

Electricity supply in the National Electricity Market (NEM), 2005-12

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Over the 2005-12 period the evolution of the NEM, and the challenges it faces, will be driven by:

- economic growth and its components, for example personal disposable income and major projects, and the impacts of these trends on electricity demands, for example air conditioner sales and electricity intensive projects such as aluminium smelting (expansions at current plants and new, such as Aldoga in Queensland); and
- government policies (federal, State), particularly those relating to greenhouse. Note the very different greenhouse policies of the Federal Government and the Opposition on Kyoto and the Mandated Renewable Electricity Target (MRET). Hence the importance of the federal election outcome on electricity market developments, which in essence means greenhouse, renewables (and perhaps gas) and energy efficiency, will receive less emphasis over the short and medium terms.

In addressing these drivers and the trends arising from them, we analyse three scenarios.

1. Business-as-usual based on medium term NIEIR projections of economic growth and components and current policies, that is, no introduction of new policies (taxation, trade, greenhouse, etc.).
2. Introduction by 2008 of a mild carbon signal of \$10/t CO₂e, through an Emissions Trading System (ETS) or a carbon tax.
3. Introduction by 2012 of a more stringent carbon signal of \$30/t CO₂e, through an Emissions Trading System (ETS) or a carbon tax.

Each of these scenarios is outlined and analysed below.

The impacts of the two carbon price scenarios on a range of NEM generators are presented in **Table 1**.

Generator	CO ₂ e intensity: sent out (t CO ₂ e/MWh)	Impact of carbon prices (\$/MWh) ¹	
		\$10/t CO ₂ e	\$30/t CO ₂ e
Brown coal			
Hazelwood	1.50	15.0	45.0
Loy Yang	1.25	12.5	37.5
IDGCC or similar technology	0.80	8.0	24.0
Black coal			
Munmorah, NSW	1.0	10	30
Bayswater, NSW	0.9	9	27
Stanwell, QLD	0.9	9	27
Millmerran, QLD	0.8	8	24
Gas			
OCGT			
Somerton, VIC	0.70	7	21
New	0.60	6	18
CCGT			
Pelican Point, SA	0.50	5	15
New	0.40	4	12
Renewables	0	0	0

Note: 1. Impact on electricity prices depends on the extent of carbon price pass-on, which in turn depends on the form of the carbon signal (carbon tax, emissions trading system), the design of the chosen carbon signal, market competition, market shape (peak, off-peak, etc.) and demand elasticity.

Carbon prices above about \$15/t CO₂e begin to change the generator merit order.

1. Business-as-usual (BAU)

In this scenario base load additions continue in Queensland from coal plants (Kogan Creek, 2008) and combined cycle gas turbines (CCGTs). Gas for generation mainly comes from coal seam methane and PNG (by 2010-11). Most gas plants, including cogeneration units, come into service to meet the Queensland Clean Energy Policy targets.

In New South Wales mothballed units at Munmorah and Liddell are brought back into service by 2007-10. Expansions are introduced at Bayswater and Liddell, and gas fired generation plants (cogeneration, CCGTs) are introduced to meet the New South Wales Greenhouse Gas Abatement Scheme (GGAS).

In Victoria no additional base load plants are constructed in the period (NEMMCO 2004 SOO projects 500 MW in 2012-13). Supplies to meet base and intermediate demand growth come from imports, reduced exports, incremental additions to existing brown coal plants (Hazelwood, Loy Yang) and an intermediate load CCGT. Significant (200 MW plus) new industrial loads, for example from magnesium and/or aluminium plants, could see a new base load plant prior to 2012.

In South Australia slow economic growth plus imports means additional base load is not required over the period. Similar conditions apply in Tasmania with the completion of Basslink in 2005 and full gas conversion of Bell Bay.

In the mainland States additional peak demands from air conditioning and overall growth are met by open cycle gas turbines (OCGTs) peakers and Basslink in Victoria. Peak demand growth is, overall, about 30 per cent above total demand growth (Table 2). Renewables expansion via MRET virtually ceases after 2007 unless the States introduce measures similar and complementary to MRET. (Opposition policy is to double the MRET to 20,000 GWh by 2010.)

Inter-connection augmentations include Basslink (Tasmania to Victoria, 600 MW, by 2006), Snovic (Snowy to Victoria, 400 MW, by 2010). SNI remains problematic but may proceed by 2010.

NEM average wholesale price reach about \$35/MWh (2004 dollars) by 2010 to attract new entrants and refurbished plants to meet demand growth. Retail prices for each class of customer will depend on, besides wholesale prices, regulatory treatment of network augmentations and retail margins.

Demand impacts include adoption of 5-star or equivalent for all new homes and significant expansion, albeit from a small base, of solar hot water heating driven by MRET and State rebates. Aluminium production grows slowly except in Queensland where Alcoa commences production in 2007.

This is not a zero carbon cost scenario. The federal Mandated Renewable Electricity Target (MRET), the New South Wales Greenhouse Gas Abatement Scheme (GGAS), the Queensland Clean Energy Policy, the Victorian Greenhouse Strategy (VGS) and other measures to address greenhouse concerns will lead to an implicit average NEM carbon price of about \$4/t CO₂e.

Scenario probability (P) = 0.3.

Table 2 Key projections in BAU scenario, percentage changes, 2004-05 to 2011-12¹

	QLD	NSW	VIC	SA	TAS	AUST
2004-05 to 2011-12						
GSP (average annual growth rates)	4.4	3.1	3.1	2.0	1.3	3.2 (GDP)
Electricity demand (average annual growth rates)						
Total energy	3.9	1.9	1.9	1.6	1.6	2.6
– Industrial	3.8	1.6	1.3	1.0	1.3	2.4
– Commercial	5.5	3.4	3.6	3.2	3.3	3.8
– Residential	4.0	1.7	1.6	1.0	0.9	2.3
2004-05 to 2011-12						
Peak – total summer	6.0	3.0	2.9	3.0	1.9	3.4
– Industrial	4.5	2.2	1.8	2.0	1.3	2.7
– Commercial	7.7	5.0	5.3	4.6	3.9	4.9
– Residential	6.4	3.0	2.9	2.1	1.2	3.3

Note: NIEIR estimates; currently being reviewed.

2. Mild carbon signal of \$10/t CO₂e by 2010

We regard this as the most probable scenario as:

- Australia will soon realise it will have to sign up to Kyoto or its successor because of a realisation that global warming concerns and policies to address them will not go away;
- an ETS or similar policies will be introduced by 2010 to position Australia for a more stringent greenhouse regime post 2012; and
- only a mild signal is required to put, initially, Australia on a greenhouse restructuring path.

The form and detailed design of the carbon signal will determine the response of each generator. If permits are allocated free of charge for a **proportion** (<100 per cent) of their output generators could purchase permits to cover their non-permit allocated output, reduce output and sell any surplus permits, reduce emissions per MWh produced or undertake some combination of the above options.

In this scenario demand impacts are overall mild except that the introduction of a carbon signal leads to a rethink of future investment in energy (particularly electricity) intensive projects (particularly aluminium and magnesium).

Demand impacts: low, reacting to moderate price increases.

Supply impacts: low immediately but significant for medium and long terms; no significant change in electricity supply occurs except that this carbon price signals the need to reduce the greenhouse gas intensity (GHGI) of electricity supply. To achieve lower GHGI levels existing plants would be modified and new plants would be built to lower GHGI specifications.

Electricity prices will rise by \$5-10/MWh relative to BAU depending on the carbon signal design and the pass-on of carbon costs.

In this probable scenario the security of energy supply can be enhanced, over the next ten years, by jurisdictions (States and Territories, but preferably federal) stating clearly that a carbon signal is coming and indicating that it is likely to be in the \$10/t CO₂e range. This needs to be accompanied by, in broad terms, statements on what this signal means for the electricity and overall energy system.

For example, the need to consider the greenhouse gas intensity (GHGI: tonnes of CO₂/MWh) of new generators, re-assessment of refurbishment economics for existing generators and the improvement of end-use energy efficiency. Attention to the factoring in of carbon prices in energy system decision making at the end-use, network and generation/production level is required if an efficient and non-disruptive transition to a carbon price environment is to be achieved.

It is also necessary to develop and implement, as soon as possible, a national innovation policy and effective innovation measures to address the challenges posed by carbon pricing and other trends in electricity supply and demand.

This policy and accompanying measures should cover each element of the innovation spectrum: R, D, D and C research, development, demonstration and commercialisation. And it should cover generation/production, networks and end-use. For example, new generation technologies, network augmentation and generation refurbishment techniques and end-use technologies for both efficiency improvement and load control.

The recent (18 June 2004) federal White Paper is deficient in both the security of supply and innovation areas. Although there are some useful initiatives, such as the Low Emission Technology Fund (LETF), there is no vision and accompanying strategy for effective action over the medium term (2005-2020).

Australia **may** achieve its 2008-12 Kyoto target: mainly due to land clearing reduction. But beyond 2012 there will probably be a more stringent global greenhouse regime in place, and additional land clearing emissions reduction will not be available. We cannot afford to depend on technology developments which **may** become commercial between 2020 and 2030. Australia needs an effective plan and supporting measures to effectively reduce the growth of greenhouse gas emissions in the 2005-25 period. That is, to **position** ourselves for the high probability of carbon pricing in that period.

The White Paper does not present any strategy or effective measures for dealing with greenhouse in the 2005-2020 period. The paper seems to assume, against the global policy trends, that no effective greenhouse policy action will be needed by Australia post-2012 until the 2020s.

If we are poised to achieve our Kyoto target by 2012 why don't we ratify? What is the penalty in ratifying? We can gain by:

- being involved with ratifiers in designing beyond 2012 policies; and
- from Kyoto flexibility mechanisms (Clean Development Mechanism, Joint Implementation; CDM, JI) only available to ratifiers.

And as only mild (up to \$10/t CO₂e) carbon signals are likely to be required to attain our Kyoto target, economic impacts would be low. Such a carbon signal would provide net economic benefits beyond 2012 compared with no action.

This industry support fund (LETF) of \$500 million, leveraging a minimum of \$1,000 million of private funding for R, D, D and C of low emission technologies aimed at greenhouse gas abatement over 2020-30 will:

- favour large entities as small innovative companies, particularly in the renewable energy area, will find it hard to raise the minimum 2/3 required;
- as such will probably focus on geosequestration (which will inevitably raise electricity prices) and low GHGI coal technologies; and
- the commercial outcomes are uncertain and unlikely until well beyond 2020.

This is a useful long term initiative if refined to provide practical assistance to small innovative companies. But as indicated above, it is not complemented with initiatives to produce greenhouse gas abatement (GHGA) and other energy sector issues in the 2005-20 period.

Scenario probability (P) = 0.6.

3. More stringent signal of \$30/t CO₂e by 2012

This may occur (with a low probability by 2012) as the science increasingly shows the reality and pace of global warming. Kyoto is by-passed as a new global agreement, covering most countries, emerges. This price level would accelerate greenhouse policy development entailing introduction of an Emissions Trading System (ETS) and complementary measures such as energy efficiency improvement. Electricity price (average wholesale) increases would be significant (\$20-30/MWh) and only low intensity (<0.85t CO₂e/MWh) electricity generators would be built. There would be a significant reduction in older coal plant asset values and serious consideration given to their closure or substantial refurbishment.

At the electricity prices resulting from the carbon price some renewables (biomass, wind) become competitive but geosequestration remains commercially non-viable (costs >\$30/t CO₂e) in the time period.

New investment in electricity intensive (particularly aluminium) industries virtually ceases and current production reduces as energy contracts expire. It is realised that the cost of insulating these industries, for example aluminium, from carbon prices is too high. However, as the impact on gas prices is lower than the electricity price, impact gas intensive processes, such as alumina, continue to expand based on Australia's resource base, low sovereign risk and continued process energy efficiency improvement.

Supply impacts: gas generation is lower cost than coal generation in most cases (except for black coal in Queensland where low cost high quality coal is available). There is a reduction in asset value of most existing coal generators.

Demand impacts: Overall sectoral demands will decline relative to BAU because of structural adjustment and energy efficiency improvement (driven by price increases and specific measures).

Acceleration of energy greenhouse gas abatement (GHGA) supply and demand RDD&C paves the way for lower cost GHGA post-2015.

Scenario probability (P) = 0.1.

Likely level of the carbon signal by 2012 based on scenario probability analysis

Scenario 1	=	0.3p x \$4/t CO ₂ e	=	\$1.2/t CO ₂ e
Scenario 2	=	0.6p x \$10/t CO ₂ e	=	\$6/t CO ₂ e
Scenario 3	=	0.1p x \$30/t CO ₂ e	=	\$3/t CO ₂ e
Probable signal (weighted probability average)				\$10.2/t CO₂e

Probable NEM price increase?

\$10.2 x average greenhouse gas intensity (GHGI) of 1t CO₂e/MWh = \$10.2/MWh if passed on: full pass-on is unlikely.

Conclusion

The National Electricity Market (NEM) could, but is unlikely to, continue on a business-as-usual (BAU) path over the next 10 years because global economic and environmental policies are likely to change, possibly significantly.

From a policy perspective there is a need to recognise this and to position the NEM, and overall Australian energy markets, in a flexible way, to meet these potential changes and the challenges they pose.

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