

Smart Energy Conference

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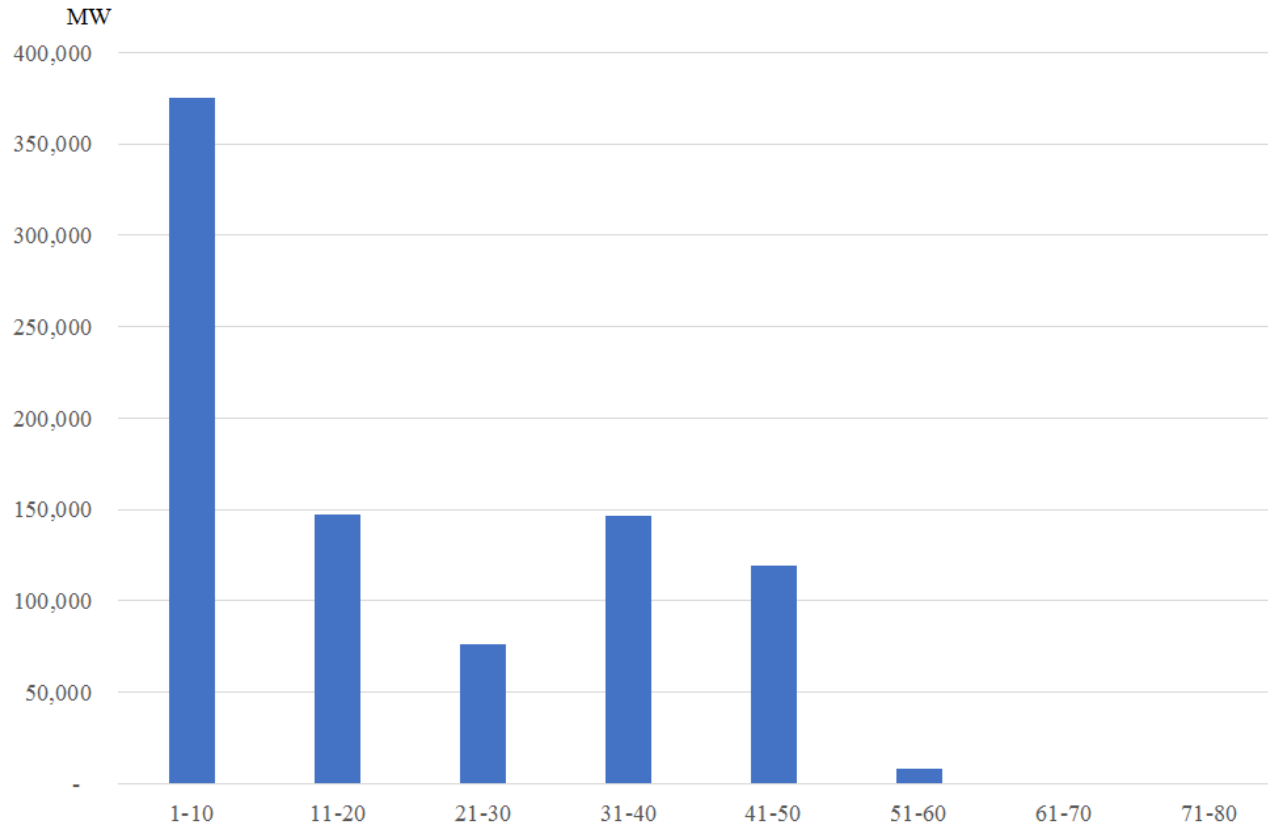


Future of generation – NSW case study



Not many power stations operate beyond 50th year

Internationally, only 1% of power stations in operation are older than 50 years



Source: EPRI (2017) –
excludes China and Russia

Exit and entry – Australia and the US

Australian exit has exceeded entry of ‘firm’ dispatchable capacity since 2013



Year of Exit/Entry	Coal Retirements		Gas Plant Entry			Renewables Entry	
	No. of plant	Capacity (MW)	No. of plant	Total (MW)	CCGT (MW)	No. of plant	Capacity (MW)
2005-2012	2	740	31	8,674	2,546	112	2,640
2013+	9	4,656	4	218	52	49	2,422
Total	11	5,396	35	8,892	2,598	161	5,062
Av. Age		42 years					

Coal-fired generation closure – 18% of fleet

Source: Simshauser (2017)

CGT column is a subset of the total gas capacity column.

Exit and entry – Australia and the US

US entry has significantly exceeded exit – largely a function of low cost gas



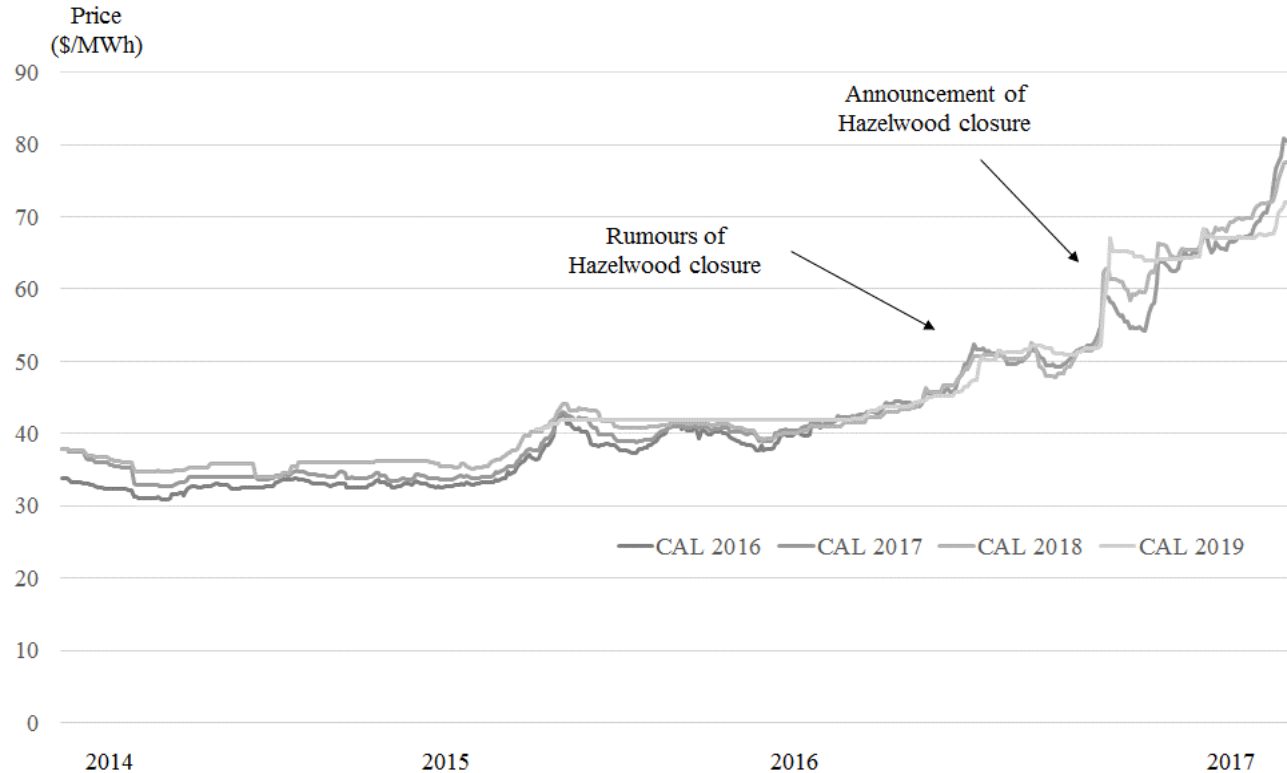
Year of Exit/Entry	Coal Retirements		Gas Plant Entry			Renewables Entry	
	No. of plant	Capacity (MW)	No. of plant	Capacity (MW)	CCGT (MW)	No. of plant	Capacity (MW)
2005-2012	245	11,257	648	81,775	72,925	1,500	57,449
2013+	384	50,367	241	36,183	14,490	2,042	44,998
Total	629	61,624	889	117,958	87,416	3,542	102,447
Av. Age		52 years					
Coal-fired generation closure – 18% of fleet							

Source: Simshauser (2017)

ⓘ CCGT column is a subset of the total gas capacity column.

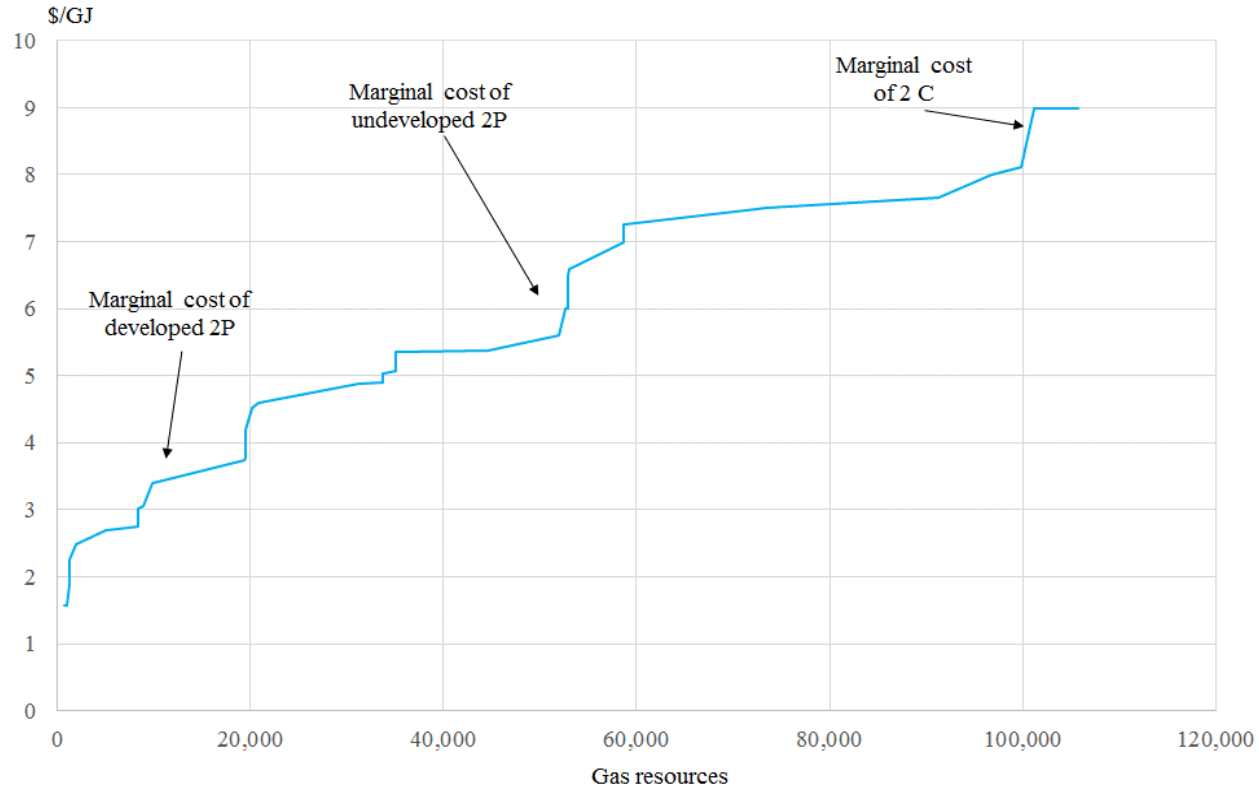
A disorderly transition – Australia's NEM

Hazelwood power station withdrawn from service with only six months notice – proof of 'inter-period pricing' concept



Issues in Australia

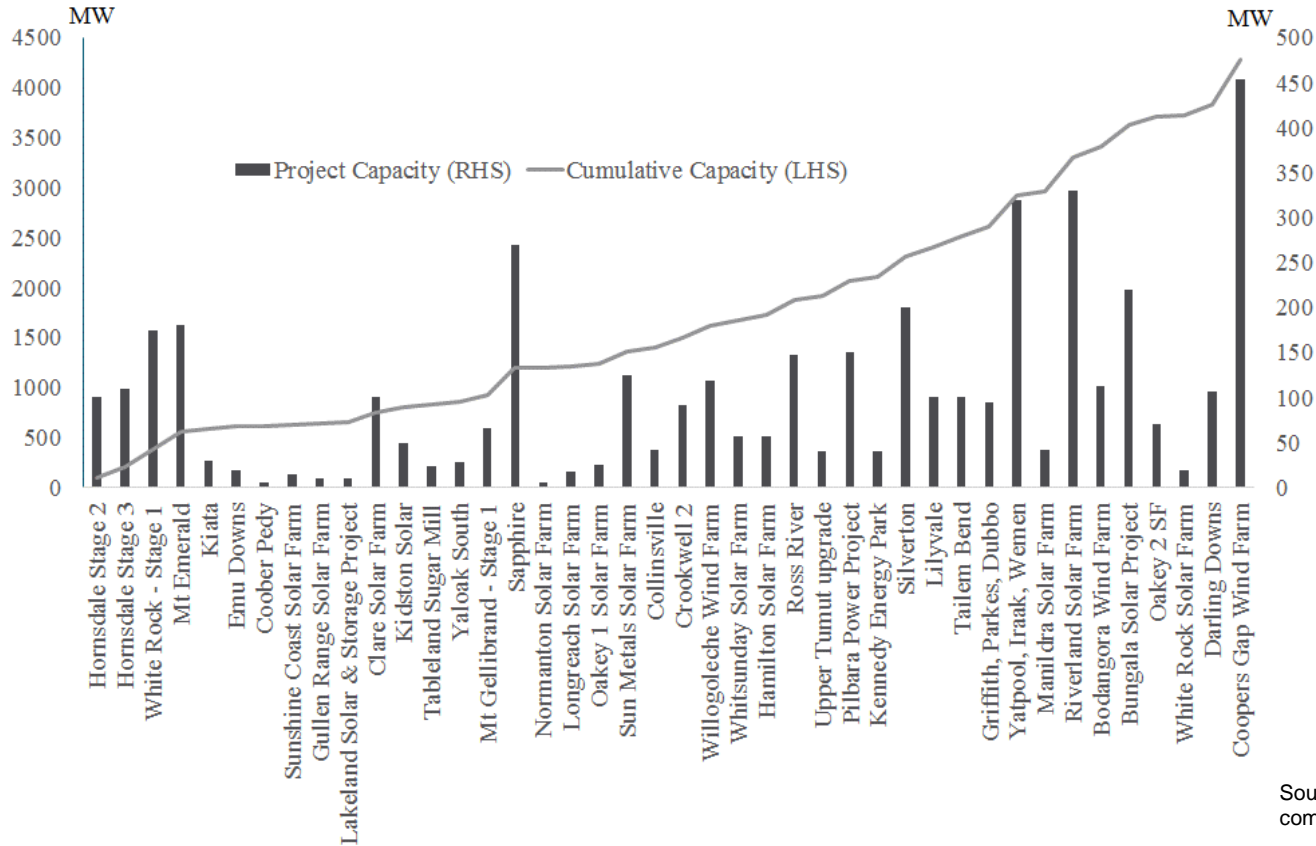
Policy uncertainty in relation to climate change objectives and issues related to gas supply



Source: Compiled from various companies and AEMO

But new supply is on the way.....

Around 4.5 GW of new renewables and some low capacity factor gas is being built



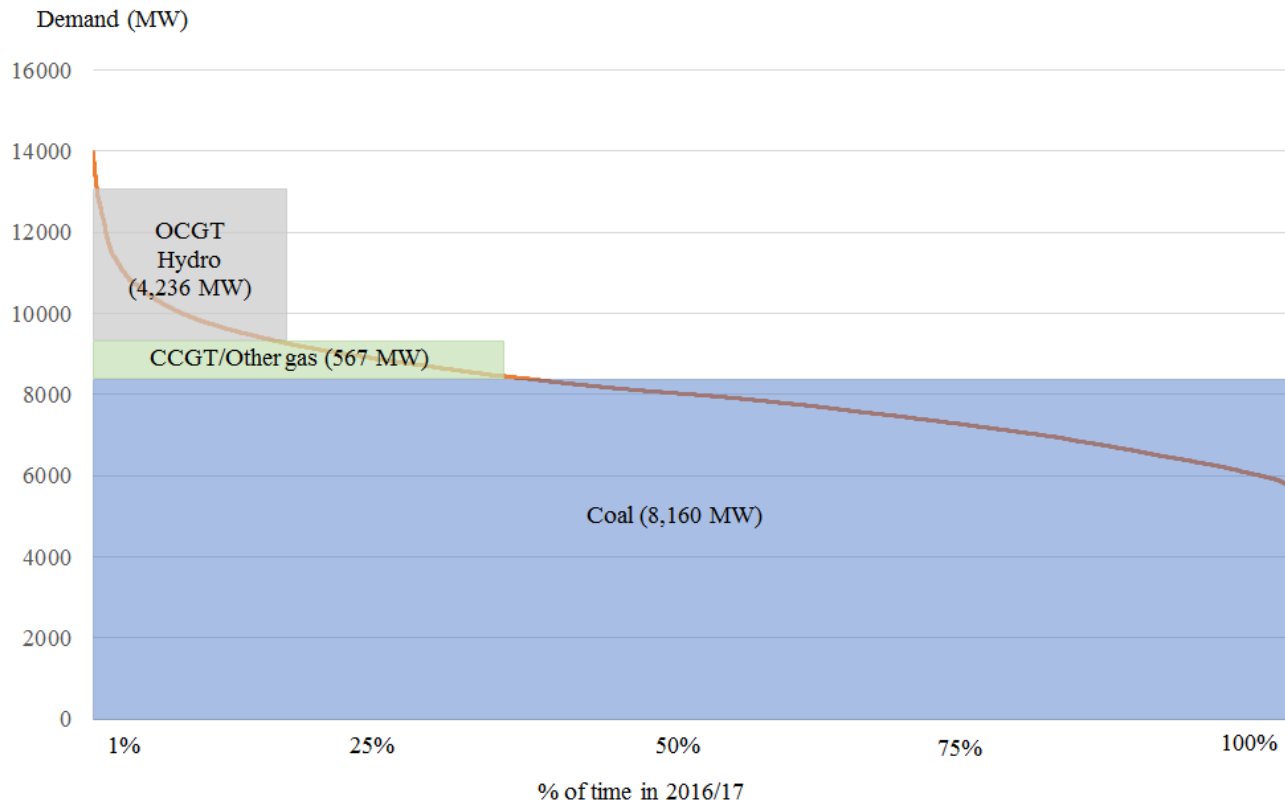
Source: Compiled from various companies and AEMO

Quick overview of NSW market



Existing 'firm' supply to meet demand

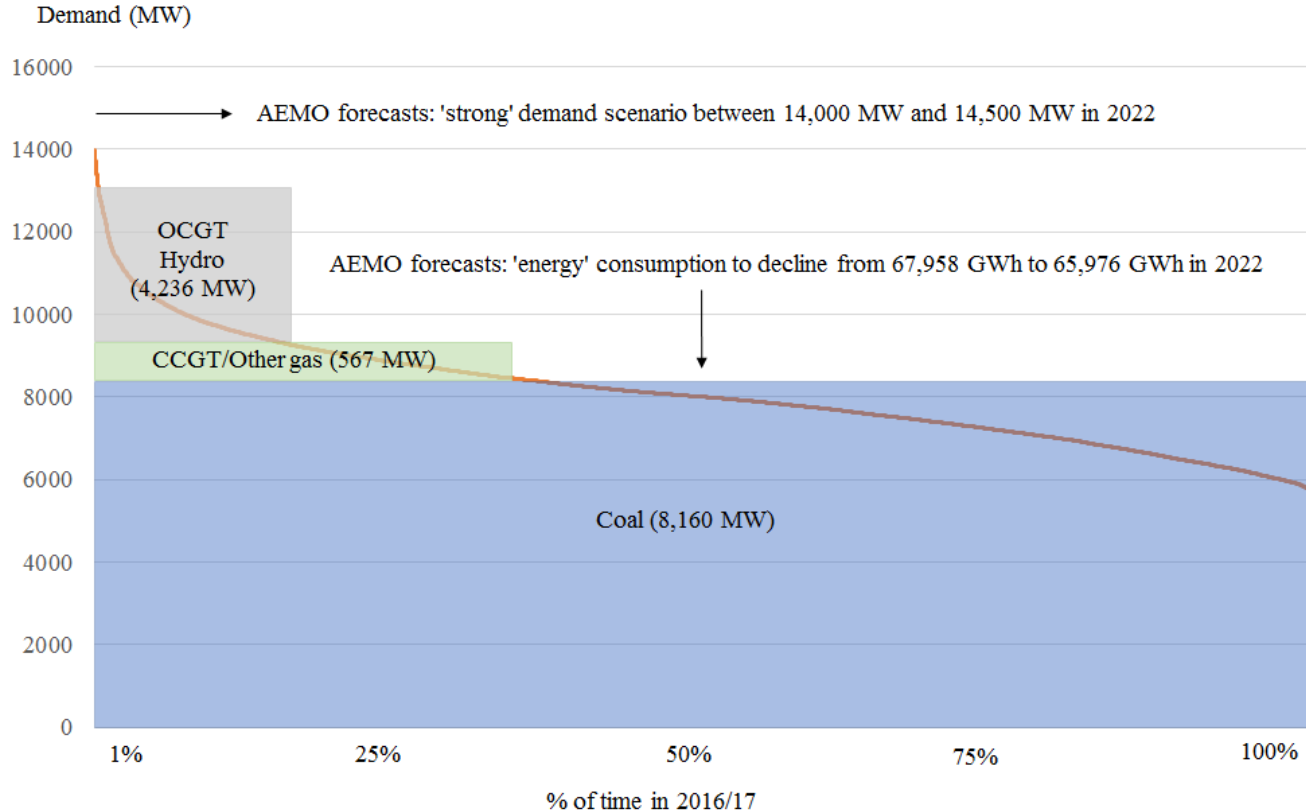
Without Liddell, existing 'baseload' and 'intermediate' plant is adequate but more peaking plant is required



Source: AEMO

Existing 'firm' supply to meet demand

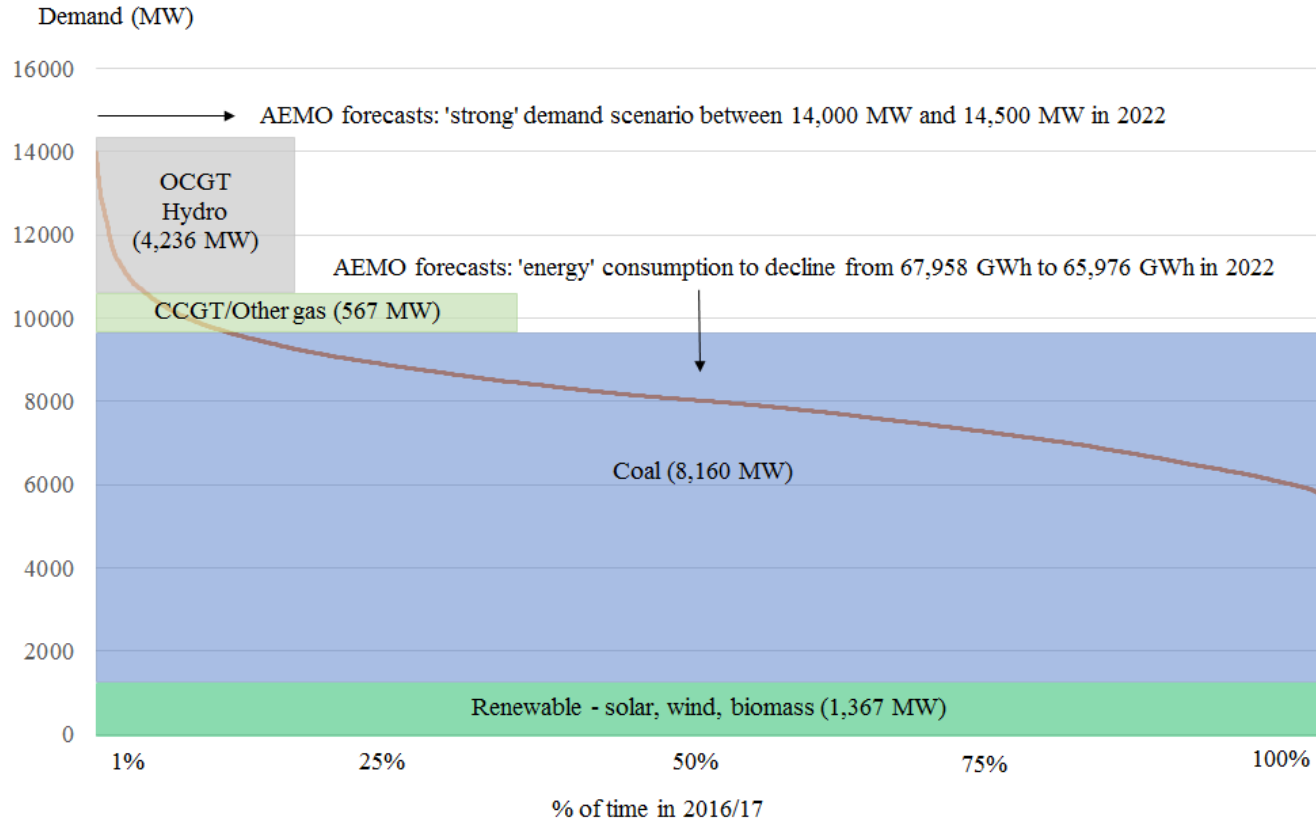
With peak demand growth and underlying consumption declining, still mainly a requirement for 'peaking' capacity



Source: AEMO

And then there is renewable energy

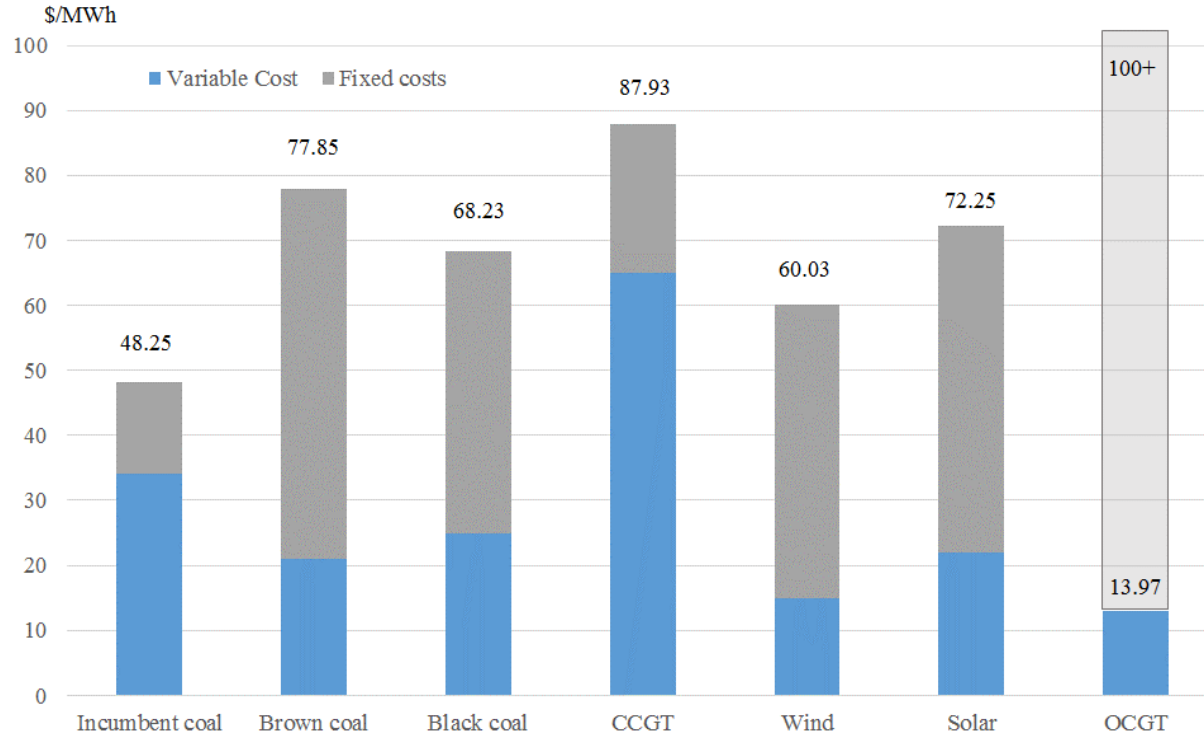
Renewable energy is not 'firm' but still provides energy (in a market with declining *energy* consumption)



Source: AEMO

Cost of building and operating power stations

Renewables are increasingly cost-competitive with traditional 'thermal' sources such as coal and gas



Source: Simshauser (2017)

Optimal plant mix results

Given *energy* consumption forecast to decline and new renewables providing more energy, peaking capacity required



Category	Optimal	Actual (2022)	Imbalance	Weighting
Baseload	7,295	8,160	865	overweight
Intermediate	1,669	567	-1,102	underweight
Peaking	5,022	4,236	-786	underweight
	13,986	12,963	-1,023	

This assumes no new investment apart from plant under construction. It also assumes Liddell power station is closed.

So what can we
conclude?



Some observations....

Not all dispatchable plant is also flexible



1. Renewable energy provides the lowest *long-run marginal cost* of 'energy'
2. But as renewables begin production, they require complementary firm 'capacity'
3. In the short-term, existing coal-fired units can provide some 'flex'
4. But while dispatchable, coal is not as 'flexible' as gas or hydro
5. In the medium-term, an 'optimal plant mix' is likely to transition to gas-fired peaking units and demand response
6. Gas-fired peaking units provide 'capacity' but not significant volumes of 'energy'
7. In the long-term, renewable energy is likely to be complemented by pumped hydro and battery storage to allow energy to be consumed at times when it is needed

Innovation in contract markets – responding to the NEG



Policy recommendations

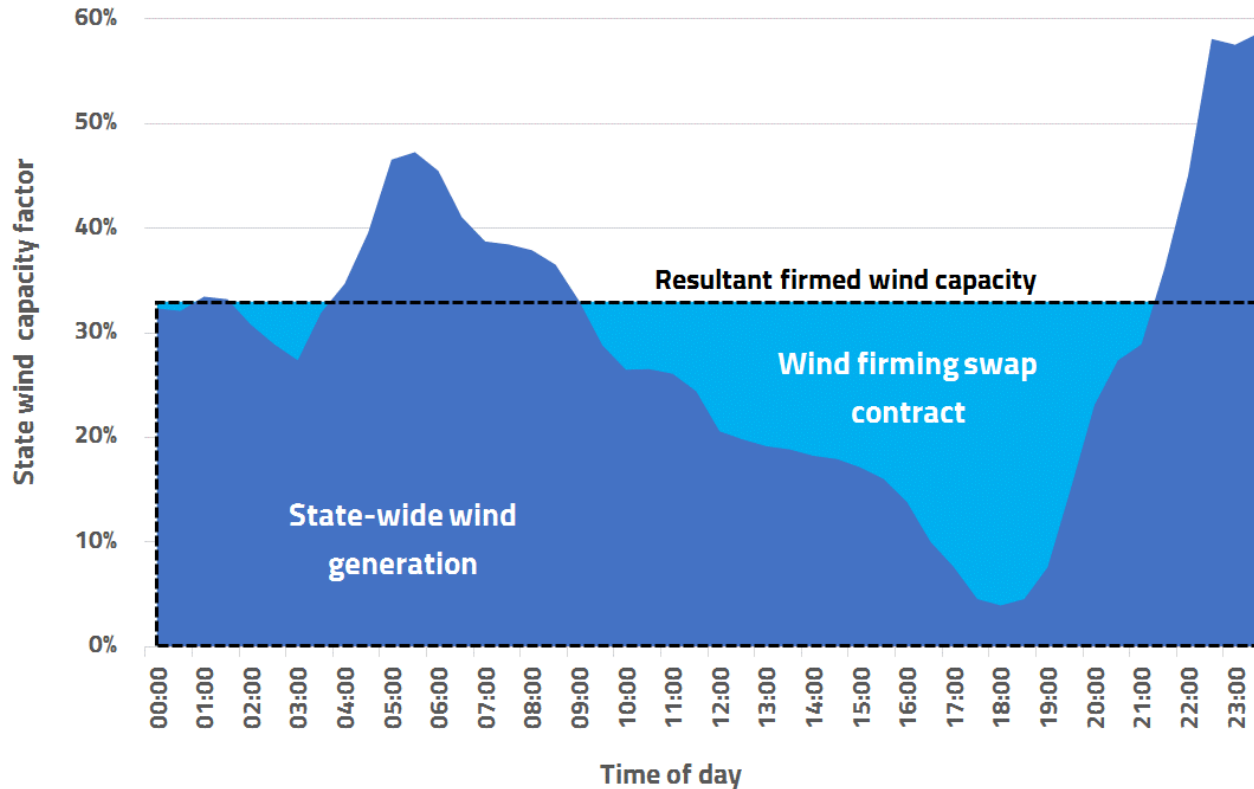
Contract market is critical for ongoing functionality of retail markets – renewables should become participants in these markets



Criteria	Achieved by current NEM 'energy-only' market	Policy recommendation
Efficient dispatch	Yes	None
New investment	No	Ensure climate policy incentivises complementary 'firm' capacity
Security and reliability	No	Establish supplementary markets (e.g. inertia, reserve generator)
Real political economy of pricing	No	Rule-based mechanism for ensuring advanced warning of impending generator closure

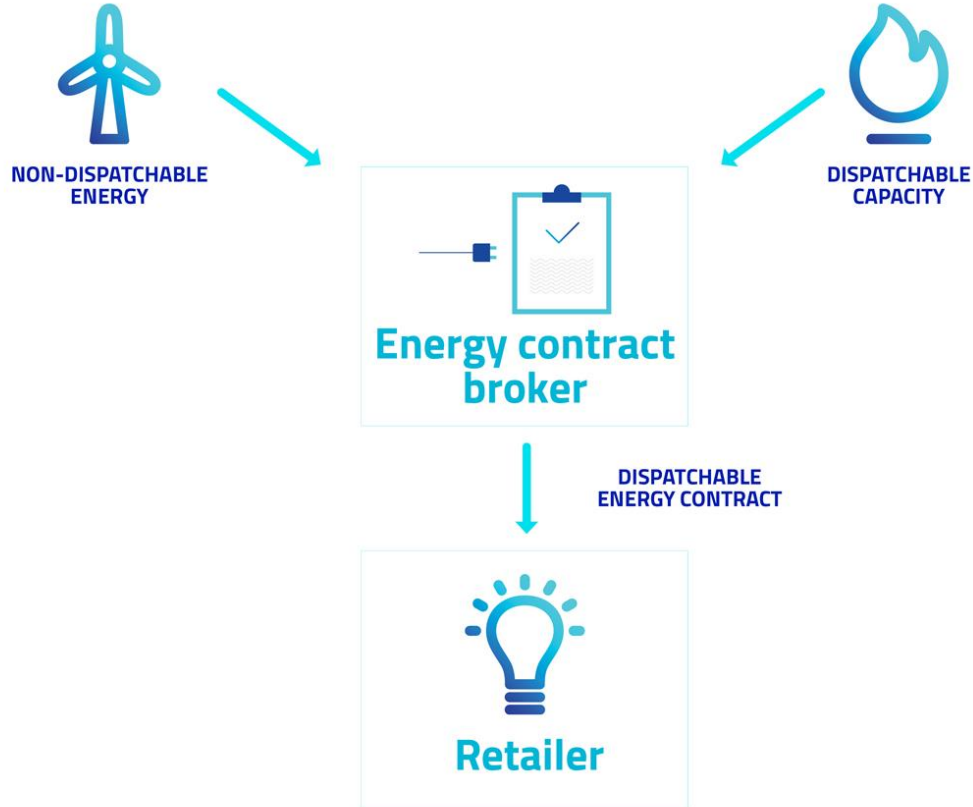
How the NEG can drive innovation

New dispatchable renewable derivative products now being offered to facilitate compliance with NEG



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New dispatchable renewable derivative products now being offered to facilitate compliance with NEG



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