. pa.
- **Elec. Production**
260 TWh



Electricity and Gas Network



Gas Resources



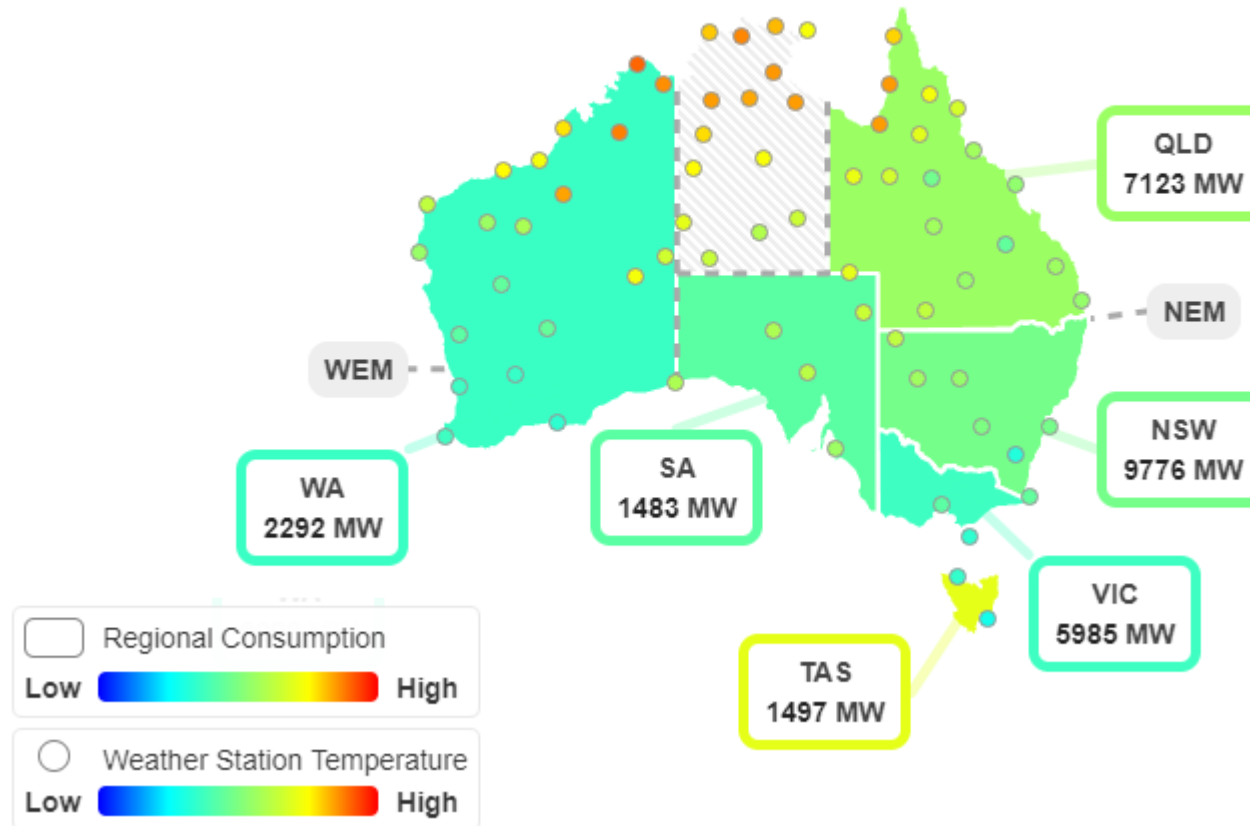
Electricity Consumption



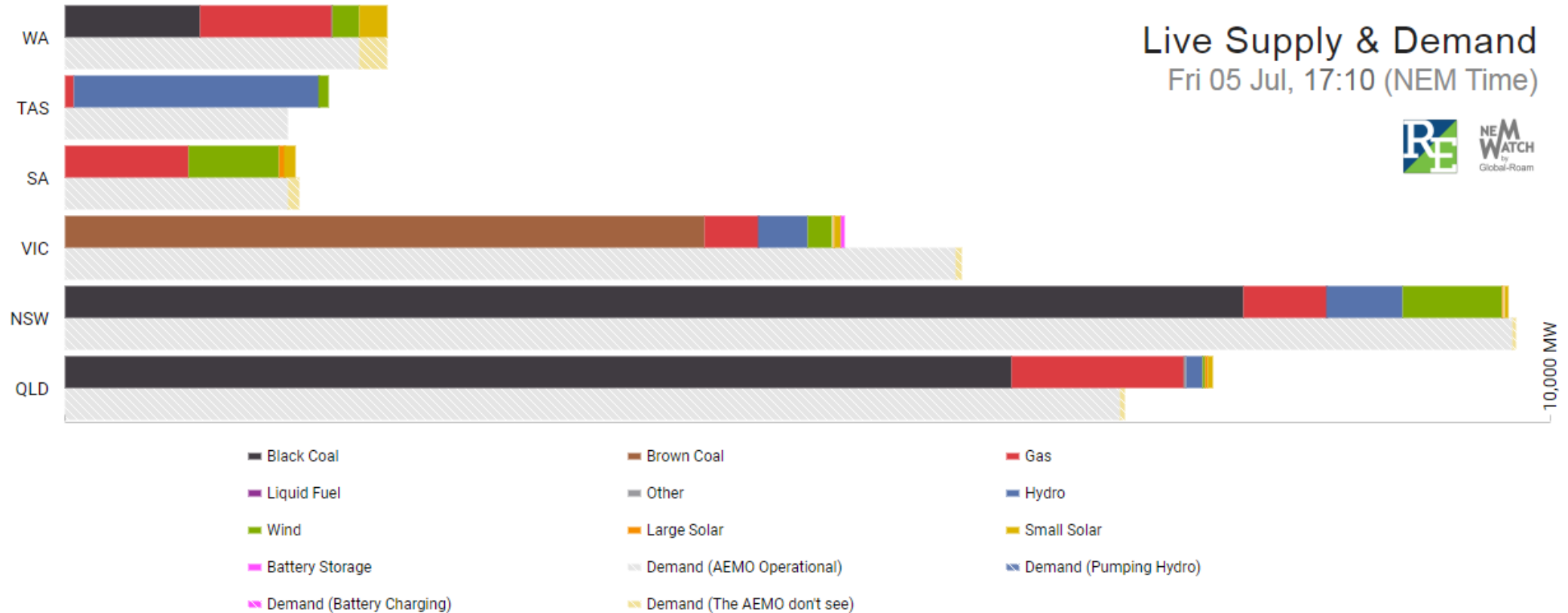
Live Electricity Consumption
sponsored by ECA



Live: Fri 5th Jul 19 17:03 UTC +10:00



Peak Usage



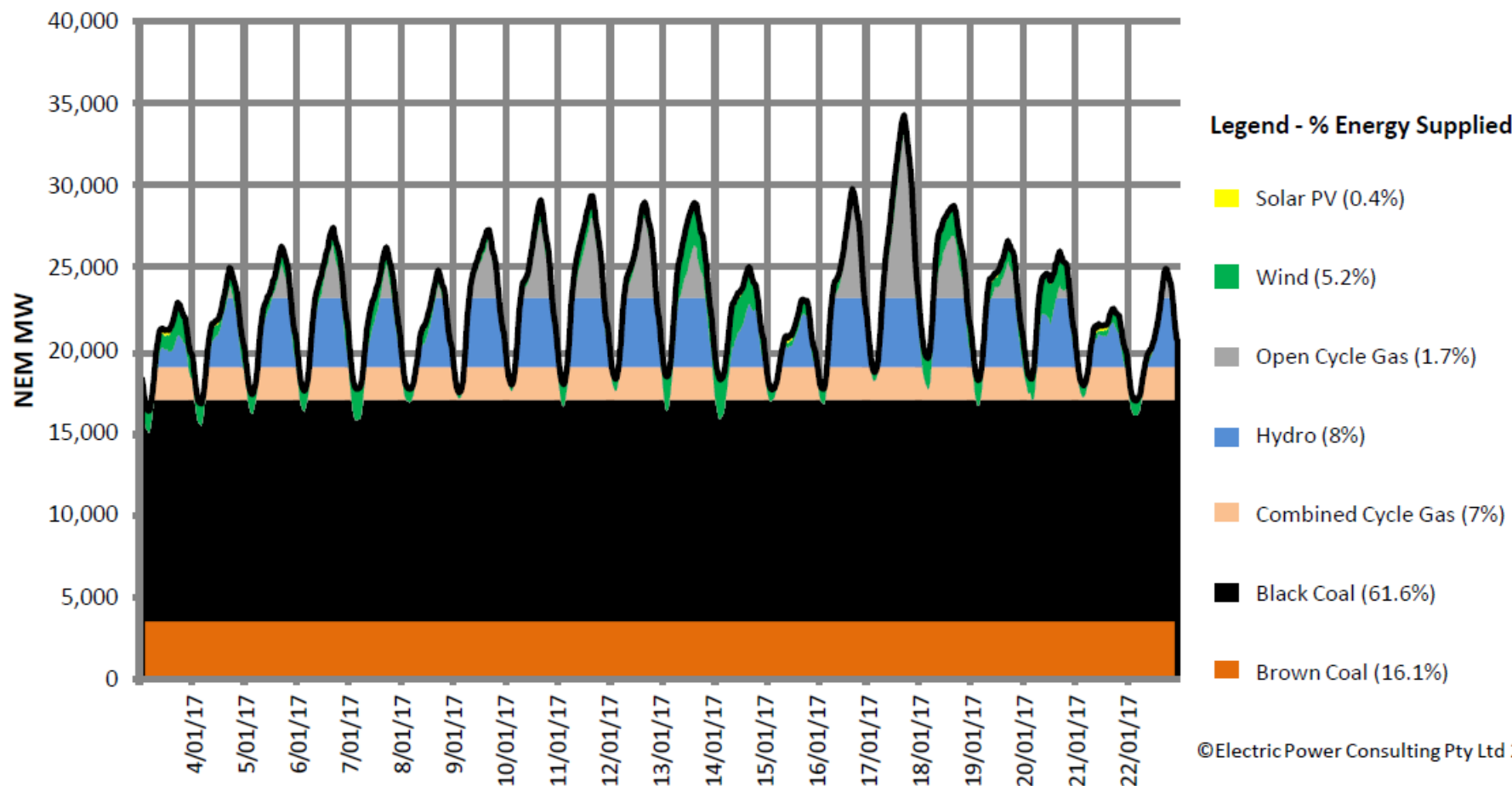
NEM Generation Capacity 2016-17

	Coal	Gas	Water	Wind	Solar	Biomass	Storage	Other	Total
NSW	10,160	2,283	2,706	1,307	452	163	0	9	17,080
VIC	4,630	2,461	2,288	1,496	6	57	0	0	10,938
QLD	8,186	3,698	738	12	365	419	0	1	13,420
SA	0	3,141	4	1,809	122	20	100	145	5,341
TAS	0	386	2,287	373	0	5	0	0	3,051

Total: 49,830 MW

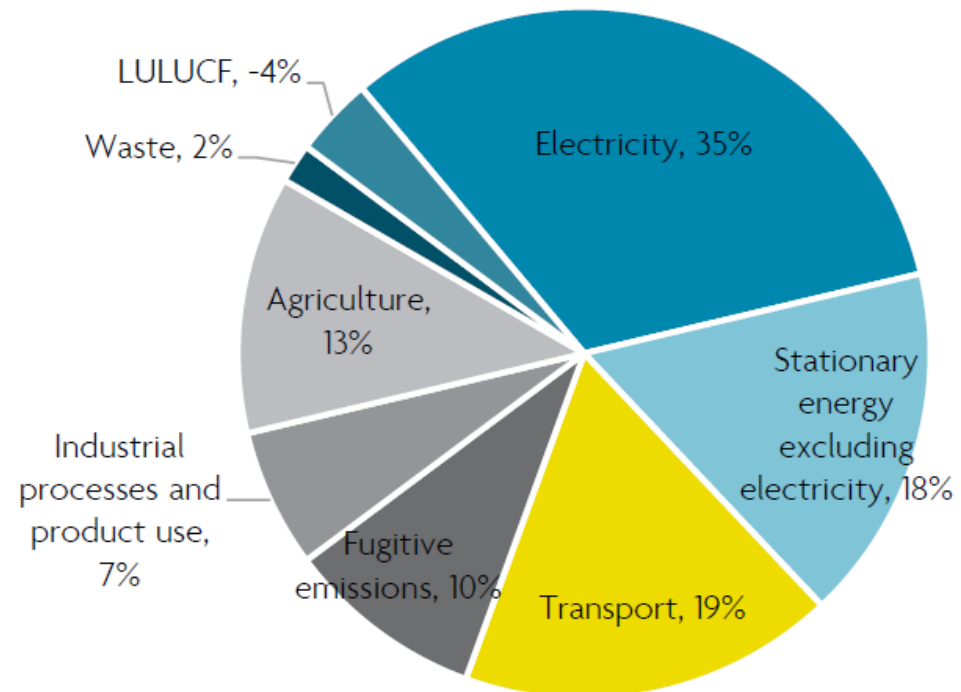
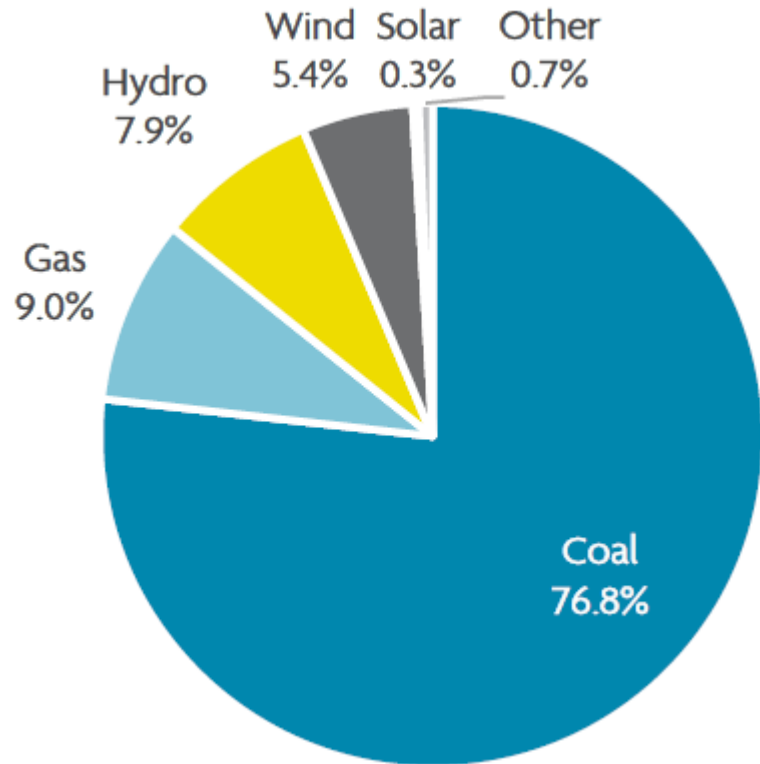
Demand and Supply

Existing NEM approximation

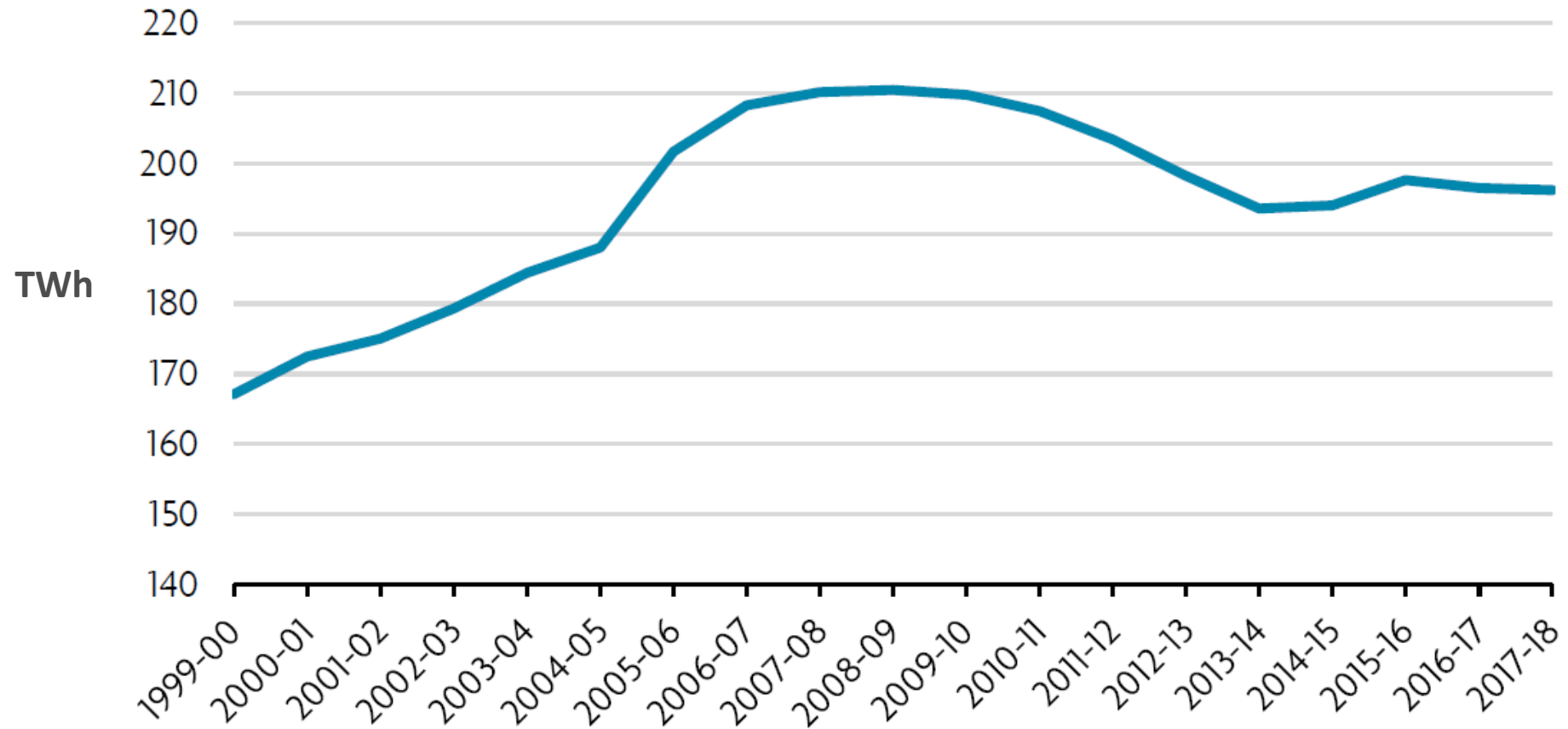


■ SLCOE	=	68.87	\$ / MWh
■ Base transmission & distribution cost	=	142.25	\$ / MWh
■ Total delivered cost	=	211.12	\$ / MWh

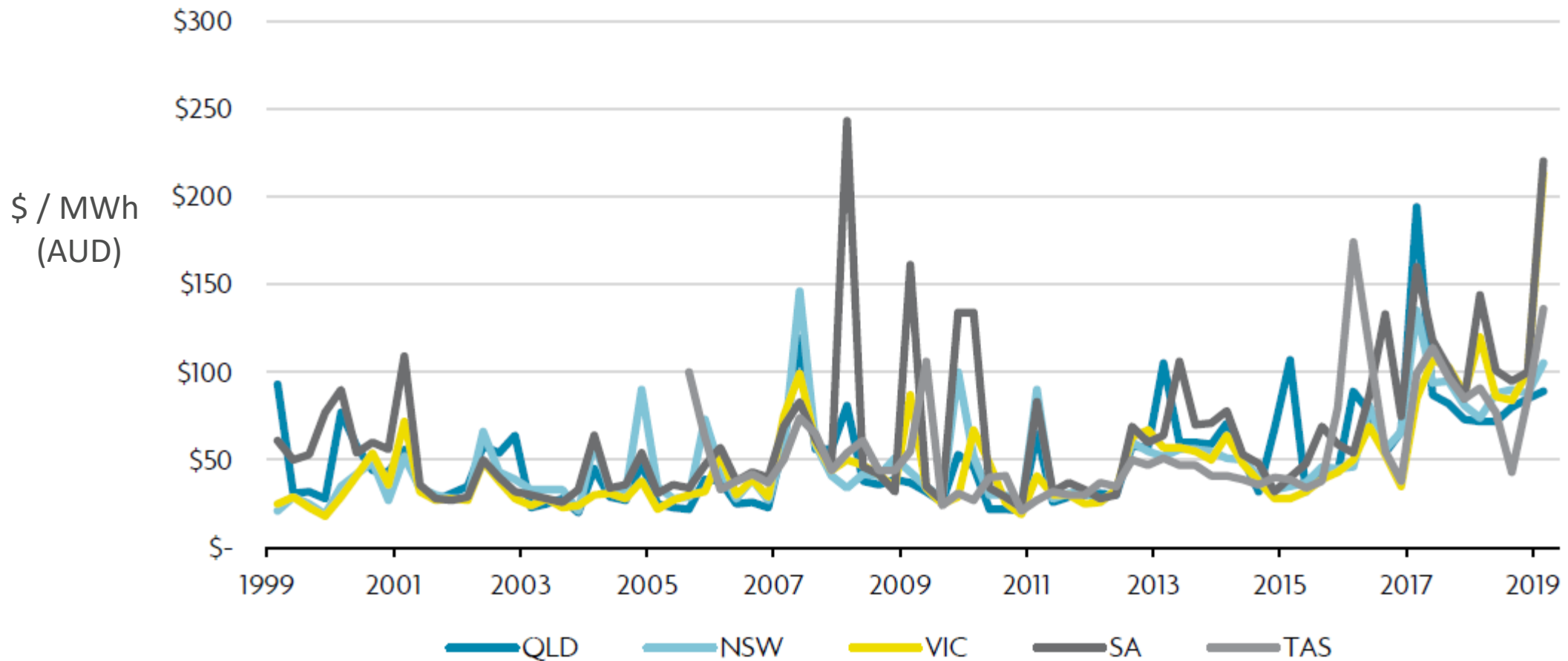
Generation Mix & Emissions by Sector



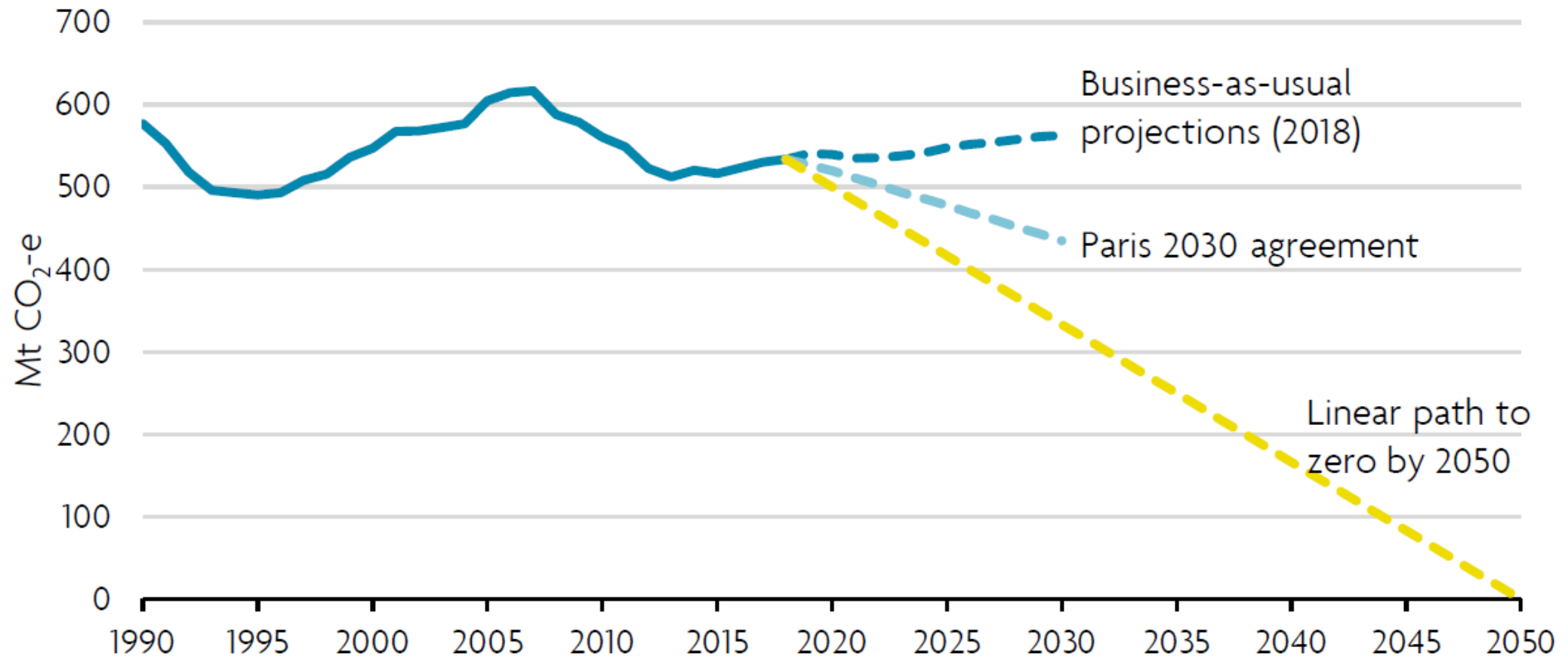
NEM Electricity Demand



Av. Electricity Spot Price



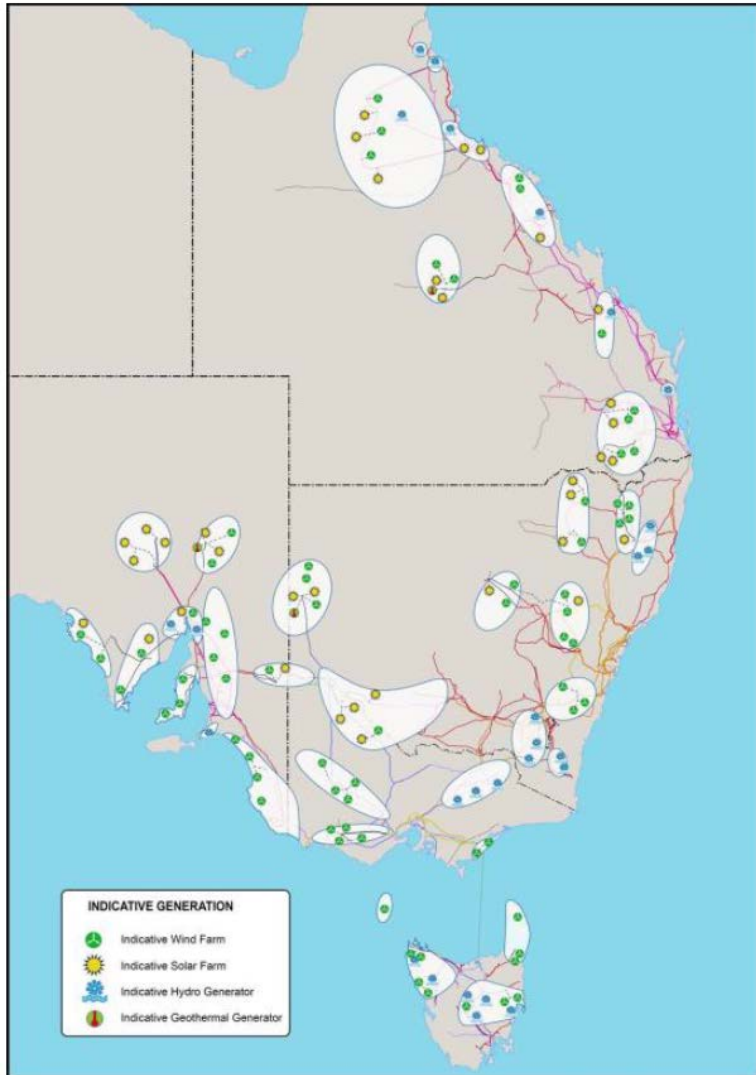
Australian Emissions



State Targets (non binding)

	% renewable	% solar households	Renewable capacity (kW) per capita	Renewable energy targets	Net-zero emission targets
TAS	96	14	0.7	100% by 2022	Net-zero by 2050
ACT	77	14	1.1	100% by 2020	Net-zero by 2045
SA	53	32	1.1	-	Net-zero by 2050
VIC	21	16	0.3	40% by 2025	Net-zero by 2050
QLD	10	33	0.1	50% by 2030	Net-zero by 2050
NSW	15	18	0.2	-	Net-zero by 2050
NT	4	14	0.1	50% by 2030	-
WA	16	27	0.2	-	-

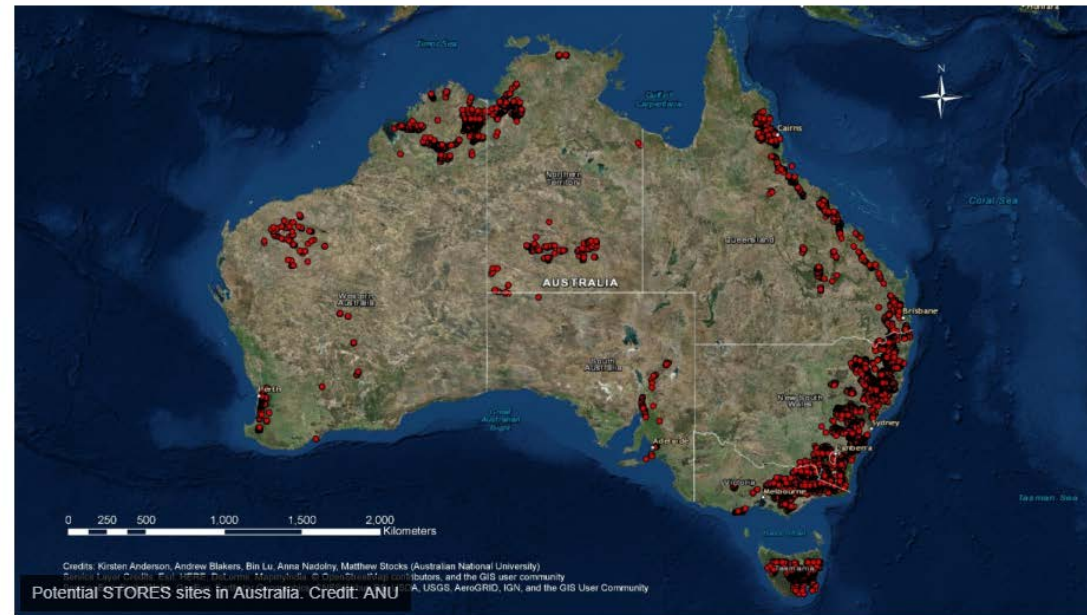
Renewables & Storage



Possible “renewable energy zones” (AEMO)

ANU finds 22,000 potential pumped hydro sites in Australia

21 SEPTEMBER 2017



The Australian National University (ANU) has completed an audit of 22,000 potential sites across Australia for pumped hydro energy storage, which can be used to support a secure and cheap national electricity grid with 100 per cent renewable energy.

The zero-emissions grid would mainly rely

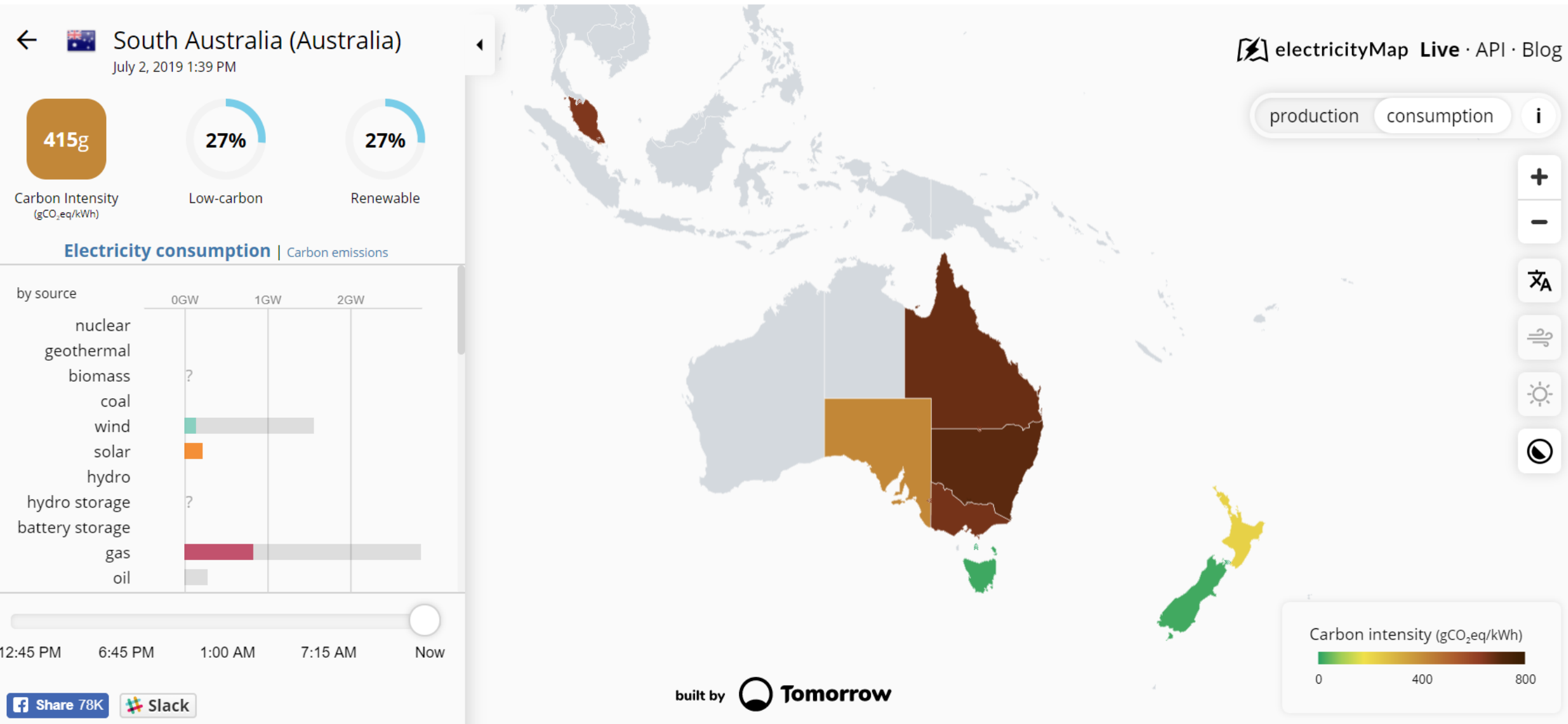
“Fast tracking the development of a few of the best sites by 2022 could balance the grid when Liddell and other coal power



For journalists

Australia: Real time electricity

- SA



Tasmania (Australia)

July 2, 2019 1:39 PM

22g

Carbon Intensity
(gCO₂eq/kWh)

100%

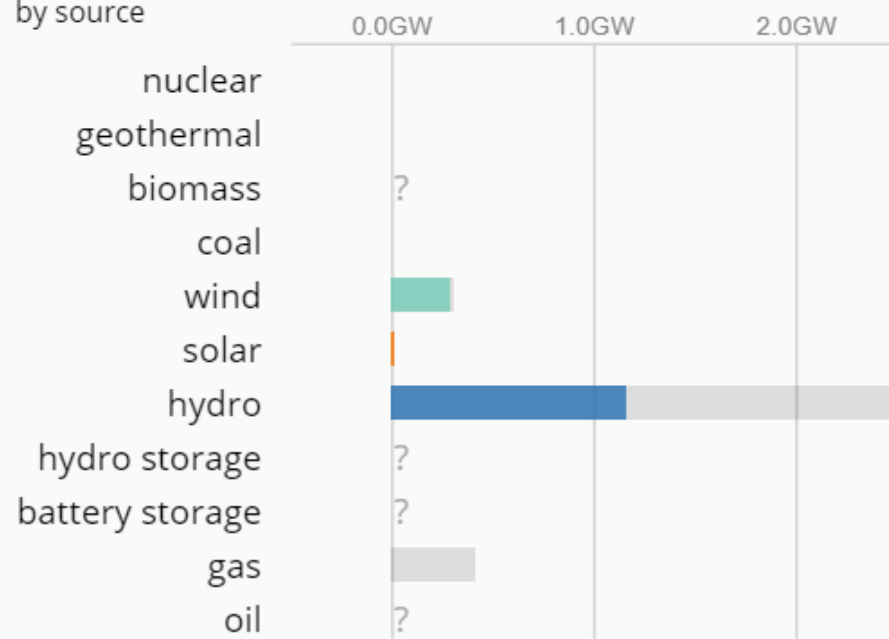
Low-carbon

100%

Renewable

Electricity consumption | Carbon emissions

by source



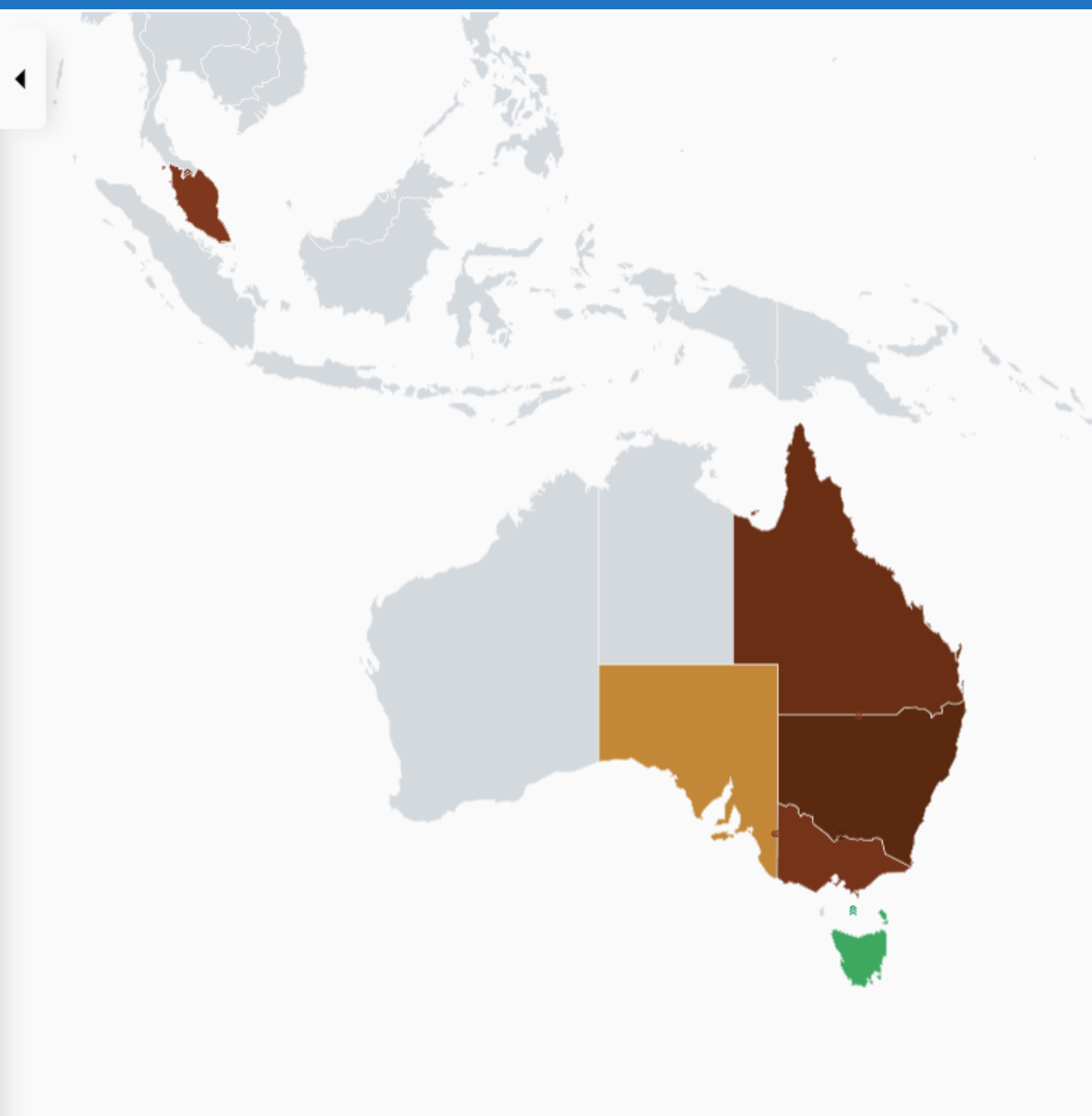
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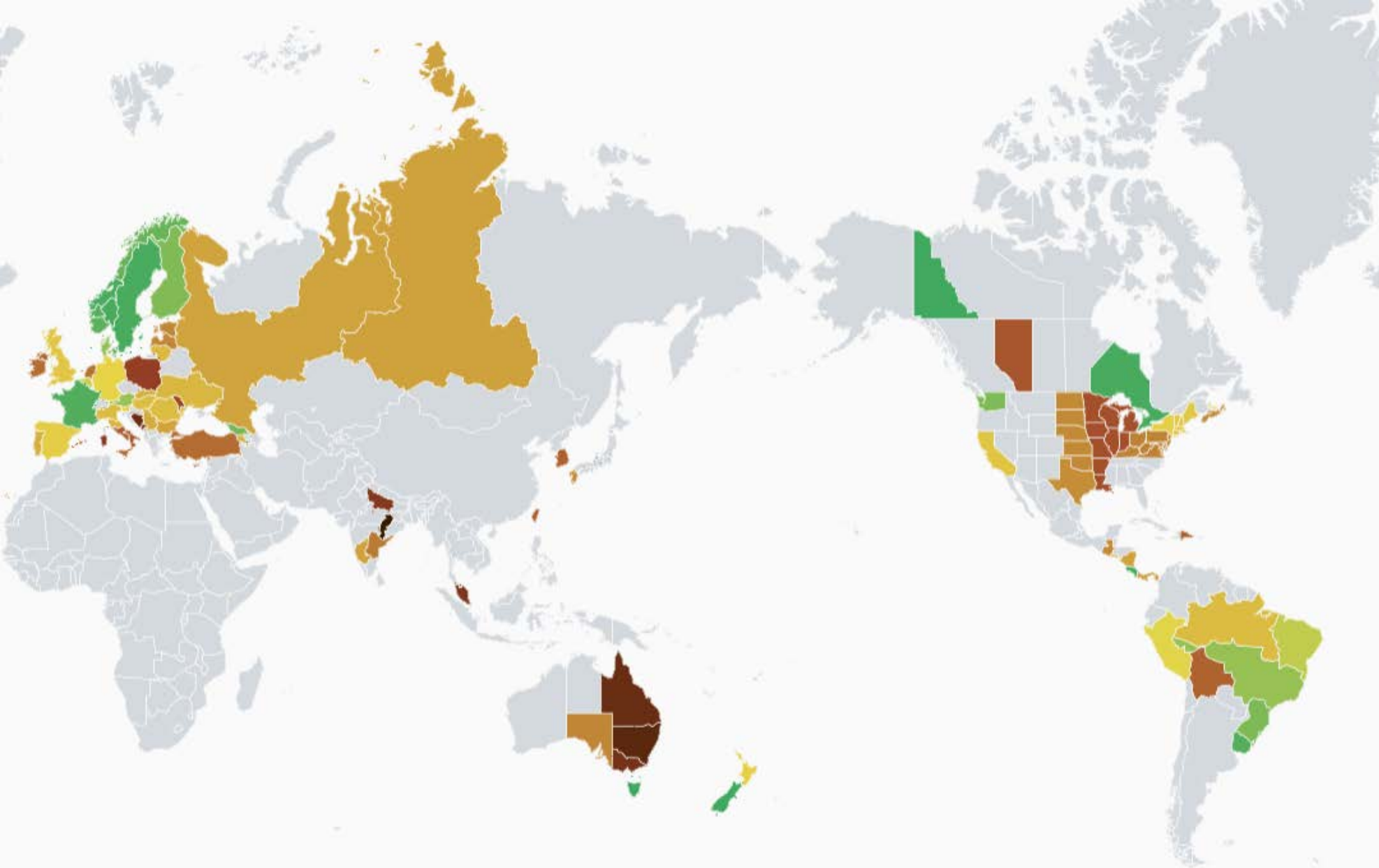
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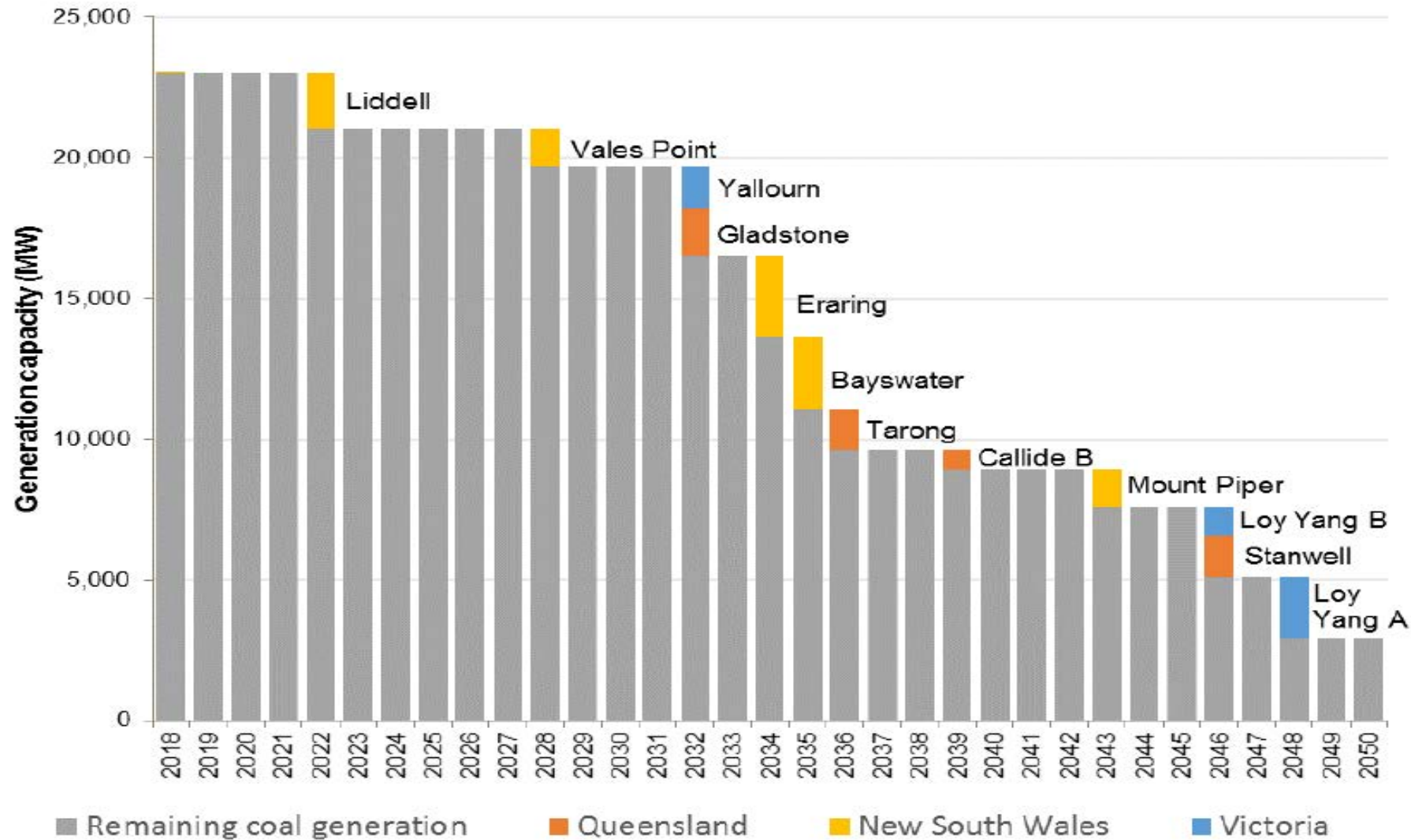
Now





World Perspective

Energy Transition is Coming



NEM coal generation fleet operating life to 2050, by 50th year from full operation or announced retirement (AEMO)

Nuclear power is prohibited in Australia

NUCLEAR LAW

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 prohibits certain **nuclear** actions specified in s.22A unless a federal approval is obtained. It specifically prohibits **nuclear power** generation in s.140A



THE NUCLEAR OPTION

An Industry
Super paper says
we need long-
term power plans

GRAHAM LLOYD

ENVIRONMENT EDITOR



In the opening scenes to *The Smartest Guy in the Room*, a documentary that traces the collapse of US energy trading giant Enron, there are several accounts of what went wrong.

Enron was a \$US63 billion company that grew quickly but imploded in an instant after making profits from gaming the Californian energy squeeze two decades ago.

Australia provides a blueprint for patient capital in the energy sector.

Superannuation is a natural fit for long-term infrastructure investment and has been a big supporter of renewable energy projects with mixed results.

The discussion paper seeks to strip away the ideological baggage to set out an over-the-horizon view of where Australia's energy market may be heading.

It is critical of the chaotic nature of government policy and sets out where governments should have started with efforts to decarbonise the energy system.

The document is technology neutral.

Controversially, it says nuclear must be considered part of the mix.

Energised debate

The super fund discussion paper does not set out to push nuclear but it has arrived as the issue is gaining renewed traction in Australia's energy debate.

solve it," he says.

NSW Deputy Premier John Barilaro has called for a national vote to end the ban and says the northern cities of Tamworth or Armidale could be the site of a new nuclear power station.

Scott Morrison says he won't oppose nuclear if the economics stack up but no one is offering to build a reactor in Australia.

Advocates of the nuclear option are playing a long-term game.

In April, OECD Nuclear Energy Agency director general William Magwood made his first official visit to Australia. He met the energy ministry, the Australian Safeguards and Non-proliferation Office, the Australian Radiation Protection and Nuclear Safety Agency, the Australian Nuclear Science and Technology Organisation and the Energy Policy Institute of Australia.

Australia has no nuclear power plants but is the world's third largest uranium producer and holds about 30 per cent of the world's

Arguments for ...

12 Jun 2019

Daily Telegraph, Sydney

Time to Finnish up our fears of nuclear power



Question: Do you think a Greens Party could ever support Nuclear as a solution to our energy needs?

Well, it has already happened — in Finland.

Why haven't you heard about this? Because here in Australia, nuclear is the energy solution that we "dare not speak its name".

Finland, along with its Scandinavian neighbours, is often viewed as one of the world's most progressive first world economies. The Finnish people are world leaders, particularly in the field of technology and have never been afraid to go it alone if they think it is the right thing to do for their people and the global environ-

clear fuel needed that powers large conventional reactors.

They can be placed in remote areas (unlike old reactors that need to be near large water catchments) and can be buried to withstand almost any physical or natural disaster.

They can be mass-produced in an off-site factory, shipped to locations, and then assembled. Such a production line also results in cost efficiencies making them more affordable.

Technology is also contributing to major advances in the use of nuclear waste with none other than Bill Gates leading the charge.

Gates, universally acknowledged for his work in the humanitarian field, is a major investor in the firm TerraPower. TerraPower develops technologies that allow new reactors to use the spent fuel from old reactors,

which will eventually be decommissioned.

to all research and development on low carbon technologies that respect the environment".

Green Party chairman Touko Aalto told the Finnish daily Helsingin Sanomat, "Before, and until today, people resisted nuclear energy for ideological reasons".

From now on, the program urges that "green economic policy (be) based on sustainability and reason", and that the ecologically minded must work with the market economy to promote their objectives.

According to Aalto, the "wellbeing of humanity" is now considered to be of the highest importance.

The "wellbeing of humanity" — that sounds like a pretty good goal to me.

John Barilaro is Deputy Premier and NSW leader of the Nationals

...and against

04 Jul 2019

Sydney Morning Herald, Sydney

You've seen the TV series, now understand Chernobyl isn't over



It is more than three decades since the world's worst nuclear accident, but it will poison generations to come, writes **Helen Caldicott**.

It is 33 years since the radioactive accident at Chernobyl. The HBO miniseries *Chernobyl* has re-awakened interest in this dreadful moment in history. But Chernobyl is by no means over. And with commentators once again flagging the idea of overturning Australia's long-standing opposition to a home-grown nuclear industry – and even suggesting our own nuclear weapons – it is timely to revisit Chernobyl's consequences.

The Chernobyl death toll is highly contentious, from the absurdly low 31 following the initial blast trauma to 4000 (the conclusion of a joint consortium of the United Nations and the governments of Ukraine, Belarus

overwhelming", according to the noted evolutionary biologist Tim Mousseau.

Millions were initially exposed to very high doses of radiation from short-lived isotopes. But the report indicates that medical effects will continue to affect millions of exposed people because 40 per cent of the European land mass is polluted, and will remain contaminated for thousands of years by long-lived isotopes – plutonium 239, 238 and 241, americium 241, cobalt 60 and technetium 132. Parts of Turkey and Britain also received high fallout, which affected their crops and livestock.

A large body of literature now records the medical impact. In Belarus and

in babies who were in utero at the time of the accident. Embryologist Wladimir Werteleki recorded high cases of microcephaly and microphthalmia in babies and severe neural tube defects in Ukraine related to very high levels of cesium 137 and 134 in food eaten by pregnant women. Increased cases of congenital cataracts, retinal pathology

and adult cataracts occur in many European countries. The study indicated thyroid carcinoma arose two to four years after the accident, increasing to 7000 cases in Belarus by 2000 and, despite surgery, 30 per cent had metastasised. Congenital thyroid cancer in newborns was documented.

Nuclear activities

1. **Australia supplies 10% of the world's uranium with 30% of global reserves**
2. **National Radioactive Waste Management Facility (NRWMF) work ongoing**
3. **Gen IV Forum activities in HTGRs and MSR ongoing**
4. **Uranium Mining and Nuclear Facilities (Prohibitions) Repeal Bill 2019. – underway**
<https://www.parliament.nsw.gov.au/committees/inquiries/Pages/inquiry-details.aspx?pk=2525>
5. **Nuclear Fuel Cycle Royal Commission (South Australia, 2016) – positive findings**
6. **OPAL (20 MW_{th}) research reactor - 300 operational days p.a.**



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Thank you

Questions?