THE TREASURY

Carbon Pricing and Australia's Electricity Markets

Additional scenarios

September 2011

SINCLAIR KNIGHT MERZ SKM | MMA |

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Abbreviations

AEMO	Australian Energy Market Operator (formerly NEMMCO)
CCGT	Combined cycle gas turbine
CCS	Carbon capture and storage
DKIS	Darwin-Katherine Interconnected System
DSM	Demand side management
ESOO 2010	Electricity Statement of Opportunities 2010, a document published by AEMO to provide information on the electricity demand and supply situation in the NEM
GEC	Queensland Gas Electricity Certificate
GGAS	Greenhouse Gas Abatement Scheme
IGCC	Integrated Gasification Combined Cycle Gas Turbine
IMO	Western Australian Independent Market Operator
IPP	Independent Power Producers
LGC	Large-scale Generation Certificate
LNG	Liquefied Natural Gas
LRET	Large-scale Renewable Energy Target
LRMC	Long run marginal cost
MMAGas	Market Model Australia – Gas
MMRF	Monash Multi Regional Forecasting Model
MRET	Mandatory Renewable Energy Target
NEM	National Electricity Market
NGAC	New South Wales Greenhouse Abatement Certificate, which can be earned under the New South Wales Greenhouse Gas Abatement Scheme
NWIS	North-West Interconnected System
OCGT	Open Cycle Gas Turbine
PV	Photovoltaic generation
QNI	Queensland New South Wales interconnect
RET (aka MRET)	(Mandatory) Renewable Energy Target scheme. The scheme established under the Renewable Energy (Electricity) Act 2000
SKM MMA	Sinclair Knight Merz – McLennan Magasanik Associates
SRES	Small-scale Renewable Energy Scheme
SRMC	Short run marginal cost
STEM	Short-term Energy Market
SWIS	South-West Interconnected System in Western Australia
WEM	Wholesale Energy Market (applies to the SWIS in Western Australia)

1. Introduction

The Federal Treasury has engaged SKM MMA, part of the Sinclair Knight Merz Group, to undertake an assessment of the cost and benefits to the electricity market of a national carbon pricing mechanism. The analysis has been directed towards providing insights into the economic costs and benefits to the electricity sector, where cost is defined in terms of a reduction in the productivity of resource use in the sector and benefit is defined in terms of abatement of greenhouse gas emissions. Distributional impacts, such as changes to customer costs, are also examined.

This report updates the modelling results in a prior report[1]. This report contains results for two further scenarios as follows:

- **Clean Energy Future Scenario:** World action to achieve a 550ppm emissions target, with a $23 per tonne starting carbon price, and where possible incorporates features of the *Clean Energy Future* package endorsed by the MPCCC, and reflected in the legislation currently before Parliament; and
- **Government Policy Scenario:** World action to achieve a 550ppm emissions target, with a $23 per tonne starting carbon price, and includes additional Government-only measures for heavy on-road transport and some of the additional assistance for the steel industry.

Both scenarios are based on the Core Policy Scenario of the previous report, but are aligned with the agreed form of the Clean Energy Future policy announced by the Government.

However, not all elements of the Clean Energy Future policy were modelled. The modelling does not include the Clean Energy Finance Corporation, a capital fund to be set up to invest in clean energy and low emission technologies. The Government is yet to finalise how the fund will operate, and therefore it is not possible to model the outcomes from this measure at this stage. Similarly, the modelling does not include the planned closure of 2,000 MW of electricity generation capacity under the proposed contract for closures arrangements, which aims to provide certainty to investors in low pollution generation. Modelling of this measure would require assumptions on which generators close and when they close.

The method and assumptions in this report are the same as in the prior report, except for changes to the carbon pricing and electricity consumption assumptions as outlined above.

In this report monetary values are in mid 2010 dollar terms and, unless otherwise stated, and stated years refer to financial year ending June.

Some results, such as the cumulative cost of new generation investment, are largely unchanged from the core policy scenario. As such, they have not been reproduced in this summary report[2].

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[1] SKM MMA (2011), *Carbon Pricing and Australia's Electricity Market*, report to the Australian Treasury, July

[2] Revised charts and tables from the *Strong Growth Low Pollution* report, including the updated policy scenarios, are available at http://www.treasury.gov.au/carbonpricemodelling.

2. Changes to Assumptions

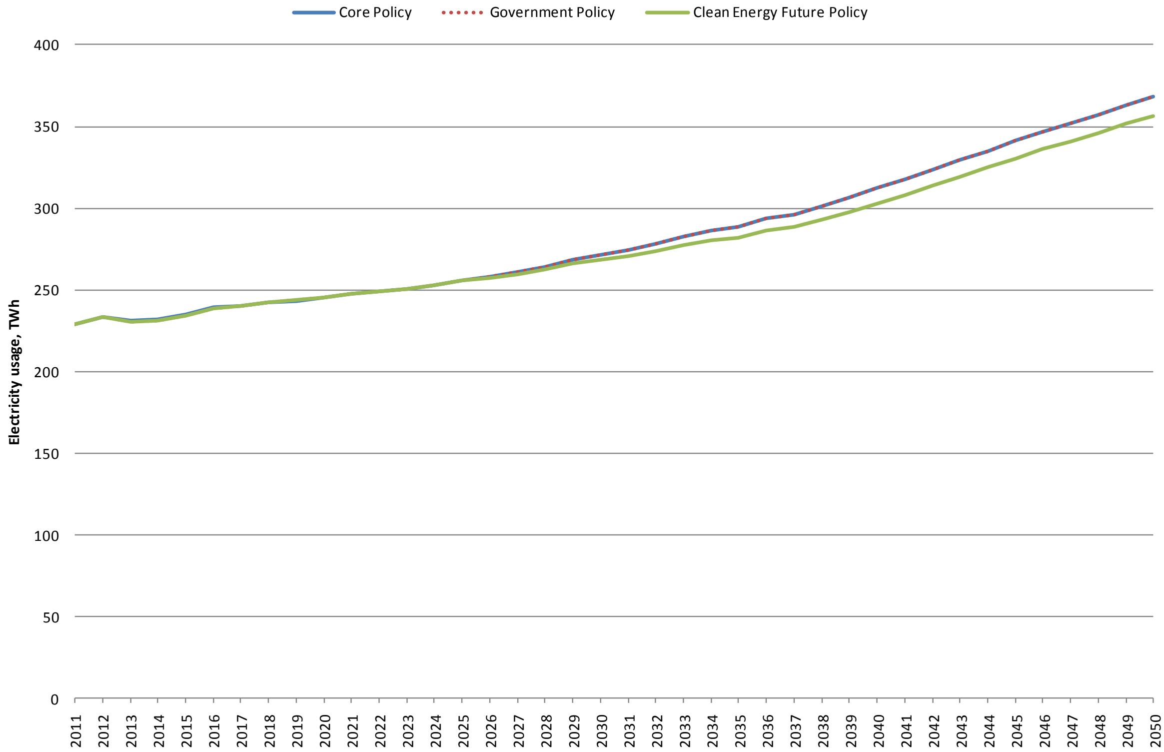
2.1. Carbon Prices

Carbon prices are similar to the prices in the Core Policy Scenario modelled previously. Carbon prices in both new scenarios start at nominal $23/t CO_2e, and rise by 2.5 % per annum in real terms for the first three years. Carbon prices after mid 2015 for the two new scenarios are identical to those of the Core Policy scenario in the *Strong Growth Low Pollution* report.

2.2. Electricity consumption

Assumptions on the impact of carbon pricing on electricity demand differed slightly across the scenarios. Electricity consumption is similar for the Core Policy and Government Policy scenarios, although the latter has slightly less demand from 2025 onwards. Demand for the Clean Energy Future Policy scenario is projected to be lower, being about 1% lower in 2030 and 3% lower in 2050.

▪ **Figure 1 Electricity demand assumptions**



3. Impacts

3.1. Overview

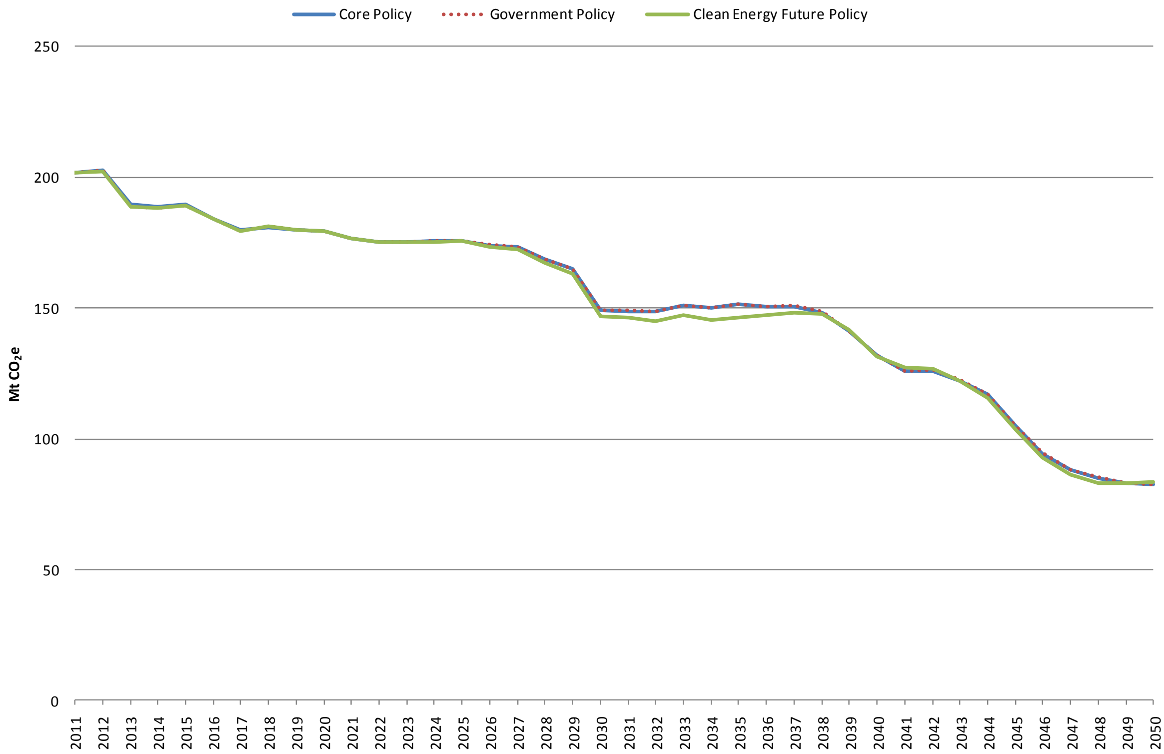
The impacts of the differing policy scenarios are outlined below. The results are compared to the Core Policy scenario described in the previous report.

3.2. Abatement

The level of abatement achieved in the electricity sector depends intrinsically on the carbon price and the complementary policies that are operational. Because the differences across the three scenarios are slight, the impacts on emissions are also slight (see Figure 2). Cumulative emissions in the electricity generation sector are some 3 Mt CO_2e lower by 2020 in the Government Policy and Clean Energy Future scenarios. By 2030, cumulative emissions are projected to be some 2 Mt CO_2e lower in the Government Policy scenario and some 10 Mt CO_2e lower in the Clean Energy Future scenario, with the latter driven by the lower demand projection. Even though the lower demand projection also defers investment in new low emission technologies, by 2050 cumulative emissions are lower by about 39 Mt CO_2e for the Clean Energy Future scenario, whereas there is no difference between the other two scenarios.

The difference in cumulative emissions across the scenarios by 2050 is just over 0.6%.

- Figure 2 Emissions from electricity generation, Mt CO_2

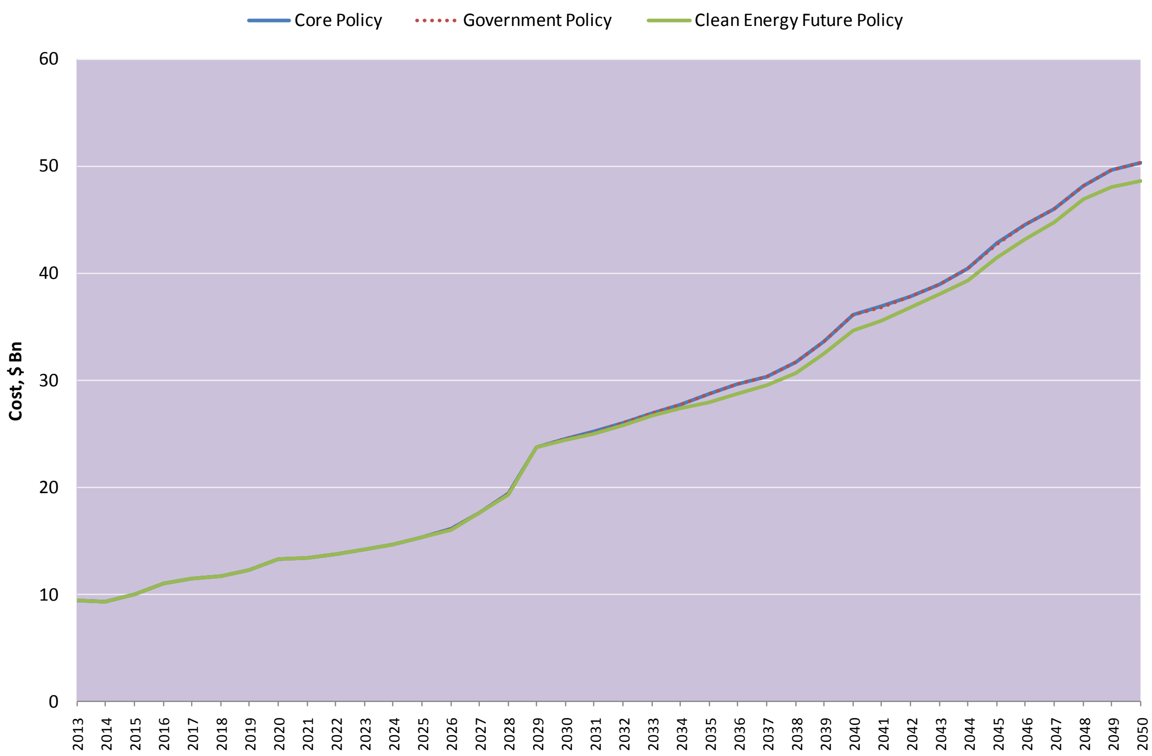


3.3. Cost of Abatement

Abatement of greenhouse gases comes at a cost to the economy due to the fact that higher cost forms of generation are deployed to meet the emission targets than would otherwise have been applied. Predicted trends in resource costs are shown in Figure 3. The resource costs cover the cost of fuel, operating and maintaining plant and the capital costs of new plant.

Across the three scenarios there is no major difference in resource costs. For all three scenarios, resource costs rise over time due to the need for investment in new low emission plant both to meet load growth and to replace retiring high emission plant. The difference in resource costs to 2050 in present value terms across the three scenarios amounts to less than $100 million lower for the Government policy scenario (when compared to the Core Policy scenario) and $1.5 billion lower for the Clean Energy Future Policy, or less than 1% difference in costs.

■ **Figure 3 Resource cost by scenario**



3.4. Energy Prices

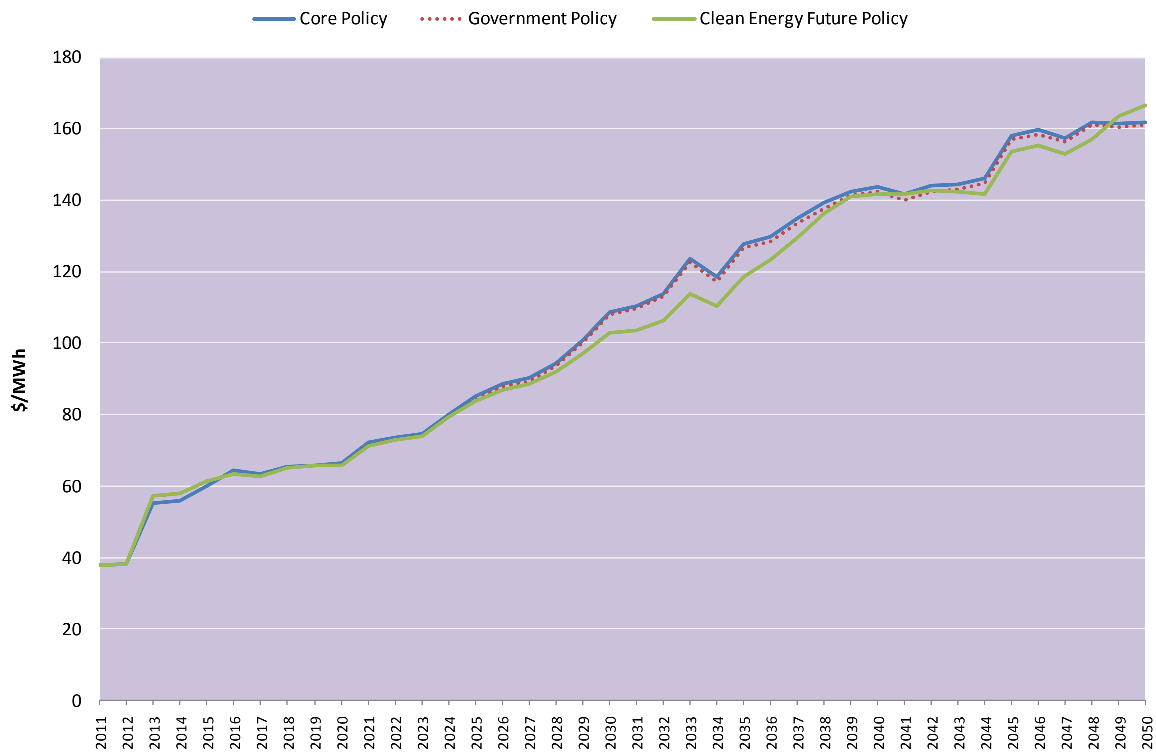
Average pool prices for Australia under carbon pricing for the three scenarios are shown in Figure 4. Pool prices are driven by two major factors: the permit price and the escalating price of gas. The higher the permit price, the higher the pool price, although the relative increase diminishes as permit prices increase and more lower emissions plant enter the system, displacing higher emitting incumbents. Gas prices also play a central role in determining pool prices since under a sufficiently high permit price, CCGT technology becomes the marginal new entrant. The LRET tends to place downward pressure on prices in the short to medium term due to excess generation capacity entering the market, but has little impact on prices in the long-term as renewable energy is taken up under carbon pricing.

As in the global action scenarios, rising gas prices contribute to the increase in pool prices under the carbon pricing scenarios, as shown in Figure 4.

There is little difference in price across the scenarios until 2025. After 2025, prices are projected to be generally lower for the Clean Energy Future Policy scenario principally due to the lower level of demand growth for this scenario. Prices average about $3/MWh lower for the Clean Energy Future Policy or around 2% lower than for

Core Policy scenario. Prices for the Government Policy scenario are similar being less than $1/MWh lower on average or less than 1% lower than prices for the Core Policy scenario, with this difference mainly being due to slightly lower demand over the longer term.

- **Figure 4 Electricity pool prices (time weighted average), Australia, $/MWh**

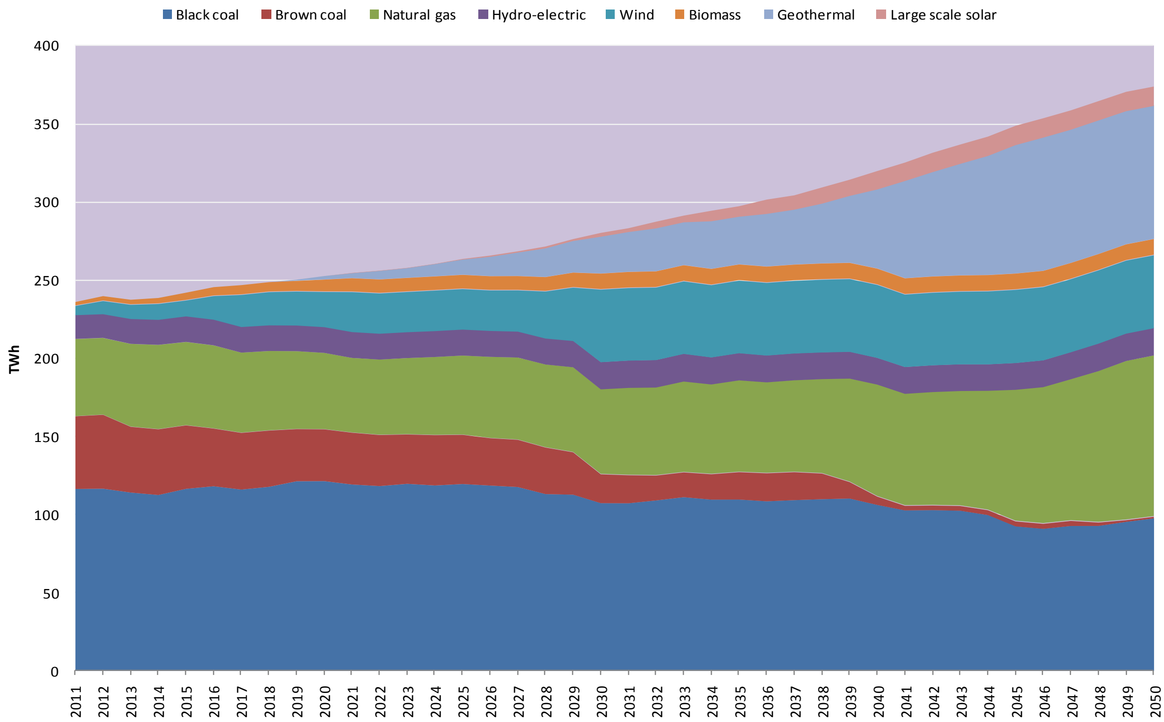


3.5. National Generation Mix

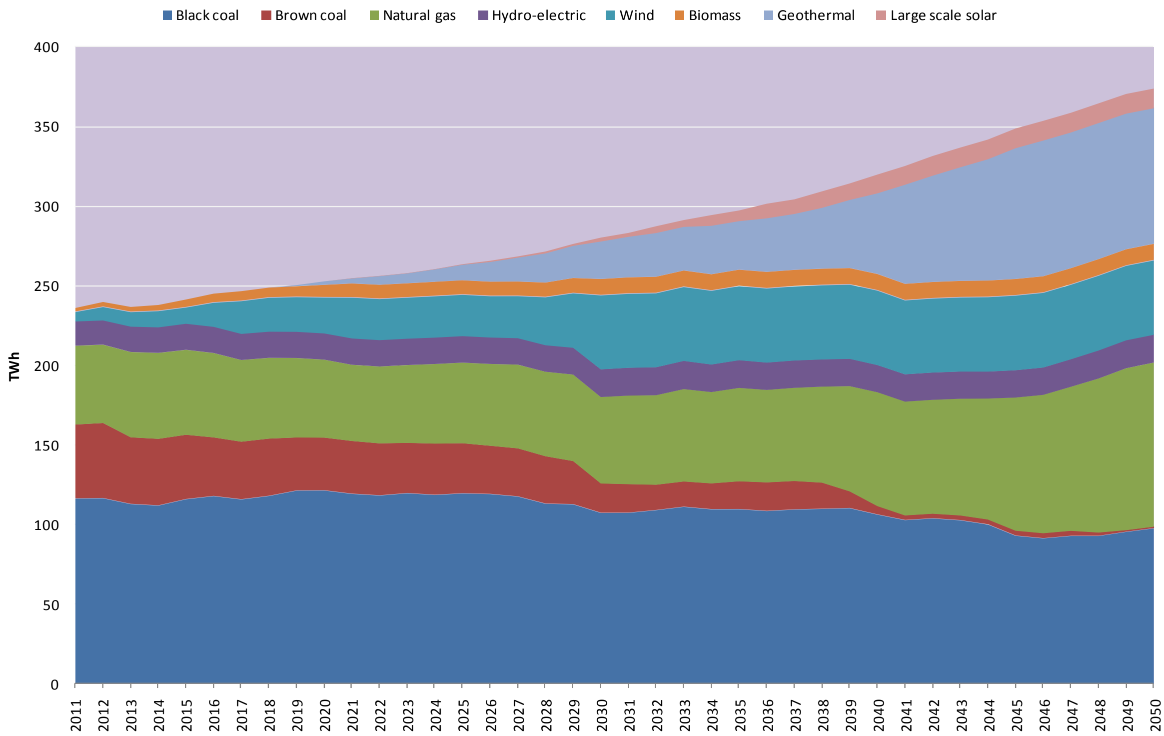
Under carbon pricing, coal-fired generation is predicted to decline slowly over time for the core policy scenario (see Figure 6). There is no difference in the generation mix in the Government Policy scenario. Over the first three years of the scheme, black coal generation is slightly lower in the Government Policy scenario by about 2 TWh. Natural gas fired generation is slightly higher as a result. There is no impact on the level of renewable energy generation.

The generation mix is also similar for the Clean Energy Future scenario. However, after 2025, the lower level of electricity consumption in this scenario leads to lower levels of generation, particularly black coal generation and natural gas generation. The reduction in black coal generation occurs mainly as a result of the deferment of investment in black coal with carbon capture and storage. Renewable energy generation is also affected mainly in the form of deferred investment in geothermal energy.

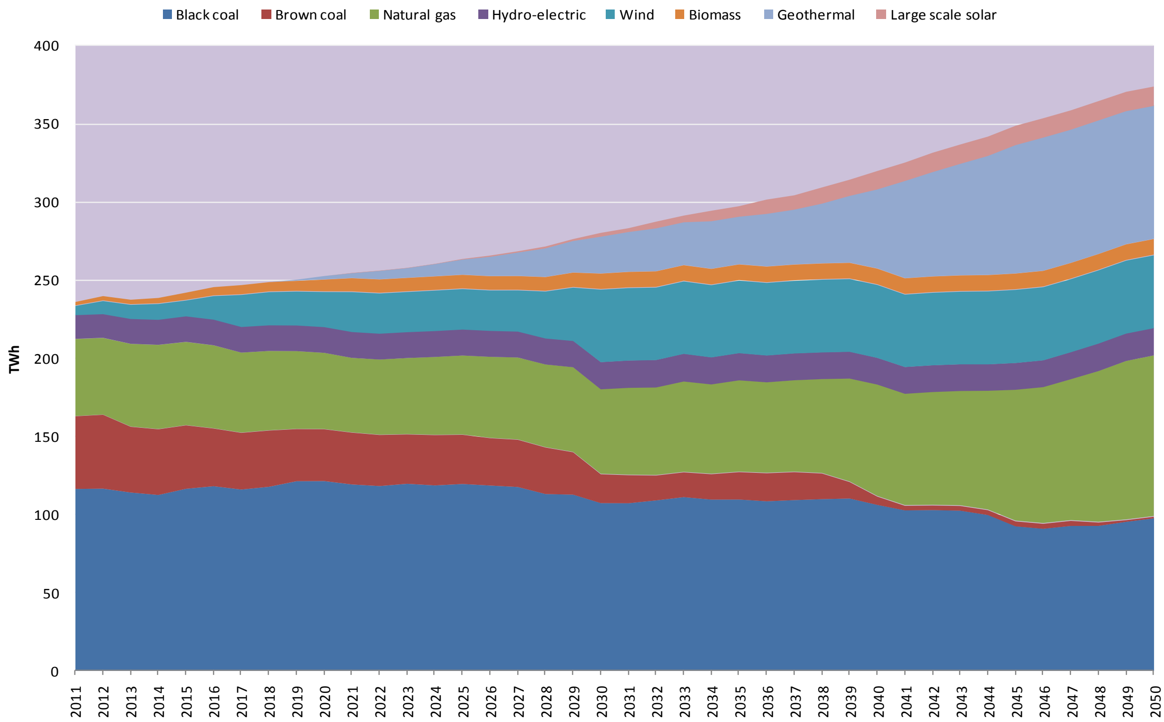
■ **Figure 5 Generation trends for the Core Policy scenario, GWh**



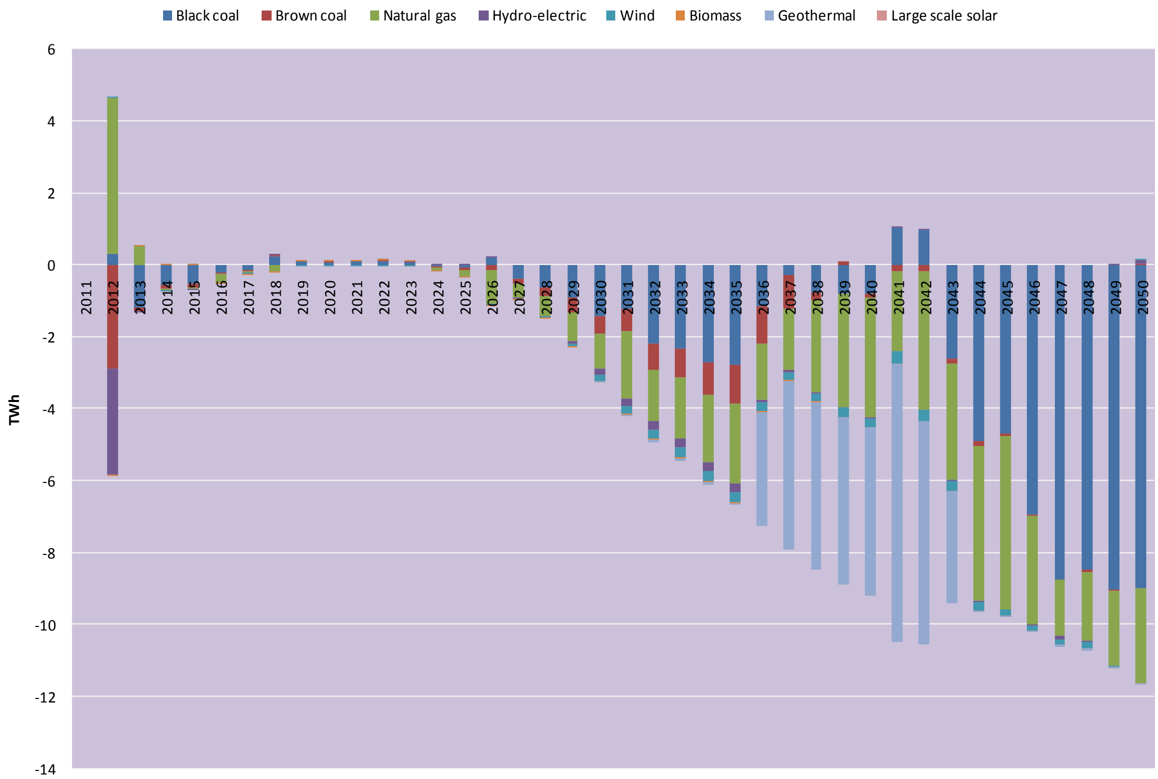
■ **Figure 6 Generation trends for the Government Policy scenario, GWh**



■ **Figure 7 Generation trends for the Clean Energy Future scenario, GWh**



■ **Figure 8 Difference in generation by technology type, Clean Energy Future versus Core Policy scenario**



For more information please contact:

AUSTRALIA Walter Gerardi

T: +61 3 8668 3081 E:wgerardi@globalskm.com

www.globalskm.com

Asia, Australia, Europe, Middle East, New Zealand, South America

SINCLAIR KNIGHT MERZ

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