



Matching the pace of transformation

SIEW October 2017

Dr Tony Marxsen, Chairman AEMO

Our vision

To deliver energy security for all Australians, and meet the changing needs of the market by involving multiple jurisdictions, participants, and communities.



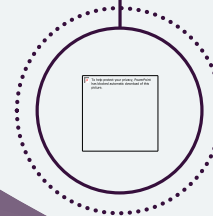
We operate Australia's National Electricity Market and power grid in Australia's eastern and south-eastern seaboard, and the Wholesale Electricity Market and power grid in south-west WA.



We also operate retail and wholesale gas markets across south-eastern Australia and Victoria's gas pipeline grid.



We are a company with three control centres and multiple offices across five States. Our costs are recovered through fees.



Ownership

40%

Market participants

60%

Governments of Australia

Overview of the Australian power system

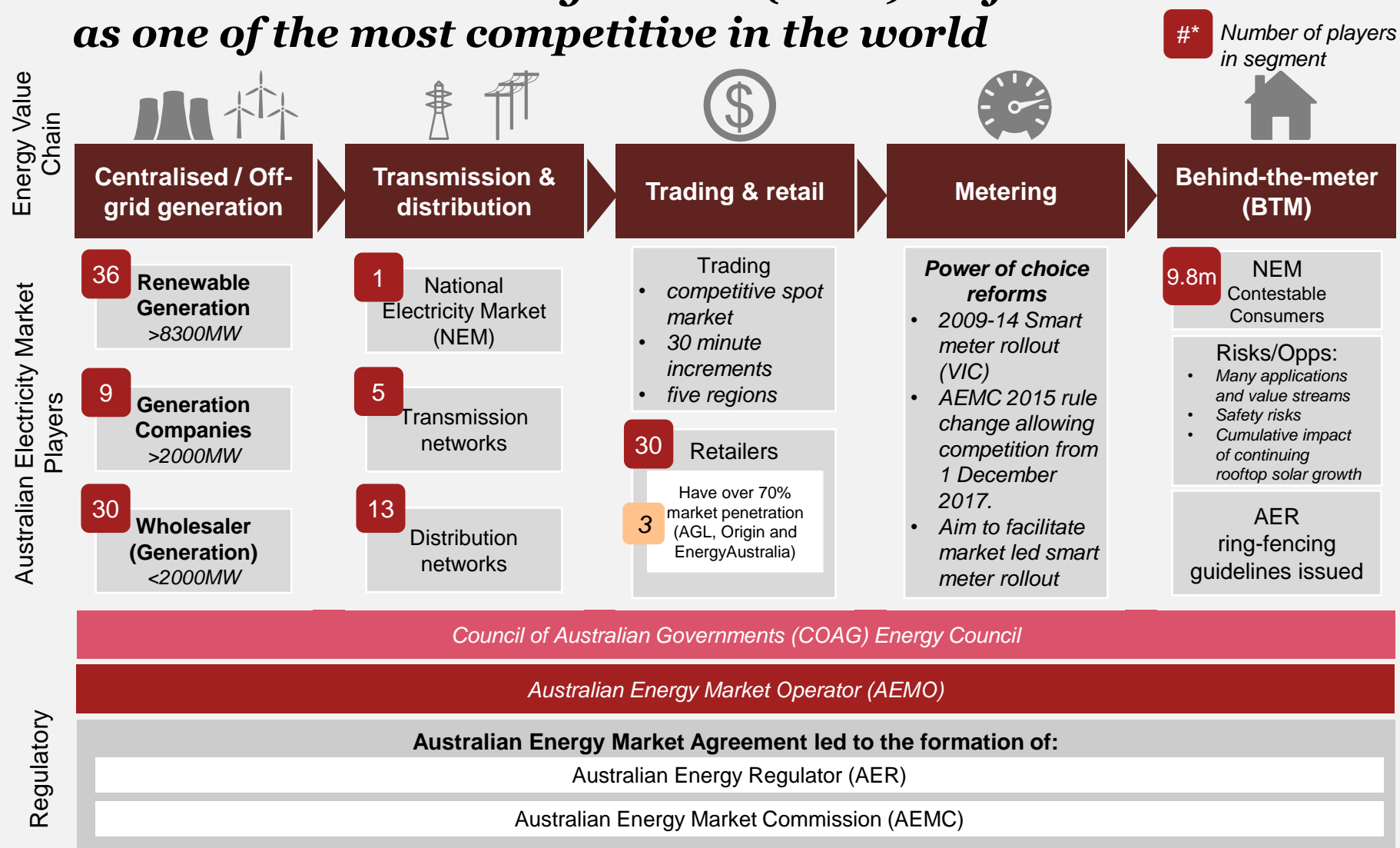
The National Electricity Market and Wholesale Electricity Market

- The National Electricity Market (NEM) Wholesale Electricity Market (WEM) in Western Australia incorporates around 48,000 km of transmission lines and cables.
- It supplies about 220 terawatt hours of electricity to businesses and households each year.
- It supplies around 11 million connections.
- It has a total electricity generating capacity of more than 50,000 MW.

Australia's gas markets

- AEMO operates the Retail and Wholesale Gas Markets across South-Eastern Australia.
- Australia has a growing LNG export industry, making up the largest portion of domestic demand.

The National Electricity Market (NEM) is often described as one of the most competitive in the world



The Australian energy industry changed on 28 September 2016

Black system event - with a state losing power, impacting 1.8 million Australians



- Loss of three transmission lines (tornado wind speeds 190-260km/h)
- Six system faults, protective settings activated, disconnection of wind farms, 465 MW loss
- Heywood Interconnector compensated, safety protection measures activated, 900 MW from Victoria to SA lost.

FINKEL VISION OF A CLEAN WORLD

Power play The Chief Scientist has plotted a masterly path for the country's energy future, writes Ben Potter.

Business has spoken. Large companies are desperate to end the impasse over energy policy that has given Australia the costliest and dirtiest energy in the Western world, and see Alan Finkel's energy stability plan become a reality.

The decade of dysfunction has claimed three prime ministers and bewildered most of the nation's businesses and many households – who are getting on with installing solar panels, starting to embrace batteries and looking forward to their political leaders embracing a clean-energy future.

Business is virtually unanimous in supporting Finkel's plan for a clean-energy target modelled on one former Prime Minister John Howard took to the 2007 election. Finkel's version would favour wind, solar and gas power over coal power and other measures to stabilise the power grid, such as mandatory firm – likely to come from batteries – supply for new wind and solar projects.

About 1.7 million households have solar panels on their roofs, the highest penetration in the world.

A Lowy Institute poll finds that 81 per cent of voters polled believe Australia should focus on renewable energy, even if it costs more, and only 17 per cent want a focus on the traditional sources of coal and gas. Fifty-seven per cent believe climate change is a

critical threat, up from 46 per cent in 2014.

Yet the coal industry isn't going without a fight. Coal supplies two-thirds of our power, renewables only about a fifth, but the positions will be virtually reversed by 2050. Domestic coal power is only a small customer alongside our export industry – but coal power is symbolic for the coal industry.

The Minerals Council is noisily fighting coal's corner, spending millions of dollars advertising the benefits of so-called "clean coal", lobbying for federal funding for a high tech coal plant to be built in Australia, labelling Finkel an "anti-coal" zealot.

Their pained response confirms what Finkel and the power industry are telling us. Even the most efficient new coal power plants are unbanksable in Australia because they are costly and their future carbon liability is unquantifiable.

Coal power has served us faithfully for decades but is a "legacy technology", EnergyAustralia's Mark Collette says. Carbon capture and storage, the hope of the side a decade ago, is still unviable, Energy Council chief Matthew Warren says.

Finkel confirms that wind and solar energy generate electricity more cheaply than new coal plant, even without a carbon price.

Finkel and win

costs are stable. Rooftop solar already pays its way and residential batteries are approaching break even. Distributed energy will supply 35 per cent of our electricity by 2040, Bloomberg New Energy Finance projects.

The Minerals Council is a tenacious foe, most famous for its ruthless campaign against Labor's mining and carbon taxes. It has influential allies – led by former prime minister Tony Abbott – even if they are in a minority.

They will be doing their best to turn the conversation back to the legacy our fossil fuel economy bequeathed on the nation: cheap abundant power, big resource processing industries and export wealth.

They won't be underestimated by Finkel or Energy Minister Josh Frydenberg.

But the economics of energy have changed. The really cheap coal power Australia enjoyed from the

1960s to the 1990s is gone. Finkel told disbelieving senators at a hearing last week.

That is why smelter operators such as Glencore, Rio Tinto (Tomago Aluminium), and Alcoa (Portland Aluminium) are threatening to shut plants that have become unviable at current electricity prices without subsidies.

The belief that we can bring back the past is

US firm to build SA solar plant

Simon Evans

United States company Solar Reserve will construct a new \$650 million solar thermal power plant near Port Augusta in northern South Australia, after winning a bid to supply the state government with electricity for its own power needs.

The South Australian government went out to tender for a long-term contract for the supply of 75 per cent of the power required by state government agencies and users in late 2016, in a push to entice a new operator into the fragile South Australian market.

Solar Reserve was announced on Monday as the winner of the contract by South Australian Premier Jay Weatherill, and will build what is known as the Aurora Solar Energy Project.

He said it would have an influence on energy markets because it would put downward pressure on electricity even before it was fully up and running, because other operators would factor its output into their future planning.

Solar Reserve aims to begin construction in 2018, with the project to be completed by 2020. It uses thousands of mirrors to reflect and concentrate sunlight onto a central receiver on top of a tower, with the process heating molten salt. The molten salt provides a stored heat source to produce steam to power a turbine that generates electricity.

"This is a massive game-changer for the energy market in this country," Mr Weatherill said in Adelaide.

Solar Reserve has secured a 20-year contract to supply all of the power required by the South Australian government. Mr Weatherill said the state government would pay no more than \$78/MWh over the contract.

It is the third major commercial

announcement made by the South Australian government in the past five weeks as the biggest planks of a controversial \$550 million energy plan announced in March by the state government come to fruition.

The state has been heavily criticised for being too aggressive in the pursuit of renewable energy, driving up the cost of power.

In early July, Elon Musk's Tesla Motors and French wind farm developer Neoen won a landmark tender to supply a 100-megawatt battery to strengthen the South Australian electricity grid. It will be the world's biggest storage battery and is being built near Jamestown.

A few weeks later, on August 1, Mr Weatherill announced that US firm APR Energy had secured the rights to build a 276-megawatt fast-start power plant comprising nine GE TM2500 aero-derivative turbines that sit on large trailers. They will be powered by diesel for the first two years to help pre-

vent summer blackouts, and will eventually move to a permanent site as a fast-start power station turned on only if demand excess supply.

Mr Weatherill said on Monday that the offer from Solar Reserve was the lowest-cost option. "It beat all bids," he said. The Aurora plant will also be able to supply into the broader grid because the government doesn't need all of the planned 150MW output.

The Aurora project would produce synchronous renewable energy that could be dispatched into the grid even when the sun was not shining.

Key points

Premier Jay Weatherill says it will be a massive game-changer for Australia.

The project will begin in 2018, and is expected to be completed by 2020.



SA Premier Jay Weatherill.

► Turnbull's pumped hydro plan to boost electricity output by 50pc

► Extra capacity to power 500,000 additional homes

\$2b Snowy hydro fix for crisis

Phillip Coorey
Chief political correspondent

Prime Minister Malcolm Turnbull will make a dramatic intervention into the energy debate on Thursday by announcing plans for a series of tunnels and power stations that will boost the output of the Snowy Mountains hydro-electric scheme by 50 per cent.

Two days after the South Australian government re-entered the power game by promising to build, own and operate a gas-fired power station, the federal government will pour out to \$2 billion into expanding the iconic power scheme it co-owns with the governments of NSW and Victoria.

Badging the great renewable energy venture as Snowy Mountains Scheme 2.0, Mr Turnbull says the expansion will add 2000 megawatts of renewable energy to the scheme's current output of 4100MW. The extra capacity, to be pumped into the national electricity market, will be enough to power 500,000 additional homes.

It will use pumped-hydro technology that involves using water to drive turbines, then pumping the water back up a hill to a storage dam.

The Snowy scheme, a great post-war job creation project initiated by the Chifley Labor government, was built between 1949 and 1974. It comprises 16 dams, 145 kilometres of tunnels, 80 kilometres of pipes and aqueducts.

options, using existing dams, will all be looked at. The initial favourite model is to use the Tantangara Reservoir and the Talbingo Reservoir.

Mr Turnbull said a feasibility study would be commissioned to examine various sites after which a cost estimate would be prepared. Initial estimates were about \$2 billion.

One source said Victoria and NSW could be asked to help fund it given the value of the company would escalate upon its expansion.

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Biggest wind farm set for Victoria

Nick Lenaghan

German-backed WestWind Energy has submitted plans for a \$1.7 billion wind farm in south-west Victoria, making it the largest such facility potentially in the southern hemisphere.

If approved, the massive Golden Plains wind farm of 231 turbines will generate 3,000GWh of power annually, enough to power 500,000 homes.

Some 39 landholders around Rokewood, south of Ballarat, can expect to earn at least \$3.5 million in annual income combined for hosting the turbines.

The Golden Plains project is among the next generation of wind farms in the pipeline as the state government legislates its own state-based renewable energy target.

The state planning authority is now considering four wind farm projects, along with applications to amend three existing permits.

Adding momentum to the sector two years ago, Victoria limited the setbacks around wind farms to one kilometre, reducing the two-kilometre zone within which land holders could previously veto a proposal.

For WestWind, the Victorian initiatives are helpful but they are not core to the project's business case.

Indeed, for chief executive Tobias Geiger, the Golden Plains project must



stand on its own merits, particularly when energy policy is at the mercy of politicians.

"Renewable energy needs to be an adult now in the energy sector," Mr Geiger told *The Australian Financial Review*.

"That means the less we rely on any government support scheme, the less the risk is of an adverse impact on the investors long-term from a change in regulations."

What makes the massive Golden Plains stack up for WestWind, which has developed other Victorian projects, is the rising cost of traditional energy.

In its business case for the project, WestWind did not ascribe a value for the large-scale generation certificates – a form of renewable energy certificate – that the project will generate. "At that moment our cost of energy is closer to half the market price, because the market price has finally gone to levels that are actually reflective of the true cost of generation with a mix of generators," Mr Geiger said.

Until more recently, wholesale energy prices were relatively subdued, as costs reflected old, fully written-off, coal-fired power stations without taking into account the cost of their replacement, he said.

"Now that some of them get mothballed because they are just too old to keep them running commer-

cially viably, the market price has bounced up," he said. "It is now at levels where investment in new generation capacity actually makes sense again."

Even so, Mr Geiger is keeping a watching brief on the energy debate, as uncertainty lingers over the future of the Finkel Review's clean energy target, and debate rumbles on over extending the life of coal-fired clunkers such as AGL Energy's Liddell plant.

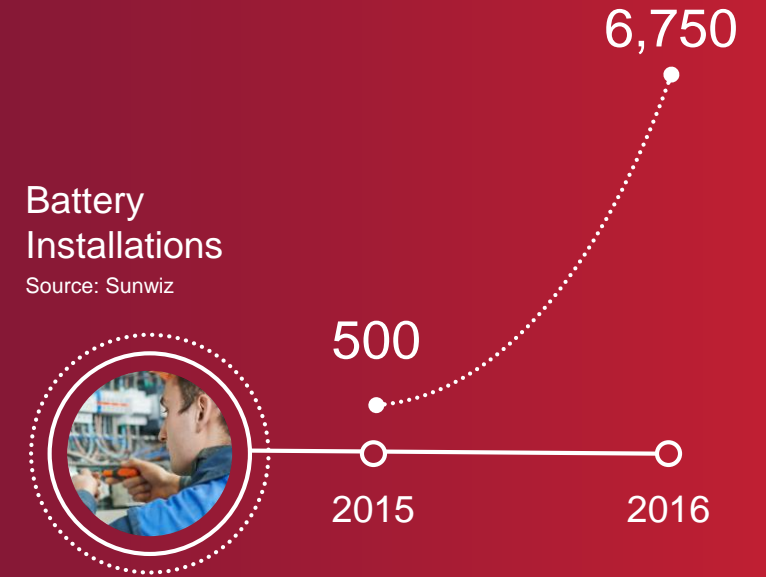
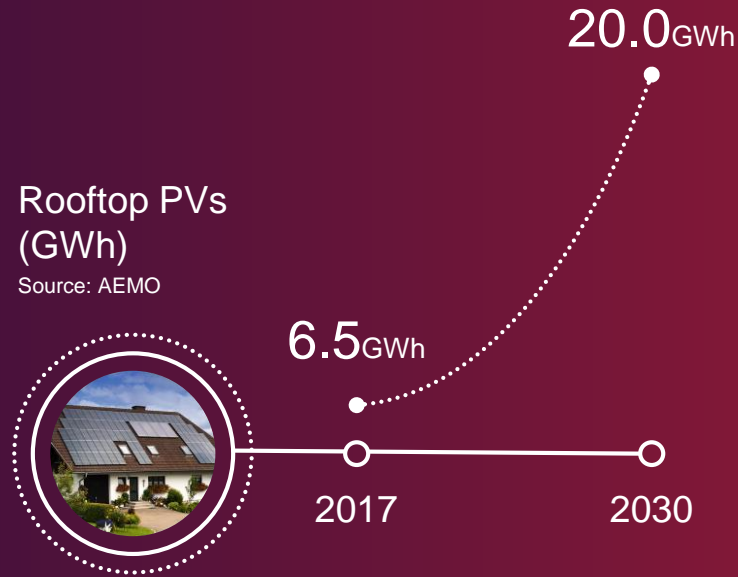
"What we are more afraid of is government doing really stupid things by propping up old coal-fired power stations for them to operate longer," he said.

"That may dilute the market price to a point where investment for the private sector becomes unattractive."

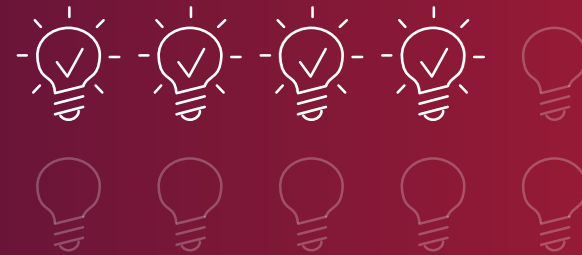
"That would then leave potentially stranded assets, but more importantly would actually lock-out Australia out from the energy transition for a bit longer."

Two-way power grid evolution

Huge growth in customers providing energy back to the grid.



By 2050
customer-owned
generators will supply

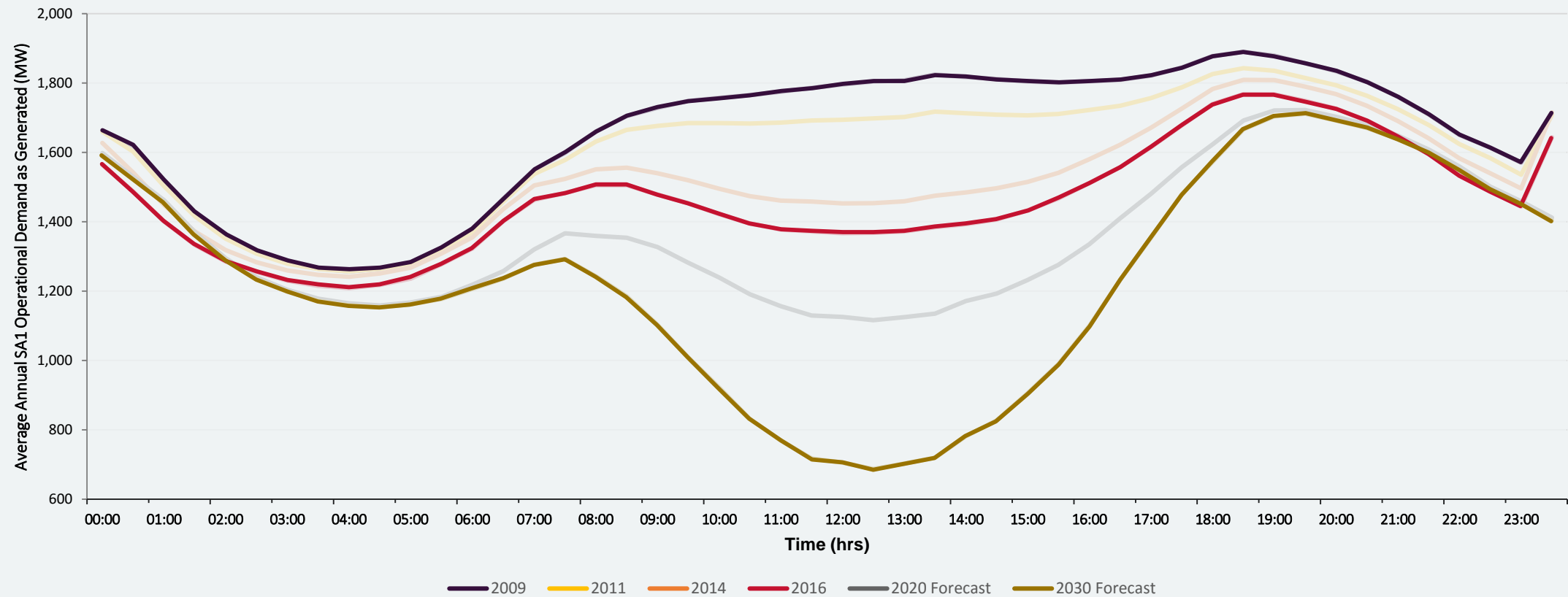


30-45%
Australia's electricity needs

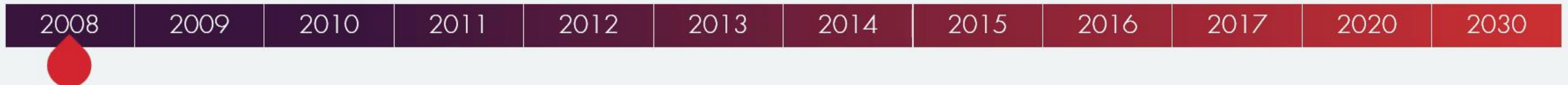
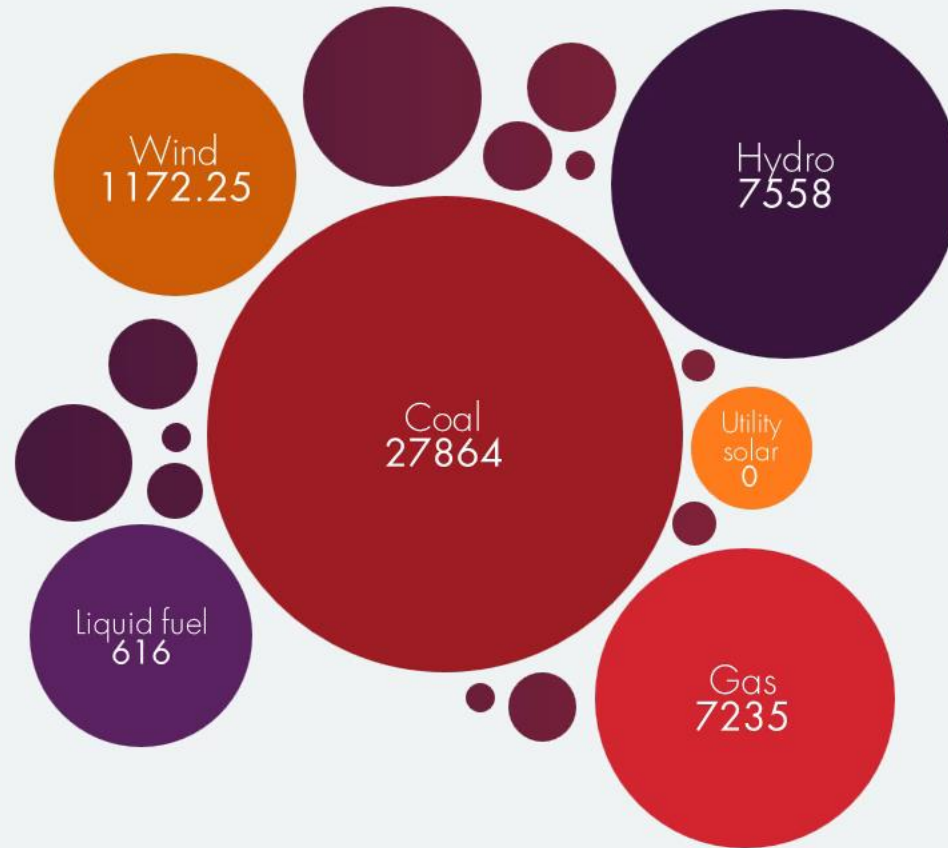
Source: CSIRO

Australia's changing load profile

South Australia daily demand for grid electricity



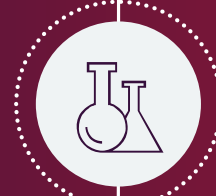
The changing generation mix



AEMO's actions to support the transformation



Frequency and inertia requirements



Operational changes and advanced forecasting tools



Proof of concepts

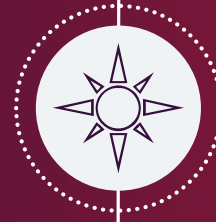


Advice on reserves and need for flexibility



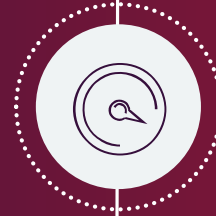
Storage

AEMO is playing an active role in managing the transformation



Australian market has changed rapidly

- with government policy, consumer attitudes and technology all contributing



Reaching a tipping point

- where renewables are becoming cheaper than traditional resources and can be deployed more rapidly



Markets need to value and price supply reliability and security

- inertia, system strength, and dispatchability all need to be considered.