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NERA
Economic Consulting

Adapting Energy Markets to a Low-Carbon Future

Twelfth ACCC Regulatory Conference

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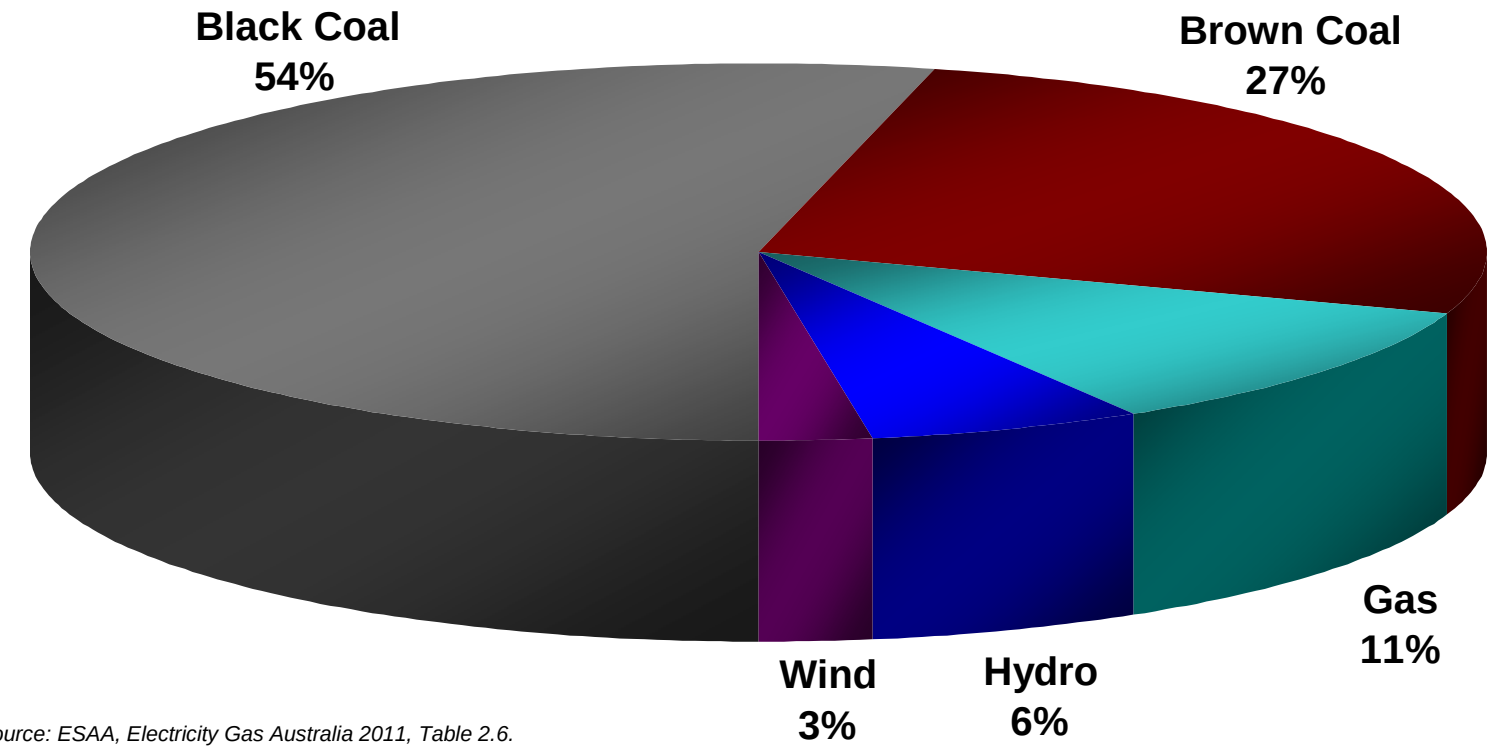
28 July 2011

Insight in Economics™

A High-Carbon Starting Position

- NEM is the highest carbon-emitting market in the OECD
  - Surpassed only by Cambodia, Cuba and India!



Source: ESAA, Electricity Gas Australia 2011, Table 2.6.

A High-Carbon Starting Position

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Emissions Intensity Factors for Existing Generation in the NEM (Tonnes CO_2/MWh)

Fuel	Average	Range
Brown Coal	1.37	0.95-1.53
Black Coal	1.01	0.86-1.19
Gas—OCGT, Steam Turbine	0.75	0.43-1.05
Gas—CCGT	0.47	0.40-0.60

Source: AEMO, Spreadsheet entitled Generation C02 intensity.xls

Key Policy Parameters…

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Carbon-related initiatives affecting electricity market

- $23/tonne carbon tax from 1 July 2012
- Trading of permits from 1 July 2015, $20/tonne price floor
- Energy Security Fund
  - Payments for ‘managed closure’ of 2000MW high emitting generation by 2020
  - $5.5bn allocation of free permits, cash until 2016-17
  - Loans to distressed generators, to refinance debt, buy permits
- Renewable energy target (RET) of 45,000GWh by 2020
  - Large-scale renewable energy target (LRET)
  - Small-scale renewable energy scheme (SRES)

Carbon Price Effect on Generators

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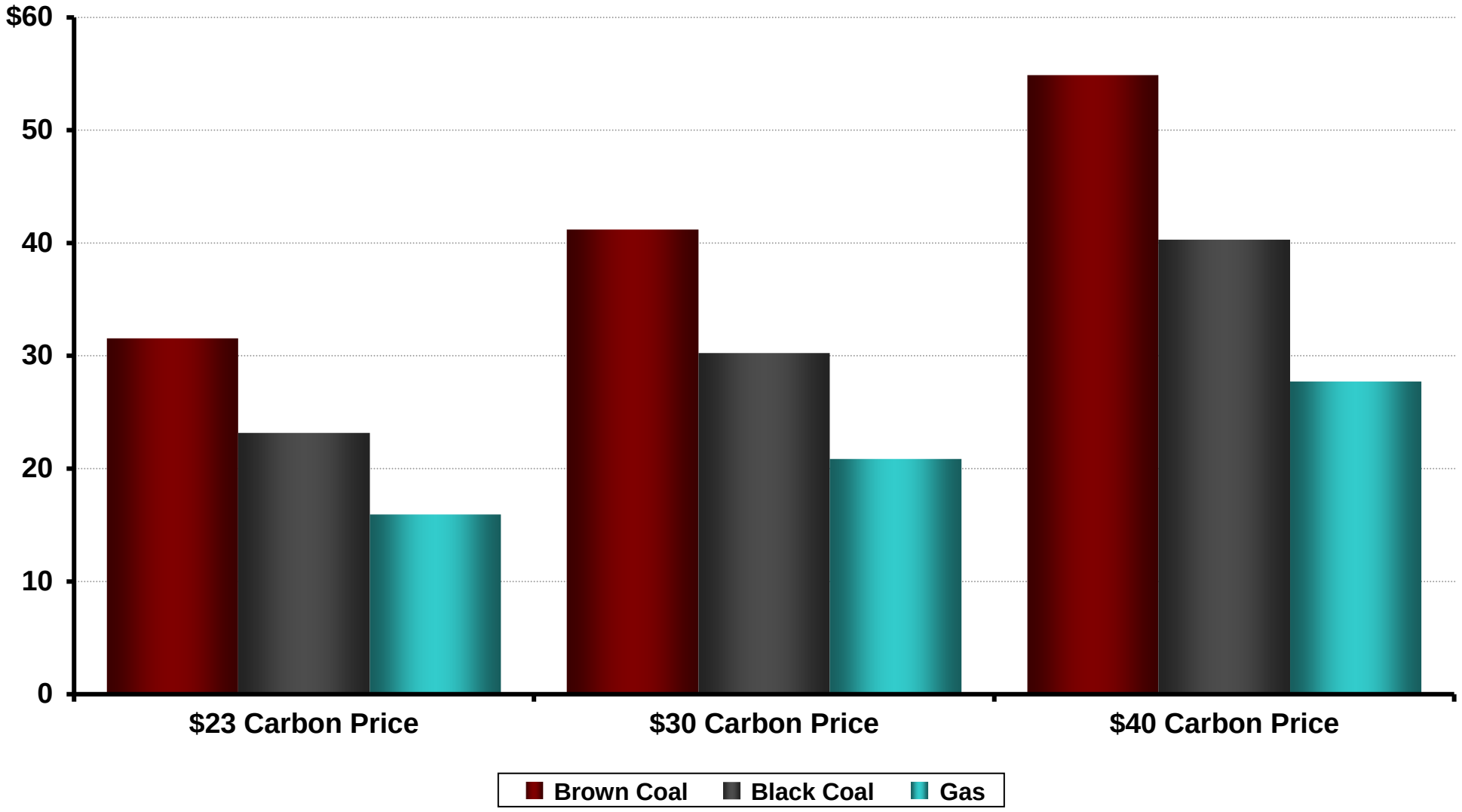
Effect of Alternative Carbon Prices on Generation Costs by Fuel Type



Notes: Emissions factors based on average measures recorded in: AEMO, Spreadsheet entitled Generation C02 intensity.xls.

Carbon Price Effect on Merit Order

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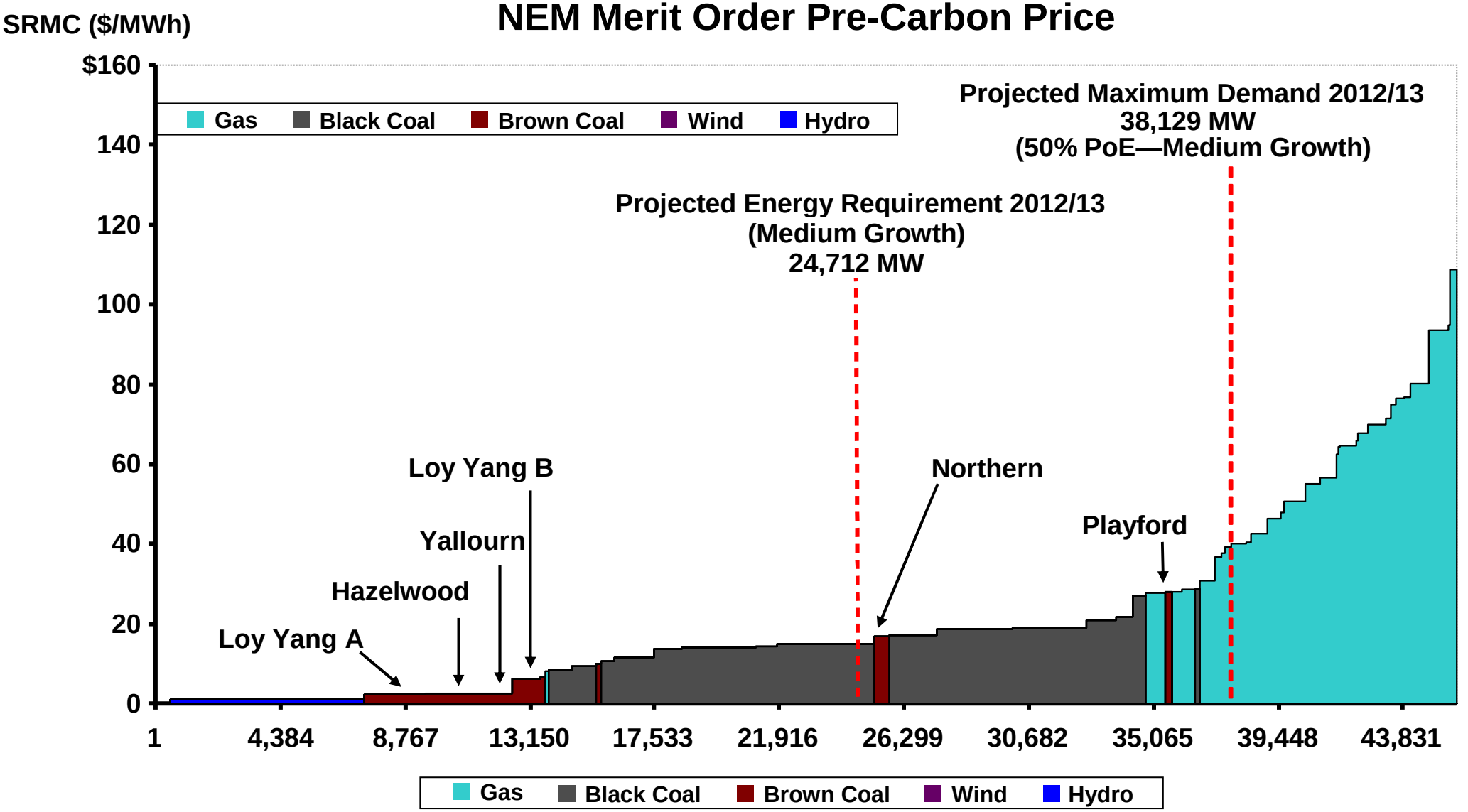
NEM Merit Order Pre-Carbon Price



Sources: SRMC data from ACIL Tasman, Fuel Resource, new entry and generation costs in the NEM; Projected energy and maximum demand from AEMO, 2010 Electricity Statement of Opportunities; Emissions factors from AEMO, Spreadsheet entitled Generation C02 intensity.xls

Effect of $23 Carbon Price

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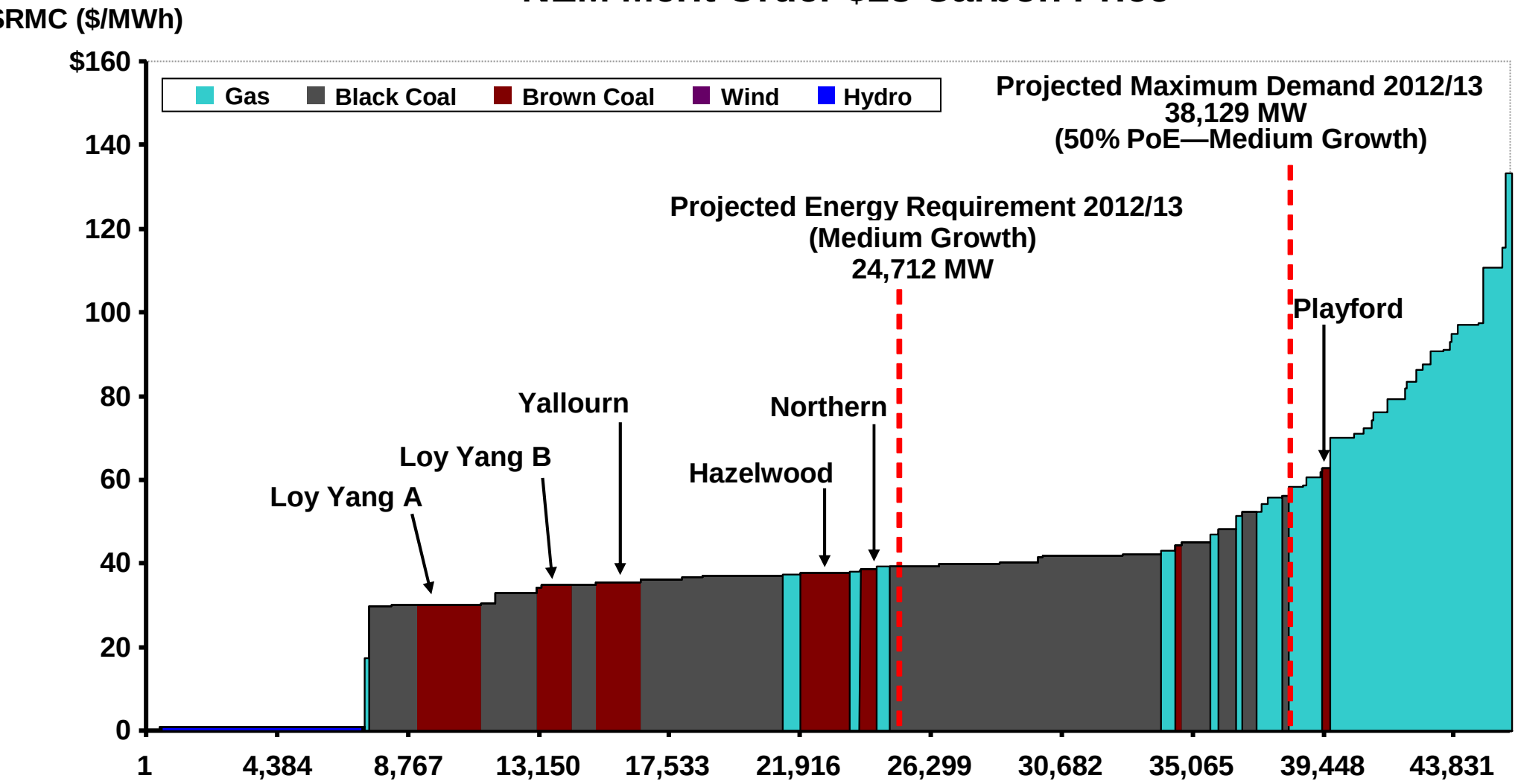
NEM Merit Order $23 Carbon Price



Sources: SRMC data from ACIL Tasman, Fuel Resource, new entry and generation costs in the NEM; Projected energy and maximum demand from AEMO, 2010 Electricity Statement of Opportunities; Emissions factors from AEMO, Spreadsheet entitled Generation C02 intensity.xls

Effect of $30 Carbon Price

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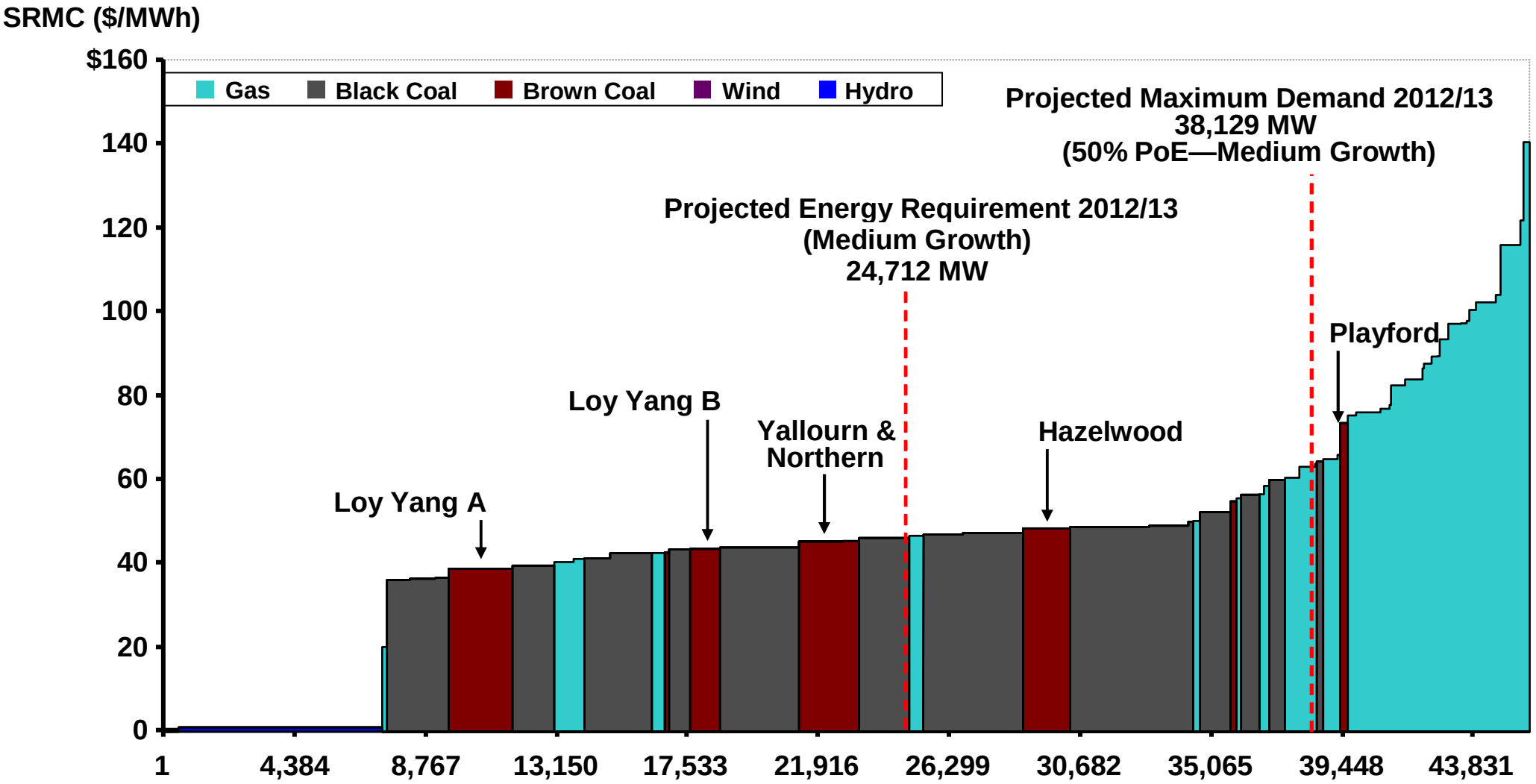
NEM Merit Order $30 Carbon Price



Sources: SRMC data from ACIL Tasman, Fuel Resource, new entry and generation costs in the NEM; Projected energy and maximum demand from AEMO, 2010 Electricity Statement of Opportunities; Emissions factors from AEMO, Spreadsheet entitled, Generation C02 intensity.xls

Effect of $40 Carbon Price

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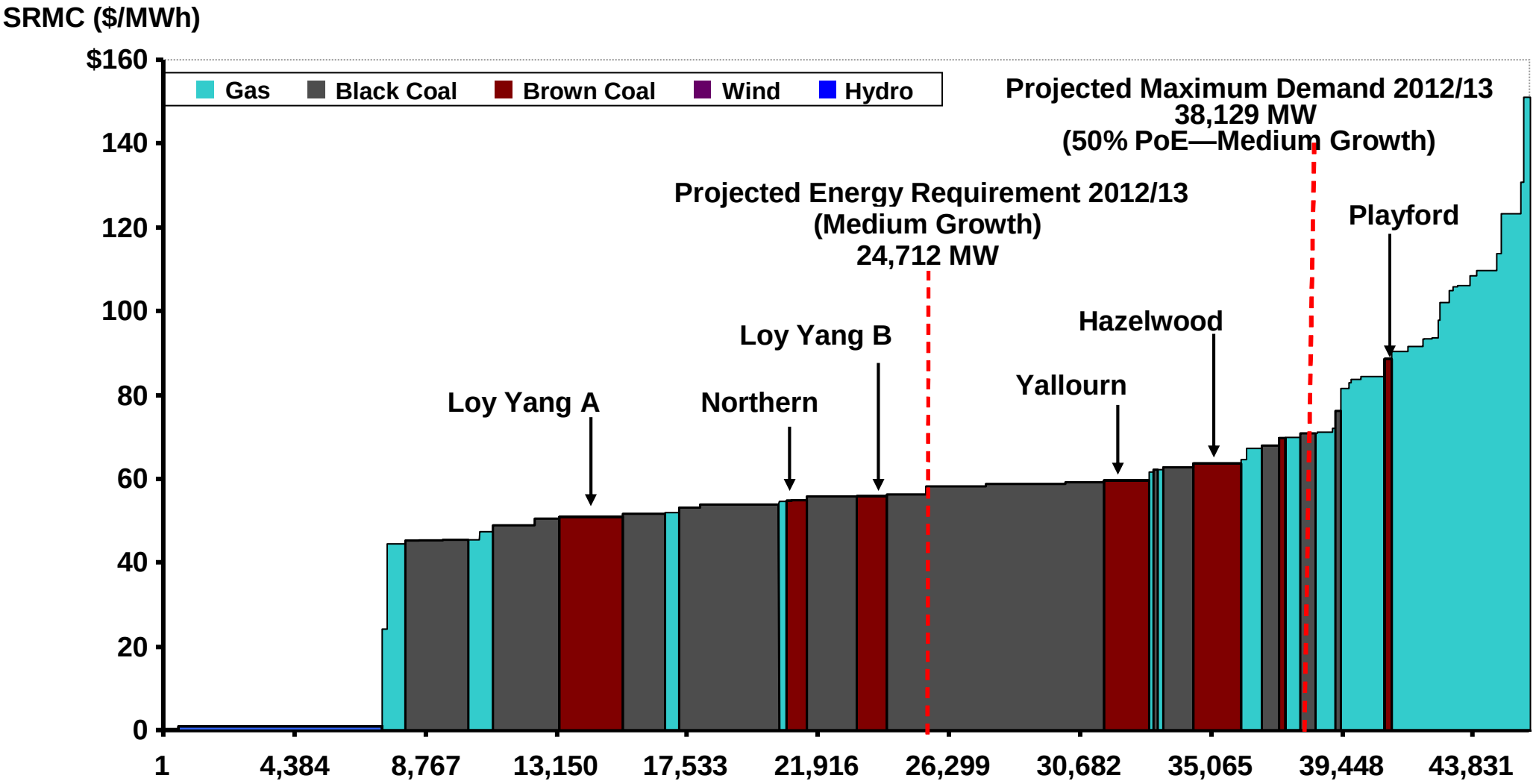
NEM Merit Order $40 Carbon Price



Sources: SRMC data from ACIL Tasman, Fuel Resource, new entry and generation costs in the NEM; Projected energy and maximum demand from AEMO, 2010 Electricity Statement of Opportunities; Emissions factors from AEMO, Spreadsheet entitled Generation C02 intensity.xls

General Observations

- RET ensures that load growth to 2020 is effectively served by renewables – but significant idle capacity needed as ‘backup’
- Black coal output increases, displacing brown coal that has more frequent/longer periods of minimum-level operations (night time)
- Some gas fired generators move up merit order, but limited to Queensland coal seam supplied plants with cheap legacy fuel contracts
- Effect on individual brown coal plants differs significantly given varying emissions intensity factors (ranging from 1.21-1.53)
- Increased reliance on black coal likely to cause increased imports into Victoria, from NSW
- Load growth uncertainty given substantial assistance to energy efficiency and significant retail price effects (both carbon- and network cost-related)

Most Pronounced Effects in Victoria

- Brown coal presently accounts for 63% of installed capacity and over 90% of electricity generated in Victoria
- Of the four large brown coal generators, Hazelwood and Yallourn are 'natural candidates' for the government's 2,000 MW retirement plan

Scheduled Victorian Brown Coal Generators

Plant	Registered Capacity (MW)	% of Electricity Produced in Victoria 2009-10	Emissions Intensity Factor (tCO_2/MWh)
Hazelwood	1,600	21%	1.53
Yallourn	1,480	21%	1.42
Loy Yang A	2,120	32%	1.21
Loy Yang B	1,000	16%	1.24
Energy Brix	195	2%	1.49
Anglesea	150	0.1%	1.21

Source: AEMO, 2010 Electricity Statement of Opportunities, pp. 108 and 113; AEMO, Spreadsheet entitled Generation C02 intensity.xls

Case Study: Closure of 2000 MW

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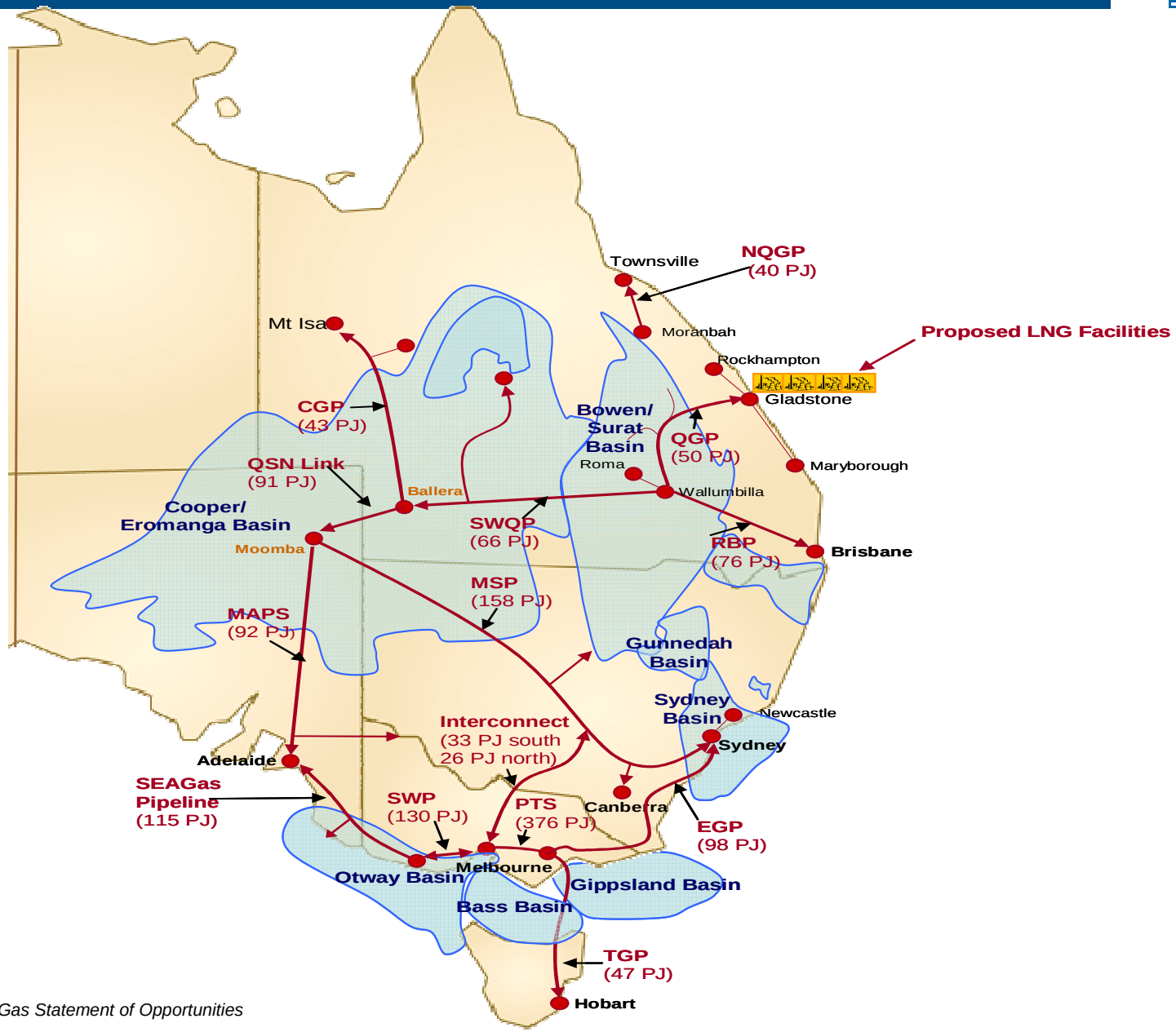
- 'Managed closure' of 2000 MW high emissions plant by 2020 most likely to result in:
  - Complete shutdown of Hazelwood (1600 MW)
  - Partial shutdown of Yallourn (400 MW)
- Gas-fired CCGT is the only credible technology/fuel source capable of replacing base load capacity in that timeframe.
- Energy market implications begin with fuel supply
  - 2000 MW running as base load represents ~120 PJ gas per annum
  - Victorian total gas demand in 2009-10 was 266 PJ*
  - Demand increment represents a 45 per cent increase!

Substantial implications for eastern Australia gas market!

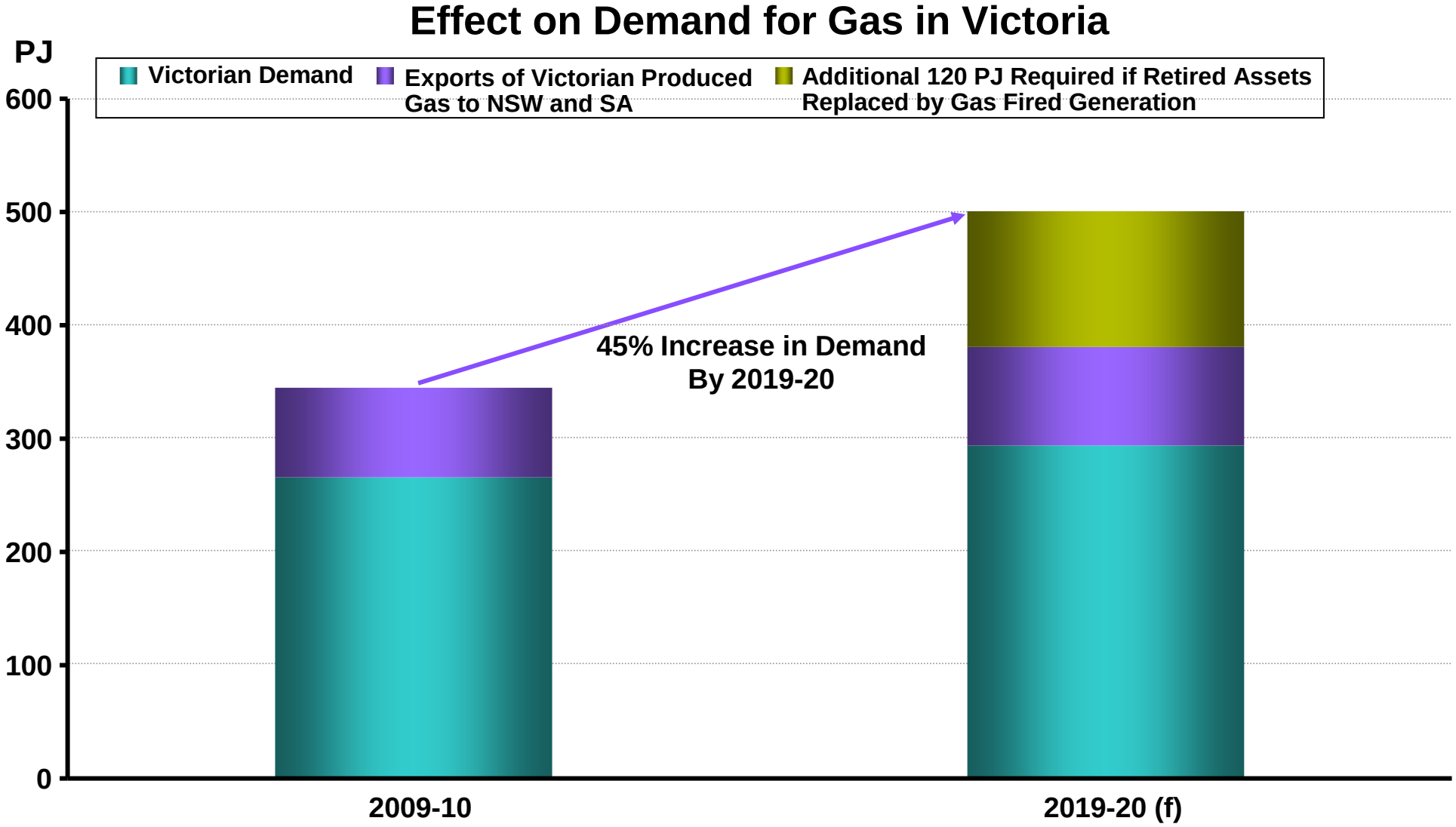
** Source: ABARE, Australian Energy Statistics, 29 June 2011*

Eastern Australia Gas Market



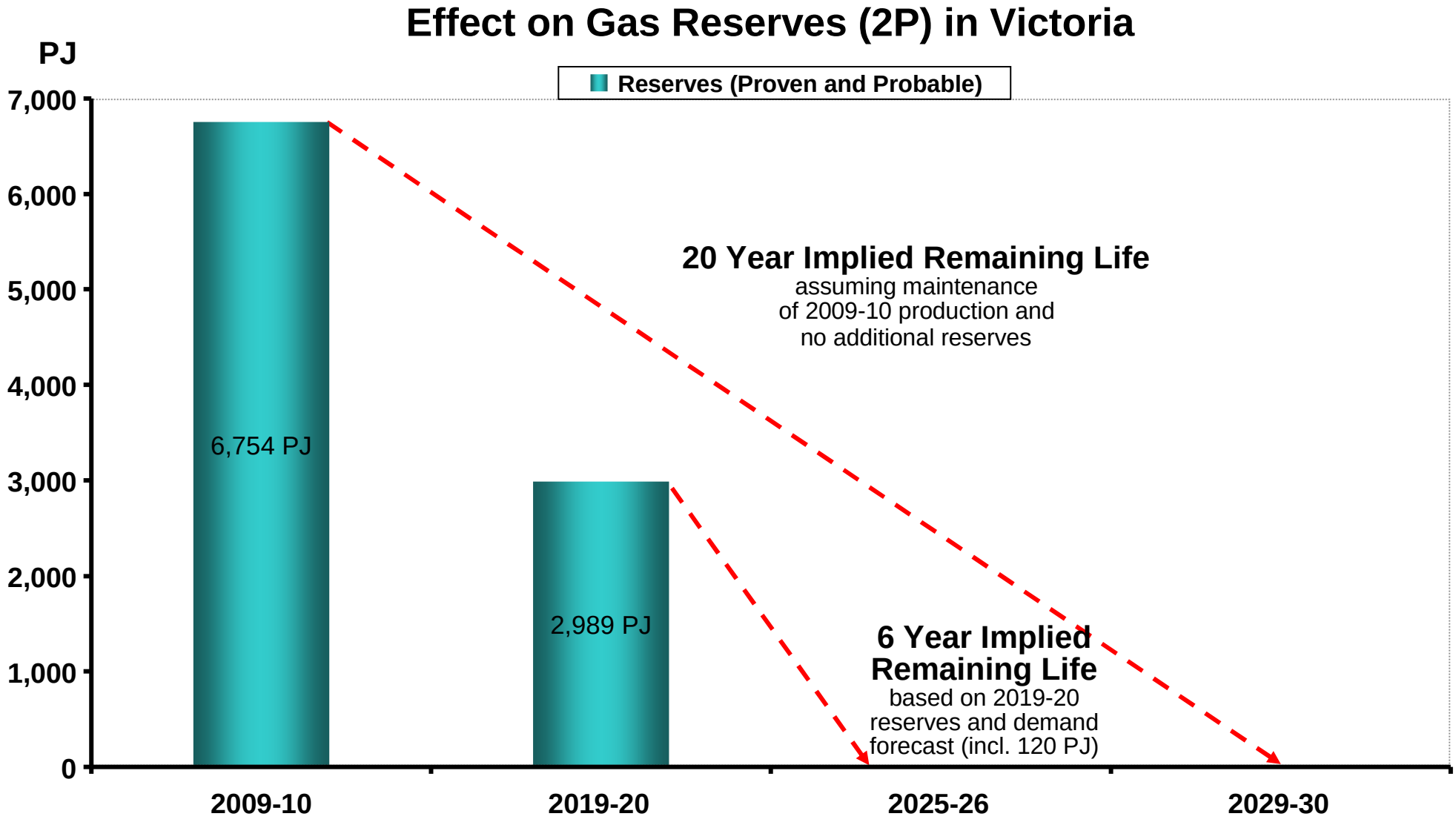
NERA Stylised Map.
Source for pipeline capacities: AEMO, 2010 Gas Statement of Opportunities

Effect on Demand for Gas in Victoria



Sources and Notes for 2009-10 data:
Victorian demand data: ABARE, Australian Energy Statistics, Energy Update 2011
Exports derived from the difference between production from Victorian basins and Victorian demand.
Production data: EnergyQuest, Energy Quarterly, August 2010.

Effect on Gas Reserves



Source for reserve estimates: EnergyQuest, Energy Quarterly, May 2011.

Effect on Gas Prices, Pipeline Flows?

- Prevailing Victorian/NSW wholesale gas prices are ~$3.50-$4.00/GJ*
- Certified Victorian reserves are based on economic extraction at prevailing prices
- Queensland LNG developments represent long term demand sink at ~$6-12/GJ, depending on world oil prices*
- Queensland to Victoria gas transport costs ~$2/GJ**

NERA Stylised Map.
Source for pipeline capacities: AEMO, 2010 Gas Statement of Opportunities

Sources:
** EnergyQuest, Energy Quarterly, May 2011*
*** Estimated using SWQP and QSN charges information from EnergyQuest, Energy Quarterly; MSP, Interconnect and PTS charges from APA website.*

Effect on Transmission Networks

- Latrobe Valley to Melbourne transmission capacity will presumably become spare, although its costs will still need to be met
- If gas pipeline costs are met by CCGT developers and electricity transmission build is not, CCGT will want to locate close to gas supply
- Potential reduction in gas supply from Victoria to NSW and SA (100PJ pa) could reduce demand for SEAGas and EGP pipelines, but expand demand for MAPS and MSP

Can our Current Institutions Cope?

- Adapting to a low-carbon future involves energy market restructuring well beyond the experience of the NEM institutions
- The challenges for policy makers, regulators, business decision-makers and financiers are unprecedented
- Big market adaption questions arise in relation to:
  - achieving sufficient certainty to finance substantial infrastructure investment across gas and electricity markets
  - managing risks to security of supply in the face of major change
  - electricity market design - can it cope with lumpy base load retirements and new investment needs?
  - transmission frameworks, and the relative roles of planning vs pricing

New Institutional Arrangements and Assistance Measures are Planned

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Measures to Promote Transformation to Low Emissions Generation

Institutional Arrangements

Energy Security Council

Advice to government on:

- Emerging risks to energy security
- Measures to avert risks arising from financial impairment and carbon pricing
- Loans to generators for refinancing existing debt

AEMO – new responsibilities

- Advice on generation closure timetable
- Implications of greater renewables for transmission network

AEMC – new reviews

Market and regulatory reforms to encourage efficient balance between demand and supply of electricity.

Assistance Measures

Energy Security Fund

Assistance to emission intensive generators through

- Payment for **closure** of around **2,000 MW** by 2020
- Transitional assistance to generators facing 'sizeable asset value losses', including:
  - Up to $**5.5 billion of free permits** over six years;
  - **Limited term loans** where generator is unable to obtain refinancing on reasonable terms from the market
- Assistance conditional upon development of clean energy investment plans

Measures to Encourage Innovation

New Institutions to Administer Funding

Clean Energy Finance Corporation

Investment of up to $10 billion on clean energy initiatives

Australian Renewable Energy Agency

Responsible for administering $3.2 billion of *existing* funding

Funding to encourage clean energy

$10 billion of new funding for commercialisation and deployment of renewable energy, energy efficiency and low pollution technologies

$3.2 billion of existing funding for R&D, demonstration and commercialisation of renewable energy technologies

Concluding Observations

- Electricity and gas markets are integrating, but policy-development may be lagging
- Continuing, critical need for long term policy certainty, eg, an announced program for plant closures, parameters that affect long term carbon price
- Prices should be allowed to do their work – wholesale gas and electricity prices need to find the 'right' level
- The list of wholesale market 'interventions' is growing, and risks unintended consequences (eg, insufficient capacity)
  - RET is a disguised tax on fossil fuelled-base load (yet, we may need it)
  - New technology-based subsidies risk having the same effect
  - Generation market power is hardly our most pressing problem
  - Restrictions on the introduction of time-of-use tariffs hampers the development of demand side response
- Setting up additional institutions gives rise to increased risk for policy coordination and execution

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