FACTSHEET

NATIONAL ENERGY SCENARIOS MODELLING

A modelling exercise commissioned as part of the Energy White Paper process.

The *National Energy Scenarios Modelling* work examines the sensitivity of electricity generation technologies to long term changes in key factors such as economic growth, population growth, global fuel prices, and climate change policy.

KEY POINTS

- The Department of Resources, Energy and Tourism (RET), in conjunction with the Australian Energy Market Operator (AEMO), commissioned the *National Energy Scenarios Modelling* work as part of the Energy White Paper process to examine the impact on the electricity sector of scenarios testing different variables including: economic growth, population growth, global fuel prices (oil, gas and coal), technology development, and global response to climate change (via a carbon price).
- The aim of this work is to gain an insight into a range of potential scenario outcomes, particularly for regional generation and transmission infrastructure.
- The *National Energy Scenarios Modelling* reports provide publicly available information on the findings and assumptions derived from long term (2030 and 2050) modelling of Australia's national energy supply sector for a set of possible future scenarios.
- The work draws upon collective input from a diverse range of stakeholders.
- Findings are reported at a national and regional level for a range of outputs, including:
    - projected trends in generation technology mix and capital costs; and
    - potential transmission system upgrade requirements opportunities and costs.

BACKGROUND

The *National Energy Scenarios Modelling* reports are the fourth output published as part of the Energy White Paper process.

The other three key analytical reports developed as part of the Energy White Paper process, include:

- The **Australian Energy Resource Assessment** (AERA), that was prepared by Geoscience Australia and the Australian Bureau of Agricultural and Resource Economics, and was released on 1 March 2010. The AERA brings together, in one place and for the first time, a comprehensive understanding of Australia's rich energy resource endowment.
- The **Report of the Prime Minister's Task Group on Energy Efficiency** that was released on 8 October 2010. The report provides advice on the development of policy that can increase energy efficiency outcomes in the Australian energy context.

- The **Australian Electricity Generation Technology Costs – Reference Case 2010** that was released on 25 November 2010. The report provides a data set to examine the cost and performance of globally available electricity generation technologies in Australia.

The ***National Energy Scenarios Modelling*** work released today was carried out in two phases: Phase one includes five scenario definitions, with modelling input data and analysis out to the year 2030 using two separate modelling techniques; and Phase two extends the original modelling time horizon out to the year 2050. This was done to ensure that the results at the year of interest (2030) were not being impaired by the modelling end period being set at 2030.

These scenarios and the underpinning data and assumptions for electricity and gas supply across Australia were used in developing:

- **AEMO's National Transmission Network Development Plan** (NTNDP) and **Gas Statements of Opportunity** (GSOO) – released in conjunction with these scenarios modelling reports; and
- **Electricity Statement of Opportunities** (ESOO).

SCENARIO APPROACH

The *National Energy Scenarios Modelling* work was jointly funded by RET and AEMO, with AEMO providing project direction and management services drawing on a range of modellers including:

- McLennan Magasanik Associates (MMA) – scenario development;
- KPMG – economic forecasts;
- ACIL Tasman – input assumptions;
- ROAM – modelling outputs (to 2030); and
- Intelligent Energy Services (IES) – modelling outputs (to 2030 and 2050).

The work is based on rigorous stakeholder input and review processes to ensure all assumptions, data and modelling approaches are reasonable and realistic.

The *National Energy Scenarios Modelling* defined a set of five scenarios that explore variation in key factors likely to influence the long term development of Australia's energy supply.

Each scenario was modelled for two carbon price trajectories chosen to align with local and global climate change policy responses consistent with that scenario. These were selected from a set of four carbon price trajectories.

The modelled scenarios are:

- Fast rate of change;
- An uncertain world;
- A decentralised world;
- Oil shock and adaptation; and
- Slow rate of change.

Each scenario specifies assumed levels of economic growth, population growth, global fuel price levels and the balance between centralised and decentralised response to sustainability, energy efficiency and climate change challenges. Details on assumptions are included in Table 1.

As the purpose of this work was to model a range of potential outcomes rather than to predict or forecast a likely scenario, assumptions underpinning this work differ from those used for other Australian Government modelling.

Further information on the scenarios, detailed assumptions data and modelling results can be found on AEMO's website www.aemo.com.au

Table 1: Scenario Drivers and Emission Targets

Scenario	Economic Growth	Population Growth	Global Carbon Policy	Centralised Supply-side Response	Decentralised Supply-side Response[4]	Demand-side Response[5]	Emission Targets Below 2000 Levels
Fast Rate of Change	High	High	Strong	Strong	Strong	Strong	-25%[3] (sensitivity -15%[2])
An Uncertain World	High	High	Weak	Strong	Weak	Weak	-5%[1] (sensitivity no carbon price)
A Decentralised World	Medium	Medium	Strong	Weak	Strong	Strong	-15%[2] (sensitivity -25%[3])
Oil Shock and Adaptation	Low	Medium	Moderate	Moderate	Weak	Weak	-15%[2] (sensitivity -5%[1])
Slow Rate of Change	Low (mixed)	Low	Weak	Moderate	Weak	Weak	-5%[1] (sensitivity no carbon price)

1. The -5% emissions target (low carbon price) is associated with a carbon price trajectory from $A0 to $A58 tonne $CO_{2\text{-}e}$ in 2030 and $A129 tonne $CO_{2\text{-}e}$ in 2050 (real $2009-10).
2. The -15% emissions target (medium carbon price) is associated with a carbon price trajectory from $A0 to $A81 tonne $CO_{2\text{-}e}$ in 2030 and $A176 tonne $CO_{2\text{-}e}$ in 2050 (real $2009-10).
3. The -25% emissions target (high carbon price) is associated with a carbon price trajectory from $A0 to $A98 tonne $CO_{2\text{-}e}$ in 2030 and $A220 tonne $CO_{2\text{-}e}$ in 2050 (real $2009-10).
4. Embedded generation and small-scale distributed generation.
5. Improved energy efficiency, storage technologies, smart-grid technology with real-time pricing and “smart” appliances in the home.

HIGH-LEVEL RESULTS

Generation Profile - National

The *National Energy Scenarios Modelling* show that under different GDP, fuel price, demand side assumptions and carbon prices a range of technologies and fuels could play different roles in shaping the stationary energy sector.

Key overarching modelled results at the national level for electricity supply are:

- Without the introduction of a price on carbon there is very little diversification in Australia’s electricity generation mix and demand predominantly continues to be met by the development of coal-fired generation.
- Fossil fuels continue to maintain a major share of generation, gas expands considerably in all scenarios except where gas prices are high, and all scenarios show a major role for Carbon Capture and Storage (CCS) by 2050 in the presence of a carbon price.
- For renewable energy to play a significant role in the generation mix, and to compete on a commercial basis with other technologies, a carbon price is required.

Generation Profile – Regional with carbon price

The *National Energy Scenarios Modelling* outlines the importance that coal, gas and renewable combinations play in the transitioning of the stationary energy sector to a low carbon economy. The development of the generation mix over time has implications for regional mix of current and future generation to meet future demand growth.

The modelling provides some indicative key trends for regional electricity generation mix:

- **NSW**: Becomes a net importer of electricity; renewables increases strongly after 2030; base-load coal fired electricity after 2030 is substituted by conventional gas, gas-CCS or black coal-CCS.
- **Victoria**: Traditional brown coal technology is replaced initially by conventional gas, geothermal and wind and beyond 2030 by gas-CCS and/or brown coal-CCS.
- **Queensland**: Black coal-fired generation is predominately replaced by conventional gas in the short term and gas-CCS and/or black coal-CCS in the longer term.
- **SA**: Growing generation of wind and open cycle gas turbines (OCGT), and baseload brown coal fired generation is replaced by geothermal as the carbon price increases.
- **WA**: In the short term conventional black coal is replaced by conventional gas, in the longer term by gas-CCS and/or black coal-CCS.
- **Tasmania**: Remains predominately hydro based with wind, supported by OCGT, over the longer term playing an increasing role.
- **Northern Territory**: Remains dominated by gas-fired generation with increasing solar development beyond 2040.

Electricity Prices

Results from the *National Energy Scenarios Modelling* show that wholesale electricity prices will increase with or without the introduction of a carbon price. The results also show that Australia needs a carbon pricing mechanism to achieve the transition to a lower carbon economy.

The results test a number of scenarios and do not predict likely or expected outcomes for household electricity bills.

Household electricity bills are made up of a range of cost components including wholesale electricity prices, transmission, distribution and retail charges.

This modelling work has been undertaken to stress test the impacts of a range of variables on Australia's energy sector. It does not model any associated assistance measures that could accompany the introduction of different Government policies.

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