

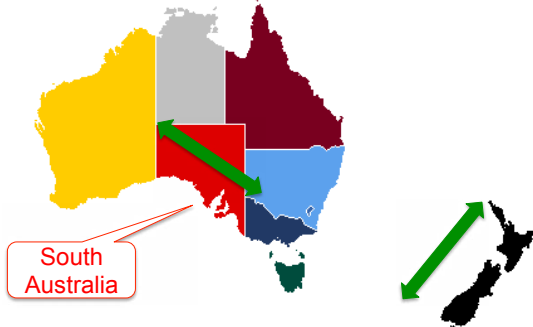
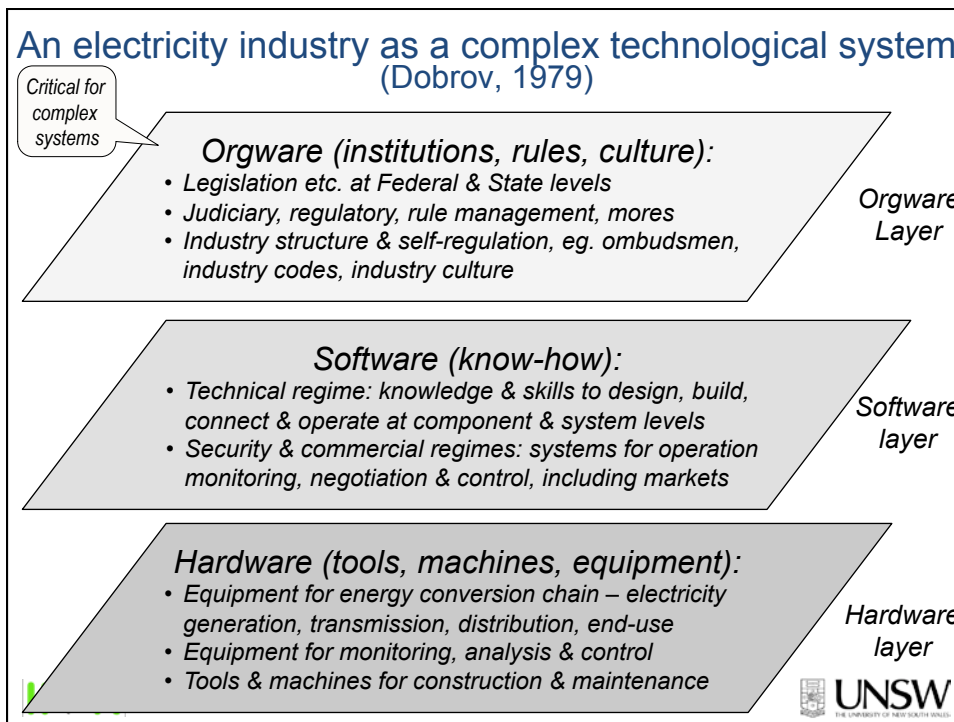


Achieving 25% wind energy penetration: Lessons from South Australia and the Australian National Electricity Market

**Achieving 25% wind energy penetration:
Lessons from South Australia & the NEM**

Hugh Outhred, UNSW & Ipen Consulting
2013 New Zealand Wind Energy Conference, 21/3/13



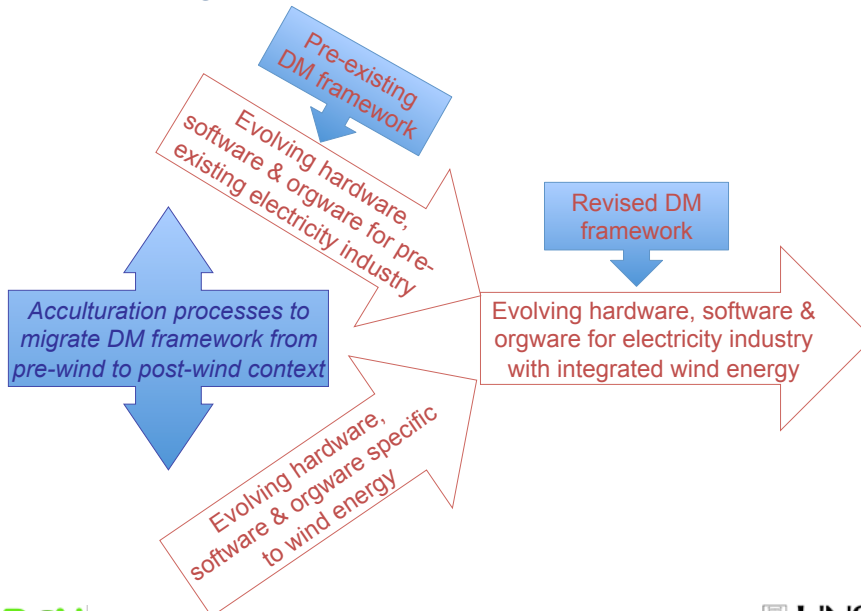
Decision-making (DM) framework for managing electricity industry H/S/O

Governance & regulatory regime (O)	<ul style="list-style-type: none"> Formal institutions, legislation & policies <i>Informal social context including politics</i>
Security regime (H, S, O)	<ul style="list-style-type: none"> Responsible for core integrity on local or industry-wide basis, with power to override <i>Issues that can't be commercialised</i>
Technical regime (H, S, O)	<ul style="list-style-type: none"> To allow connected industry components to function as industry-wide machine <i>Technical standards & requirements</i>
Commercial regime (H, S, O)	<ul style="list-style-type: none"> To coordinate decentralised decision-making according to commercial criteria <i>Market rules & industry structure both matter</i>

Interactions matter



Wind integration as a process of acculturation



Acculturation process for wind in South Australian region of National Electricity Market

- Assess pre-wind DM framework:
 - Is NEM wind-ready? Is SA wind-ready?
- Assess wind compatibility with SA & NEM:
 - Is wind technology ready for integration?
- Identify DM acculturation requirements:
 - Project approval, technical requirements, connection requirements & rights, forecasting, security management, commercial integration
- Develop & implement acculturation process:
 - Over 5 years to complete



South Australia wind energy policy

(<http://www.renewablesa.sa.gov.au>)

RenewablesSA

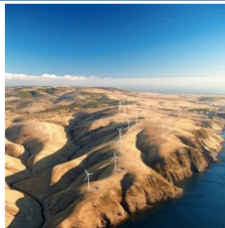


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Statewide Wind Farm Planning Policy Finalised

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On 18 October 2012, the Minister for Planning approved the Statewide Wind Farm Development Plan Amendment (DPA). For more information see [Wind Farm Planning Policy](#)

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18/10/2012

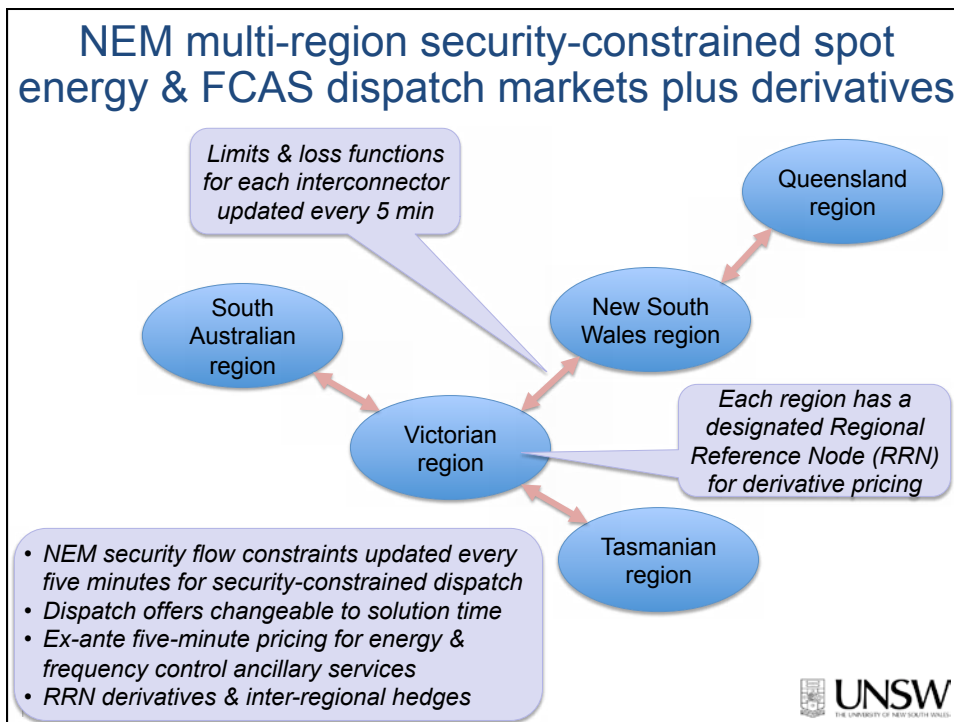
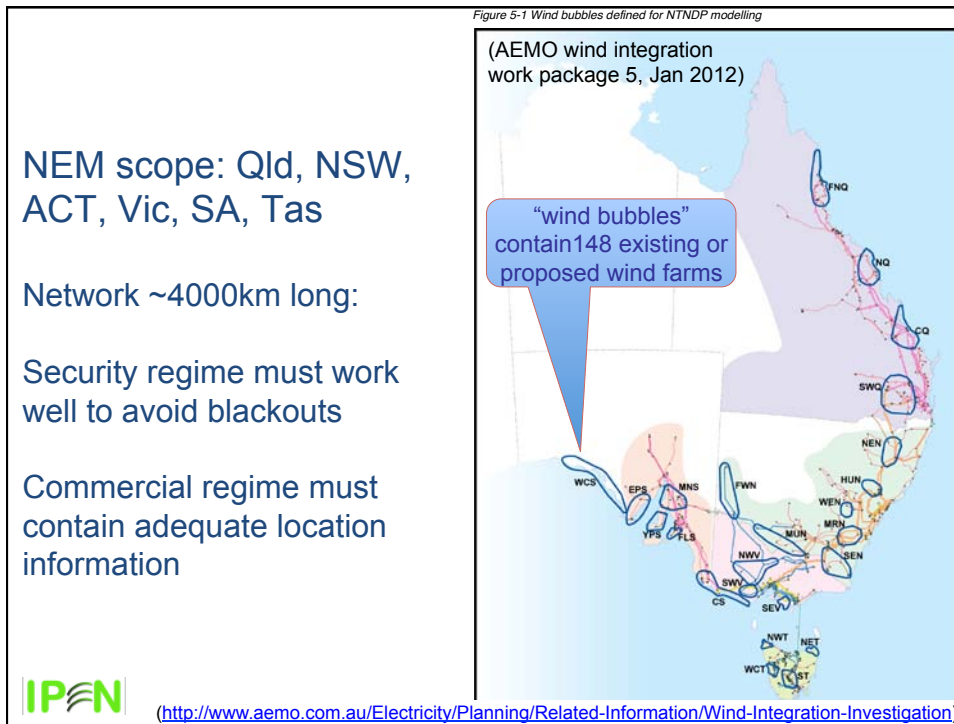
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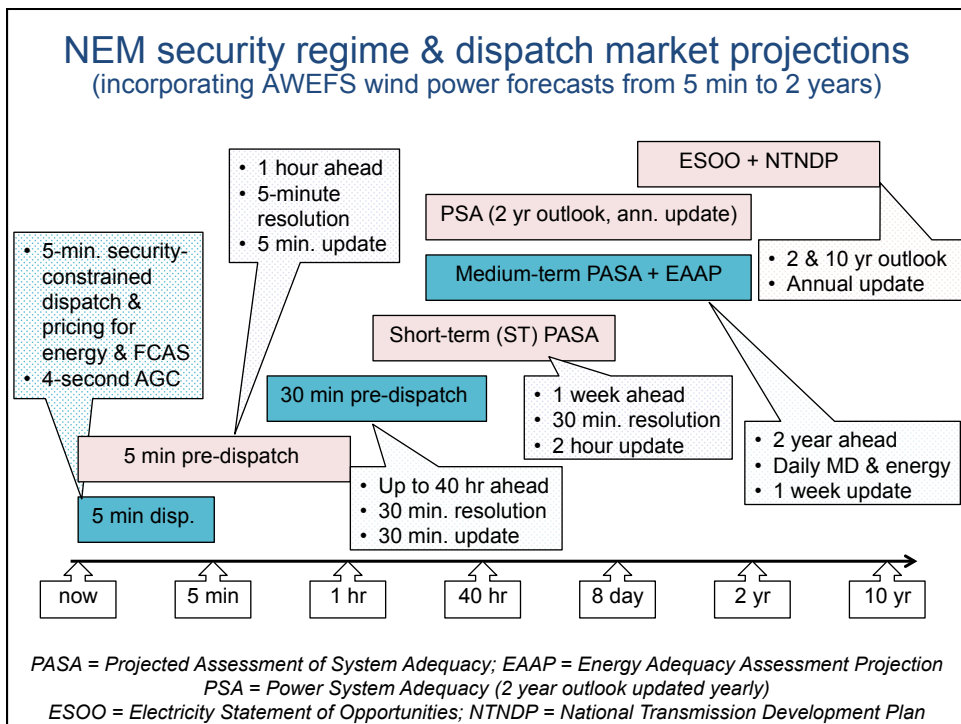
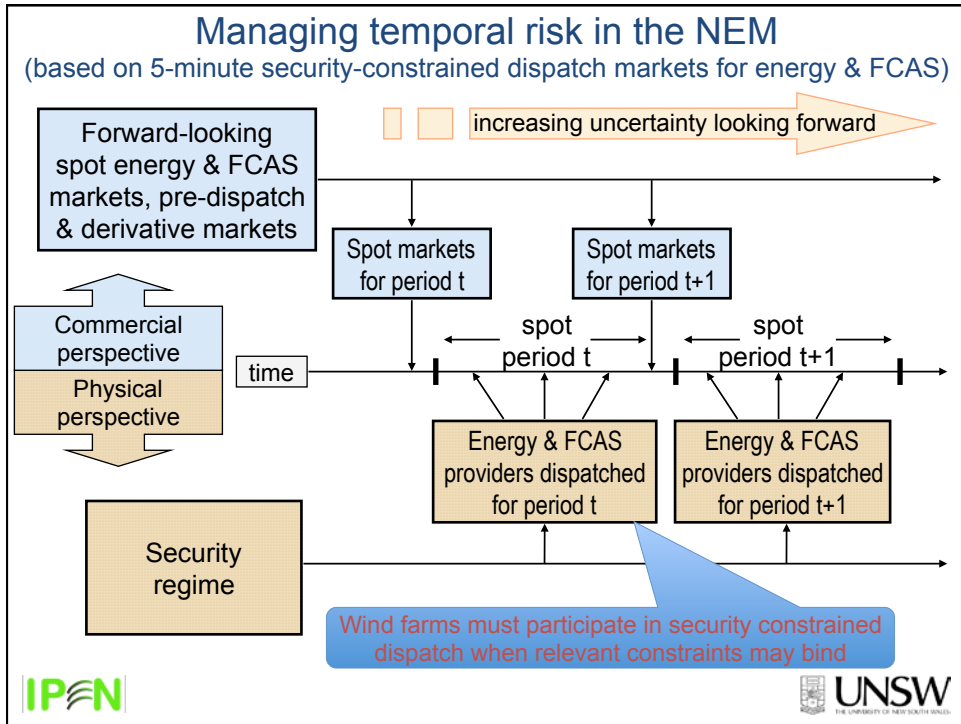
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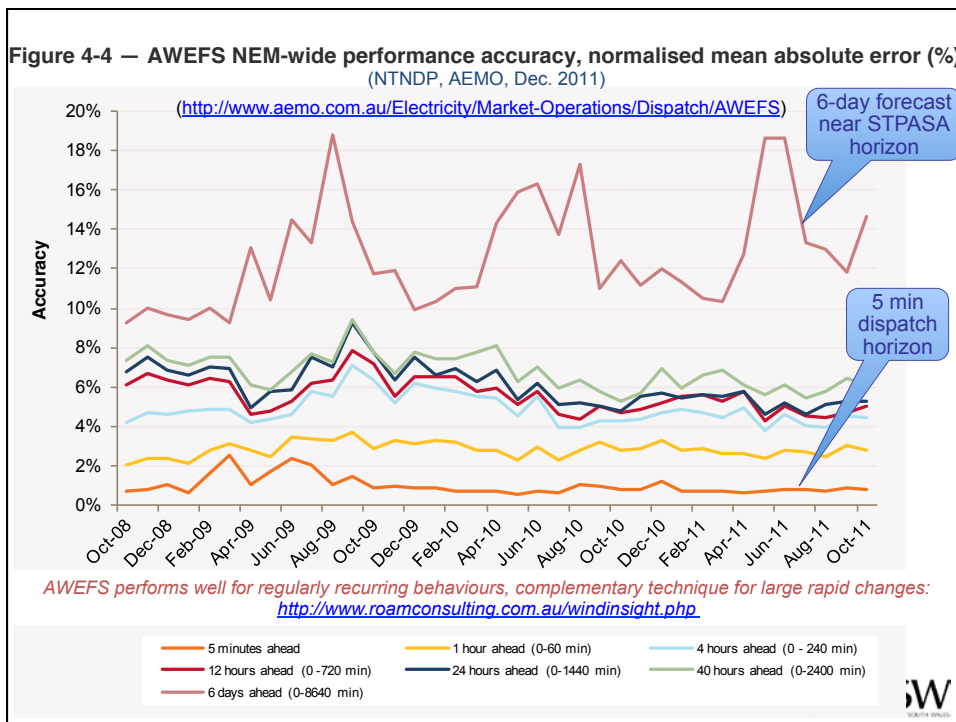
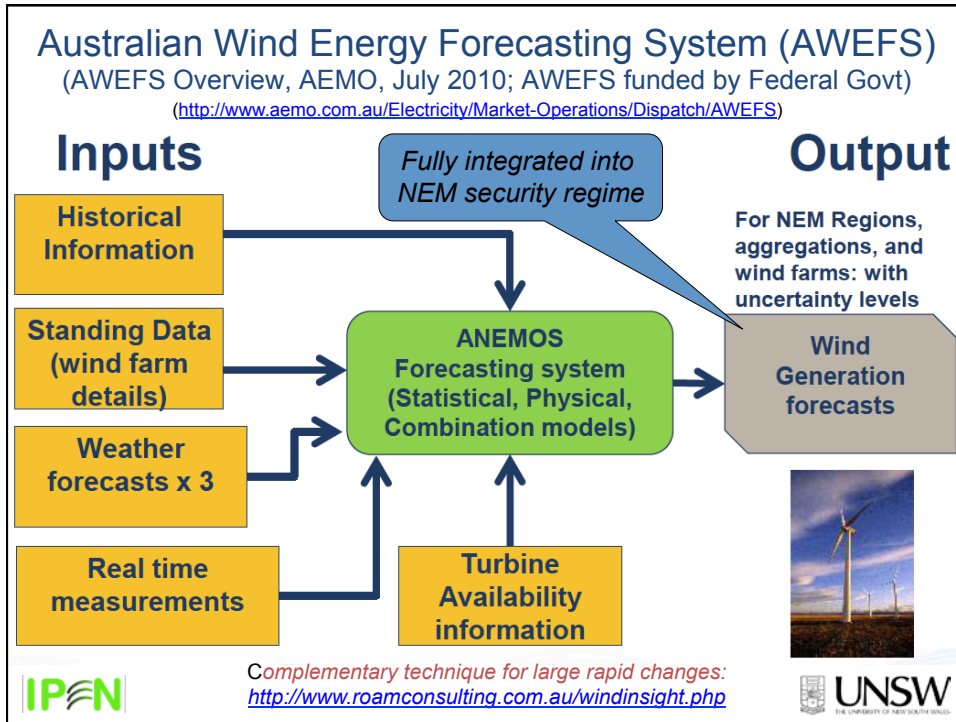
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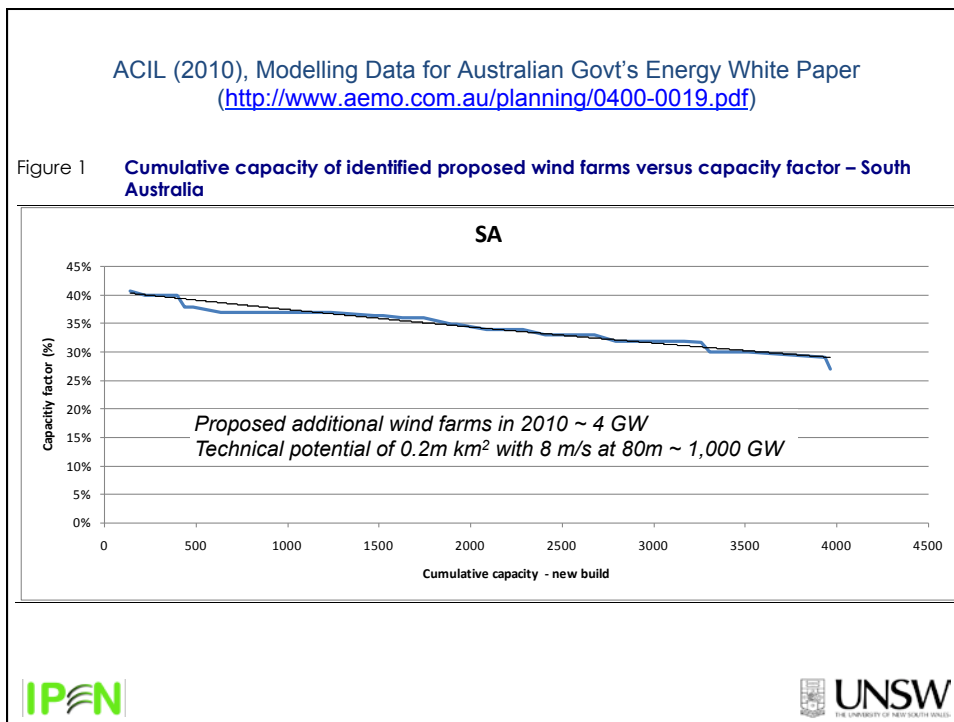
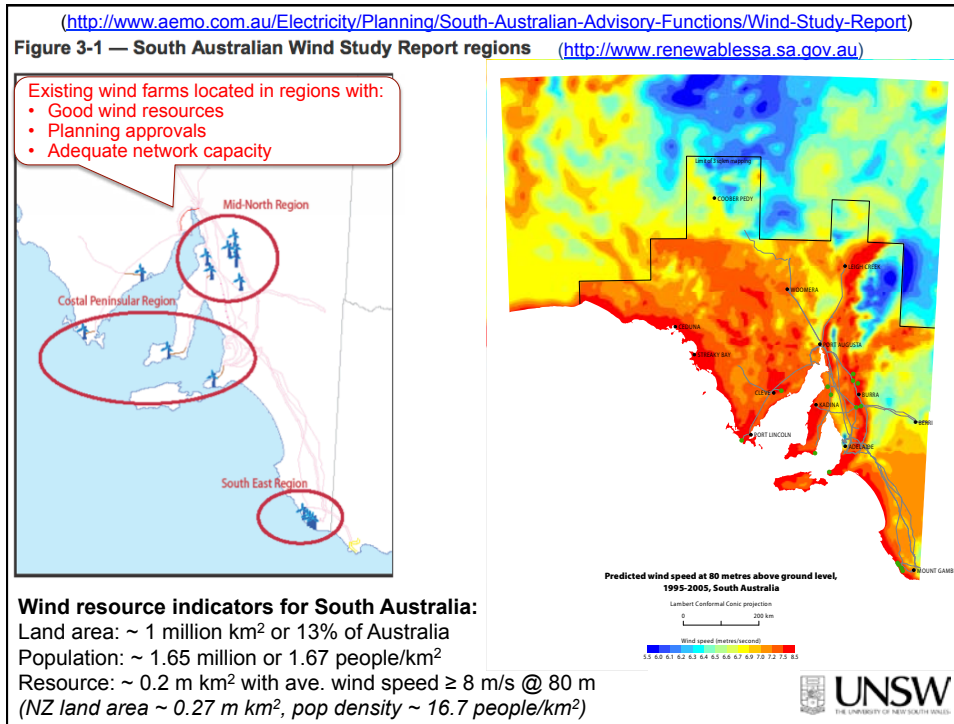
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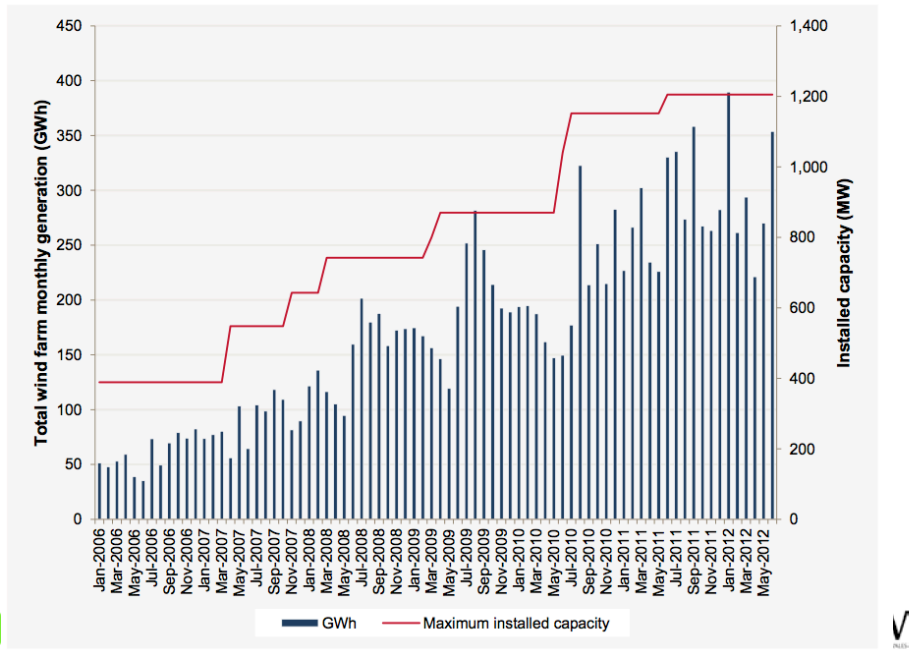
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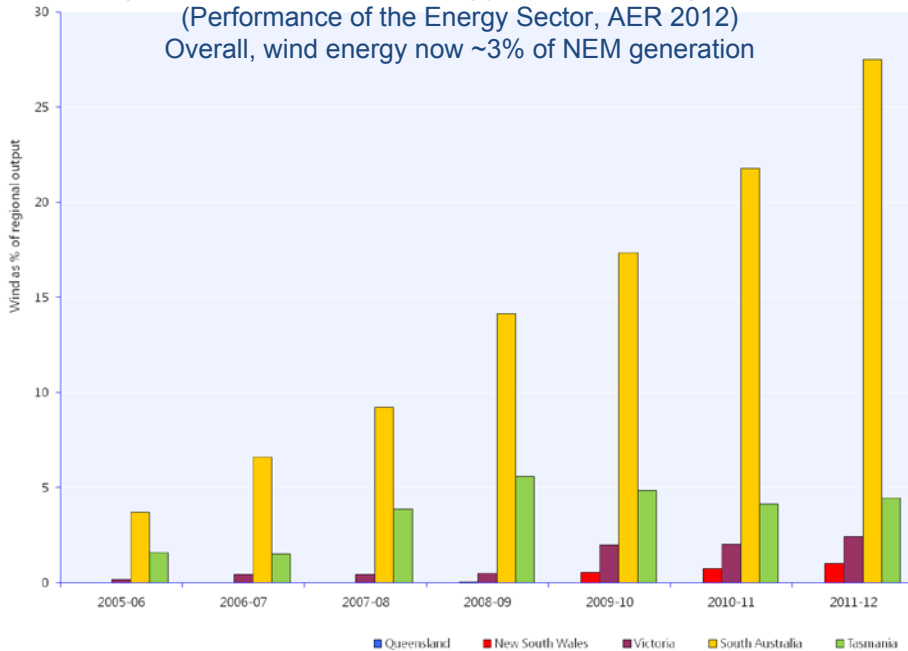
(<http://www.aemo.com.au/Electricity/Planning/South-Australian-Advisory-Functions/Wind-Study-Report>)

Figure 2-3 — Total monthly South Australian wind generation (January 2006 to June 2012)



Wind generation ann. energy as % of regional output

(Performance of the Energy Sector, AER 2012)
Overall, wind energy now ~3% of NEM generation

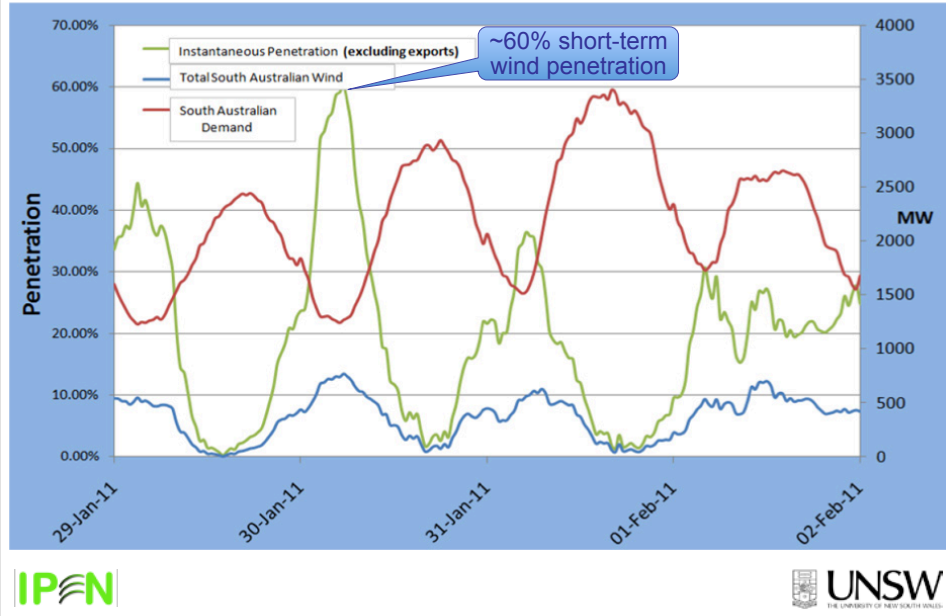


Source: AER, AEMO. Last updated: 21 November 2012. 3:46pm

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(<http://www.aemo.com.au/Electricity/Planning/South-Australian-Advisory-Functions/Wind-Study-Report>)

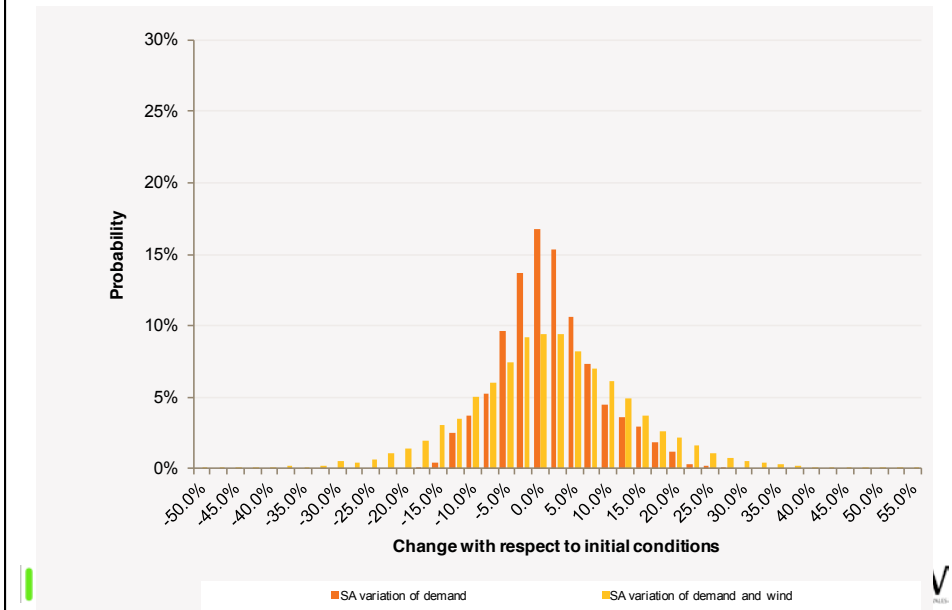
Figure B - 1— South Australian demand and wind on peak summer days³⁸



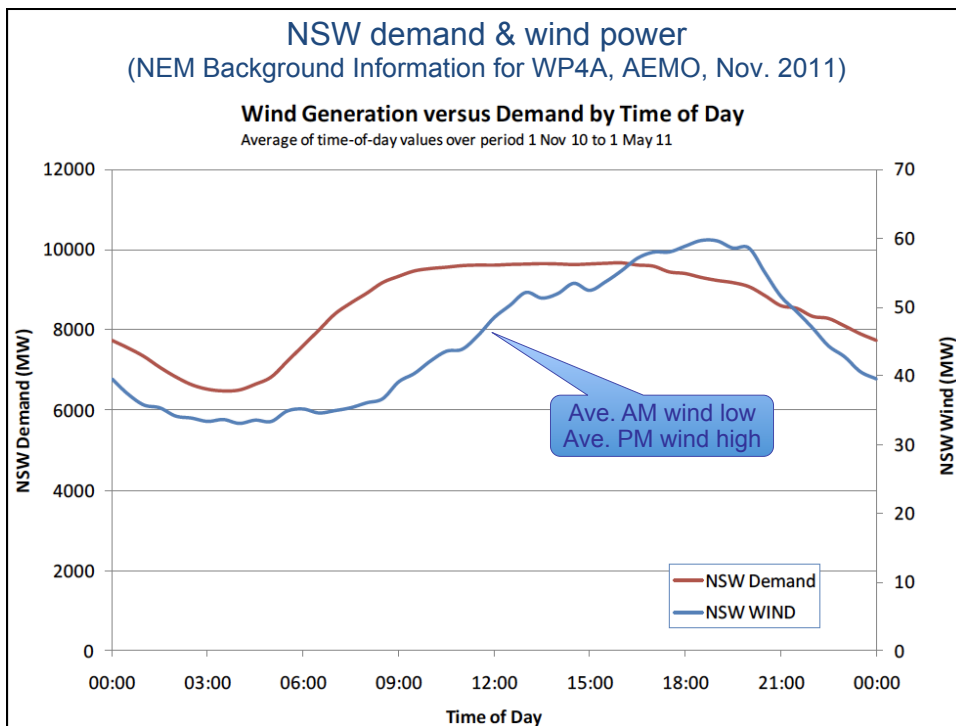
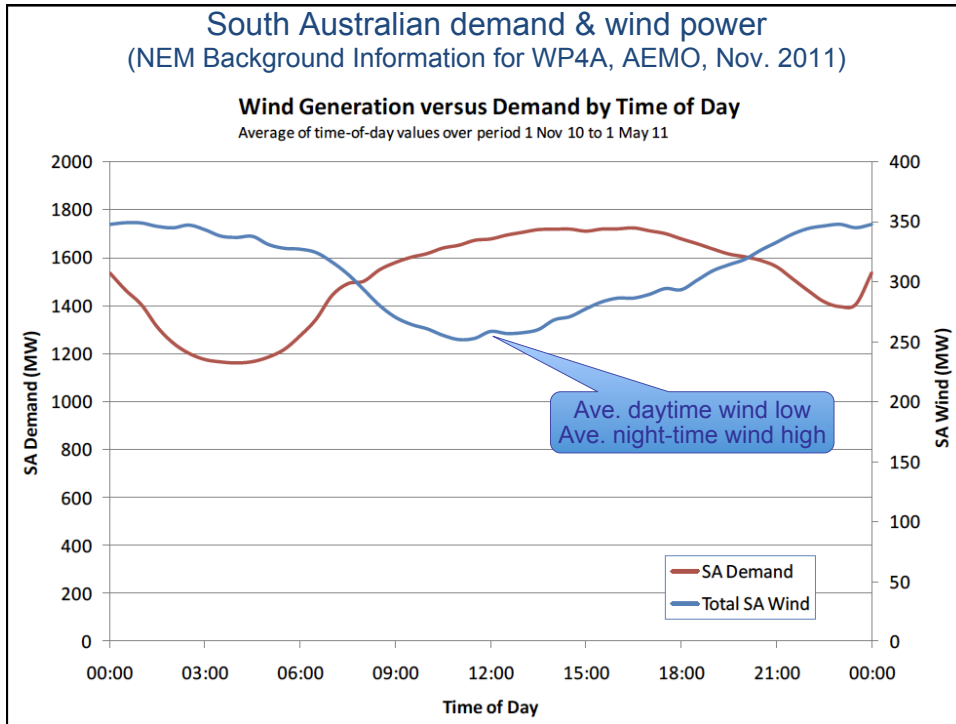
One-hour change in demand & wind power in SA

(Fig 4.3, NTNDP, AEMO, Dec. 2011)

Figure 4-3 — South Australian variability of demand, and wind and demand

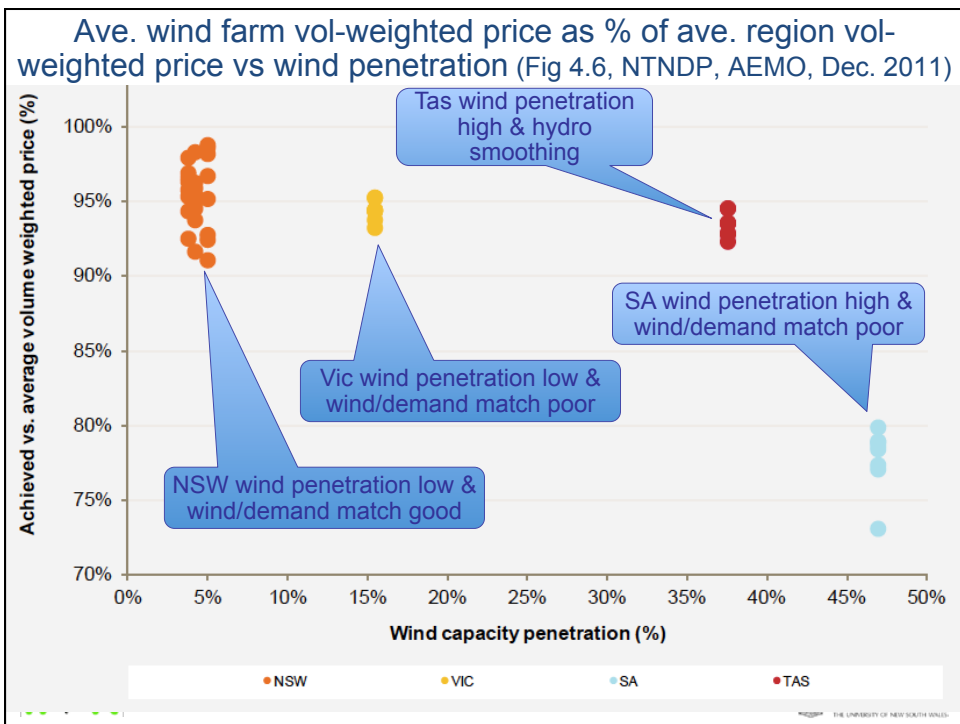
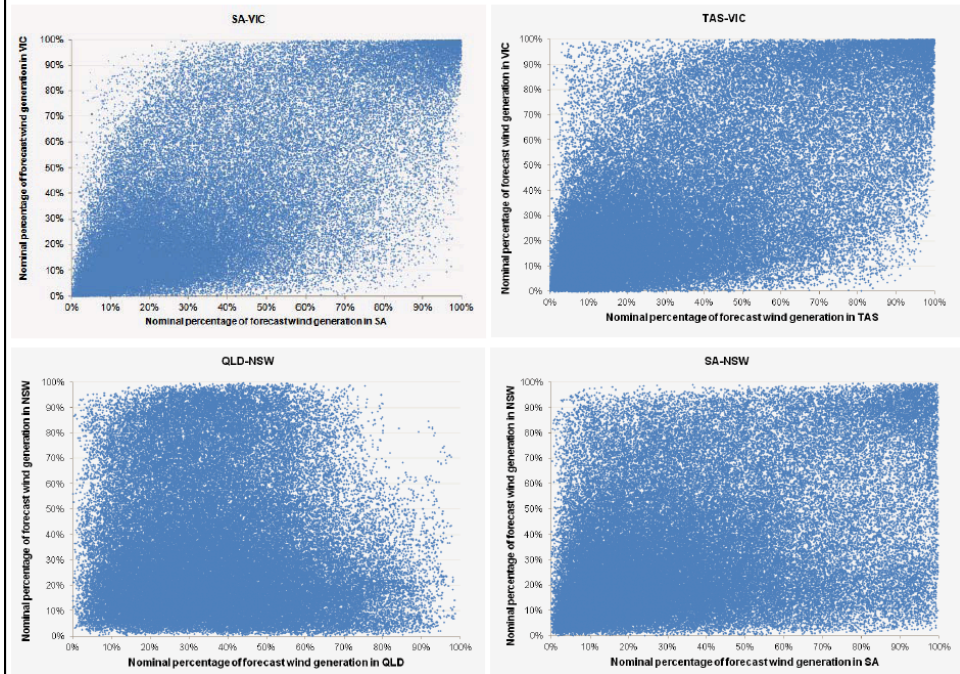


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Figure 4-1 — Regional wind diversity (Simulated hourly ave. wind power, NTNDP, AEMO, Dec 2011)



Facilitating wind energy integration

- Wind resource mapping & forecasting:
 - Centralised forecasting using all relevant information
 - Focus on large rapid changes & long widespread lulls
- Wind farm siting & approvals processes:
 - Should be consistent, fair & “evidence-based”
- Grid connection requirements & costs:
 - Difficult choices on grid augmentation
- Operation with high wind penetration:
 - Security constrained wind farm dispatch
- Clear & consistent investment signals:
 - Important for industry stability



Hugh Outhred Bsc, BE (Hons 1), PhD



Hugh Outhred is a Senior Visiting Fellow at the University of New South Wales, an Adjunct Professor at Murdoch University, *Guru Besar Luar Biasa* at STTNAS Jogjakarta, Indonesia and a Director of Ipen Pty Ltd, which provides advisory and educational services on energy, society and the environment.

Hugh retired in 2007 after a 35-year career at UNSW, most recently as Presiding Director, Centre for Energy and Environmental Markets and Head, Electrical Energy Research Group, School of Electrical Engineering and Telecommunications.

During his career, Hugh has been a Fulbright Senior Fellow at the University of California Berkeley, a Member of the National Electricity Tribunal, a Member of the New South Wales Licence Compliance Advisory Board, a Board Member of the Australian Cooperative Research Centre for Renewable Energy, an Associate Director of UNSW's Centre for Photovoltaic Devices and Systems, a Member of CSIRO's Energy Flagship Advisory Committee and a Lead Author for the IPCC Special Report on Renewable Energy Sources & Climate Change Mitigation, 2011.

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Selected documents by Hugh Outhred on wind energy integration in the Australia National Electricity Market:

www.ceem.unsw.edu.au/sites/default/files/uploads/publications/AGO_SA_Wind_Energy.pdf

http://www.ceem.unsw.edu.au/sites/default/files/uploads/publications/unsw_readilyacceptablewindpowerinnem_000.pdf

<http://www.ceem.unsw.edu.au/sites/default/files/uploads/publications/090910REintegrationAust-HICSS43-Accepted.pdf>

