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Gas at the crossroads

Australia's hard choice

Tony Wood



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Overview

For some time the price of natural gas has been rising well above the cost of living. As with electricity, rising network prices are the main reason for a 36 per cent increase in average gas bills over the past five years. But in the next few years, huge changes in the gas market will push up prices even more sharply, adding more than \$300 a year to the average household gas bill in Melbourne and over \$100 a year in Sydney and Adelaide. The increases will mean tough decisions for many households and businesses.

Natural gas is one of Australia's main sources of energy. We use it to cook, heat water and heat our homes. It is an important fuel source for businesses such as dry cleaners and commercial food processors. Some large industries, such as explosives and fertilisers, use it heavily as a primary material in production. It is also used to produce electricity, and produces fewer CO₂ emissions than coal does, while being more affordable than most renewable energy sources. Gas has always been commercially competitive, with heating qualities that most prefer to electricity.

But Australia is about to undergo changes that will have a major impact on how we use gas. Gas producers have been building Liquefied Natural Gas (LNG) facilities, mostly in Queensland, since 2010, and will start exporting as early as this year. By 2018 east coast gas, added to growing Western Australian supplies, could create the world's biggest gas export industry, worth \$60 billion a year. The economic benefits that will flow as a result represent an opportunity too good to miss.

The downside is that domestic gas prices will increase to compete with the higher prices that other countries are prepared to pay for our gas. As a result, many households will reconsider the benefits of gas against electricity. Some will replace gas appliances with electrical ones and won't return any time soon. Most may just cope with higher prices, because they still prefer gas for cooking or heating, or they aren't able to justify the immediate cost of switching or they are just confused by the competing choices.

Business gas users may be able to pass costs onto customers, or be forced to consider alternative energy sources. The implications for manufacturing output and jobs in gas-intensive sectors are bad indeed. Electricity produced by gas (gas-fired power) is likely to be priced out of the electricity market, except to meet short-term peaks in demand. A shift away from gas means a shift back to coal. Such a trend is already being seen, and is bad news for the climate. Australia's 2020 emissions target will be harder to meet.

Many affected groups will demand protection from price increases. Since household users make up a large share of voters, and the gas industry has failed to prepare its customers for the shift to higher prices, the pressure on governments to keep gas cheap is likely to be strong. They should resist it.

Consumers face higher prices, but the economic benefits of the change will be overwhelmingly positive. Governments should avoid poorly designed intervention. Instead, they should remove barriers to a healthy market, and ensure that all Australians share in the value of our gas revolution.

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1 Introduction

A 2013 report for Grattan Institute, *Getting gas right*, explored the changing gas market and some of the challenges facing governments and gas users.¹ This report examines how a rising gas price will affect the decisions of the major players in the market, including households (Chapter 3), businesses and industry (Chapter 4), and the gas supply sector (Chapter 5). It considers whether households will disconnect their gas appliances in response to rising bills, and whether businesses will be able to pass on additional costs or similarly switch to alternative energy sources. Chapter 2 explains why gas prices are rising and looks at the likely short and long-term scenarios, and Chapter 6 investigates the options for governments. This chapter gives a brief history of how the natural gas market has developed in Australia.

1.1 Early gas use and building the pipeline network

Gas has long been a source of energy in Australia. In the early 19th century gas was used as a source of lighting, and then later introduced for cooking. This was not natural gas that we use today, but what was known as town gas, manufactured from coal in numerous gasification plants located near consumers.²

Around the 1950s, the gasification process became more centralised; larger plants replaced a number of smaller ones. Advances in technology also led to the development of 'syngas' (synthetic gas), manufactured from by-products of oil refining.

¹ Wood, *et al.* (2013)

² Morse (2000)

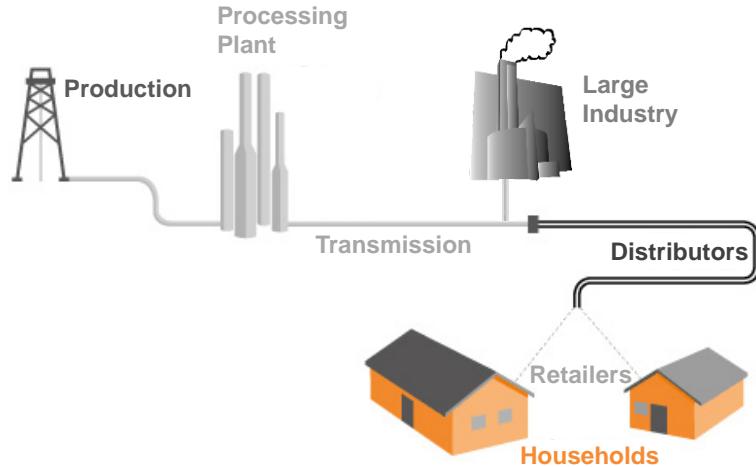
In the 1960s the discovery of significant natural gas reserves, including two major offshore oil and gas fields in Bass Strait, transformed gas use in Australia. Natural gas held two important advantages over town gas and syngas: it required little processing and it was not toxic.

Melbourne and Brisbane came to represent the two extremes of gas consumption. In Melbourne, household connection and use of natural gas is common, mainly for heating homes in cold winters. Brisbane's milder climate means that gas is used mostly for water heating and cooking. The Roma to Brisbane pipeline was built primarily for a fertiliser manufacturer; there may not have been an economic case for building the pipeline if households were the only customers.³ Fortunately for Brisbane, the distribution pipeline network for town gas to households could also be used to transport natural gas.

Figure 1 shows the natural gas supply chain: major transmission pipelines transport gas to large industrial users, while smaller distribution pipelines transport this gas to households and small businesses.

³ Wood and Woodman (2005)

Figure 1: How natural gas is transmitted to households and industrial users



Source: United Energy and Multinet Gas (2014)

1.2 Natural gas in Australia today

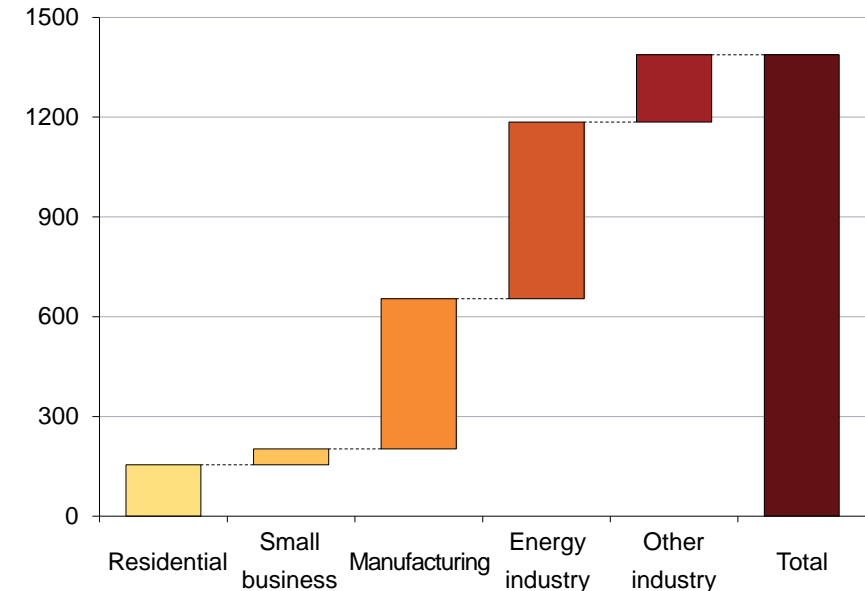
New South Wales, Victoria, Queensland, South Australia, and Tasmania are all connected through a network of pipelines. Parts of Western Australia and Northern Territory have access to natural gas, but are not connected to the east coast. In contrast to the wholesale national electricity market, where all electricity is traded through a gross pool, most gas is sold under long-term contracts between producers and wholesalers or retailers.

While natural gas accounts for more than a third of all total residential energy use, more gas is consumed in manufacturing and in the energy sector itself, as shown in Figure 2. For some businesses, gas is used as a feedstock in production – for

instance, Orica uses gas to produce ammonia, a key input into ammonium nitrate, used to manufacture explosives. Other manufacturing activities, such as paper production, use natural gas for heat and steam.

Figure 2: Gas is used across the Australian economy

Consumption of natural gas, 2012-13, petajoules



Source: BREE (2014)

Gas is also used to produce electricity. Gas-fired power is much less emissions-intensive than coal-fired power, and is relatively flexible because gas plants can be easily switched on and off to meet peak demand when wholesale electricity prices are high.

The vast majority of Australia's conventional gas reserves lie off the coast of Western Australia. Since 1989 the state has exported liquefied natural gas from the North West Shelf, mostly to Japan. While this has exposed domestic consumers in Western Australia to movements in international prices, domestic wholesale prices remained relatively low until recent years.

Box 1: Liquefied natural gas (LNG) in Australia

The liquid form of natural gas takes up around one six-hundredth of the volume of natural gas in gaseous form. This makes LNG an efficient way of storing gas and transporting it over long distances where a pipeline is not feasible. However, the gas must be chilled to -161°C, which can add significantly to the cost.

Australia's first LNG plant was built in 1980 in Dandenong, Victoria for storage purposes.⁴ The plant has helped the state to meet peak demand in winter and has provided some security against disruptions to supply.

Numerous LNG plants have since been built in Western Australia and in the Northern Territory for export purposes. Three LNG export projects, based on coal seam gas, are under construction in Gladstone, Queensland, with the first due for completion in late 2014. It will be the first time natural gas is exported from Australia's east coast.

The east coast has had a balanced gas market; conventional gas reserves have met domestic demand.⁵ Recent technological advances in extracting the natural gas in coal deposits, commonly known as coal seam gas, have created a new export opportunity. Once extracted, coal seam gas can be liquefied and exported in the same way as gas from conventional sources.⁶ The vast majority of identified coal seam gas deposits are in the Bowen-Surat Basin in Queensland (see Figure 3).

With the ability to mine coal seam gas, Australia has more than enough natural gas reserves to supply both the domestic and export markets for many years.⁷ Just as the mining boom of coal and iron ore has contributed significantly to Australia's prosperity over the last 15 years, so too the export of LNG will greatly benefit the country.⁸

More than \$63 billion is being invested in LNG export projects in Queensland, leading to almost 30,000 jobs during the construction phase and up to 17,000 ongoing jobs from 2020 when the projects are fully operational. This investment will increase Australian LNG exports, currently worth \$14.5 billion a year to over \$60 billion in 2017-18.⁹

⁴ Morse (2000)

⁵ Based on current yearly production levels relative to proven and probable conventional reserves. See EnergyQuest (2013), as cited in AER (2013)

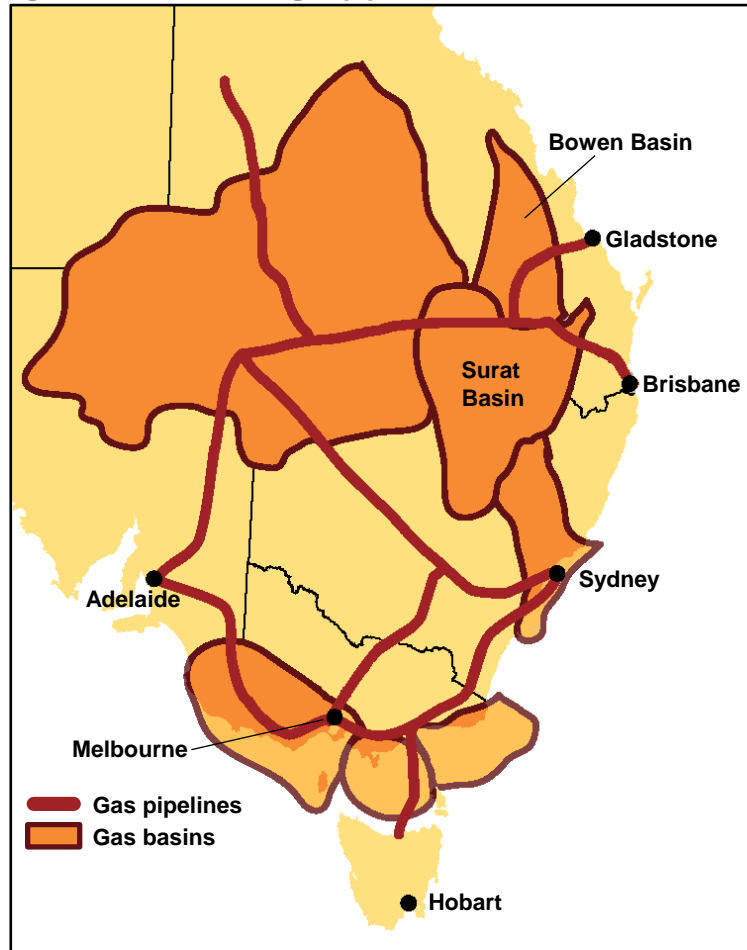
⁶ Natural gas mined from coal seams is essentially the same product as that mined from conventional reserves – it is used in exactly the same way. However, the way it is held in geological structures and the way it is extracted are different.

⁷ Commonwealth of Australia (2014)

⁸ Minifie, *et al.* (2013)

⁹ Commonwealth of Australia (2014)

Figure 3: A network of gas pipelines connects the east coast



Source: Grattan Institute

2 Why are natural gas prices rising?

Households and most businesses buy their gas from energy retailers. They, in turn, have long-term supply contracts with gas producers. These contracts determine what retailers will pay producers for gas, which in turn affects the price that retailers charge households and businesses. Some large industrial users may contract directly with producers. Such contracts typically last for five years or more.

Short-term trading markets in major centres such as Sydney are used to manage short-term imbalances. Only a small volume of the total gas supplied is traded this way and the traded prices do not reflect the wholesale gas prices that are passed on to consumers. By contrast, all electricity at the wholesale level is traded through the national spot market.

For more than a decade wholesale gas prices on the east coast have remained relatively stable, typically averaging around \$3 to \$4 a gigajoule (GJ). But today domestic and international factors are affecting both supply and demand for natural gas. This chapter outlines how these forces are pushing up wholesale prices, which will flow through to gas consumers.

2.1 Domestic consumers must compete with the international market

Until recently, it has not been economically viable for the east coast to export natural gas. Firstly, the commercial potential for coal seam gas extraction had largely been unmeasured, and was not seen as large enough to justify the large capital investments required to build gas liquefaction plants. But recent developments surrounding coal seam gas, including technological advances, mean that the east coast now has more than enough gas to supply both domestic and international markets.¹⁰

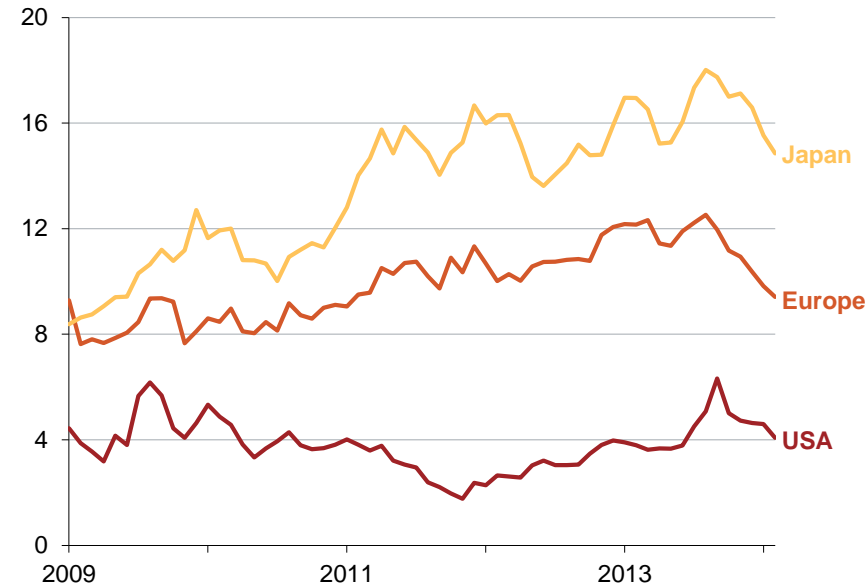
Secondly, the price of natural gas has been on the rise in key international markets, such as Japan, as Figure 4 shows. These factors have combined to make LNG exports from Australia profitable.

A key event triggering the rise in international prices was the Fukushima Daiichi nuclear disaster of early 2011. It led to tighter restrictions around nuclear power and increased demand for alternative energy sources, both in Japan and internationally.

¹⁰ Ibid.

Figure 4: There is a general rising trend in international wholesale gas prices

Nominal AU\$ per gigajoule



Source: World Bank (2014)

There are other factors behind the international price increase. With countries looking for cost-effective ways to reduce emissions, gas-fired power has emerged as a stepping stone between coal and renewable energy sources. Political factors also play a role. For instance, about a third of the natural gas Europe consumes is imported via pipelines from Russia, the world's second-largest producer of gas behind the US. But political tensions between Russia and the EU make European countries likely to look to other sources, such as imported LNG, to improve

their energy security.¹¹

The downside of Australia's east coast opening up to the international market is that domestic consumers of natural gas must compete with international buyers. Gas producers, attracted by higher global prices, will move supply from the cheaper to the more expensive market until prices converge. As a result, the wholesale price of gas will rise, and domestic gas users will pay more.

Over time the price is expected to peak and fall back somewhat, because increasing prices should lead to increased supply, either from higher-cost conventional sources that become competitive or from unconventional sources, as happened with the emergence of shale gas in the United States. The fact that new supply agreements are being reached, like the one announced in 2013 between Origin Energy and Esso/BHP Billiton, is evidence that the market is already responding to the higher prices.¹²

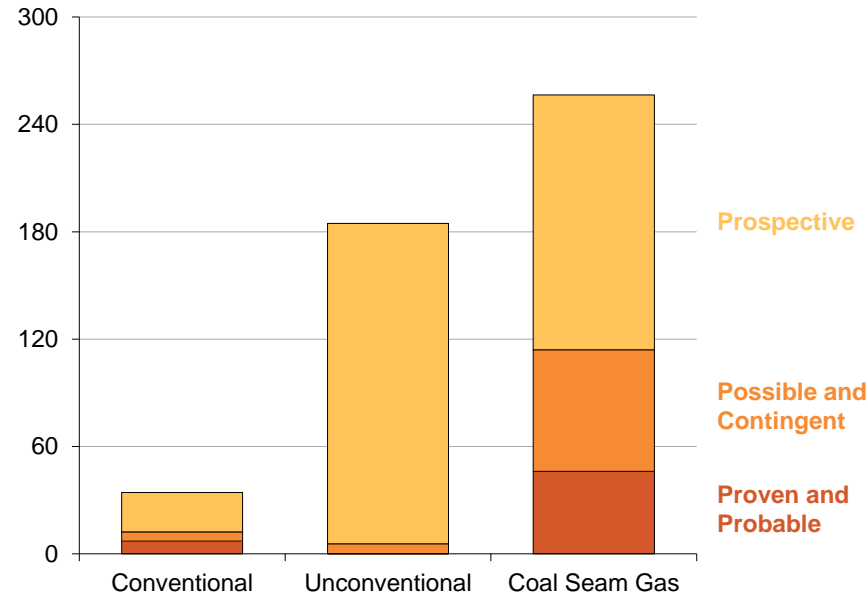
2.2 The supply response is slow and constrained by government intervention

The vast majority of the east coast's gas reserves are in coal seams, as Figure 5 shows. These reserves will form the basis of much of the LNG export industry. Coal seam gas is typically more costly to extract than conventional gas, but high international prices have made coal seam gas profitable to mine.

¹¹ Australia's location means that most LNG will be shipped to Japan and other Asian markets rather than Europe. However, the European price still has an effect on prices paid in Japan and elsewhere.

¹² Origin Energy (2013)

Figure 5: The east coast has vast reserves of coal seam gas
 Total reported reserves and resources as at 31 December 2012, Eastern and South Eastern Australia, exajoules



Note: 1 exajoule = 10¹⁸ joules. Unconventional refers to shale gas and tight gas
 Source: Core Energy Group (2013)

The extraction of coal seam gas has been resisted in some areas. Community and environment groups have expressed concern about the risk of contaminated water supplies resulting from hydraulic fracturing (fracking), a process that is often used to stimulate the flow of coal seam gas. As a result the Victorian Government placed a moratorium on coal seam gas extraction and fracking, then lengthened the ban to July 2015 and extended it to cover all onshore gas exploration. The New South Wales Government has recently extended a ban on coal seam gas

exploration licences for a further twelve months.

Such policies have constrained the supply of natural gas to domestic customers on the east coast, particularly in New South Wales where there are no conventional reserves. The moratoriums have not resolved the concerns of gas developers, land owners or environmentalists and have done nothing to relieve supply or cost pressures.

Some community concerns about coal seam gas may prove to be overblown, but it is important to properly manage the risks in the mining process. A balanced outcome is surely possible, drawing on the South Australian Government’s decision to proceed with fracking, the recommendation to proceed provided by former Federal Minister Peter Reith in his 2013 report to the Victorian Government, and the report from the New South Wales Chief Scientist & Engineer, Mary O’Kane.¹³ Gas moves freely across state boundaries on the east coast, so a nationally consistent and effective regulatory process for the safe development of coal seam gas should be a priority for all governments. Such a clear regulatory framework needs to move beyond the guidelines for good practice to which state and territory ministers committed in 2013.

It is likely that local community concerns in part reflect frustration at the disruption to livelihoods caused by coal seam gas development, such as noise and the impact on both the landscape and local roads. Under existing legal regimes, owners of land where the gas is extracted and adjacent landowners are not compensated for these impacts. These issues may explain the ferocity of community opposition to coal seam gas extraction. Any

¹³ Government of South Australia (2012); Reith (2013); O’Kane (2014)

aggressive actions by some companies will heighten such concerns.

The benefits from gas developments usually accrue far from where these disruptions and costs are incurred. Reforming the regulatory regimes to include comprehensive compensation to landowners and local communities may ultimately be the price of permitting coal seam gas extraction.

2.3 Reducing emissions will also drive higher prices for gas consumption

Because natural gas is a fossil fuel, its price will rise under emissions reduction policies such as an emissions trading scheme or a carbon tax. Yet these policies will have relatively less effect on gas than on coal and oil, since burning gas produces less carbon dioxide (CO₂) for each megawatt hour of energy produced.¹⁴ Australia's Renewable Energy Target reduces the opportunity for gas-fired generation of electricity by allocating a share of the electricity generation market to renewable energy.

In the short-term, the attractiveness of gas for power generation is determined by the complex interplay between the prices of gas, coal, and emissions. In the longer term, the decarbonisation of the energy system will mean the phasing out of all burning of gas. In large industries, including electricity generation, this could be altered if carbon capture and storage can be successfully deployed.¹⁵ While the decline in gas usage is likely to occur over several decades, it would speed up with higher gas prices.

¹⁴ Moomaw, *et al.* (2011)

¹⁵ Wood and Mullerworth (2012)

2.4 The price outlook is less clear beyond the short-term

The export of LNG from Queensland will increase the wholesale price of natural gas on all the eastern states (including South Australia) since the states are linked by major pipelines. Although most LNG for export will come from coal seam gas reserves in Queensland, the infrastructure now exists for all gas suppliers on the east coast to access the international market. The only constraints will be internal transport costs and related pipeline capacity.

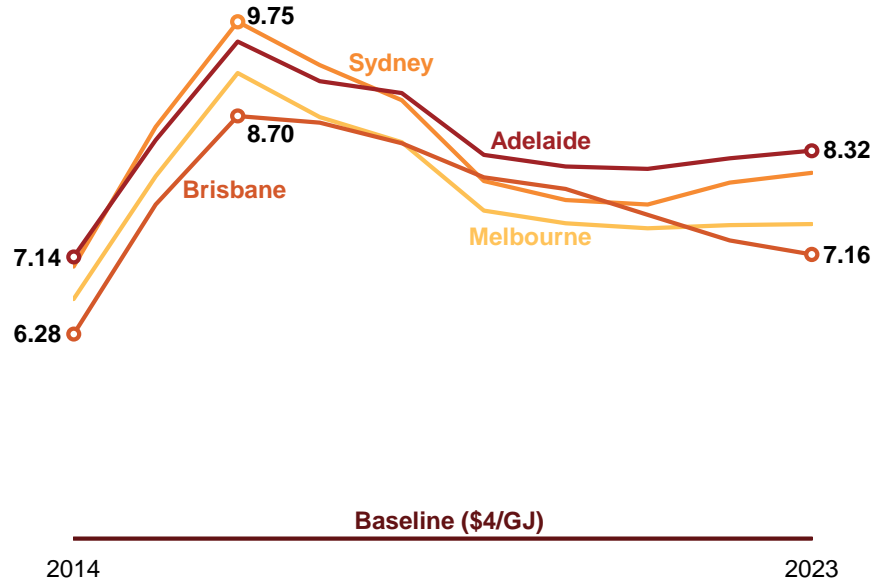
Domestic wholesale prices will not reach the level that Japanese importers are paying for LNG. Instead, they are likely to increase to an export parity price, which deducts the costs of liquefying and shipping the gas from the delivered price in export markets. Figure 6 shows the results of economic modelling by research group Sinclair Knight Merz (SKM) on how wholesale prices are likely to rise across the east coast.

These forecasts suggest that the wholesale price will be similar across each city, peaking in 2016 at around \$9 a gigajoule, up from levels of around \$4 a gigajoule. Such price increases are already being factored into long-term contracts.¹⁶ In the medium term, SKM predict that the price will begin to decline as international markets respond with new supply, and steady at about \$7.50 to \$8 per gigajoule from 2019. However, the wholesale gas price on the east coast is not expected to return to historical levels. One reason for this is that future gas extraction will steadily become more expensive.

¹⁶ Deloitte Access Economics (2014)

Figure 6: Wholesale prices are likely to rise to more than double historical levels

Forecast domestic gas price, \$ per gigajoule

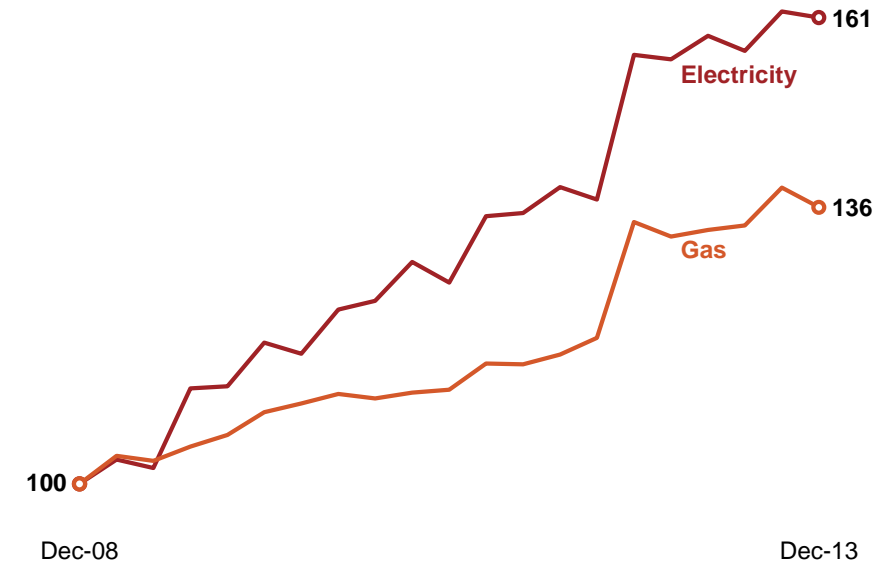


Note: Baseline based on average wholesale prices for eastern states 2012-14
 Source: SKM (2013b)

While households and small businesses are yet to experience the full force of the wholesale price increase, retail gas prices have already risen by 36 per cent in real terms over the five years to December 2013, as Figure 7 shows. These increases have been largely overshadowed by even more significant increases in electricity prices of 61 per cent. In both cases, most of the increase has been due to rising network prices.

Figure 7: Increases in retail gas prices have been overshadowed by increases in electricity prices

Index of real retail gas and electricity prices, 100 = December 2008



Note: the introduction of the carbon tax in July 2012 had an immediate impact on both gas and electricity prices, raising each by around 10 per cent. The abolition of the tax in July 2014 is likely to lead to a fall in prices.
 Source: ABS (2014)

The price outlook for the next few years will place sharp and intense pressure on household and business gas consumers. The following chapters describe these impacts in detail and the actions that could or should be taken in response.

3 What do rising prices mean for households?

This chapter investigates how an increase in the wholesale gas price on the east coast will affect household bills. It then looks at the options households will have to reduce these additional costs.

In response to higher prices, households may choose simply to use less gas, or they may decide to switch from gas appliances to electric ones. The choices are different in Melbourne, Sydney, Brisbane, and Adelaide because each city uses gas differently. For instance, most gas-connected households in Melbourne use it for all of their cooking, hot water, and heating, but most gas households in Brisbane use gas for one appliance only. Each city also has a very different retail gas price.

To keep the analysis simple and transparent, this chapter uses as its benchmark a \$5 per gigajoule increase in the wholesale price of gas. The benchmark is based on the SKM forecasts (see Figure 6) that predict a rise in wholesale gas prices from historical levels of about \$4 to about \$9 a gigajoule.

3.1 Increases in household gas bills will vary greatly

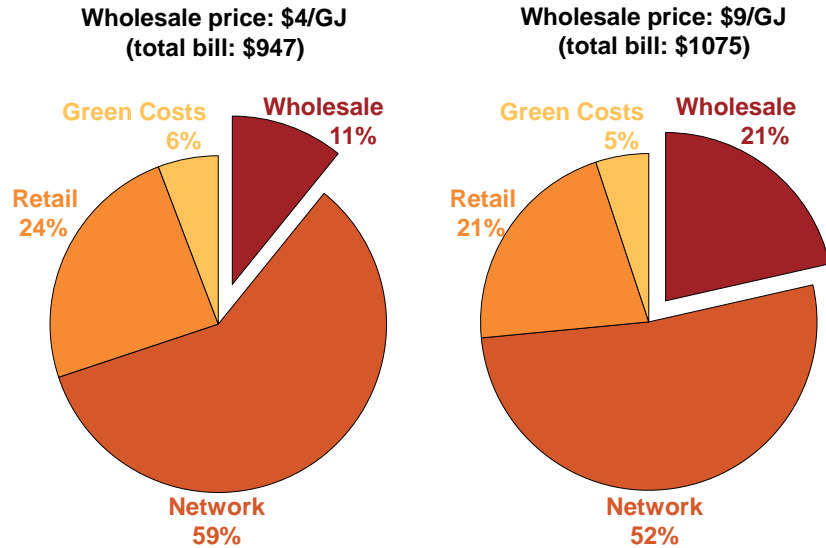
A higher wholesale price will inevitably translate into a higher price paid by households connected to natural gas. But the price paid to gas producers is only one component – usually a relatively small one – of the cost of getting gas to the end consumer. Except for very large gas users, the network connection and retail costs make up most of what a household actually pays for. These costs do not depend on how much gas is consumed. While network costs have increased over the last few years, the outlook is that

these costs will begin to flatten, providing some relief from rising wholesale gas prices. As a result, the percentage increase in a gas bill will be much lower than the percentage increase in the wholesale price.

For example, consider a gas bill for a household in the average three-bedroom house in Sydney, consuming just over 25 gigajoules per year. At \$4 a gigajoule, wholesale costs only account for around 11 per cent of the bill. If the wholesale price increases to \$9 a gigajoule, the typical household bill would only increase by about 14 per cent, assuming no change in other costs. This is shown in Figure 8.

Figure 8: While wholesale costs will rise significantly, this accounts for a small component of household bills

Components of average three-bedroom household's bill, Sydney, 2014



Source: ABS (2012); IPART (2014); Jemena (2014); Grattan analysis

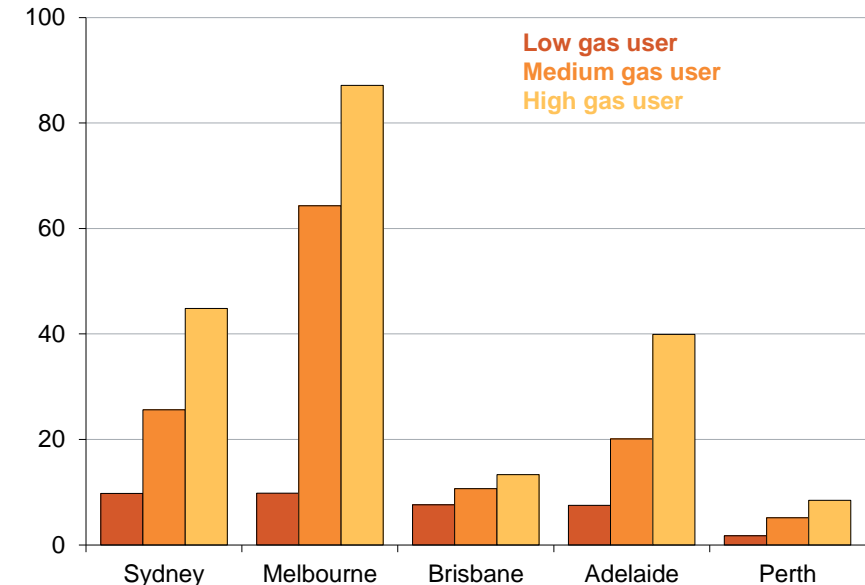
As Australia's heaviest household users of natural gas, Melbourne consumers face the highest price rises. The vast majority of Melbourne households will be affected, as more than 90 per cent are connected to mains gas, compared with about 75 per cent in Adelaide, 50 per cent in Sydney and only 20 per cent in Brisbane.¹⁷ About 80 per cent of Perth households are connected, but, as with Brisbane households, consumption is low.

¹⁷ ABS (2012)

Figure 9 divides households in each city into three categories: low, medium and high gas users, displaying the average consumption for each. A low gas user is a household in a small dwelling (one or two bedrooms) using gas for cooking and maybe hot water; a medium gas user is a household in a standard sized dwelling (three bedrooms) that has gas for cooking and hot water; and a high gas user is a household in a large dwelling (four or more bedrooms) using gas for cooking, hot water and home heating.

Figure 9: Large households with gas heating consume much more gas than others

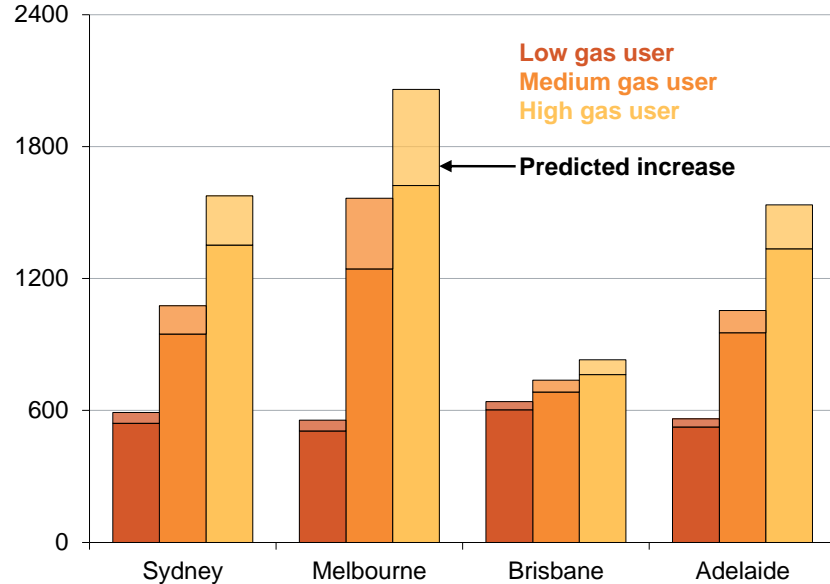
Yearly consumption, gigajoules



Source: ABS (2012)

Most medium gas users in Melbourne are also connected to gas heating, and this group consumes about 40 per cent more than high users in Sydney and Adelaide. By contrast, high gas users in Brisbane consume far less than medium users in other cities. Figure 10 shows how household bills are expected to increase for each of these household types in each city.

Figure 10: Melbourne gas bills are likely to increase the most
Average household bill, 2014, with predicted increase, \$ per year



Notes: average household bill based on 2014 retail tariffs assuming 2012 consumption levels. Predicted increase assumes no changes in consumption, and that a \$5/GJ increase in the wholesale price of gas is passed on uniformly through retail tariffs, with no changes to the network and retail costs. Perth is not shown as the WA market is not impacted by changes to the east coast market.

Source: ABS (2012); Energy Australia (2014); Origin Energy (2014); Grattan analysis

With a wholesale price increase of \$5 per gigajoule, a medium gas user in Melbourne can expect a yearly bill increase of about \$320 if they do not change their consumption. A high gas user in Melbourne can expect a hit of about \$435. High gas users in Sydney will face an increase of about \$225, while high users in Adelaide will pay an extra \$200 a year. By contrast, even a high gas user in Brisbane should only see an increase of about \$65 a year, due to far lower levels of consumption.

For low gas users, most of which are households connected to gas cooktops or using a small-capacity gas hot water system, the effect of the price rise will be minimal relative to current bills. For each city the increase is less than \$50 per year.

3.2 What options do households have?

The decisions facing households will differ depending on the number of appliances they have. A household with multiple appliances can choose to keep all their existing gas appliances and pay the increased costs of running them. Or it can replace one or two gas appliances but retain the gas connection. Alternatively, it can replace all gas appliances with those that use an alternative fuel source and disconnect from the gas network. A household with only one gas appliance has a simpler choice: whether or not to remain on the gas network.

These decisions are complicated by the nature of the gas tariff structure. A typical gas tariff comprises a small fixed daily charge with declining usage tariffs, known as a declining block tariff. It means that the more gas used the cheaper gas becomes. In Sydney for example, a household is charged 41 cents a megajoule for the first 40 megajoules of gas used a day. For the next 50 megajoules, the price falls to 23 cents.¹⁸

For a household using gas for heating, cooking, and hot water, the savings from switching one appliance to electricity may be small because the switch removes the cheapest gas from the bill. In contrast, a household using gas only for cooking could make a large saving by switching to an electric cooktop. Not only does it stop paying for gas at the highest price, but the connection cost can be avoided by switching off from the gas network.

Households will also need to consider the upfront costs of purchasing and installing an alternative system. When building a home and deciding between gas and electric appliances, the

owner is likely to consider both the upfront and the running costs. If a gas hot water system is a similar price to an electric hot water system, the owner is likely to install the system that is cheaper to run. But the decision is less straightforward if the upfront costs of one system are much higher, but the running costs are lower. This is the case when comparing gas appliances to energy efficient electric alternatives.

For existing dwellings, the factors influencing the decision are different again. With a working gas hot water system, most households are unlikely to switch to an electric system and incur high upfront costs unless the yearly savings are substantial. Most households do not consider the options available until the system needs replacing.

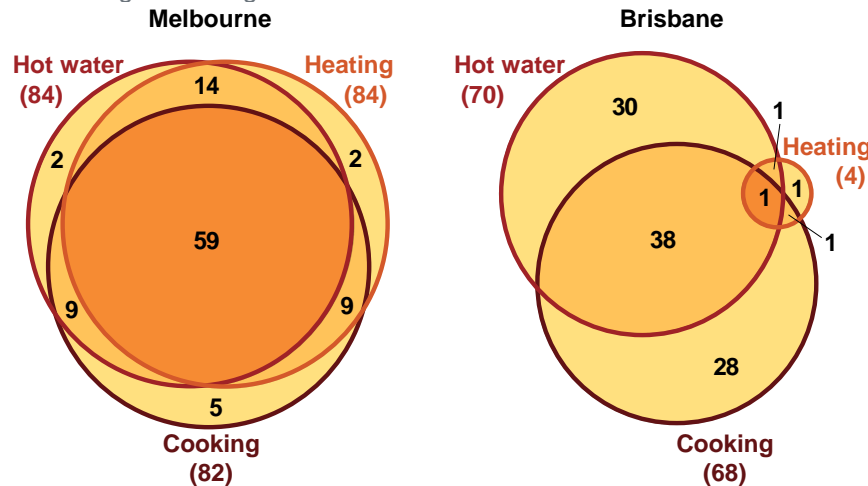
Provided the system is reliable, most households probably don't have a strong preference for gas or electric hot water. But for cooking and heating, the choice between gas and electricity comes down to more than just relative costs. For instance, many people prefer gas cooktops to conventional electric cooktops because of the speed at which they heat up. Similarly, many prefer the feel of gas to electric heating.

¹⁸ Energy Australia (2014)

3.3 How will households respond to rising gas prices?

Households in different states use gas very differently. Figure 11 shows that more than 90 per cent of Melbourne households have multiple gas appliances; a combination of hot water, heating and cooktops, whereas nearly 60 per cent of Brisbane households have only a single gas appliance, usually for hot water or cooking.

Figure 11: Gas appliance connections vary greatly across two cities
Percentage of total gas connections



Source: ABS (2011); 2012

Households with only a single gas appliance will realise greater savings when they replace it with an electric appliance. This would suggest Brisbane households are more likely to switch off gas appliances than Melbourne households. But variation in the gas and electricity tariffs across cities affects how households will respond.

This section considers the cost of running various appliances for a typical three-bedroom house in Melbourne, Sydney, Adelaide and Brisbane respectively, taking into account local climate and local energy costs.¹⁹ It considers the cost of gas versus energy efficient and advanced electric alternatives:

- For heating, a gas ducted system is compared to the heating costs of reverse-cycle air conditioners.²⁰
- For hot water, a 5-star gas system is compared to an electric heat pump system.²¹
- For cooktops, natural gas is compared to electric induction.²²

In the examples that follow, the gas bill includes the usage component for each appliance, the cost of connecting to gas, and the predicted increase in the bill arising from a \$5 per gigajoule rise in the wholesale price of gas.

While the examples show that households may be able to reduce their bills by switching to electric appliances, it is important to stress that this analysis does not take the upfront costs of switching into account – whether households will switch or not will depend on their financial circumstances, and on how they value gas against electric appliances.

¹⁹ Costs are calculated using the most affordable gas and electricity tariffs on offer (with no lock-in contract) across major retailers in the CBD of each city.

²⁰ Annual energy demand is estimated by ATA (2014), and is assumed to occur across a six-month period.

²¹ Conventional electric systems are not considered, as these are typically more expensive to run than gas systems, even after price increases. Annual energy demand is estimated by Pitt & Sherry (2012) and Energy Consult Pty Ltd (2010).

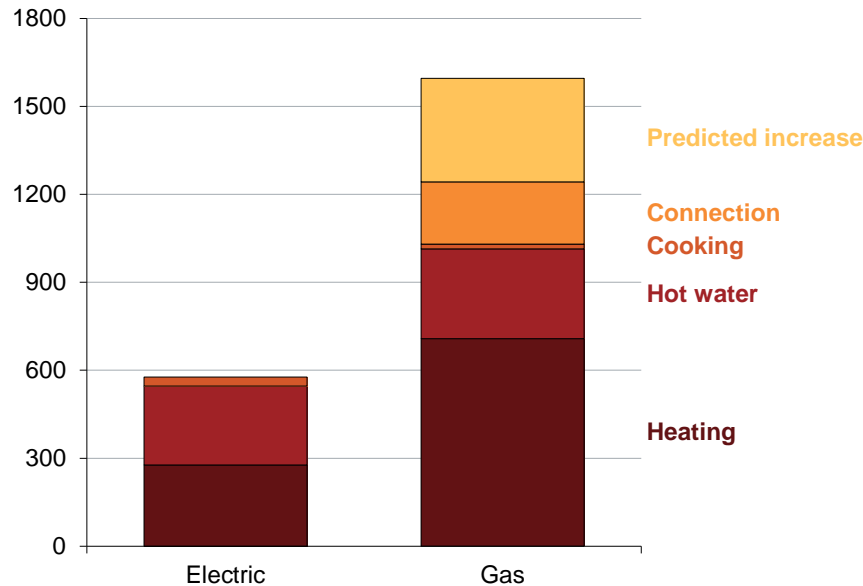
²² Conventional electric systems have similar running costs to induction cooktops. Annual energy demand is estimated by ATA (2014).

Melbourne

Nearly all Melbourne households are connected to gas and use it for multiple appliances. Figure 12 shows that for a household in a three-bedroom dwelling using gas for cooking, heating and hot water, replacing all appliances with energy efficient electric alternatives could reduce their running costs by \$1,000 a year after a \$5 a gigajoule increase in wholesale gas prices.

Figure 12: Replacing all gas appliances could reduce energy bills by \$1,000 a year after the increase in gas prices

Running cost of cooktop, hot water and heating, Melbourne, \$ per year



Note: multiple reverse-cycle air conditioners assumed.
 Source: Energy Consult Pty Ltd (2010); Pitt & Sherry (2012); ATA (2014); Energy Australia (2014); Origin Energy (2014); Grattan analysis

In some cases, even households that chose to replace only one appliance and remain connected to the gas network would still save. Investing in reverse cycle air conditioning when replacing their gas ducted heating would save over \$650 after the price increase. However, there are little savings to be made when switching from gas cooking or hot water while keeping gas heating connected.

Whether Melbourne households choose to switch will depend on the extent to which they are willing and able to pay the upfront costs of replacing their appliances. The cost of a complete switch, including installation, is likely to be well over \$5,000. Even with savings of \$1,000 a year, such a cost may be difficult to justify or meet, particularly as new appliances have a lifespan of 10 to 15 years. Rather than switch off from the gas network immediately, households are more likely to wait until their gas appliances need replacing before considering alternatives.

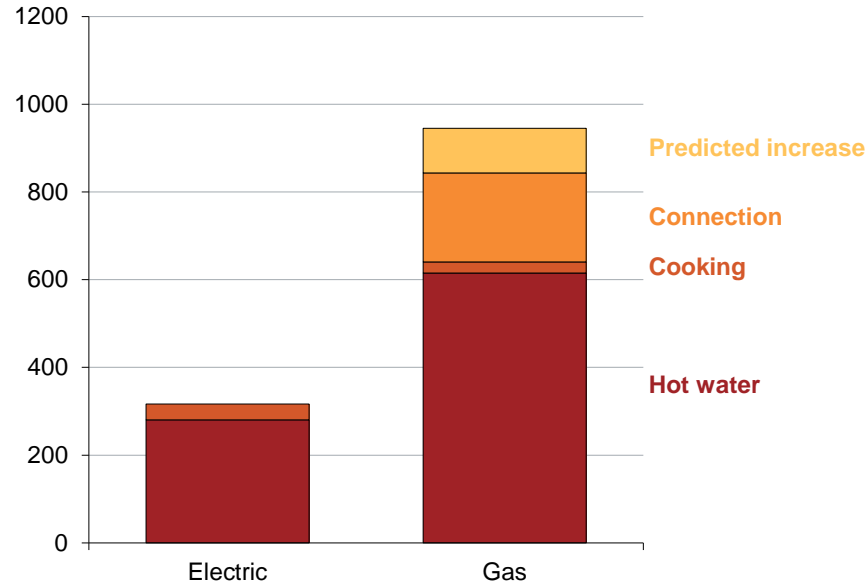
Sydney

About three quarters of the households connected to gas in Sydney use gas for multiple appliances. Unlike Melbourne, however, most of these only use gas for cooking and hot water. Because these households use less gas in total, the running cost of each appliance is higher. A household in a three-bedroom dwelling can reduce running costs by over \$600 a year after gas prices increase if gas appliances are replaced with electric alternatives, as shown in Figure 13.

Replacing just one appliance for these households can also reduce energy costs. For example, changing from gas hot water to an electric heat pump would save more than \$400 a year.

Figure 13: Switching off the gas network could reduce running costs by over \$600 a year

Running cost of cooktop and hot water, Sydney, \$ per year



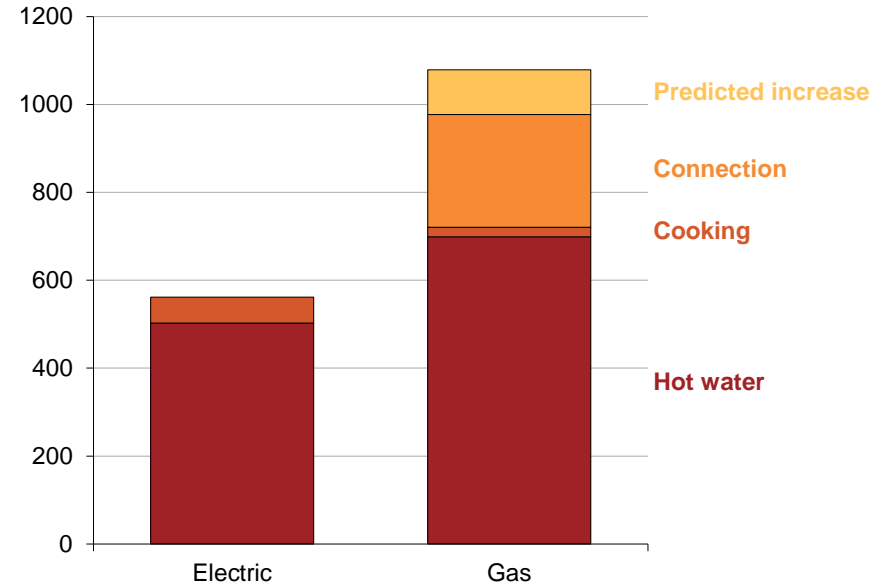
Source: Energy Consult Pty Ltd (2010); Pitt & Sherry (2012); ATA (2014); Energy Australia (2014); Origin Energy (2014); Grattan analysis

Adelaide

Similarly to Sydney, a typical gas household in Adelaide uses gas for two appliances. But Adelaide faces higher charges for gas than Sydney, meaning that the running cost of gas cooking and hot water is higher, as shown in Figure 14. Yet the cost of electricity is even higher in Adelaide, meaning that the savings from switching are around \$110 a year less than in Sydney.

Figure 14: The savings from switching are less due to higher electricity costs

Running cost of cooktop and hot water, Adelaide, \$ per year



Source: Energy Consult Pty Ltd (2010); Pitt & Sherry (2012); ATA (2014); Energy Australia (2014); Origin Energy (2014); Grattan analysis

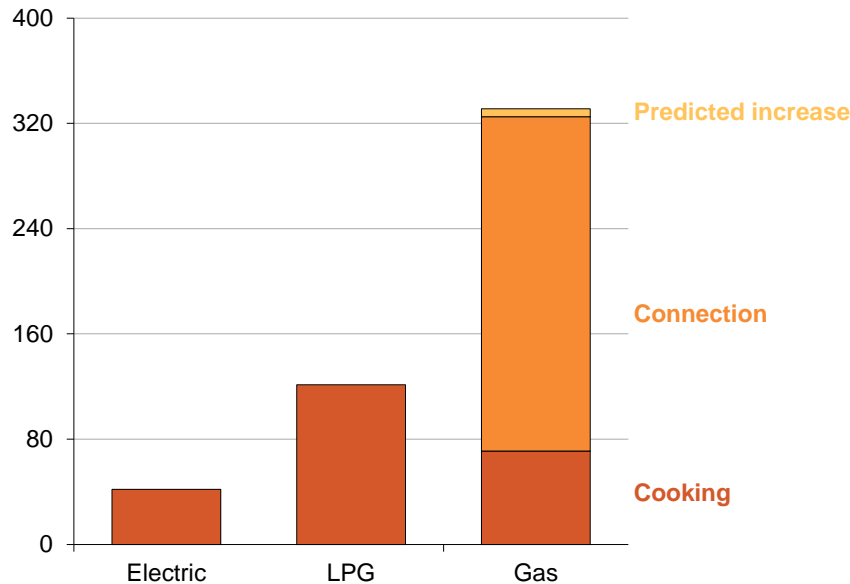
An electric heat pump hot water system costs around \$220 more to run in Adelaide than in Sydney. While it is still cheaper to run than gas hot water, it would be more difficult for an Adelaide household to justify investing in such a system to replace a gas system, especially if the household wanted to remain connected to gas for cooking.

Brisbane

Most gas-connected Brisbane households use gas for only one appliance, generally cooking or hot water. For a household in a three-bedroom dwelling connected to gas for cooking only, Figure 15 shows that running an electric induction cooktop rather than a gas cooktop would save more than \$280 a year. For households that still prefer gas, switching to Liquefied Petroleum Gas (LPG) would save around \$200 a year, with little upfront cost.

Figure 15: Using gas only for cooking is much more expensive than alternatives

Running cost of cooktop, Brisbane, \$ per year



Source: ATA (2014); Energy Australia (2014); Origin Energy (2014); Grattan analysis

In spite of the savings to be had, there may not be large-scale switching. Most gas households in Brisbane will be facing a relatively small bill increase as a result of the rise in the price of gas. If households are already prepared to pay more to use natural gas, a small bill increase is unlikely to influence a change in behaviour.

3.4 Will households disconnect from the gas network?

Even under the current tariff structures, many households across the east coast of Australia would save money by switching from gas to electricity. This gives rise to the possibility that, in response to the increase in gas prices, many householders will choose to leave the gas network en masse. The consequence of this is that those households remaining connected to gas must pay more to cover the cost of the network, potentially leading to more disconnections.

A household dash from gas is unlikely, however. In order to realise the savings, households will have to buy energy efficient electric appliances. The upfront costs of these appliances are normally higher than conventional electric or gas appliances. While higher gas prices make these appliances more attractive, households may still hesitate to buy them.

One of the reasons for this is that households apply high discount rates to energy appliances.²³ Analysis of consumer behaviour finds that “the discount rates implied by consumers in their energy-related decision-making tend to be substantially higher

²³ The discount rate impacts the value a consumer places on future savings resulting from an investment. For example, a discount rate of 20 per cent implies that a \$100 saving on an energy bill next year is valued at \$80 today.

than those applied for other investment decisions.”²⁴ For an average household, the savings from switching to electricity are unlikely to cover the upfront costs within a short enough time frame to justify the investment.

Some households may not even have the option to switch. Cooking, heating and hot water appliances in rental properties are normally provided by the landlord. Residents in these properties would need to persuade the landlord to invest in new electric appliances for them to benefit from lower bill costs. Landlords and tenants may choose not to go down this path: landlords, because they would see no benefit from the investment that they make; and tenants, because they may only envisage being in the property for a short amount of time and decide that it is not worth the bother.

In Melbourne, a high gas user will see a large increase in their gas bills of over \$400. Yet Melbourne households will face the highest costs in disengaging from the gas network. Most use gas for three applications and are unlikely to replace all of them in a short time. While Brisbane households will generally only have to replace one appliance to leave the network, a bill increase of between \$10 and \$15 a quarter is unlikely to drive a large and rapid change in behaviour.

Over the next few years, some households will switch off from the gas network, but a dash from gas is unlikely. With uncertainty about future electricity prices, many households will keep their options open by remaining connected to the gas network.

²⁴ SKM (2013a)

3.5 Electricity tariff reform will further encourage households to switch from gas appliances

The above comparisons are based on current electricity and gas tariffs and tariff structures. The Federal Government’s recent Energy Green Paper has made tariff reform and cost-reflective pricing a key goal.²⁵ The structure and exact timing of this reform is unknown, as are the prices that electricity consumers will face.

Under a more cost-reflective tariff structure, consumers would face a much reduced consumption fee and an increased fixed or capacity-based charge, as the 2014 report for Grattan Institute, *Fair pricing for power*, demonstrated.²⁶ This is because the cost of transporting electricity via transmission and distribution networks does not depend on the volume of electricity used, even though customers are generally charged for them on this basis.

Moving to a cost-reflective electricity tariff structure could make it even more attractive to switch from gas to electricity. However, it is not clear how this will influence households’ switching decisions until the electricity network tariff reforms are announced.

New tariffs are unlikely soon. The Australian Energy Market Commission’s arrangements for new network pricing are to be implemented between 2015 and 2017, which makes it impossible to assess how tariff reform might impact on the gas-to-electricity switching decision.²⁷ Instead, it means that such decisions are complex and uncertain.

²⁵ Commonwealth of Australia (2014)

²⁶ Wood, *et al.* (2014)

²⁷ AEMC (2014)

3.6 Informed households can manage gas bill shocks

The sharp increase in gas prices over the next two years will provide unpleasant energy bill shocks for households in some areas of eastern Australia. Victorian households, most of whom use a lot of gas, will be hit particularly hard. In areas such as Queensland, where residents rely less on gas, the increase in bills will be far lower and more manageable.

Yet households do have options for dealing with rising energy costs. One would be to reduce gas consumption by adopting simple measures such as reducing the temperature on their thermostat. Alternatively, households can save money by replacing gas appliances with energy efficient electric ones. The potential savings are considerable, if households are prepared to make the investment. Some households will be unable to afford the upfront costs of purchasing energy efficient appliances.

Regardless of what decisions they take, households should be able to make informed choices. These decisions are complex and households need access to information to help make the right choices. It will be vital to understand what is happening to energy prices, both for electricity and gas. Knowledge of which appliances are available to them and how much they cost will influence a household's decision. Yet even with this information, households may decide that they still prefer using gas and are willing to bear the increase in prices. While this choice may not result in the lowest energy costs, it is important that households make informed decisions.

4 What are the implications for businesses and large industries?

While gas price rises will have big impacts on some households, households only use a small proportion of Australia's gas. Industries use much more natural gas as a source of heat, as a raw material for making petrochemicals, and as a fuel for power generation.

Since the wholesale cost of gas is a larger percentage of the gas bill for many businesses, the anticipated price increases will be proportionally larger than for households. In research for this report, some businesses said that their gas retailers had recently told them to expect bill increases of 30 per cent or more in each of 2015-16 and 2016-17. Very large users with contracts up for renewal have already been confronted with these big increases.

Over many years, wholesale gas prices have been relatively stable, and network price rises had not been as severe as for electricity. Many businesses had not expected such a big increase over such a short period, and few had been alerted to the prospect by their suppliers. Some of the owners and operators of these businesses feel frustrated and angry.

The effects of the rising gas price will vary, depending on the capacity of businesses to pass on cost increases to customers, and the availability of alternatives to gas. Businesses unable to do either will face a squeeze on profit margins and some Australian manufacturing companies might not survive.²⁸

²⁸ Deloitte Access Economics (2014)

In a report commissioned by a number of manufacturing groups, Deloitte Access Economics analysed how projected gas price increases would affect various industries in Australia, in particular the manufacturing sector.²⁹ They concluded:

- with the exception of the gas, construction and services industries, other sectors would reduce output from 2014 to 2021, compared to a scenario in which gas prices continued at historical levels
- manufacturing industry output could be up to 4.4 per cent lower in 2021 as a result of the gas price rise.

The report also shows that employment in a number of affected industries could fall by more than 14,500 full time equivalent jobs over this same period.

4.1 The cost increase will be material for small businesses that use a lot of gas

Gas is used as a heat source in a variety of small businesses such as dry-cleaners, bakeries, and small manufacturers. Before the use of natural gas, small businesses in many cities used town gas. Alternative fuels included coal, oil, LPG, and wood. Some businesses still use other sources as they improve the product they are selling – for example, wood-fired pizza is different to

²⁹ This report was commissioned by the Australian Industry Group, the Australian Aluminium Council, the Australian Food and Grocery Council, the Australian Steel Institute, the Energy Users Association of Australia and the Plastics and Chemicals Industries Association.

pizza baked in a gas or electric oven. Today, most small businesses use either electricity or gas, or both.

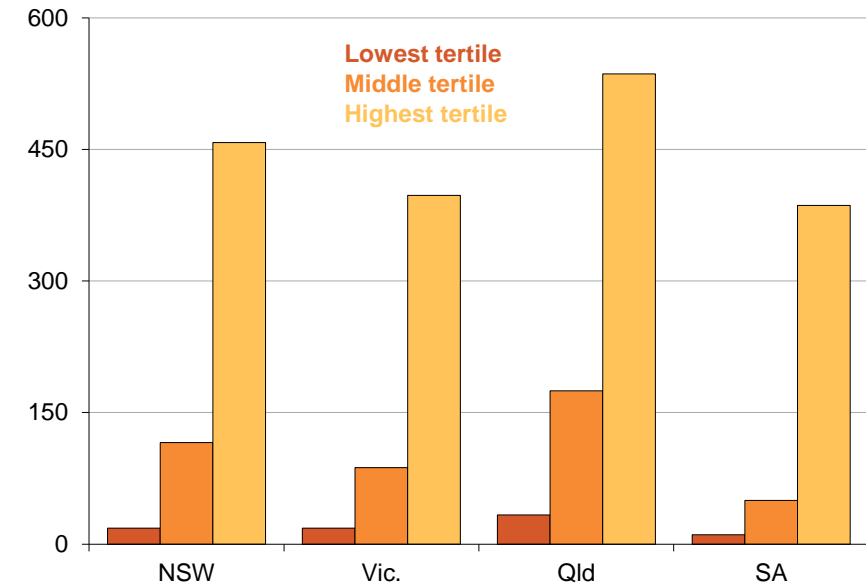
Network costs have driven most of the price increases for both electricity and gas users over the last five years. These increases have created difficulties for Australian business. Now businesses will have to manage a wholesale gas price increase, just when network prices were starting to steady.

Around a third of small business gas users consume over three quarters of all the gas used by small businesses, as Figure 16 shows. For gas-intensive businesses a rapid cost increase will require a response. For example, a \$5 per gigajoule wholesale price increase will increase gas costs by \$2,500 for a dry-cleaning business using around 500 gigajoules a year. It is almost impossible to reduce consumption without reducing output, whether that be loaves of bread or dry-cleaned garments.

Whilst some cost pass through may be possible, these businesses will otherwise absorb a relatively large cost or take the decision to replace existing equipment. The latter can be a difficult capital investment decision, requiring an assessment of future gas and electricity costs in uncertain times. Once a switch is made, a return to gas would be highly unlikely.

Figure 16: Some businesses use a lot of gas

Average annual small business gas consumption, gigajoules



Note: based on billings between October 2012 and September 2013
Source: undisclosed retailer

As shown in Figure 2, small businesses only use about 3.5 per cent of gas consumed in Australia. Nevertheless, fuel-switching decisions, particularly by gas-intensive small businesses, could contribute to significant reductions in gas network businesses' revenue. The network operators may seek to offset this reduction by increasing prices for remaining customers, including households on the same gas grid. This could make gas even more costly in the short-term, and greatly damage the gas sector in the longer term.

Box 2: Regional manufacturing in the spotlight: a case study

KAGOME Australia is the country's largest tomato processor. It has produced tomato-based goods in Echuca, Victoria, since 1996. It has 50 full-time employees as well as offering 350 seasonal jobs. The business injects more than \$24 million a year into the local economy.

Tomato processing requires a large amount of heat in the form of steam, and its production uses more than 280,000 gigajoules of gas a year, most of it from February to April. The cost of gas is significant, representing around 5 per cent of total costs.

Gas suppliers have advised KAGOME Australia that its next gas contract will involve a gas price increase that could be as much as 100 percent.

Passing through costs will be hard, as KAGOME Australia discovered when the carbon tax added around \$500,000 to their annual operating costs, just as imports from places such as California became more competitive. Alternative energy sources such as coal are cheap but produce pollution and are difficult to handle. LPG is even more expensive, electricity would require major reinvestment and biomass is logistically impractical. The company's managers are considering all their options.

In manufacturing and food processing industries across regional and rural Australia, gas is an important and competitively priced energy source. This is about to change and the consequences look severe.

4.2 Industries that use gas as a source of heat or steam generation may look for alternative sources

A number of large businesses use gas as a source of heat or steam generation in their manufacturing process. Many of these compete with imports and may struggle to pass on cost increases to consumers. Such businesses include cement manufacturing, food and beverage processing, and pulp and paper processing. They may be able to replace gas with alternative heat sources if price rises are sustained. Yet this will almost always require major capital investments in coal, oil or electricity. The decision to switch for each industry depends on its competitive position in its sector's supply chain in terms of trade exposure and its capacity to pass on cost increases to customers.

4.3 Industries that use gas as a direct feedstock for chemical production have few options available

Gas is a material cost input for a small number of large manufacturers that use gas as a feedstock. Typically they have no realistic alternative to gas. They include fertilisers, explosives and plastics. To date, individual companies such as Orica have invested in gas production to protect themselves from volatile gas prices. Some may respond by eliminating the gas-dependent step in the process, and import the intermediate raw material instead. For example, in the case of ammonium nitrate for explosives or fertilisers, ammonia could be imported rather than manufactured from domestic natural gas.³⁰

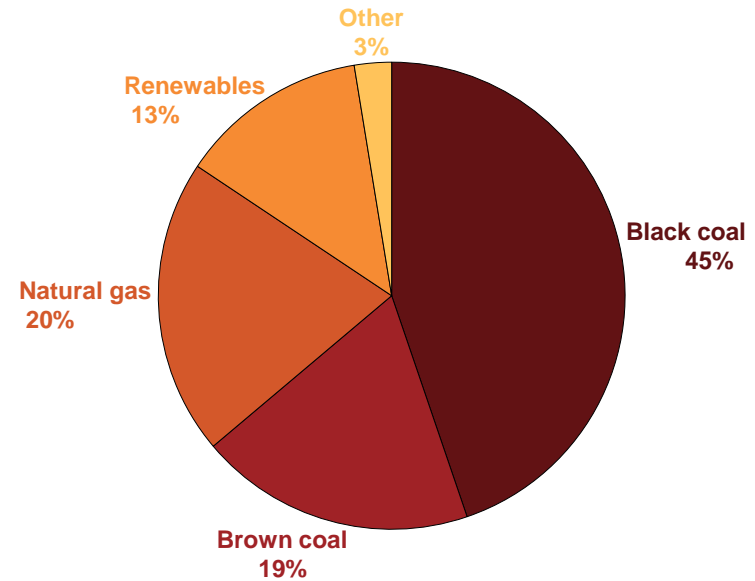
³⁰ Deloitte Access Economics (2014)

These businesses, like others, will have to make decisions for the medium to long term in a highly uncertain time. Neither producers nor large consumers will want to lock into a price that exposes them to too much uncertainty, and will be reluctant to sign long-term contracts. Buying options or entering into risk-sharing supply agreements may be among the few viable choices these businesses have.

4.4 Gas will be priced out of power generation

Gas-fired power generation plants exist to provide capacity that can quickly respond to changes in demand, particularly at peak times (Open Cycle Gas Turbines), or to provide generation that is more flexible than coal plants to meet average demand (Combined Cycle Gas Turbines). In the past, the flexibility of gas plants also meant they could temporarily meet increasing demand until that growth was enough to justify a new coal plant. Gas plants generally have lower capital costs than coal plants but are more expensive to operate, mostly because of the cost of the fuel. Gas-fired power now represents just over 20 per cent of electricity generation in the Australian market, as Figure 17 shows.

Figure 17: Gas-fired power is a major source of electricity
Australian electricity generation by fuel source, 2012-13



Source: BREE (2014)

In Victoria, brown coal provides a source of low-cost fuel that has few, if any, alternative uses. Other states use black coal. The latter is a major source of exports, with the two different grades being used for different purposes; thermal coal used for heating or power uses, and coking coal used in steel manufacture.

Different kinds of coal vary in the amount of CO₂ they produce when burned. Coal-fired power stations using black coal generally produce 0.8-1.0 tonnes of CO₂ per megawatt hour of electricity, whereas brown coal produces emissions in the range 1.2-1.6

tonnes per megawatt hour. Modern combined cycle gas turbine gas-fired power plants produce about 0.35-0.40 tonnes per megawatt hour. The difference has led to an expectation that gas would be favoured over coal in a low-carbon world, all other things being equal.

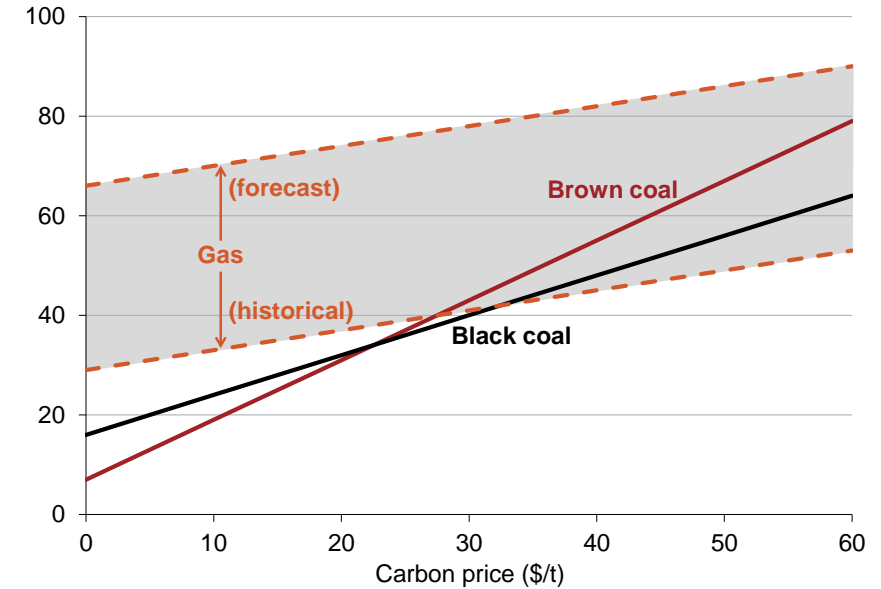
But today all other things are far from equal in Australia. Electricity consumption is falling, gas prices are rising, and the Renewable Energy Target favours renewable sources of electricity. A rising gas price will affect the decisions of both plant operators and investors.

Figure 18 shows the marginal cost per megawatt-hour of power generation for existing plants, comparing different fuels. It also considers how this cost will change for different levels of carbon pricing, if and when the latter is reintroduced. The marginal cost determines which source of electricity is the cheapest; either coal or gas.

The chart compares a wholesale gas price close to its historical level of about \$4 a gigajoule to the predicted price of \$9 a gigajoule. It also uses a thermal black coal price of \$40 a tonne, which is around the price that most coal plants have in their existing long-term contracts.

Figure 18: Natural gas will be uncompetitive even with a high carbon price

Marginal cost per megawatt-hour for existing plants, \$

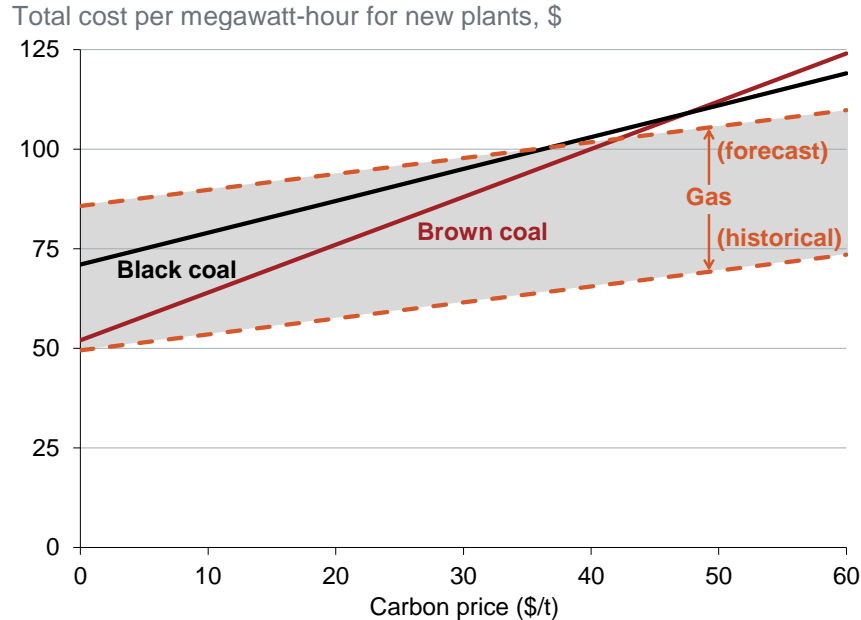


Source: Grattan analysis

Under these circumstances, with a carbon price of \$30 a tonne of CO₂ or higher, existing gas plants would be more competitive than existing coal plants. But if gas prices increase by \$5 a gigajoule, gas would not be favoured over coal, unless the carbon emissions price were \$70 a tonne or more, an implausible figure at present.

Figure 19, by contrast, shows how investors will assess investment in new power stations based on the total cost per megawatt-hour of gas, black coal and brown coal. This scenario uses \$70 a tonne (close to recent market prices) for black coal.

Figure 19: Even for new energy investments, natural gas is likely to be uncompetitive



Source: Grattan analysis

At the historical gas price of \$4 a gigajoule, gas-fired power is competitive with coal, even with no carbon price. But a \$5 per gigajoule increase in the wholesale price makes investment in new gas-fired power stations to meet base load capacity unlikely in the near future. Such investment would require a carbon emissions price of about \$35 per tonne of CO₂.

Falling electricity demand means that the industry is unlikely to face such decisions to invest in new plants for the best part of a decade.³¹ While increased domestic supply is likely over the next few years in response to higher prices, a return to conditions that would favour building new gas-fired power stations remains less likely.

What could change this position is an alternative climate change policy that sets emissions standards for new power plants rather than pricing emissions. An emissions standard of 0.4 tonnes of CO₂ per megawatt hour, for example, would mean that coal-fired power plants could only be built if at least 60 per cent of the emissions were captured and stored. Without developments in carbon capture and storage technology, gas-fired power could become the lowest cost option for base-load power.³² While such a narrow policy would reduce emissions at a higher overall cost than would market-based mechanisms, it may be considered if the political challenges of the most efficient emissions-reduction policy – a market-based mechanism – become insurmountable.

Shutting down existing coal plants to build new gas plants would require an even higher emissions price than the one projected above. This policy shift is unlikely in the near future unless the government adopts some form of direct regulatory standard or financial incentives to withdraw existing capacity. This approach failed under the recent Labor Government’s Clean Energy Future policy, but some environment groups and companies continue to propose it.³³

³¹ AEMO (2014)

³² GCCSI (2013)

³³ Nelson, *et al.* (2014)

Falling demand, the abolition of the carbon tax, uncertainty about the Renewable Energy Target, and changing commodity price mean that there is much uncertainty about the future electricity supply mix and the greenhouse gas emissions it produces. What is clear is that the shift away from gas as described above will mean a shift back to coal and an increase in emissions. Such a trend is already being seen today.³⁴

If even half of the electricity produced from gas in 2012-13 had been produced from coal, Australia's emissions would have been more than 15 million tonnes higher. This is bad news for the climate, and makes achieving Australia's modest 2020 emissions reduction target just a bit harder.

4.5 The net economic effects will be overwhelmingly positive

Higher gas prices will impact different industries in different ways. For some, such as the gas industry itself and the construction industry, the increase in gas prices will lead to an increase in their output; for the gas industry, high prices will stimulate increased production (which has a higher value) and for the construction sector due to its involvement in building the LNG plants.

For other industries, such as manufacturing, high gas prices will increase their costs leading to a reduction in their output. Economic analysis undertaken by Deloitte Access Economics shows that by 2021, gas price increases would reduce the

contribution of Australia's manufacturing industry to yearly Gross Domestic Product (GDP) by \$3.2 billion.³⁵

However, as the same report shows, the contribution to the Australian economy from the gas sector will increase by more than \$18.5 billion in 2021, as shown in Figure 20. In total, the Deloitte report found that in 2021, Australian GDP would be \$15.5 billion higher as a result of gas exports and higher prices. While there would be decline in production from some industries, the net impact to Australia will be positive.³⁶

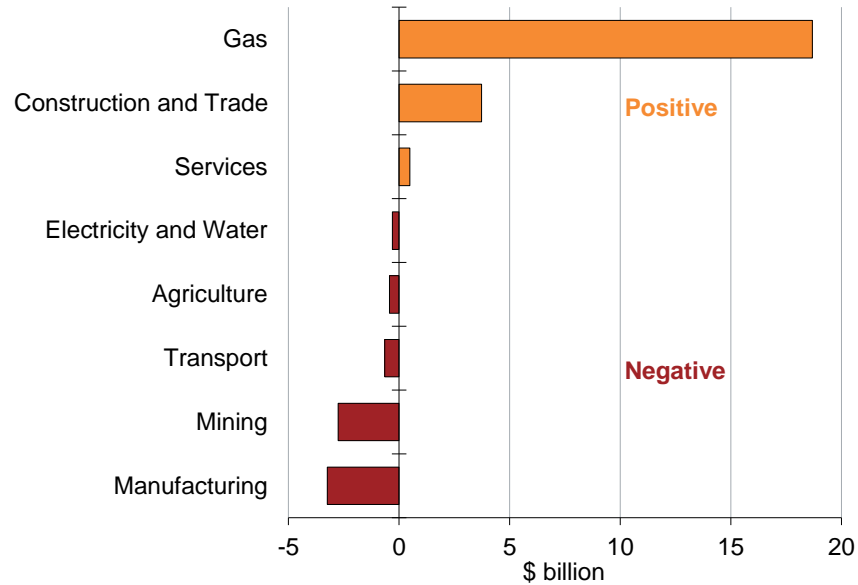
³⁴ Pitt & Sherry (2014)

³⁵ Deloitte Access Economics (2014)

³⁶ Ibid.

Figure 20: The economic benefits of exporting LNG far outweigh the costs

Difference in industry contribution to GDP in 2021 under SKM price forecasts relative to baseline (no exports)



Source: Deloitte Access Economics (2014)

A report on behalf of the US Department of Energy in late 2012 reached a similar conclusion.³⁷ This report looked at how US LNG exports would affect the public. It examined 13 separate scenarios, varying the outlook for the US gas supply and making a range of assumptions about gas export restrictions. In every scenario, the conclusion was that the USA would benefit economically if it allowed LNG exports, even if the price rose for manufacturers. Scenarios with unlimited exports always provided greater net economic benefits than corresponding scenarios with limited exports.

³⁷ NERA Economic Consulting (2012)

5 What do rising prices mean for the gas supply sector?

5.1 Gas producers

Rising international gas prices mean higher profits for gas producers and an incentive to find and develop further gas resources. Due to the higher costs involved in mining coal seam gas, without these price rises there would have been little incentive to develop the coal seam gas industry to the level now being undertaken.

In Australia, international gas market opportunities will motivate big export-oriented producers such as Woodside, Chevron and BG to develop their exploration, production and export facilities. International market demand and prices will drive their investment decisions. The ability to charge the export-parity price will flow through to producers of gas from fields without direct access to export facilities, such as the Gippsland Basin partners, Exxon-Mobil and BHP Billiton. Higher prices will also encourage them to develop and produce gas resources that may otherwise have remained dormant for some time.

Smaller gas explorers and producers, such as Beach, Strike, and Lakes Oil, typically sell their gas to wholesalers such as AGL, Energy Australia or Origin Energy. Higher prices and frustration with the operation of the wholesale market may induce these producers to bypass wholesalers and sell directly to large gas consumers such as Orica and Dow Chemicals. Projected price increases are already driving some of these companies to buy direct from producers in order to get a cheaper, albeit slightly

riskier, deal.

Meanwhile, gas producers such as Santos and Origin Energy have developed their business models to manage risk by selling to both domestic and export markets. Origin has even built its own gas-fired power stations in recent years.

There are two reasons why producers won't simply sell their gas at the highest price they could command on the export market to the exclusion of the domestic market. Firstly, losing a domestic market, perhaps to alternative energy, would not be done lightly since it is unlikely that the market would be recovered any time soon. Secondly, there is a risk that governments could intervene in the market if the consumer backlash or the loss of jobs were to become overwhelming.

There are already signs of producers responding to these pressures. Santos, for example, has committed to supply the domestic market from nominated gas resources, while Origin has contracted additional gas from Victoria to supply New South Wales.

In the short-term, there is great uncertainty, real and perceived, over how the market will balance in the next couple of years. At least part of this uncertainty will disappear as the LNG facilities in Queensland are commissioned through 2015 and some actual performance data become available. Gas prices will also be affected if the balance between supply and demand shifts in the Asian market. Imports from other countries and a restart of some of Japan's nuclear power stations would reduce demand for Australian gas and push down prices.

5.2 Gas networks

Reductions in demand arising from sustained high gas prices would substantially hurt the balance sheets of gas transmission and distribution networks. The risks for transmission pipelines vary considerably, depending on the markets they serve. Those connected primarily to export terminals may not see much change. Since distribution businesses are regulated monopolies, if a consumer moves away from gas, they may well try to recover the lost revenue by lifting prices for their remaining consumers. Yet these price increases would lead to further disconnections, creating a spiral with potentially terminal consequences.

However, a rapid decline is unlikely in the near future. Network businesses such as Jemena in New South Wales have been running strong marketing campaigns to add new connections and stem signs of falling consumption. As we have described, customers are reluctant to switch off gas, once they have committed to gas by buying appliances.

5.3 Gas retailers

Before the wave of partial privatisation and the introduction of competition in the 1990s, gas and electricity retailing were separate businesses, integrated vertically with distribution and wholesaling, and often with gas production or electricity generation as well. These businesses were committed to the domestic gas market. Today the world of energy has changed and most retailers offer both electricity and gas. Households switching off gas while remaining connected to electricity are unlikely to significantly affect customer numbers.

For this reason, retailers are unlikely to resist a consumer switch from gas. Wholesalers and retailers who do not produce their own gas simply pass on any price increase to their customers. Evidence from gas consumers suggests this is already happening, much to their frustration. Many small and medium-sized businesses say their retailers failed to warn them about impending large price increases. This has been a consistent theme in our discussion with businesses.

6 What should governments do?

Energy bills are already a sensitive issue. When households see a big increase in their gas bills, there is likely to be a consumer backlash directed at both state and federal governments. Today it is the large industrial gas consumers who are complaining. When the price increases and the limited range of available responses become clear to small businesses and households, the frustration will be magnified.

Governments are already being called to act. Industry groups have begun to put pressure on governments, with some advocating a reservation policy and a national interest or public interest test.³⁸ In researching this report, we also heard calls for governments to fix a domestic price – either temporary or permanent – that is lower than the international price.

The range of proposed government actions reflects the range of views on the nature of the problem. It is usually framed as a looming shortage of gas, a large, sharp price increase that may be sustained for a long time or a failure of the market to respond effectively to external shocks. In this report and others we argue that there is no underlying gas shortage in Australia and that protecting specific sectors against efficient prices is always a bad idea, no matter how such protectionist arguments are disguised. Any government actions should be to address market failures or barriers to effective and efficient market responses.

Even if a gas shortfall is foreseen on a few winter days in 2016 or 2017, it is unlikely that governments could take any actions now to

address that shortfall. It is more likely that sellers and buyers of gas will find more appropriate commercial solutions, such as paying customers to reduce demand.

The future of gas prices is highly uncertain. Uncertainty about prices in our region is reflected in the risk premiums that producers are seeking from their customers. On the other hand, the recent rises in gas network prices could be behind us and these prices could even reduce in the next five-year regulatory period as businesses and the AER advance their negotiations. These uncertainties make it essential that government intervention is targeted at specific problems and designed so that the action improves the outcome without the unintended consequences that too frequently follow policy interventions in the energy sector.

6.1 Things governments should not do

Governments should not intervene in the operation of the gas market in the absence of market failure or barriers. If intervention is unavoidable, governments should be clear about how they will address the failure or remove the barrier.

6.1.1 Do not reserve gas for domestic markets

Reserving a percentage of Australia's gas production for domestic use would be a form of protection. It would effectively tax gas producers in order to subsidise domestic gas users. It would effectively increase the costs of producing gas for export and thus

³⁸ Manufacturing Australia (2014); EUAA (2014); AIG (2014)

reduce the development of Australian gas exports and reduce the incentive to develop further gas supplies. The economic benefit of the gas resources is shifted from producers to particular industry consumers. This redistribution “would be achieved at a net cost to the Australian community”, according to the Bureau of Resources and Energy Economics.³⁹ More bluntly, economics professor Stephen King has described such a reservation scheme as “blatant, inefficient and inequitable”.⁴⁰ Western Australia has a reservation policy with bipartisan support. Yet the Government’s own economic regulation authority recently concluded that domestic gas reservation policy “is not required; indeed, the policy is likely to inhibit development of the Western Australian gas market in the long term.”⁴¹

6.1.2 Do not introduce a national interest test on LNG exports

The Australian Industry Group has proposed a national interest test on LNG exports. Such a test would require any future LNG export project proposal to show that the development was in the national interest. A number of criteria for a project to pass such a test have been suggested, including:

- the project would leave adequate gas supply for domestic requirements in relevant Australian markets
- the project is in the national interest, taking account of its economic, strategic and social impacts

³⁹ BREE (2012)

⁴⁰ King (2013)

⁴¹ ERAWA (2014)

- opportunities for and the net benefits of parallel supply to domestic and export markets have been adequately considered.⁴²

Assessing a proposal against these criteria will be more difficult than it seems and impose significant red tape. Provided that Australian gas markets continue to function normally, producers are unlikely to divert supply towards exports if Australian consumers are prepared to pay comparable prices. It is likely that the LNG facilities approved for Queensland would have passed such an adequacy test. So a national interest test would have added considerable regulatory burden for little, if any, benefit.

6.1.3 Do not subsidise domestic prices in any form

The increase in gas prices will motivate developers to find and exploit new gas reserves. Any new development will increase the supply of gas and help to reduce gas prices. Government intervention to artificially suppress prices or reserve supplies for domestic use will reduce the incentive to develop new supplies, and thereby potentially prolong the period of high gas prices.

6.2 Things governments should consider

Some other proposals to respond to rising gas prices require more thought. Actions that should be considered include reviews of the current tax and royalty arrangements for natural gas and gas market competition, as well as interventions to encourage greater energy efficiency.

⁴² AIG (2014)

6.2.1 All Australians should share the benefits of our gas resources

Australian gas, as a natural resource, is owned by the Australian people. Therefore, as LNG exports begin to expand rapidly, governments should ensure that Australians benefit from the sale of these assets.

Domestic reservation schemes impose an implicit tax on gas producers and deliver a subsidy to specific (gas) consumers. An explicit tax regime is a more efficient means of collecting revenue. It also gives governments more flexibility to decide how to spend that revenue, whereas protectionist policies confer all of the benefits on gas users.

The argument that Australians have more to gain from trading LNG than they have to lose from higher prices assumes that appropriate tax and transfer systems are in place.⁴³ Governments need to ensure that the public really does benefit by levying the appropriate taxes and royalties on LNG exports. A review of these arrangements is beyond the scope of this report, but should be seriously considered given the scale of the change. The Australian Industry Group recently made a similar argument.⁴⁴

6.2.2 Commission a review of gas market competition

In our discussions, major gas consumers told us consistently that the gas market was failing to produce more supply in response to

⁴³ Australia has the Petroleum Resource Rent Tax, which is a compulsory tax that from 1 July 2012 applies to all onshore and offshore oil and gas projects, oil shale and coal seam gas projects.

⁴⁴ AIG (2014)

significantly and rapidly rising prices. Section 6.3 proposes several actions that governments should take to address specific issues. There remains a further concern that the gas market, underpinned by long-term contracts, is uncompetitive and opaque to most consumers. Consumers have claimed that suppliers are failing to provide competing offers. On the other side, producers and retailers argue that they stand ready to make offers of supply.

In its recently published Energy Green Paper, the Federal Government sought comments on a suggestion that either the Australian Competition and Consumer Commission or the Productivity Commission should review the gas market in order to “identify any barriers to competition as the market responds to current high gas price signals”.⁴⁵

The sharpness and expected size of the price increases and their likely impact on households and businesses are enough to justify such a review.

6.2.3 Promoting energy efficiency

A recent report by the Consumer Utilities Advocacy Centre argues that, in response to rising gas prices, governments should help households to upgrade their homes and appliances to more energy efficient ones.⁴⁶ Using energy more efficiently is a sensible way to respond to shocks. Households can reduce gas use in many ways. They can set home heating at a level that provides comfort without excessively high temperatures. They can install

⁴⁵ Commonwealth of Australia (2014). The Productivity Commission has commenced a research project to analyse factors regarding the efficient functioning of Australia’s gas markets, see Productivity Commission (2014).

⁴⁶ CUAC (2014)

insulation or double glazing. Alternatively, they can switch from gas to electricity.

An investment in energy efficient appliances, such as heat pumps or induction cooktops, will reduce energy bills over the long term. However, the significant upfront costs can be a barrier to investing in energy efficient appliances and other measures. These barriers are particularly high because households tend to value a dollar today much more than tomorrow and some are particularly sensitive to upfront cash costs. Retailers have limited interest in promoting efficiency in the absence of government programs because it reduces customer revenue.

Government support to encourage energy efficiency has included rebates for energy efficient appliances, no-interest loans schemes and white certificate schemes, such as those in place in Victoria, New South Wales, South Australia and the ACT.⁴⁷ Such schemes help participants to reduce their gas consumption and manage their energy bills. However, the costs of these benefits are paid by other parts of society: either taxpayers, in the case of rebates and loan schemes; or other energy users in the case of white certificate schemes.

The balance of interests depends on how much is saved, and how the up-front cost is ultimately shared between the consumer and others. Loan schemes are inherently more fair as the household that benefits ultimately pays much of the cost. By contrast rebate

⁴⁷ A white certificate scheme creates a market in which energy efficiency certificates are traded. These certificates are created through the take up of energy efficiency activities; the more energy saved through the activity the more certificates are created. A liability is placed on energy retailers to create or acquire a number of certificates to meet a specified target.

and white certificate schemes usually impose most of the costs on others. Government should consider introducing loan schemes for energy efficient appliances, if the scheme can be designed to ensure that the costs are borne by the participant and not passed on to other consumers.

6.3 Things governments should do

Governments should address existing market failures and avoid introducing new ones. There are a number of steps governments can take to ensure the market is functioning efficiently.

6.3.1 Remove inappropriate barriers to gas supply

Governments should remove inappropriate barriers to the development of gas resources. The increase in the wholesale price of gas will make the discovery and development of gas more attractive. Governments need to minimise the regulatory burden to developers, whilst meeting the concerns of environmentalists and land owners.

Both the Victorian and New South Wales Governments have restricted coal seam gas developments. In May, the Victorian Government extended the moratorium on coal seam gas to all onshore gas developments. The risks of inappropriate or poorly regulated coal seam gas development have raised serious concern amongst potentially affected communities. On the other side, industry players are prevented from developing a productive resource that could help to meet future gas demand in Australia. The current impasse in both states is unsatisfactory for all and creates knock-on effects for broader gas development. A clear decision is needed. Replacing the ban with a clear

regulatory regime would allow producers to develop the resource. If coal seam gas development is considered too risky and a permanent ban is imposed, then producers can focus on other sources of gas supply. Yet the current impasse may deter gas producers from investing in alternative options if they believe the restrictions on coal seam gas development will be lifted in 2015.⁴⁸

The issues around coal seam gas are complex. Yet governments need to provide clarity and certainty to deliver a stable environment for future gas development. Both state and federal governments, working with industry and communities, should develop a clear, nationally consistent regulatory framework for coal seam gas development that balances the needs and concerns of the respective groups. The current situation, in which governments have decided neither for nor against coal seam gas development, is the worst of all worlds.

6.3.2 Communicate the price rises issues clearly

Governments can ensure that the messages around rising energy bills are timely and accurate. Gas has often been promoted as a cheap and clean alternative to electricity. With rising prices and the development of more energy efficient electricity appliances, these claims may no longer be true in many situations. The potential introduction of fairer pricing for electricity networks is likely to make electricity an even cheaper alternative to gas. Yet the pace and extent of price responses to these forces are complex and will be very confusing for many consumers.

In responding to concern over increasing gas prices, governments need to be clear regarding the options that consumers have in

⁴⁸ O'Kane (2014)

managing their bills, including switching to electricity. Governments should not advocate one source of power supply over the other, but make consumers aware of the choices available to them. This message must be reiterated in public communication about the introduction of tariff reforms in the electricity market.

A household's decision to switch will depend on future electricity and gas prices. Governments need to ensure that consumers are aware of the impact of network tariff reform on energy prices so that they can make informed decisions about using gas or electricity.

6.3.3 Current gas support measures should not be repeated

Increases to wholesale gas prices have made other sources of energy, such as electricity, more economic for households and businesses. As a result, Governments should remove, suspend or scale back regulations and interventions that provide incentives for connecting to the gas network.

In 2011, the Victorian Government announced the \$100 million Energy for the Regions program to subsidise the expansion of gas networks to parts of regional Victoria. The program was justified on the ground that access to natural gas would make regional Victoria more attractive for businesses and households, while providing an alternative form of energy to those already living and operating in these areas.

The program is already well advanced. In August, Huntly became the first town under the program to be connected to gas. Commercial agreements have been made to connect a further six regional towns to the gas network and expand gas access in Mildura. In September 2014, the Victorian Government announced an \$85 million project that will provide eleven further communities with access to compressed natural gas.⁴⁹ Commercial agreements have been reached to supply gas to all of the regional communities under the program.

At present, consumers in these areas meet their energy needs with electricity, LPG, briquettes and wood. Delivering gas at a competitive price to these towns has required a subsidy that has been borne by the Victorian taxpayers. As wholesale prices rise, even greater subsidies will be required to make natural gas competitive.

People in regional Victoria may initially welcome the option of connecting to natural gas. With the predicted increase in gas prices, however, households in regional areas may well be better off from continuing to use other fuel sources, rather than connecting to the gas network. In some cases, regional consumers who commit to gas in good faith may find themselves financially disadvantaged. The Victorian Government's decision to proceed with the roll out of the program during a period of gas price uncertainty could simply cost both taxpayers and current gas users more without benefiting regional communities.

It may be too difficult to unwind the commercial agreements to extend the gas network. However, the Victorian Government should avoid trying to make a poor policy look good in the future,

⁴⁹ Regional Development Victoria (2014)

by actively encouraging consumers to use gas, or by subsidising gas even further.

6.3.4 Remove clear barriers to competition in the gas market

The eastern gas market is currently dominated by long-term contracts, both for the supply of gas and access to the pipelines. Because the price and terms and conditions of these long-term contracts are confidential, the market lacks transparency, both in terms of the level of supply and price. As a result, participants in the market who wish to buy gas have limited information on its price and availability. These information asymmetries in favour of the gas producers may lead to households and businesses paying a higher price for gas than in a more transparent, competitive market.

The development of short-term trading markets in eastern states and, most recently, the voluntary trading hub at Wallumbilla, are small steps towards moving away from a market dominated by long-term contracts. Yet state and federal governments should consider whether the current structure of the eastern gas market is appropriate to encourage the transparency and flexibility required in a competitive market.

The 2013 report for Grattan Institute, *Getting gas right*, outlined actions that governments should take now to create more efficient market frameworks.⁵⁰ They should:

- **Encourage greater price transparency.** Governments should provide regulatory guidance in the development of a price index mechanism. The setting of gas prices is dominated by long-term contracts, which make it difficult for end users to assess price trends. The adoption of a transparent price index mechanism would give customers more reliable gas price estimates when they negotiate current and future gas contracts.
- **Eliminate barriers to pipeline access.** Governments should facilitate the removal of barriers to efficient supply by freeing up trading of pipeline capacity. Lack of transparency in the gas market means that buyers and sellers of pipeline capacity are unaware of other participants in the market. Development of capacity markets would help to encourage competition and efficient transactions, and lower the price of both pipeline capacity and gas.
- **Constrain joint marketing arrangements.** These arrangements, in which suppliers who share a common resource decide to sell gas together at one price, may limit competition in the upstream gas market as it reduces the number of sellers in a market.⁵¹ As the market matures

⁵⁰ Wood, *et al.* (2013)

⁵¹ A joint marketing arrangement is where multiple owners of a gas field join together to sell the output of the gas field, rather than sell the gas as separate entities. Proponents of joint marketing arrangements argue that by selling the

and exhibits greater levels of competition, requests to the Australian Competition and Consumer Commission for joint marketing arrangements should be rebuffed.

6.3.5 Ensure effective support to vulnerable consumers

In Melbourne, the average bill for a three bedroom household with gas heating is anticipated to increase by between \$250 and \$400 a year. This increase will significantly affect households who already face financial hardship.

Governments are likely to try and help these households deal with the increase in gas prices by adjusting their concessions frameworks. While this would help reduce the impact of the price increases, it would not be the most efficient means for assisting concessions households.

Energy concession payments are usually paid as a credit on a household's energy bill; as such, a concession household will pay a lower price for their energy than other households. Because of this, the price signals from their energy bills are muted for concession households. This reduces the incentive for these households to adjust their energy use in response to price increases.

gas as one entity they can reduce risk and share marketing costs, thereby reducing the end cost to the consumer.

An alternative approach would be to abolish energy concessions, and incorporate these payments into the broader welfare payments received by low-income households. We are not advocating that the level of financial support is decreased, but that the household gets the choice as to how to use that financial support.

Under the current concessions framework, the household has no option but to use their energy concessions payment to pay for their energy bills. If this payment were to be included in their broader welfare payment, the household could still use it to help pay off their gas and electricity bills. Alternatively, they could respond to the increases in gas prices by reducing their consumption and spending their payment on goods or services that they value more highly.

In 2013-14, the Victorian Government spent almost \$60 million on concession payments to gas users and over \$150 million on electricity concessions.⁵² Incorporating these payments into general welfare payments would reduce administration costs for both the Government and energy retailers, and reduce the potential for duplication. In responding to rising gas prices, the Government would then adjust the general welfare payment rather than the having to adjust the range of concession payments that are currently available. Of course, this would require cooperation between the State and Federal Governments, and is an appropriate topic for the current review of Commonwealth-state responsibilities.

⁵² Victorian Government (2014)

7 Conclusion

Several years of inaction, poor communication and misinformation have made a mess of the east coast Australian gas industry:

- Coal seam gas producers have failed to adequately respond to the legitimate concerns of landowners, local communities and environmentalists. Whatever technical claims the industry might have to safe and responsible behaviour, its failure to respect these concerns has made it easier for more extreme and overblown claims about the risks to environment and livelihoods to gain traction in local communities.
- LNG exporters have failed to address concerns that their exports could trigger gas shortages on the east coast. Certain commercial arrangements will understandably remain confidential. But even a self-interested industry should have seen the need to communicate more effectively to allay the fears of gas shortages held by governments and consumers. In some cases members of the same gas industry have stoked those fears.
- Gas retailers have failed to explain the imminent changes to customers. In our discussions with affected businesses, a common theme has been frustration with the lack of information and the difficulty of gaining competing supply offers. These failures rapidly erode confidence in the operation of an effective gas market.
- Governments have failed to address concerns about the lack of transparency and liquidity in the wholesale gas market and associated gas pipeline access regime. Grattan Institute's 2013 report, *Getting gas right: Australia's energy challenge*, documents this problem and recommends actions. Some steps, such as the Wallumbilla trading hub, are heading in the right direction. More of the same is needed.
- State governments have failed to respond quickly and clearly to the mix of legitimate and overblown concerns in the community. The NSW and Victorian moratoriums on development are a poor substitute for action. Victoria's decision to extend its moratorium on fracking for coal seam gas to conventional gas exploration is bizarre.

This report documents the likely impact of impending gas price increases on Australian homes and businesses. Effective and efficient markets will provide the best solution. We have identified what actions governments should take to ensure an effective market response and also actions that should be avoided since they would probably be counterproductive.

A massive export gas industry is rising on our northern shores. The massive benefits will be accompanied by serious adverse consequences for some homes and businesses. The industry must be encouraged to proceed, but all Australians have the right to share in the bounty of our natural resources.

8 References

- ABS, Australian Bureau of Statistics (2011) *Environmental Issues: Energy Use and Conservation, March 2011 - Additional Tables*, cat. no. 4602.0.55.001, from www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4602.0.55.001Mar%202011?OpenDocument
- ABS, Australian Bureau of Statistics (2012) *Household Energy Consumption Survey 2012*, Basic CURF. Findings based on use of ABS CURF data
- ABS, Australian Bureau of Statistics (2014) *Consumer Price Index, Australia, Jun 2014*, cat. no. 6401.0, from www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6401.0Jun%202014?OpenDocument
- AEMC, Australian Energy Market Commission (2014) *Draft rule determination. National electricity amendment (distribution network pricing arrangements)*, from www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements
- AEMO, Australian Energy Market Operator (2014) *Electricity statement of opportunities for the National Electricity Market*, August 2014, Melbourne, from www.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities
- AER, Australian Energy Regulator (2013) *State of the Energy Market 2013*, from www.aer.gov.au/node/23196
- AIG, Australian Industry Group (2014) *AI Group submission on the Eastern Australian gas market study*, from www.industry.gov.au/Energy/EnergyMarkets/Documents/GasMarketStudySubmissions/AustralianIndustryGroup.pdf
- ATA, Alternative Technology Association (2014) *Are we still cooking with gas? An analysis of cost effective residential energy options*, Forthcoming report
- BREE, Bureau of Resources and Energy Economics (2012) *Gas market report*, July 2012, from www.bree.gov.au/publications/gas-market-report
- BREE, Bureau of Resources and Energy Economics (2014) *2014 Australian Energy Statistics*, from www.bree.gov.au/publications/australian-energy-statistics
- Commonwealth of Australia (2014) *Energy White Paper - Green Paper*, Department of Industry, from www.ewp.industry.gov.au/
- Core Energy Group (2013) *Current and projected gas reserves and resources for Eastern and South Eastern Australia*, Commissioned by the Australian Energy Market Operator, from www.aemo.com.au/Gas/Planning/Gas-Statement-of-Opportunities/GSOO-2013-Gas-Reserves-Update-and-Projections
- CUAC, Consumer Utilities Advocacy Centre Ltd (2014) *Our Gas Challenge: The role of gas in Victorian households*
- Deloitte Access Economics (2014) *Gas market transformation - Economic consequences for the manufacturing sector*, Commissioned by the Australian Industry Group, the Australian Aluminium Council, the Australian Food and Grocery Council, the Australian Steel Institute, the Energy Users Association of Australia and the Plastics and Chemicals Industries Association, from www.deloitte.com/view/en_AU/au/services/financial-advisory/deloitte-access-economics/aedc1d313b857410VgnVCM2000003356f70aRCRD.htm#
- Energy Australia (2014) 'Plans', accessed 1 October 2014, from www.energyaustralia.com.au/residential/electricity-and-gas/plans

- Energy Consult Pty Ltd (2010) *Estimated hot water system running costs in Victoria*, prepared for Sustainability Victoria, from www.solarthermalworld.org/content/estimated-hot-water-system-running-costs-victoria-2010
- EnergyQuest (2013) *Energy Quarterly*, August 2013
- ERAWA, Economic Regulation Authority Western Australia (2014) *Inquiry into Microeconomic Reform in Western Australia*, 30 June 2014, from www.erawa.com.au/inquiries/industry-and-resources-inquiries/microeconomic-reform-2014
- EUAA, Energy Users Association of Australia (2014) *EUAA submission on the Eastern Australian Domestic Gas Market Study*, from www.industry.gov.au/Energy/EnergyMarkets/Documents/GasMarketStudySubmissions/Energy%20Users%20Association%20of%20Australia.pdf
- GCCSI, Global CCS Institute (2013) *The Global Status of CCS: 2013*, from www.globalccsinstitute.com/publications/global-status-ccs-2013
- Government of South Australia (2012) *Roadmap for unconventional gas projects in South Australia*, Energy Resources Division, Department for Manufacturing, Innovation, Trade, Resources and Energy, from www.pir.sa.gov.au/_data/assets/pdf_file/0008/179621/Roadmap_Unconventional_Gas_Projects_SA_12-12-12_web.pdf
- IPART, Independent Pricing and Regulatory Tribunal (2014) *Regulated retail gas prices from 1 July 2014 to 30 June 2016*, Fact Sheet, from www.ipart.nsw.gov.au/Home/Industries/Gas/Fact_Sheets_Information_Papers
- Jemena Gas Networks (NSW) Ltd (2014) *Customer Overview of JGN's 5-year plan: 2015/16 - 2019/20*
- King, S. (2013) 'A gas reservation scheme is protectionism in disguise', *The Conversation*, 30 January 2013, from www.theconversation.com/a-gas-reservation-scheme-is-protectionism-in-disguise-11810
- Manufacturing Australia (2014) 'Response to the Eastern Australia Domestic Gas Market Study', from www.industry.gov.au/Energy/EnergyMarkets/Documents/GasMarketStudySubmissions/ManufacturingAustralia.pdf
- Minifie, J., Cherastidtham, I., Mullerworth, D. and Savage, J. (2013) *The mining boom: impacts and prospects*, Grattan Institute, from www.grattan.edu.au/wp-content/uploads/2013/07/194-mining-boom-impacts-and-prospects.pdf
- Moomaw, W., Burgherr, P., Heath, G., Lenzen, M., Nyboer, A. and Verbruggen, A. (2011) 'Annex II: Methodology', in *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation*, O. Edenhofer, R. Pichs-Madruga, Y. Sokona, et al., Eds., Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 982
- Morse, R. N. (2000) 'Energy', in *Technology in Australia 1788-1988*, Australian Academy of Technological Sciences and Engineering, p. 748-825
- Nelson, T., Reid, C. and McNeill, C. (2014) *Energy-only markets and renewable energy targets: complementary policies or policy collision?*, AGU Applied Economics and Policy Research, Working paper No. 43. Sydney, Australia, from www.aglblog.com.au/wp-content/uploads/2014/08/No-43-energy-only-and-renewable-targets-FINAL.pdf
- NERA Economic Consulting (2012) *Macroeconomic impacts of LNG Exports from the United States*, Commissioned by the U.S. Department of Energy, from www.energy.gov/fe/services/natural-gas-regulation/lng-export-study
- O'Kane, M. (2014) *Final report of the Independent Review of coal seam gas activities in NSW*, NSW Government, Chief Scientist & Engineer, from www.chiefscientist.nsw.gov.au/coal-seam-gas-review
- Origin Energy (2013) 'Origin secures 432 PJ of natural gas from ESSO/BHPB to boost its portfolio to meet customer demand', from www.originenergy.com.au/news/article/asxmedia-releases/1516

- Origin Energy (2014) 'Pricing', accessed 1 October 2014, from www.originenergy.com.au/priceguide
- Pitt & Sherry (2012) *Running costs and operational performance of residential heat pump water heaters*, Prepared for Hot Water Implementation Group, from www.pittsh.com.au/assets/files/CE%20Showcase/Residential_heat_pump_water_heaters.pdf
- Pitt & Sherry (2014) 'Post carbon price trends continue as coal generation and electricity demand signal comeback', from www.pittsh.com.au/news/post-carbon-price-trends-continue-as-coal-generation-and-electricity-demand-signal-comeback
- Productivity Commission (2014) 'Examining Barriers to More Efficient Gas Markets', from www.pc.gov.au/research/commission/gas-markets
- Regional Development Victoria (2014) 'Energy for the Regions Program', from www.rdv.vic.gov.au/infrastructure-programs/energy-for-the-regions
- Reith, P. (2013) *Gas Market Taskforce*, Victorian Government, October 2013, from www.energyandresources.vic.gov.au/about-us/publications/Gas-Market-Taskforce-report
- SKM, Sinclair Knight Merz Pty Ltd (2013a) *Assessment of economic benefits from a National Energy Savings Initiative (ES)*, Department of Climate Change and Energy Efficiency, from www.industry.gov.au/Energy/IndustrialEnergyEfficiency/NationalEnergySavingsInitiative/Documents/Economic-benefits-from-NESI.pdf
- SKM, Sinclair Knight Merz Pty Ltd (2013b) *Gas market modelling*, Gas Market Study Task Force, 15 October 2013, from www.industry.gov.au/Energy/EnergyMarkets/Documents/SKMGasMarketModelling.pdf
- United Energy and Multinet Gas (2014), from www.multinetgas.com.au/about-us/victorian-gas-industry.aspx
- Victorian Government (2014) *Department of Human Services Concessions 2013-14*, Department of Human Services, from www.dhs.vic.gov.au/about-the-department/documents-and-resources/reports-publications/department-of-human-services-concessions-2013-14
- Wood, B. and Woodman, R. (2005) 'The Roma to Brisbane Natural Gas Pipeline - 1969', from www.pipeliner.com.au/news/the_roma_to_brisbane_natural_gas_pipeline_-_1969/043171/
- Wood, T., Carter, L. and Harrison, C. (2014) *Fair pricing for power*, Grattan Institute, from www.grattan.edu.au/report/fair-pricing-for-power/
- Wood, T., Carter, L. and Mullerworth, D. (2013) *Getting gas right: Australia's energy challenge*, Grattan Institute, from www.grattan.edu.au/report/getting-gas-right-australias-energy-challenge/
- Wood, T. and Mullerworth, D. (2012) *Building the bridge: a practical plan for a low-cost, low-emissions energy future*, Grattan Institute, from www.grattan.edu.au/report/building-the-bridge-a-practical-plan-for-a-low-cost-low-emissions-energy-future/
- World Bank (2014) *World Bank Commodity Price Data (Pink Sheet)*, from <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/0,,contentMDK:21574907~menuPK:7859231~pagePK:64165401~piPK:64165026~theSitePK:476883,00.html>