KPMG

# The National Energy Guarantee

## Pricing and the Australian economy

KPMG Economics

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November 2017

# Executive Summary

In October 2017 the Turnbull Government released an outline of its energy policy for the period beyond 2020. Its centrepiece is the National Energy Guarantee (NEG), which is designed to target the three objectives of affordability, reliability and sustainability.

At the time of release, comprehensive economic modelling of the NEG had not been performed. However, the Government suggested that the NEG was capable of saving households of around $110-$115 per year over the period 2020-2030. The Turnbull Government has written to the states and territories seeking their input into the design of modelling.

KPMG has examined the NEG and has the following observations:

1. The NEG, being a market mechanism, will enable electricity retailers to choose the generation mix that enables them to meet reliability and emissions reductions obligations at an efficient cost. KPMG anticipates that the NEG and other recent policy reforms are likely to assist in moderating wholesale electricity price increases into the future, however its precise design features and implementation will determine whether or not the NEG achieves these objectives.
2. KPMG's analysis of electricity usage reveals that households and businesses in recent years have adapted to sharply rising electricity prices by reducing their consumption. This has been achieved by using electricity more efficiently and by the adoption of new energy-saving technologies. Efficiency in electricity usage and demand management are capable of playing an important role; however, it is clear that Australia's needs for additional dispatchable sources of energy generation/storage remains a priority to meet our current and future energy needs. These will be combined with growth in intermittent renewables sources in the years ahead while we continue with an orderly transition to an increasing share of renewables. Ultimately, additional supply will help curb pressure on energy price rises.
3. The importance to the Australian economy of moderating electricity prices is critical. To illustrate this, KPMG Economics has used its national Computable General Equilibrium model (KPMG-CGE) to assess the short-run and long-run impacts associated with a 10% increase in the cost of generating electricity. In the *short run*, Australia's GDP is estimated to be 0.24% below its baseline level, a cost to the economy of around $4.2 billion per annum, with the export sector being the hardest hit. Total employment falls by 0.21%, or nearly 26,000 jobs. In the *long run*, the economy is smaller than it otherwise would have been by around 0.17%, which is consistent with a reduction in household disposable income of around $150 per annum (in $2017). This decline in household disposable income reduces consumption activity in the economy by 0.29%, which is a larger decline than that experienced in the short run.
4. Relatively capital intensive sectors like *Basic Non Ferrous Metal Manufacturing* sub-sector and the *Non Ferrous Metal Ore Mining* sub-sector are projected to continue to be significantly adversely impacted in the long run - because they will not get a significant offsetting benefit from the reduction in real wages. The relatively large reduction in household consumption in the long run is the key driver behind the entry of sub-sectors *like Gambling, Water Supply, Sewerage and Drainage Services, Gas Supply, and Telecommunication Services* into the bottom 20 performers.

In summary, the sensitivity of the Australian economy to rising electricity prices highlights the importance of establishing a stable, effective policy for achieving the objectives of affordability, reliability and sustainability. The longer the existing uncertainty remains, the slower will be the investment response to these challenges, resulting in the continuation of unnecessary volatility in electricity prices into the foreseeable future.

# Contents

# Introduction

Electricity prices and their impact on Australian businesses and households have become one of the leading issues currently facing politicians, businesses and households.

The Commonwealth Government has recently announced its new energy policy, the National Energy Guarantee (NEG), which the Prime Minister has suggested will enable the delivery of '*more affordable and reliable electricity while meeting our international commitments*'. While detailed modelling has yet to be completed, the Energy Security Board (ESB) has estimated that '*typical household bills will fall by an average of $110-$115 per year over the 2020-2030 period.'*

KPMG Economics recognises that over the last two decades there has been a significant amount of modelling work done to estimate the impact of various carbon policies on electricity prices and the wider economy. However, much of this analysis is now dated, and with domestic energy policy evolving we believe it is important to present contemporaneous information on how electricity prices impact the Australian economy.

In this brief paper we look at the importance of electricity to the structure and performance of the economy, and recent movements in electricity prices and how households and businesses have responded.

Section 3 discusses the NEG in the context of its potential impact on electricity prices. Section 4 presents a macroeconomic simulation which shows how the Australian economy is impacted by higher electricity prices. Concluding remarks are presented in section 6.

# State of Play

### *Introduction*

All households use electricity directly. Any increase in electricity prices has consequences for household budgets. Households also use electricity indirectly through their purchases of goods and services that require electricity for their production. Increases in electricity prices usually flow through to higher final prices for these goods and services.

This effect induces two further impacts on the Australian economy.

First, the price of goods and services that are produced with electricity-intensive technologies will tend to increase relative to those goods and services produced with less electricity-intensive technologies. These relative price impacts induce substitution as consumers will choose to purchase cheaper goods and services that use less electricity to produce.

Second, the increase in the cost of goods and services also induces an income effect as the economy's real income is reduced. This will tend to reduce the demand for all goods and services and reinforce the negative impact of the electricity price increase on the economy.

In the following sections we present an analysis on recent electricity prices and consumption for both households and small businesses.

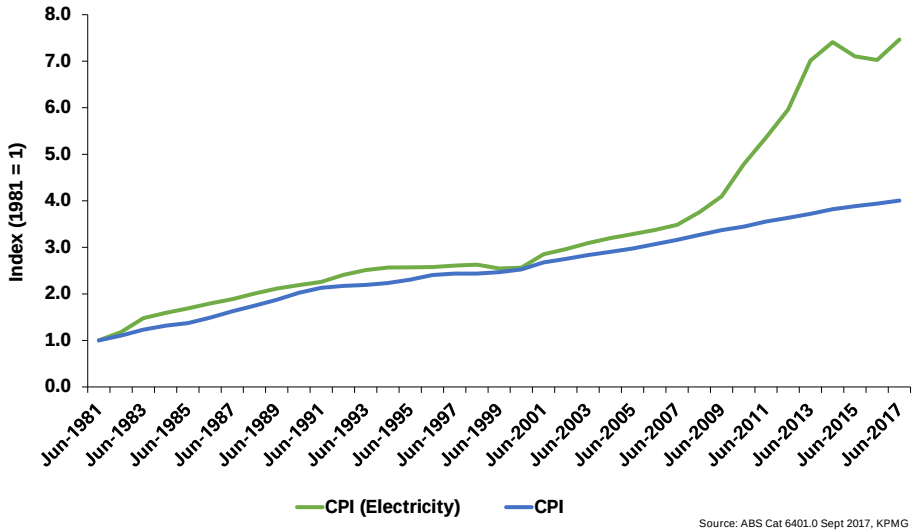
### *Households*

Australian households have experienced more recently a rapid increase in electricity prices. Chart 1 plots the National Electricity Price Index for households against the National Consumer Price Index (CPI), indicating how electricity prices have changed compared to prices in general over the past 35 years. It shows that since 2007 there has been a rapid increase in electricity prices, which has coincided with major changes in the electricity sector, including:

- increasing deregulation of retail electricity prices;

**Chart 1**

**National Electricity Price Index for Households and CPI**




Source: ABS Cat 6401.0 Sept 2017, KPMG

- privatisation of some generation and transmission/distribution assets;
- changes in the performance standards required of regulated transmission and distribution networks;
- Fluctuating demand patterns, with the electricity market experiencing steady annual increases to flat demand growth. When considered in the context of increased network capital expenditure, some of this expenditure was incurred on the assumption of continued demand growth which hasn't eventuated (as yet);
- the introduction of policies designed to reduce Australia's carbon emissions (RETs, irregular use of the ETS and a multitude of policies designed to encourage solar and renewable generation).

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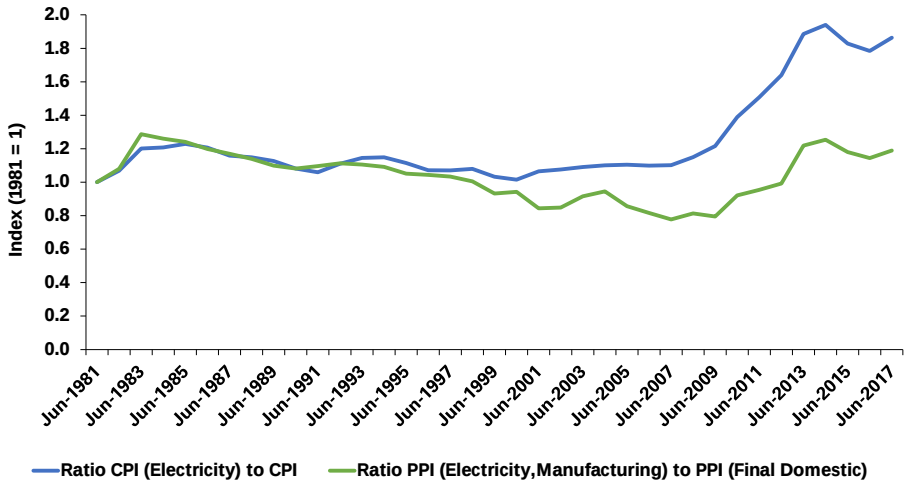
Over the period during which electricity prices have risen sharply the share of household expenditure on electricity has increased from almost 1.55% in 2009/10 to nearly 1.74% in 2014/15. The increase in household expenditure on electricity has been less than the increase in the price of electricity, reflecting the responsiveness of households to adjust their electricity consumption to price movements. That is, in the five years between 2009/10 and 2014/15 there has been an 11% reduction in the number of megawatt hours (MWh) of electricity use per capita and a 12% reduction in the number of MWh of electricity use per household.

**Chart 2**

**Real Cost of Electricity for Households and Business**

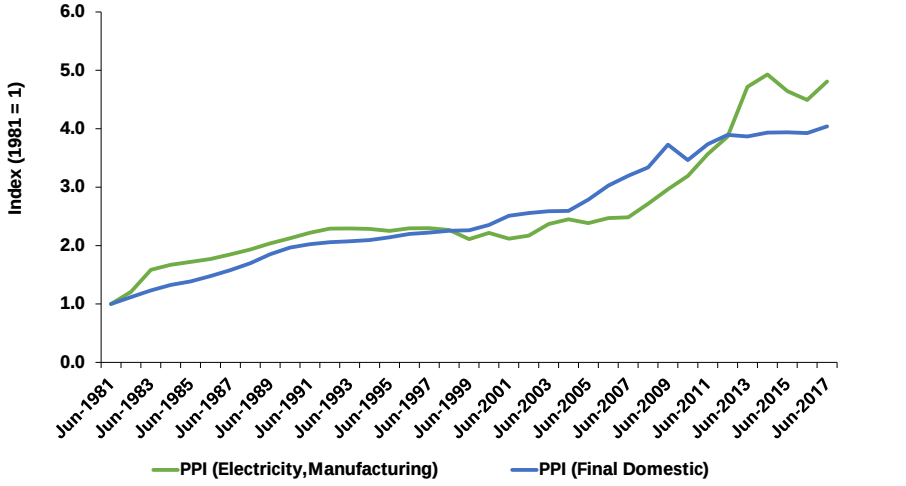



Source:ABS Cat 6401.0 Sept 2017, ABS Cat 6427.0 Sept 2017, KPMG calculations

This reduction in electricity usage by households reflects a range of factors, including distributed generation (incorporating solar photovoltaic) reducing net demand, efficiency gains from better energy-use practices by more-informed, cost-conscious consumers as well as the adoption of lower-energy technologies for lighting, refrigeration, heating/cooling and a range of other energy-using household activities.

**Chart 3**

**Electricity Prices for Manufacturers**




Source: ABS Cat 6427.0 Sept 2017, KPMG calculations

## *Business*

For small businesses, electricity prices have generally followed the same pattern described above for households. However, it is difficult to be definitive about electricity price movements for larger businesses as they have bespoke, and usually confidential, contracting arrangements.

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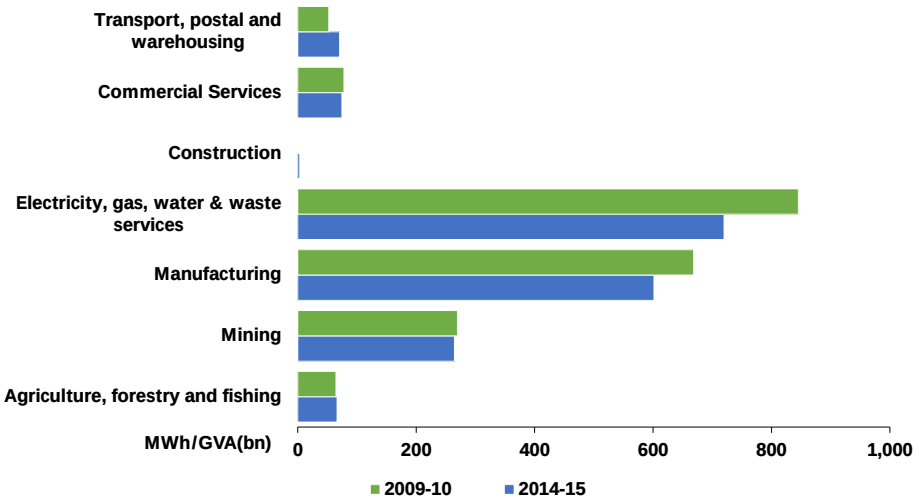
While this is the case, it is possible to get an indication of electricity price movements for larger businesses by looking at the Producer Price Index (PPI) for electricity inputs to the manufacturing sector (as published by the Australian Bureau of Statistics).

Chart 3 plots the PPI for electricity inputs into the manufacturing sector against the PPI for domestic production (including exports), which shows electricity prices for manufacturers increased strongly over the period 2009/10 to 2014/15.

**Chart 4**

**Sectoral Electricity Intensity – MWh per Billion Dollars of GVA**



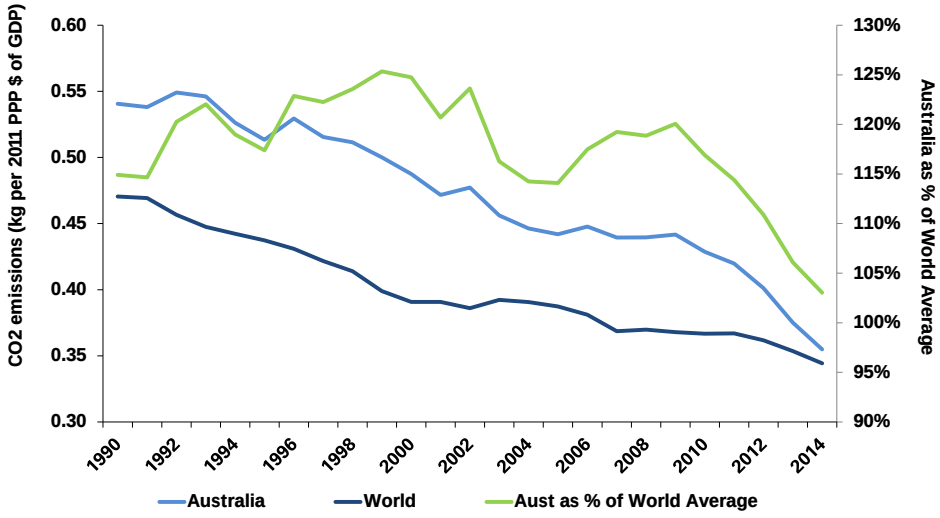

Source: ABS Cat 4660.0 July 2016, ABS Cat 5206.0 Sept 2017, KPMG Economics

Like households, businesses have also been sensitive to price increases, which has been reflected in their patterns of electricity consumption.

From an industry perspective, most sectors in the Australian economy have decreased their relative consumption of electricity, with the *Electricity, gas, water & waste services* and *Manufacturing* sectors leading the way with reductions of 15% and 10% respectively between 2009/10 and 2014/15. This decline in energy intensity has enabled Australia's CO2 emissions per dollar of GDP to fall rapidly from 2009. As shown in Chart 5, by the end of 2014 Australia's emissions per dollar of GDP were only marginally higher than the global average.

**Chart 5**

**CO2 Emissions (kg per 2011 PPP $ of GDP), Australia and World**




Source: World Bank, KPMG Economics

# National Energy Guarantee

The Turnbull Government has recently released a new energy policy, the National Energy Guarantee (NEG), which seeks to tackle the energy 'trilemma' of affordability, reliability and emissions.

This policy framework requires electricity retailers to meet dual targets of reliability and emissions, and it does so without being prescriptive as to the energy mix to be applied. This agnostic policy approach to energy supply enables the market to determine how best to achieve the two targets (or constraints) at, presumably, least cost.

The *reliability guarantee* requires retailers to either own or contract a defined amount of 'dispatchable energy' to meet targets established by the Australian Energy Market Commission (AEMC) and the Australian Energy Market Operator (AEMO).

The *emissions guarantee* requires retailers to again either buy or contract electricity that enables them to achieve a set level of emissions per year. The emission targets will be set by the Commonwealth Government and enforced by the Australian Energy Regulator (AER), and are proposed to be consistent with our international commitments.

While no detailed financial or economic analysis of the NEG has been made publicly available, the ESB has indicated that the NEG is likely to result in a reduction in household electricity bills by between $100 and $115 per year over the 2020 - 2030 period.

KPMG Economics has not completed a detailed electricity price modelling exercise on the NEG for this study. Rather, we have sought to consider the NEG policy framework in the context of recent electricity market reports prepared by independent bodies like the AEMC, AEMO, AER and CO2CRC, and assess the likely impact on the cost of electricity as a consequence of the NEG and other recent energy policy directions, including those from the Finkel Review.

### NEG and Electricity Pricing

At its simplest, the price of electricity reflects what it costs to generate electricity, transport it from its source to its destination, and sell it through a retailer, plus recover any other government charges specific to energy policy, such as costs of renewable energy schemes (eg: feed-in-tariffs).

Each of these elements of the 'supply chain cost' are driven by different factors, including the cost of new technologies, the quantum of investment, reliability standards and operating expenses.

Network charges represent on average about half of the electricity supply chain costs, with generation and retail costs (combined into the 'competitive market' category) accounting for 42%, and environment policies adding the remaining 8%, based on the latest AEMC Electricity Price Trend report.

The make up of the total average retail cost is shown in Chart 6 which reveals the single largest component of the price of electricity is distribution costs, which represented about 40% of the average cost of electricity. Over the AEMC forecast period to 2018/19, these costs are still expected to represent by far the largest component of the electricity cost stack, albeit fractionally lower in a couple of years' time.

The next largest component is the wholesale price of electricity, which in 2015/16 represented about 28%. Under the AEMC Base Case scenario – which includes the retirement of the brown coal fired Hazelwood Power station in Victoria – this cost component had been anticipated to rise steadily over the forecast period to represent about 30% of the cost of electricity by 2018/19.

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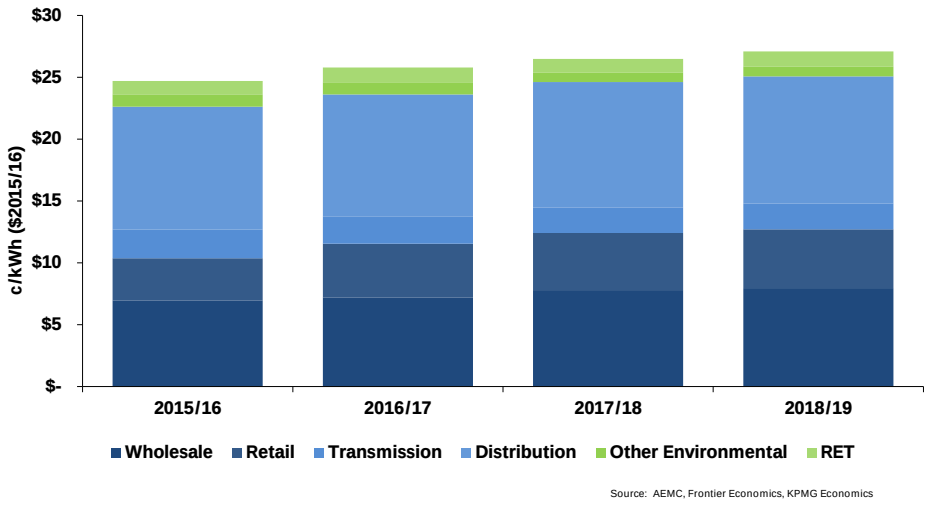
**Chart 6**

**Estimated Electricity Supply Chain Cost Components, National**



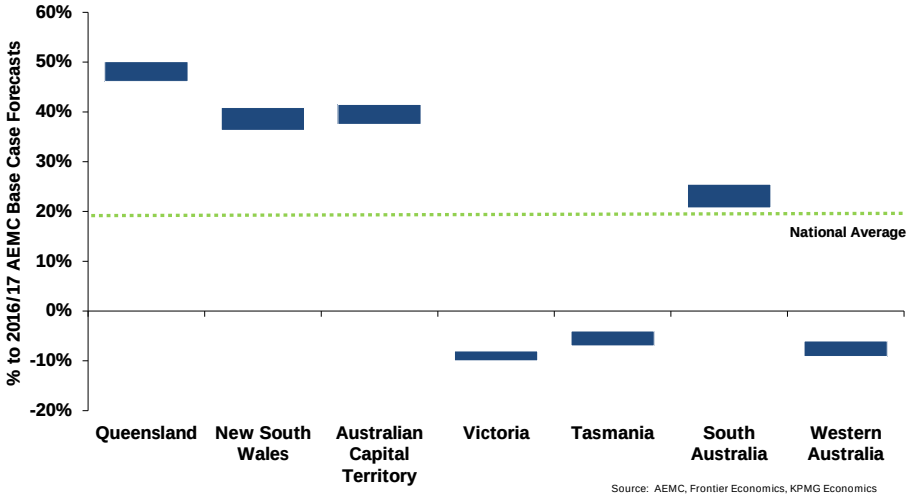

Source: AEMC, Frontier Economics, KPMG Economics

In the latest AER State of the Energy Market Report (May 2017), it was acknowledged that the cost of wholesale electricity prices had risen by between 50% and 60% in nearly every NEM region over the FY2015/16, with Tasmania recording a rise of 160% as a consequence of a six-month outage of the BassLink interconnector with Victoria. More importantly, the AER study also revealed that the upward trajectory of the wholesale electricity prices had been maintained into FY2016/17, with the largest rises being experienced in South Australia, Queensland and New South Wales. These rises were significantly greater than anticipated when compared to the either the Base Case or even the High Fuel Cost scenario that was modelled as a high-case sensitivity.

As shown in Chart 7 below, these three jurisdictions experienced higher than anticipated wholesale electricity costs in the order of between 30% and 80% when compared to original forecasts for FY2016/17. When considered on a weighted average basis, using the same methodology applied by the AEMC to estimate the values for the National Summary, wholesale electricity costs have therefore been about 17% to 20% higher than anticipated.

**Chart 7**

**Estimated Difference in Actual and Base Case Forecasts of Wholesale Electricity Prices, 2016/17**




Source: AEMC, Frontier Economics, KPMG Economics

The AER provided a clear explanation of what has caused the higher wholesale electricity prices, including:

- A tightening in the supply-demand balance;

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- A resurgence in peak demand;
- Closures of coal-fired power stations, either permanently or temporarily for maintenance, resulting in the gas-fired power stations setting the dispatch price at a time when gas fuel costs were 'extremely high'; and
- Limitations of electricity imports into South Australia due to interconnector maintenance.

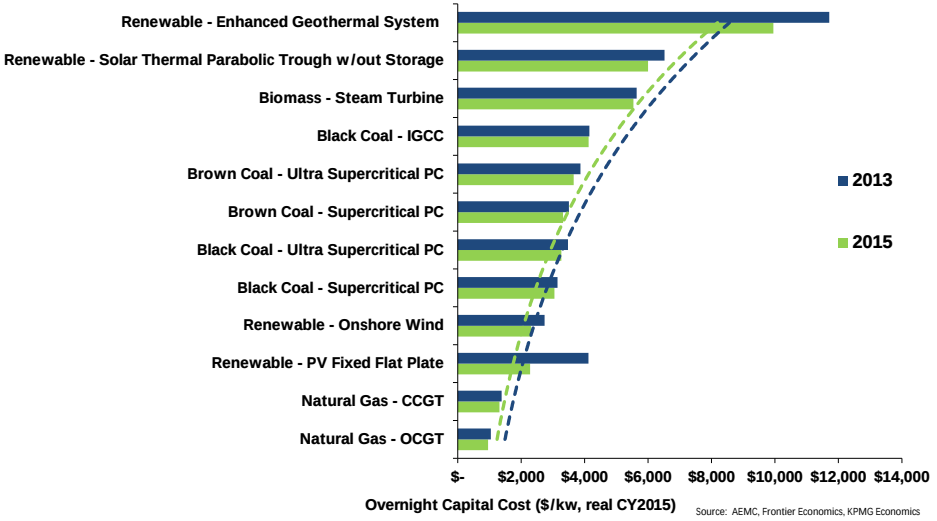
This increase in wholesale electricity costs pushed the bundled cost of electricity to rise by about 5% higher than anticipated by the AEMC, and shifted the relative importance of wholesale prices in the cost stack from about 28% to 31%.

KPMG Economics anticipates the NEG and other recent policy reforms are *likely* to assist in moderating wholesale electricity price increases into the future. In particular, the requirement for existing plants to provide three years' notice prior to closure and the obligation for retailers to contract for 'dispatchable generation', means that volatility within the NEM *should* be curtailed relative to recent experiences.

The NEG also places the onus on the retailer to establish a portfolio of electricity generation, either owned or contracted, that balances cost, emissions and 'dispatchability'. As shown from Chart 8, the capital cost curve for electricity generation has been shifting inwards, meaning capital costs per KW of electricity has been declining in real terms. KPMG anticipate this cost curve to continue to shift inwards in respect of renewable technologies, recognising gas will play an important role to firming renewable generation.

However, under the NEG it is not just dispatchable generation that retailers are obliged to target, but also emissions. Each different form of generation produces a different level of emissions per MW of electricity produced.

**Chart 8**
**Capital Costs for Generation Plant**



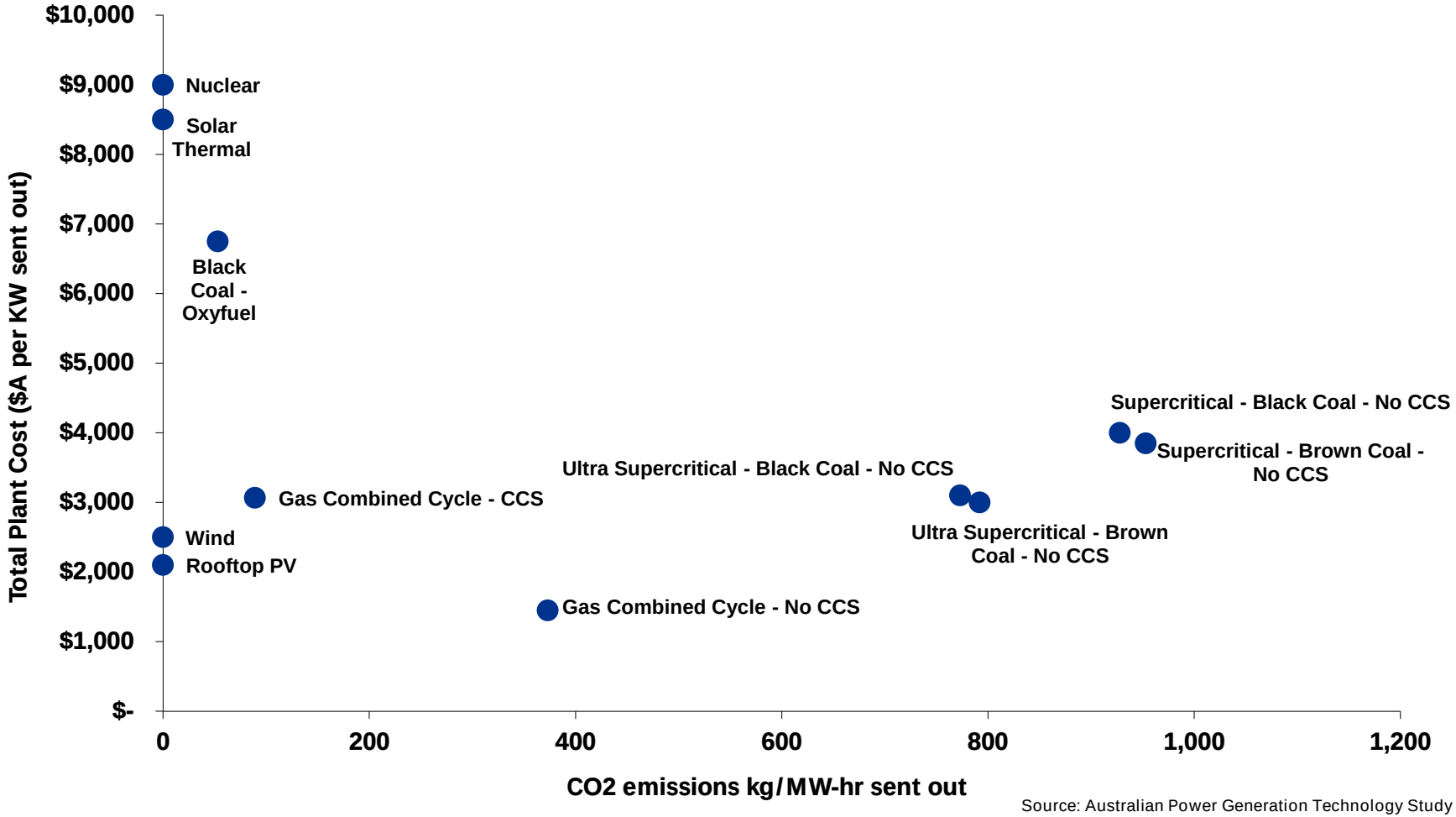
Source: AEMC, Frontier Economics, KPMG Economics

Chart 9 shows the variation of CO2 emissions per MWh of energy sent out, and anchors those to the total plant cost associated with the different forms of generation.

Our analysis of capital costs reveals essentially three groupings of different types of electricity generators from a capital cost per kg of CO2 emissions perspective. The lower capital cost grouping, ranging from broadly $3,500 to $6,500 per MW per kg of CO2 emission, are the traditional brown and black coal base load generators; although this analysis shows combined cycle gas generators are the second-lowest capital cost form of generation per kg of CO2 emission produced. There is then a clear step-up in the capital cost profile when black or brown coal electricity generation incorporates Carbon Capture and Storage technology (CCS).

## Chart 9

## Electricity Generation Technologies Plant Cost v Emissions, 2015




Source: Australian Power Generation Technology Study

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The NEG, in conjunction with the other policy measures under way, in particular gas market reforms, greater focus on demand side management and contracting for reserve capacity, is anticipated to put downward pressure on wholesale energy costs. Further, if the NEG allows a retailer to take an optimal portfolio approach achieving reliability and emissions, then it is likely that a mixture of generation types will be engaged.

The impact of the NEG on wholesale energy prices will therefore depend on the relative strength of two off-setting factors, being:

- the costs associated with meeting the emission target, given the cost of low emission generating technology is generally higher than higher CO2 emitting generation capacity, all else being equal; and
- an expected decrease in the return on capital associated with investment in generation assets and subsequent entry as a consequence of policy certainty within the sector.

The NEG, and other reforms approved by CoAG, are also likely to have other cost reducing impacts on the bundled price of electricity, and while KPMG Economics has not completed formal price modelling to see whether the NEG and other recent policy measures will achieve cost savings for consumers, it would appear there *should* be downward pressure on the annual cost of electricity compared to a business-as-usual scenario.

| Cost Stack Element | Proportion of Cost Stack (2016/17) | Direction | KPMG Rationale |
|---|---|---|---|
| RET | 5% | ↓ | Policy certainty allows for least cost, low emissions solution to be implemented. No new support mechanism for renewables, except overall obligation to achieve target CO2 emissions under the NEG |
| Other Environmental | 4% | ↔ | |
| Transmission | 8% | ↓ | Prices are flat or declining due to low interest rates and businesses focusing on efficiencies and better asset management |
| Distribution | 37% | ↔ | Prices are flat or declining due to low interest rates and businesses focusing on efficiencies and better asset management |
| Wholesale energy | 31% | ↓ | Gas market reform, demand side management |
| Retailers | 16% | ↔ | |

# Simulation Results

In this section we use KPMG's national Computable General Equilibrium model, KPMG-CGE, to simulate the impact of an increase in the cost of electricity generation. The simulations are designed for illustrative purposes only, although as just discussed, wholesale energy cost increases have been the dominant cause of electricity price rises in the very recent past.

The two illustrative simulations that we report are designed to highlight key mechanisms that are relevant to a detailed analysis of specific policies or commercial behaviours relating to the electricity sector. The two simulations are characterised by the same shocks: a 10% increase in the price of the output of the *Electricity Generation* sector caused by a reduction in the technical efficiency of the sector. These shocks mean that 10% more inputs are required by the *Electricity Generation* sector per unit of output.

The difference between the two simulations that we report is that one is conducted in the context of an economic environment characterised as a short run and the other is conducted in the context of an economic environment characterised as a long run.

In our modelling the key difference between the short and long run economic environments relates to the behaviour of businesses making decisions about investment in fixed capital.

The short run is defined as a period during which businesses cannot adjust their stock of fixed capital in response to a shock. In the short run, rates of return absorb the impact of shocks in the capital market.

The long run is defined as a period sufficiently long so that businesses can fully adjust their stock of fixed capital in response to a shock. Full adjustment of capital stocks to a shock implies that sectoral rates of return converge to long run equilibrium levels determined on global capital markets.

Other key distinguishing characteristics of the short and long run environments that we model include:

- in the short run we assume that real wages are exogenous and not impacted by the shocks with employment determined by demand;
- in the long run we assume that the supply of labour is exogenous and not impacted by the shocks with real wages adjusting to clear the labour market; and
- in the long run we impose solvency constraints on the economy via constraints on the budget balance and the current account deficit.

***Short run impacts***

The macroeconomic impacts of a 10% increase in the cost of generating electricity in the short run is summarised in Chart 10. All the headline macroeconomic aggregates are below their baseline levels (i.e., the level projected in the absence of the electricity shock), including GDP which is projected to be around 0.24% below the baseline level, equal to about $4.2 billion per annum (in $2017).

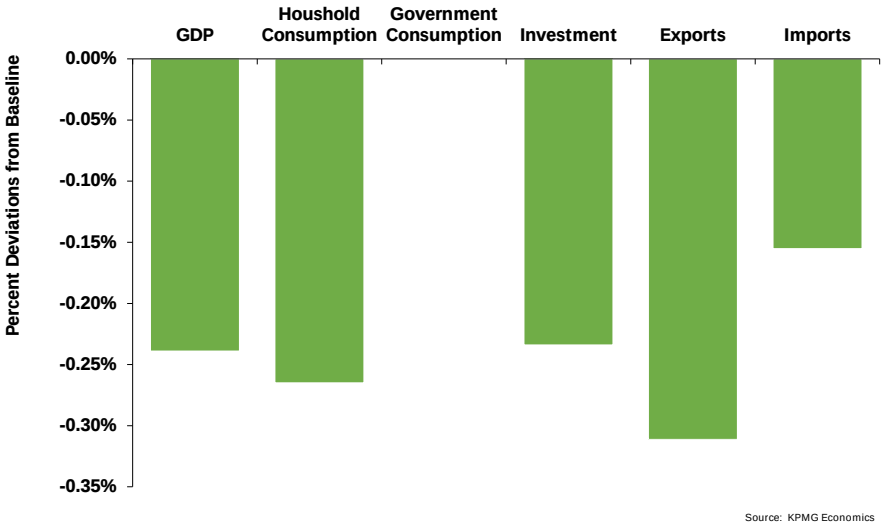
The increase in domestic costs is particularly negative for the cost-sensitive export sector, which is projected to contract by about 0.31% relative to the baseline. Household consumption is negatively impacted by the direct and indirect impacts of the rise in electricity generation costs.

The indirect impacts include the increases in the price of goods and services that households consume as well as the reduction in income emanating from the 0.21% reduction in aggregate employment, which is equivalent to nearly 26,000 jobs. Despite the reduction in the competitiveness of Australian producers, aggregate imports contract by about 0.16%. The reduction in domestic activity reduces demand for imports and this effect dominates the positive impact that Australia's reduced competitiveness has on import demand.

# Simulation Results

**Chart 10**

**Short run real macroeconomic impacts**




Source: KPMG Economics

The short run impacts of the electricity shock on sectoral output are shown in Charts 11 and 12. These charts show the same information except that Chart 12 suppresses the result for the *Electricity* sector which allows a manageable analysis of the impact on other sectors.

The *Electricity* sector records the biggest contraction as all its customers (households and businesses) reduce their demand for electricity. *Manufacturing* sector records the next largest contraction in output. This sector is a relatively intensive user of electricity and its outputs are tradeable. The loss of competitiveness results in a loss of market share to foreign substitutes as sales to domestic and foreign customers contract.

The *Manufacturing* sector provides inputs to a broad range of domestic industries and sells a large share of its output to the household sector. The general contraction of the economy, including the household sector, reinforces the contraction in the *Manufacturing* sector.

The sectors that are highly exposed to household consumption, such as *Accommodation and Food Services*, *Retail Trade*, *Arts and Recreation Services* and *Other Services* are also negatively impacted by the reduction in household consumption.

The traditional export sectors, *Mining* and *Agriculture, Forestry and Fishing*, record relatively modest contractions in output. The *Agriculture, Forestry and Fishing* sector is not an intensive user of electricity so its costs are less impacted by the increase in the cost of electricity generation.

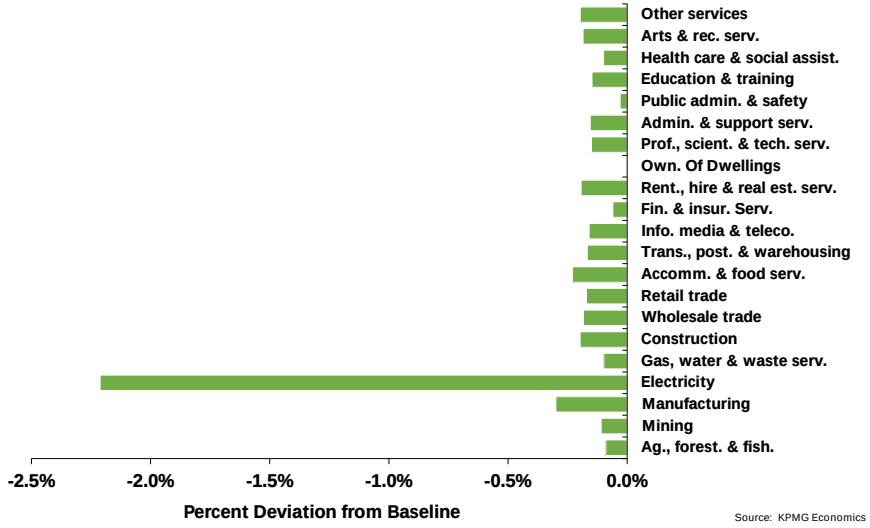
While some parts of the *Mining* sector are intensive users of electricity, a key characteristic of this sector is its capital intensity. With an aggregate measure of real wages held fixed in this simulation, there is limited ability for the economy to adjust to the electricity price shock through wage adjustments.

Cost-sensitive labour intensive sectors have little option but to shed labour and reduce output. In the case of the *Mining* sector the fact that it is capital intensive means that in the short run it can absorb more of the electricity price shock as reduction in profitability than is the case for less capital intensive sectors. In turn, this moderates the negative impact that the electricity price shock has on the *Mining* sector's export sales and, hence, output.

# Simulation Results

**Chart 11**

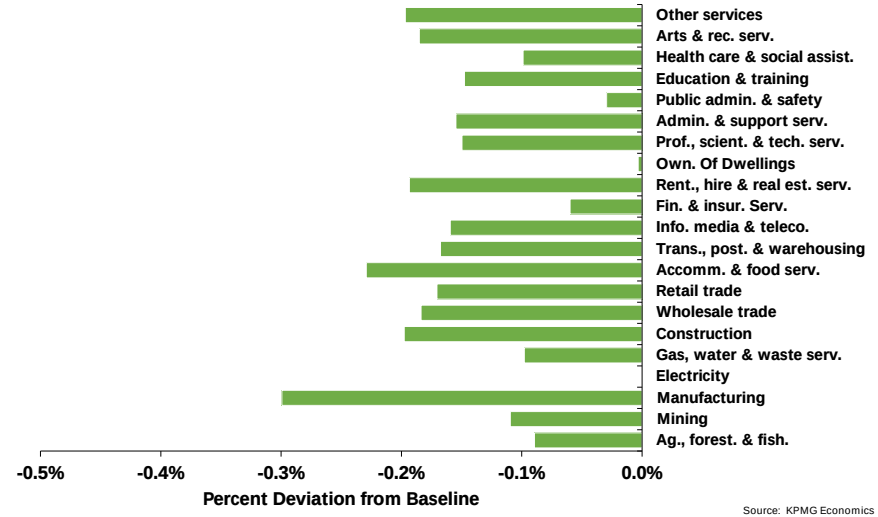
**Short Run Sectoral Output Impacts - All Sectors**




Source: KPMG Economics

**Chart 12**

**Short Run Sectoral Output Impacts - Excluding Electricity**




Source: KPMG Economics

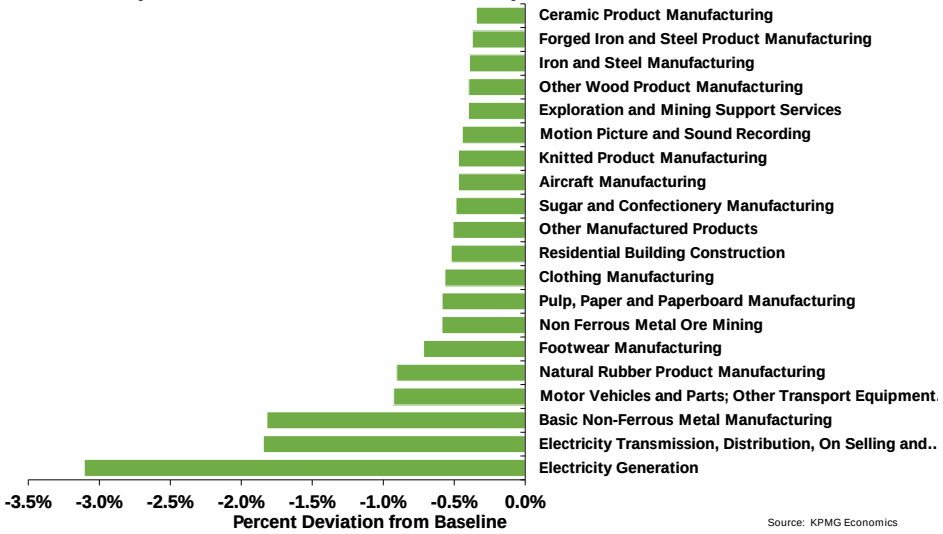
In Chart 13 we report a selection of results at a more detailed sectoral level; specifically, the output responses of the 20 most adversely impacted sub-sectors. The *Electricity Generation* and *Electricity Transmission, Distribution, On Selling and Electricity Market Operator* sub-sectors, which make up the *Electricity* sector are directly impacted by the shock and they are projected to record the largest contractions in output as demand for electricity by households and businesses is reduced. Further, the trade-exposed sub-sectors that are intensive users of electricity are all represented in Chart 13.

A strength of the detailed industry modelling approach that we have used is that it captures key supply chain linkages and other linkages in the economy that are important for understanding the indirect impacts of the electricity price shocks. For example, in Chart 13 the negative response of the *Residential Building Construction* sub-sector is driven by the reduction in household consumption. This is also a key driver behind the *Motion Picture and Sound Recording* sub-sector although in this case the sub-sector's share of electricity in total cost is inconsequential and it also sells a significant share of its output to other sub-sectors that are contracting.

# Simulation Results

**Chart 13**

**Most Impacted Industries – Short Run Output**




Source: KPMG Economics

The *Sugar and Confectionary Manufacturing* sub-sector, which is one of the most electricity-intensive sub-sectors in the economy, is highly exposed to the household sector directly and indirectly through supply chain links to other sub-sectors that are heavily exposed to the household sector. The *Exploration and Mining Services* sub-sector is not trade-exposed and electricity is not a significant share of its total costs. The projected reduction in this sub-sector's output is driven by the projected output reductions of its major customers in the broader *Mining* sector.

### *Long run impacts*

The 10% increase in cost of generating electricity is also a negative for the economy in the longer run. In the long run simulation capital stocks are allowed to respond to the increased cost of electricity generation shock. Most sectors negatively impacted by the electricity price shock tend to reduce their stocks of fixed capital to restore rates of return to their long run equilibrium values.

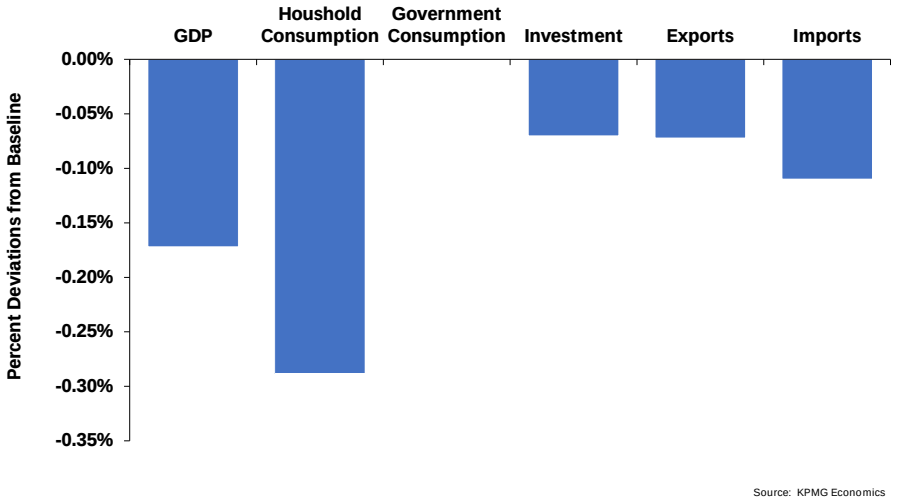
With aggregate employment assumed to be unaffected by the electricity price shock in the long run the contraction in the economy tends to reduce real wages, which puts downward pressure on costs. This cushions the impact of the electricity price shock on cost-sensitive exporters and import competitors relative to the short run. In the long run simulation we have assumed that real government consumption moves in line with real GDP. The reduced demand for resources by the government sector, which is relatively labour intensive, also puts downward pressure on labour costs.

The economy is smaller after the shock, although the projected reduction in real GDP is smaller in the long run relative to the short run. However, the opposite is true for real household consumption, which is a more relevant indicator of the overall impact of the shock on the economy. The occurs due to the decrease in real wages required to maintain aggregate employment at its pre-shock level which results in a decrease in household disposable income, which is a negative for household consumption.

The sectoral output results are summarised in Chart 15. Again, the *Electricity* sector records the largest decline, followed by *Ownership of Dwellings*. The *Ownership of Dwellings* sector contracts because all of its output is sold to households, and household consumption is projected to decrease relatively strongly.

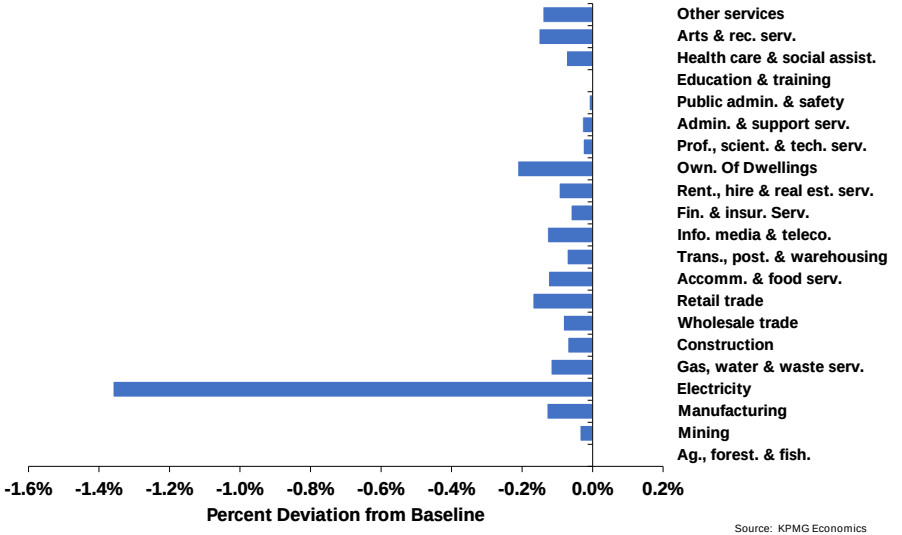
# Simulation Results

**Chart 14**
**Long run real macroeconomic impacts**




Source: KPMG Economics

**Chart 15**
**Long Run Sectoral Output Impacts - All Sectors**




Source: KPMG Economics

The *Ownership of Dwellings* sector also uses inputs of capital and land only and these are assumed not to change in the short run simulation where output by this sector remained unchanged, with the negative impact of the shock accommodated by a reduction in the price of dwellings.

The *Agriculture, Forestry and Fishing* sector is a traditional exporter that is not significantly exposed to increased electricity prices (either directly or indirectly) and it receives a competitiveness boost from the reduction in real wages. The *Education and Training Services* sector exports a significant share of its output and, as a labour intensive sector, also gets a competitiveness boost from the reduction in real wages, which means the net impact of the shock on the sector is virtually zero.

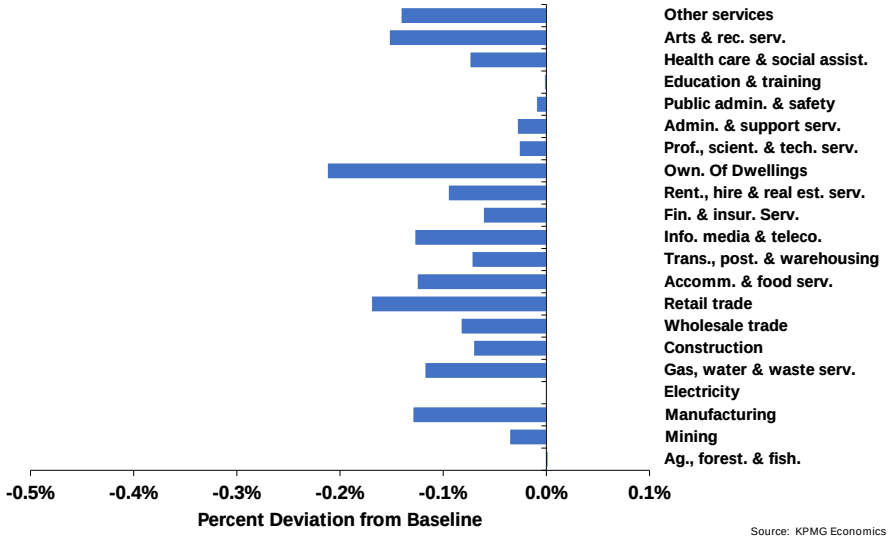
Other notable results in Chart 15 and 16 include the contractions in *Retail Trade*, *Accommodation and Food Services*, and *Arts and Recreational Services* sectors. Again, like the short run results, these sectors are highly exposed to household consumption, and with the reduction in real wages of 0.31% in the long run, then these sectors are negatively impacted proportionally more.

In Chart 17 we report a selection of long run results at a more detailed sectoral level; specifically, the output responses of the 20 most adversely impacted sub-sectors. Whilst these results are generally similar to the corresponding results from the short run simulation, there are some notable exceptions.

# Simulation Results

**Chart 16**

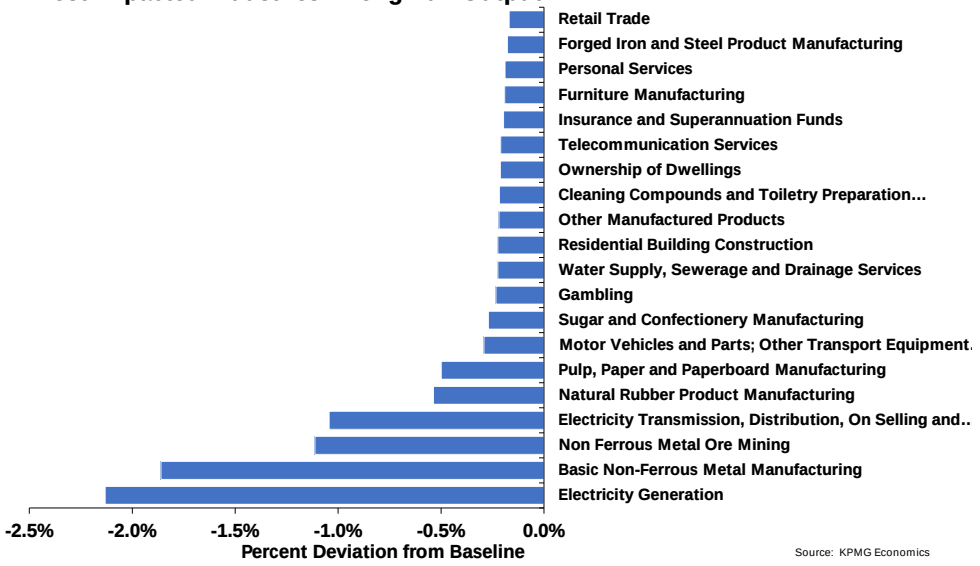
**Long Run Sectoral Output Impacts - Excluding Electricity**




Source: KPMG Economics

**Chart 17**

**Most Impacted Industries – Long Run Output**




Source: KPMG Economics

There are several notable differences between the detailed long run and short run results. Firstly, the relatively electricity-intensive import competing *Footwear Manufacturing*, *Clothing Manufacturing* and *Knitted Product Manufacturing* sectors are no longer projected to be in the 20 most adversely impacted sub-sectors.

These sectors are relatively labour intensive and they benefit from the reduction in real wages in the longer run. On the other hand, the relatively capital intensive *Basic Non Ferrous Metal Manufacturing* sub-sector and the *Non Ferrous Metal Ore Mining* sub-sector are projected to continue to be significantly adversely impacted in the long run.

The key reason for this result is that these sub-sectors, like other capital intensive sectors, do not get a significant offsetting benefit from the reduction in real wages in the long run.

The relatively large reduction in household consumption in the long run is the key driver behind the entry of sub-sectors like *Gambling*, *Water Supply, Sewerage and Drainage Services, Gas Supply*, and *Telecommunication Services* into the bottom 20 performers.

# Concluding remarks

Electricity is an essential good in our modern world.

Formalising policy settings for its production, consumption and transportation have long been challenging; which has become even more complex with the overlay of mitigating global climate change.

KPMG's high-level analysis suggests that the National Energy Guarantee (NEG), Australia's latest iteration of electricity policy, has the potential to deliver energy supply reliability and emissions reductions and put downward pressure on the cost of electricity compared to a business-as-usual scenario. Understanding the details of NEG design and implementation following the 24 November 2017 COAG meeting will be vital for all stakeholders affected by the current challenges being experienced by the energy sector.

We have also completed a brief overview of Australian electricity prices and usage in recent years. An important conclusion from this analysis is that households and businesses have demonstrated considerable capacity to respond to increased electricity prices by reducing usage on a per capita or per unit of output basis. This electricity efficiency gain has been driven by the adoption of new technologies and by improved processes and behaviours.

However, the business impact of unreliable supply and increasing electricity prices has been very challenging for businesses and consumers. Additional dispatchable and flexible sources of generation/storage remain a priority to meet our current and future energy needs. Ultimately, more supply will curb pressure on energy price rises.

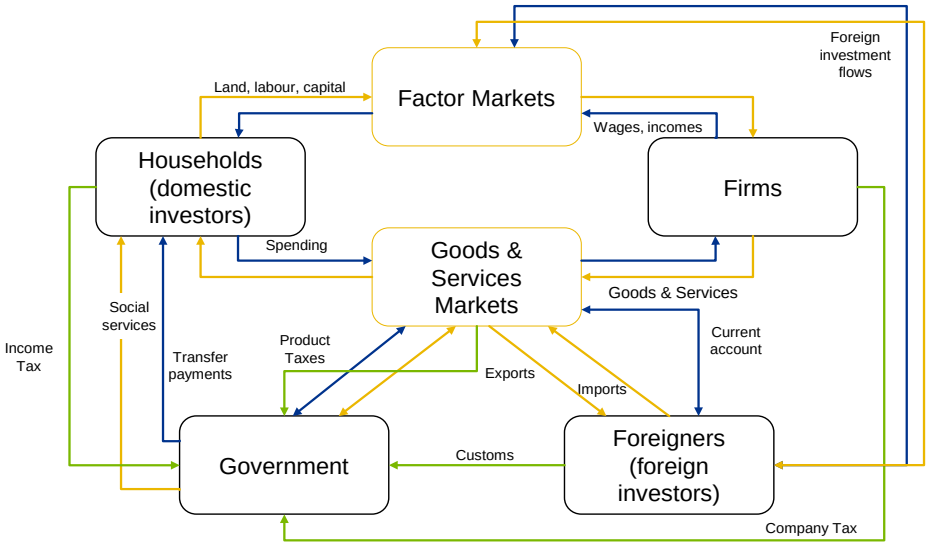
Finally, our macroeconomic simulations confirm electricity prices have the capacity to significantly influence the size and structure of the domestic economy. Careful modelling of any policy response to the current circumstances facing Australia's energy market is therefore vitally important to manage potential concerns of households and businesses regarding how any change to electricity prices will impact them.

# Appendix A - KPMG CGE

KPMG-CGE is a multi-sectoral model of the Australian economy that has been specifically designed for policy analysis. KPMG-CGE belongs to the computable general equilibrium (CGE) class of models exemplified by the world-leading ORANI and MONASH models created at the Centre of Policy Studies. KPMG-CGE builds on the ORANI and MONASH traditions by incorporating a number of theoretical and empirical advancements. We briefly describe these features below.

KPMG-CGE has a flexible simulation design: it can be run in comparative-static or dynamic mode. In dynamic mode, a KPMG-CGE simulation of the effects of a policy change involves running the model twice to create the baseline and policy runs. The baseline is designed to be a plausible forecast of how the economy will evolve over time in the absence of the policy shock of interest. The policy run quantifies deviations of variables from their baseline values caused by the policy shock modelled. In default applications of KPMG-CGE, the paths of most macroeconomic variables are exogenous in the baseline and set in accordance with forecasts made by KPMG-MACRO, KPMG's macroeconomic model. For specific applications, alternative settings for the paths of macroeconomic variables can be sourced from other forecasting groups (e.g., Treasury). In the policy run, macroeconomic variables are endogenous. With the exception of the policy variables of interest (e.g., tax variables), all exogenous variables in the policy run are assigned the values they had in the baseline. The differences in the values of variables in the policy and baseline runs quantifies the effects of moving the variables of interest away from their baseline values.

KPMG-CGE distinguishes 114 sectors and commodities, based on the 2013/14 input-output tables published by the ABS (Australian Bureau of Statistics) (2013). Primary factors are distinguished by 114 types of capital (one type per industry), nine occupations, two types of land, and natural resource endowments (one per industry).




A representative firm in each sector produces a single commodity. Commodities are distinguished between those destined for export markets and those destined for domestic sales.

Production technology is represented by nested CRESH functions (Hanoch, 1971) allowing a high degree of flexibility in the parameterisation of substitution and technology parameters. Energy goods are treated separately to other intermediate goods and services in production, and are complementary to primary factors.

# Appendix A - KPMG CGE

The supply of labour is determined by a labour-leisure trade-off that allows workers in each occupation to respond to changes in after-tax wage rates thus determining the hours of work they offer to the labour market. The overall supply of labour is normalised on working-age population.

Household consumption decisions are determined by a LES function (Stone, 1954) that distinguishes between subsistence (necessity) and discretionary (luxury) consumption. Total household spending moves with household disposable income.

KPMG-CGE includes detailed government fiscal accounts including the accumulation of public assets and liabilities; these are based on the ABS's Government Finance Statistics (ABS, 2015). On the revenue side, detailed modelling of over 20 direct and indirect taxes and income from government enterprises is included. On the expenditure side, government consumption, investment and payments of various types of transfers (such as pensions and unemployment benefits) are modelled.

Investment behaviour is industry specific and is positively related to the expected rate of return on capital. This rate takes into account company taxation and a variety of capital allowances, including the structure of the imputation system.

Foreign asset and liability accumulation is explicitly modelled, as are the cross-border income flows they generate and that contribute to the evolution of the current account. Along with other foreign income flows like labour payments and unrequited transfers, KPMG-CGE takes account of primary and secondary income flows in Australia's current account; these are particularly important for Australia as they typically comprise the significant share of the balance on the current account.

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