

# Overview of Wind Energy Grid Integration in Australia

ADB Wind Energy Grid Integration Workshop

Sept 23, 2013

Dr Geoff James

Specialist, Renewable Energy Integration and Energy Storage

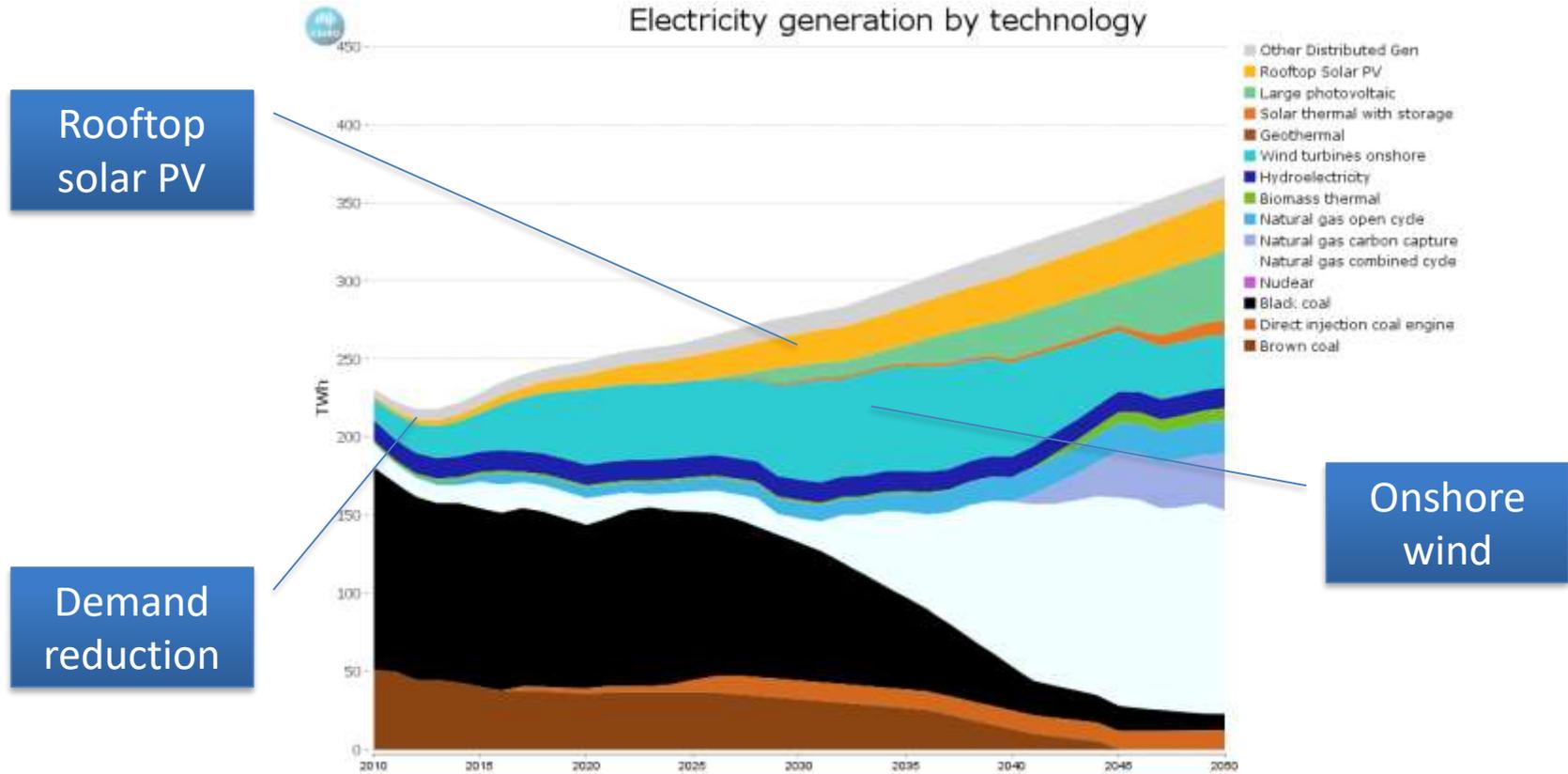
[geoffcjames@gmail.com](mailto:geoffcjames@gmail.com)

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# Projected energy mix to 2050

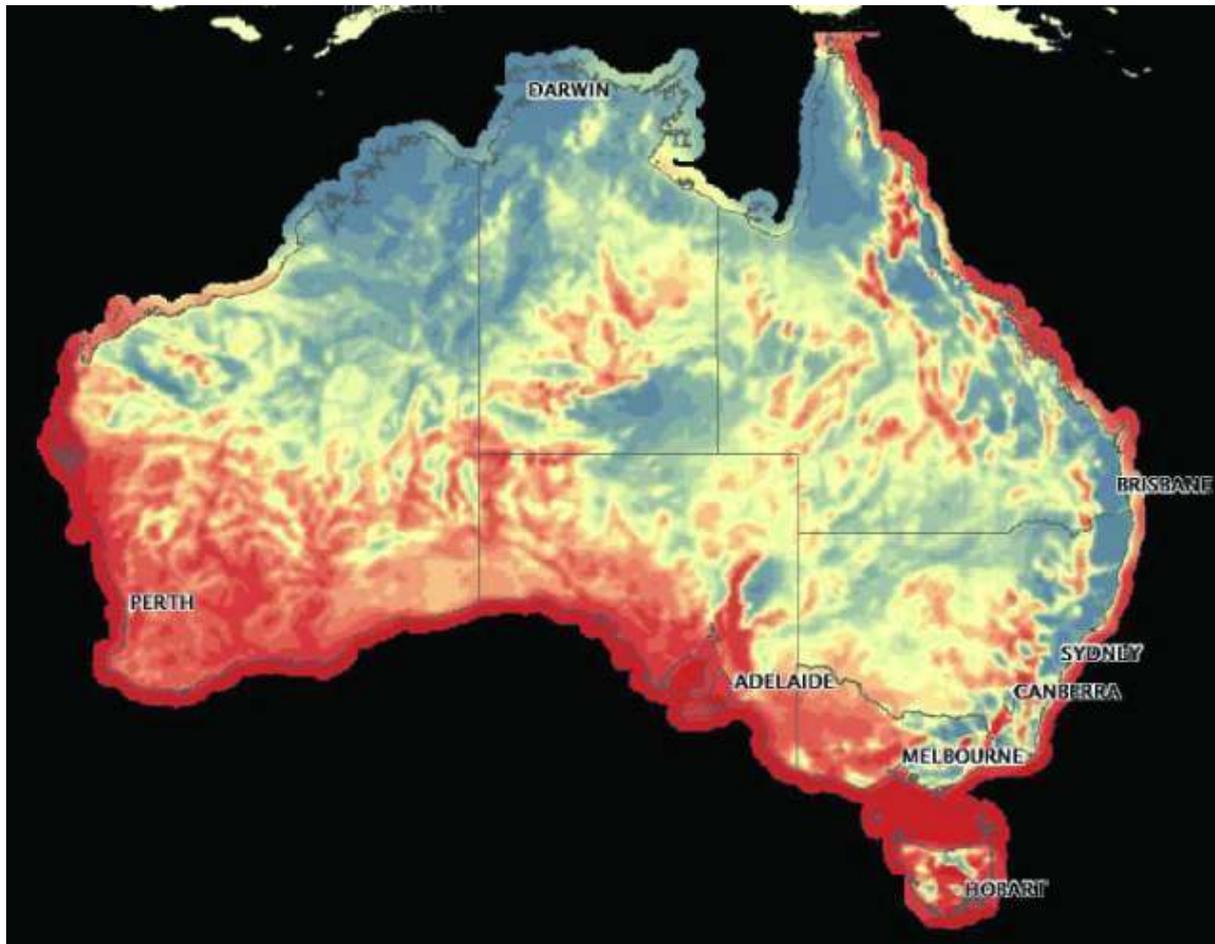
CSIRO, <http://efuture.csiro.au>



Source: Copyright Commonwealth Scientific and Industrial Research Organisation 2012-.  
Chart based on user selected assumptions and generated by CSIRO's eFuture tool,  
Electricity Simulation Model #2240. Conditions of use, see [www.efuture.csiro.au](http://www.efuture.csiro.au) (Background).  
Med Demand, Med Fuel Cost, Nuclear: No, Peak: Backup, Med Cost All Technologies;

# Wind Energy Resources

Dept of Environment (2008) Renewable Energy Atlas



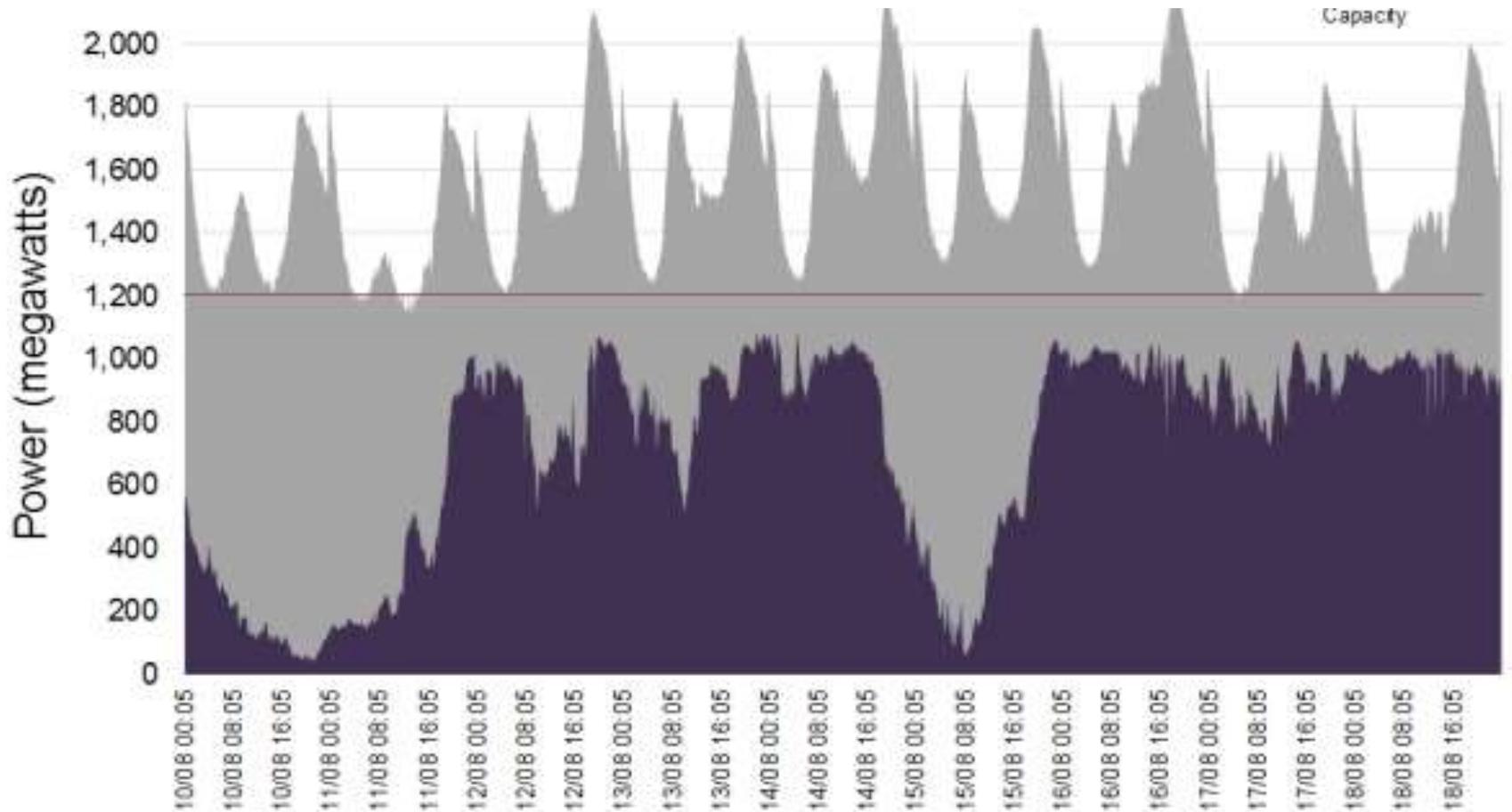
# Wind Energy Status

BREE (2013) Energy in Australia, AEMO (2012) 100% renewable energy study, on-line commentary

	Onshore	Offshore
Wind Power Potential in the <a href="#">Country</a>	880 GW (eastern states with CF > 35%)	660 GW (eastern states with CF > 50%)
Wind Power Installations (MW) as of 2012	2,127 MW	0
% Wind Power in Grid as of 2012	2.4% of energy 4.1% of capacity	0
<a href="#">Tariff</a> for wind energy (range)	Wholesale: 40-70 \$/MWh in 2012/13 Bilateral contracts: 90-100 \$/MWh	
Incentives for wind energy	Renewable Energy Certificate 40 \$/MWh	
Maximum penetration of wind energy into grid (if this has been studied)	47% of power observed in South Australia 26% of energy from wind in 2011-12	

# Demand and wind in South Australia

AEMO MMS database for 10-16 August 2013



# Wind Penetration by Region

BREE (2013) Energy in Australia

State	Capacity in 2012 (MW)
NSW & ACT	188
Victoria	428
Queensland	12.5
South Australia	1,152
Western Australia	205
Tasmania	143
Northern Territory	0.1

# Wind Penetration by Region

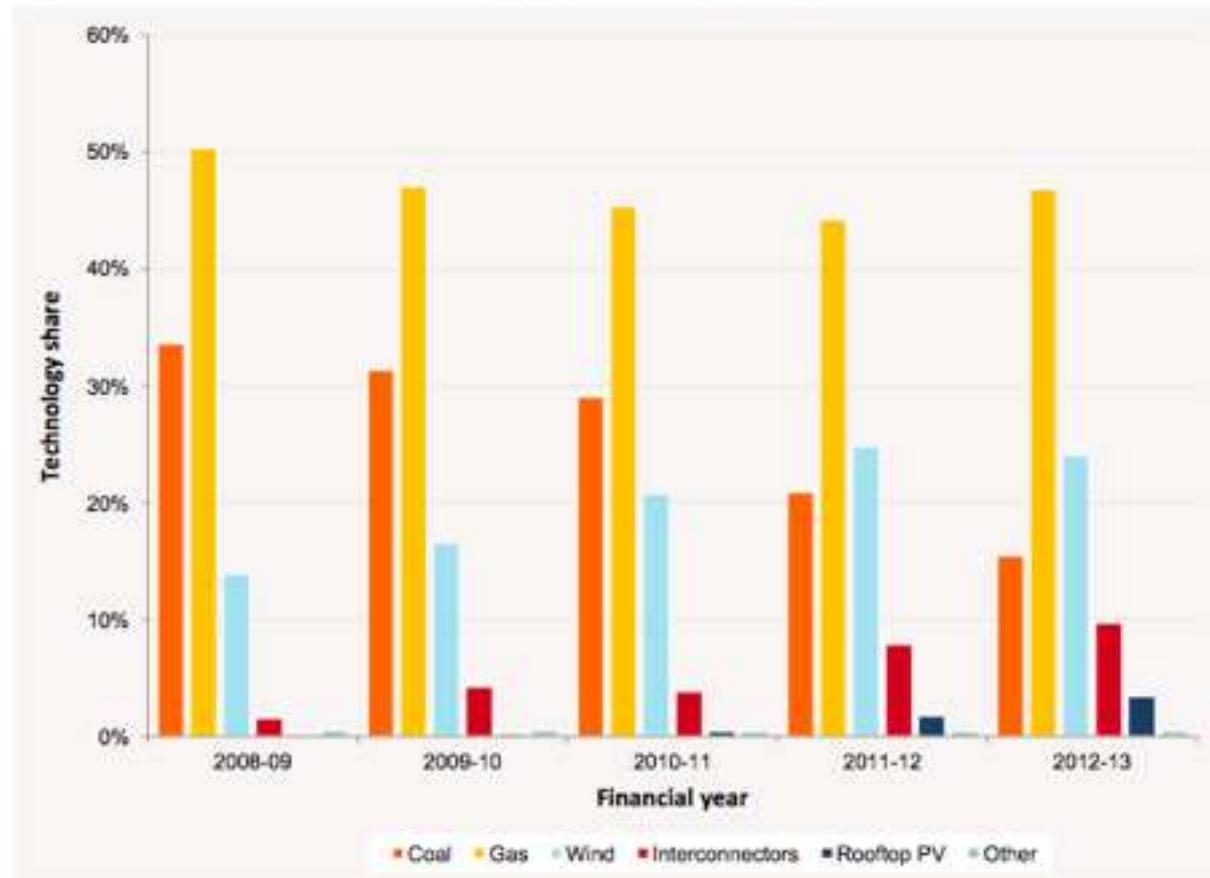
Jackson (2012) Wind in the NEM

	Installed capacity		Total	Proposed capacity	
	Scheduled & Semi Scheduled	Non-Scheduled		Committed	Publically Announced (Approx.)
<b>NSW</b>	95	186	281	0	4,635
<b>SA</b>	388	815	1203	0	2,215
<b>Tas</b>	0	140	140	168	330
<b>Vic</b>	432	67	499	440	3,518
<b>Qld</b>	0	12	12	0	1,129

# Generation mix in South Australia

Parkinson (2013) South Australia's changing energy mix

Figure 2-1 — South Australian energy generation by fuel type



# Grid Integration Issues

Issues	Comments
Lack of Transmission	Integrated national planning allows for changing generation mix. However policy uncertainty inhibits investment in wind and associated transmission.
Lack of spinning reserves	There is no present lack of spinning reserves due to investments in gas generation. Energy storage is advancing as an alternative flexibility resource. Considering markets for inertia or very fast FCAS.
Demand is low at off-peak hours	Interconnectors and other network elements can constrain wind at times of high wind and low demand, and this has caused price collapse in South Australia.
Lack of flexibility in current generation	Gas and hydro provide flexibility.
Lack of flexibility in demand	Demand response programs are not yet widespread but are steadily advancing.

# Grid Operations/Wind Power Dispatching

Scheduling timeframe	5-minute dispatch operates across the eastern states of Australia – an attractive market for wind integration.
Curtailement of wind power	Network-constrained curtailement has occurred.
At peak supply of wind energy, which source of generation is reduced	Short term: gas-based generators and hydro (where available) are balancing resources. Long term: coal generators are proving uneconomic and being decommissioned or reduced to seasonal operation.
Is Wind Energy Forecast required?	Yes, using the European ANEMOS system adapted for 5-minute dispatch, which has proved highly successful.
How is rapid ramping up/down of wind energy managed?	Gas and hydro generators are the traditional means, while energy storage is increasingly used by system integrators and some generators.
What are integration costs?	Not quantified yet.