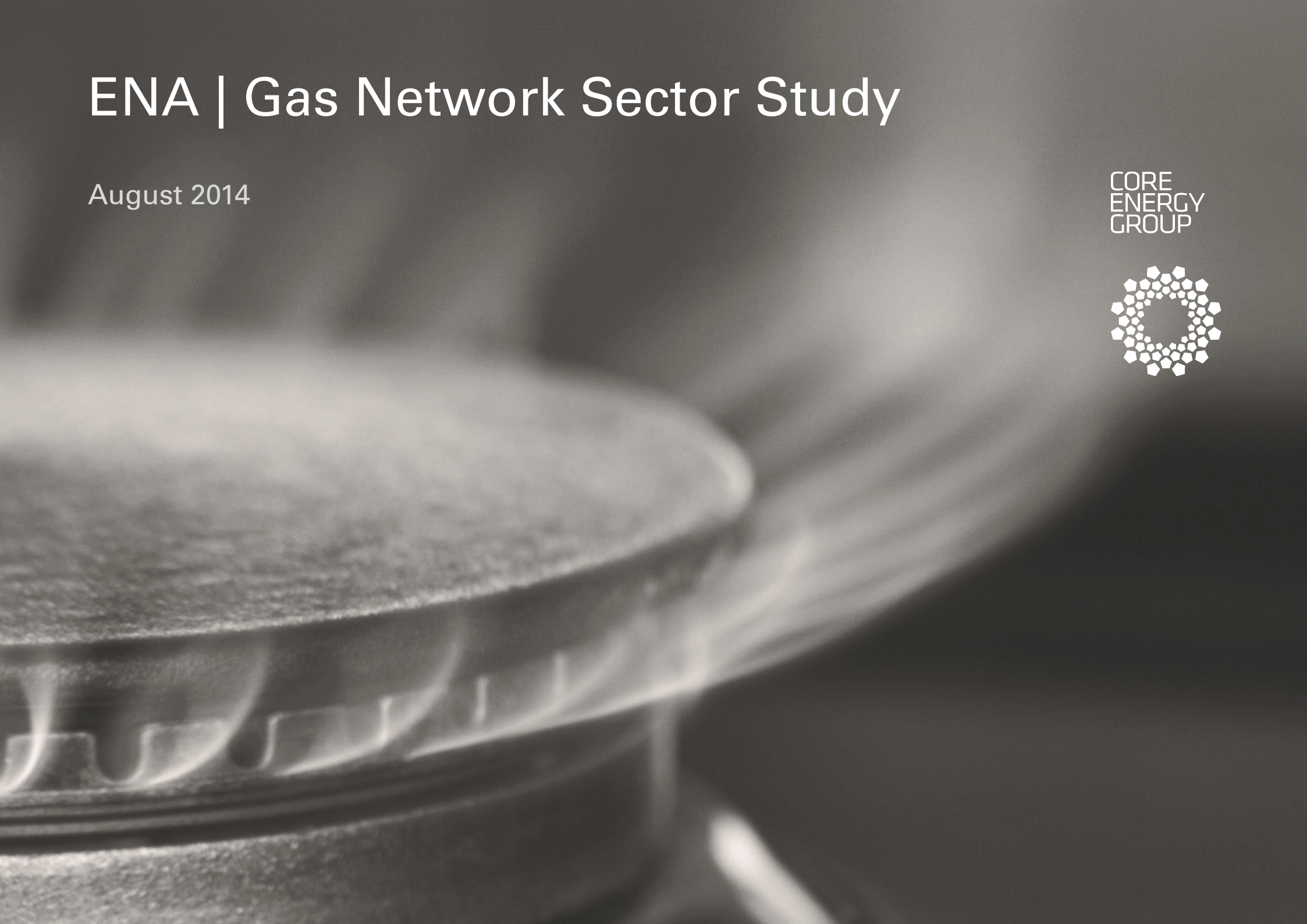
ENA | Gas Network Sector Study

August 2014

CORE ENERGY GROUP



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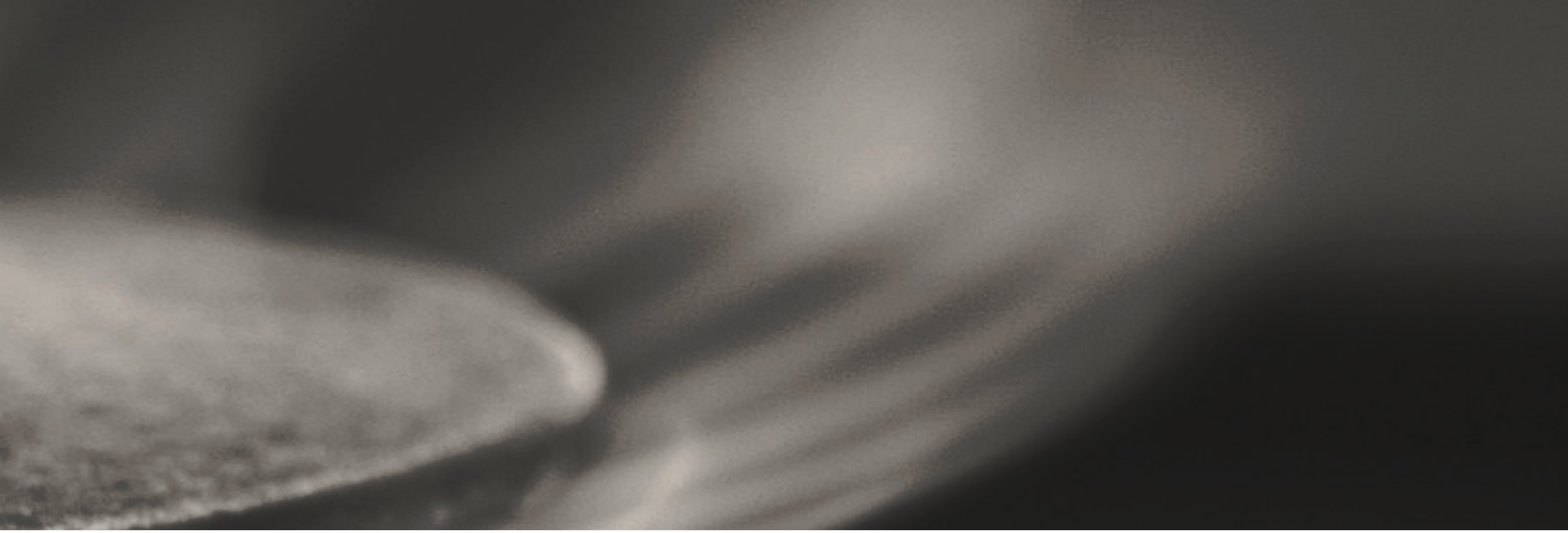
1. EXECUTIVE SUMMARY



This Section presents a summary of an independent study of the outlook for the Australian Gas Network Sector which has been undertaken by Core Energy ("**CORE**") for the Energy Networks Association ("**ENA**"). The Study focuses primarily on the projected impact of movements in gas price and energy policy on gas Network demand during the 2014 to 2034 period.

Study Scope and Approach

Introduction

Core Energy Group ("**CORE**") has been engaged by the Energy Networks Association ("**ENA**") to undertake a Study which has two primary objectives:

- To develop three scenarios of gas Network demand for the 2014 to 2034 period - Expected, High and Low, with a particular focus on price and policy influences.
- To assess the impact of projected movements in Network gas demand on Network tariffs and retail gas prices, carbon emissions and economic impacts more broadly.

This report includes seven primary sections:

1. Overview of Australia's national gas market
2. Outlook for Australia's gas market | 2014-34
3. Overview of Australia's gas distribution Network
4. Overview of gas Network demand drivers
5. Outlook for gas network demand | 2014-35
6. Analysis of the implications of projected movements in network gas demand.
7. Conclusions

Methodology

CORE has developed three scenarios of demand for gas across Australia's gas Network sector in the context of a changing national gas market as a whole.

Total national gas sector demand, supply, cost and policy factors have been modelled to derive scenarios of the outlook for gas price in both Western Australia ("**WA**") and eastern Australia. CORE has used a range of proprietary models and datasets to support this analysis. The results have also been analysed against third party estimates for the purpose of cross-checking.

Gas demand scenarios for the Australian Gas Network sector as a whole (excluding NT) have been derived via the aggregation of gas demand projections for each individual gas Network. The individual Network projections are based on key drivers of gas customer connections and demand per connection, which have been developed in consultation with ENA members and cross-checked against third party data and analysis.

The network models have been used to analyse the impact of future gas price movements and alternative energy policies, relative to a baseline demand scenario.

Gas Demand Scenarios

CORE has defined three gas demand scenarios for the WA and eastern Australia Gas Markets as a whole:

- Expected Gas Demand - assumes an extension of recent historical demand trends, adjusted for an expected demand response to future price rises.
- Low Gas Demand - assumes a stronger demand response to price, negative policy impact, a larger reduction in industrial demand and lower use of Gas Powered Generation ("**GPG**").
- High Gas Demand - assumes a weaker demand response to price, positive policy impact, a modest reduction in industrial demand and higher use of GPG.

In addition, CORE has undertaken sensitivity analysis to identify the impact of price and policy movements on projected Network demand. This analysis uses the Projected demand, which is consistent with the recent year Historical Trend, as a base and determines the movement in demand for the following sensitivities:

- Higher Price sensitivity - addresses the impact of a projected increase in eastern Australia prices on Gas Network demand.
- Positive Policy sensitivity - addresses impact of policies which will positively impact upon Gas Network demand.
- Negative Policy sensitivity - addresses impact of policies which will have a negative impact upon Gas Network demand.

National Gas Market

Overview

The national gas sector comprises three separate markets–Western, Eastern and Northern. Each region has independent gas pipeline infrastructure.

Integrated Domestic and LNG Export Markets

Australia's gas market is comprised of two related elements:

- Domestic Market; and
- LNG Export Market.

Whilst the focus of this Study is on the outlook for Gas Networks within the Domestic Market, it is important to note the linkage between the Domestic and Export Markets. Both elements compete for gas supply, with material consequences for domestic gas prices. As LNG is sold into a higher priced global market, LNG gas buyers are willing to offer higher prices to attract gas supply which may otherwise be available to domestic consumers.

CORE analysis indicates that Australia's LNG projects will consume almost 120,000 PJ of gas over the next 20 years, which is six times the level of domestic consumption over the same period.

Domestic Market Segments

For the purpose of this Study, Australia's Domestic Market is defined by the following customer segments:

- Residential (**R)** - source via a gas Network
- Commercial (**C**) - source via a gas Network
- Industrial:
  - > Small Industrial (**SI**) - source via a gas Network
  - > Large or Direct Industrial (**DI**) **-** source directly via a gas transmission pipeline
- GPG - source directly via a gas transmission pipeline

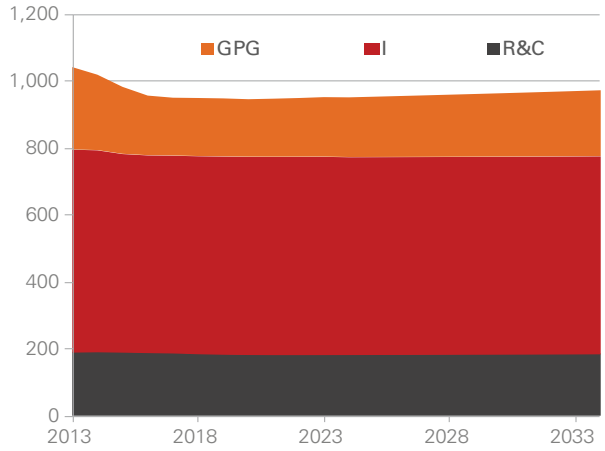
National Demand Outlook

The national gas sector outlook is characterised as follows:

- Tightening of supply available to domestic customers due to large scale demand by the LNG sector (as referred to previously, CORE estimates a gas resource requirement for LNG of ~120,000 PJ over a 20 year period of full production).
- Increased supply risk as exploration and development activities focus increasingly on less certain unconventional gas resources.
- Softening demand due to lower use in the GPG sector, lower Industrial demand and potentially lower Network demand.
- Marginal wholesale gas prices in eastern Australia are increasing and are expected to double over the next four years relative to 2013 levels.
- A policy environment which continues to favour alternative energy sources over gas.

In aggregate, Australian domestic gas consumption is expected to fall by 10% from ~1,041 PJ in 2013 toward 944 PJ by 2020 before returning to a flat to modest growth trend. CORE analysis indicates that WA demand growth will be stronger than eastern Australia due primarily to a more buoyant industrial sector outlook. Figure 1.1 summarises CORE's projection of Expected gas demand for the combined WA and eastern Australia markets to 2034 by demand segment.

Figure 1.1 Total Domestic Demand by Segment | PJ



National Gas Network Sector

Overview

Australia (excluding NT) has 12 gas networks, which provide gas to approximately 4.5 million customers, across the residential, commercial and industrial segments.

In 2013, networks delivered ~188 PJ of gas to residential and commercial gas customers and 191 PJ to small industrial customers. This total consumption of 379 PJ represents approximately 40% of total domestic gas consumption in 2013.

The remaining gas demand is delivered directly via gas transmission systems to large industrial customers and gas-fuelled electricity generators.

Figures 1.2 and 1.3 show the breakdown of gas Network demand in 2013 by segment and region.

Demand Drivers

Gas use is driven in the R&C segments by room heating, water heating and cooking appliance usage, and a range of heat applications in the industrial segment.

Gas Network demand is analysed in two parts:

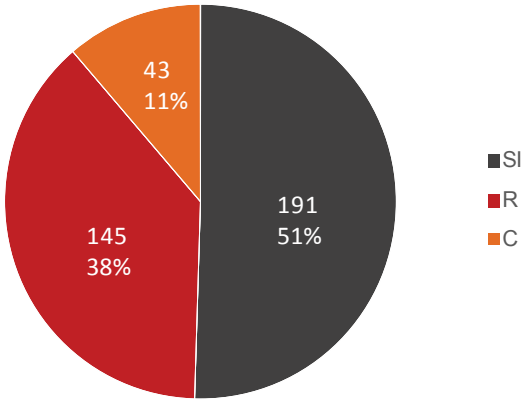
- Annual growth in connections to the gas networks.
  - > Whilst virtually all houses connect to electricity for base lighting and other electrical appliance needs, customers have a high degree of discretion relating to gas use. Consumer choice to use gas is driven by cost factors, accessibility to the mains grid and personal appliance preferences. Adverse price and policy trends can reduce gas connections as the consumer assesses alternatives to be more attractive. Further, a low level gas use in a household (e.g. cooking only) can result in a high cost per unit of consumption (due to fixed costs being allocated over a small volume) and this can impact consumer connection/disconnection decisions.
- Movements in annual demand per connection - which is ultimately linked to the type of gas appliances installed and the annual usage of those appliances.
  - > These factors are directly influenced by the price of gas relative to alternative energy sources and policies, which favour an alternative energy source over gas. An example is the combination of the RET/SRES solar rebates and feed-in-tariffs which have made it attractive for customers to use solar power for hot water and other purposes rather than gas.

Regulation and Tariffs

The National Gas Law and Rules set out the regulatory framework for the gas Networks sector. The Australian Energy Regulator regulates pipelines in eastern Australia, and the Economic Regulation Authority is the regulator in WA.

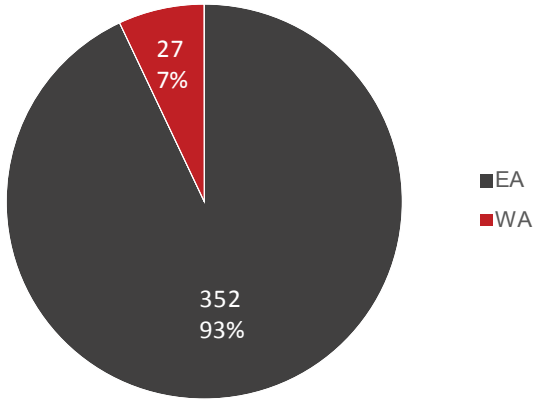
In summary, the regulator assesses the revenues needed to cover efficient costs (including a benchmark return on capital), then derives reference tariffs for the pipeline. These network tariffs represent approximately 50% of a customers retail gas bill as summarised in Figure 1.4. Therefore any material movement in network tariffs will impact retail prices materially.

Figure 1.2 Network Demand by Segment | PJ



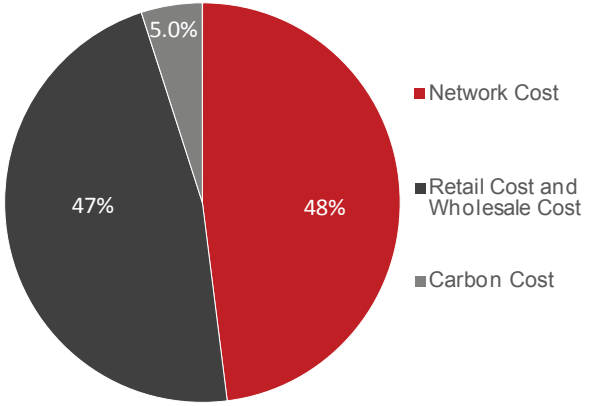
Source: Core Energy

Figure 1.3 Network Demand by Region | PJ



Source: Core Energy

Figure 1.4 NSW 2014 Retail Gas Price | % share



Source: IPART, 2013/14

Impact of Price and Policy on Gas Network Sector Demand

Price

Increases in gas price, all other things equal, will give rise to a fall in gas demand. CORE has undertaken Price Elasticity of Demand analysis to determine the extent to which Network demand will fall due to projected price increases.

Western Australia

In WA, prices have increased from historical lows of ~AUD3/GJ (well-head) to current marginal prices of AUD7.50-8/GJ and for the purpose of this Study have been assumed to remain flat in real terms to 2034. The increases are attributable to tightening of the demand/supply balance in WA and the related commitment of large scale gas resources to higher value LNG export projects.

Eastern Australia

In eastern Australia, prices are in a transition phase. There are strong market signals that prices have moved well above recent historical averages of close to AUD4/GJ (well-head). CORE has derived a projected wholesale price path which rises progressively from AUD4/GJ in 2014 to AUD8/GJ in 2014 real terms, by 2018. Key influences include the emergence of a large scale LNG segment and increasing cost of gas extraction.

This increase has the potential to cause a reduction in annual Network demand (R&C and SI segments combined) of over 25 PJ by 2034, which represents almost 7% of total Network demand in 2013.

Policy

A range of State and Federal energy policy measures have been introduced over recent years which favour renewable energy sources and coal-fired electricity.

These policies include:

- Mandated targets - e.g. RET which favours solar over Network gas
- Carbon pricing - a low carbon price favours electricity (R-C air conditioning) over gas use for ducted and space heating.
- Incentives - e.g. rebates and feed-in-tariffs - which favour solar over gas.

The impact has been the reduction in both the rate of growth in gas connections (as consumers bypass gas in favour of an energy alternative) and the level of gas used per connection (in favour of other sources and reductions due to improved energy efficiency.

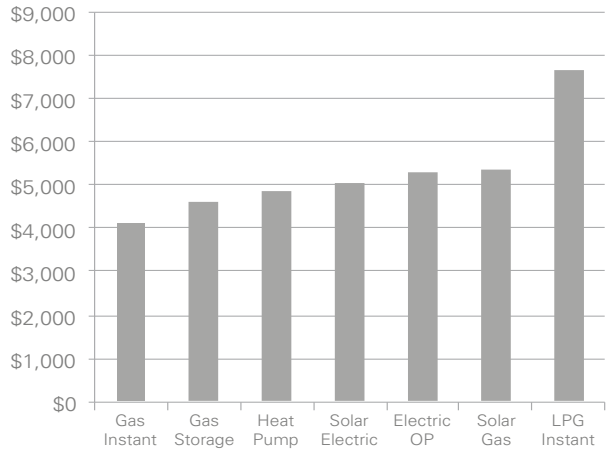
In order to illustrate how policy measures influence gas demand, CORE has undertaken analysis of the full life cycle cost of a range of water heating appliances, using 2010 as a base year (a year when maximum solar policy support existed - RET + feed-in tariff + rebates).

Figure 1.5 illustrates the full life cycle cost of the water heating appliances without any form of policy impact. This figure shows that instantaneous gas appliances are the lowest cost alternative. However, if rebates are provided for select appliances, the relative cost to a consumer changes. Figure 1.6 illustrates that a rebate for solar and heat pump appliances causes these applications to become competitive with instantaneous gas.

CORE estimates that adverse policy measures could reduce demand in the R&C segment by 32 PJ p.a. by 2034 or 17% of total R&C demand in 2013.

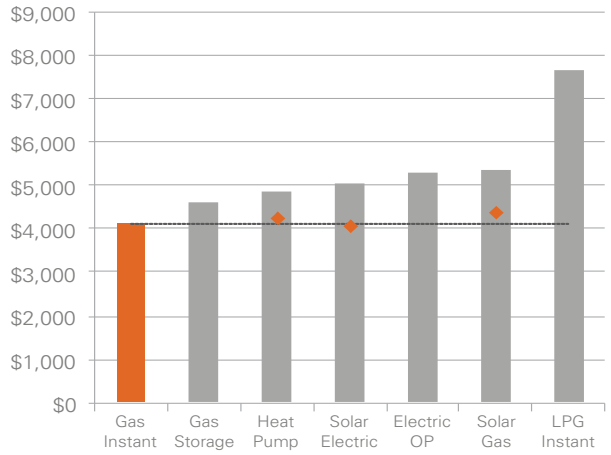
The following paragraphs provide a more detailed analysis of the scenario modelling undertaken by CORE.

Figure 1.5 Water Heating Cost | No Incentives



Source: Core Energy (2010 year)

Figure 1.6 Water Heating Cost | With Rebates



Source: Core Energy Group (2010 year)

Scenario Analysis | Outlook for Gas Network Sector Demand

Total Network Demand

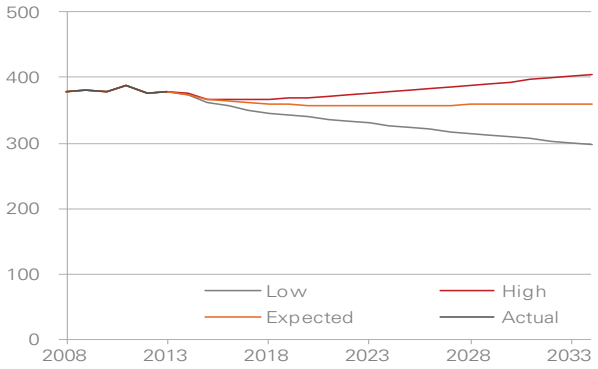
CORE's scenario analysis highlights that Network gas demand could vary within a 108 PJ range over the Study period (High vs. Low scenario - comprising 65 PJ Residential & Commercial ("**R&C**")) and 43 PJ Small Industrial ("**SI**"). The uncertainty range is due to a combination of price and policy impacts. [Note: the large range is a direct reflection of the significant level of uncertainty facing the gas network sector].

- Under CORE's Expected scenario total Network demand (R,C and SI) is projected to fall from a high of 379 PJ in 2013 to 357 PJ in 2022, and remaining relatively stable thereafter with demand at 360 PJ in 2034.
- Under the Low scenario, adverse price and policy movements and significant further improvements in energy efficiency are projected to reduce demand from the 2013 level at a rate of -1.1% p.a. (compound annual growth rate ("**CAGR**") basis), representing a total demand reduction of 81 PJ by 2034 at which point total demand is projected to be 298 PJ.
- Under the High scenario, more favourable price and policy impacts are projected to increase demand from the 2013 level at a rate of 0.3% p.a. (CAGR basis), representing a total demand increment of 27 PJ to 406 PJ by 2034.

Figure 1.8 summarises the potential range in demand by segment for gas Networks as a whole.

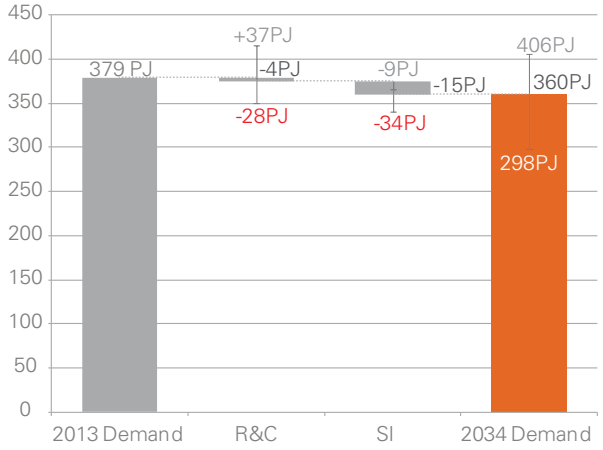
- Annual R&C segment demand has the potential to move as follows by 2034:
  - > fall by 4 PJ under the Expected scenario
  - > fall by up to 28 PJ under the Low scenario
  - > increase by up to 37 PJ under the High scenario
- SI segment demand could fall in the range of 9 PJ (High) to 34 PJ (Low) and is Expected to fall by 15 PJ by 2034.

Figure 1.7 Total Network Demand by Scenario | PJ



Source: Core Energy

Figure 1.8 Summary of Network Demand Range



Source: Core Energy

Scenario Analysis | Outlook for Gas Network Sector Demand (continued)

R&C Network Demand

CORE has developed three scenarios of R&C segment demand:

- Under the Expected scenario R&C demand is projected to fall from a high of 188 PJ in 2013 to 181 PJ in 2022 and remaining relatively stable thereafter with demand of 184 PJ in 2034.
- Under the Low scenario, assumed price increases and adverse policy measures are projected to reduce demand from the 2013 level at a rate of -0.87% p.a. (CAGR basis), representing a total demand reduction of 32 PJ; reaching 156 PJ by 2034.
- Under the High scenario, favourable price trends and policy measures are projected to increase demand from the 2013 level at a rate of 0.77% p.a. (CAGR basis) representing a total demand increment of 32 PJ, reaching 221 PJ by 2034.

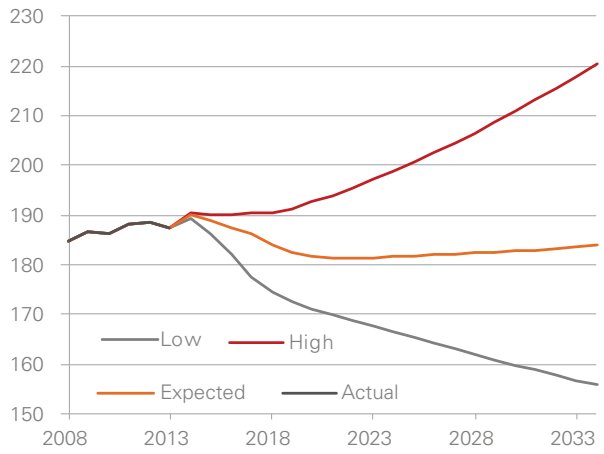
As illustrated in Figure 1.10, there is a wide range of potential demand outcomes. This is a direct reflection of the high level of price and policy uncertainty facing the Network sector.

The total variance of demand for the R&C segment is 65 PJ over the period 2014-2034.

- under the Expected scenario R&C demand falls from 188 to 184 PJ
- under the Low scenario demand falls from 188 to 156 PJ
- under the High scenario demand increases from 188 to 221 PJ

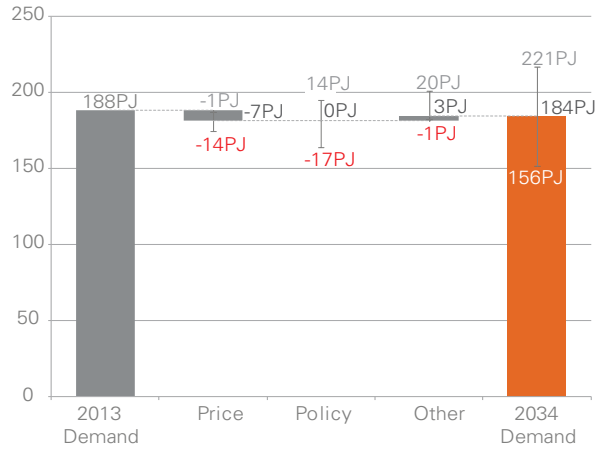
Figure 1.10 shows that the potential downside impact of price and policy are similar.

Figure 1.9 Network R&C Demand by Scenario | PJ



Source: Core Energy

Figure 1.10 Summary of R&C Demand Range



Source: Core Energy

Scenario Analysis | Outlook for Gas Network Sector Demand (continued)

Policy Impact on R&C Segment

Figures 1.9 and 1.10 above illustrate the full range of projected R&C segment demand due to movements in both energy policy and gas price.

To highlight the potential impact of energy policy on Network R&C demand CORE has undertaken sensitivity analysis using the Network Expected Demand scenario as the baseline.

The sensitivities include:

- Historical Trend - which is an extrapolation of historical actual
- Negative Policy - which shows the impact of policy measures which favour renewable and electricity over gas.
- Positive Policy - which shows the impact of removing policy measures which favour renewable and electricity over gas

Figure 1.11 presents a summary of the sensitivity analysis. This Figure shows that policy impacts alone could cause R&C demand to vary from the Expected Demand line by 11 PJ to the downside under a Negative policy case.

CORE's analysis shows that two policy measures could have the most significant impact on gas demand:

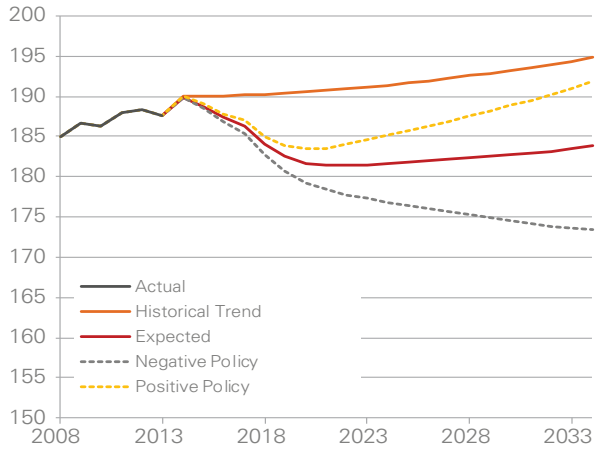
- Policy/ies which favour solar over gas in the water heating market.
- Policy/ies which favour electricity over gas in the room heating market (via R-C air conditioning displacement of gas ducted systems and space heating units).

To assess the impact of solar policy on Network gas demand CORE has developed two projections of the impact of solar policies in the R&C segment.

- Negative Solar Policy Impact (which reduces gas demand).
- Positive Solar Policy Impact (which increases gas demand).

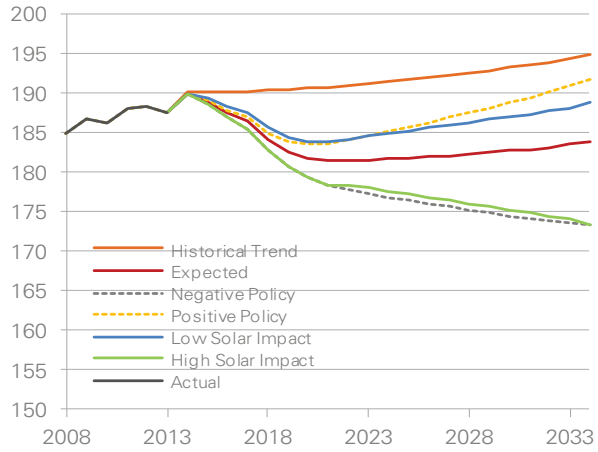
This analysis, as summarised in Figure 1.12, shows that solar policy alone could cause gas demand to vary in the range of -10.5 PJ to +5PJ p.a.

Figure 1.11 R&C Demand Sensitivities (Policy) | PJ



Source: Core Energy

Figure 1.12 R&C Demand Sensitivities (Solar) | PJ



Source: Core Energy

Scenario Analysis | Outlook for Gas Network Sector Demand (continued)

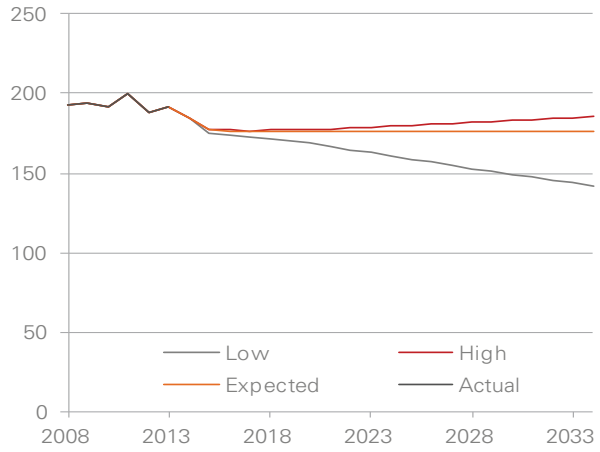
SI Network Demand

CORE has developed three scenarios of future demand for the SI segment:

- Under the Expected scenario total Network SI demand is projected to fall from a high of 191 PJ in 2013 to 176 PJ in 2017 (a loss of 15 PJ), and remaining relatively stable thereafter.
- Under the Low scenario adverse price, policy and other factors are projected to reduce demand from the 2013 level at a rate of -1.4% p.a. (CAGR basis), representing a total demand reduction of 49 PJ to 142 PJ by 2034 (34 PJ below the Expected scenario).
- Under the High scenario, favourable price, policy and other factors are projected to increase demand from the 2013 level at a rate of -0.15% p.a. (CAGR basis), representing a total demand reduction of 6 PJ to 185 PJ by 2034 (9 PJ above the Expected scenario).

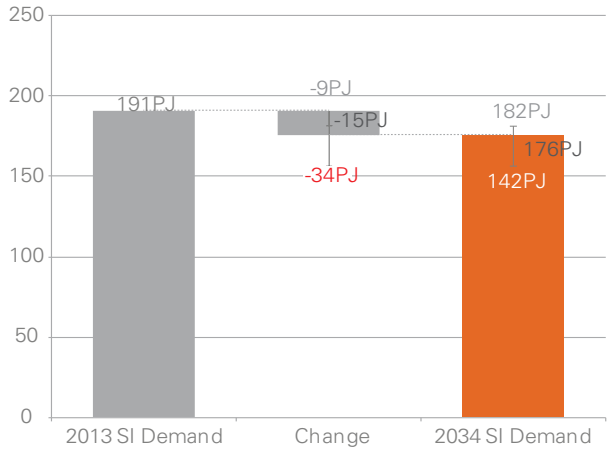
The major drivers of the projected change in demand are price, policy and global competition.

Figure 1.13 Network SI Demand by Scenario | PJ



Source: Core Energy

Figure 1.14 Summary of SI Demand Range



Source: Core Energy

Implications

The projected fall in Network demand due to price and policy influences is summarised as follows:

Network Tariffs

The Study has found that there is potential for Network costs to increase by up to 20% in real terms by 2034 due to price and policy factors alone, with the majority of this increase to occur by 2019.

Retail Prices

Assuming that Network costs remain approximately 50% of a total retail bill, there is potential for price and policy factors to give rise to a 10% real increase in retail prices, with the majority of the rise over the next five years.

Carbon Emission

Under a high solar policy sensitivity gas will lose up to 1.15 million equivalent connections to solar appliances. Based on an assumed 10 GJ of gas use per connection this translates to a gas demand loss of 11.5 PJ p.a. by 2034.

The gain in solar share will give rise to an estimated reduction in emissions of 900,000 tonne of CO2-e.

CORE estimates that this reduction will cost AUD180m based on an assumed abatement cost of AUD200 per tonne.

Economy

A loss of material Network demand will give rise to a material loss of economic activity:

- Potential to lose AUD200m p.a. in capital investment.
- Potential to lose 150 FTE employment positions.
- Potential direct losses of tax revenues and indirect losses of tax and State royalties.
- Potential loss of economic value of over AUD1.5bn based on the net present value of lost profits.
- An increase cost in energy for over 4 million households by 2034 who will not be connected to solar nor receive full benefit of subsidised R-C air-conditioning via a low carbon price.

Conclusions

Natural gas is an abundant, reliable and cost effective energy source which makes a material contribution to Australian living standards and economic activity more broadly.

- Gas is the only existing large scale energy alternative to electricity in the stationary energy sector, and thus plays an important role as a competitive force in Australia's energy market.
- Gas is used by over 4.5 million households and more than 120,000 commercial and industrial enterprises.
- Federal Government estimates indicate a gas resource base which could support domestic demand for at least fifty years.
- Natural gas has the potential to provide up to 35% of Australia's future primary energy requirements.
- The LNG sector is poised to become the largest export sector in Australia, and is projected to remain in this position for over 20 years.
- The gas sector is a major contributor to economic activity in terms of Government tax and royalty revenue, cost-effective input to industrial activity, capital investment, exports/balance of trade and employment.

Natural gas has the potential to play a key role in meeting Australia's GHG emission reduction targets.

- Gas used directly at the household or commercial enterprise displaces carbon-intensive electricity which is the major contributor to Australia's high carbon intensity per capita. Gas use by household appliances emits 0.06 kg of carbon per MJ or 60,000 tonnes for each PJ.
- For electricity generation purposes, gas is up to 60% less carbon intensive than coal-fuelled electricity.
- CORE modelling demonstrates that gas can play a lead role in achieving sustainable level of GHG emissions at a globally competitive cost of abatement, through direct household and business use and progressive replacement of coal-fired electricity capacity.

The gas Network sector plays a critical role within the natural gas value chain and Australia's integrated energy system.

- Gas Networks contribute to the maintenance of Australia's high living standards by delivering reliable and cost effective energy for essential water heating, room heating and cooking applications.
- The Network sector provides a transport link between gas suppliers and over 4.5 million households, and over 120,000 commercial and industrial enterprises.
- Approximately 40% of Australia's domestic gas consumption is delivered by the national gas Network system.

Major benefits can be derived through economies of scale.

- The gas Network segment is characterised by large scale investment in long term capital with significant fixed costs.
- Maintaining a minimum scale of throughput is critical to realising economies of scale or avoiding diseconomies.
- All other things equal, any reduction in gas Network demand will flow through to an equivalent percent increase in the regulated Network tariff.

The upward trend in wholesale gas price in eastern Australia is virtually certain to strengthen through to 2018-19, which will cause gas Network demand to fall materially, with adverse consequences for Network tariffs.

- Gas prices in eastern Australia are projected by CORE to increase from close to AUD4/GJ today toward AUD8/GJ (and potentially above) between 2015 and 2018.
- Both commercial and residential consumers are expected to reduce consumption in response to these price increases. CORE estimates that gas Network demand could fall be up to 10% by 2020 due to wholesale price movements alone.
- The ability of gas networks to compete against energy alternatives, will depend largely on future wholesale prices and energy policy measures, given that major capital programs have been largely completed.

Conclusions (continued)

The price of gas relative to alternative energy sources will be a major driver of future gas demand within the Gas Network sector, over the next 2-5 years

- Unlike electricity, which is largely a nondiscretionary energy source for basic lighting and other applications, gas is an energy source of choice which will be substituted for an alternative energy source if consumers observe a shift in the cost/benefit relationship.
- Over the last five years there is clear evidence of substitution away from gas across water heating, room heating, cooking and industrial applications in eastern Australia and WA. The response has been most pronounced in WA where marginal prices have doubled over the last five years.
- CORE analysis demonstrates that the two primary drivers of future gas prices will be the wholesale price of gas (field supply point) and Network costs.
- Network tariffs account for approximately 50% of a household retail gas bill. Therefore any increase in tariffs will have a direct impact on retail energy prices.
- There is potential for a downward demand spiral - price increases reduce demand - demand reductions give rise to an increase in regulated network tariffs - network tariff increases flow through to retail prices, with this cycle perpetuating into the future.

Any policy measures which have an adverse impact on gas demand will have a compounding impact on gas Network tariffs and retail gas prices.

- CORE analysis indicates that adverse policy measures could result in a further 10% reduction in gas demand over the next 20 year period, which would result in a further 10% increase in Network tariffs, all other things equal.

The coincidence of price increases and any adverse policy measures will ensure gas is materially disadvantaged relative to alternative, policy-favoured energy sources.

- A combination of unfavourable wholesale prices and adverse policy measures will translate to a 20% reduction in gas Network demand.
- All other things equal, such an increase in gas Network costs will cause retail prices to increase by 10% in real terms by 2034.
- An increase in gas prices by 10% will place gas at a significant disadvantage to two major competitive energy sources, including:
  - Renewable energy, which receives strong energy policy support.
  - Electricity, which is receiving indirect policy support in that it is not subject to the full cost of its high level carbon emissions.

The gas Network sector is at an important 'cross-road'. Stabilisation and reversal of negative demand trends must be addressed as a priority to ensure Australia enjoys globally-competitive gas prices.

- Australia's gas prices have been among the lowest in developed nations for many years. However, fundamental changes in cost structure are now in play that could rapidly move Australia's position toward the upper end of international cost curve.
- The Network sector, as well as the gas sector more broadly, must address ways to minimise further cost increases in order to remain competitive; both nationally and internationally.
- For the gas Network sector, the key to minimising tariff increases will be sustained growth in demand.
- Policies which provide a demonstrable advantage to alternative energy sources should be addressed as a matter of high priority.

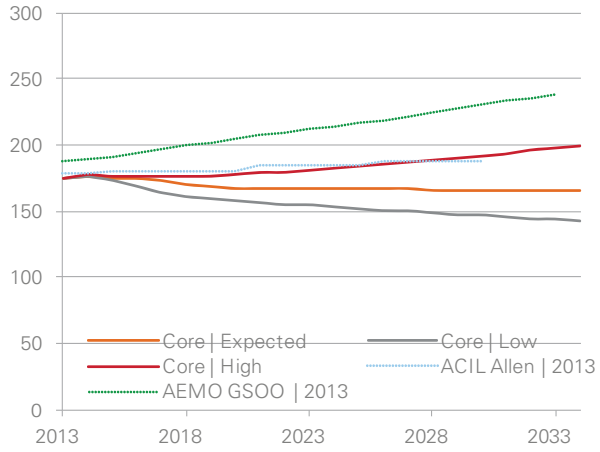
Validation

Various third party demand projections have been used as a cross-check against CORE's gas demand projection scenarios to 2034. This analysis is provided in Section 10 and the Demand Validation tab of the accompanying Gas Market Databook.

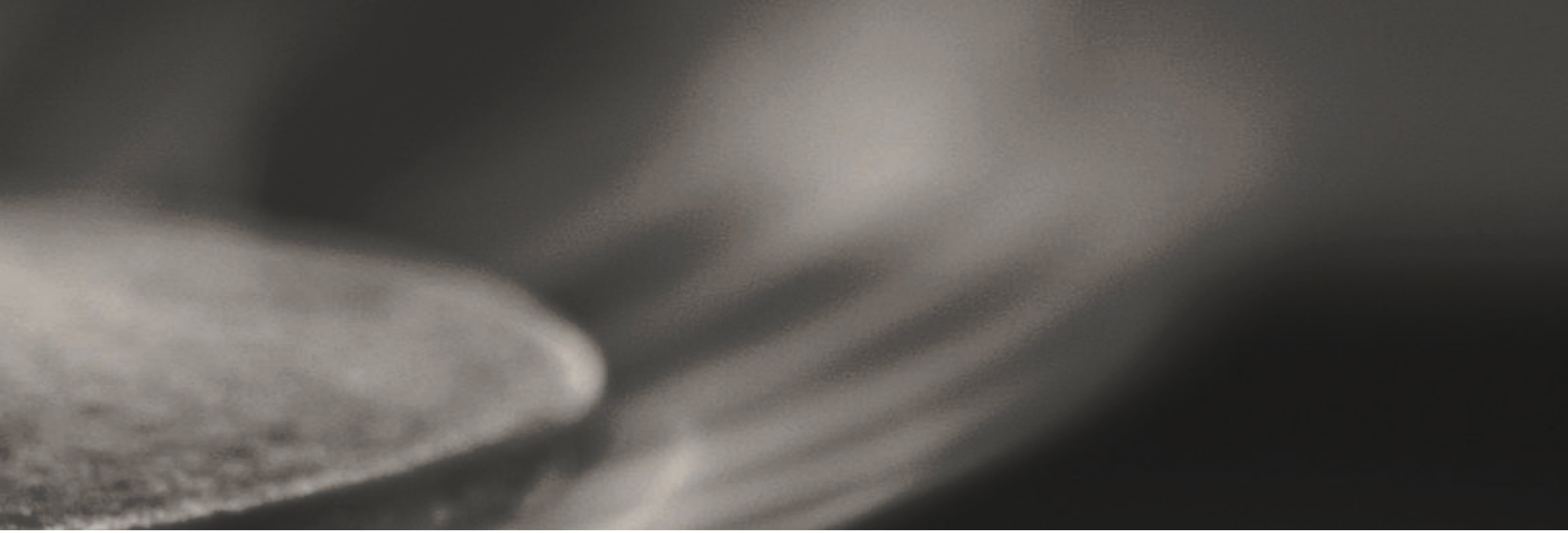
It should be noted that the majority of third parties provide demand projections for the total domestic market as a whole and not individual customer segments. The following figure provides a comparison of CORE's projections of Eastern Australia gas demand against two third party sources - the Mass Market gas demand forecast developed by AEMO for the 2013 GSOO, and Residential/Commercial gas demand outlook developed by ACIL Allen Consulting in October 2013.

CORE did not identify any reason to vary its projections following a review of third party analysis.

Figure 1.15 Eastern Australia R&C Gas Demand Validation PJ



2. METHODOLOGY



This Section of the Study provides an overview of CORE'S approach to developing gas demand scenarios for Australian Gas Market and the Gas Network Sector for the 2014 to 2034 period.

2.1 Introduction

The analysis presented in this report in based upon detailed modelling of projected gas demand scenarios. The modelling framework adopted by CORE is based upon several key criteria:

- Proven – a methodology which has been used successfully on numerous prior occasions.
- Rigorous – combines bottom-up and top down approaches which ensure results are robust.
- Practical – it incorporates assumptions which are reasonable reflections of key Network gas demand drivers.
- Flexible – the ability to meet changing requirements and to provide a foundation for ongoing analysis by the ENA.
- Transparent – all inputs, assumptions, calculations and results are presented openly, in a well organised manner.
- Simple – avoids the use of overly complex and cumbersome logic.

2.2 Market Demand Scenarios

CORE has developed three scenarios of total domestic gas market demand. The main purpose of this analysis is to provide a complete industry sector context for a detailed analysis of the Network segment.

Figure 2.1 provides an overview of the approach adopted by CORE to develop scenarios of Australia-wide gas demand between 2014 and 2034. Demand projections are an aggregation of demand by three consumer segments:

- The Gas Networks segment, which includes Residential ("**R**"), Commercial ("**C**") and Small Industrial enterprises ("**SI**").
- The Direct Industrial ("**DI**") segment which generally includes larger scale industrial businesses.
- The Gas Powered Generation ("**GPG**") segment.

The following paragraphs provide an explanation of the approach used by the Study Team to arrive at three scenarios of demand for these segments.

The models used to develop the demand scenarios are structured to allow demand to be analysed at both a detailed and consolidated, or national, level. Further, the models are structured to facilitate extensive scenario and sensitivity analysis to develop insights about key factors which influence demand outcomes.

CORE's methodology embraces international best practice. This includes rigorous approach to validation of assumptions, logic and results.

Whilst the Network elements of this analysis have been tailored to meet the specific requirements of this Engagement, the market level demand analysis has been applied consistently by CORE for over a decade. The models and approach have been reviewed and relied upon my the majority of leading energy organisations in Australia.

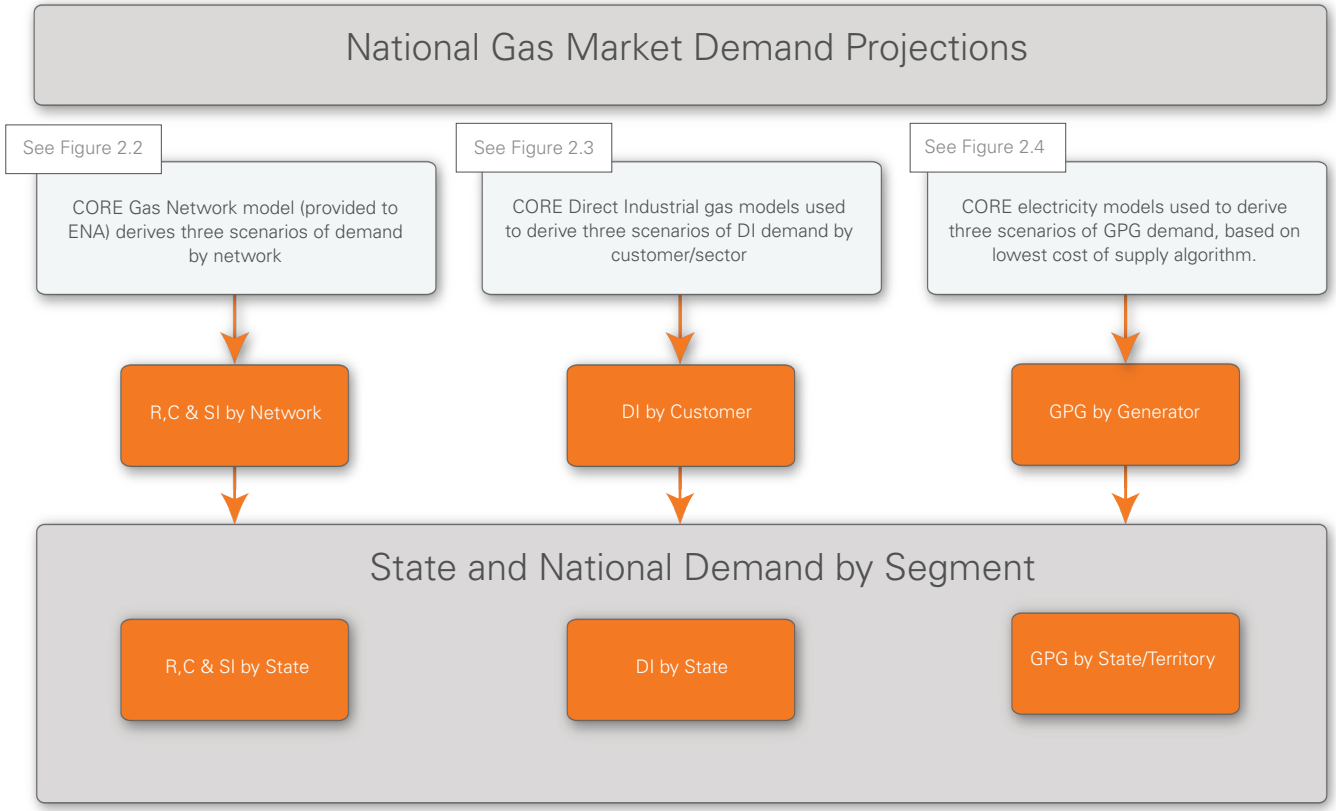
The outcome of the modelling and analysis process is three robust scenarios of gas demand between 2014 and 2034, using 2013 actual gas demand as the base.

Demand projections include:

- Network demand - demand for each of 12 individual Networks in Australia which can then be aggregated by State and at a national Network segment level. Analysis is focused on the R&C segment (households and commercial enterprises) and small industrial businesses separately due to differences in demand drivers.
- Direct industrials - demand scenarios are derived by combining analysis of individual large enterprises, where sufficiently granular data is available, together with analysis of industrial sectors or clusters of similar businesses. The focus is on the specific factors which influence demand for each enterprise of sector.
- GPG - demand scenarios are developed by projecting total electricity demand for WA (SWIS ad NWIS) and eastern Australia (NEM).

These segments are addressed in further detail below.

Figure 2.1 **Methodology | Gas Market Demand Projections**



2.2.1 Network Demand Scenarios

Figure 2.2 presents an outline of the approach adopted to develop scenarios of demand for the Gas Networks Segment between 2014 and 2034.

For each of the R&C customer Networks, two data series were developed – a projection of gas connections and a projection of demand per connection.

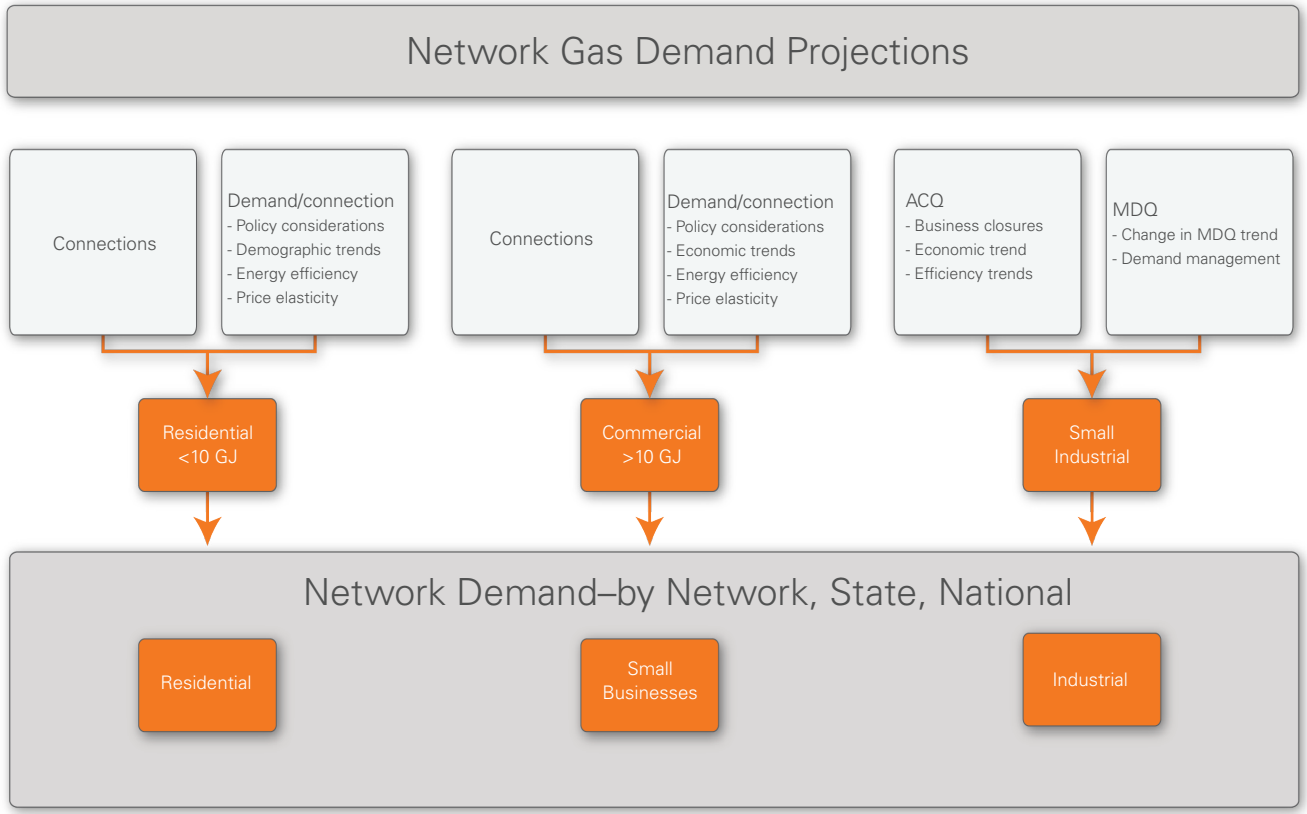
These demand projections have derived through modelling; based on a set of assumptions reviewed by Network owners and the ENA. The model observes the recent historical trend in demand based on a number of key demand drivers, and develops projections, having regard to:

- Factors which are expected to impact future demand, which were not observable in the historic trend. These factors are incorporated to develop forecast demand.
- Factors which were observable in the historic trend, which are not expected to influence future demand. These factors are removed to develop forecast demand.

For the Small Industrial customer group a projection of average annual demand or annual contract quantity ("**ACQ**") has been developed by reference to historical actual results and forecast changes in key demand drivers. CORE has also undertaken analysis of the capacity demand by this segment or ("**MDQ**"), which is the primary basis for deriving tariffs for this customer class.

The models used to develop these projections incorporate logic which calculates the impact that a change in any assumption will have on Network demand, including price and policy factors which are the primary focus under the Terms of Reference for this Study.

Figure 2.2 **Methodology | Network Gas Demand Projections**



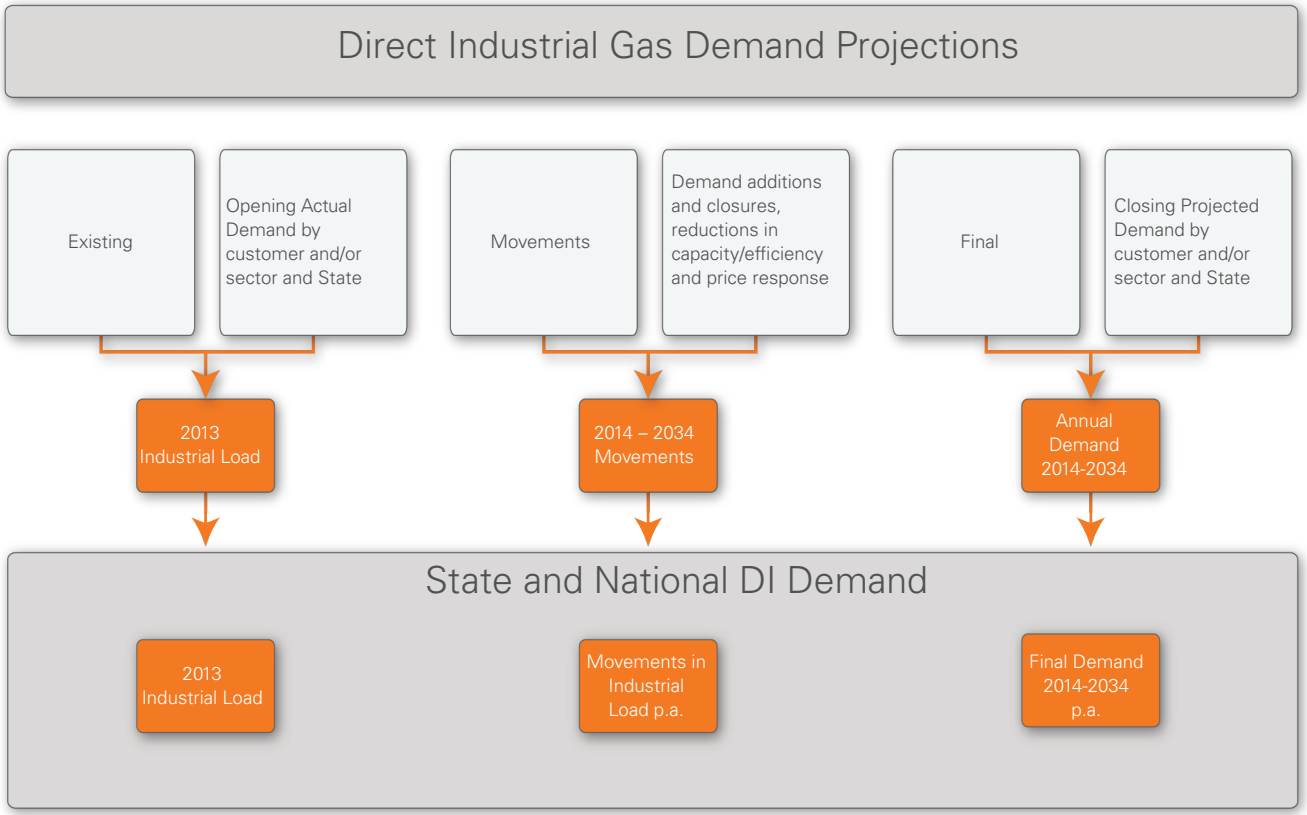
2.2.2 Direct Industrial Demand Scenarios

Figure 2.3 presents an outline of the approach adopted to develop demand scenarios for the Direct Industrial segment between 2014 and 2034.

Direct Industrial demand scenarios are based on detailed modelling work undertaken by CORE. This work involved two types of analysis.

- The first involves analysis of the demand outlook for individual large industrial customers, having regard to specific forces impacting those customers. Examples include the large Alumina refineries, ammonia and steel producers.
- The second involves economic analysis of the outlook for industry sectors/clusters of customers where there is insufficient information to consider customers individually. For these sectors, a base demand has been established for 2013 and assumptions have been made about the future movement in demand over time, based of CORE's economic and broader modelling work.

Figure 2.3 Methodology | Direct Industrial Gas Demand Projections



2.2.3 GPG Demand Scenarios

Figure 2.4 presents an outline of the approach adopted to develop demand scenarios for the GPG Segment between 2014 and 2034.

Three GPG demand scenarios have been developed based on detailed electricity system modelling work undertaken by CORE.

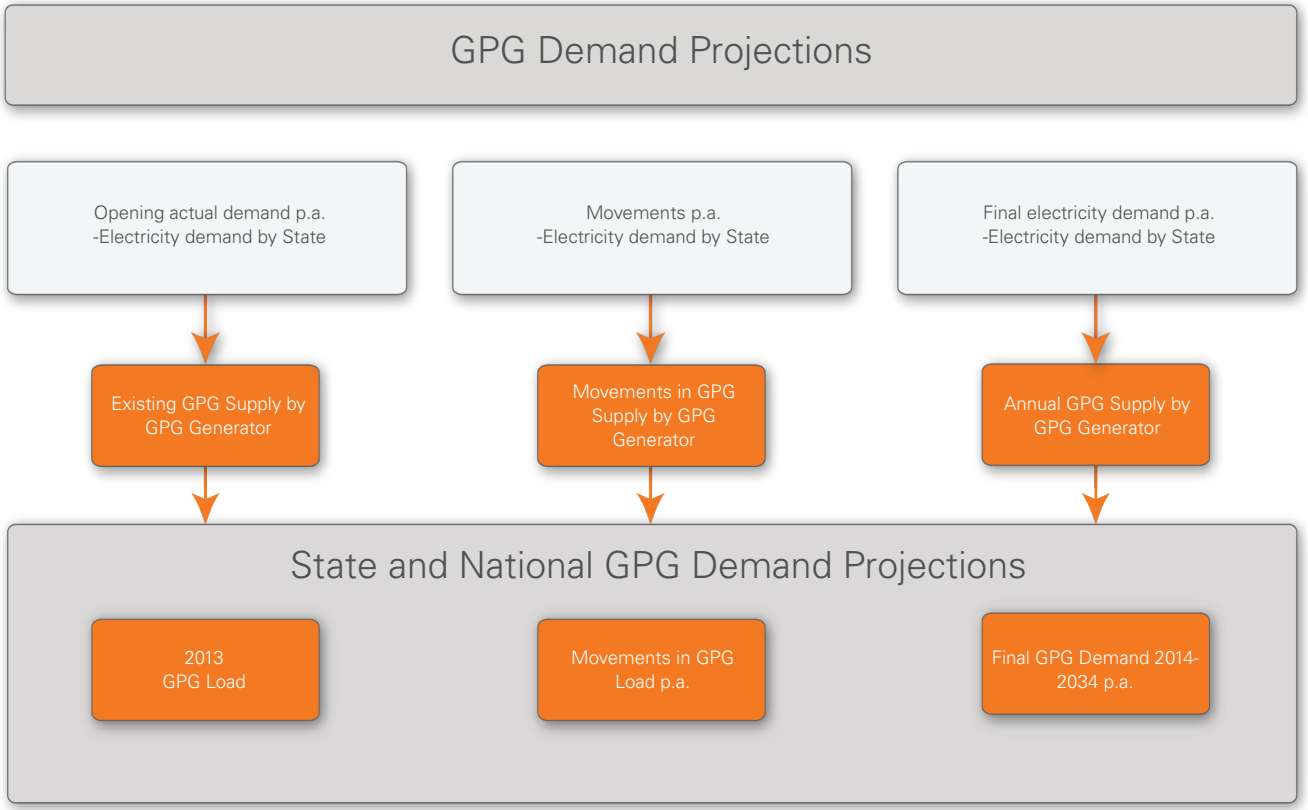
CORE's analysis of GPG demand commences with a detailed analysis of the historical demand and the forces shaping demand, including price and policy factors. In addition, historical bidding and dispatch behaviour is observed of each major generator within the relevant electricity system, together with an analysis of gas fuel usage.

CORE develops projections of both demand and the dispatch of electricity by individual generators, having regard to changing ownership (e.g. NSW privatisations), costs (gas prices) and other policy related factors (such as RET, carbon price) which are expected to change the bidding behaviour of generators.

For each scenario gas fuel usage is determined together with GPG-based CO_2 emissions.

Importantly, CORE data and systems enable a rigorous analysis to be undertaken of the interactions between renewable, gas, coal, hydro and other elements of the electricity system including resultant levels of carbon emission and the cost of abatement.

Figure 2.4 Methodology | GPG Gas Demand Projections



2.3 Scenario Analysis

CORE has developed three Scenarios of demand for each segment outlined above. These scenarios have been aggregated to present projections of gas demand at a range of levels-Segment alone (e.g. R&C), Networks as a total segment, States as a whole, Regions (WA and eastern Australia) and Australia as a whole.

The three scenarios of demand are described as Expected, High and Low for the purpose of this Study. The major differences between these scenarios as they relate to the Networks sector are summarised in the following table and further detail is presented in Attachment A.1.

Table 2.1 Scenario Description

Scenario	Major Assumptions
Expected CORE's assessment of the most likely level of future demand	▪ Gas continues to lose some ground to solar and coal-fired electricity but not to same degree as the Low scenario ▪ Major connection and demand per connection trends observed in recent years will continue to impact future demand (adjusted as appropriate to address any observable changes only) ▪ Gas price rises will take place in eastern Australia from 2015 and this will reduce demand based on an Expected level of price sensitivity
Low CORE's assessment of the lower level of potential gas demand outcomes	▪ Solar and coal-fired electricity generally favoured over gas ▪ Connections will be adversely impacted by price and policy as will demand per connection resulting in lower demand than the Expected scenario ▪ Gas price rises will reduce demand to a higher degree than the Expected scenario ▪ Industrial sector will experience a significant reduction in demand relative to the Expected scenario due to a range of economic, policy and other factors
High CORE's assessment of the upper level of potential gas demand outcomes	▪ Gas is highly competitive relative to solar and coal-fired electricity ▪ Gas prises will reduce demand to a lower degree than the Expected scenario ▪ Industrial sector is more bouyant than the Expected scenario

2.4 Policy Sensitivity Analysis

CORE has also undertaken Sensitivity analysis, as summarised in Table 2.2, to analyse the impact of assumed policy changes on the Expected Network demand scenario.

Table 2.2 Sensitivity Analysis Description

Sensitivity	Major Assumptions
Expected Scenario Gas continues to lose market share due to existing policies which favour solar and coal power	▪ Expected–RET continues to 2020 ▪ Low Sensitivity–RET continues to 2020 and augmented by other incentive programs ▪ High Gas Sensitivity–no RET from 2015
Low Significantly lower gas demand due solar and coal power being favoured strongly by policy	▪ Expected–existing policies continue ▪ High Gas Sensitivity–policies increase use of low carbon intensity gas ▪ Low Gas Sensitivity –policies reduce use of gas in favour of renewable and electricity
High Higher gas demand due to level playing field with solar and coal power	▪ High ▪ Expected–policy impact as observed in the recent historical trend. ▪ RET repealed from 2015 allow gas to compete effectively against solar ▪ New carbon pricing mechanism which creates level playing field between gas and coal-fired power

2.5 Modelling Assumptions

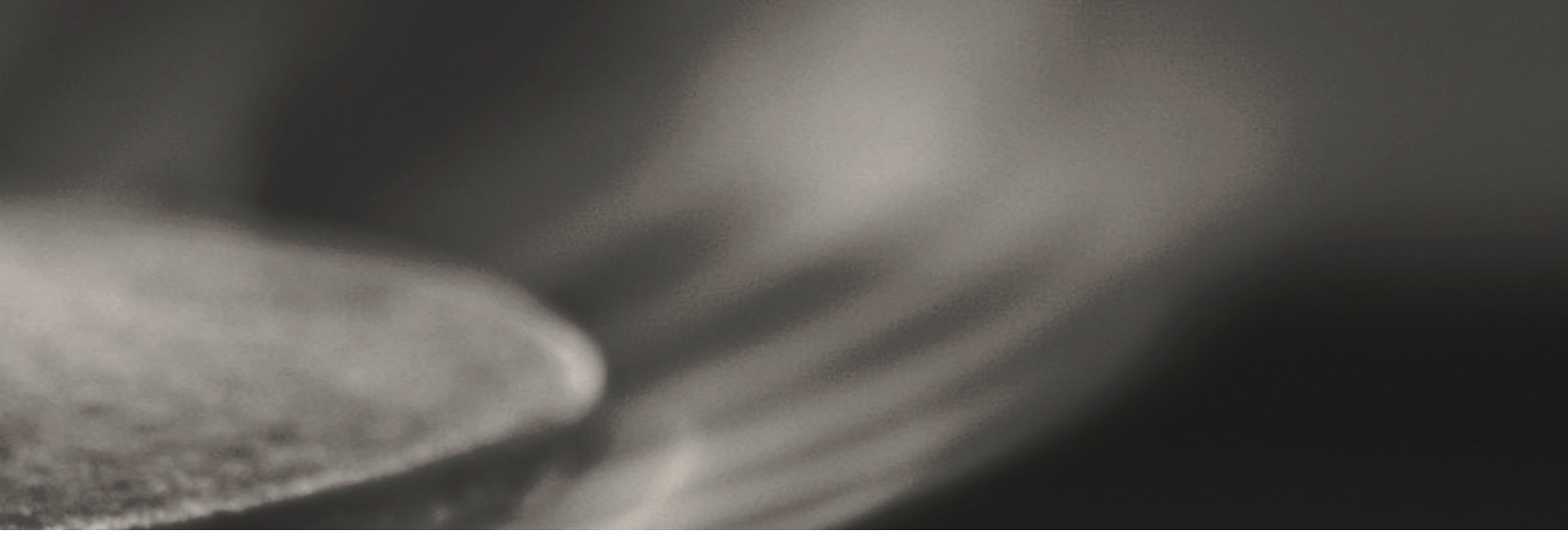
CORE projections of gas demand are based on a range of macro level assumptions as summarised in the following table.

Table 2.3 Summary of Macro Level Assumptions

Segment	Major Assumptions
Economic	▪ All scenarios–moderate GDP and GSP growth (2.0 to 3%). ▪ No material change in household disposable income.
Demographic	▪ All scenarios–population and household assumptions per State and Federal Government mid case projections.
Prices	▪ Expected Demand–prices increase from AUD4/GJ in 2013 to UAD8/GJ real by 2018 in eastern Australia ▪ High Demand–prices stabilising at AUD6.50/GJ real in eastern Australia, flat in real terms thereafter ▪ Low Demand –prices increasing toward AUD9/GJ real in eastern Australia, flat in real terms thereafter ▪ In WA prices stabilise at AUD7.50/GJ in 2014 real terms – all scenarios

Further detail relating to modelling assumptions is included in Attachment A.1.

3. GAS MARKET OVERVIEW



This Section presents an overview of the Australian national gas market, including recent historical trends, to provide an appropriate context for evaluating the outlook for the Gas Network Sector.

3.1 Domestic Market Overview

3.1.1 Regional Markets

The Australian domestic gas sector comprises three regional markets – Eastern Australia, Western Australia and Northern Australia.

Each region is considered to be a separate market as there is no gas pipeline connection between the regions, as illustrated in the figure opposite.

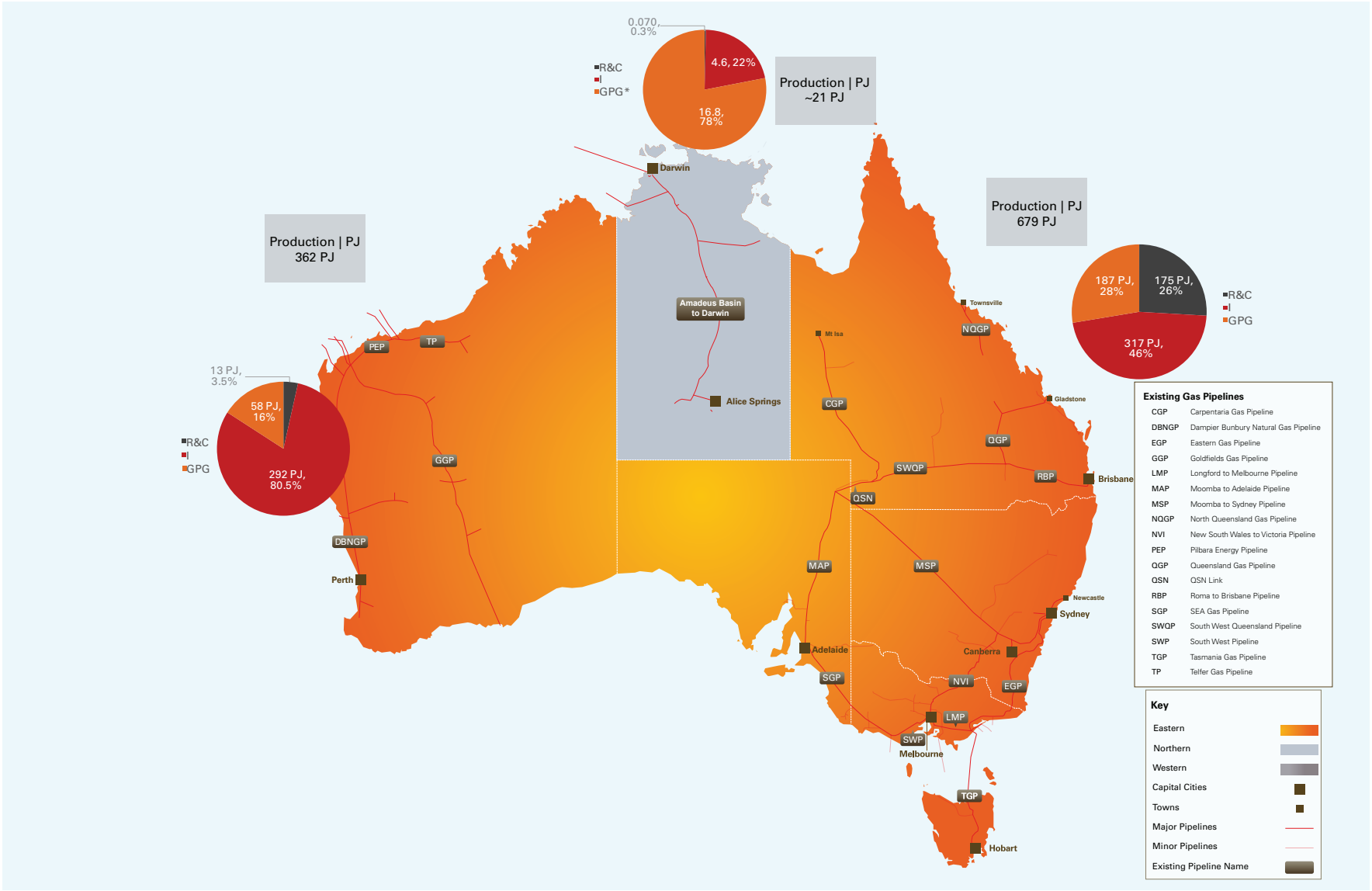
In 2013 annual domestic consumption was 1,041 PJ, with the allocation of demand between the regions as summarised in the Figure 3.1.

3.1.2 Customer Segments

For the purpose of this Study the Australian domestic customer base is segmented as follows:

- Residential – households including single houses and multi-storey dwellings.
- Commercial – all commercial enterprises (offices, Government agencies, shops etc) excluding industrial customers.
- Industrial – larger enterprises engaged in activities such as manufacturing and resource extraction and processing. Industrial customers can be further segmented as follows:
  - Distributed/Small industrials – receive gas via a distribution network.
  - Direct/Large industrials – receive gas directly from a transmission pipeline.
- GPG - gas fired power generation.

Figure 3.1 Domestic Market Overview



Source: Core Energy

3.2 Export/LNG Market Overview

3.2.1 Regional Markets

Australia has one emerging and two existing LNG export hubs:

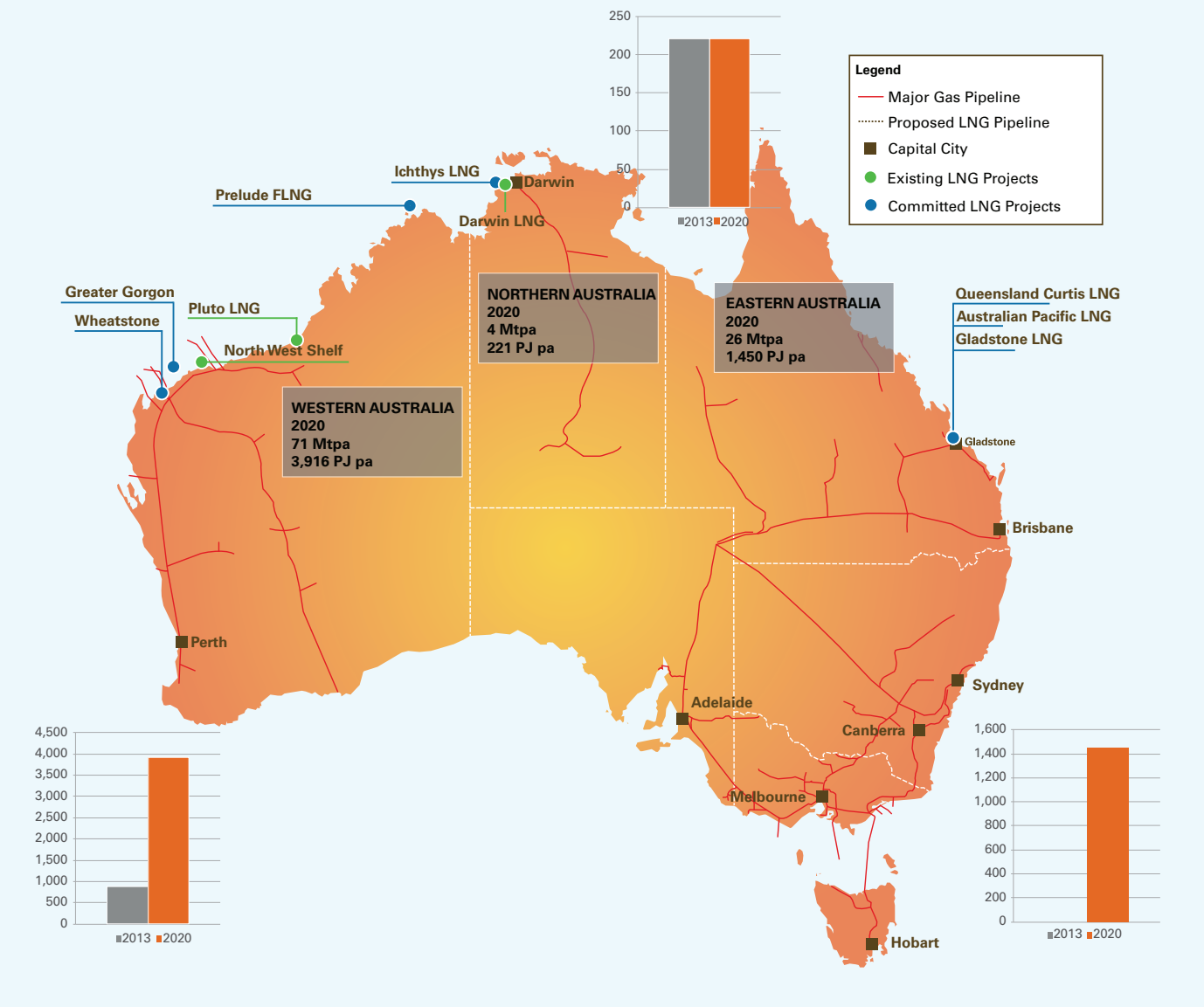
- Western Australia–two existing projects (NW Shelf and Pluto) and four projects under development (Gorgon, Prelude, Wheatstone and Ichthys).
- Northern Australia – one existing project (Darwin LNG).
- Eastern Australia – three projects under development (GLNG, QCLNG and APLNG).

The annual gas consumption of these hubs, expressed in PJ, and the level of LNG export, expressed in millions of tonnes, is summarised in the Figure 3.2.

3.2.2 LNG Resource Consumption

Once all approved LNG projects are in full production, LNG market will consume ~6,400 PJ p.a. which is almost seven times the annual domestic consumption. Over a 20 year term a total of ~120,000 PJ of gas will be exported as LNG.

Figure 3.2 Existing and Proposed LNG Projects and 2020 Production | PJ



Source: Core Energy

3.3 Historical Gas Demand

3.3.1 National Gas Demand

Since 2009, total Australian domestic and LNG/export gas demand has increased from 1,597 PJ to 1,911 PJ in 2013, as shown in Figure 3.3. This equates to a CAGR of ~3.7% p.a.

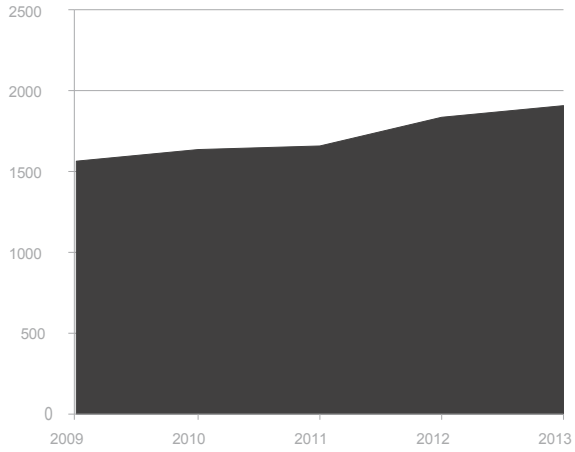
Between 2009 and 2013, domestic gas demand has increased by ~2.0% p.a. from 946 PJ to 1,041 PJ, accounting for 54–59% of total Australian gas demand, as shown in Figure 3.4.

Between 2009 and 2013, export gas demand has increased by ~6.0% p.a. from approximately 650 PJ to 870 PJ.

Gas exports have accounted for between ~ 41– 46% of total Australian gas demand, as shown in Figure 3.4.

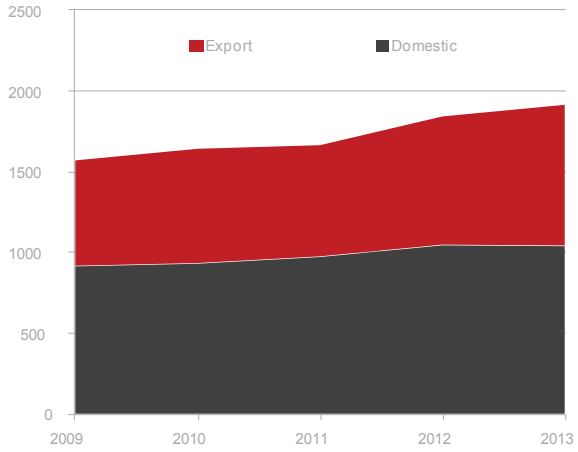
Currently, only WA and NT provide gas to the export market, with the commencement of gas exports from eastern Australia planned for late 2014 through to 2015.

Figure 3.3 Total Australia Demand | PJ



Source: Core Energy

Figure 3.4 Domestic and Export Demand | PJ



Source: Core Energy

3.3.2 Domestic Demand by Region

3.3.2.1 Domestic Eastern Australia Demand

Historical growth in eastern Australia gas demand has been largely driven by growth in the Industrial and GPG demand segments (Refer Table 3.1).

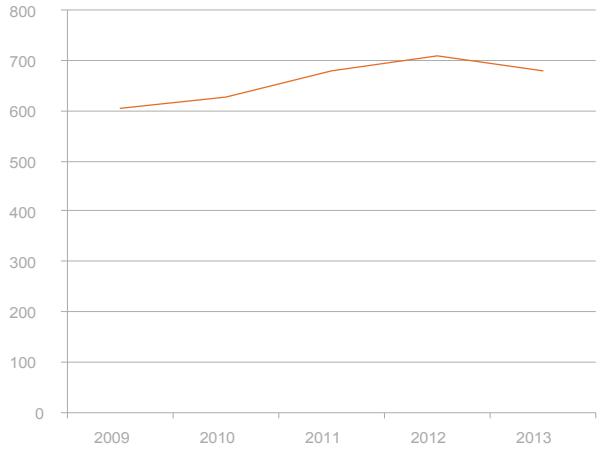
Over recent years eastern Australia demand has been characterised by slow to falling demand due to a slowing or reducing Industrial and GPG demand due to economic, gas price and policy-related factors.

3.3.2.2 Domestic WA Demand

Between 2009 and 2013, WA domestic demand experienced stronger growth than eastern Australia, with demand increasing from 309 PJ to 362 PJ (CAGR 3.3%) during this period.

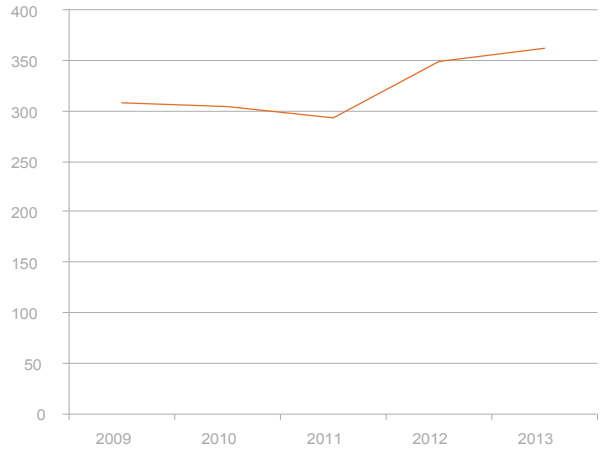
Growth in WA domestic demand is attributable primarily to growth in resource-related Industrial demand. In contrast, the R&C and GPG demand segments have both experienced demand reductions in recent years.

Figure 3.5 Domestic East. Aus. Demand | PJ



Source: Core Energy

Figure 3.6 Domestic WA Demand | PJ



Source: Core Energy

Table 3.1 Domestic Demand CAGR 2009-2013 | %

Region	R&C	Industrial	GPG	Total
Australia	0.23	3.4	0.1	2.0
East. Aus.	0.13	2.0	1.1	1.3
WA	-0.4	5.0	-2.7	3.3

Source: Core Energy

3.3.3 Domestic Demand by Segment | 2013

Figures 3.7 to 3.9 illustrate the breakdown of demand by segment for the national domestic and regional eastern Australia and WA domestic markets in 2013.

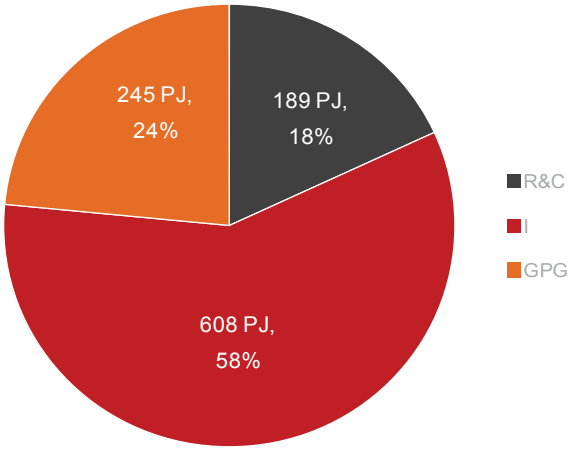
In 2013, 58% of Australian domestic demand was associated with the Industrial segment (a material portion of which is distributed via gas Networks), 24% GPG and the remaining 18% R&C (exclusively distributed through gas Networks).

Eastern Australia and WA markets have significantly different domestic demand profiles.

- R&C demand in eastern Australia accounts for a greater proportion of total eastern Australia domestic demand (26%), in comparison to in WA is 3.5%.
- GPG demand accounts for 28% of eastern Australia domestic demand, while in WA it accounts for 16%.
- Eastern Australia and WA Industrial demand segments are comparable in terms of quantity of gas consumed, 317 PJ and 292 PJ respectively. However, eastern Australia Industrial gas demand accounts for 46% of total eastern Australia domestic gas demand, while WA Industrial demand accounts for 81% of total WA domestic gas demand.

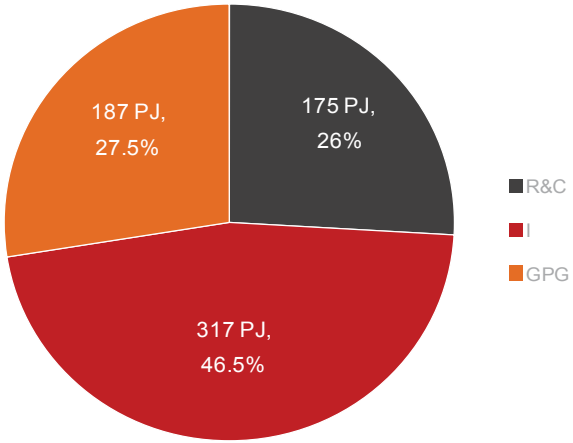
Paragraphs 3.3.3.1 to 3.3.3.3 provide further detail of historical demand by Segment.

Figure 3.7 Total Demand 2013 | PJ & %



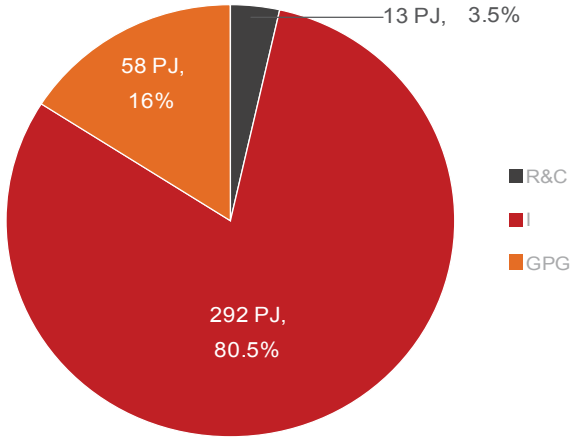
Source: Core Energy

Figure 3.8 East. Aus. Demand 2013 | PJ & %



Source: Core Energy

Figure 3.9 WA Demand 2013 | PJ & %



Source: Core Energy

3.3.3.1 Residential and Commercial Demand

There has been limited growth in eastern Australia R&C demand, increasing from 173 PJ in 2009 to 175 PJ in 2013 (CAGR 0.13%) (refer Figure 3.10).

WA R&C demand has fallen from 13.3 PJ to 12.8 PJ (CAGR -0.42%) between 2009 and 2013 which has been mainly due to increased appliance and building efficiencies, other energy policies, and response to gas price increases, which offsets the impact of population and dwelling growth.

3.3.3.2 Industrial Demand

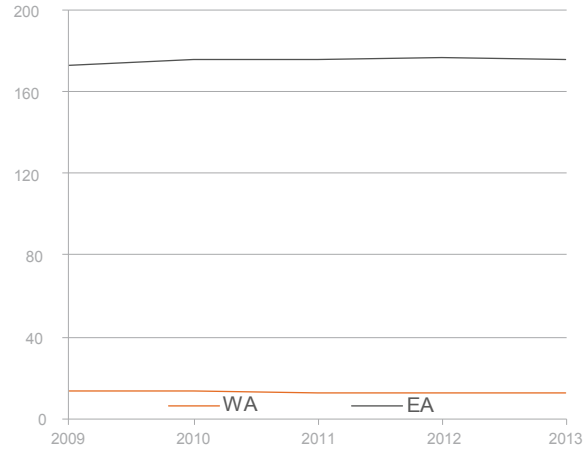
Eastern Australia Industrial demand has experienced growth of 2.0% p.a., from 286 PJ in 2009 to 317 PJ in 2013 (refer Figure 3.11). This growth stems from a few specific projects rather than an economy-wide trend.

- Since 2011 Industrial demand has remained steady due to reduced manufacturing activity associated with a softer domestic economy, increased cost pressure and competition from imports.
- WA Industrial demand has increased from 229 PJ to 292 PJ (CAGR 5.0%) between 2009 and 2013.
- Continued growth in WA Industrial demand beyond 2011 is linked to continued growth in mining and mineral processing activity.

3.3.3.3 GPG Demand

- There has been moderate growth in eastern Australia GPG demand over the past five years, increasing from 177 PJ to 187 PJ (CAGR 1.1%) between 2009 and 2013 (refer Figure 3.12).
- Historically, low gas prices and carbon emission initiatives have driven this trend in demand.
- WA GPG demand has declined from 66 PJ to approximately 58 PJ (CAGR -2.7%) between 2009 and 2013. This decline can be attributed to increased generation from renewables and coal capacity due to policy influences and significant increases in gas price.

Figure 3.10 R&C Demand by Region | PJ

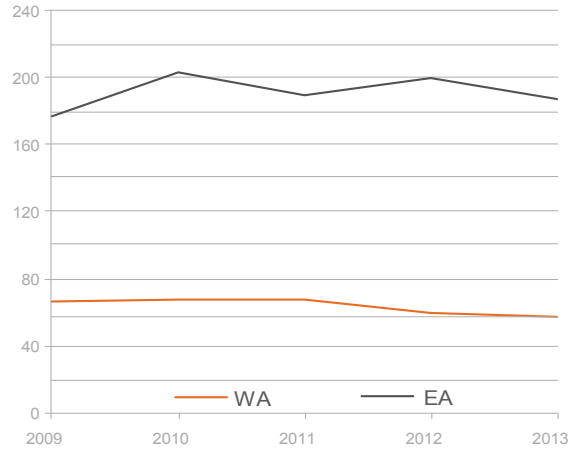


Source: Core Energy

Figure 3.11 Industrial Demand by Region | PJ

Source: Core Energy

Figure 3.12 GPG Demand by Region | PJ



Source: Core Energy

3.4 Gas Supply & Infrastructure

3.4.1 Gas Supply

The location of Australia's major existing and potential gas supply basins are highlighted on Figure 3.13.

A key supply trend taking place in eastern Australia and WA is the increasing focus on unconventional gas systems such as coal seam gas, shale and tight gas resources (e.g. Cooper Basin unconventional, Perth Basin unconventional and Canning Basin unconventional). The unconventional resources being pursued in Australia (in contrast to USA) are expected to be complex and substantially more costly to develop than the conventional resources, which have supplied the vast majority of Australia's historical gas needs.

The vast majority of gas sold historically has been under contracts with a term of up to 20 years. A significant proportion of eastern Australia's contracts will mature by 2018, requiring suppliers and customers to renegotiate arrangements. This timing is significant as it coincides with strong demand from the LNG sector and an increasing supply cost environment.

3.4.2 Gas Infrastructure

The two main elements of gas infrastructure include transmission pipelines, which transport gas from the gas fields to nominated delivery points via high pressure pipelines, and distribution gas networks, which receive gas from transmission pipelines and distribute to R,C & I customers.

The location of major transmission lines and distribution networks is shown in the Figure 3.13.

3.5 Gas Cost & Price

3.5.1 Gas Cost

The cost of extracting a larger scale gas resource involves the following major activities:

- Exploration including seismic surveys and exploratory drilling and testing.
- Drilling and completion to develop a discovered resource.
- Facility construction – water handling, gas processing, infrastructure.
- Labour – throughout value chain including ongoing operations and maintenance.

Each of these elements has experienced significant cost inflation over the last five years or more. Of particular note is the higher cost associated with extracting gas from lower quality/more complex geology. The lower quality is a natural result of the better quality resources being depleted with time to meet domestic and LNG demand and reserve requirements.

3.5.2 Gas Price

The price of gas is considered at two levels:

- Wholesale – the price of acquiring gas from the gas producer at the outlet of the gas processing plant/ inlet to the transmission pipeline.
- Retail – the price paid by an end consumer who sources gas via a retailer. The retail price includes the following major elements:
  - Wholesale price
  - Transmission pipeline tariff
  - Distribution network tariff
  - Retailers costs and margin

In 2013, the marginal wholesale price of gas in WA stood at approximately AUD7.50/GJ for new gas supply. In eastern Australia wholesale prices under long standing contracts are ~AUD4/GJ and new contract prices are rapidly moving toward AUD8/GJ and in some cases above this level.

Retail prices in 2013 were approximately:

- AUD34/GJ in West for residential customers
- AUD29/GJ in East for residential customers.

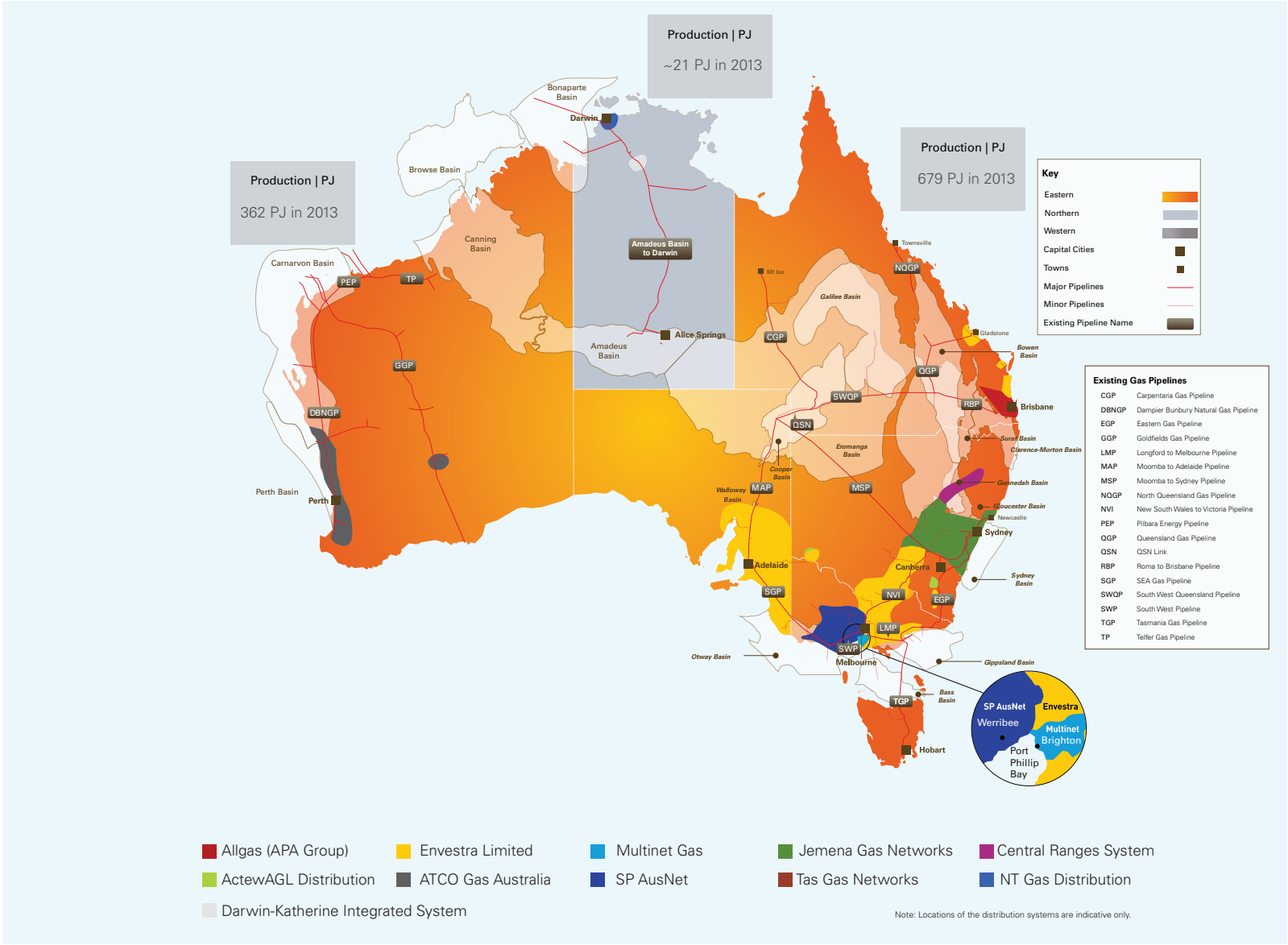
For over 10 years Australian consumers have enjoyed gas prices which were in the bottom quartile of global prices.

Over more recent years prices have increased materially due to increases in wholesale prices in WA, and national requirements to address ageing network infrastructure.

Recent increases in network capital expenditure, combined with Australia's relatively low population density, has resulted in materially higher network costs per consumer. This is significant as network costs represent approximately 50% of a retail bill.

CORE expects the next major trend to be increasing wholesale prices in eastern Australia, which will flow through to higher retail gas prices.

Figure 3.13 Map of Gas Infrastructure, Regional Gas Markets and Major Gas Supply Basins



Source: Core Energy

3.6 Gas Industry Benefits

Whilst it is beyond the scope of this Study to present a complete analysis of the benefits of the gas industry to the Australian economy, it is considered important to to include a high level analysis as a context for an analysis of the Network sector of this industry.

Energy Security

- Gas is the only existing large scale energy alternative to electricity in the stationary energy sector, and thus plays an important role as a competitive alternative energy source within Australia's energy market.
- Gas is used over 4.5 million households and more than 120,000 commercial and industrial enterprises.
- Natural gas has the potential to provide more than 30% of Australia's future energy requirements.

Environmentally Sustainable

- Ability to contribute substantially to meeting GHG targets due to low carbon intensity.
- Opportunity to extend use in residential, commercial, industrial, electricity and LNG sectors to reduce emissions domestically and internationally.

Abundant Resource

- Federal Government estimates indicate a gas resource base which could support domestic demand for at least fifty years.

Export Revenue

- The LNG sector is poised to become the largest export sector in Australia and is projected to remain in this position for over 20 years.

Economic Activity

- The gas sector is a major contributor to economic activity in terms of Government tax and royalty revenue, cost-effective input to industrial activity, capital investment, exports/balance of trade and employment.

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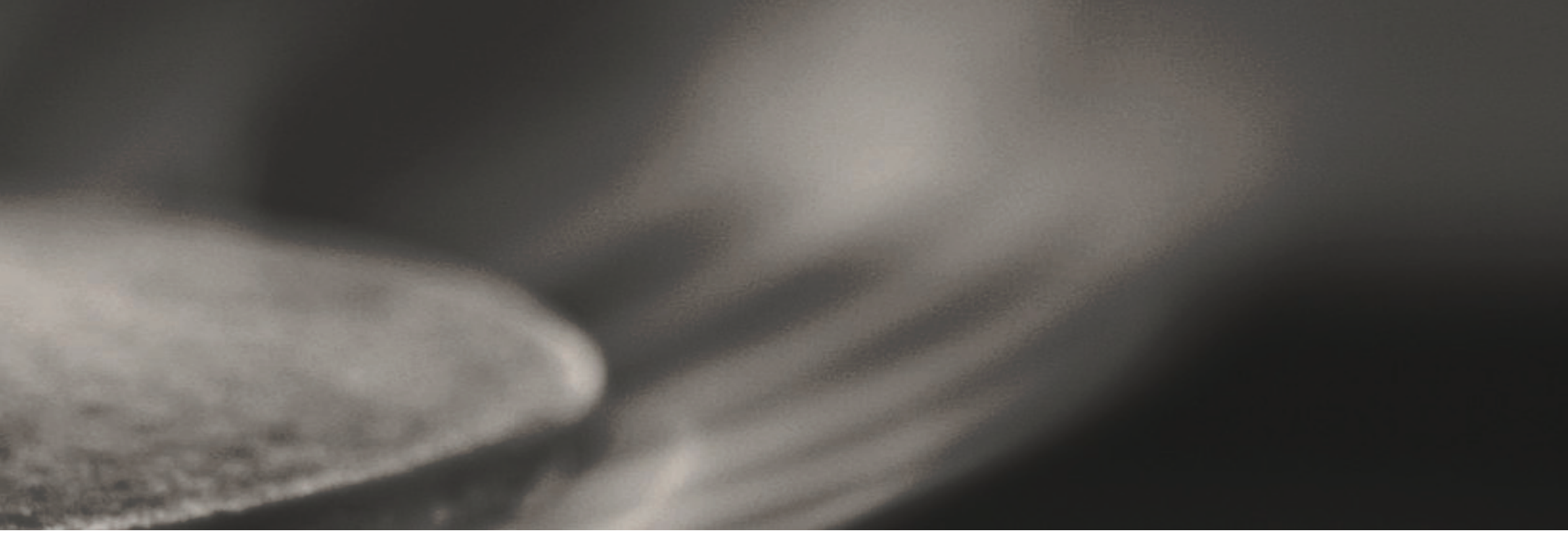
4. GAS MARKET OUTLOOK | 2014 - 2034



This Section presents an overview of the demand outlook for the Australian gas market from 2014 to 2034 – including both domestic and export segments.

4.1 Market Overview

4.1.1 Total National Market

- Total Australian gas demand is expected to increase from 1,911 PJ in 2013 to 7,383 PJ in 2034. The increase is attributed to export demand alone, with domestic demand projected to fall below 2013 levels throughout the Study period.
- Exports are projected to increase from 870 PJ in 2013 to 6,412 PJ in 2022, as a number of eastern Australia and WA LNG projects commence production.
- Domestic demand is expected to fall from 1,041 PJ to 944 PJ by 2020, and then increase moderately to 971 PJ due to overall decreases in R&C, Industrial and GPG demand segments.

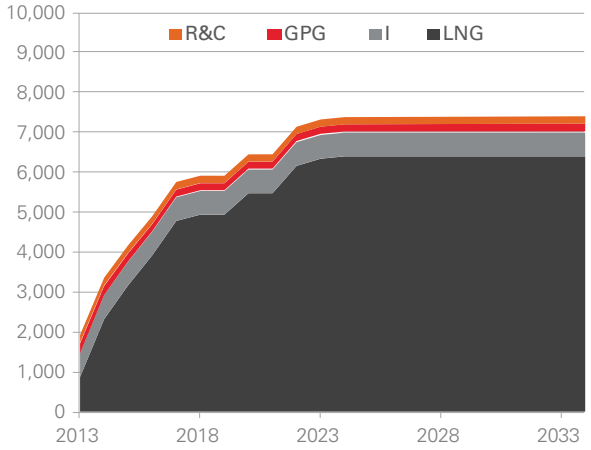
4.1.2 Domestic Market

- The projected fall in domestic gas demand stems from decreases in demand in all segments of the market; namely R&C, Industrial and GPG.
- R&C demand is expected to experience a 5 PJ fall from 188 PJ to 184 PJ, mainly due to improved energy efficiency, rising retail gas prices and policy driven appliance substitution.
- Industrial demand is projected to fall from 608 PJ to 591 PJ due to a number of expected industrial closures and limited capacity expansions.
- GPG demand is likely to fall from 245 PJ to 171 PJ in 2020 as gas contracts mature and the wholesale price of gas is expected to almost double. Demand increases to 196 PJ by 2034.

4.1.3 Network Sector

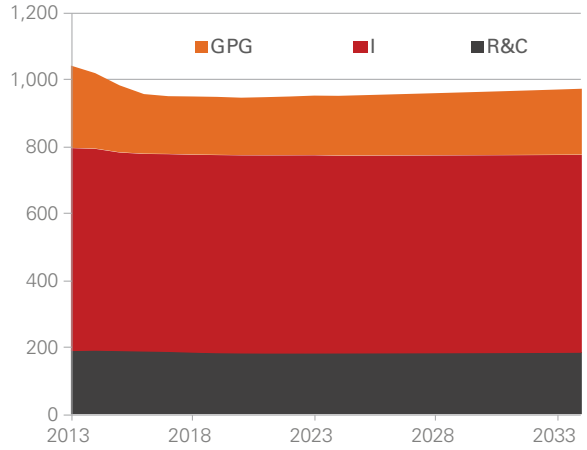
- Network demand comprises R, C and SI demand, as presented in Figure 4.3.
- The expected fall in network demand of 19 PJ, from 379 PJ to 360 PJ, is attributed to falls in both R&C segment and the SI segment.
- The projected fall in R&C is addressed in Section 4.2.
- The likely fall in SI from 191 PJ to 176 PJ is mainly due to energy policy and response to higher gas prices.

Figure 4.1 Total Gas Demand by Segment | PJ



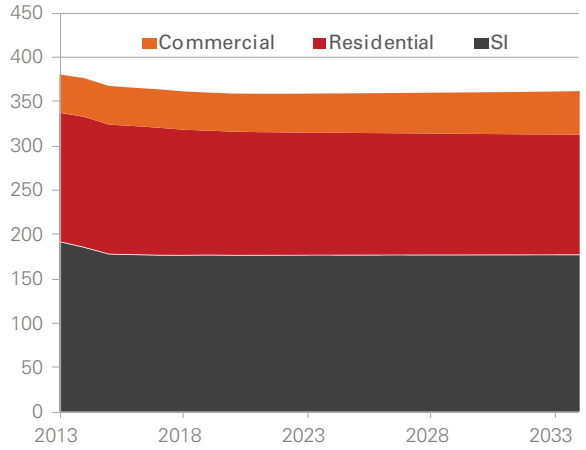
Source: Core Energy

Figure 4.2 Total Domestic Demand by Segment | PJ



Source: Core Energy

Figure 4.3 Network Demand by Segment | PJ



Source: Core Energy

4.2 Segment Analysis | R&C Demand

Under the Expected Scenario, R&C demand is projected to fall by 4 PJ or -0.1% p.a. between 2013 and 2034, as shown in Figure 4.4.

The fall in demand is attributable to three major forces:

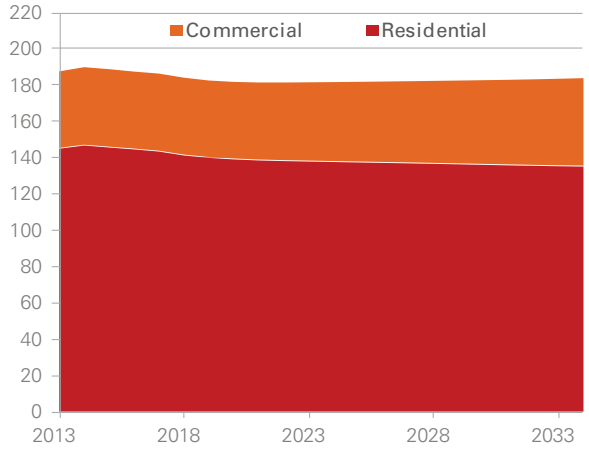
- Improvements in appliance and building energy efficiency.
- Gas appliance substitution, mainly in favour of solar heating and electrical reverse cycle air-conditioning.
- Customer response to higher retail gas prices.

Under a High Gas Demand Scenario, R&C gas demand is expected to increase by 0.74% p.a. to 221 PJ in 2034. This assumes that consumer response to retail gas price increases will be more favourable, as will the impact of future energy policies.

Under the Low Scenario, gas demand falls by -0.84% p.a. due to higher gas price and policy impacts.

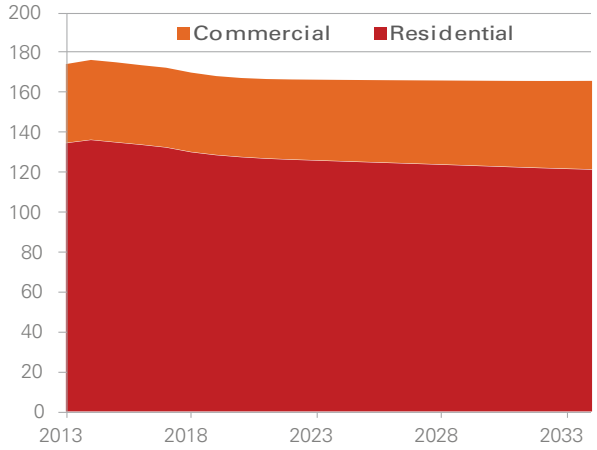
These scenarios are addressed in further detail in Section 6 below.

Figure 4.4 R&C Demand by Scenario | PJ



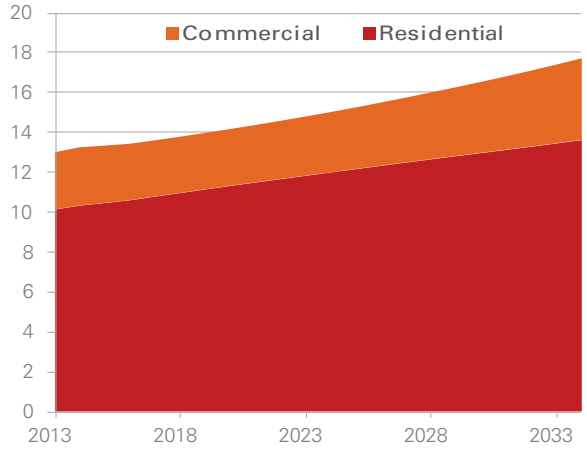
Source: Core Energy

Figure 4.5 East. Aus. R&C Demand by Scenario | PJ



Source: Core Energy

Figure 4.6 WA R&C Demand by Scenario | PJ



Source: Core Energy

4.3 Segment Analysis | Industrial Demand

Under the Expected Scenario Industrial demand is projected to fall by 18 PJ or -0.25% p.a. on a CAGR basis between 2013 and 2024, followed by a period of stability and low growth of 0.007% p.a. to 2034, as shown in Figure 4.7.

The fall between 2014 and 2024 mainly stems from an assumed fall in eastern Australia Industrial demand from 317 PJ to 288 PJ. This fall is attributable to three major forces:

- Deterioration in competitiveness of certain energy intensive sectors.
- Impact of energy efficiency measures.
- Response to higher gas prices.

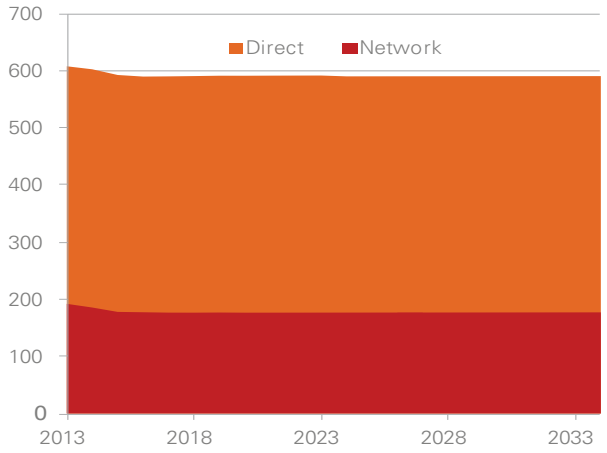
The key sectors to experience material reduction in demand include – ammonia production/fertiliser; steelmaking; petroleum refining; mineral processing and broader manufacturing.

WA Industrial demand is projected to grow modestly from 292 PJ to 304 PJ, as shown in Figure 4.9. This growth can be attributed to strong potential in iron ore and copper industries, driven by Asian demand for these commodities and assumed retention of gas intensive industrial capacity.

Under the High Scenario, gas demand falls at a lower rate due to an assumption of improving global competitiveness and a tapering of energy efficiency gains.

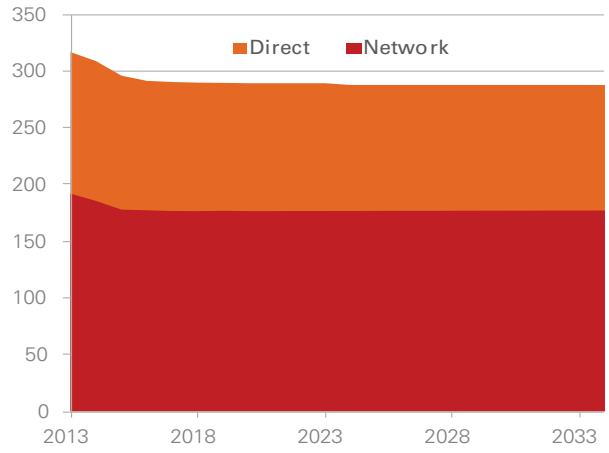
Under the Low Scenario, gas demand falls further due to an assumed deterioration in global competitiveness.

Figure 4.7 Industrial Demand by Scenario | PJ



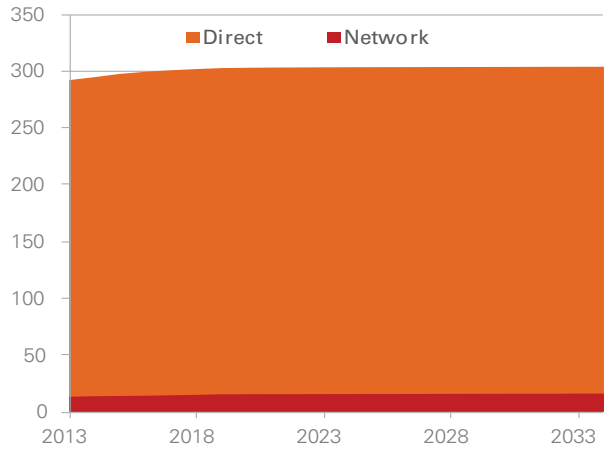
Source: Core Energy

Figure 4.8 East. Aus. Industrial Demand by Scenario | PJ



Source: Core Energy

Figure 4.9 WA Industrial Demand by Scenario | PJ



Source: Core Energy

4.4 Segment Analysis | GPG Demand

The GPG segment is expected to experience the largest fall in demand during the Study period. Under the Expected Scenario, GPG demand is projected to fall by 74 PJ, from 245 PJ in 2013 to 171 PJ in 2020, followed by a period of stability and a low rate of growth of 0.9% between 2021 and 2034, as shown in Figure 4.10.

The fall between 2014 and 2020 stems largely from a fall of -2.7% p.a. in eastern Australia and is attributable to two major forces:

- The diversion of 'GPG supply' to the higher value LNG segment, to meet LNG contract commitment shortfalls.
- The reduction in GPG electricity output in favour of lower cost coal capacity (excluding cost of carbon) and mandated growth in renewable energy.

Figure 4.12, shows that a growth in WA GPG demand of 2.3% p.a. is projected, resulting in expected demand of 94 PJ in 2034. GPG and other renewable sources will increase electricity supply when the 400 MW coal-powered Kwinana C is decommissioned in 2016.

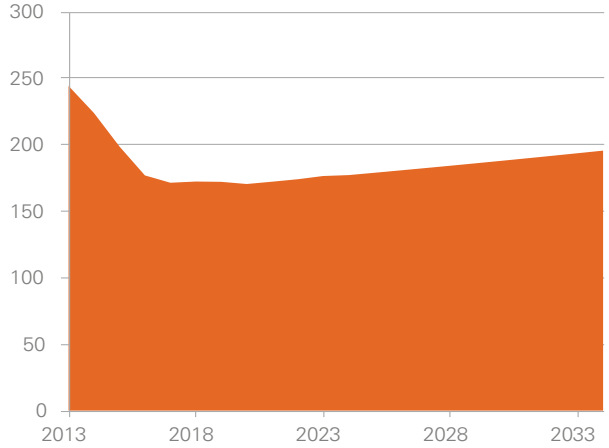
Under the High Scenario GPG gas demand is projected to increase to 372 PJ, primarily due to an assumed reduction of coal capacity in eastern Australia.

Under the Low Scenario, gas demand is likely to fall at -2.6% p.a., to 137 PJ in 2034, due to assumed coal and renewable sectors gaining strength, supported by energy policy and negative response to projected gas price rises.

Emissions

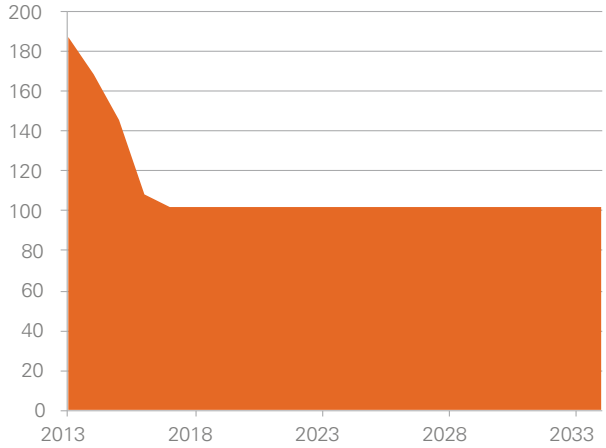
Under the Expected Scenario, emissions from power generation falls from 172 million tonnes CO2-e in 2013 to 165 million tonnes CO2-e in 2020. This is projected under the assumption that the LRET target will be largely met. With decreasing GPG, renewable energy is expected to increase its share in power generation. Emissions are projected to grow by 13 million tonnes CO2-e from 2021 to 178 million tonnes CO2-e in 2034, due to expected increase in coal-powered generation.

Figure 4.10 GPG Demand by Scenario | PJ



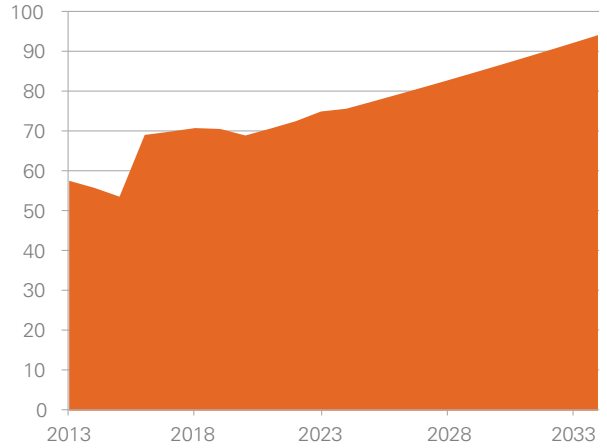
Source: Core Energy

Figure 4.11 East. Aus. GPG Demand by Scenario | PJ



Source: Core Energy

Figure 4.12 WA GPG Demand by Scenario | PJ



Source: Core Energy

4.5 LNG Demand

Due to the WA and eastern Australia focus of this Study, CORE has divided LNG demand into two geographic segments–east and west (i.e. the Northern hub has been excluded).

The Study developed three LNG demand scenarios as shown in Figures 4.13 to 4.15.

Eastern Australia LNG Demand

Under the Expected Scenario, APLNG, QGLNG and GLNG are projected to require over 25,000 PJ of reserves to fulfil export contracts over the twenty year term to 2034. The Low Scenario has the same projected demand between 2014 and 2034, however a longer ramp up period is expected.

Under the High Scenario, LNG demand is extended to include the 9,500 PJ of 2P reserves linked to Arrow LNG, and as a consequence the level of reserves and resource held for LNG increases to ~35,000 PJ.

Whilst the shorter term focus is on existing LNG contract commitments, it is important to maintain a longer term perspective. The enormous commitment of capital (approximately AUD200bn) makes it compelling for operators to pursue further LNG sales, beyond the life of existing contracts. This will require a significant level of reserves ahead of final contract commitment, which would be circa 2030 (each 4 mtpa train would require ~2,000 PJ for each ten year contract term). This will naturally have a longer term influence on domestic gas pricing, although the extent of this impact is highly uncertain at this time.

Figure 4.14 below shows the projected LNG gas demand in eastern Australia under the three scenarios developed for this study.

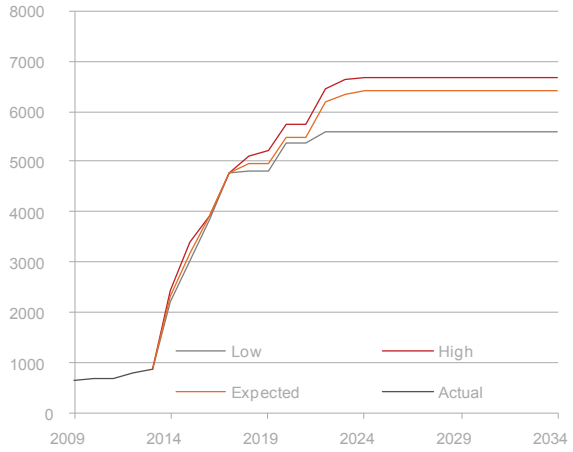
WA LNG Demand

Under the Expected Scenario, six LNG projects are projected to require greater than 80,000 PJ of reserves to fulfil export contracts. The Low Scenario excludes the potential Browse LNG project, which would require approximately 7,250 PJ of reserves, and also assumes a longer ramp-up period.

Under the High Scenario, it is projected that Bonaparte LNG, Scarborough LNG and Sunrise LNG will proceed to completion. In aggregate these new projects will require approximately 8,500 PJ of reserves over the twenty year term to 2034.

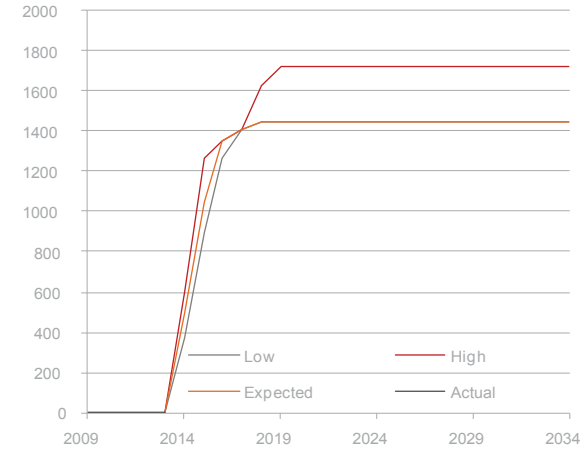
Figure 4.15 below shows WA LNG demand under the three scenarios developed for this Study.

Figure 4.13 LNG Demand by Scenario | PJ



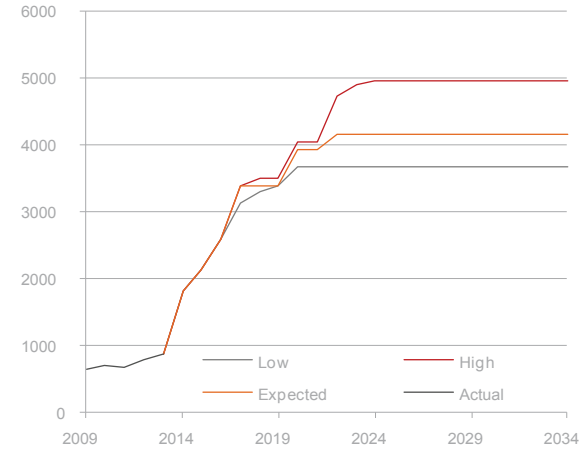
Source: Core Energy

Figure 4.14 East. Aus. LNG Demand by Scenario | PJ



Source: Core Energy

Figure 4.15 WA LNG Demand by Scenario | PJ



Source: Core Energy

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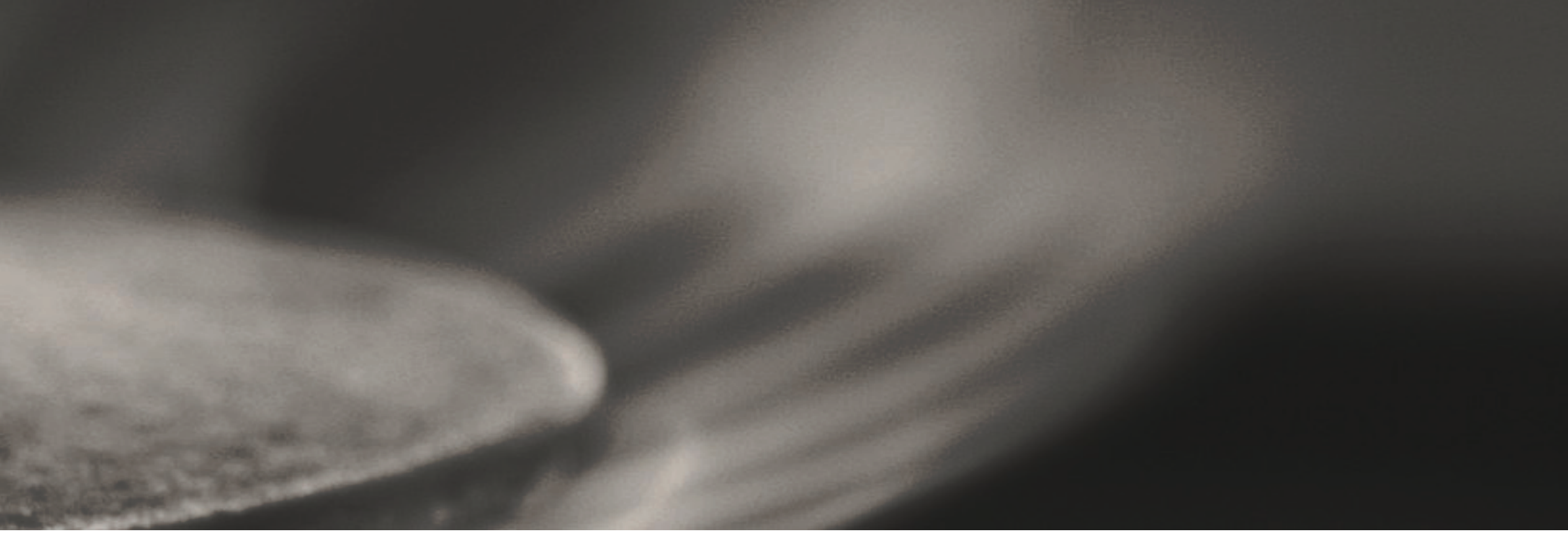
5. GAS NETWORK OVERVIEW



This Section presents an overview the Australian Gas Network Sector to provide a basis for analysis of the outlook for the Sector from 2014 to 2034 (Section 7).

5.1 Overview of Gas Networks

5.1.1 Introduction

The Australian gas networks sector comprises a series of regulated gas distribution systems, which operate within defined geographic boundaries as summarised in Figure 5.2.

5.1.2 Use of Network Delivered Gas

The primary end use of gas varies between customer segments as summarised in the following table:

Table 5.1 Main Gas Use by Customer Segment

Customer Segment	Main Use
Residential	Room heating, water heating, cooking appliances.
Small business/commercial	Room heating, water heating.
Industrial	Industrial heating processes and power facilities.

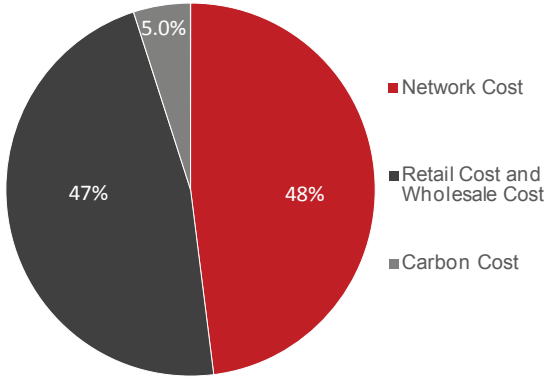
5.1.3 Regulated Tariffs

The networks charge a regulated tariff to customers (mainly gas retailers), who pass on the tariff to end users as a component of the retail price.

The regulated tariff is derived under a regulated Access Arrangement by applying an approved rate of return against the asset cost base of each network. The tariff will move with increases/decreases in capital and operating cost, movements in the approved rate of return, and movements in the level of gas demand in each network.

In 2013, gas network costs accounted for approximately 50% of the average residential customer retail gas bill (refer Figure 5.1).

Figure 5.1 Average Breakdown of Retail Gas Bill | %



Source: IPART; 2013/14.

5.1.4 Key Trends

The growth of the network market can be generally analysed in two parts:

- Growth in connections – the number of customers who are connected to gas mains in any given year and the percent of new connections relative to new dwelling completions.
- Growth in demand per connection – the average amount of gas consumed per connection by each customer segment; measured in GJ p.a.

In general terms, the networks sector has been characterised by a slower rate of growth in connections and a more pronounced reduction in demand per connection over recent years.

The major drivers of these changes are summarised below:

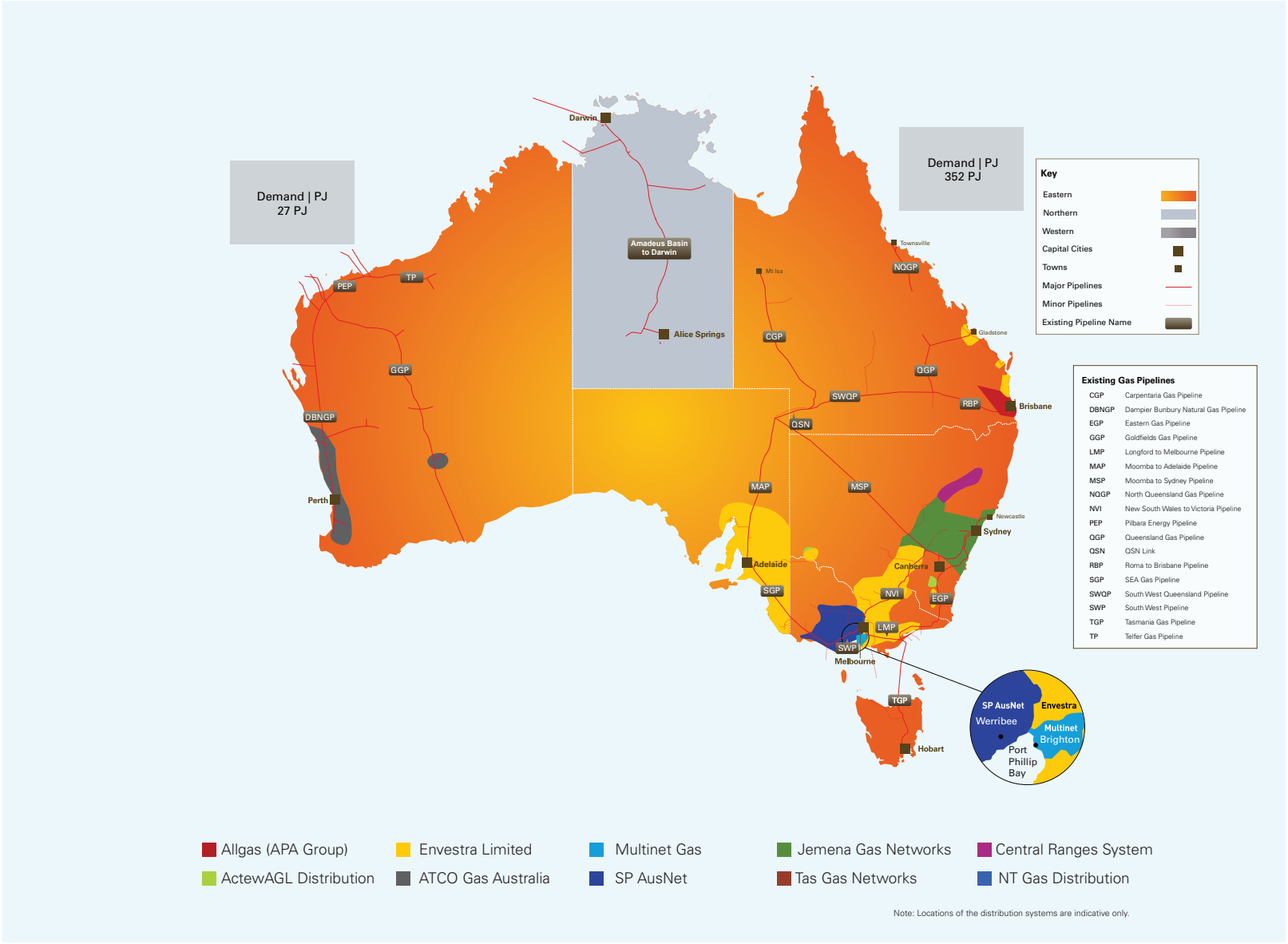
Connection Rate

- Customers favouring substitute energy sources and deciding against gas connection. Examples include electricity, particularly where gas prices have risen materially (such as WA and VIC), and solar, where incentives are available to customers to encourage installation.
- Low penetration in fast growing economies of WA and QLD.

Demand per Connection

- Response to increased prices.
- State and Federal energy policies which result in lower gas demand:
  - > Federal RET/SRES scheme, which favours solar hot water systems over gas.
  - > State and Federal energy sustainability measures.
  - > Insulation – lowering gas use for heating.
  - > Solar rebates and feed-in tariffs – favour solar over gas in water heating segment.
  - > Federal carbon price mechanism – which favours electricity over gas in room heating market (reverse cycle air conditioning) given the significantly higher carbon emission intensity of electricity.
  - > Improved building efficiency which lowers gas use for heating for a given floor area.
  - > Improved gas appliance efficiency, such as gas water heaters and room heaters.

Figure 5.2 Eastern and Western Australia Gas Network Areas



Source: Core Energy

5.2 Overview of Gas Use in Network Sector

In the R&C segment ~43% of gas is used for room heating, ~48% for water heating and less than 10% for cooking.

In the Small Industrial segment the vast majority of gas is used either as feedstock or for industrial heat.

In simple terms, there has been a trend away from gas in the room heating arena in favour of electrical R-C air conditioning. In the water heating market, gas has gained some share from electrical appliances but lost significant ground to solar-powered systems.

Figure 5.3 shows the relative contribution of each customer segment to total Network demand in 2013.

5.2.1 Room Heating

This Study distinguishes between two types of room heating:

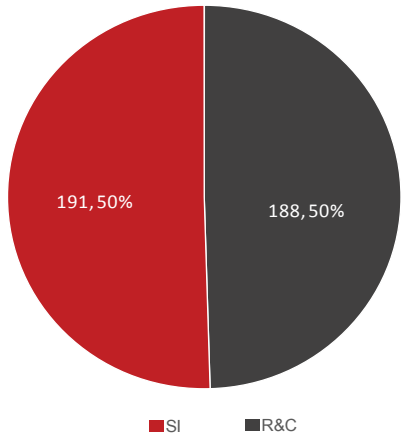
- Ducted heaters which are also called central heating systems as they can be used to heat a whole house or commercial area; and
- Space heaters which are used to heat a specific area or single room.

Ducted heating accounts for approximately 75% of the energy used in residential heating by gas, with the remaining 25% attributable to space heating.

5.2.1.1 Ducted Heating

Major features of the ducted heating segment are summarised in the Table 5.2.

Figure 5.3 2013 Network Demand by Segment | PJ,%

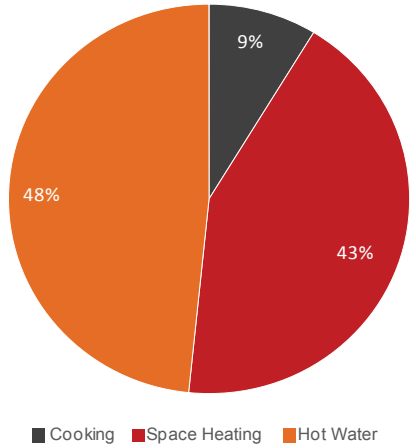


Source: Core Energy

Table 5.2 Ducted Gas Heating (DGH) Features

Feature	Details
Penetration	Occupied an estimated 16% of Australian homes in 2012 and ~42% of total gas heating penetration.
Connected units	~1 million in 2009 of which ~800,000 were in Victoria, ~80,000 in NSW and ~50,000 in ACT.
Annual unit sales	50,000 – 55,000 units.—New homes builder market 50%; Renovations making up 20% to 25%; Replacement in existing homes 25 to 30%
Useful/ technical life	Technical; ~20 years/ average replacement 13 years
Historical growth	2005-2008: 0.2% p.a.
Growth	This growth is largely due to the growth in the stock of gas ducted heaters in Victoria with less material growth in ACT, WA, SA and NSW (in order of growth rate).
Growth drivers	Rate of new sales (cumulative stock) Level of use (climatic factors)
Efficiency	Efficiency (low to mid efficiency units 65-80% efficiency vs high efficiency up to 95%)
Competition	The growth in air conditioner sales is assumed to have impacted on DGH sales, as ownership numbers of air conditioners have more than doubled in the last ten years and the vast majority of these sales are of reverse cycle units that can be used to supply room heating.
Gas Consumption	Consumption is expected to increase from 63 PJ in 2012 to 80 PJ p.a. by 2034. In 2012 DGH systems consumed an estimated 75% of the energy used in residential heating by gas.

Figure 5.4 R&C Gas Demand by Appliance | %



Source: Core Energy

5.2.1.2 Space Heating

Gas space heaters can be either radiant or convection, permanent or portable, flued or flueless. The Australian Standard AS 4553-2008 defines a number of space heater types, including:

- Convection heater–an appliance with an effective output of heated air and no visible source of radiation.
- Radiant convection heater–an appliance with an effective output of both radiation and heated air.
- Radiant heater–an appliance with an effective output mainly in the form of radiation.
- Wall heater or wall furnace–a flued convection heater designed for installation external to a wall, or partly or wholly inside the room wall.

Table 5.3 Gas Space Heating Features

Feature	Details
Household penetration	Approximately 25% of households in 2012
Connected units	~1.9M 2008
Annual unit sales	~70,000
Useful/ technical life	Technical; ~20 years/ average replacement 13.4 years
Growth trend	The decrease in energy consumption is largely due to the decreases in the stock of gas space heaters, especially of wall furnaces (partly due to the increased penetration of gas ducted heaters and reverse-cycle air conditioners). The declining use of non-ducted space heating is most obvious in Victoria where the proportion of households with non-ducted gas space heating declined from 40.1% in 1999 to 31.2% in 2008. The same data also shows that the proportion of those households in Victoria with ducted gas heating increased from 31.5% in 1999 to 40% in 2008. The overall stock of gas space heaters is projected to decline from 1.9M units in 2008 to 1.3M units in 2020. The stock of certain categories, such as decorative appliances, balanced flue convection and flued radiant/convection heaters is projected to increase over this period.
Competition	The growth in air conditioner sales is assumed to have impacted on DGH sales, as ownership numbers of air conditioners have more than doubled in the last ten years and the vast majority of these sales are of reverse cycle units that can be used to supply space heating. Low carbon price favours electricity.
Gas Consumption	Unit consumption is variable but as a guide ~25 MJ/hour for a 7 kw unit. Victoria average close to 600 hours per year –15 GJ p.a. per unit, less in other regions other than ACT. Consumption is expected to fall from ~20 PJ in 2012 to 15 PJ p.a. by 2034. In 2012 space heating systems consumed an estimated 25% of the gas used in residential heating.

5.2.2 Water Heating

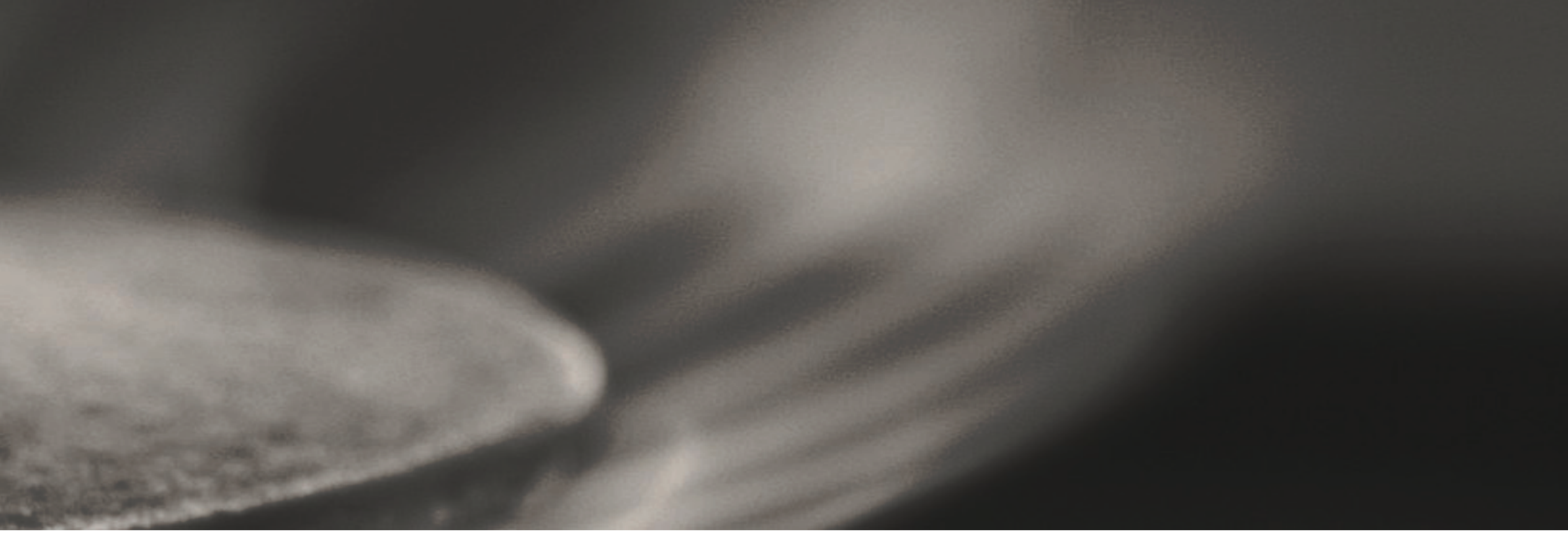
Consumers face a range of choices when purchasing a water heating system including solar, heat pump and gas.

Gas heaters benefit from a range of factors including instantaneous heat, energy efficiency, associated low carbon intensity and competitive cost.

Table 5.4 Water Heating Features

Feature	Details
Household penetration	Under Expected gas demand scenario penetration increases marginally from 42% of households in 2009 to 44% in 2020.
Connected units	3.4 Million in 2009
Annual unit sales	294,000
Useful/ technical life	Technical life ~15 years; average replacement ~13 years
Growth	3.5 million in 2009; 4.4 million in 2020.
Growth trend	Trend away from electric water heating, increasing distribution of reticulated gas, the electric water heater phase out and the introduction of BASIX in NSW. Sales of gas instantaneous water heaters have grown since the mid-1990s and now form the majority of sales of gas water heaters.
Competition	Solar water heaters; Heat pump units supported by policy
Gas Consumption	5 star instantaneous 50 litres per day 5 GJ p.a., 200 litres, 20 GJ p.a.

6. GAS NETWORK DEMAND DRIVERS



This Section presents a summary of the major drivers of gas Network sector demand, with a particular focus on gas price and policy.

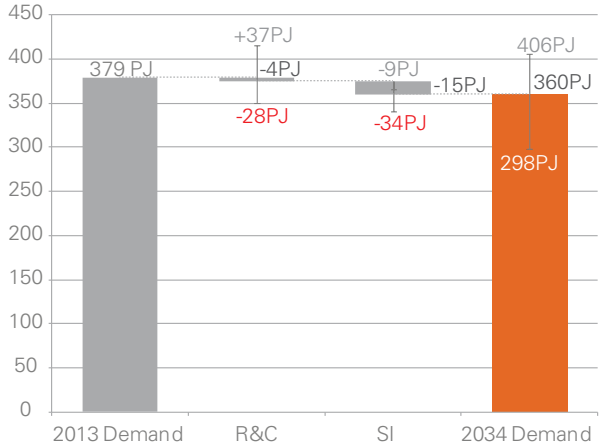
6.1 Introduction

CORE has undertaken an analysis of all factors which have the potential to materially influence Network demand during the period to 2034.

Figure 6.1 presents a summary of CORE's analysis. From a base level of demand of 379 PJ in 2013 CORE projects that total Network demand has the potential to rise to 406 PJ under favourable circumstances or fall to 298 PJ under unfavourable circumstances. Three primary types of demand driver have been considered by CORE:

- The continuing influence of factors which have driven the historical trend in Network demand over recent years.
- The impact of projected price increases in eastern Australia (not observable in the historical trend).
- The impact of potential change in energy policy on future network demand (outside of levels observed in the historical trend).

Figure 6.1 Impact of Demand Drivers



Source: Core Energy

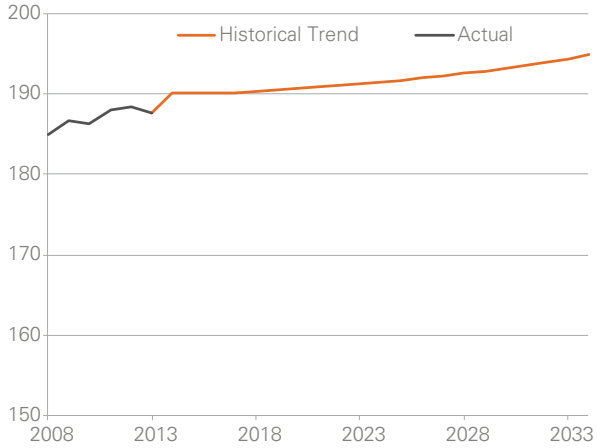
The focus of this section of the report is on the R&C segment.

6.2 R&C Segment

6.2.1 Continuation of Historical Trend

CORE has undertaken a statistical analysis of historical demand observed by each gas network in Australia (excluding NT) over recent years (comprising the trend in connections and demand per connection) to derive a baseline demand trend. The trend varies between States and individual networks within State boundaries, but is presented as a national composite trend for ease of reference. The baseline national Network demand grows at a CAGR of 0.2%.

Figure 6.2 Historical Trend Change in Demand | PJ



Source: Core Energy

Factors influencing connections:

- Population growth
- Dwelling completion rates
- Policies influencing energy substitution/consumer preferences

Factors influencing demand per connection:

- Price of energy alternatives
- Economic factors
- Appliance and building efficiency policies
- Policies influencing energy substitution

In essence, the historical trend represents the rate of change in demand that would be observed if no change in demand influences took place during the 2014 to 2034 time frame.

The following paragraphs address factors which have the potential to change this trend.

6.3 Price Related Factors

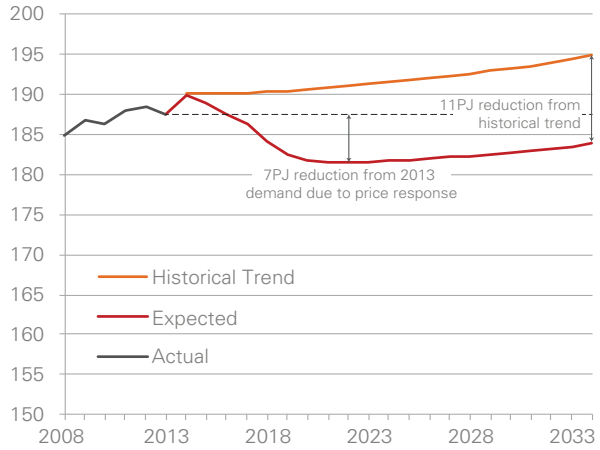
The price impact analysis undertaken by CORE has focused on the eastern Australia gas Networks sector on the basis that future price increases are expected to be material in eastern Australia and less material in WA.

CORE has assessed the Price Impact by applying price elasticity variables against forecast price increases. The price elasticity factors applied are supported by AER and other precedents, and the price increases assumed are based on detailed analysis by CORE and are also broadly consistent with those addressed in a recent IPART retail price review and prices projected by other third party experts. Further details of the assumptions relied upon to derive this price impact are included in Section 6.3.1.

The resultant Price Impact for the R&C segment is presented in the Figure 6.3. By 2034 CORE estimates that total Expected R&C demand will fall by approximately 7 PJ or 3.7% of eastern Australia R&C Network demand in 2013 due to pricing impacts, with the majority of the impact during the period prior to 2020.

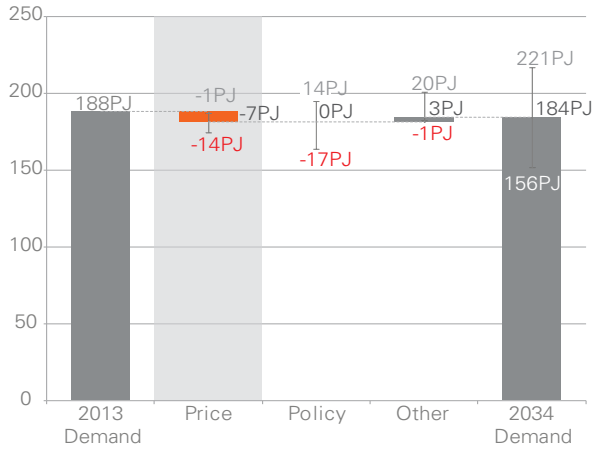
CORE has also considered High and Low price sensitivities to illustrate the full range of potential outcomes. Figure 6.4 illustrates the results of this analysis. The downside impact is attributable to an assumed price of AUD8.50/GJ in real terms and a higher assumed elasticity factor (see Attachment 2).

Figure 6.3 Impact of Price on AUS Gas Demand | PJ



Source: Core Energy

Figure 6.4 Impact of Price on R&C Gas Demand | PJ



Source: Core Energy

6.3.1.1 Price Assumptions

The following tables summarise CORE price assumptions. The wholesale gas price in eastern Australia is expected to increase from AUD4 to AUD8/GJ in real terms (see Table 6.1). In addition gas and electricity prices are projected to vary, in relative terms, by over 30% in the non-residential segment and over 25% in the residential segment.

Table 6.1 Summary of Wholesale Gas Cost Projections | Real AUD/GJ 2014

Retail Price Component	2014	2015	2016	2017	2018	2019	2020
Wholesale Cost (ex-field)	4.00	5.00	5.00	6.00	8.00	8.00	8.00

Source: Core Energy

Table 6.2 Retail Gas and Electricity Price Projections | Real % change

Change in Retail Bill	2014	2015	2016	2017	2018	2019	2020
Residential							
Gas	6.91	6.78	-3.40	1.57	4.07	-0.89	-0.88
Electricity	-2.19	0.11	-7.34	0.00	0.00	0.00	0.00
Differential	9.10	6.67	3.94	1.57	4.07	-0.89	-0.88
Cumulative Differential	**9.10**	**15.80**	**19.70**	**21.30**	**25.30**	**24.50**	**23.60**
Non-Residential							
Gas	6.91	8.15	-4.78	3.70	7.93	-0.69	-0.68
Electricity	-2.19	0.11	-7.34	0.00	0.00	0.00	0.00
Differential	9.10	8.04	2.56	3.70	7.93	-0.69	-0.68
Cumulative Differential	**9.10**	**17.14**	**19.70**	**23.40**	**31.33**	**30.64**	**29.96**

6.3.1.2 Price Elasticity of Demand

CORE has derived a forecast of the impact on gas demand of expected changes in absolute gas prices and gas price relative to electricity prices. The results of the analysis are summarised Table 6.3 below. The result is an 0.7% reduction in demand on a CAGR basis between 2014 and 2034.

Table 6.3 Price Elasticity Impacts | Real % change

Price Elasticity	2014	2015	2016	2017	2018	2019	2020	CAGR (%)
Residential								
Own Price	-2.4	-2.4	-0.5	-0.5	-0.8	-0.4	-0.3	-0.5
Cross Price	0.4	-0.1	-1.0	0.0	0.0	0.0	0.0	-0.2
Total	**-2.0**	**-2.5**	**-1.5**	**-0.5**	**-0.8**	**-0.4**	-0.3	-0.7

Attachment A.3 presents a detailed analysis of price elasticity of demand.

6.4 Policy Related Factors

6.4.1 Overview

CORE has undertaken an analysis of the impact of policies on Network demand with a particular focus on the R&C segment. These policies include:

- RET/SRES Policy
- Rebates/Incentives
- Sustainability Policy
- Building efficiency
- Appliance efficiency

Attachment A.4 provides a summary of the Federal and State policies which have a material influence on Network demand (both past and present).

Figure 6.5 presents a summary of the High to Low range of policy-related R&C demand outcomes.

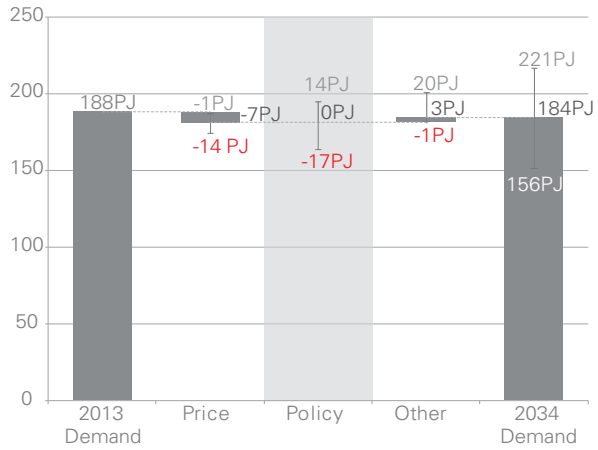
Further details are provide in the following Sections.

6.4.2 RET/SRES

CORE has focused SRES analysis on the impact of solar water heating. CORE has developed both Low Solar Impact and High Solar Impact sensitivities.

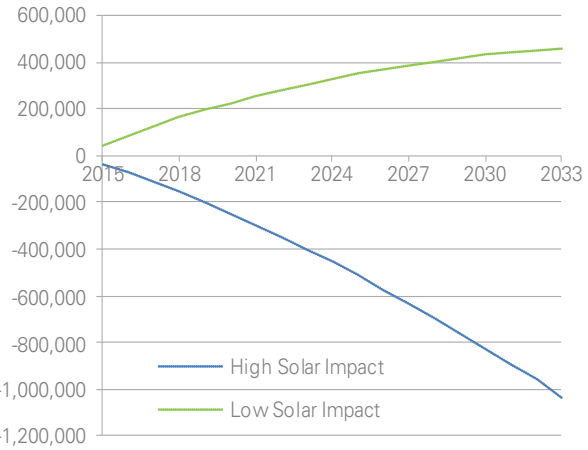
- Low Solar Impact
  - > Assumes a low level of policy support for the solar sector and a resultant higher growth in gas demand – 400,000 of the total solar connections under the Expected Demand scenario are assumed to become gas connections (representing 6% of total gas connections as at 2034). At an assumed 10 GJ per connection this represents 4 PJ of demand growth by 2034 (see Figure 6.6 and 6.7). The lower limit is consistent with the growth in solar sector observed over recent years (under favourable policies and incentive programs).
- High Solar Impact
  - > Assumes a high level of policy support for the solar sector and a resultant lower growth in gas demand – a total of 1.15 million potential gas connections are assumed to be lost to the solar sector (representing 18% of total gas connections as at 2034). At 10 GJ per connection this represents 11.5 PJ of demand growth by 2034 (see Figure 6.6 and 6.7). This assumes that a program similar in nature to the proposed Million Solar Roof program is introduced, and a return of incentive mechanisms.

Figure 6.5 Impact of Policy on R&C Demand | PJ



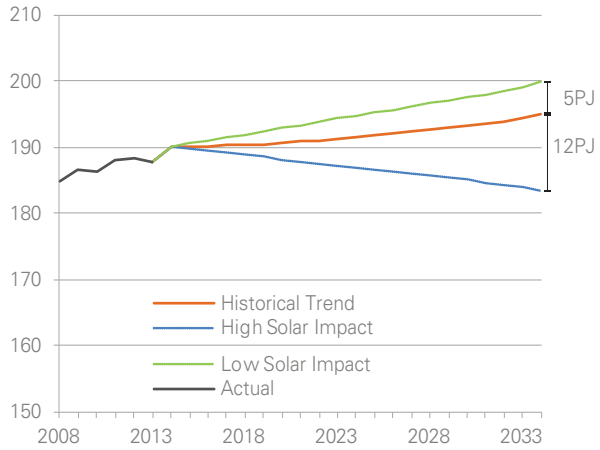
Source: Core Energy

Figure 6.6 Impact of Solar Policy on Connections



Source: Core Energy

Figure 6.7 Impact of Solar Policy on Demand | PJ



Source: Core Energy

6.4.3 Rebates/Incentives

In order to illustrate how policy influences gas demand CORE has undertaken an analysis of the full life cycle cost of a range of water heating appliances.

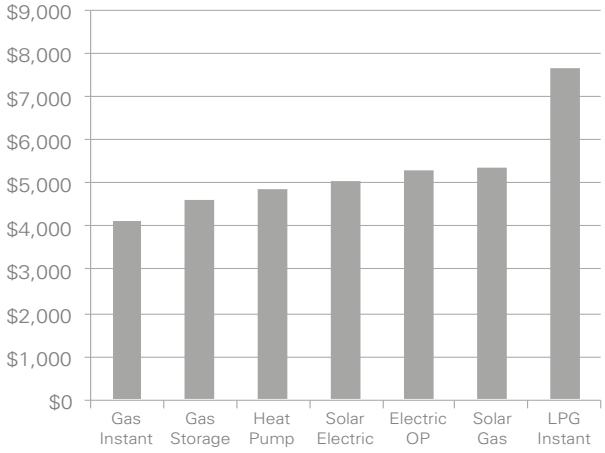
Figure 6.8 illustrates the full life cycle cost of the water heating appliances without any form of policy impact. The figure shows that instantaneous gas appliances are the lowest cost alternative. However, if rebates are provided to a selection of certain appliances, the relative cost to a consumer changes.

Figure 6.9 illustrates that a rebate for solar and heat pump appliances causes them to become competitive with instantaneous gas.

A further illustration of the impact of policy, is in the area of solar PV, which acts to reduce gas and electricity use.

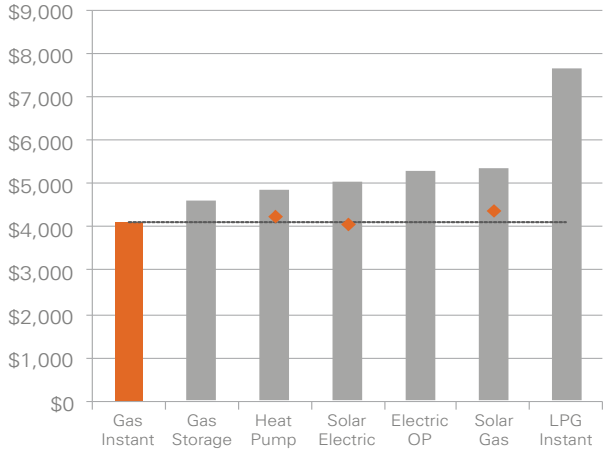
Table 6.4 illustrates that the excess cost of power from solar PV was AUD6.7bn to the end of February 2014.

Figure 6.8 Water Heating Cost | No Incentives



Source: Clean Energy Council

Figure 6.9 Water Heating Cost | With Rebates



Source: Clean Energy Council

Table 6.4 Economic Welfare Losses Due to Solar PV

Average subsidy-free cost of installed PV 2009-2013	$3,600/kW
Annual average capital city PV output	1,500kWh
True value of PV based on escalated 8c/kWh, 25 year life and 8% discount rate	$1,500/kW
Installed domestic PV to Feb 2014	3,200 MW
Excess cost of power from solar PV ($2.1 million/MW*3,200 MW)	$6.7bn

Source: Frontier Economics, reviewed for reasonableness by CORE

6.4.4 Sustainability

There are a range of Federal and State policies with a sustainability focus (both energy and water). The impact of such measures on gas demand is variable, from positive to negative.

An example of a major program is the BASIX program in NSW.

Whilst CORE does not advocate a dilution of such policies - it is simply referenced to highlight each element of the complex 'puzzle' which is impacting Gas Network demand.

6.4.5 Building Efficiency

This category of policies directly targets improvement in building efficiency in order to reduce National and/or State energy intensity; generally by targeting a reduction in energy use per unit of floor area.

An example is NABERS - a national rating system that measures the environmental performance of Australian buildings, tenancies and homes. Put simply, NABERS measures the energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy and its impact on the environment.

NABERS has now been used to rate 72% of Australian office space. Office buildings using NABERS to regularly measure their performance have reported an average improvement in energy efficiency of 8.5%.

6.4.6 Appliance Efficiency

This category of policies directly targets improvement in appliance efficiency in order to reduce National and/or State energy intensity; generally by targeting a reduction in the level of energy input to deliver a defined level of energy output (refer example provided in Table 6.5).

Table 6.5 3 Star vs 4 Star Energy Rating Energy Efficiency

State	Estimated Saving (MJpa)	$ cost saving p.a.	PV of costs saving (20 years)	Payback (years)	Lifetime GHG savings (t CO_2-e)
NSW/ACT	8,512	$144.70	$1,475	2.8	12.1
QLD	1,920	$30.72	$313	13.0	2.6
SA	4,667	$60.67	$619	6.6	6.9
VIC	8,684	$95.53	$974	4.2	11.1
WA	3,692	$51.69	$527	7.7	4.5

Source: Equipment Energy Efficiency Program (E3)

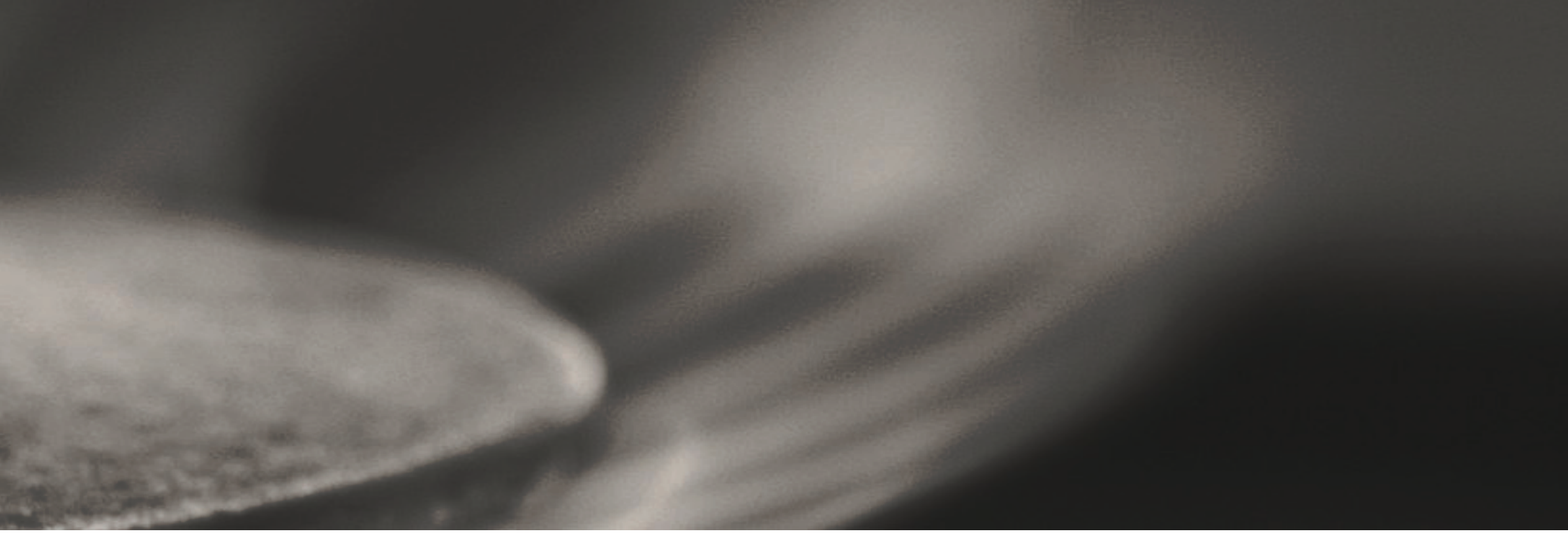
Table 6.6 Hours of DGH Use by State

Appliance	NSW/ACT	QLD	SA	TAS	VIC	WA
DGH	576	130	316	1,200	588	250

6.5 Other Factors

In addition to price and policy there are a range of other factors which CORE has found to influence gas Network demand. Collectively, these factors are projected to cause demand to increase gas demand by 3 PJ by 2034 under the Expected Demand scenario and to reduce demand by 1 PJ under the Low scenario. The most material potential movement is under the High scenario. The largest impact here is an assumed increase in population and housing (per Government scenarios) and a lowering of the efficiency of new appliances and buildings (due to diminishing technology and behavioural impact).

7. NETWORK DEMAND OUTLOOK



The objective of this Section of the Report is to provide a concise summary of the outlook for the Australian Gas Network Sector at a national level.

7.1 National Gas Network Demand

7.1.1 Total Network Sector Demand

Total National network demand (refer to Figure 7.1) is projected to fall under both Expected and Low scenarios and grow under the High scenario:

- decrease from 379 PJ to 360 PJ or a CAGR -0.2%, under the Expected scenario;
- increase from 379 PJ to 406 PJ or a CAGR 0.3%, under the High Gas Demand scenario;
- decrease from 379 PJ to 298 PJ or a CAGR -1.1%, under the Low Gas Demand scenario.

7.1.2 Network R&C Segment Demand

The R&C segment of the gas Networks sector is projected to fall under Expected and Low scenarios and grow under the High scenario (refer Figure 7.2):

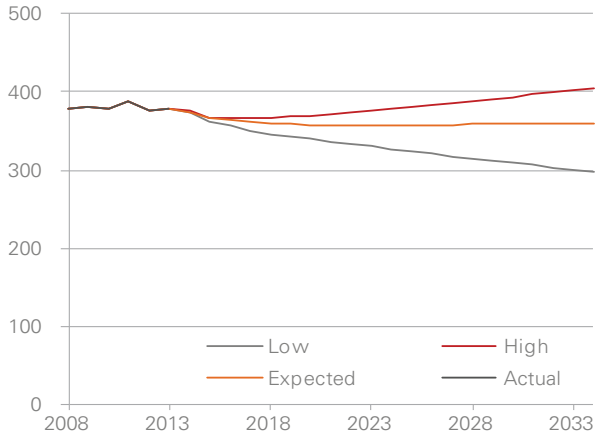
- decrease from 188 PJ to 184 PJ or a CAGR -0.1%, under the Expected scenario;
- increase from 188 PJ to 221 PJ or a CAGR 0.8%, under the High Gas Demand scenario;
- decrease from 188 PJ to 156 PJ or a CAGR -0.9%, under the Low Gas Demand scenario.

7.1.3 Network SI Segment Demand

SI demand (Refer Figure 7.3) is projected to fall from 2013 levels under all scenarios:

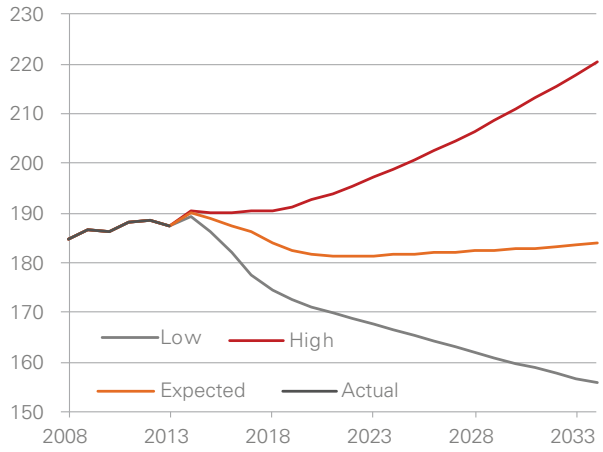
- decrease from 191 PJ to 176 PJ or a CAGR -0.4%, under the Expected scenario;
- decrease from 191 PJ to 185 PJ or a CAGR -0.2%, under the High Gas Demand scenario;
- decrease from 191 PJ to 142 PJ or a CAGR -1.4%, under the Low Gas Demand scenario.

Figure 7.1 Total National Demand by Scenario | PJ



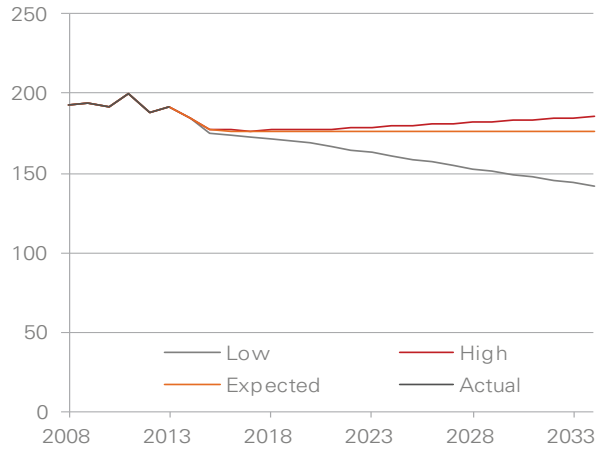
Source: Core Energy

Figure 7.2 R&C by Scenario | PJ



Source: Core Energy

Figure 7.3 SI Demand by Scenario | PJ



Source: Core Energy

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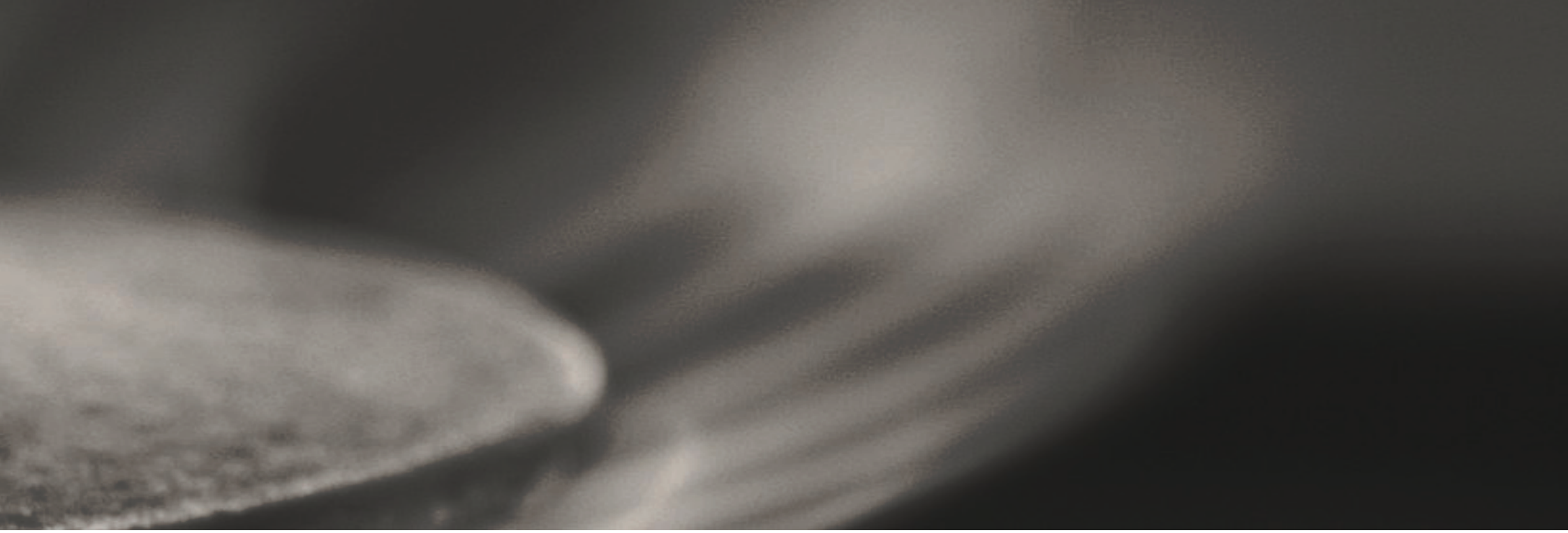
8. FINDINGS & IMPLICATIONS



This Section provides a summary of the CORE's assessment of the implications of projected movement in Network demand on Network tariffs and retail gas prices, carbon emissions and the broader impact on the Australian economy.

8.1 Key Findings | Demand Outlook

8.1.1 High Level of Demand Uncertainty

The gas Network sector faces a high level of uncertainty relating to future demand. This is due primarily to price and policy factors.

Figures 8.1 to 8.5 and Table 8.2 summarise the key quantitative results of this Study.

While it is Expected that demand will fall from 379 PJ to 360 PJ over the Study period, there is scope for this range to extend from a Low of 298 PJ and a High of 406 PJ by 2034.

The potential downside in demand is spread relatively evenly between the R&C and SI segments.

8.1.2 Price Influence

CORE estimates that projected increases in eastern Australia gas prices will result in a 7 PJ fall in demand by 2034, however there is potential for demand to fall by as much as 14 PJ if price rises are higher than expected and demand response is more severe than expected.

8.1.3 Policy Influence

CORE analysis highlights the material impact of energy policy on Network demand.

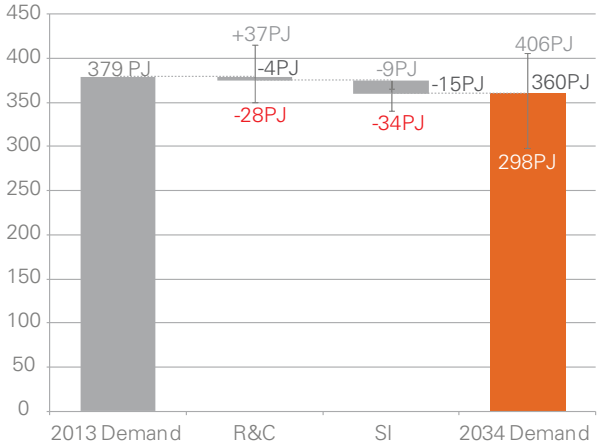
Two sensitivities have been developed to illustrate the impact of Positive and Negative policy influences relative to the Expect Demand scenario - refer Table 8.1 and Figures 8.4 and 8.5.

Under all scenarios policy is expected to reduce demand from 2013 levels:

- 15 PJ under the Expected scenario;
- 34 PJ under the Low scenario; and
- 9 PJ under the High scenario

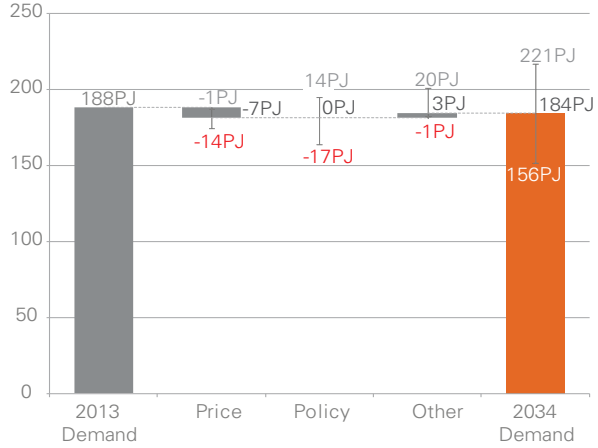
The implications of these findings are addressed in the following paragraphs.

Figure 8.1 Total Network Demand Range



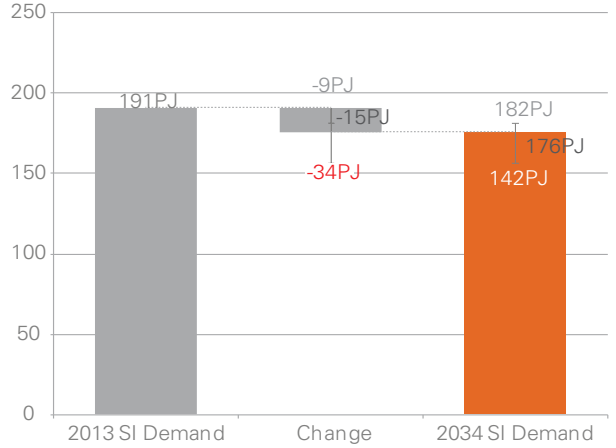
Source: Core Energy

Figure 8.2 R&C Demand Range



Source: Core Energy

Figure 8.3 SI Demand Range



Source: Core Energy

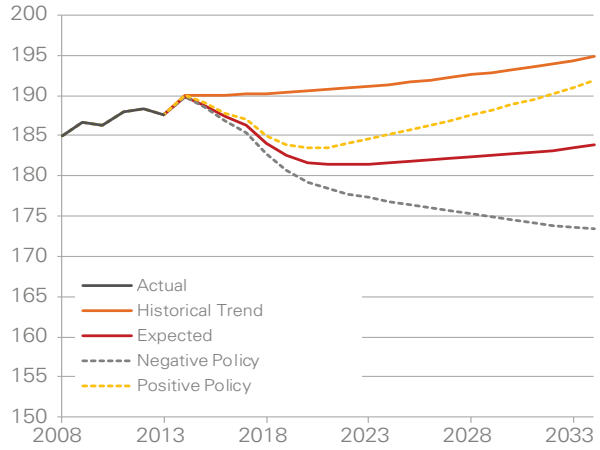
Table 8.1 Policy Scenarios

Range	Drivers
Low	▪ Low net connection rate in favour of solar and electricity. ▪ Water heating demand loss > Increased solar use > Water efficiency gains > Heat pumps penetration ▪ Room heating demand loss > R-C Air-conditioning - low/no carbon price > Building efficiency improvements
High	▪ Other jurisdictions adopt focused sustainability measures similar to NSW (BASIX) ▪ Increased net connection rate - gas competitive with solar and electricity ▪ Removal of SRES > Low solar competition > Modest heat pump competition ▪ Room heating > Gas growth > R-C Air-conditioning - higher carbon price ▪ Lower rate of building and appliance efficiency improvement.

Table 8.2 Scenario Results

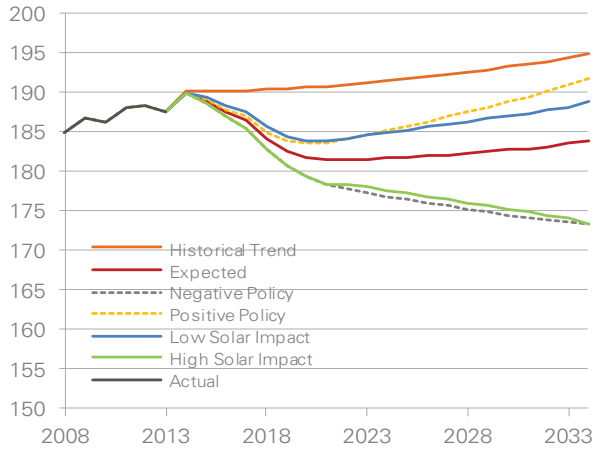
Total Australia (excl. NT)	2013 Actual	2034 Historical Trend	2034 Expected	2034 Low Policy Impact	2034 High Policy Impact
Number of R&C Connections (million)	4.57	6.23	6.23	6.1	6.41
Avg Residential Demand per connection (GJ)	33	24	22	22	23
Avg Commercial Demand per connection (GJ)	333	231	217	211	222
Total Demand (PJ)	**188**	**195**	**184**	**173**	**192**
Movement: 2013 actual compared against historical trend projection to 2034					
Number of R&C Connections (million)	-	1.7	1.7	1.5	1.8
Avg Residential Demand per connection (GJ)	-	-9.0	-11.0	-11.0	-10.0
Avg Commercial Demand per connection (GJ)	-	-102.0	-116.0	-122.0	-111.0
Total Demand Movement (PJ)	**-**	**7.0**	**-4.0**	**-15.0**	**4.0**
Movement: Historical Trend vs Expected and policy selectivities:					
Number of R&C Connections (million)	-	-	0.0	-0.1	0.2
Avg Residential Demand per connection (GJ)	-	-	-2.0	-2.0	-1.0
Avg Commercial Demand per connection (GJ)	-	-	-14.0	-20.0	-9.0
Total Demand Movement PJ)	**-**	**-**	**-11.0**	**-22.0**	**-3.0**

Figure 8.4 R&C Policy Range



Source: Core Energy

Figure 8.5 R&C Solar Impact



Source: Core Energy

Implications

CORE has undertaken an assessment of the implications of projected movements in gas network demand from three perspectives:

- Impact on future Network tariffs and retail gas prices.
- Impact on carbon emissions.
- Broader economic implications.

Impact on Network Tariffs and Retail Prices

Over the last five year period network tariffs have increased by approximately 50%. This increase is primarily attributable to large scale capital investment programs to replace and augment the Network pipelines, together with increases in operating cost.

Whilst annual capital expenditure by the Network sector is projected to reduce materially over the foreseeable future, there is scope for material increases in tariffs if unfavourable trends in demand are experienced, due to one or a combination of increased gas prices and the adverse impact of energy policy.

The following tables provide a guide to the potential impact of the High and Low Demand outcomes on both Network tariffs and retail prices under a Price + Policy impact and Policy impact only scenario.

- Table 8.3 illustrates the combined impact of price and policy movement:
  - Under both the Expected and Low gas scenarios, Network tariffs are projected to cause retail prices to rise materially above CPI (1.9% to 8.2%) and under the High gas scenario, retail prices will fall by -3.5% below CPI (-0.15% on a CAGR basis).
- Table 8.4 illustrates the impact of policy alone:
  - Under the Expected scenario, there is no impact on Network tariffs and retail prices. Under the Low gas scenario, the increase in Network tariffs will result in retail prices rising over 4.5% in real terms and under the High gas scenario, retail prices will fall by over 3.7%in real terms.

This analysis assumes that all other factors influencing network tariffs remain constant. Therefore a projected movement in demand translates to an equivalent percentage movement in tariffs. Further Network costs are assumed to continue to represent 50% of a retail gas bill. Therefore 50% of the projected increase in Network tariffs will equate with the projected percentage increase in retail prices.

Table 8.3 Price and Policy Impact Analysis

Range	Demand Movement | PJ	Tariff Impact | %	Retail Price Impact | %
Expected Gas Demand	- 7	3.72%	1.86%
Low Gas Demand	-31	16.5%	8.24%
High Gas Demand	13	-6.91%	-3.46%

Table 8.4 Policy Only Impacts

Range	Demand Movement | PJ	Tariff Impact	Retail Price Impact
Expected	0	0.00%	0.00%
Low	-17	9.04%	4.52%
High	14	-7.44%	-3.72%

Implications (continued)

Impact on Carbon Emissions and Cost of Abatement

CORE has undertaken an analysis of policies which favour solar energy over gas to determine the impact on the abatement of carbon emissions.

Whilst feed-in-tariff and rebate mechanisms have been largely withdrawn, the retention of a RET/SRES policy will continue to favour solar energy in the PV and solar hot water sectors at the expense of gas. Further there is a risk that policy positions change over time due to changes in political and/or economic circumstances.

To illustrate the impact on carbon emissions, CORE has derived an estimate of the level of gas demand that would be displaced by solar under a Negative Solar Policy and Positive Solar Policy scenario, relative to the Expected scenario. Further CORE has derived an estimate to the cost of emission abatement to provide an understanding of cost/benefit.

Table 8.3 presents a summary of CORE's analysis.

- Under the Low gas scenario, gas demand will fall by 15 PJ, replaced by solar, which is expected to enjoy high growth and reduce carbon emissions by 900,000 tonnes p.a. by 2034 at an estimated abatement cost of $180 million p.a.
- Under the High gas scenario, gas will only increase 1 PJ above 2013 levels as the growth in market share will only just offset the projected fall in demand associated with gas price increases. This will cause emissions to increase by 60,000 tonnes relative to 2013 levels and thus a negligible cost of abatement (circa AUD2m at AUD40/tonne).

Table 8.5 Solar Impacts on Demand

Range	Demand Movement | PJ	Emissions Reduction | tonne CO_2e	Abatement Cost | AUD
Expected	-	-	-
Low	-15	900,000	$180m
High	1	-60,000	negligible

The analysis summarised in Table 8.5 relies upon the following assumptions:

- Solar is assumed to operate with zero emissions.
- Gas consumption at the household (as opposed to gas power generation) is assumed to emit 0.06 kg of CO_2-e per MJ.
- Solar abatement cost is assumed to be AUD200/tonne which has been referenced in prior Government evaluations and by independent consultants and reviewed by CORE for reasonableness.

Implications (continued)

Broader Economic Implications

CORE has undertaken a high level analysis of the economic contribution of the gas industry as a whole and the Network sector specifically.

The facts which relate to the industry as a whole are presented for completeness purposes and to provide a broad perspective of energy policy impact.

CORE's view is that economic and policy analysis is often focused too narrowly and loses sight of important linkages between related sectors of the economy. In CORE's view it is critical that energy policy is analysed from the widest practical perspective, to ensure that unintended consequences are avoided or promptly addressed.

In CORE's opinion gas has the potential to play a central role in reshaping Australia's energy mix. Nevertheless CORE acknowledges that gas must demonstrate an ability to compete without policy favour. At the same time other energy sources which receive favoured status will render gas less competitive in key market segments and this will diminish the ability of the gas industry to deliver its full value add potential.

Further CORE believes it is critical to understand the long investment lead time in the gas industry. The term from larger scale activity, from exploration to gas delivery will fall within a 5 to 10 year time frame. Therefore any action which stifles development is likely to be felt for up to a decade.

Key aspects of the industry and Network sector contribution to the economy follow:

Energy Supply

- The Network sector delivers 40% of the gas consumed in Australia to approximately 4.5 million residential consumers and over 120,000 commercial and industrial enterprises.
- Gas delivered to retail customers has a value approaching AUD5bn per annum.

Investment

- The Network sector operates assets with an estimated cost base of approximately AUD9bn and has invested almost AUD3bn during the latest five year access arrangement period.

Gross Domestic Product/Value Added

- The oil and gas industry as whole directly and indirectly accounted for approximately 2.0% of GDP, or approximately $30 billion of value added in 2013 and is projected to grow toward $70 billion by 2020.
- The domestic gas sector is estimated to contribute close to 10% of total industry value add and the Network sector, as shown above, is a critical element of this sector.

Employment

- The oil and gas industry will employ approximately 95,000 Australians on full time equivalent (FTE) basis in 2014, during an active project development phase, before reducing to more permanent workforce of approximately 15,000 FTE's.

This analysis serves to highlight the economic significance of the gas industry and Network sector and the need for an energy policy framework which will ensure that economic contribution is optimised.

CORE analysis of the economic impact of a reduction in gas Network sector activity from 2013 trend levels to 2034 projected levels under the Low Demand scenario is summarised as follows:

- Loss of up to 400,000 gas customers.
- Gas retail costs which move toward the upper end of the projected range for OECD economies.
- Increase in Network costs of 17% in real terms and retail costs of close to 10% in real terms.
- Potential reduction in annual Network sector revenues of >AUD1bn and retail sales revenues of over AUD2bn with material consequences for government tax receipts.
- Potential reduction in annual direct and indirect capital investment of up to AUD200m per annum.
- Potential reduction in direct and indirect employment (FTE's) of >200.
- Potential loss of economic value (NPV of projected loss in profits): >AUD1.5bn.

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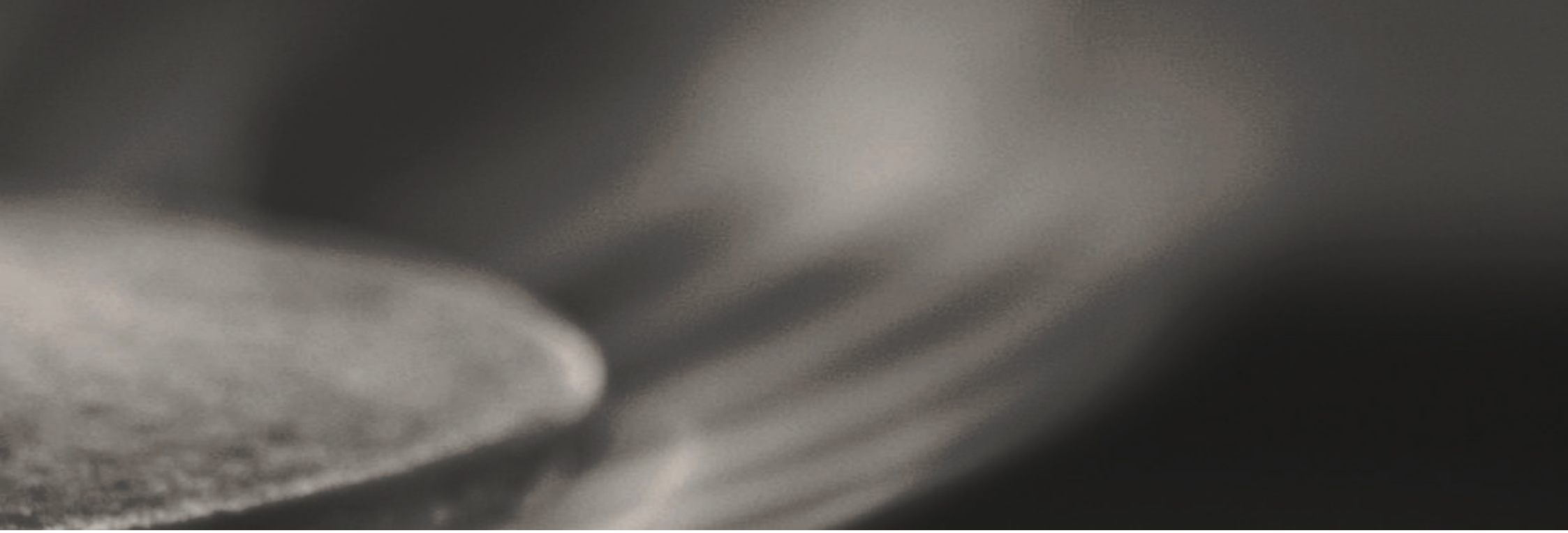
9. CONCLUSIONS



This Section provides a summary of the CORE's major conclusions arising from the study of demand within Australia's gas Network sector between 2014 to 2034.

Conclusions

Natural gas is an abundant, reliable and cost effective energy source, which makes a material contribution to Australian living standards and economic activity more broadly.

- Gas is the only existing large scale energy alternative to electricity in the stationary energy sector, and thus plays an important role as a competitive alternative energy source within Australia's energy market.
- Gas is used over 4.5 million households and more than 120,000 commercial and industrial enterprises.
- Federal Government estimates indicate a gas resource base which could support domestic demand for at least fifty years.
- Natural gas has the potential to provide more than 30% of Australia's future energy requirements.
- The LNG sector is poised to become the largest export sector in Australia and is projected to remain in this position for over 20 years.
- The gas sector is a major contributor to economic activity in terms of Government tax and royalty revenue, cost-effective input to industrial activity, capital investment, exports/balance of trade and employment.

Natural gas has the potential to play a key role in meeting Australia's GHG emission reduction targets.

- Gas used directly by household or commercial enterprises displaces carbon-intensive electricity, which is the major contributor to Australia's high carbon intensity per capita.
- For electricity generation purposes, gas is up to 80% less carbon intensive than coal-fuelled electricity.
- CORE modelling demonstrates that gas can play a lead role in achieving sustainable level of GHG emissions at a globally competitive cost of abatement, through direct household and business use and progressive replacement of coal-fired electricity generation capacity.

The gas Network sector plays a critical role within the natural gas value chain and Australia's integrated energy system.

- Gas Networks contribute to the maintenance of Australia's high living standards by delivering reliable and cost effective energy for essential water heating, room heating and cooking applications.
- The Network sector provides a transport link between gas suppliers and over 4.5 million households, and more than 120,000 commercial and industrial enterprises.
- Approximately 40% of Australia's domestic gas consumption is delivered by the national gas Network system.

Major benefits can be derived through economies of scale.

- The gas Network segment is characterised by large scale investment in long term capital with significant fixed costs.
- Maintaining a minimum scale of throughput is critical to realising economies of scale or avoiding diseconomies.
- All other things equal, any reduction in gas Network demand will flow through to an equivalent % increase in the regulated Network tariff.

Material wholesale gas price rises are virtually certain to take place in eastern Australia , which will cause gas Network demand to fall materially from 2015 with adverse consequences for Network tariffs.

- Gas prices in eastern Australia are projected by CORE to increase from close to AUD4/GJ today toward AUD8/GJ (and potentially above) between 2015 and 2018.
- Both business and household consumers are expected to reduce consumption in response to these price increases. CORE estimates that gas Network demand could fall be up to 10% by 2020 due to wholesale price movements alone.
- The ability of gas networks to compete against energy alternatives, will depend largely on future wholesale prices and energy policy measures, given that major capital programs have been largely completed.

Conclusions

Any policy measures which have an adverse impact on gas demand will have a compounding impact on gas Network tariffs and retail gas prices.

- CORE analysis indicates that adverse policy measures could result in a further 10% reduction in gas demand over the next 20 year period, which would result in a further 10% increase in Network tariffs, all other things equal.

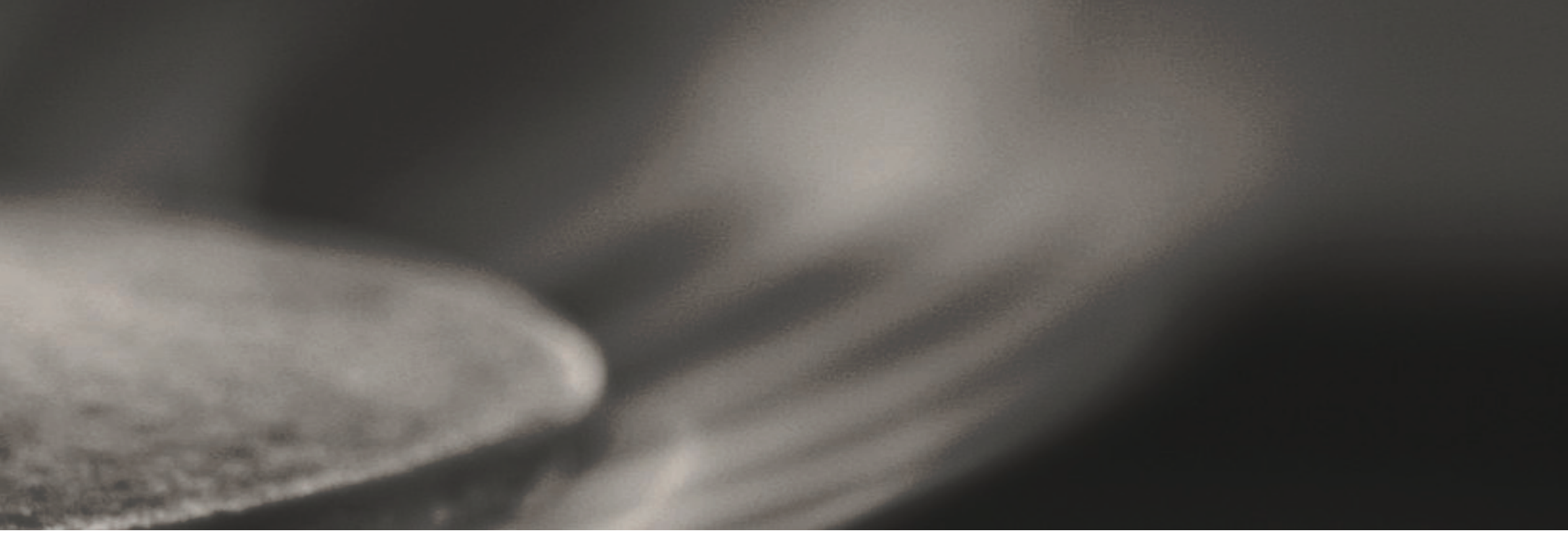
The coincidence of price increases and any adverse policy measures will cause gas to be materially disadvantaged relative to alternative, policy-favoured energy sources.

- A combination of unfavourable wholesale prices and adverse policy measures will translate to a 20% reduction in gas Network demand.
- All other things equal, such an increase in gas Network costs will cause retail prices to increase by 10% in real terms by 2034.
- An increase in gas prices by 10% will place gas at a significant disadvantage to two major competitive energy sources:
  - Renewable energy, which receives strong energy policy support.
  - Electricity, which is receiving indirect policy support in that it is not subject to the full cost of its high level of carbon emissions.

The gas Network sector is at an important 'cross-road'. Stabilisation and reversal of negative demand trends must be addressed as a priority to ensure Australia enjoys globally-competitive gas prices.

- Australia's gas prices have been at the lower end of the range of developed nations for many years. However, fundamental changes in cost structure are now in play that could rapidly move Australia's position toward the upper end of the international cost curve.
- The gas sector broadly and the Network sector specifically must address ways to minimise further cost increases in order to remain competitive, at both nationally and international level.
- For the gas Network sector the key to minimising tariff increases will be sustained growth in demand.
- Policies which provide a demonstrable advantage to alternative energy sources should be addressed as a matter of high priority.

10. VALIDATION



This Section provides third party projections to validate CORE's demand projection scenarios to 2034.

10.1 Validation

Various third party demand projections have been used as a cross-check against CORE's gas demand projection scenarios to 2034. This Section should be read in conjunction with the Demand Validation tab of the Gas Market Databook.

Validation of CORE's demand projections were performed on two levels; the market as a whole and the R&C segment alone. The majority of third parties provide demand projections for the total domestic market only. Figures 10.1 and 10.2 provide a comparison of CORE's projections of Eastern Australia and Western Australia overall gas demand against third party projections. Figure 10.3 provides a comparison of Eastern Australian R&C demand against the AEMO GSOO's Mass Market demand projections.

CORE has not identified any reasons to vary its forecasts following an analysis of third party projections.

Figure 10.1 East. Aus. Domestic Gas Demand | PJ

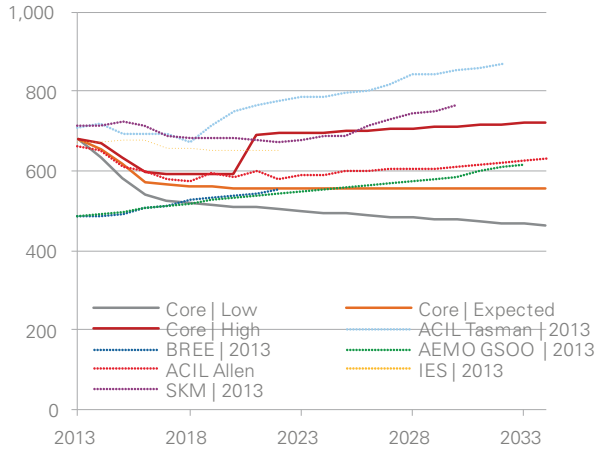


Figure 10.2 WA Domestic Gas Demand | PJ

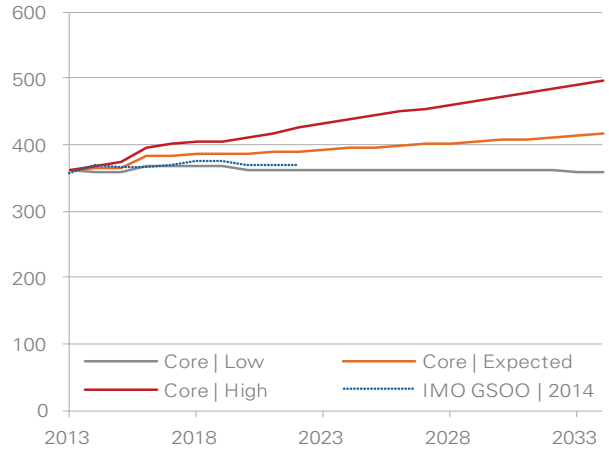
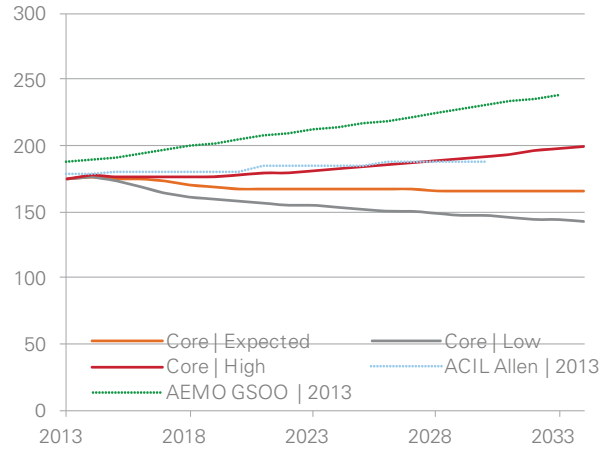


Figure 10.3 East. Aus. R&C Gas Demand | PJ



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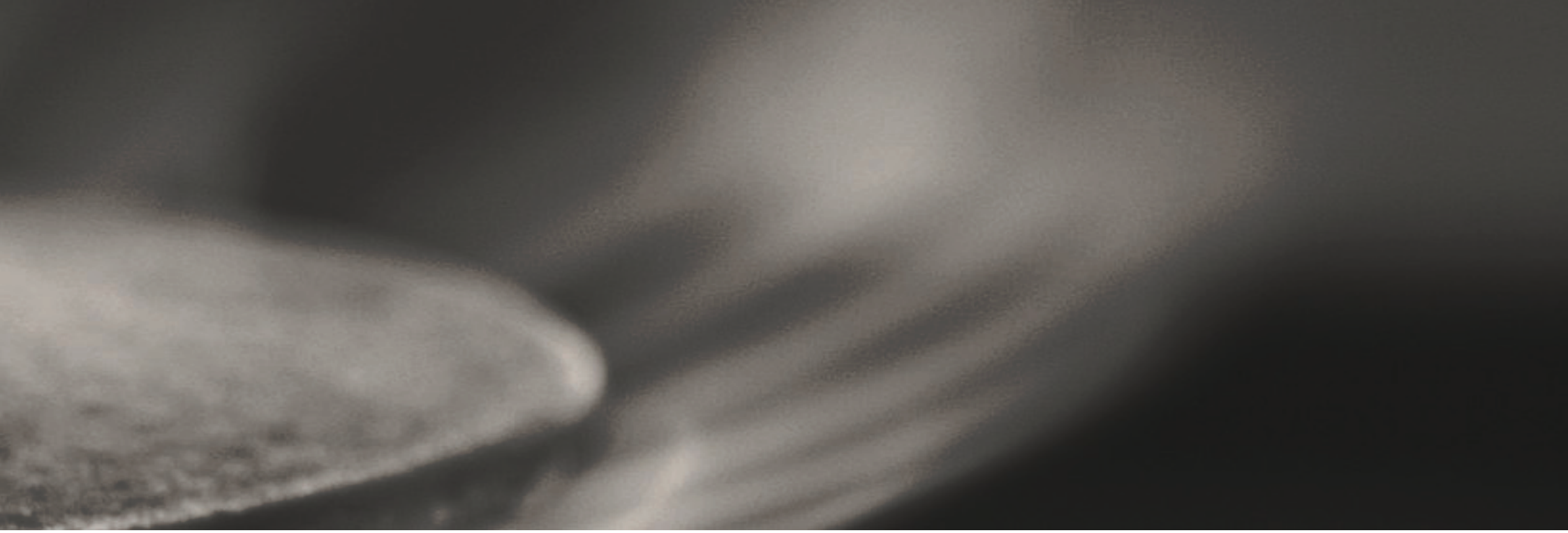
A.1 DEMAND ASSUMPTIONS



The Attachment presents details of the demand assumptions relied upon to develop scenarios of future gas demand between 2014 and 2034.

Table A 1.1 Demographic, Macroeconomic and Pricing Assumptions

Driver	Low	Expected	High
Macro Drivers			
Population	Per ABS and State Government estimates	Per ABS and State Government estimates	Per ABS and State Government estimates
Dwellings	Per ABS and State Government estimates	Per ABS and State Government estimates	Per ABS and State Government estimates
Economic Growth	<2.0%	2.5% p.a.	>3.0%

Table A 1.2 Gas and Electricity Price and Price Elasticity Assumptions

Driver	Low	Expected	High
Price and Price Response			
Gas Prices	AUD8.50/GJ wholesale by 2018 Unchanged carbon price 2016+	AUD8.00/GJ wholesale by 2018 Half of current carbon price 2016+	AUD6.50/GJ wholesale by 2018 Zero carbon price 2016+
Price Sensitivity	High sensitivity to future price changes (unfavourable for gas demand) Own price elasticity: -0.35 Residential, -0.40 Non-Residential Cross price elasticity: 0.15 Residential and Non-Residential	Own price elasticity: -0.30 Residential, -0.35 Non-Residential Cross price elasticity: 0.10 Residential and Non-Residential	Low sensitivity to future price changes (favourable for gas demand) Own price elasticity: -0.25 Residential, -0.30 Non-Residential Cross price elasticity: 0.05 Residential and Non-Residential

Table A 1.3 Residential Demand Assumptions

Connections – Residential	Low	Expected	High
Disconnection Rate	Between 0.8% to 1.4%pa (Network specific) TAS disconnections commence in 2023 (new network)	Approximately 0.5%pa (Network specific). TAS disconnections commence in 2023 (new network)	Approximately 0.2% (Network specific). TAS disconnections commence in 2023 (new network)
Penetration Rate–Policy	Policy-driven fall in penetration rate of new households: VIC -11.5% NSW -10.5% SA -6.3% QLD -2.5% TAS -4.25% WA -11% ACT -4.25% Total decline in penetration rate applied as equal step-changes to 2020 then constant.	No change to penetration rate of new households: VIC 93.6% NSW 82.4% SA 72.4% QLD 10.9% TAS 35% WA 72.9% ACT 90%	Policy-driven fall in penetration rate of new households: VIC +1.2% NSW +6.5% SA +6.5% QLD +3.5% TAS +4.25% WA +6% ACT +4.25% Total growth in penetration rate applied as equal step-changes to 2020 then constant.
Demand per Connection – Residential	**Low**	**Expected**	**High**
Policy – Water Heating	Further decline in demand trend by -0.2%pa (i.e. a historical trend in usage of -1%pa moves towards -1.2%pa by 2020)	No change in demand trend	Increase to the trend in demand by +0.2%pa (i.e. a historical trend of -1%pa moves to -0.8%pa by 2020) Policies increasing gas attractiveness (e.g. gas hot water rebates) Solar policy impact reduced (RET repealed) Lower relative gas price
Policy – Room Heating	Further decline in demand trend by -0.2%pa (i.e. a historical trend in usage of -1%pa moves towards -1.2%pa by 2020)	No change in demand trend	Increase by +0.2%pa (i.e. a historical trend of -1%pa moves to -0.8%pa by 2020)
Policy – Cooking	No change in demand trend	No change in demand trend	No change in demand trend
Base Trend for new customers (improved building and appliance efficiency)	Same trend in demand as existing customers	30-60% of demand decline relative to existing customers (i.e. less severe due to newer appliances). The actual figures are network specific.	Between 90% of demand decline relative to existing customers to no decline.

Table A 1.4 Commercial Demand Assumptions

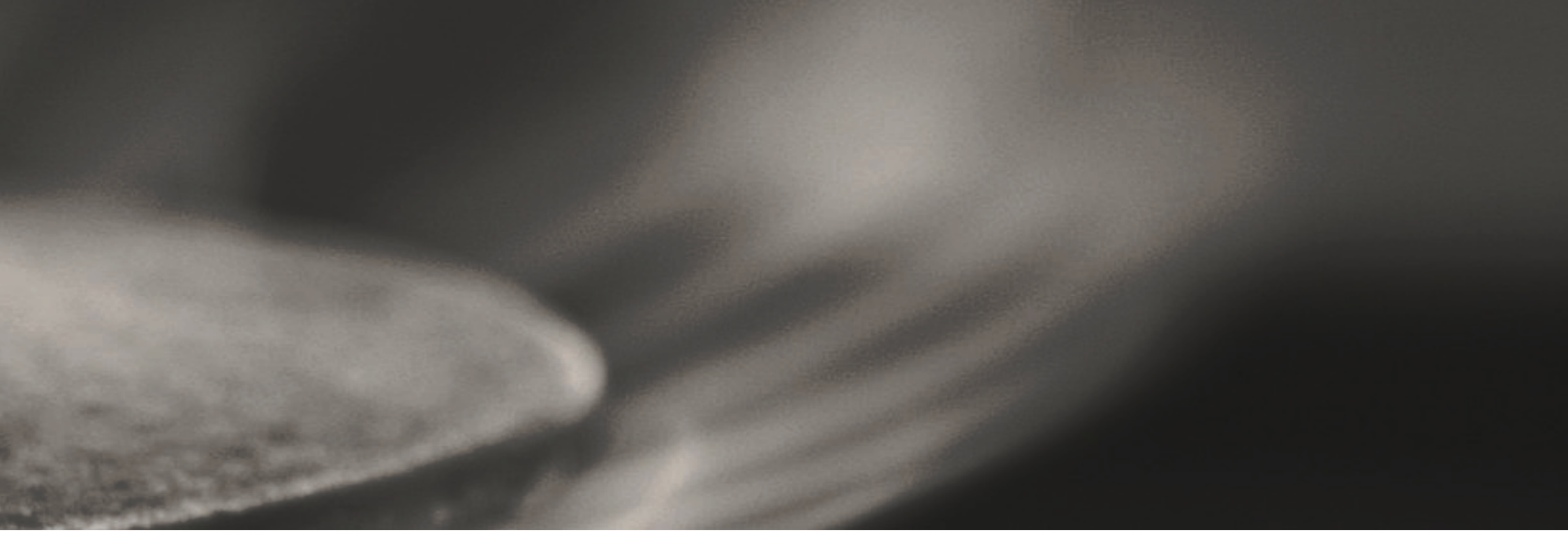
Connections–Commercial	Low	Expected	High
Disconnection Rate	0.5%pa	0.2%pa	0%pa
Growth in connections–Policy	Fall in the growth of connections of -0.1%pa by 2020 (i.e. connections growing at 1.5% will grow by 1.4%pa by 2020) room heating favoured based on price, efficiency policy repeals, hot water impacted by solar uptake).	No change in trend in connections	Increase in the growth of connections of +0.1%pa by 2020 (i.e. connections growing at 1.5% will grow by 1.6%pa by 2020) Lower relative gas price vs. electricity/solar.

Demand per Connection–Commercial	Low	Expected	High
Policy – Water Heating	Further decline in demand trend by -0.2%pa (i.e. a historical trend in usage of -1%pa moves towards -1.2%pa by 2020) Increased solar attractiveness (feed-in tariffs, rebates reintroduced) High relative gas price. Policy similar to Million solar roofs.	No change in demand trend	Increase to the trend in demand by +0.2%pa (i.e. a historical trend of -1%pa moves to -0.8%pa by 2020). Policies increasing gas attractiveness (e.g. gas hot water rebates). Solar loss of competitiveness (zero feed-in tariffs and rebates) Lower relative gas price.
Policy – Room Heating	Further decline in demand trend by -0.2%pa (i.e. a historical trend in usage of -1%pa moves towards -1.2%pa by 2020) Policies increasing efficiency standards (building, appliances)	No change in demand trend	Increase to the trend in demand by +0.2%pa (i.e. a historical trend of -1%pa moves to -0.8%pa by 2020). Policies increasing gas attractiveness (e.g. ducted gas rebates.
Policy – Cooking	No change in demand	No change in demand	No change in demand
Base Trend for new customers	Same trend in demand as existing customers	30-60% of demand decline relative to existing customers	Between 10% of decline relative to existing customers to no decline.

Table A 1.5 Small Industrial Demand Assumptions

Distributed Industrial	Low	Expected	High
ACQ	Low annual demand growth (energy efficiency initiatives, business rationalisation, cost reduction) VIC -1.5% NSW -1.5% SA -1.5% ACT -1.5% TAS -1.5% WA flat (i.e. any fall in demand will be offset by economic growth) QLD -0.5%	Generally flat annual demand growth (i.e. any fall in demand will be offset by economic growth): VIC flat NSW flat SA flat ACT flat TAS flat WA +0.25% QLD flat	High annual demand growth (higher industrial activity) VIC +0.25% NSW +0.25% SA +0.25% ACT +0.25% TAS +0.25% WA +0.5% QLD +0.5%
MDQ/MHQ	Low annual capacity growth (energy efficiency initiatives, business rationalisation, cost reduction) VIC MHQ -1.5% NSW MDQ-1.5% SA MDQ -1.5% ACT MDQ -1.5% QLD MDQ -0.5%	Flat annual capacity growth in all States (i.e. any falls through energy efficiency will be offset by economic growth):	High annual capacity growth (economic growth) VIC MHQ +0.25% NSW MDQ +0.25% SA MDQ +0.25% ACT MDQ +0.25% QLD MDQ +0.5%

A.2 GAS PRICE PROJECTIONS



This Attachment sets out details of CORE'S projection of gas and electricity price movements during the Study period, as a basis for estimating the extent of customer gas demand response to movements in absolute gas prices and gas prices relative to electricity prices (as an energy substitute - particularly for ducted and space heating).

A 2.1 Eastern Australia Wholesale Gas Price Projections

A 2.1.1 Introduction & Summary

The integrated eastern Australia gas system comprises the States of NSW, VIC, QLD, SA, TAS and the ACT.

In 2016 and 2017, several large, long standing gas contracts associated with gas supply from the Cooper Basin and Gippsland Basin respectively, come to an end. This is an important milestone as they are major supply sources for NSW and VIC customers and also represent a significant proportion of total gas supply into eastern Australia more broadly.

It is widely reported that this period of recontracting will witness a significant change in ex-field gas prices.

Core's forecast of ex-field gas prices is set out in Table A3.1.

Table A 2.1 Summary Wholesale Gas Price Projections | Real AUD/GJ 2014

Retail Price Component	2014	2015	2016	2017	2018	2019	2020+
Wholesale Cost (ex-field)	4.00	5.00	5.00	6.00	8.00	8.00	8.00

Source: Core Energy Group.

This Section of the Report sets out the basis for the Core forecast.

A 2.1.2 Approach

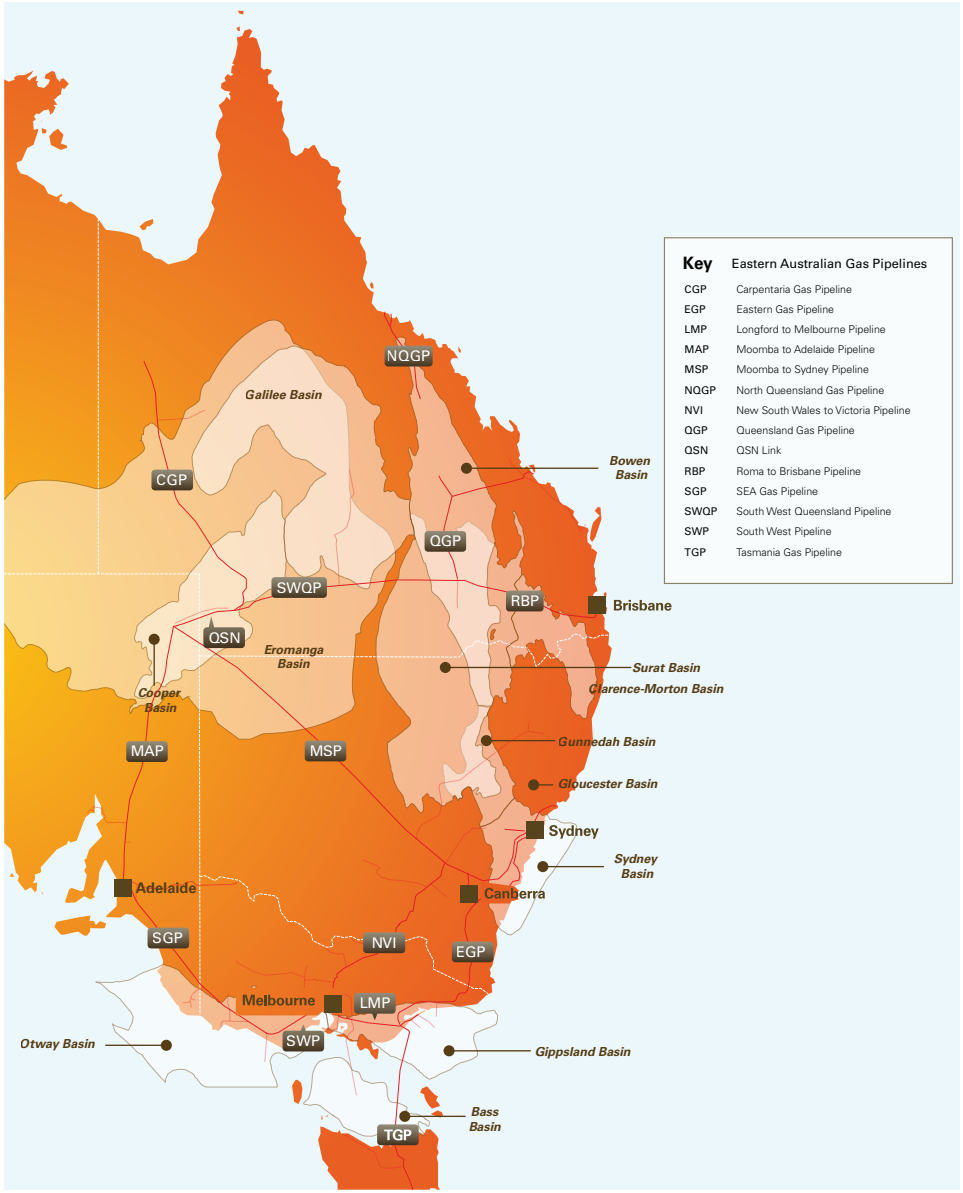
CORE has utilised its extensive databases and analytical systems to derive a projection of demand, supply, cost and price of gas over the Study period. This analysis develops scenarios of the lowest cost supply available to meet forecast uncontracted demand in each State, for all individual wholesale customers.

This methodology has been applied consistently by CORE for over a decade and has provided the basis for independent expert advice to the majority of large gas producers, customers and transport companies in eastern Australia.

A 2.1.3 Background

The map on the opposite page illustrates the integrated eastern Australia gas system, which comprises gas demand centres, gas hubs and pipeline networks which link demand centres to supply hubs.

Figure A 2.1 Existing Eastern Australia Gas Basins & Transmission Network



A 2.1.2 Gas Price Drivers

In developing the price forecast to 2020 Core Energy has considered two primary pricing forces:

- Demand pull from LNG export projects, which introduces a linkage between domestic and export prices.
- Cost push–increasing cost of existing and new supply sources which will also drive price increases, to provide project owners with cost recovery plus a return on capital invested.

These forces are addressed in further detail in the following paragraphs.

Gas Price Diver | Price Pull

It is widely recognised, within the eastern Australian gas market, that at least one LNG project, GLNG, is actively seeking reserves and production to meet contract commitment shortfalls relating to the two-train GLNG project[1]. This is placing an upward pressure on the price of gas resources and is also introducing a linkage to LNG prices. LNG prices are in turn linked to oil prices via a Japanese Cleared Crude ("**JCC**") price benchmark. LNG prices at Gladstone are up to USD14.85/GJ (F.O.B).

A number of analysts/commentators have assessed the resultant domestic prices to be in the range AUD7.00 to AUD8.00/ GJ ex-Moomba which is closer to AUD8.00 to AUD9.00 delivered at Sydney gate (refer to Third Party Analysis below).

CORE believes that the rise in wholesale gas prices will be approximately AUD1.00/GJ in 2015 to 2016 to reflect the outcome on price of some smaller contract renegotiations at higher prices, price reviews under contracts, MDQ service fees and related costs. The expiration of the Cooper Basin contract in 2016 is likely to translate to a further increase of AUD1.00/GJ in 2017, followed by a AUD2.00/GJ increase in 2018 following the expiration of the GBJV contracts.

Clearly there is uncertainty regarding timing of these increases but Core believes this path is a reasonable representation of the way prices will evolve in the wholesale market.

Table A 2.2 Summary Wholesale Gas Cost Projections | Real AUD/GJ 2014

Retail Price Component	2014	2015	2016	2017	2018	2019	2020+
Wholesale Cost (ex-field)	4.00	5.00	5.00	6.00	8.00	8.00	8.00

Source: Core Energy Group, 2014.

Gas Price Driver | Cost Push

CORE has also considered the price path that may result if LNG projects become fulfilled and prices are then set by domestic forces alone.

CORE's analysis of existing and proposed resource projects, other than GBJV, indicates that there is unlikely to be material new gas reserves and production available to the domestic market prior to 2017 and thus demand pull influences are likely to outweigh cost push influences through to 2018.

In 2015-16 (ahead of contract expiry in 2017) it is likely that EnergyAustralia and AGL will seek new contracts with GBJV to meet post 2018 requirements. This being the case, there is unlikely to be material supplier competition during this period–particularly if NSW CSG projects (Gloucester and Gunnedah) continue to be delayed. Therefore Demand Pull forces are likely to remain a major force until at least 2019.

From 2019 to 2020 if new resources are developed they will be competing for a smaller residual uncontracted market as retailers should have met substantial elements of their portfolio requirements by that time. Nevertheless there is scope for prices to stabilise or fall if resource owners are prepared to sell at lower prices. However, CORE and third party analysis suggests that costs of gas extraction are likely to increase materially, leaving limited scope, if any, for price falls. These cost increases are attributable to lower well productivity (due to higher capital costs and lower quality geology), higher labour costs and increasing compliance costs.

Based on the above analysis, CORE believes that the price path presented in Table A2.2 is reasonable having regard to both cost push and demand pull factors.

Third Party Analysis

A summary of third party analysis/commentary relating to matters of relevance to wholesale gas price projections in eastern Australia is outlined in the following tables.

1 Santos Announcement 19 December 2013 'GLNG signs gas purchase agreement with Origin Energy'

General Price References

Table A 2.3 Third Party Wholesale Gas Price Summary

Third Party	Publication	Price Reference
AGL/Brattle Group, February 2014	Proposed Price Path for NSW Regulated Gas Prices	Wholesale costs of AUD7.12/GJ in 2015 and AUD8.12/GJ in 2016.
ACIL Tasman, April 2013	Cost of Gas for the 2013 to 2016 Regulatory Period	Delivered prices into Sydney of approximately AUD10/ GJ.
SKM, October 2013	Gas Market Modelling	Upstream contract prices of AUD7-8.50/ GJ 2015- 2020.
Australian Industry Group, July 2013	Energy Shock: the Gas Crunch is Here	Contract price quotes of AUD8.72 /GJ for customers seeking long term contracts beyond 2015.
Oakley Greenwood, September 2013	Gas and Electricity Forecasts for NSW	Delivered prices rise above AUD9/GJ by 2018
AGL	Michael Fraser, CEO	Deals are being done at AUD9-AUD10 [per GJ] and who knows where it will go when [LNG] starts up.
Santos	David Knox, CEO	Stated that Santos was signing gas contracts at the high end of a AUD6 to AUD9/GJ range that Santos had been predicting prices would rise to once the LNG plants started.
Credit Suisse	Credit Suisse Securities Research & Analytics, May 2013, Beach Energy,	Post 2015 prices to reach AUD8-10/GJ

Source: Core Energy

Table A 2.4 Recent Specific Gas Contract References

Third Party	Publication	Price Reference
AGL&APA/Diamantina Power Project	APA ASX Release 2011	▪ AGL to supply gas for 6 years as part of a JV to develop a CCGT power station in Mt Isa. ▪ Third party view that it may reach AUD9/GJ).
Origin/MMG	ASX Announcement, December 2012	▪ Origin Energy signed a gas deal with Chinese-controlled, Melbourne-based miner MMG. ▪ Third party view (e.g. The Australian) that it may reach AUD9/GJ).
Origin/QGC	Origin Media Release 28 November 2013	▪ Origin will supply QGC with up to a total of 30 PJ of gas at Wallumbilla in calendar year 2014 and 2015 at oil-linked pricing. ▪ Third party opinion that price was AUD8/GJ.
GLNG/Origin	Origin Media Release 19 December 2013	▪ Origin will supply GLNG with at least 100 PJ of gas at Wallumbilla over a period of five years, commencing on 1 January 2016.–Oil-linked pricing. ▪ Third party opinion that price was AUD8/GJ.
Origin/ Beach	Beach Energy ASX Release 10 April 2013	Beach signs major gas sales agreement with Origin Energy for up to ~139 PJ over eight years, with the potential for a two year extension. Commencement date window for supply under the agreement is from July 2014 to June 2015. The supply of gas will be delivered ex-Moomba, with the price incorporating a combination of an oil linked curve and other parameters.

Source: Core Energy

A 2.2 Retail Gas and Electricity Price Projections | Eastern Australia

The following paragraphs describe the approach adopted by CORE to forecast future retail gas and electricity prices during the Study Period. This analysis is used to define both absolute movement in gas prices and relative movement in gas and electricity prices.

A 2.2.1 Increases in Wholesale and Retail Gas Prices

CORE has conducted an independent analysis of the outlook for wholesale gas prices during the 2014 to 2020 time frame. This analysis is summarised above and the results are presented again in the table below for ease of reference.

Table A 2.5 Summary Wholesale Gas Cost Projections | Real AUD/GJ 2014

Retail Price Component	2014	2015	2016	2017	2018	2019	2020
Wholesale Cost (ex-field)	4.00	5.00	5.00	6.00	8.00	8.00	8.00

Source: Core Energy Group, 2014.

CORE has used the above projections of wholesale prices to derive projections of retail gas price for each eastern Australian State as this is the price which is most relevant to Network R&C customers. The CORE analysis assumes that only two factors are likely to impact future retail gas prices in a material way – the wholesale price of gas and the cost of carbon.

The result of this analysis is presented in the table below for NSW. The same methodology has been used for each State

Table A 2.6 Summary–Retail Gas Price Changes | Real 2013 %

Retail Price Component	2015	2016	2017	2018	2019	2020+
NSW						
Residential	7.06%	-6.56%	2.63%	5.12%	0.00%	0.00%
Non-Residential	8.38%	-7.34%	4.62%	8.84%	0.00%	0.00%

Source: Core Energy

A 2.2.2 Increase in Retail Electricity Prices

CORE has relied upon a combination of studies to develop a forecast of future retail electricity prices, including the Independent Pricing and Regulatory Tribunal's ("**IPART**") Review of Regulated Retail Prices for Electricity for NSW.

In its determination of retail electricity prices in NSW, IPART published changes in regulated NSW retail electricity prices for the 2015 and 2016 financial years as shown in the table below.

Table A 2.7 Indicative Changes in Regulated Retail Electricity Prices | Nominal

Indicative Price Changes (%)	2015	2016
NSW Weighted Average – Real	-0.77%	-9.56%

Source: Core Energy Group with data from IPART's Review of Regulated Electricity Retail Prices for 2013-2016, p3. Core has assumed CPI of 2.5% to arrive at real price changes.

Increase in NSW Retail Gas Prices Relative to Electricity Prices

A comparison of CORE's forecast of retail gas and retail electricity prices for NSW (and consistent approach for other States), shows a price divergence of 25-31% by 2020 from end of 2013 levels (in favour of electricity (Refer Table A2.10 below)

A 2.2.3 Demand Response to Gas Price Movement

To assess the potential R&C customer demand response to the projected price increases outlined above, CORE has applied widely accepted elasticity of demand analysis.

This technique involves the application of an elasticity factor against the price movement. The elasticity factors used by CORE have been widely accepted as reasonable estimates of the demand response, including approval by the AER for Access Arrangement purposes.

Two elasticity factors have been considered:

- Own Price Elasticity – customer demand response to a given level of gas price increase.
- Cross Price Elasticity – customer demand response to an increase in the price of gas relative to a substitute energy source – electricity.

Own Price Elasticity

Core has used reference values of -0.30 (residential) and -0.35 (commercial) as long-run elasticity factors in its final demand forecast model.

The interpretation of these elasticity factors is that for every percentage increase in retail gas price, residential gas demand will decrease by 0.3% (0.35% for commercial customers).

These long-run elasticity factors are a summation of the individual short-run elasticity factors which are applied as shown in the table below. Demand impacts are highest in the year of the price change (for residential) and the year after the price change (commercial).

Table A 2.8 Short-run Elasticity Factors

Elasticity	Residential	Non-Residential
Δp(t)	-0.13	-0.06
Δp(t-1)	-0.08	-0.16
Δp(t-2)	-0.05	-0.09
Δp(t-3)	-0.03	-0.03
Δp(t-4)	-0.01	-0.01
Total	-0.30	-0.35

Source: Core Energy, based on AER Access Arrangements

These short-run elasticity factors are applied to the annual real increase in gas prices, as shown in Table A2.9, to arrive at the own price elasticity impact in each year. The results vary slightly for each State. The allocation of the price elasticity response, using NSW as an example, is summarised below.

Table A 2.9 NSW Own Price Elasticity Impact on Demand.

	2014	2015	2016	2017	2018	2019	2020
Residential							
Price Change	6.9%	6.8%	-3.4%	1.6%	4.1%	-0.9%	-0.9%
Elasticity	-2.4%	-2.4%	-0.9%	-0.6%	-0.8%	-0.3%	0.0%
Commercial							
Price Change	6.9%	8.1%	-4.8%	3.7%	7.9%	-0.7%	-0.7%
Elasticity	-3.3%	-3.0%	-2.1%	-0.5%	-1.0%	-1.5%	-0.6%

Source: Core Energy

Cross Price Elasticity

CORE acknowledges that cross price elasticity has not been addressed widely in regulatory reviews. CORE believes that this is attributed to the fact that relative prices of gas and electricity historically have not been sufficiently different to cause changes in demand over the regulatory time frame under consideration.

However, CORE is of the opinion that material changes in gas prices relative to electricity price are likely to occur during the Study period and that it is reasonable to expect a cross-price demand response.

Based upon CORE's analysis the forecast price movement between gas and electricity prices (from current levels) is expected to exceed 25% for Residential customers and above 30% for Commercial customers by 2020 (from end 2013 levels), in favour of electricity. The specific results vary for each State and again NSW is presented as an example.

Table A 2.10 Retail Gas and Electricity Price Projections (Real Percentage Change)

Change in Retail Bill	2014	2015	2016	2017	2018	2019	2020
Residential							
Gas	6.91%	6.78%	-3.40%	1.57%	4.07%	-0.89%	-0.88%
Electricity	-2.19%	0.11%	-7.34%	0.00%	0.00%	0.00%	0.00%
Differential	9.10%	6.67%	3.94%	1.57%	4.07%	-0.89%	-0.88%
Cumulative Differential	**9.10%**	**15.80%**	**19.70%**	**21.30%**	**25.30%**	**24.50%**	**23.60%**
Commercial							
Gas	6.91%	8.15%	-4.78%	3.70%	7.93%	-0.69%	-0.68%
Electricity	-2.19%	0.11%	-7.34%	0.00%	0.00%	0.00%	0.00%
Differential	9.10%	8.04%	2.56%	3.70%	7.93%	-0.69%	-0.68%
Cumulative Differential	**9.10%**	**17.14%**	**19.70%**	**23.40%**	**31.33%**	**30.64%**	**29.96%**

Source: Core Energy

The interpretation of the cross price elasticity is that for every percentage increase in retail gas price in a given year, demand for electricity will increase by 0.1%. Alternatively, for every percentage increase in electricity price, gas demand will increase by 0.1%.

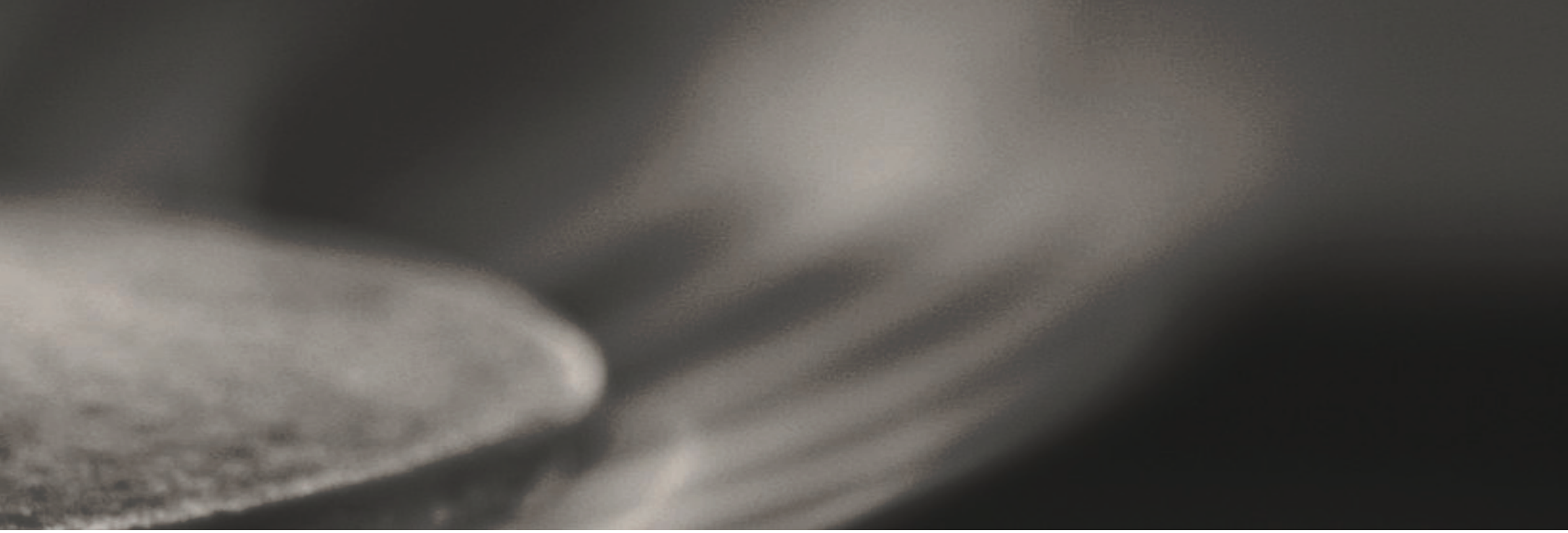
These price elasticity factors are applied to the forecast annual real increase in electricity prices to arrive at the cross price response for each tariff class as summarised below.

Table A 2.11 Cross Price Elasticity Impact on Demand

	2014	2015	2016	2017	2018	2019	2020
Residential							
Price Change	3.7%	-0.8%	-9.6%	0.0%	0.0%	0.0%	0.0%
Elasticity	0.4%	-0.1%	-1.0%	0.0%	0.0%	0.0%	0.0%
Commercial							
Price Change	3.7%	-0.8%	-9.6%	0.0%	0.0%	0.0%	0.0%
Elasticity	0.4%	-0.1%	-1.0%	0.0%	0.0%	0.0%	0.0%

Source: Core Energy

A.3 POLICIES IMPACTING GAS DEMAND



The Attachment presents a concise summary of Federal and State policies which have a material direct or indirect impact on Network gas demand.

Table A 3.1 Federal Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Renewable Energy Target ("**RET**")	Targets 20% renewable content in electricity sector including SRES which targets small scale renewable energy	Water heating Room heating	Reduction in water and room heating growth in favour of solar
Carbon Pricing Policy	A price on carbon emissions which is reducing to zero or modest level in Study period	Water Heating Room Heating Cooking	Lower carbon price favours electricity (reverse cycle)
National Strategy on Energy Efficiency ("**NSEE**")	To accelerate energy efficiency improvements and deliver cost-effective energy efficiency gains across all sectors of the Australian economy	Water Heating Room Heating Cooking	Reduction in gas usage due to energy efficiency
National Construction Code ("**NCC**")	Minimum performance requirements for new buildings and major refurbishments.	Room heating	Reduction in gas usage due to energy efficiency
Nationwide House Energy Rating Scheme ("**NatHERS**")	Rating the potential energy efficiency of Australian homes.	Room heating	Reduction in gas usage due to energy efficiency
National Australian Built Environment Rating System ("**NABERS**")	Performance-based environmental impact rating.	Room heating	Reduction in gas usage due to energy efficiency
Minimum Energy Performance Standards ("**MEPS**")	Energy efficiency rating of appliances.	Water Heating Room Heating	Reduction in gas usage due to energy efficiency
Water Efficiency Labelling and Standards ("**WELS**")	Water efficiency labelling scheme that requires certain products to be registered and labelled with their water efficiency	Water heating	Reduction in water heating and gas usage
Window Energy Rating Scheme ("**WERS**")	Enables windows to be rated and labelled for their annual energy impact on a whole house.	Room heating	Reduction in gas use

Source: Core Energy

Table A 3.2 NSW Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Building Sustainability Index ("**BASIX**")	Assessment aimed to reduce residential homes' water and energy consumption and greenhouse gas emissions.	Room heating Water heating	Positive impact on gas water heating, partially offset by lower heating penetration.
Solar Feed–In Tariff	2011/12: 5.2 – 10.3 cents per kWh 2012/13: 7.7 – 12.9 cents per kWh 2013/14: 6.6 – 11.2 cents per kWh	Water heating	Reduction of gas use in favour of solar.

Table A 3.3 VIC Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Living Victoria Water Rebate Program	Provides rebates on a range of water-efficient products and appliances for use around the home, garden and small business	Water heating	Reduced gas usage as customers switch to water-efficient appliances.
Energy Saver Incentive/ Victorian Energy Efficiency Target ("**VEET**")	Designed to make energy efficiency improvements more affordable, contribute to the reduction of greenhouse gases, and encourage investment, employment and innovation in industries that supply energy efficiency goods and services.	Water heating Room heating	Lower gas usage due to improved efficiency.
Phase-out of greenhouse intensive hot water heaters	To reduce energy consumption and greenhouse gas emissions.	Water heating	Positive impact as customers switch to solar and gas water heating.
6-star Building Standard	Thermal performance standards to meet energy efficiency requirements.	Room heating	Lower gas usage due to improved efficiency.
Solar Feed–In Tariff	60c/kWh premium feed-in tariff (ended Dec 2011) 28.83c/kWh standard feed-in tariff (ended Dec 2012) 25c/kWh transition feed-in tariff (Jan to Dec 2012) 8c/kWh feed-in tariff (2013-present)	Water heating	Reduction of gas use in favour of solar.

Table A 3.4 ACT Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Wood heater and fireplace Replacement Subsidy	Runs from March to December 2014.	Room heating	Positive impact as some residents switch from wood-fired to gas heating.
Energy Efficiency Improvement Scheme ("**EEIS**")	A Territory-wide energy savings target and includes obligations for ACT electricity retailers to meet an individual Retailer Energy Savings Obligation ("**RESO**").	Room heating Water heating	Lower usage due to improved efficiency.
Solar Feed–In Tariff	50.05c/kWh (mar 2009 – June 2010) 45.7c/kWh as of July 2010 7.5c/kWh as of July 2013	Water heating	Reduction of gas use in favour of solar.

Source: Core Energy

Table A 3.5 SA Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Water Heater Installation Requirements	Commenced in July 2008. No immediate plans to remove these requirements.	Water heating	Some advantage for gas water heating.
Residential Energy Efficiency Scheme ("**REES**")	Large energy providers help households save energy by offering energy audits and energy efficiency activities. Operates to the end of 2014.	Room heating	Reduction in gas use.
6-star building standard	All new homes and extensions built in South Australia need to achieve a 6-star level of energy efficiency. This is a requirement under the Development Act 1993 as of September 2010. South Australian 6 star building standard which requires installation of a solar water heater or a plumbed water tank in new residences.	Room heating	Reduction in gas use.
Solar Feed–In Tariff	No longer offered to new solar connections. Retailer contribution of 7.6 cents/kWh. Customers receiving 16c per kWh continue to 2016, customers receiving 44c per kWh continue to 2028.	Water heating	Reduction of gas use in favour of solar.
Solar Hot Water Rebate Scheme	Provides a rebate of AUD500 on the cost of a new solar or electric heat pump water heater system installed on or after 1 July 2008.	Water heating	Reduction in connections and demand per connections in favour of solar

Source: Core Energy

Table A 3.6 WA Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
6-star building standards	Thermal performance standards to meet energy efficiency requirements.	Room heating	Reduce gas use for heating
Solar Water Heater Subsidy Scheme	Ended June 2013. AUD500 for gas-boosted solar water heaters connected to a reticulated gas network. AUD700 for bottled LPG-boosted solar water heaters where reticulated gas was not available.	Water heating	Reduction of gas use in favour of solar.
Solar Feed–In Tariff	40c/kWh before July 2011 20c/kWh after July 2011 Suspended to new applicants as of 1 August 2011	Water heating	Reduction of gas use in favour of solar.

Source: Core Energy

Table A 3.7 QLD Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Electric Resistance Hot Water System Phase-out (Repealed on 1 February 2013)	Existing houses and townhouses located in a reticulated natural gas area must install a greenhouse efficient hot water system (gas, solar or heat pump) when the existing electric resistance system needs replacing. Householders will not need to replace their existing hot water systems that are in good working order.	Water heating	Favours solar and gas
Solar Feed–In Tariff	8 cent feed-in tariff customers in SE Qld will not receive regulated feed-in tariff payment from 1 July 2014. 44c per kWh will receive feed-in tariff until 2028.	Water heating	Reduction of gas use in favour of solar.
Energex Hot Water Rewards Scheme	Provides a rebate of AUD100 to eligible South East Queensland households that connect an electric hot water system to an off-peak electricity tariff. Households benefit by accessing the savings of a cheaper electricity rate as well as helping to reduce peak electricity demand.	Water heating	Favours electric systems
'Switch on Gas' Energy Efficiency Strategy	10 year strategy (2005-2015) to improve energy efficiency of gas appliances and equipment, via regulation of energy efficiency standards. Expected to reduce gas consumption by 5%.	Water heating	Reduction in demand per connection

Source: Core Energy

Table A 3.8 TAS Policies Impacting Gas Demand

Policy	Description	Key Appliance Market	Impact
Solar Feed–In Tariff	Feed-in tariff rate of 8c/kWh. Customers who had already submitted an approved application form to connect a renewable energy generation system (or an application to upgrade an existing system) before 30 August 2013 are eligible for the transitional legacy rate of 28.283 per kWh, subject to meeting ongoing eligibility conditions.	Water heating	Reduction of gas use in favour of solar..

Source: Core Energy

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Glossary

Acronym	Definition
ACQ	Annual Contract Quantity
ACT	Australian Capital Territory
AER	Australian Energy Regulator
APLNG	Australian Pacific LNG Project
APPEA	Australian Petroleum Production & Exploration Association
AUD	Australian Dollar
BASIX	Building Sustainability Index
C	Commercial
CAGR	Compound Annual Growth Rate
CO_2	Carbon Dioxide
CORE	Core Energy Group
CPI	Consumer Price Index
CSG	Coal Seam Gas
DGH	Ducted Gas Heating
DI	Direct Industrial
EEIS	Energy Efficiency Improvement Scheme
ENA	Energy Networks Association
GBJV	Gippsland Basin Joint Venture
GHG	Greenhouse Gas
GJ	Gigajoule
GLNG	Gladstone LNG Project
GPG	Gas Powered Generation
IPART	Independent Pricing and Regulatory Tribunal
JCC	Japanese Cleared Crude
kWh	Kilowatt Hour
LNG	Liquefied Natural Gas
MDQ	Maximum Daily Quantity
MEPS	Minimum Energy Performance Standards
MJ	Megajoule
NABERS	National Australian Built Environment Rating System
NatHERS	Nationwide House Energy Rating Scheme
NCC	National Construction Code
NSEE	National Strategy on Energy Efficiency
NSW	New South Wales
NT	Northern Territory
NW	North West
PJ	Petajoule
PV	Photovoltaics
QCLNG	Queensland Curtis LNG Project
QLD	Queensland
R	Residential
R-C	Reverse Cycle
REES	Residential Energy Efficiency Scheme
RESO	Retailer Energy Savings Obligation
RET	Renewable Energy Target
SA	South Australia
SI	Small Industrial
SRES	Small-scale Renewable Energy Scheme
TAS	Tasmania
APPEA	Australian Petroleum Production & Exploration Association
VIC	Victoria
WA	Western Australia

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