Australian Government

Department of Resources, Energy and Tourism

2009

NATIONAL ENERGY SECURITY ASSESSMENT

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national energy security assessment

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Minister's foreword

The energy sector is fundamental to Australia's social and economic prosperity. It underpins every form of economic activity from powering our industries to turning on the lights in our homes. The strategic management of our energy resources and the secure supply of energy are essential to economic growth, jobs, and the prosperity and wellbeing of all Australians.

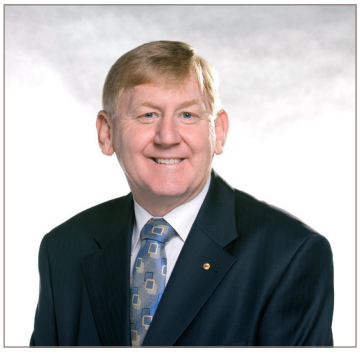
The Australian Government recognises the importance of ensuring the nation's energy security. During the 2007 election campaign we committed to undertake an assessment that would provide an integrated picture of supply and demand for liquid fuels, natural gas and electricity in 5, 10 and 15 years. In addition, the vital importance of energy security to Australians was recently recognised in the National Security Statement, released by the Prime Minister on 4 December 2008.

The 2009 National Energy Security Assessment is the first step in developing a national energy policy for Australia and identifies a range of challenges for ensuring our energy security. The findings of this report provide a key input into the development of Australia's future energy-related policies, including those that will be contained in the Energy White Paper later this year. The Energy White Paper will assess and further develop the Australian Government's policies affecting the reliability, adequacy and affordability of energy supplies. For Australia to maintain its future prosperity, it is imperative that the longer-term implications of our policy objectives be assessed against their impact on energy security.

Maintaining secure energy supplies requires careful balancing of many policy objectives: facilitating timely and appropriately sized investment in the energy sector; moves to a lower carbon economy; providing internationally competitive frameworks for Australian industry; and delivering reliable, adequate and affordable energy to Australian households.

This assessment will also provide a benchmark for future energy security assessments and will enable us to assess the effectiveness of the policies we implement.

I understand that not everyone will agree with all the assumptions used or conclusions of this assessment. The Government welcomes the debate this report will stimulate which will ultimately assist the policy development process, and inform future assessments.



The Hon Martin Ferguson AM MP
Minister for Resources and Energy, Minister for Tourism

March 2009

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List of acronyms

ABARE	Australian Bureau of Agricultural and Resource Economics
CNG	Compressed Natural Gas
CPRS	Carbon Pollution Reduction Scheme
CTL	Coal-to-liquids
GTL	Gas-to-liquids
IEA	International Energy Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
NEM	National Electricity Market
NESA	National Energy Security Assessment
OPEC	Organisation of Petroleum Exporting Countries
RET	Renewable Energy Target

Executive summary

Energy security has been identified as one of the priorities for the Australian Government. The Government has endorsed the development of the National Energy Security Assessment (NESA) to consider the key strategic energy security risks facing Australia currently and in 5, 10 and 15 years.

The NESA's key finding is that Australia's level of energy security has decreased in the face of mounting challenges. These challenges are diverse and include new policy initiatives as well as factors outside the control of governments such as the global economic downturn. However, Australia remains a country well endowed with energy resource options, and is therefore able to address many of the issues identified here with appropriate policy settings and market responses.

The NESA's findings highlight that governments face a number of key challenges if Australia's energy security position is to be improved or at least maintained. These challenges include:

- the need for further market (supply and demand-side) reforms to maximise appropriate investment and improve the flexibility and resilience of energy markets in the face of disruptions or structural change;
- the impact of tightening supply/demand balances and infrastructure reliability on supply chain resilience;
- an increase in energy costs, including those from policies to address climate change, notably the Carbon Pollution Reduction Scheme (CPRS) and the expanded national Renewable Energy Target (RET);
- the sharply increasing cost of investment capital, global demand for energy infrastructure components and skilled labour; and
- threats to well functioning international energy markets such as reduced availability of capital from the current global financial crisis and growing resources nationalism.

The NESA's analysis of the main factors challenging the adequate, reliable and affordable delivery of energy in each of the liquid fuels, natural gas and electricity sectors will provide a key input into the development of other government policies, including the Energy White Paper. Conversely, addressing some of the challenges identified by the NESA, such as the need for key market reforms and strengthening network resilience, will be important for facilitating other Government objectives, such as reducing our energy supply's carbon intensity (which is vital to bringing about long-term energy security in an increasingly carbon constrained global environment). Consideration of the following points will enhance our energy security position in the future:

- investment frameworks for converting energy resources for delivery of energy to the economy;
- energy diversification to assist in managing supply shocks;
- price transparency and flexibility to signal appropriately timed, sized and located investment; and
- efficient allocation of resources in energy markets.

The assumptions and the conclusions set out in this assessment reflect 'on-balance' judgements about future developments affecting the energy sector. The Government understands that not everyone will agree with all the assumptions and findings of this report, but welcomes the debate it will stimulate. This debate will assist the energy policy development process and inform future energy security assessments.

The Australian Government's ability to influence energy security will depend on the strategic energy policy framework it adopts and how that policy affects the adequate, reliable and affordable delivery of energy.

Introduction

Australia's natural resource endowment, traditional access to international markets and the capacity of the economy to provide sufficient investment in the energy system all contribute towards energy security. Conversely, interruptions to energy supplies can cause major financial losses and create havoc in economic centres, as well as causing potential damage to the health and wellbeing of the country.

The NESA provides a national perspective on energy security. The regional nature of our liquid fuels and natural gas resources, and the location of major energy demand centres on the south-eastern seaboard, northern communities and southwest Western Australia make it necessary to isolate some issues and markets. However, there are a number of factors driving energy security issues that are common to all regions.

This assessment considers the key influences on the supply of energy in Australia currently, and in 5, 10 and 15 years. The NESA is divided into the three main energy sectors of:

- liquid fuels (including the range of refined liquid fuel products used in the domestic economy, and the feedstock, including crude oil, used in their production);
- natural gas (used domestically both as a direct energy source and as an input fuel for electricity generation); and
- electricity.

The NESA is based on information from a variety of sources, including domestic sources, such as the Australian Bureau of Agricultural and Resource Economics, Geoscience Australia and the National Electricity Market Management Company as well as key international bodies. It was prepared in consultation with relevant Australian Government agencies including the Department of the Prime Minister and Cabinet, the Department of the Treasury, the Department of Climate Change, and the Department of Environment, Water, Heritage and the Arts.

Definition of energy security

In the Australian context, energy security is defined as the adequate, reliable and affordable supply of energy to support the functioning of the economy and social development, where:

- *adequacy* is the provision of sufficient energy to support economic and social activity;
- *reliability* is the provision of energy with minimal disruptions to supply; and
- *affordability* is the provision of energy at a price which does not adversely impact on the competitiveness of the economy and which supports continued investment in the energy sector.

These three dimensions are interrelated and, to a large extent, mutually reinforcing. For example, if energy supplies are not adequate to meet the needs of the economy or community, the price of energy will need to rise or intervention in the market will be required to allocate scarce energy resources. However, if the price of energy rises to an extreme level, the affordability of energy will be reduced, thereby constraining economic and social activity.

Assessing Australia's energy security

The benchmark for this assessment is Australia's historical levels of energy security rather than that of other countries. This report provides an 'on-balance' assessment of energy security in 5, 10 and 15 years for the liquid fuels, natural gas and electricity sectors. In each of the sectors, key issues that are expected to influence the adequacy, reliability and affordability of energy supplies are highlighted. Some factors are expected to have varying influence across these timeframes.

Over the past few years, the interrelations between energy sectors have become more important to Australia's energy security position. These interrelationships mean that assessments of energy security, be it for a specific sector or Australia's overall position, should take into account factors from all three sectors. Additionally, within a sector there are issues that are dependent on each other.

The factors examined in the assessment include:

(a) supply-side factors, including drivers affecting the mix of energy sources;

(b) demand-side factors that relate to the demand for energy by fuel source;

(c) market and institutional arrangements that affect individual sectors;

(d) incentives for investment in energy infrastructure in the various sectors, and interactions between the sectors that impact on investment outcomes;

(e) technological change in the development of new, renewable and/or more efficient energy technologies;

(f) publicly available information on climate change policies, including on the CPRS and the RET;

(g) conditions in the domestic economy; and

(h) international factors and vulnerabilities.

The overall assessment of energy security takes into account these factors, and is analysed within the context of the effectiveness of international and domestic markets in supplying energy. The level of energy security is expressed using classifications of high, moderate and low levels of energy security.

Low energy security is when the economic and social needs of Australia are not, or might not be met. A low rating means that the energy sector and/or energy users are significantly affected by major shocks to the energy system.

Moderate energy security is when the economic and social needs of Australia are being met. However, there could be a number of emerging issues that will need to be addressed to maintain this level of security. Further, a moderate rating might suggest that current risks to energy security are being, or have been, mitigated or that price movements are manageable within the broader economy, with minimal social and economic impacts. However, the mitigation strategies may take some time to resolve negative influences.

High energy security is when the economic and social needs of Australia are being comfortably met.

Australia's energy security is dependent on the supply and demand balance of primary fuels and electricity. The ability to meet energy demand is determined by a number of factors including the level of investment, efficient supply chain management and reliable access to energy sources. Energy investment tends to fall under one of four categories: production, transformation, transmission and distribution.

For timely investment to occur, readily obtainable information needs to be made available to decision makers. The fluidity of the energy policy environment has implications for the investment environment. This means that it is difficult to quantify the impacts of proposed policies on energy security.

The findings of the assessments are based on assumptions about energy market developments, including relevant government policies, most likely to influence Australia's future energy security. These assumptions were developed during consultations within the Australian Government, and reflect a whole-of-government position. Government policies are assumed to be optimally designed, start on time and deliver policy objectives without unintended consequences.

Importantly, this assessment assumes that the CPRS is represented by the minimum and unconditional commitment to reduce emissions to 5 per cent below 2000 levels by 2020. It does not assume the 15 per cent reduction that is conditional on the agreement of all major economies to commit to substantially restrain emissions and of all developed countries taking on comparable reductions to that of Australia.

The key challenges identified from the assessments will provide a key input into future energy policy, in particular, the Energy White Paper. The Energy White Paper will consider national markets and national solutions across a consistent policy framework that will deliver adequate, reliable and affordable energy to Australia.

The information provided in this report is based on analysis contained in a series of technical working papers that were developed by the Department of Resources, Energy and Tourism in consultation with other government agencies during 2008.

This report benefited from the input of State and Territory Government and industry stakeholders, obtained through targeted consultation, which included a series of workshops held in Canberra and Perth on 13, 14 and 15 August 2008.

Liquid fuels

Summary of liquid fuels security to 2023

	Current	2013	2018	2023
Adequacy	High	High	High	Moderate
Reliability	High	High	High	Moderate
Affordability	Moderate	Moderate	Moderate	Moderate
Overall	**High**	**High**	**High**	**Moderate**
Comment	Domestic crude production declining. Tight global supply/demand balance outweighed by global economic downturn which weakens demand and depresses prices. Lower prices and uncertainty fed by high price volatility dampens exploration and development investment. Effective supply chain management and supply diversity drive reliability. LPG provides a minor contribution to transport fuels. Bio-fuels and CNG are niche providers of transport fuels. No contribution from CTL and GTL.	Domestic crude production increases as new fields start production. Tightening of global supply/ demand balance with demand growth recovery and mature field decline. Development of production capacity is more focused on difficult geological and geo-political regions. Crude prices rising as global economic growth recovers. Refining capacity increases in the Asian region. High reliability continues with minor refinery upgrades and increased investment in import infrastructure. LPG share remains constant if no change to current excise arrangements. Bio-fuels and CNG remain niche contributors. No contribution from CTL and GTL.	Domestic crude production plateaus and starts to decline without new discoveries. Tight global supply/ demand balance returns with ongoing demand growth and mature field decline. Development of more difficult geological and geo-political regions continues. Global refining capacity in Asian and Middle East regions makes up larger proportion of global capacity. Risk of domestic refining capacity reducing. Demand growth met by imports. Storage infrastructure supports imports. LPG share remains constant if no change to current excise arrangements. Bio-fuels and CNG remain niche contributors. CTL and GTL may start production, but are niche contributors.	Domestic crude production declines at a moderate rate in the absence of new discoveries. Ongoing demand growth and mature field decline continues to lead to a tight supply/ demand balance. Geological and geo-political cost pressures continue. Production is concentrated in less stable regions. Asian and Middle East regions become central to global refining capacity. Domestic refining may decline. Demand growth met by imports. Storage infrastructure supports imports. LPG share still constant if no change to current excise arrangements. Bio-fuels and CNG continue as niche contributors. CTL and GTL remain niche contributors.

The level of security for liquid fuel supplies in Australia will remain relatively constant out to 2023 with a risk of decline in reliability with any further rationalisation of Australian refineries. However, the dominant drivers affecting this security will vary over this timeframe.

Australia's participation in the global oil market means that domestic liquid fuel security is intrinsically linked to global oil market outcomes. This integration means that Australia is exposed to global conditions that have both positive and negative impacts on adequacy, reliability and affordability. Positive impacts include the increased diversity of supply sources for both crude and refined product. Negative impacts include increasing concentration of production of crude oil in unstable regions and exposure to fundamentals affecting the global oil price. Global oil prices are affected by the combination of a number of drivers, including demand, the ability of investment to match growth in demand and the increasing concentration of global production of crude oil in unstable regions.

Australia's declining liquid fuel self-sufficiency does not necessarily imply reduced energy security. However, a greater reliance on long global supply chains, particularly as crude oil becomes increasingly sourced from unstable regions, does threaten reliability.

Diversifying fuel types and sources will become increasingly important in improving Australia's liquid fuel security. However, taking into account the small contribution currently made by alternatives such as biofuels, and the technical and commercial challenges they face over the projection period, they are likely to remain niche products. These challenges include large up-front capital costs, the availability and cost of credit, the state of technological development and the policy environment.

Assumptions: Liquid fuels security

Four key influences that are likely to affect the security of liquid fuel supplies in Australia during the next fifteen years have been identified. These are crude oil supply, refined product supply, infrastructure resilience and carbon pricing.

Crude oil supply – the global financial crisis will delay investment and slow the development of projects. As economies recover, there will be a return to the tight supply/demand balance. Global crude production capacity will increasingly be influenced by the higher costs associated with reserves located in more difficult geological and geographic conditions.

Domestic crude will continue to be traded on the global market, consistent with commercial principles and an open market approach. In the absence of further significant discoveries, domestic crude production is assumed to increase briefly with the introduction of a number of small fields, before returning to the long-term trend of decline.

Crude imports for domestic refinery feed-stock will continue to grow, with refineries sourcing the most economic feed-stock grade. Crude demand will be capped by domestic refining capacity.

Refined product supply – petroleum products will remain the primary source of transportation fuel in the foreseeable future. Global refining capacity will increase, with the majority of new capacity built in the Asian region. Globally, refining capacity will then rationalise with greater focus on the Asian region. The introduction of cleaner fuel standards has led to greater interdependency between the operating units of individual refineries which increases the potential impact from production disruptions in Australian refineries. This does not necessarily mean lower overall supply reliability given refiners' ability to use stockholdings and alternative supplies.

There is a risk that domestic refining capacity could rationalise in the face of competition from Asian refineries. This would increase refined product imports to supply the domestic market, with import and other infrastructure providing additional capacity to manage domestic reliability risks. Refined product imports will grow to meet demand growth and replace any reduction in domestic refinery output.

It is assumed there will be no change to the excise arrangements for LPG, and as a result, LPG continues its current market share through to 2023. In the absence of new production feed-stocks, biofuels and CNG will remain niche contributors to the liquid fuels mix through to 2023.

CTL and GTL will not have infrastructure in place before 2018. Based on global crude oil price assumptions, CTL and GTL will remain niche contributors in 2023.

Infrastructure resilience – refers to the capacity of the supply chain to meet demand when disruptions occur, and the factors that influence the frequency of these disruptions. Any reliability issues associated with domestic refineries will be mitigated by continued proactive supply chain management, including greater reliance on imported refined product and the impact of improved storage capacity provided by investment in import and other infrastructure.

Carbon pricing – the CPRS will be implemented in 2010 and the carbon price trajectory will not exceed investors' ability to make appropriate and timely responses. The carbon trajectory will continue uniformly, from implementation in 2010, through and beyond 2023. Further, the domestic refining industry appears likely to be eligible for assistance as an emissions-intensive trade-exposed activity subject to the formal emissions-intensity and trade exposure assessments. The level of assistance will influence the competitiveness of Australian refineries with those in Asia. It is also assumed that the fuel tax adjustment measures, as per the CPRS White Paper, will be in place until 2013, and 2011 for CNG and LNG. The impact of the CPRS on pump prices will have a relatively minor impact on the market for alternatives and demand side responses.

Likely impact of key influences on liquid fuels security

Crude oil supply – over the long-term, Australia will become increasingly dependent on oil imports as demand growth outstrips domestic production. Access to international markets will therefore be crucial to domestic liquid fuel security. The longer term outlook for liquid fuel security will see increasing reliance on difficult geographic and geopolitical regions. This may result in price volatility.

Refined product supply – the proportion of Australia's demand for refined products sourced from domestic refineries is likely to decrease with any further rationalisation of domestic refining capacity. In the long-term, investment in refining capacity is likely to be in Asian refineries due to economies of scale. As a result, Australia is likely to become more dependent on imports from this region to meet demand growth.

Infrastructure resilience – the capability of the system to recover in the event of a disruption to supplies is a function of the system's resilience. Continued investment in import infrastructure and domestic refineries will ensure the resilience of liquid fuels supply chains.

Carbon pricing – carbon pricing will impact on the liquid fuels sector by imposing a cost on end-users and decreasing refining margins. This impact will be moderated by assistance measures, especially up to 2013.

Assessments: Liquid fuels security

Current situation

The adequacy of domestic liquid fuels supplies is assessed as **high**. This is due to robust and flexible supply chains and diversity of supply which includes domestic refineries as well as Australia's access to well functioning international markets. Consistent with the analysis of the IEA, global supply is currently also adequate to meet global demand, particularly given declining demand since mid-2008. Domestically, Australia has legislative arrangements in place to respond to liquid fuel adequacy issues that might arise. Nevertheless, Australia is becoming more dependent on longer supply chains, especially for imported crude oil.

Reliability of the domestic liquid fuels sector is assessed as **high**. Domestic refining disruptions to date have been managed through effective supply chain management, with supplies sourced from both alternative domestic sources and imports. Improved stock management and greater storage capacity associated with import infrastructure investment along with ongoing investment in domestic refineries will further increase reliability. Global investment in refining capacity, particularly in the Asia-Pacific region, has also improved Australia's geographic supply source diversity, and therefore reliability.

Affordability for the liquid fuels sector is assessed as **moderate**. This is due to high international energy prices. The resilience of Australia's economy, and a continuing decrease in its oil intensity, has enabled it to absorb much of the impact of the large price increase experienced up to mid-2008.

Overall, Australia's liquid fuels security is currently **high**, see table below.

Current liquid fuels security assessment

Issue Impact on:	Adequacy	Reliability	Affordability	Assessment
Crude oil supply				
Refined product supply				
Infrastructure resilience				
Carbon pricing				
Overall assessment	**High**	**High**	**Moderate**	**High**

Key Negative impact | Slightly negative impact | No impact | Slightly positive impact | Positive impact

Five years (2013)

Adequacy for the liquid fuels sector is assessed as **high** in 2013. This is primarily due to Australia's continued access to global oil markets, supply diversity and an increase in regional refining capacity, tempered by a growing reliance on long crude oil supply chains.

Reliability for the liquid fuels sector is assessed as **high** in 2013. This is primarily due to resilience within the domestic and global supply chains. This is expected to reflect domestic refinery investment in maintenance and upgrades as well as Australia's good access to international markets and refiners.

Affordability for the liquid fuels sector is assessed as **moderate**. This is due to Australia's continued exposure to international oil markets and global oil price movements. Price is expected to be influenced by production capacity in more difficult geographic and geological regions and a tightening supply/demand balance as the global economy recovers. The degree of price volatility will be determined largely by the supply decisions of OPEC members. The domestic carbon price will have a minor impact on affordability and is not expected to be significant enough to affect the overall assessment.

Overall, Australia's liquid fuels security in five years is expected to be **high**.

Five year liquid fuel security assessment

Issue / Impact on:	Adequacy	Reliability	Affordability	Assessment
Crude oil supply				
Refined product supply				
Infrastructure resilience				
Carbon pricing				
Overall assessment	**High**	**High**	**Moderate**	**High**

Key: Negative impact; Slightly negative impact; No impact; Slightly positive impact; Positive impact

Ten years (2018)

Adequacy of liquid fuel supply is assessed as **high** in 2018. This assessment is primarily based on Australia's continued access to well functioning global oil markets. However, if global investment in crude oil production capacity does not, at a minimum, keep pace with demand growth and field declines, there is a real risk of a supply side crunch. As a result this rating could drop to moderate.

Reliability of liquid fuel supply is assessed as **high** in 2018. This assessment is based on continued effective supply chain management, including the ongoing operation of the domestic refining industry, improved storage capacity and stock management in the domestic supply chain. Further, Australia's good access to regional refining capacity and well functioning global oil markets also strengthens domestic reliability. However, a decrease in the stability of key crude oil production regions could negatively affect this rating.

Affordability is assessed as **moderate**. Ongoing tightness in upstream supply capacity and an increasing concentration of production capacity volume in unstable regions will be the primary driver for price volatility. Crude oil prices are expected to settle to around the cost of new production capacity. This rating could change to low if: global investment in production capacity does not, at a minimum, keep pace with demand growth and field declines; stability in key production regions declines; and/or supplier groups withhold significant supply capacity. The domestic carbon price will have a minor impact on affordability, but this impact is not expected to be significant enough to affect the overall assessment.

Overall, liquid fuels security in 2018 has been assessed as **high**. This is due to effective supply chain management, which includes domestic refining, access to well functioning international markets and the overall resilience of the domestic economy. This rating would be lowered by weakening investment outcomes and any degradation in the efficiency of the global oil market.

Ten year liquid fuel security assessment

Issue / Impact on:	Adequacy	Reliability	Affordability	Assessment
Crude oil supply				
Refined product supply				
Infrastructure resilience				
Carbon pricing				
Overall assessment	**High**	**High**	**Moderate**	**High**

Key: Negative impact; Slightly negative impact; No impact; Slightly positive impact; Positive impact

Fifteen years (2023)

Liquid fuel adequacy has been assessed as **moderate** in 2023. This assessment is primarily based on Australia's continued access to well functioning global oil markets. If global investment in production capacity does not, at a minimum, keep pace with demand growth and field declines, this rating could drop to low.

Reliability of liquid fuels is assessed as **moderate** in 2023. This is expected to stem from an increased reliance on long global supply chains sourcing crude oil from unstable regions which will more than offset continued effective supply chain management and good access to regional refining capacity. There is also the ongoing risk of domestic refinery closures in the face of strong competition from Asian refineries.

Affordability is assessed as **moderate**. Prices are expected to continue to settle. However this rating could change to low if global investment in production capacity is insufficient to keep pace with demand growth and field declines.

Overall, liquid fuels security has been assessed as **moderate** in 2023. This rating could be reduced by inadequate crude oil investment outcomes and any degradation of the efficiency of the global oil market. In 2023, the key issue expected to reduce liquid fuels security is access to reliable and affordable crude oil. On the other hand, improved infrastructure resilience and access to refined product from new Asian refineries is likely to improve liquid fuels security in Australia in 2023.

Fifteen year liquid fuel security assessment

Issue Impact on:	**Adequacy**	**Reliability**	**Affordability**	**Assessment**
Crude oil supply				
Refined product supply				
Infrastructure resilience				
Carbon pricing				
Overall assessment	**Moderate**	**Moderate**	**Moderate**	**Moderate**

Key Negative impact | Slightly negative impact | No impact | Slightly positive impact | Positive impact

Natural gas

Summary of natural gas security to 2023

	Current	2013	2018	2023
Adequacy	Moderate	Moderate	Moderate	Moderate
Reliability	Moderate	Moderate	Moderate	High
Affordability	High	Moderate	Low	Low
Overall	**Moderate**	**Moderate**	**Moderate**	**Moderate**
Comment	Tight market conditions stemming from overdue investment in production and transmission together with previous strong demand growth. High production capital costs and small domestic demand in WA limit development of reserves for WA domestic supply. Market infrastructure and institutions still underdeveloped. Immature market arrangements limit investment signals and competitive outcomes in some markets and submarket regions. Notwithstanding effects of drought, international LNG demand and expectations about carbon pricing, domestic prices still low internationally despite being high historically.	Market remains tight with investment in production and transmission being offset by economic recovery and carbon pricing driving increased demand. Domestic supply in WA increasingly dependent on production infrastructure supplying LNG developments. Economies of scale critical to manage per unit capital costs. Market infrastructure and institutions becoming more developed. Market structures begin to improve investment signals. Domestic gas prices face upward pressure as eastern domestic gas demand grows strongly.	Market remains tight as investment in production and transmission attempts to keep pace with continued demand growth. Economies of scale associated with LNG developments and domestic gas price conditions drive production investment decisions in WA. Market infrastructure and institutions becoming well developed. Improved investment signals begin to influence the size and timing of investment. Domestic gas prices face upward pressure as eastern gas demand continues to grow strongly. Eastern domestic gas market could face competition with LNG exports.	Market remains tight with investment in transmission being offset by the need to source production from more difficult to access reserves. Economies of scale associated with LNG developments and domestic market conditions continue to drive production investment decisions in WA. Market infrastructure and institutions well developed. Investment size and timing increasingly driven by efficient demand signals. Gas demand for domestic supply maintains domestic gas price pressures. Eastern LNG export investment contributes to domestic gas supply.

The level of security for natural gas supplies in Australia will remain moderate over the assessment period, mainly due to investment in new production and transmission and growing market maturity. Despite the slowing of the domestic economy as a result of the global economic downturn, in the longer term, the tightness of the natural gas supply/demand balance will continue to be a dominant driver affecting natural gas security. The CPRS has further implications for the supply/demand balance, as gas is increasingly used as a transition fuel for electricity generation while renewable and low emission coal technologies develop.

Historically, gas markets in Australia have developed with government support. Currently, the domestic gas industry is moving toward market maturity, with capital increasingly allocated by the private sector in response to demand signals. The primary issue for gas supply in the east is rapid growth in drought-related demand and the increasing uptake of gas for electricity generation. The development of significant coal seam gas deposits in recent years will dramatically increase Australia's gas reserves and improve the diversity of gas supply in the east over the assessment period. While Western Australia has vast reserves of natural gas, the immaturity of market arrangements, geographic distances, high capital costs of gas supply infrastructure, and relatively small domestic market combine to pose challenges to natural gas security. In the Northern Territory, there is a lack of diversity of supplies, with transmission historically coming from a single reserve.

Assumptions: Natural gas security

Five key influences that are likely to affect the security of natural gas supplies in Australia during the next fifteen years have been identified. These are general market conditions, carbon pricing, international LNG demand, infrastructure resilience and market reforms.

General market conditions – supply will be affected by the extent to which demand supports commercial investment decisions. In the short-term, demand will be driven by the pace of economic recovery. Over the full assessment period, general market conditions will be influenced by the impact of climate change policies on fuel use choices (primarily in electricity generation). The supply/demand balance, and its impact on prices, will be extrapolated from reserve additions relative to increases in demand. An important aspect of reserve additions is the ability to convert them to production for use in the economy.

Carbon pricing – the CPRS will be implemented in 2010 and the emissions reduction trajectory will not drive the market's investment requirements beyond investors' ability to make appropriate and timely responses. The carbon trajectory will continue uniformly, from implementation in 2010 and beyond 2023. The impact of the CPRS is assumed to be principally on the demand for gas in the domestic market, with this demand driven primarily by a change in the merit order of fuels for electricity generation. With economic recovery, gross output from gas-fired electricity will grow strongly under the CPRS in the medium-term.

The LNG industry appears likely to be eligible for assistance as an emissions-intensive trade-exposed activity subject to the formal emissions-intensity and trade exposure assessments. Treasury modelling of the CPRS suggests gross output from gas production will continue to grow under the CPRS, albeit at a slower rate, than without it.

International LNG demand – exports from Western Australia and the Northern Territory will continue to grow and exports from the eastern market will commence during the assessment period. While the current global economic downturn will slow growth in global demand for LNG in the short-term, this demand will recover in the medium to long-term. LNG price movements will be influenced by oil price movements but the long-term contracts covering most LNG sales will dampen the former's volatility. Investment inputs, including inputs such as skilled labour, will again constrain investment timeframes and increase costs as the global and domestic economy recovers. The spur to the development of natural gas resources provided by LNG projects is likely to contribute domestic gas supply.

Infrastructure resilience – refers to the capacity of the supply chain to meet demand when disruptions occur, and the factors that influence the frequency of these disruptions. Tight supply conditions will impact on infrastructure resilience by limiting the availability of spare capacity to offset infrastructure outages. This increases supply chain reliability risk. Negative impacts of

this will be offset, at least in part, where improvements in infrastructure, supply diversity and co-ordination across the energy supply chain increase asset and system resilience.

Market reforms – current market reforms will be implemented within the timeframes agreed, and in a manner that facilitates their intent. Some gas market reforms, such as the Short-Term Trading Market and closer integration of gas and electricity market operations, currently under consideration by the Ministerial Council on Energy, will be implemented nationally during the assessment period.

Likely impact of key influences on natural gas security

General market conditions – domestic gas supply has been tightening in the western and eastern markets. While there are a number of factors that have contributed to this situation, the dominant factor has been additions to the gas supply chain capacity struggling to keep pace with gas demand growth. While the near term slowing of the Australian economy will reduce this pressure, in the longer term, future natural gas security will again depend on the ability of investment to keep pace with demand growth.

Carbon pricing – the primary impact of the CPRS on the domestic gas sector will be through increased demand, possibly leading, in the medium-term, to adequacy, reliability and affordability issues. Longer term natural gas security is most likely to derive from ongoing structural changes in electricity generation as a result of the CPRS. Increased domestic investment will be driven by demand growth fuelled in part by this structural change over time.

International LNG demand – LNG developments in Australia to meet international demand will increase domestic gas supply options where they have associated domestic gas developments. The primary impact of increased exports will be to expand Australia's gas supply infrastructure.

Infrastructure resilience – the capability of the system to recover in the event of a disruption to supplies is a function of the system's resilience. Ongoing development and implementation of management and continuity plans are likely to have a positive impact on natural gas security. Further, easing supply chain conditions will provide greater resilience and reliability in the future.

Market reforms – the ongoing development of effective gas markets ensuring efficient, affordable and reliable supply of natural gas is critical to maintaining Australia's international competitiveness. Continued reforms, such as the establishment of the Australian Energy Market Operator, and improvements to market transparency, should have a positive effect on natural gas security.

Assessments: Natural gas security

Current situation

The adequacy of natural gas supplies readily available for domestic consumption is assessed as **moderate**. In the Western Australian market, adequacy is **low**. Despite slowing domestic economic growth, there has been no widespread loosening of the tight gas supply chain which has resulted from previous rapid increases in demand, recently driven by the drought, together with overdue investment in supply-side infrastructure.

Reliability of natural gas supplies is assessed as **moderate** due to tight supply chain conditions in the east and west. Investment in transmission and production infrastructure is occurring. However, any further significant increase in gas demand before this infrastructure is commissioned will have reliability implications and could shift this rating from moderate to low.

Affordability of natural gas is currently assessed as **high**. Despite the volatility in spot prices, the bulk of Australia's demand is still being met by long-term contract arrangements characterised by moderated prices.

Market reforms being developed for the gas sector are having a positive impact on natural gas security.

Overall Australia's level of natural gas security is currently **moderate**.

Current natural gas security assessment

Issue / Impact on:	Adequacy	Reliability	Affordability	Assessment
General market conditions				
Carbon pricing				
International LNG demand				
Infrastructure resilience				
Market reforms*				
Overall assessment	**Moderate**	**Moderate**	**High**	**Moderate**

Key Negative impact | Slightly negative impact | No impact | Slightly positive impact | Positive impact

** Note: This assessment has been undertaken before design arrangements have been finalised.*

Five years (2013)

In 2013, adequacy for the natural gas sector is assessed as **moderate**. Abundant gas reserves exist in all gas markets. Production capacity remains an issue, particularly in the western market. Transmission capacity is also assessed as adequate if transmission investment in the eastern market is commissioned as planned. However, this assessment could fall to low if demand growth, as the economy recovers, outstrips additions to supply chain capacity before 2013.

In 2013, reliability of natural gas supplies is assessed as **moderate**. However, this assessment could fall to low if supply conditions tighten in 2013. Demand growth remains the key moderating factor in this assessment, particularly with the introduction of the CPRS in 2010, which will encourage switching to gas-fired electricity generation. If demand growth exceeds the ability of the market to respond with timely investment, taking into account the time lags in commissioning investments in new capacity, this will further tighten the supply/demand balance.

In 2013, the affordability of natural gas is assessed as **moderate**. Australian gas prices are expected to remain competitive with the rest of the world. However, affordability will start to fall in 2013 compared to historical levels, as an increasing proportion of supply contracts include price rises. These increased prices are likely to be driven by tighter gas supply conditions. For example, demand for Australian LNG is likely to grow from 2013 as supply contracts to the North Asian region from Brunei and Indonesia come to an end.

Further market reforms and improved infrastructure resilience are likely to impact in a positive manner on natural gas security.

Overall natural gas security is assessed as **moderate** in 2013. Factors that could impact negatively on this assessment include delays to additional supply capacity associated with the global economic downturn and an acceleration of demand as the economy recovers from the current slowdown. Positive factors include potential reserve additions and a maturing emergency response system.

Five year natural gas security assessment

Issue / Impact on:	Adequacy	Reliability	Affordability	Assessment
General market conditions				
Carbon pricing				
International LNG demand				
Infrastructure resilience				
Market reforms*				
Overall assessment	**Moderate**	**Moderate**	**Moderate**	**Moderate**

Key: Negative impact; Slightly negative impact; No impact; Slightly positive impact; Positive impact

** Note: This assessment has been undertaken before design arrangements have been finalised.*

Ten years (2018)

The adequacy of the natural gas sector is assessed as **moderate** in 2018. Significant reserves remain in all Australian gas markets. However, gas production and transmission capacity will remain tight as investment is under pressure to keep pace with demand growth, particularly LNG demand.

Reliability of natural gas supplies is assessed as **moderate** in 2018. The negative impact of tight supply conditions driven by demand growth will have been offset by the development of market infrastructure and institutions.

Affordability of natural gas is assessed as **low**, predominantly due to continued tightness in the supply chain. Affordability will face increasing pressure from competition between domestic gas and LNG markets, but will be offset to some extent by increased gas supply infrastructure underpinned by LNG developments.

Further market reforms and improved infrastructure resilience are likely to impact in a positive manner on natural gas security.

Overall, the level of natural gas security is **moderate**. If investment in gas supply chain infrastructure does not keep pace with demand growth to 2018, this assessment could fall to **low**.

Ten year natural gas security assessment

Issue / Impact on:	Adequacy	Reliability	Affordability	Assessment
General market conditions				
Carbon pricing				
International LNG demand				
Infrastructure resilience				
Market reforms*				
Overall assessment	**Moderate**	**Moderate**	**Low**	**Moderate**

Key: Negative impact; Slightly negative impact; No impact; Slightly positive impact; Positive impact

** Note: This assessment has been undertaken before design arrangements have been finalised.*

Fifteen years (2023)

The adequacy of the natural gas sector is assessed as **moderate** in 2023. Significant reserves remain in all Australian gas markets. However, reserve exploitation costs will be higher in 2023 as production is increasingly dependent on reserves that are more difficult to access. Gas production and transmission capacity will remain tight, despite easing since 2018, as investment is likely to marginally outstrip demand growth, which will still be boosted by implementation of the CPRS, in 2023.

Reliability of natural gas supplies is assessed as **high** in 2023. This assessment is primarily due to a slight easing in the supply/demand balance, together with the impact of improved national supply infrastructure and a mature national gas market.

Affordability of natural gas is assessed as **low** in 2023. This is primarily due to contract prices reflecting ongoing, although slightly easing, supply tightness, the higher cost of supply, and the increasing competition between domestic and international markets.

Factors contributing to market tightness are likely to be weaker compared to previous assessments. In addition, further market reforms and improved infrastructure resilience are likely to impact in a positive manner on natural gas security.

Overall, the level of natural gas security is **moderate**. If investment in the gas supply chain does not keep pace with demand growth, this assessment could fall to low.

Fifteen year natural gas security assessment

Issue **Impact on:**	**Adequacy**	**Reliability**	**Affordability**	**Assessment**
General market conditions				
Carbon pricing*				
International LNG demand				
Infrastructure resilience				
Market reforms*				
Overall assessment	**Moderate**	**High**	**Low**	**Moderate**

Key Negative impact | Slightly negative impact | No impact | Slightly positive impact | Positive impact

** Note: This assessment has been undertaken before design arrangements have been finalised.*

Electricity

Summary of electricity security to 2023

	Current	2013	2018	2023
Adequacy	High	Moderate	Moderate	Moderate
Reliability	Moderate	Moderate	Moderate	Moderate
Affordability	Moderate	Low	Low	Low
Overall	**Moderate**	**Moderate**	**Moderate**	**Moderate**
Comment	Some easing of tight market conditions due to economic downturn. Market structure and architecture requires development. Retail price caps limit competition as wholesale price rises squeeze retail margins. Market infrastructure and institutions becoming more developed. Release of CPRS design details reduces uncertainty. Global financial crisis and future carbon pricing impacting on the prudential and project finance environment. Prices still internationally competitive despite drought impacts.	Market tightens again as economy recovers along with shift to lower emission generation, especially gas and renewables. Market structure and architecture becoming more developed and lessening price pressures. Retailers increasingly able to pass through higher wholesale prices with price caps raised or removed. Market infrastructure and institutions becoming well developed. Investor confidence increases with implementation of CPRS and RET, facilitating investment signals and enabling risks to be quantified and priced. Market participants still adapting to commercial ramifications of the CPRS and RET. Carbon pricing, RET and tight gas market increasing prices despite improved water availability. Price pressure from carbon pricing, RET and higher gas prices continues.	Market remains tight with lessening, but continuing, impact of carbon pricing and RET on investment. Market structure and architecture should be well developed. Retailers still able to pass through higher wholesale prices with price caps raised or removed. Market infrastructure and institutions well developed. Investor confidence continues to increase as the market settles to equilibrium and commercial signals are stabilised. Investors and market participants operating with more confidence in new commercial conditions and changed fundamentals. Price pressure from carbon pricing, RET and higher gas prices continues.	Market remains tight as investment attempts to keep pace with continued demand growth and technology shifts to lower emission generation. Market structure and architecture, as well as infrastructure and institutions, well developed. Retailers continue to pass through higher wholesale prices with price caps raised or removed. Investors respond to market and investment signals based on economic fundamentals. Investors and market participants understand new commercial conditions and market fundamentals and respond accordingly. Price pressure continues as costs of supply rise.

The level of electricity security over the next fifteen years will be moderate. Currently, the primary factors affecting electricity security include: the level of electricity demand, the ongoing need for reform to retail price regulation, the need for further market reforms, market reaction to climate change policies, gas supply issues, drought, and the global financial crisis. While electricity markets in Australia are well-developed, significant challenges exist in terms of exposure to supply-side shocks. The effects of previous shocks, which include uncertainty about climate change policies, drought in South Eastern Australia, and the increasing reliance on gas supplies, are currently being observed in the market. Current market arrangements, including architecture and structure issues, are limiting the capacity of the market to absorb such shocks and respond in an efficient manner.

In the medium-term, these arrangements will continue to have an impact, although the extent of the impact of each will vary. The degree of variation will depend on a range of factors impacting on investment outcomes. These factors include the market's overall efficiency, the implications of the CPRS and RET, and related tight conditions in the gas market. Electricity security will be improved if market reforms provide outcomes that allow the market to respond to changing policy and operating environments.

Assumptions: Electricity security

Six key influences that are likely to affect the security of electricity supplies in Australia during the next fifteen years have been identified. These are carbon pricing, the revised RET, implementation of market reforms, gas supply issues, infrastructure resilience and reduced water availability.

Carbon pricing – the CPRS, designed to achieve least-cost economy-wide reductions in carbon emissions, will be implemented in 2010 and the emissions reduction trajectory, including associated carbon prices, will enable investors to make appropriate and timely responses. The emissions reduction trajectory will continue uniformly through and beyond 2023. Also, the impact of the CPRS will be on the wholesale cost of electricity, the dispatch merit order of different generator fuels (with gas, and eventually renewables, increasing their share of electricity generated), and on the technology mix of generation investment (primarily an increase in gas generation capacity). Coal will continue to play a major role in electricity generation and this role will be preserved by the adoption of carbon capture and storage, but not until at least 2020.

Electricity demand will fall initially with the introduction of the CPRS. Energy cost increases associated with the CPRS will be passed through to end-use consumers. The electricity industry will be subject to the Electricity Sector Adjustment Scheme outlined within the CPRS White Paper. The Scheme will include assistance for carbon capture and storage technologies through existing programs, structural adjustment for regions dependent on the coal-fired generation sector and limited direct assistance to coal-fired generators. The Scheme will increase investor confidence in the electricity generation sector.

Revised RET – the new RET will be implemented in 2009, with a target of 45,000GWh by 2020 and will be introduced with a gradually increasing annual renewable energy profile. The RET will be phased out between 2020 and 2030. The RET will encourage a range of renewable energy technologies, of which wind power is expected to be the largest contributor. Geothermal energy is anticipated to contribute from around 2015. Water availability issues are expected to limit future investment in hydro technologies in response to the revised RET to incremental small-scale installations. The assessment is made on the premise that investment is not hindered by input constraints and the rules covering wind forecasting, technical requirements and semi-dispatch will be in place under currently agreed timeframes.

Implementation of market reforms – current market reforms will be implemented within timeframes currently agreed, and in a manner that facilitates their intent. In addition, the reform program through such processes as the Australian Energy Market Commission's *Review of Energy Market Frameworks in light of Climate Change Policies,* will address market efficiency issues not addressed under the current reform program.

Gas supply issues – new gas supply infrastructure, and new gas-fired generation investment, will be commissioned as currently proposed. Additional gas supply capacity will keep pace with gas demand growth, including from electricity generators. Gas price increases, associated with tight supply and competition with LNG exports, will not significantly affect the CPRS-driven change to the fuel merit order in electricity generation. Demand conditions for gas will be driven by the state of the economy, the impact of carbon trading on the electricity generation technology mix, drought and water availability.

Infrastructure resilience – tight supply conditions will reduce infrastructure resilience by limiting the availability of spare capacity or reserves that would offset infrastructure outages. The negative impacts of this will be offset, in part, where asset hardening, supply diversity and operational coordination across the energy supply chain improve asset and system resilience. This assessment also assumes that arrangements to better coordinate energy supply during infrastructure outages, within the electricity sector and across electricity and gas sectors, are put in place.

Reduced water availability – the current drought continues to ease, with some remaining concerns in Victoria and Tasmania through 2009-10. Water storage does not return to normal levels until 2018, and water availability continues to impact operational decisions of affected generators in the interim.

Likely impact of key influences on electricity security

Carbon pricing – uncertainty about carbon pricing has delayed investment in the electricity sector. Following on from the Government's previous announcement to introduce an emissions trading scheme, the recent release of the design details in the CPRS White Paper will improve investment certainty as mechanisms for facilitating least cost approaches to reduction in the generation sector's carbon-intensity are now clear. The longer term impact will primarily be on affordability, although depending on the resultant generation mix, there may also be implications for reliability and adequacy.

Expanded RET – increased encouragement of renewables in the market model, combined with the investment response as a result of the RET, will reduce electricity affordability (depending on scale economies and costs of key technologies), along with adequacy and reliability. Issues around network capacity that are necessary to take advantage of new technologies are currently being addressed by market regulators.

Implementation of market reforms – with the dynamic electricity market, the investment environment is rapidly changing, and inefficient price and investment signals could magnify or embed adequacy, reliability or affordability problems.

Gas supply issues – the trend towards greater uptake of gas-fired generation could result in increased vulnerability in the electricity sector due to limited production and transmission infrastructure which means a significant share of supply can be interrupted in the event of fire explosion or other incidents. Higher gas prices could also reduce electricity affordability. Further, tight gas supply/demand balances could reduce the adequacy and reliability of electricity, especially where gas is being utilised more for base load generation. Increased market signals will continue to drive further investment in gas infrastructure over time.

Infrastructure resilience – the capability of the system to recover in the event of a disruption to supplies is a function of the system's resilience. Ongoing development and implementation of management and continuity plans are likely to have a positive impact on electricity security. In addition, government policies and industry/government information sharing forums are aimed at improving infrastructure resilience.

Reduced water availability – reduced water availability leads to energy constraints within electricity systems. This impacts on affordability and the generation mix, although ongoing restrictions to water access could have longer term implications for reliability.

Assessments: Electricity security

Current situation

Adequacy of the electricity sector is currently assessed as **high**. Despite some uncertainty about the implementation of the CPRS and RET, investment proposals for 2009-10 in all regions suggest that investment is occurring and will be available to meet projected increases in demand. However, Victorian and South Australian supply/demand conditions have been reported by the National Electricity Market Management Company as being uncomfortably tight in 2009/10. Nevertheless, the current economic downturn will decrease the likelihood that a rapid increase in maximum demand in these NEM regions over the 2009-10 year might reduce reliability in these areas.

The reliability of Australian electricity systems is currently assessed as **moderate**, due to ongoing implications of energy input constraints such as gas supply conditions and drought-related water availability limitations. These negative impacts are somewhat offset by improvements to system and contingency management arrangements as well as the economic slowdown.

Current electricity affordability in Australia is assessed as **moderate**. Despite some easing of prices in late 2008, the NEM and the Western Australian markets are expected to continue to experience historically high electricity prices through 2009, mainly as a result of greater reliance on natural gas for electricity generation.

The ongoing market reforms being undertaken in the electricity sector are improving electricity security.

Overall, Australia's current electricity security has been assessed as **moderate**.

Current electricity security assessment

Issue **Impact on:**	**Adequacy**	**Reliability**	**Affordability**	**Assessment**
Reduced water availability				
Gas supply issues				
Carbon pricing				
Expanded RET *				
Implementation of market reforms *				
Infrastructure resilience				
Overall assessment	**High**	**Moderate**	**Moderate**	**Moderate**

Key Negative impact | Slightly negative impact | No impact | Slightly positive impact | Positive impact

* *Note: This assessment has been undertaken before design arrangements have been finalised.*

Five years (2013)

Adequacy of the electricity sector has been assessed as **moderate** in 2013. This is predominantly due to a re-emergence of both tight market conditions as the economy recovers and the effects of inadequate investment stemming from past uncertainty.

The reliability of the electricity system has been assessed as **moderate** in 2013. The primary impact on reliability is expected to be a tight supply/demand balance. The increase of intermittent plant and new merit order dispatch associated with the CPRS and introduction of the expanded RET will place further pressure on market operators to manage system reliability and security. Current work by market operators should minimise the risks related to market rules. Further, greater reliance on gas-fired generation as a transition fuel opens the electricity sector to reliability issues resulting from limited infrastructure in the gas sector. However, these factors could be improved by ongoing market reforms, the easing of the drought and appropriate investment in water and gas infrastructure.

Affordability of electricity in Australia has been assessed as **low** in 2013. Significant risks to cost are emerging, including through the impact of greater gas utilisation and gas price pass-through, inefficient market operation and investment, and pass-through of a carbon price. To mitigate the above impacts, it will be necessary to undertake reforms in market structure and architecture in conjunction with policy reforms.

The ongoing market reforms being undertaken in the electricity sector and improved infrastructure resilience are likely to improve electricity security in 2013.

Based on the issues and information presented above, Australia's electricity security in 2013 has been assessed as **moderate**. There are several factors that could impact negatively on this assessment, including a failure to progress reforms which improve efficiency of the gas and electricity markets, the ongoing drought, a risk-averse investment climate, larger than expected demand growth and the impacts of the CPRS and the expanded RET. These factors could be mitigated in part by market reforms and timely access to relevant information to assist in investment decisions.

Five year electricity security assessment

Issue **Impact on:**	**Adequacy**	**Reliability**	**Affordability**	**Assessment**
Reduced water availability				
Gas supply issues				
Carbon pricing				
Expanded RET*				
Implementation of market reforms*				
Infrastructure resilience				
Overall assessment	**Moderate**	**Moderate**	**Low**	**Moderate**

Key Negative impact · Slightly negative impact · No impact · Slightly positive impact · Positive impact

* *Note: This assessment has been undertaken before design arrangements have been finalised.*

Ten years (2018)

Adequacy of the electricity sector has been assessed as **moderate** in 2018. There is likely to be a slight easing of adequacy conditions since 2013. This easing is dependent on investment needs having been met, and market reforms providing a market framework to deliver an efficient mix of generation technologies and balance between generation and transmission investment. However, if the investment climate was hindered by a lack of progress in the reform agenda, or availability of capital, this assessment could fall to low.

The reliability of the electricity system has been assessed as **moderate** in 2018. The primary impact on reliability remains the tight supply/demand balance, driven predominantly by investment delivered beyond 2013. Gas market reforms are likely to deliver greater transparency to the gas market, resulting in timely and efficient investment, which is likely to result in an easing of gas supply reliability issues. However, if the necessary electricity and gas investment does not occur, the reliability of Australia's electricity supplies could be reduced to low.

Affordability of electricity has been assessed as **low** in 2018. However, there is expected to be a slight improvement on the situation in 2013. This is likely to be the result of an easing of the supply/demand balance and drought-related impacts. However, gas issues could have an impact on the cost of electricity.

In 2018, carbon pricing will play a key role in shaping electricity security as investors consider investment returns and the range of available technologies. However, improved efficiency, as a result of the expanded RET, could improve the national situation compared to 2013. Further, ongoing market reforms and improved infrastructure resilience are likely to improve electricity security in 2018. In addition, the impacts of reduced water availability are likely to continue to ease.

Overall, electricity security in 2018 has been assessed as **moderate**. If the investment climate was inhibited by a lack of progress in the reform agenda, this assessment would fall to low.

Ten year electricity security assessment

Issue **Impact on:**	**Adequacy**	**Reliability**	**Affordability**	**Assessment**
Reduced water availability				
Gas supply issues				
Carbon pricing				
Expanded RET*				
Implementation of market reforms*				
Infrastructure resilience				
Overall assessment	**Moderate**	**Moderate**	**Low**	**Moderate**

Key Negative impact; Slightly negative impact; No impact; Slightly positive impact; Positive impact

* *Note: This assessment has been undertaken before design arrangements have been finalised.*

Fifteen years (2023)

Adequacy of the electricity sector has been assessed as **moderate** in 2023, although investment decisions in preceding years should somewhat ease supply-demand pressures. However, if the investment climate was constrained by a lack of progress in the reform agenda, lack of capital, and distorting government policies, this could fall to low.

The reliability of the electricity system has been assessed as **moderate** in 2023. Improved reliability in 2023 will depend on timely, adequate and efficient investment in cost-effective generation technologies and maintenance. If market reforms have delivered the correct signals, the resultant market model will be positioned to deliver reliable electricity. If this investment and progression of market reforms do not occur, the reliability of Australia's electricity supplies could be reduced to low.

Affordability of electricity has been assessed as **low** in 2023. Carbon pricing is likely to continue to influence affordability as more cost-effective low-emission generation technologies become more available. Any failure to progress further market reforms in a way that supports efficiency or minimises input costs could result in an exacerbation of these issues.

Overall, Australia's electricity security in fifteen years has been assessed as **moderate**, provided timely investment occurs between 2018 and 2023.

Fifteen year electricity security assessment

Issue **Impact on:**	**Adequacy**	**Reliability**	**Affordability**	**Assessment**
Reduced water availability				
Gas supply issues				
Carbon pricing				
Expanded RET*				
Implementation of market reforms*				
Infrastructure resilience				
Overall assessment	**Moderate**	**Moderate**	**Low**	**Moderate**

Key Negative impact; Slightly negative impact; No impact; Slightly positive impact; Positive impact

* *Note: This assessment has been undertaken before design arrangements have been finalised.*