

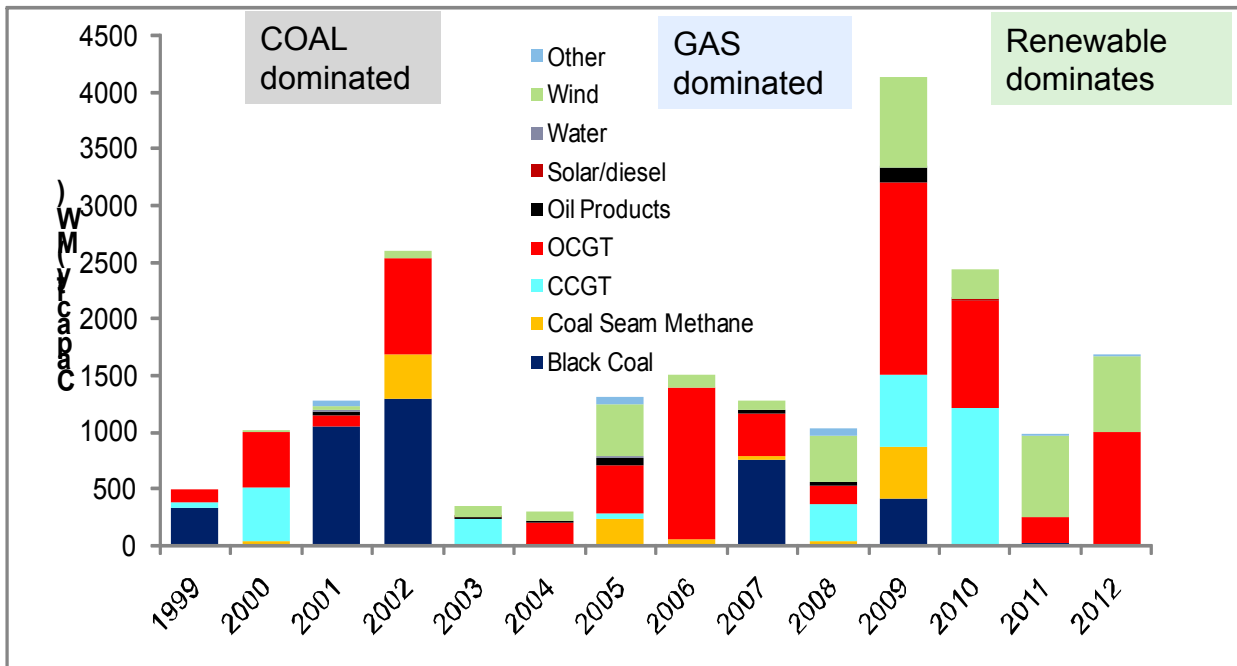
Electricity Generation Investment Challenges under Carbon Policy Uncertainty

November 9, 2011

Overview

- Investment trend
 - Major changes in last 10-11 years
- Investment choices going forward
 - No clear winner on dominant technology/fuel
 - Significant nervousness expressed by investors
- Cost impact
 - Significant cost of uncertainty

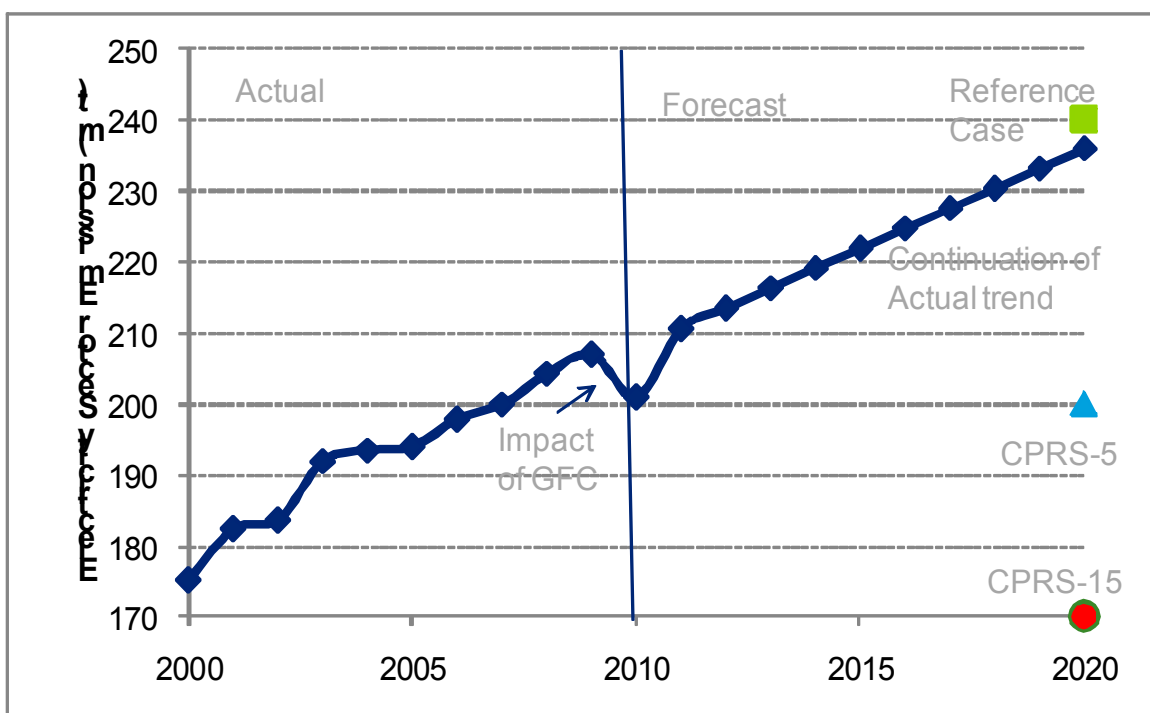
Historic Investment Trend



Distinct change in investment trend away from coal → gas/renewables → renewables/gas

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CO₂ Emissions Trend (Electricity Generation)



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Investment Choices Going Forward: Coal?

- Coal-based generation prospect is practically dead barring the odd projects in WA. None of the coal gencos in the NEM that we have interviewed are considering any new investment in coal-fired power stations
 - “Banks simply won’t look at it”
 - One genco has abandoned all plans to invest in Australia and has advanced generation development proposals in developing countries.
 - The current state of uncertainty has reduced growth capex drastically
 - CCS is likely to be too expensive for at least 10 more years- great uncertainty on storage potential

Source: Chattopadhyay, D., Padiseti, K., Spoor, K., Electricity generation investment analysis, Deloitte study for the Department of Resources Energy and Tourism, May 2011.

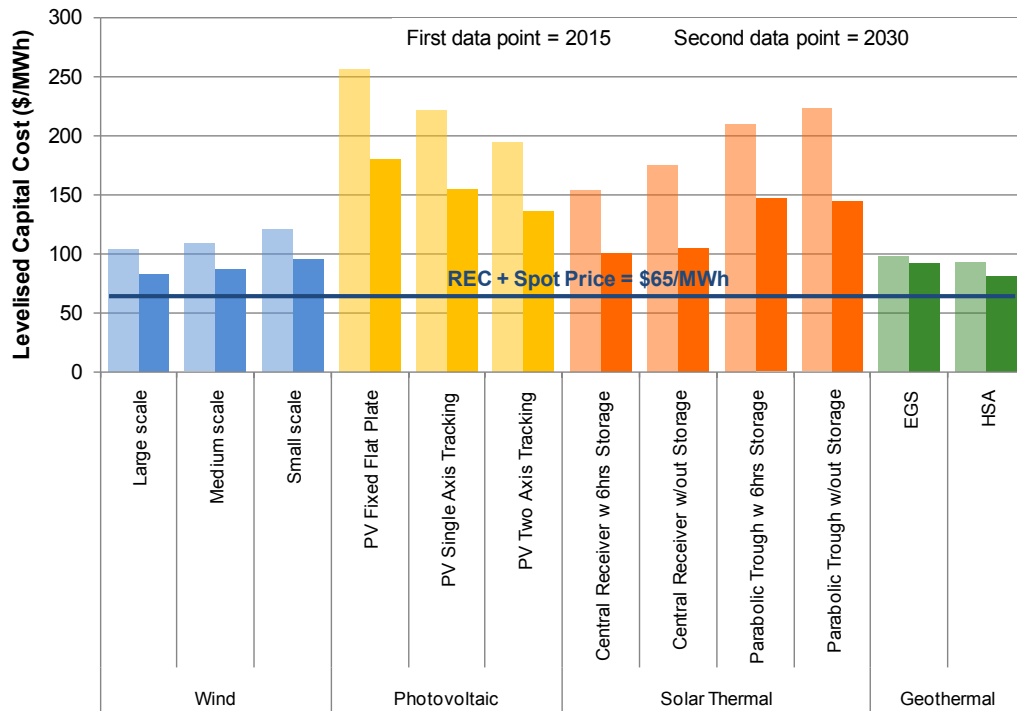
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Investment Choices Going Forward: Gas?

- Baseload gas generation is not economic at ~\$23/tonne that is likely to prevail for the next 3 years
 - Significant uncertainty on carbon prices post 2015 including the prospect of low priced international permits
 - Significant uncertainty on gas prices due to LNG export potential
 - Entry of renewable energy has depressed pool prices that also affect return on investment
 - Merchant CCGT is regarded risky
 - “...The policy uncertainty could see investment in baseload (gas plant development) set back a decade. Australia won’t run out of power. The industry will invest. But (without a carbon price) the investment will be committed on a “least risk basis... That meant the industry would build so-called open-cycle gas generators rather than the more expensive but more efficient closed-cycle plants that the gas industry hopes will one day replace much of today’s coal-fired generation capacity” [Origin Energy, August 2010]

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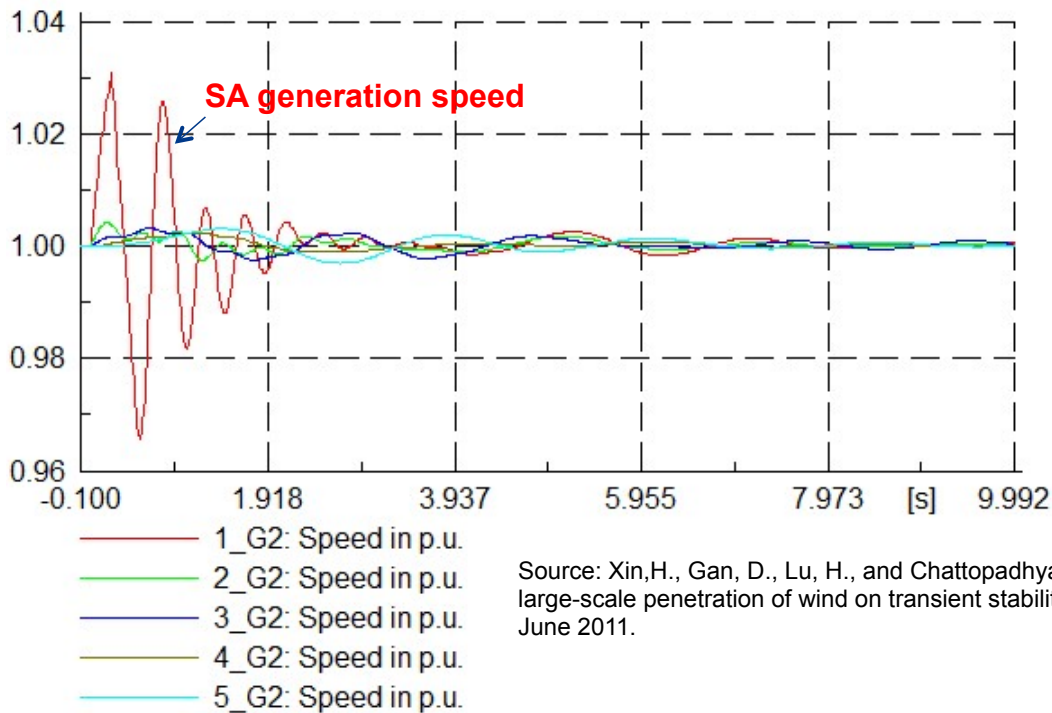
Investment Choices Going Forward: Renewable?



Levelised costs for renewable generation is higher than what they can earn from pool prices and REC prices combined

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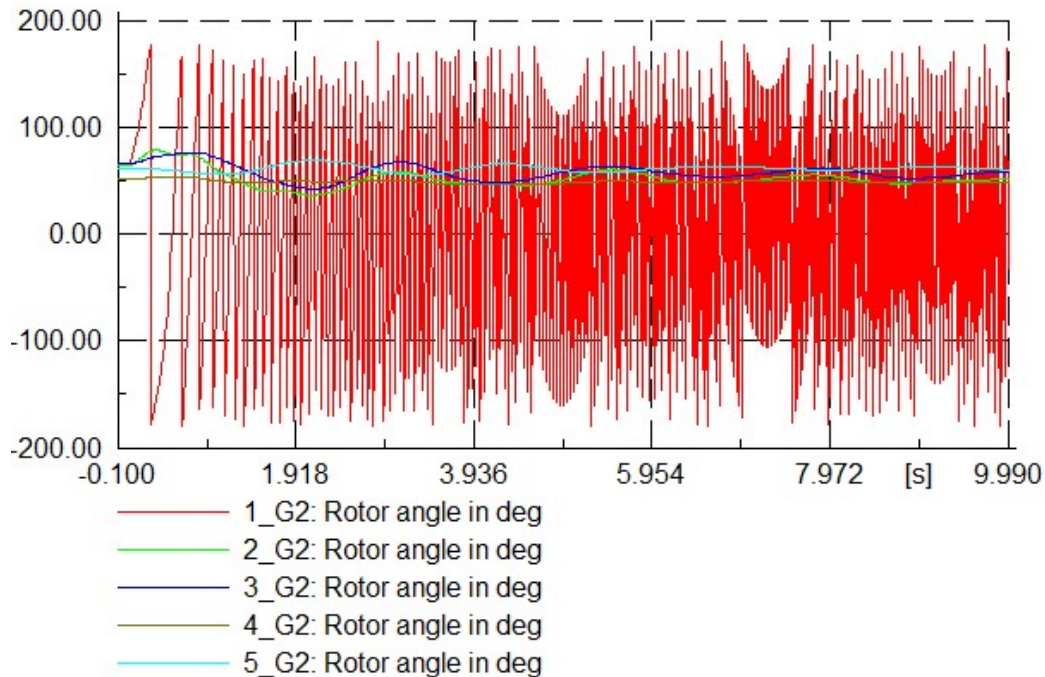
Investment Choices Going Forward: Renewable?



20% wind generation scenario: A three-phase-to-earth fault occurs on the SA-VIC transmission line, the rotor speeds and angles in SA (1_G2) exhibit the largest deviation and oscillation compared with other regions

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Investment Choices Going Forward: Renewable?



35% wind generation scenario: It is very clear that the system has fallen into instability and the generators in SA are the first to go out-of-synchronization. There are technical limits on how much wind the power system can withstand

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Cost of Uncertainty

- Coal generators commented that they could have brought forward their capex programme that would have resulted in more capacity and less emissions
- Gentailers noted significant overbuild of OCGT rather than CCGT to minimise capital risk – again higher costs *and* emissions
- AGL has estimated the uncertainty costing the economy \$2 billion per year (or, \$8.60/MWh over 200+ TWh) (“investment paralysis”)
- Major impacts maybe summarised as “Financial constraints” that imply
 - Limited debt capacity - high cost of financing
 - Less baseload investment
 - More expensive generation
 - Higher emissions

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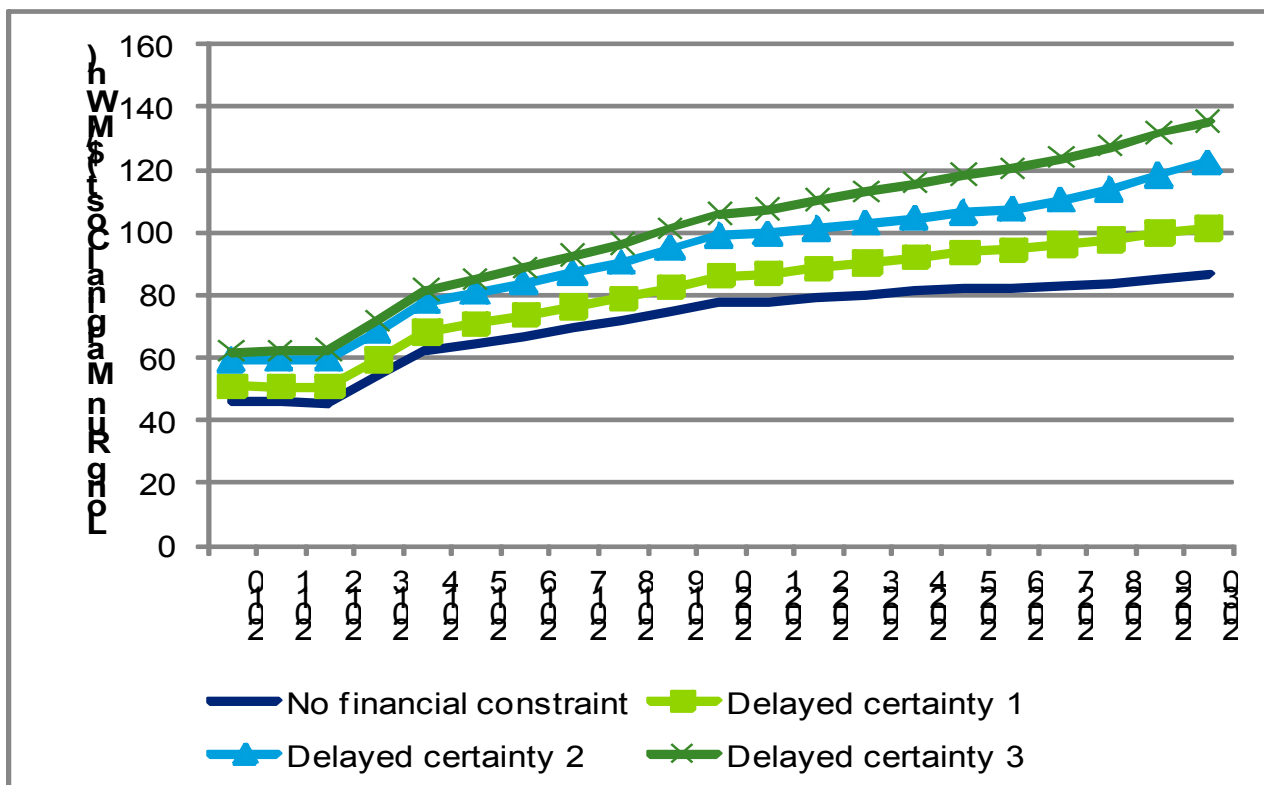
Cost of Uncertainty Forward looking analysis (2011-2030)

	No financial constraint	Delayed certainty ¹	Delayed certainty ²	Delayed certainty ³
Uncertainty resolved in	2013	2017	2020	2025
Debt capacity (\$b)	Unlimited	60	40	30
Capacity in 2030 (MW)				
Coal	27,995	28,189	30,142	23,490
CCGT	33,696	25,098	13,763	12,311
OCGT	13,900	17,730	23,146	31,250
Demand Response	3,217	4,033	8,000	8,000
Total investment in generation and discounted system costs (\$b)				
Investment (\$b)	129	122	119	109
Discounted Costs (in \$b)**	237	267	308	333
Cumulative CO ₂ 2010-2030 (mt)	4,010	4,164	4,333	4,167

Source: Majumdar, S. and Chattopadhyay, D., Debt crunch: what does it mean for baseload investment, emissions and prices, *The Electricity Journal*, October, 2011.

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Cost of Uncertainty Forward looking analysis (2011-2030)



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Key Messages

- A false sense of certainty is worse than pervasive uncertainty
- Notwithstanding the recent development on Clean Energy Bill, baseload gas generation investment will continue be affected due to policy uncertainty
- Significant clarity on the policy front is needed to avoid a baseload investment paralysis that will lead to higher cost of electricity, higher emissions and a failure to meet the renewable energy target

Deloitte.

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