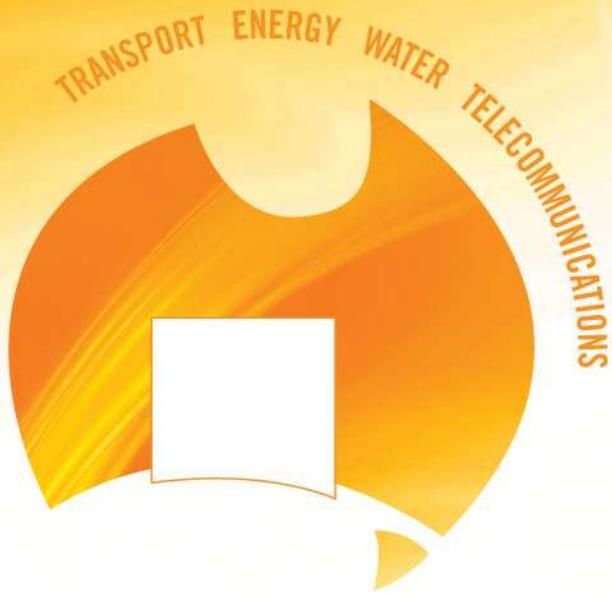


infrastructure report card 2010

South Australia

ENGINEERS
AUSTRALIA

ENERGY

Energy policy

The SA Government has three key elements to its energy policy.

Firstly, to facilitate the transition from a State-based regime to a national one. The aim of the new regime is to provide national consistency in energy market rules, regulation, operations, governance and policy. The outcome of this will be more efficient investment in, and operation of, energy production and provision, with the aim of improved outcomes for consumers. Recent developments illustrating this include the:

- Transfer from State-based economic regulation of gas and electricity to the Australian Energy Regulator
- Transfer of State-based electricity transmission planning to the Australian Energy Market Operator
- Participation in a range of national energy policy developments, including the National Strategy on Energy Efficiency (NSEE).

Secondly, to facilitate energy provision in areas where market incentives fail to provide energy at an acceptable quality and price. Examples of initiatives to do this include the:

- Remote Areas Energy Supplies Scheme, which subsidises the cost of electricity to 13 remote off-grid townships
- Renewable Remote Power Generation Program, which provides rebates for the installation of renewable energy systems to remote townships.

Thirdly, to shape the production and use of energy so as to achieve the State's sustainability objective. This sustainability objective is identified as one of six objectives in *South Australia's Strategic Plan*, and it aims to reduce overall energy consumption and increase the proportion of energy produced from renewable sources. Recent developments illustrating this include the:

- Provision of an energy advisory service for the general community
- Establishment of the Solar Hot Water Rebate Scheme, which provides a rebate of $500 on the cost of a new solar or electric heat pump water heater system, and the Residential Energy Efficiency Scheme (REES), which requires energy providers to offer householders incentives to adopt energy saving measures
- Development of the strategic and regulatory framework that supports the deployment of renewable energy, including wind, geothermal, wave and tidal, and solar energy
- Increasing the State's renewables target from 20% to 33% of all electricity generated to come from renewable sources by 2020
- Establishment of the Renewables SA Board, Renewable Energy Commission and Renewable Energy Fund. The $20m Fund was established in 2009, to be administered over 2 years, and aims to foster innovation and investment in renewable technologies[509]
- Requiring the energy efficiency of government buildings to increase by 25% from 2001/02 levels, by 2014.

SA's energy sector is governed by a combination of State and national organisations. The key ones are:

- **Australian Energy Market Commission (AEMC).** The AEMC became responsible for rule-making, market development and policy advice on the National Electricity Market (NEM) and natural gas pipelines services and elements of the broader natural gas markets from 1 July 2009.
- **Australian Energy Regulator (AER).** The AER has responsibility for the enforcement of and compliance with the *National Electricity Rules*, as well as responsibility for the economic regulation of electricity transmission and distribution. The AER issues infringement notices for certain breaches of the National Electricity Law and Rules, and is the body responsible for bringing court proceedings in respect of breaches.[510] The AER is also the economic regulator for *National Gas Law* covering natural gas transmission and distribution pipelines in all States and Territories and enforces the *National Gas Law* and *National Gas Rules*. The AER took responsibility for economic regulation of the gas distribution networks from 1 July 2008. The AER is part of the Australian Competition and Consumer Commission (ACCC).
- **Australian Energy Market Operator (AEMO).** The AEMO operates the National Electricity Market (NEM) as well as the retail and wholesale gas markets of south-eastern Australia from 1 July 2009. For the electricity network, AEMO's priority is the management of power system security and reliability. Security of supply is a measure of the power system's capacity to continue operating within defined technical limits even in the event of the disconnection of a major system element such as an interconnector or large generator. Reliability is a measure of the power system's capacity to continue to supply sufficient power to satisfy customer demand, allowing for the loss of generation capacity.[511]
- **Essential Services Commission of SA (ESCOSA).** Until 30 June 2010, ESCOSA will administer ETSA Utilities' electricity distribution price determination, which involves monitoring revenue earned and costs incurred by ETSA Utilities. From July 2010, AER will be responsible for making and administering a new price control regime. ESCOSA will continue to have a role in non-price regulation of ETSA Utilities (including licensing, determination of service standards and performance monitoring)[512] until at least 30 June 2015. Since the responsibility for administering ElectraNet's price control regime moved from ESCOSA to AER in 2001, ESCOSA has been responsible for setting and regulating the service standards with which ElectraNet must comply.[513] ESCOSA also manages the licensing regime for generators, which requires them to comply with appropriate technical standards. It has recently established a specific licensing regime for wind generators due to the risk they pose to the stability of the network.[514] ESCOSA is the economic regulator for the Standing Contract element of the gas supply and electricity industries in SA, as well as being responsible for licensing of distribution and retail market administration functions.[515]
- **The Office of the Technical Regulator.** The primary role of the Technical Regulator is to ensure the safety of workers, consumers and property, and to ensure compliance with legislation and technical standards and codes throughout the electricity generation, transmission and distribution sectors, and the gas distribution sector.[516] The Technical Regulator is responsible for overseeing the natural gas transmission and distribution reticulation pipeline network. It monitors gas supplies to ensure that gas is available in the required quantities and quality for the metropolitan and regional distribution networks and for general use in gas appliances. It is responsible for gas supplied from the Moomba and Katnook plants.[517]
- **Energy Industry Ombudsman of SA (EIOSA).** EIOSA investigates and resolves disputes between customers and electricity and gas companies.[518]
- **Energy Division of the Department for Transport, Energy and Infrastructure (DTEI) (SA Government).** The Division provides policy advice on energy issues, energy program delivery and energy regulatory services.[519]

Case study: Embedded Generation within the Adelaide CBD

Increasingly, new public and private developments are looking to incorporate embedded generation as a means of improving environmental sustainability and to reduce whole of life costs.

Embedded generation, such as co-generation and tri-generation, is considered to be environmentally sustainable in that it is able to:

- Reduce peak energy demand thereby reducing the required network and generation capacity, and reducing the demand on older, low efficiency peaking plants[520]
- Generate power that has a lower carbon emissions to that of grid power, and in the case of co-generation by also using the waste heat for heating and/or cooling (through absorption chillers).

Gas powered co-generation is the most cost effective form of large scale embedded generation. To be effective, co-generation plants need to operate continuously near capacity so that high grade heat is generated for the associated heating/cooling systems. In practice, this can only be achieved where the engine is grid connected and therefore able to provide its full capacity into the building's electrical network.

The feasibility of co-generation systems for developments within the Adelaide CBD are currently being adversely impacted by the constrained fault capacity of the CBD distribution network. The distribution network within the Adelaide CBD is near the maximum safe fault level of both existing customer and ETSA Utilities high voltage equipment.[521] As a result, ETSA Utilities will not allow any additional short circuit fault sources (such as embedded co-generation) to be connected to the Adelaide CBD distribution network. Proposals that install fault current eliminating devices will be considered, however this is generally not considered to be cost effective or reliable.

Co-generation systems that operate in 'island' mode will also be considered. However, 'island ' systems, such as at the SA Water building on Victoria Square, have proven to be problematic as building loads are not steady, resulting in the co-generation engines running well below full load for extended periods.

There are many current opportunities for large scale embedded generation within the Adelaide CBD such as the new hospital precinct and the various proposed Green Star commercial buildings. Without a better solution for grid connection, many of these systems are unlikely to be viable or reliable.

9 Electricity

9.1 Summary

Infrastructure Type	SA 2010	SA 2005	National 2005	National 2001
Electricity	B-	B-	C+	B-

This rating recognises that SA has sufficient generation capacity to meet demand until 2012/13. However, peak demand growth needs to be moderated to prevent high cost, low utilisation infrastructure being required. While the present significant expansion in transmission and distribution network infrastructure is important to rectify key limitations, ongoing growth in wind power and the development of distributed generation will require significant additional investment.

Since the last Report Card, the major electricity sector developments in SA have been:

- Transfer of economic regulation for electricity transmission and distribution from ESCOSA to the AER
- The transfer of planning and other functions from SA's Electricity Supply Industry Planning Council to the AEMO
- Rising electricity prices
- A significant increase in wind generation
- An increase in geothermal and wave power development projects
- Volatile wholesale electricity prices in the last two years, with prices persistently higher than observed in other regions of the National Electricity Market (NEM) [522]
- An increase in the State's renewable target from 20% to 33% of all electricity generated to come from renewable sources by 2020. This target is higher than required by the Australian Government's Expanded Renewable Energy Target scheme, which was introduced in August 2009 and aims for 20% by 2020
- The introduction of a net photovoltaic feed-in tariff
- Major reinforcement to the electricity supply to the Adelaide Central Business District, which includes new underground transmission lines, and construction of the Mt Barker South and Templers substations.

Recently completed and in-progress major infrastructure projects include:

- **Wind farms** - 70MW Mount Millar Wind Farm, 94.5MW Hallett Stage 1 - Brown Hill Wind Farm, 98.7MW Snowtown Stage 1 Wind Farm, 71MW Hallett, Stage 2 - Hallett Hill Wind Farm, 56.7MW Clements Gap Wind Farm and the 111MW Waterloo Wind Farm
- **Gas powered** - 126MW open cycle gas turbine adjacent to the Quarantine Power Station on Torrens Island.

Challenges to improving electricity infrastructure include:

- Renewing ageing infrastructure
- Implementing significant demand management measures
- Meeting changing electricity demand
- Converting the potential of geothermal power generation into reality
- Integrating wind generation into the network
- Providing reliable supply in the face of extreme weather events
- Capturing the opportunities of smart network technology
- Addressing the inability to add embedded generation in the Adelaide CBD.

9.2 Infrastructure overview

9.2.1 System description

Electricity infrastructure refers to stationary electricity networks that comprise interconnected electricity transmission and distribution systems, together with connected generating systems, facilities and loads. It includes non-renewable and renewable generation. It excludes mobile generators and non-grid connected electricity systems. SA's physical electricity infrastructure comprises:

- Generation
- Transmission networks
- Distribution networks
- Retail companies.

The physical elements work within a market structure called the National Electricity Market (NEM). The NEM spans SA, Victoria, Queensland, NSW, ACT and Tasmania. Over 275 registered generators across the NEM offer to supply power and their production is bought by retailers. The central coordination of the dispatch of electricity from generators is the responsibility of the Australian Energy Market Operator (AEMO). While generation and retail has been opened to competition, due to the nature of transmission and distribution networks, these are regulated monopolies.

Generation

Power is generated or supplied from the following sources in SA and in the following percentages for 2008/09:

- Coal fired power stations, 34%
- Gas fired power stations, 50%
- Wind farms, 14%
- Interconnectors, 1%
- Other (including distillate and photovoltaic), 1%.[523]

The proportion of power generated from each source changes yearly in response to new generation sources being deployed, the relative cost of each source, and technical constraints on the network. The major changes in the sources of generation over the last decade have been:

- A small increase in coal fired generation
- A reduction mid-decade in gas fired generation due to gas shortages caused by damage to the Moomba gas production facility, followed by another decline in 2008/09 as wind generation increased
- A significant increase in wind generation
- An increase in interconnector supply mid-decade to compensate for the reduction in gas fired generation, followed by a recent decline due to the higher costs of east coast electricity supply.

In 2008/09, nearly 100% of the State's electricity requirement was provided by local generation. Table 9.1 identifies the main conventional thermal generation plants in SA. The generators that provide baseload are Torrens Island, Pelican Point, Port Augusta and Osborne (a cogeneration station that supplies steam as well as power).[524] Smaller power stations at Dry Creek, Snuggery, Mintaro, Port Lincoln, Hallett, Quarantine (on Torrens Island) and one near Penola are mainly used to provide peak loads.[525]

Table 9.1: Conventional thermal generation capacity in SA[526]

Registered NEM Participant	Power Station	Units and Name-Plate Rating	Station Capacity (MW)	Plant Type	Fuel
AGL Energy	Torrens A	4 x 120	480	Conventional steam	Natural gas
AGL Energy	Torrens B	4 x 200	800	Conventional steam	Natural gas/ oil
Infratil	Angaston	30 x 1.67	50	Reciprocating diesel	Distillate
International Power	Dry Creek	3 x 52	156	Gas turbine	Natural gas
International Power	Mintaro	1 x 90	90	Gas turbine	Natural gas
International Power	Pelican Point	1 x 48714	487	Combined	Natural gas
International Power	Port Lincoln	2 x 24	48	Gas turbine	Distillate
International Power	Snuggery	3 x 26	78	Gas turbine	Distillate
NRG Flinders	Northern	2 x 260	520	Conventional steam	Coal
NRG Flinders	Osborne	1 x 190	190	Cogeneration	Natural gas
NRG Flinders	Playford	4 x 60	240	Conventional steam	Coal
Origin Energy	Ladbroke Grove	2 x 43	86	Gas turbine	Natural gas
Origin Energy	Quarantine	4 x 24.6 1 x 128.4	226.8	Gas turbine	Natural gas
TRUEnergy	Hallett	11 units	192	Gas turbine	Natural gas / distillate
Total name-plate capacity			3,644		

SA has the highest percentage of wind generation to electricity sales in Australia and one of the highest in the world.[527] By the beginning of 2010, wind accounted for 14%[528] of generated electricity compared with 6% in Victoria.[529] Table 9.2 identifies SA's operational wind farms.

Table 9.2: Existing wind generation capacity in SA[530]

Registered NEM Participant	Wind Farm	Units and Turbine Rating (MW)	Capacity (MW)	Dispatch Type
AGL Energy	Hallett Stage 1- Brown Hill	45 x 2.10	94.50	Semi-scheduled
AGL Hydro	Wattle Point	55 x 1.65	90.75	Non-scheduled
Infigen Energy	Lake Bonney Stage 1	46 x 1.75	80.50	Non-scheduled
Infigen Energy	Lake Bonney Stage 2	53 x 3.00	159.00	Scheduled
Roaring 40s	Cathedral Rocks	33 x 2.00	66.00	Non-scheduled
International Power	Canunda	23 x 2.00	46.00	Non-scheduled
Transfield Services	Mt Millar	35 x 2.00	70.00	Non-scheduled
Transfield Services	Starfish Hill	23 x 1.50	34.50	Non-scheduled
TrustPower Ltd	Snowtown Stage 1	47 x 2.10	98.70	Scheduled
Total			739.95	

Rooftop photovoltaic (PV) generators are increasing in number, although their total capacity at 10MW is small relative to all other power sources. As of 30 June 2009, there were 7,127 PV generators installed,[531] and on average, each system exports to the grid some 1,150kWh annually.[532] By June 2010, it is estimated that there will be over 15,500 PV installations connected to ETSA Utilities' network.[533] SA is home to Australia's largest PV array, located at the Adelaide showgrounds, which supplies approximately 1,400MWh annually.[534] A major reason for the growth in PV has been the introduction of a feed-in tariff from 1 July 2008. The net tariff (ie. gross production minus household consumption) is designed to encourage investment in small-scale renewable electricity generation by paying small-scale generators a *premium rate* for the amount of electricity they generate and export to the grid. The *premium rate* is currently set at 44c/kWh. The feed-in tariff applies to customers who:

- Consume less than 160MWh of electricity per annum, and

- Have a PV system with capacity up to 10kVA for a single phase connection and up to 30kVA for a three phase connection.[535]

Details of feed-in tariff schemes for other jurisdictions are listed in Table 9.3.

Table 9.3: Feed-in tariff rates in Australian jurisdictions[536]

Jurisdiction	Current status	Nature of scheme	Rate	Duration
SA	Commenced on 1 July 2008	Net	44c/kWh	20 years
NSW	Commenced in January 2010	Gross	60c/kWh	7 years
VIC	Commenced 1 November 2009	Net	60c/kWh	15 years
QLD	Commenced 1 July 2008	Net	44c/kWh	20 years (subject to review)
WA	Commencing 1 July 2010	Net	To be determined (submissions closed on 20 November 2009)	To be determined
NT	Commenced 1 July 2009 in Alice Springs only	Net	45.76c/kWh.(capped at $5 per day, then reverts to 23.11c/kWh)	To be determined
ACT	Commenced in March 2009	Gross	Reducing to 45.7c/kWh in July 2010	5 years

The payments to customers associated with the feed-in tariff are made by ETSA Utilities. It determines the amount of electricity the PV owner generates and exports to the grid, and details the monetary credit to the owner's electricity retailer. [537] The retailer then reduces the customer's electricity account or makes payments to the customer detailed on their electricity bill. ETSA Utilities' credits over 2009/10 are estimated to be $7 million, rising to $11.7 million by 2014/15.[538] This payment is levied on all SA electricity customers and translates to an additional $8.70 per customer per year. Retailers may offer to purchase the power from the producers for between 6 and 8 cents/KWh.[539]

Transmission

SA's transmission network can be divided into:

- The intrastate network that consists of over 6,500km of lines, linking generators to distribution networks
- Interconnectors that link SA's intrastate network with the transmission network of Victoria.[s]

Intrastate transmission network

SA's intrastate transmission network is owned and managed by ElectraNet Pty Limited trading as ElectraNet SA, a private limited liability company.

The network was designed to connect the major generators around Adelaide with the city via a high capacity 275kV grid. Other demand centres were connected with a 132kV lightly meshed network. It also has a number of long radial lines, meaning they only have one point of supply. Parts of the network are over 50 years old.[540] The network has 76 switching stations, of which most are exit connection point substations that step down voltage to lower levels and are the sources of supply for customers.[541] The network's control centre is located in Adelaide.[542]

SA's intrastate transmission network is illustrated in Figure 9.1.

[s] There are also a number of other small transmission networks including one operated by BHP Billiton Olympic Dam Corporation Pty Ltd and OZ Minerals Prominent Hill Operations Pty Ltd, both to support mining activities. These are not addressed in this chapter.

Figure 9.1: SA's intrastate electricity transmission network[543]

Being a monopoly service, electricity transmission networks are regulated. ElectraNet's current regulatory period runs from 1 July 2008 through to 30 June 2013. ESCOSA set the revenue cap that must operate within this period.[544] From 1 July 2013, the AER will assume responsibility for economic regulation of ElectraNet.

Interconnectors

Interconnectors connect the transmission networks of different NEM regions. They enhance competition by allowing multiple generators to compete to supply as well as improving security and reliability of supply. There are two interconnectors in SA.

- **Murraylink**, which connects ElectraNet's Monash 132kV substation in SA's Riverland (Berri) with SP Ausnet's Red Cliffs 220kV terminal station. Murraylink is a bi-directional facility (DC current flows along one cable and back along the second cable) with a steady state transfer capability of 220MW at the receiving end.[545]
- **Heywood Interconnector**, which connects SA's transmission network with Victoria's 500 kV transmission network at the Heywood terminal station. It consists of two AC circuits operating at 275kV, and enabling up to 460MW of transfer. [546]

Historically, the interconnectors have imported power from Victoria into SA, and this reached a peak following a reduction in gas fired generation in SA, which was due to a shortage of gas supplies after the Moomba gas processing plant fire in 2004. In recent years, the volume of imported electricity has reduced as power prices for State-based generation reached parity, and on occasions, below that of Victoria.[547] Exports from SA have increased as the volume of wind power generation has increased. Due to the need for increasing transfer capability between SA and the other States, arising partly from SA's increased wind generation, a study commenced in early 2010 to examine options in this area.[548]

Distribution

ETSA Utilities operates SA's distribution network under a 200 year lease from the SA Government, which commenced in January 2000.[t] ETSA Utilities is 51% owned by Cheung Kong Group of companies based in Hong Kong and 49% owned by Spark Infrastructure Group. Table 9.4 provides details of its line assets. ETSA Utilities also has:

- 86,931km of overhead and underground lines
- 402 zone substations
- 1,513 sub-transmission transformers
- 69,413 distribution transformers
- About 723,000 stobie poles[549]
- 812,529 customers.

ETSA Utilities also owns the majority of meters[550] and undertakes meter reading on behalf of electricity retailers.[551] However, billing is the responsibility of retailers.[552]

Table 9.4: ETSA Utilities' distribution network length (as at December 2009)[553]

Operating voltage	Overhead (km)	Underground (km)
132kV	11	0
66kV	1,426	41
33kV	3,988	161
19kV (SWER)	28,870	52
11kV (includes 7,6kV)	17,814	3,561
Low voltage (<1,000V)	19,107	11,899
Total	71,216	15,714

[t] There are also a number of smaller distribution entities covering remote areas but these are not covered in this Report Card.

Key high voltage components of the network are:

- 66kV sub-transmission lines within the metropolitan area, Eastern Hills, Fleurieu Peninsula, Eyre Peninsula and Riverland regions
- 33kV lines for country long distance sub-transmission
- 33kV lines for some metropolitan and Adelaide city areas
- 11kV lines for general distribution in built-up areas with some pockets of 7.6 kV network distribution in the metropolitan region
- 19kV SWER (single wire earth return) lines for sparse rural distribution.[554]

Much of the network was constructed in the 1950s and 1960s and is reaching its design life, which is typically between 40 and 50 years.

Being a monopoly service, electricity distribution networks are regulated. ETSA Utilities' current regulatory period runs from 1 July 2005 until 30 June 2010. AER will be responsibility for economic regulation from 1 July 2010.

Retail

Full retail competition for SA electricity customers was introduced in January 2003, meaning that all customers can choose a retailer from which to buy their electricity. There are 19 licensed electricity retailers in the SA, 11 of which sell to small customers.[555] The tariffs offered by these retailers are unregulated. However, the SA Government has not mandated that customers must choose a retail tariff, as customers can choose to be on the regulated Standing Tariff. A review of retail energy competition in the State in 2008 found that competition was effective for small customers and recommended that direct price control via the Standing Contract not continue. In April 2009, the SA Minister for Energy rejected this recommendation on the basis that the Standing Contract is an important mechanism to maintain public confidence and safeguard consumer interests during price volatility. ESCOSA determines the Standing Contract price. In 2010, ESCOSA will reset the Standing Contract price and one of its key challenges will be to determine how much of the costs associated with climate change response policies should be passed on to electricity and gas customers.[556]

Historically, the Standing Contract price was a ceiling pricing and market price contracts offered by retailers typically offered savings of between 3% and 7%. However, by September 2009, the Standing Contract price was near the lowest price. The Electricity Supply Industry Planning Council expects that there will be a continual reduction in the number of retail contracts offering a 'discount' below the level of the Standing Contract price.[557]

Electricity prices

Electricity prices in SA are made up of two components:

- Network charges, which are set by the economic regulator (ESCOSA/AER) of ETSA Utilities
- Retail costs, which are set by the retailers or ESCOSA for the Standing Contract.

Between 2001/02, the Standing Contract price increased by 18% and 22% in real terms for residential and small business customers.[558] Since the introduction of full retail competition in 2003, the price for residential customers has decreased by 6% in real terms, however it has increased by about 7% for small business customers.[559] In both cases, the retail component of the price has increased while the distribution component has decreased or remained static.

Electricity demand

Demand over the last few years is listed in Table 9.5. Between 2004/05 and 2008/09 the growth rate of electricity consumption averaged 3.4% per annum. Peak demand growth has been increasing faster than average growth, due to the increasing use of reverse cycle air-conditioning in homes, and a growing increase in commercial loads.

Table 9.5: Electricity customer numbers and demand[560]

Total sales (GWh)	2004/05	2005/06	2006/07	2007/08	2008/09
Residential customers	3,751	4,070	4,154	4,108	4,474
Small business electricity customers	1,269	1,363	1,324	1,281	1,268
Large electricity customer	6,451	6,559	6,625	6,637	7,299
All customers	11,471	11,992	12,103	12,026	13,041

There is a direct correlation between electricity prices and sales. The price elasticity of annual sales is estimated to be -0.25, with slightly less than half of this elasticity applying to peak demand levels.[561]

9.2.2 Policy and governance

A key component of the SA Government's vision for the electricity sector is reflected in its agreement to the *national electricity objective*. This objective is to promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to price, quality, safety, reliability and security of supply of electricity; and the reliability, safety and security of the national electricity system.[562]

The overarching regulatory framework for SA's network is provided through the *National Electricity Rules*, which are made under the *National Electricity Law*. The *National Electricity Law* is applied as law in SA by the *National Electricity (South Australia) Act 1996*. The *National Electricity Rules* provide the detailed standards that govern participation in, and the operation of, the NEM. They specify a range of technical performance criteria that network service providers must observe while planning, designing and operating their networks. The South Australian jurisdiction expands on the *National Electricity Rules* through the *South Australian Electricity Transmission Code* and the *South Australia Electricity Distribution Code*.[563] In July 2008, the new South Australian Electricity Transmission Code (SAETC) came into force. It introduced additional reliability categories, including an important new category requiring higher reliability to the Adelaide central business district. It also identified a number of connection points across the State where growing demand allows for a move to a higher category of reliability.[564]

The NEM is continuing to evolve, with the most recent change occurring on 1 July 2009, when the management of the electricity spot market and the central coordination of the dispatch of electricity moved from the National Electricity Market Management Company (NEMMCO) to the AEMO. Until 2009, SA's Electricity Supply Industry Planning Council was the State Government's main provider of expertise on the electricity supply industry in SA, including on network planning. As of 1 July 2009, SA's Electricity Supply Industry Planning Council becomes part of the AEMO. Economic regulatory functions undertaken by ESCOSA have been transferred to the AER.

The role of the SA and Australian Governments in controlling electricity infrastructure is now very constrained compared to the past, as they have transferred control to independent regulators and authorities within a market framework. However, they can indirectly influence both costs and demand through mechanisms such as applying a price to carbon and encouraging energy efficiency.

Key documents to guide the development of electricity networks in SA are summarised in Table 9.6.

Table 9.6: Key electricity planning documents

Document	Description
South Australian Annual Planning Report (renamed the *South Australia Supply and Demand Outlook* from July 2010)[565]	This document is published annually by AEMO. It was produced previously by the Electricity Supply Industry Planning Council (ESIPC). The document describes the current state of SA's electricity supply system. It presents information on SA load forecasts, an assessment of the adequacy of the generation, fuel and transmission network capacity and reviews system augmentation projects.
Electricity Statement of Opportunities (ESOO)	ESOO is published annually by AEMO and provides a 10-year forecast to help market participants to assess the future need for electricity generating capacity, demand side capacity and augmentation of the network to support the operation of the NEM. It includes a year-by-year annual supply-demand balance for SA and other regions as a snapshot forecast of the capacity of generation and distribution.
National Transmission Statement (NTS) & *National Transmission Network Development Plan* (NTNDP)	These documents are published by AEMO in its role as the National Transmission Planner for the electricity transmission grid. The annual network development plans guide investment in the power system. In 2009, an interim NTS was produced which replaced the previous Annual National Transmission Statement produced by NEMMCO. This document will be superseded by the NTNDP in 2010. The NTNDP will provide historical data and projections of network utilisation and congestion, summarise emerging reliability issues and potential network solutions, and present information on potential network augmentations and non-network alternatives and their ability to address the projected congestion.[566]
Network 2025 Vision (Transmission)	This document, produced by ElectraNet, sets out its vision for the network to 2025.[567]
Annual Planning Report (Transmission)	ElectraNet publishes this report annually. It assesses the transmission system's likely capacity to meet demand in SA over the next twenty years. It also provides information about ElectraNet's possible plans for augmentation of the transmission network.[568]
Electricity System Development Plan (Distribution)	ETSA Utilities publishes this report annually. Its purpose is to provide information about actual and forecast constraints on ETSA Utilities' distribution network, and details of these constraints, where they are expected to arise within 3 years of publication. The document includes 13 regional development plans and specific plans for metropolitan 66 kV lines and 11/7.6 kV feeder exits.[569]
Demand Management Compliance Report (Distribution)	ETSA Utilities publishes this report annually. It describes progress to date on the various demand management initiatives being undertaken by ETSA Utilities.

Regulation of the electricity supply industry in SA is based on the:

- ***Electricity Act 1996*** (and regulations)
- ***National Electricity (South Australia) Act 1996*** (and the National Electricity Law and National Electricity Rules made under that Act)
- ***Essential Services Commission Act 2002*****.**

9.2.3 Sector trends

Growing electricity demand

Electricity demand is driven by economic activity, population growth, price, domestic air-conditioner penetration, the comparative cost of natural gas and several less important factors. For residential growth, key drivers are population and hence household numbers. For commercial loads, the most significant drivers are economic activity and population growth.[570] Changes in growth include:

- A shift from domestic electric hot water systems to electric-boosted solar units, heat pumps or gas heating will reduce electricity demand
- Significant industrial electricity usage increases will occur if an expansion occurs at the Olympic Dam mine site, and a new pulp mill is built in the South East

- An increase in electricity demand for bulk water supply, which will increase from 200GWh in 2011/12 to 570GWh, with the commissioning of a 100GL desalination plant in 2012/13.[u]

Between 2009/10 and 2018/19, the average yearly growth in SA is expected to be 1.5% under low growth, 1.8% under base growth and 4.8% under high growth.[571] The summer peak electricity demand will grow faster than the average demand. Peak growth is expected to average 2.0% over the next decade.[572]

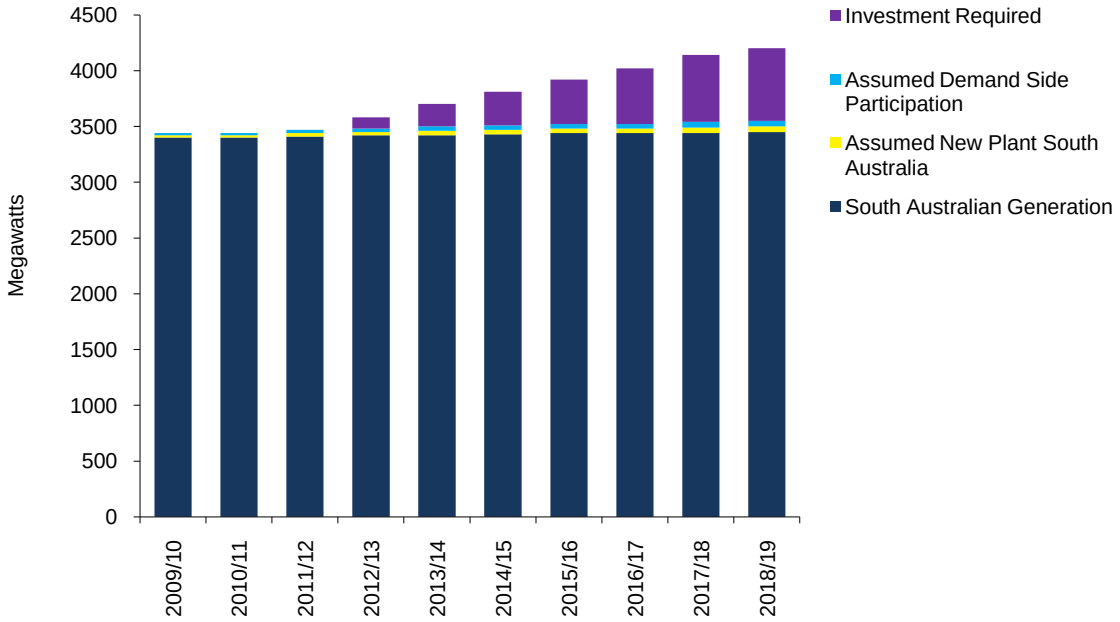
Changing supply-demand balance

AEMO considers that SA has sufficient capacity to meek both peak and average demand until 2012/13:

- Given the:
  - Committed investment in new generation in SA and Victoria
  - Increased hydroelectric supply because of the easing of drought conditions
  - Slowing of economic growth, and
- Assuming that the currently committed new generation plant is completed on time.

After 2012/13, additional capacity will be required to meet demand. AEMO 10-year predictions of the supply and demand balance are provided in Figure 9.2.

Figure 9.2: SA supply - demand balance[573]



Increasing electricity prices

Electricity prices are likely to rise significantly over the next few years.[574] Significant increases are already being seen in other States following recent price determination reviews. This increase is due to:

- Direct and indirect price impacts of a potential carbon pricing regime
- Renewable energy requirements
- Increases in the network utilisation component of electricity prices
- Increases in wholesale electricity prices due to higher fuel costs.

[u] Electricity Supply Industry Planning Council, 2009, *Annual Planning Report*, p. 31-2. The electricity forecasts also assume commissioning of a new 100 GL desalination plant to service Adelaide's water requirements from 2012-13. A desalination plant of this size would consume an estimated 500 GWh per annum or around 3.7% of South Australian customer sales if it operated at maximum output for the full year. The operation of the desalination plant could also substantially reduce the energy used for water pumping, with the net increase in sales estimated at around 350 GWh. The desalination plant is expected to have a maximum demand of 80MW. The effect on electricity peak demand and sales is included in the base, high and low growth scenarios. Electricity Supply Industry Planning Council, 2009, *Annual Planning Report*, p. 22.

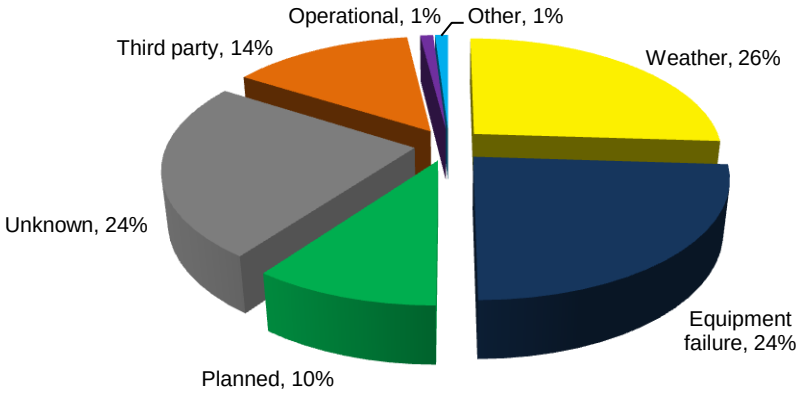
The distribution component of the network utilisation prices will increase by 14% in 2010/11 followed by a 6% yearly increase until 2014/15. This price rise was justified on the basis of the rising costs of labour and materials, the need to replace aging assets and the continuing growth in peak demand. The rise in distribution network costs translates to a 5% increase in the average residential customer's annual electricity bill in 2010/11 and a 3% rise each year after that.[575]

Increasing extreme events

In SA, climate change is forecast to impact on the number and severity of extreme weather events, including risks associated with heatwaves, such as bushfires and drought, as well as wind and lightning storms. While electricity systems are designed to cope with certain aspects of extreme weather, it is not always possible to prevent power disruptions during these events. Recent extreme weather events that caused power disruptions in greater metropolitan Adelaide included windstorms on 15 September 2008, severe thunderstorms on 13-14 November 2008, severe thunderstorms on 30 June 2009,[576] and a heatwave in January and February 2009.

Weather is the cause of between 25% and 45% of distribution outages each year. Figure 9.3 presents the causes of outages for 2008/09, and ETSA Utilities considers that the 24% of unknown events were mostly weather related.[577]

Figure 9.3: Contribution to interruptions (SAIDI) by cause for 2008/09[578]



Growing wind generation

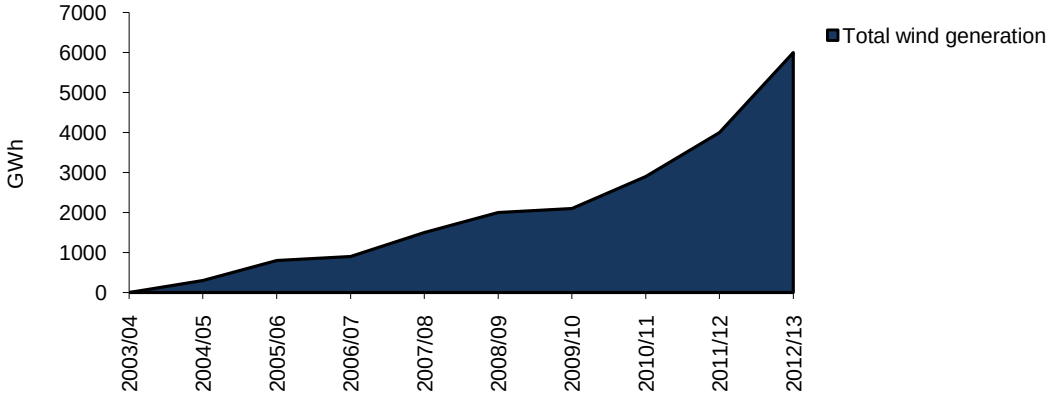
Wind power is rapidly growing as a source of generation in SA, and its deployment will accelerate due to the Australian Government's Mandatory Renewable Energy Target (MRET) scheme. The share of the State's generated energy that is supplied by wind farms is predicted to rise from 14% in 2008/09 to 15.7% in 2009/10 and to reach 34.1% by 2018/19.[579] Table 9.7 lists the total capacity of operating, under construction and under consideration wind power generators in SA.

Table 9.7: SA's wind energy industry (June 2009)[580]

Status	Capacity (MW)
Operating	740
Under construction	127
Under consideration	880

Figure 9.4 illustrates the actual and forecast growth in wind power generation.

Figure 9.4: Actual and forecast wind generation[581]



There are two key infrastructure problems with wind generation.

Firstly, wind farms are often located in places that are a considerable distance from existing generation and consumer areas. This means that new grid connections may be required as well as augmentation of existing transmission lines to reduce congestion. The networks in the mid-north and south-east of the State are already struggling to cope with the transfer of the high levels of wind energy being supplied.[582] Wind supply is constrained due to network congestion during periods of light loading and high wind conditions.[583]

Secondly, the intermittent nature of wind generation can cause risks to system reliability and security. This is because wind energy has dispatch priority over scheduled generation that can result in issues of network loading control, and instability following a sudden reduction in wind generation.[584] To address this, a range of measures is being implemented in the NEM, including the:

- **Semi-Dispatch Arrangements.** The Semi-Dispatch Arrangements provides AEMO with a degree of control over the output of wind-powered generation through the dispatch process.
- **Australian Wind Energy Forecasting System.** The Australian Wind Energy Forecasting System provides information to all market participants on the likely output, and potential variations in outputs, from wind-powered generators, increasing the ability of the market, and AEMO, to manage the variability in output from wind energy generators. Another approach is to have wind supply paired with confirmed rapid dispatchable generation on standby.

Increasing geothermal and other renewables

Geothermal power generation has a huge potential in SA due to the State's large and accessible geothermal deposits. As of February 2010, there are 28 companies in SA that have Geothermal Exploration Licences, with several having undertaken geothermal exploration and test drilling. The most advanced is Geodynamics Limited, which successfully proved in March 2009 that it was able to extract heat from hydraulically stimulated hot fractured rock to create power near Innamincka. The Company suffered a well control incident at Habanero 3, just days before the commissioning of a 1MW power plant. The result has been the selection of a different casing for Jolokia 1 and future wells, suitable to the reservoir conditions experienced. A decision about the future location of the 1MW plant will be made in 2010. The company anticipates making a final investment decision on its proposed 25MW commercial demonstration plant in December 2011, and if this proceeds, the plant would be commissioned two years later. Geodynamics believes that a successfully operating commercial demonstration plant will allow access to debt markets to finance the commercial expansion and transmission infrastructure required to produce 500MW to the national electricity market by December 2018.

Table 9.8 lists geothermal projects in SA that are well advanced.

Table 9.8: Geothermal projects in SA that are well advanced[585]

Developer	Power Station	Name-plate Rating (MW)
Geodynamics Limited	Innamincka	1
Geodynamics Limited	Innamincka	25
GreenRock Energy	Olympic Dam	NA
Pacific Hydro	Great Artesian Basin Project, far north SA	400
Petratherm	Paralana/ Beverley Uranium Mine	30

The key challenges facing geothermal development are:

- The costs and technology needed to locate and prove the resource. Exploration is high risk and deep drilling and in-ground development are both costly and technically challenging. The Australian Government's Geothermal Drilling Program has been essential in supporting deep drilling work. Capital raising is difficult for geothermal companies in the current economic climate.
- Generating energy from a resource where the conversion efficiency between heat from the ground and electricity is relatively low. The overall cycle efficiency of the generation process can be quite low, particularly on days where the ambient temperature in these remote areas is very high.
- Delivering the energy to market. Nearly all of the advanced geothermal projects in SA are remote from grid, meaning that transmission lines will be required to be built between the generators and the existing network. The Australian Energy Market Commission (AEMC) has examined this issue and is initiating a rule change in order to effect a "*more efficient framework for connection of clusters of new remote generation to energy networks*."[586] The proposed Scale Efficient Network Extensions (SENE) model requires monopoly Network Service Providers (NSPs) to plan and develop network extensions of optimal size for the expected level of future connections. Full economic cost recovery is intended to be achieved from the connection fees of generators when they ultimately connect to the extensions. Should the actual connections be less or later than expected, customers would fund the shortfall. Alternatives to electricity transmission include co-locating high-energy consumers with the power plant or to convert the energy into another form for shipment.[587] An example is to convert it into methane, which can be injected into the existing pipeline from Moomba.[588]

The SA Government has estimated that geothermal power will cost in the range of $80 -$105/MWh when delivered to regional nodes, which compares to $100-$140/MWh for wind power.[589]

Wave and tidal power developments in SA are also accelerating. The major developments over the last two years are:

- In February 2009, the SA Government approved a licence for Carnegie Corporation to test an offshore site along the Limestone Coast in SA with a view to building a demonstration 50MW wave power station. The site is near Port MacDonnell and is close to the national electricity grid. While the project was not supported in 2009 by the Federal Government's Renewable Energy Development Program, the project's proponent is still continuing with its feasibility study into the project during 2010.
- In May 2009, the SA Government gave planning approval for Wave Rider Energy to build a $5 million wave energy pilot plant off Elliston on the Eyre Peninsula. The purpose of the plant is to test their Wave Energy Converter (WEC) technology under field conditions. Following the granting of approval for the project under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* in 2010, the company is now fabricating the technology with intended deployment in 2011.

Both projects involve having sea-bed mounted infrastructure with the generation facilities on shore. This reduces the environmental impact and increases storm survivability compared with surface mounted systems.

Increasing capital works expenditure on networks

The next few years will see a significant growth in capital works for distribution and transmission networks. The projects constitute the largest investment in networks since the building of the interconnector in 1989.[590]

ElectraNet's major projects include:

- New substations at Penola West and Mount Barker
- A new underground transmission line into the heart of Adelaide to support the CBD and southern and western suburbs
- A number of reinforcements or replacements of aging assets.[591]

Table 9.9 lists ElectraNet's committed large transmission network augmentation projects, and there are a number of others under consideration.[592]

Table 9.9: Committed large transmission network augmentations[593]

Project	In service by	Cost estimate ($ millions)
New City West connection point	Dec 2011	$214
Kadina East reinforcement	Dec 2011	$19
Ardrossan West reinforcement	Dec 2012	$22
Cultana/Whyalla reinforcement/rebuild	Dec 2013	$85
Wudinna reinforcement	Dec 2012	$13
Templers reinforcement	Dec 2010	$35
New Mt Barker South connection point	Dec 2011	$35

ETSA Utilities will be spending some $1.6 billion dollars on capital expenditure between 2010/11 and 2014/15.[594] This is nearly double the investment made between 2005 and 2010. This investment requirement results from a diverse range of challenges, including:

- Electricity Transmission Code changes
- Peak demand growth
- Aged assets
- Increasing security of supply
- Changing locations of demand and supply
- A huge program of State infrastructure investment
- Building in capabilities that allow for future smart network technologies.[595]

Although the proposed program of capital expenditure will maintain ETSA Utilities' overall risk profile, current levels of reliability and network asset utilisation levels, ETSA Utilities notes that it is still a constrained program. ETSA Utilities also notes that not all the new investment needs of the SA distribution network can be addressed in the period to 2015.[596] Table 9.10 lists ETSA Utilities' proposed major projects:[597]

Table 9.10: ETSA Utilities major projects

Proposed major projects	Benefit	Project Value ($m)
CBD: new City-West connection; new substation (Post Office Place) and safety upgrades	Will improve security of supply for CBD, support major building development around the Waymouth Street precinct, and improve public and staff safety	154
Low voltage line and transformer upgrade	Will improve reliability under severe weather (heatwave) conditions	112

Proposed major projects	Benefit	Project Value ($m)
New network control centre, network monitoring and communications systems	Will improve security of supply and outage management and provide the platform for introducing future 'smart network' technologies	43
Metropolitan line and substation replacement and upgrade program	Will replace ageing substations, increase capacity and improve security of supply	250
Regional line and substation replacement and upgrade program	Will replace ageing substations, increase capacity and improve security of supply	190

9.3 Performance

9.3.1 NEM reliability and security

The performance of the National Electricity Market is based on the criteria of:

- **Reliability,** which is the availability of adequate bulk supply to meet consumer demand. The current standard for reliability is that there should be sufficient generation and bulk transmission capacity so that no more than 0.002% of the annual energy of consumers in any region is at risk of not being supplied; that is, unserved energy (USE) is less than 0.002%.
- **Security,** which is the continuous operation of the power system within its technical limits.

For the SA region of the NEM, the USE reliability criterion for a rolling 10-year average has been met. Over the last decade, the State's USE was 0.00051%.[598] However, the criterion was exceeded in 2009 due to load shedding over 29-30 January 2009. On 29 and 30 January 2009, Victoria and SA experienced 43ºC temperatures, creating enormous electricity demand. In addition, supply was diminished when the Basslink Interconnector to Tasmania was shut down and several Victorian generators were unavailable. Load shedding occurred on both days.[599] This resulted in a USE that was greater than 0.002% in both States.[600] The actual load shed was 90MW.[601]

9.3.2 Generation

The key performance measure for a generation plant is its ability to deliver a reliable supply when required. Its availability is affected by the number of internal plant planned outages (e.g. for maintenance and renewals), internal plant forced outages (e.g. plant breakdowns) and external forced outages (e.g. fuel unavailability, third party industrial actions). Internal plant outages usually increase with a plant's age, and when major upgrades occur.

Table 9.11 identifies the Equivalent Forced Outage Factor which is the percentage of power (MWh) unavailable over the year due to forced outages, and the Equivalent Availability Factor which is the percentage of power available over the year after outages are subtracted.

Table 9.11: Selected power station performance indicators (2008/09)[602]

Factor	Torrens Island Power Station A Station	Torrens Island Power Station B Station	Pelican Point	Northern	Playford
Planned Outage Factor (%)	14.13	12.16	2.20	3.5	4.3
Equivalent Forced Outage Factor (%)	2.46	1.10	0.62	3.7	42.4
Equivalent Availability Factor (%)	80.64	81.58	97.08	92.5	39.3

Table 9.12 contains the most recent national outage and availability figures, which allows a comparison of the above plants with the average for SA and the other jurisdictions.

Table 9.12: National generator indicators[603]

	Equivalent availability factor (%)		Forced outage factor (%)		Planned outage factor (%)	
State	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08
NSW & ACT	86.4	85.2	4.2	4.3	9.4	10.5
Vic	90.3	90.6	4.0	3.5	5.7	6.0
Qld	93.1	88.9	3.3	3.8	3.6	7.3
SA	85.9	95.2	6.9	0.2	7.1	4.6
WA	82.1	81.5	3.3	7.5	14.6	11.0
Tas	90.3	87.0	0.9	4.2	8.8	8.9
NT	84.1	89.7	4.6	3.6	11.3	6.7

9.3.3 Transmission

ElectraNet's performance targets and their achievements are set out in Table 9.13. Of note are the transmission line availability and outage duration figures. Transmission circuit availability is measured by the hours all circuits are available, expressed as a percentage of the total possible hours they could be available. Availability is strongly influenced by the level of maintenance and capital works. ElectraNet's transmission line availability has consistently been above target and is considered to be good industry practice by the Technical Regulator.[604] Outage duration figures, while reflecting maintenance quality, vary considerably from year to year due to random external factors and the structure of ElectraNet's network which has a number of long radial lines.[605]

Table 9.13: Performance against service targets — ElectraNet[606] [607]

Performance measure	2004	2005	2006	2007	2008	Target (2008)
Transmission line availability (%)	99.38	99.57	99.42	99.38	99.39	99.25
Peak critical circuit availability (%)					97.26	99.24
Frequency of lost supply events greater than 0.05 system minutes					3	4
Frequency of lost supply events greater than 0.2 system minutes	7	0	4	1	1	2
Frequency of lost supply events greater than 1 system minute	0	0	0	0	0	2
Average outage duration (minutes)	49	114	88	270	195	78
No. of interruptions[608]	19	26	14	11	13	
System minutes off supply[609]	2.1	0.86	1.69	0.71	1.35	

The quality of the planning of ElectraNet's network is well established and constraints are well recognised. For example, capacity is constrained in the mid-north and the southeast of the State due to increases in wind generation in this region. This will result in increasing congestion of the 132kV system.[610] ESCOSA has found that the basic system reliability performance of ElectraNet in 2008/09 was of a high standard[611] and there is some evidence that network performance has actually improved over the last four to five years.[612]

The reliability of the interconnectors has been high in the last few years, which has been essential to making SA's electricity system secure and reliable.[613]

9.3.4 Distribution

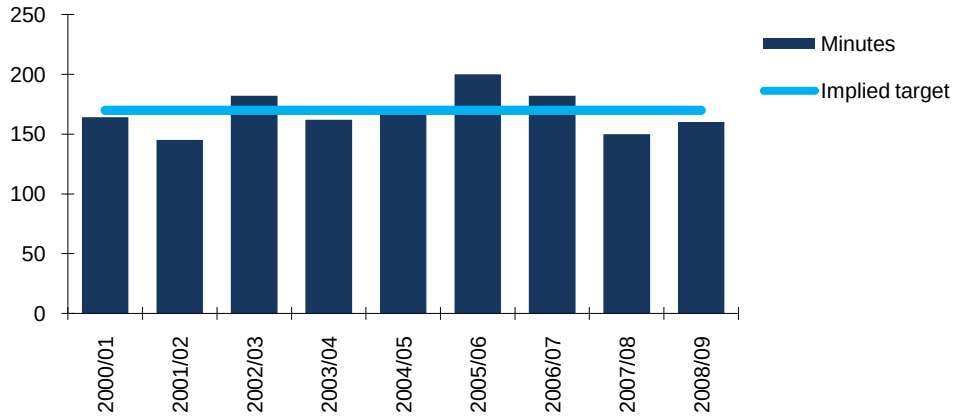
Technical performance on the distribution network is measured by reliability and quality of supply. Performance measures for these are:

- **System Average Interruption Duration Index (SAIDI).** The sum of the duration of each sustained customer interruption (in minutes), divided by the total number of distribution customers. SAIDI excludes momentary interruptions (one minute or less duration).

- **System Average Interruption Frequency Index (SAIFI).** The total number of sustained customer interruptions, divided by the total number of distribution customers. SAIFI excludes momentary interruptions (one minute or less duration).[v]
- **The time taken to restore supply to customers following an outage.** This is expressed as a percentage of customers that have supply restored within a defined time period.
- **Quality of supply factors.** These consist of voltage (e.g. sustained overvoltage and undervoltage) voltage variation (e.g. fluctuations, dips, switching transients), current (e.g. direct current, harmonic content and inter-harmonics) and other qualities (e.g. signalling reliability, noise and interference, level of supply capacity).

While SA's Electricity Distribution Code does not state an explicit State-wide SAIDI target, it can be implied from the regional targets to be 165 minutes.[614] Figure 9.5 illustrates this target and the yearly outcomes.

Figure 9.5: Total State-wide SAIDI (minutes) 2000/01 to 2008/09[615]



The State-wide figures sometimes vary year to year due to random events. For instance, a theft of copper earthing at the Elizabeth Downs substation on 9 October 2008 contributed 9 minutes to Major Metropolitan Area SAIDI in 2008/09.[616] Also, both transmission and generation outages can result in an increase in SAIDI figures. For instance, in 2008/09, transmission outages contributed about 6.3% to the total High Voltage SAIDI during 2008/09 and generation outages contributed 4.8%.[617]

The AER will be establishing targets for unplanned SAIDI and unplanned SAIFI that apply from 1 July 2010, for the calculation of financial incentives to maintain/improve supply reliability. Financial rewards and penalties will apply to ETSA Utilities depending on how performance compares with the respective targets, in accordance with the Service Target Performance Incentive Scheme (STPIS). Distribution Network Service Providers (DNSPs) are also required to make guaranteed service level (GSL) payments to customers if they experience an excessively long sustained supply outage and/or excessive number of sustained outages in a financial year.

Table 9.14 provides *Normalised SAIDI* figures that exclude severe weather events. This provides a better insight into the underlying quality of the network, and shows that interruptions have not changed markedly over the last decade.

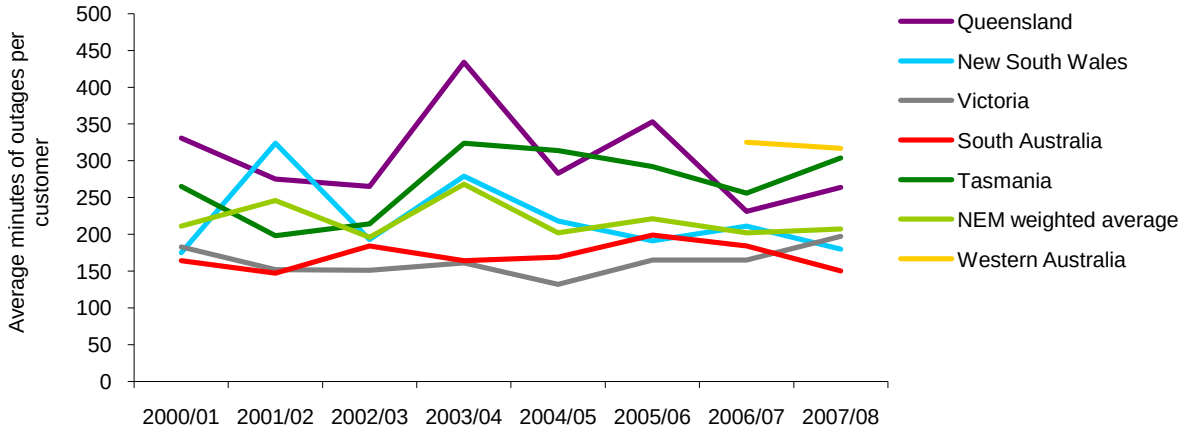
[v] AEMC, 2008, *Annual Electricity Market Performance Review 2008*, p. 66. The Essential Service Commission of Victoria (ESC) sets performance targets for unplanned SAIFI, unplanned SAIDI and MAIFI for the calculation of the financial incentive for improving supply reliability. Financial rewards and penalties apply to DNSPs depending on how their performance compares with their respective performance targets, in accordance with the S-factor scheme. DNSPs are also required to make guaranteed service level (GSL) payments to the worst-served customers if there have been excessive sustained supply outages and momentary interruptions.

Table 9.14: Total overall and normalised State-wide SAIDI[618]

Factor	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	Average
State-wide SAIDI[619] (incl. low voltage)	164	147	184	164	169	199	184	150	161	169.1
State-wide High Voltage SAIDI	158.9	142.9	179	158.8	164.2	193.3	177.6	144.5	155.1	163.8
No. of Severe Weather Events	2	2	6	3	3	7	7	2	4	4
SAIDI for Severe Weather events	12.4	16.6	50.9	15.1	26.8	57.7	37.7	11.9	23.8	28.1
Normalised HV SAIDI	146.5	126.3	128.1	143.7	137.4	135.6	139.9	132.6	131.3	135.7

Figure 9.6 compares SAIDI across the nation.

Figure 9.6: System Average Interruption Duration Index (SAIDI) across Australia [620]



There can be considerable variation in SAIDI by region. Table 9.15 shows that SAIDI targets were met in 5 of the 7 regions of the ETSA Utilities network in 2008/09.

Table 9.15: Regional SAIDI performance (minutes) of ETSA Utilities (including low voltage interruptions allowance)[621] [622]

Region	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	Target
Adelaide Business Area	45	11	15	29	19	10	7	16	23	25
Major Metropolitan Areas	110	109	122	118	108	143	118	109	118	115
Central	234	208	348	186	355	239	267	202	225	240
Eastern Hills and Fleurieu Peninsula	333	296	382	389	379	414	381	252	326	350
Upper North and Eyre Peninsula	399	293	341	303	399	610	481	361	375	370
South-East	524	277	347	345	230	256	489	328	226	330
Kangaroo Island	932	1084	905	1960	290	1354	510	565	232	450
Total	164	147	184	164	169	199	184	150	161	165

While the SAIDI performance in 2008/09 was worse than in 2007/08 (mainly due to a high number of severe weather events), the overall performance was still better than the implied target of 165 minutes. The performance in 2007/08 was also considered to be particularly good (ie. the second best performance on record).[623]

SAIFI performance over the last decade is shown in Figure 9.7.

Figure 9.7: Total State-wide System Average Interruption Frequency Index (SAIFI) 2000/01 – 2008/09[624]

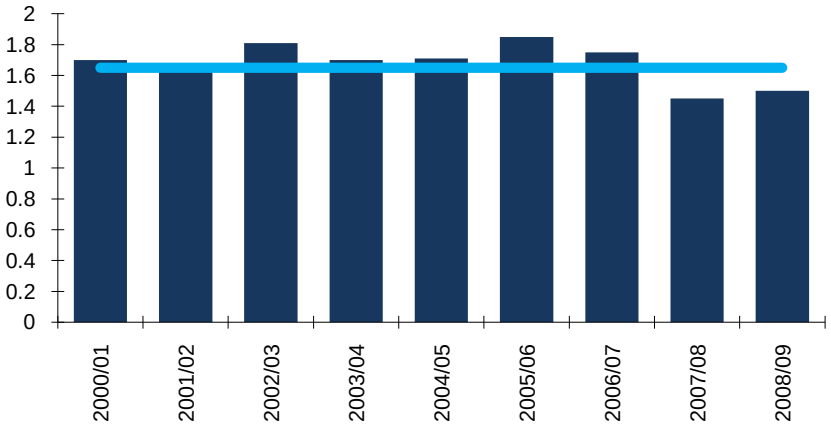


Table 9.16 identifies the national comparisons.

Table 9.16: System average interruption frequency index (SAIFI)[625]

State	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Queensland	3.0	2.8	2.7	3.4	2.7	3.1	2.1	2.4
New South Wales	2.5	2.6	1.4	1.6	1.6	1.8	1.9	1.7
Victoria	2.1	2.0	2.0	2.2	1.9	1.8	1.9	2.1
South Australia	1.7	1.6	1.8	1.7	1.7	1.9	1.8	1.5
Tasmania	2.8	2.3	2.4	3.1	3.1	2.9	2.6	2.6
NEM weighted average	2.4	2.4	1.9	2.2	1.9	2.1	2.0	1.9
Western Australia	-	-	-	-	-	-	3.3	3.3

Quality of supply performance measures are defined in the Electricity Distribution Code. Monitoring and reporting of compliance against these performance factors is based on ETSA Utilities' monitoring program and the customer complaints it receives. ESCSOA determined that ETSA Utilities has met these standards in 2008/09.[626] The amount of customer compensation events varies considerably, as seen in Table 9.17. An event is defined as one that results in a breach of power quality standards and results in some damage to a customer.

Table 9.17: ETSA Utilities customer compensation payments for quality of supply (voltage variation)[627]

Figure	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Number of customer compensation events	174	102	189	130	169	134
Total paid in compensation	$281,685	$219,407	$355,422	$193,656	$503,166	$154,251

Overall, the Electricity Supply Industry Planning Council concluded that while capacity limitations in the sub-transmission and distribution networks are emerging, "*there is sufficient inherent capability strength and flexibility embodied within the present sub-transmission and distribution networks*."[628]

9.3.5 Environmental sustainability

Electricity consumption in SA produces 31 million tonnes of greenhouse gas emissions per year. This is 64% of the State's greenhouse gas emissions.[629]

The SA Government has a range of initiatives to both reduce electricity consumption and increase renewable energy uptake. These include:

- Introduction of a feed-in tariff for roof top photovoltaic systems
- Requirement that at least 20% of electricity generated in the State is from renewable sources
- Rebates for the installation of solar water heaters
- A program to support the installation of photovoltaic systems at schools
- Rebates and grants to support renewable generation for remote area power systems[630]
- The residential Energy Efficiency Scheme (REES), which requires energy retailers licensed in SA to assist households to adopt energy efficiency improvements.[631]

ElectraNet's environmental strategy consists of:

- Developing environmental impact assessments and management plans that address all issues associated with construction projects and ongoing network operation
- Participating in initiatives that contribute to addressing and understanding the impacts of climate change
- Displaying social responsibility in network operation and network development projects
- Ensuring systems and processes are in place and are tested to prevent insulating oil spills
- Conducting ongoing awareness initiatives and training for staff in managing environmental issues affecting the electricity industry
- Complying with State and national environmental requirements
- Supporting renewable energy connections to the transmission network and exploring connections to other forms of sustainable energy.[632]

For ETSA Utilities, key environmental objectives are to:

- Reduce water and energy consumption across the organisation
- Ensure compliance with ETSA Utilities' obligations under the National Greenhouse Energy Reporting System (NGERS)
- Ensure that ETSA Utilities is able to maintain levels of network performance, reliability and risk in light of the impacts of climate change
- Dispose of all PolyChlorinated Biphenyls (PCBs) material and wastes removed from service and responsibly manage any PCBs still in service to minimise the potential for release to the environment
- Manage the environmental contamination impacts of historical and current operations
- Incorporate all environmental constraints from environmental impact assessments into operational and project management.[633]

9.4 Future challenges

The challenges to achieving improvements in electricity infrastructure are:

- **Renewing ageing infrastructure.** Much of the distribution network is nearing the end of its design life. A significant rise in the level of upgrades and renewals of network infrastructure will be needed, requiring a large pool of labour resources, which are becoming increasingly scarce.
- **Implementing significant demand management measures.** Peak demand needs to be limited to improve network reliability and security, and contain cost increases. Peak demand is growing faster than average demand. One way to reduce this is by implementing demand management, such as paying large consumers to scale back demand on peak electricity demand days. Achieving significant reduction in demand, particularly given air-conditioning demand on hot days, will be a major challenge.
- **Converting the potential of geothermal power generation into reality.** The next few years will see if geothermal power is a practical technology to deliver baseload generation reliably. If it is proved technically, then it may fail economically due to the cost of building the required

infrastructure to connect it to the national transmission networks. A challenge will be to enable geothermal power to contribute its potential in a way that is equitable for other electricity asset owners and electricity consumers.

- **Integrating wind generation into the network.** Wind generation in SA is already reaching capacity constraints, particularly on high wind and low demand days. Locating generators in areas where there is greater network capacity, increasing dynamic control and augmentation of the transmission system (including interconnectors) are all ways to increase wind power generation. Making these changes can have significant cost impacts that must be shared appropriately.
- **Providing reliable supply in the face of extreme weather events.** Climate change may lead to an increase in extreme weather events, such as wind storms and heatwaves. While networks must be planned and maintained in such a way as to take account of weather, increasing reliability in the face of extreme events is very costly. Increased community expectations and an increased number of sensitive electronic devices in households will place pressure on the electricity distributor and governments to reduce interruptions and their duration. There will be greater emphasis on reducing peak demand during heatwaves, restoring networks rapidly and informing customers of problems and rectification times.
- **Capturing the opportunities of smart network technology.** There is a need to prepare for an increasingly intelligent network, with proliferating network-integrated digital technologies, and growing numbers of small and micro-generators such as solar/photo-voltaic and wind linking into the network.
- **Addressing the inability to add embedded generation in the Adelaide CBD.** While embedded generation can reduce the need for network reinforcement projects, provide additional generation and increase energy efficiency, it can also introduce fault sources into a network. Currently, the distribution network within the Adelaide CBD is near the maximum safe fault level of both the Customers' and ETSA Utilities' existing high voltage equipment. Therefore no additional embedded generating units or other short circuit fault sources can be connected to the Adelaide CBD distribution network. This problem will only be addressed with significant modification to this network.[634]

9.5 Report Card Rating

Infrastructure Type	SA 2010	SA 2005	National 2005	National 2001
Electricity	B-	B-	C+	B-

Based on considerations of planning, funding, and infrastructure capacity and condition, SA's electricity infrastructure has been rated B-. This rating recognises that SA has sufficient generation capacity to meet demand until 2012/13. However, peak demand growth needs to be moderated to prevent high cost, low utilisation infrastructure being required. While the present significant expansion in transmission and distribution network infrastructure is important to rectify key limitations, ongoing growth in wind power and the development of distributed generation will require significant additional investment.

Positives that have contributed to the rating are:

- Growth in renewable generation in the State
- Significant expansion in investment in network infrastructure
- Sound transmission and distribution networks.

Negatives that have contributed to the rating are:

- Potentially unbalanced generation profile due to high penetration of wind farms
- Congestion and network constraints in certain areas of the transmission network

- Increasing population and increasing electricity demand resulting in a predicted reserve deficit after 2012/13
- Peak demand growth is increasing faster than average demand growth, with inadequate attention given to demand management.

10 Gas

10.1 Summary

Infrastructure Type	SA 2010	SA 2005	National 2005	National 2001
Gas	B+	B+ Overall B+ Transmission A- Distribution B+ LP Gas	C+	C

This rating recognises that SA's two transmission pipelines provide security of supply, and the distribution network is in adequate condition.

Since the last Report Card, the major gas sector developments have been the:
- Changing volume of gas required for gas powered generation
- Transfer of economic regulation for gas distribution from the ESCOSA to the AER.

Recently completed and in-progress major infrastructure projects include:
- Construction of the Ballera and Moomba pipeline (QSN Link) to allow gas from south-east Queensland to be supplied to SA
- Connection of the SEA Gas Pipeline to the South East Gas System
- Gas infrastructure projects at Noarlunga and Gillman to improve security and reliability to Adelaide's southern suburbs.[635]

Challenges to improving gas infrastructure include:
- Reducing the quantity of unaccounted for gas
- Expanding the distribution network.

10.2 Infrastructure overview

10.2.1 System description

Gas infrastructure refers to reticulated natural gas infrastructure. SA's gas infrastructure comprises the following components:
- Production
- Transmission
- Distribution
- Retail companies.

This Report Card does not cover liquefied petroleum gas (LPG), biomass and other fuel gases.

Producers extract and refine the gas, and sell gas directly to large customers, retailers or traders. Supply is also provided from interconnecting pipelines and storage providers. Transmission pipelines carry the gas under high pressure to city gates (also known as gate stations/custody transfer meters) which control and measure the gas flow into the distribution network. An odorant is normally added at the city gates to make the detection of gas leaks easier. The distribution network takes the gas from the gates and distributes it via high, medium and low pressure pipelines to the customer's meter/regulator set. The customer pays a retailer for the gas. The retailer buys the gas from producers, and pays transmission and distribution businesses for transporting the gas.[w]

[w] The charges are known as transmission use of system (TUOS) and distribution use of system (DUOS).

Retailers must balance their purchase and sale contracts to ensure security of supply. Retailers also operate customer call centres and implement customer demand curtailment in the event of major gas shortages.

Production

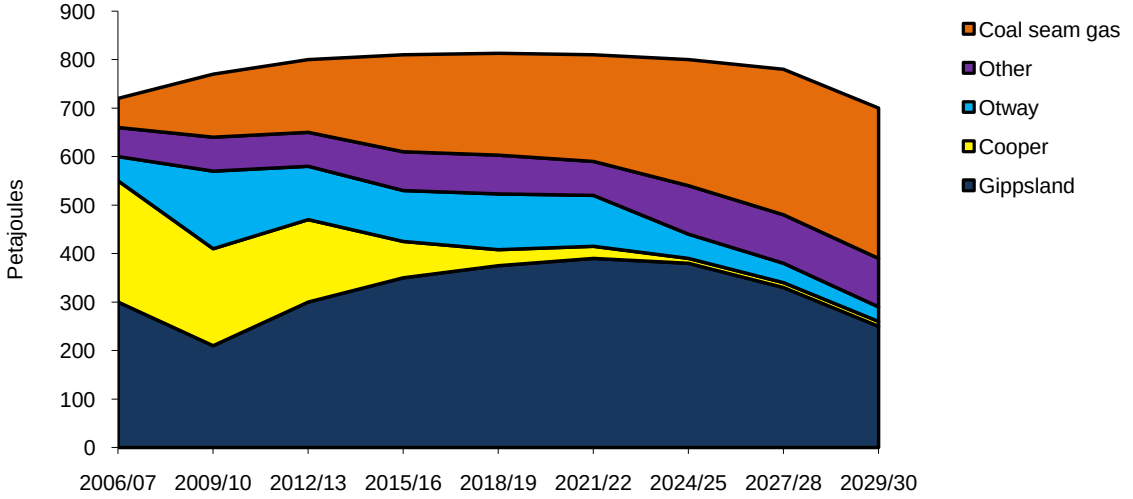
Natural gas consumed in SA comes from two main basins:

- Cooper Basin/Surat-Bowen Basin, which spans the State's north east, and into Queensland and NSW
- Otway Basin, which spans the State's south east and into Victoria.

Prior to 2003, the vast majority of SA's gas was supplied solely from the Cooper Basin, processed at the Moomba Production Facility, and transported along the Moomba to Adelaide Pipeline (MAP). Following the completion of the SEA Gas Pipeline in January 2003, gas now also comes from the Otway Basin. This secondary source of supply averted major economic damage in the State following the loss of gas supplies from the Cooper Basin after an explosion at the Moomba Production Facility in January 2004.

The Moomba Production Facility is fed from about 115 gas fields and 28 oil fields in the Cooper Basin. Its current gas production capacity is 430 TJ/day.[636] The reserves of the Cooper Basin are rapidly decreasing as it has been exporting gas via the MAP since 1969. ABARE expects a significant decline from the basin will occur after 2011.[637] Its remaining proven and probable reserves account for about 1.8% of Australian reserves.[638] However, if gas prices increase, the gas producers are confident that the volume of economically recoverable gas will increase six fold. [639] The declining importance of the Cooper Basin supply compared with other gas fields is illustrated in Figure 10.1. Following the completion of the QSN Link pipeline between Queensland's gasfields and Moomba, in January 2009,[640] gas began flowing into SA from the Bowen/Surat Basin through the MAP.

Figure 10.1: Forecast sources of eastern Australia's natural gas production[641]



The other natural gas supply source within SA's borders is in the Katnook area in the south east. This area supplies gas to Mount Gambier, and to industrial plants at Millicent and Snuggery via Epic Energy's South East Pipeline System. The area has been producing gas since 1991 and until recently, it was believed that the reserves were depleted. However, following new exploration by the gas field's new owners, Adelaide Energy, it appears that production could increase. Adelaide Energy is constructing new pipelines from its wells to the Katnook Processing Plant. The plant is now producing between 1.5 and 4.5TJ/d. It is building pipelines to connect the Jacaranda Ridge and Limestone Ridge wells to the Katnook plant and expects them to be connected in May 2010. Several new wells will be drilled in 2010 and if these are successful, production could increase up

to 10TJ/d - which is the capacity of the Katnook Processing Plant. Extra production from the Katnook area is likely to displace gas supplied into the Mount Gambier area from the SEA Gas Pipeline.[642]

Transmission and storage

Gas is transported through SA via three main transmission pipeline systems as seen in Figure 10.2.

- **Moomba to Adelaide pipeline (MAP),** which transports natural gas from the Cooper Basin/Surat-Bowen Basin into Adelaide and some major regional centres. It has lateral pipelines to Whyalla, Port Pirie, Peterborough and the Barossa Valley (all owned by Epic Energy) and to the Riverland and Murray Bridge (owned by Envestra).[643]
- **SEA Gas Pipeline**, which transports natural gas from the Otway and Bass Basins into Adelaide and regional centres.
- **South East South Australia (SESA) transmission pipeline,** which is a 70km pipeline built in 1991 to deliver gas from the Katnook processing plant near Penola in the south east of SA to Snuggery and Mount Gambier.
- **QSN Link,** which is part of the South West Queensland Pipeline, and transports gas from the south west Queensland gas fields to be injected into the MAP.

Figure 10.2: SA's gas transmission network[644]

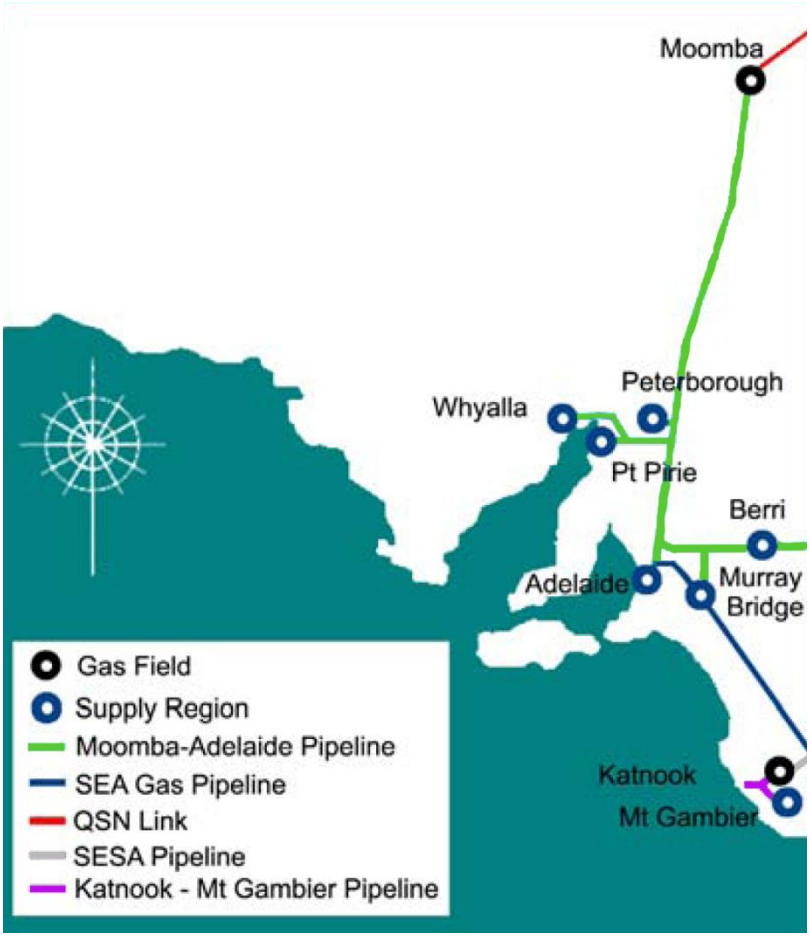


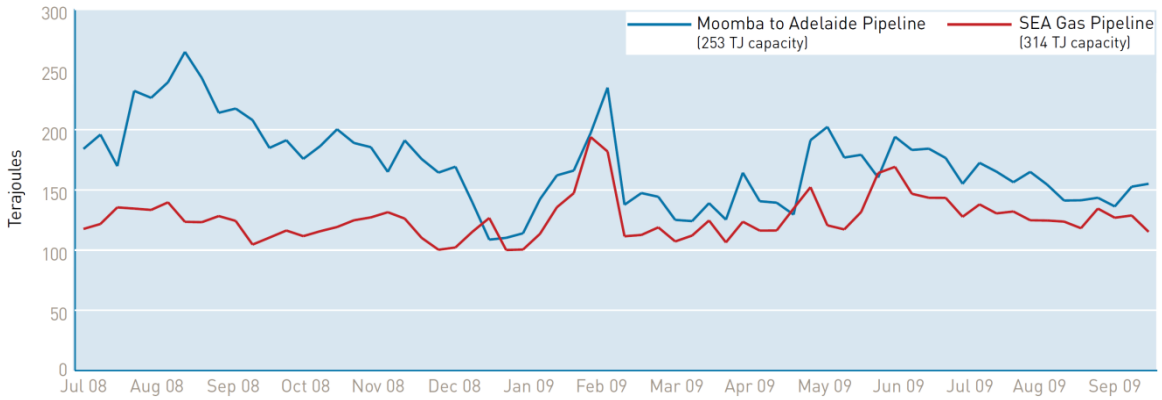
Table 10.1 provides details on these pipelines.

Table 10.1: SA's transmission gas pipelines[645]

Pipeline	Owner	Details	Capacity (TD/D)	Constructed	Covered
Moomba to Adelaide Pipeline System	Epic Energy	858km (mainline) with 326km of laterals	250 TJ/d	1969	No
SEA Gas Pipeline	International Power, APA Group, Retail Employees Superannuation Trust (equal shares)	680km pipeline from Port Campbell to Adelaide	314	2003	No
QSN Link (Qld to SA/NSW Link)	Epic Energy	180km pipeline from Ballera to Moomba	212	2009	No
South East South Australia (SESA) pipeline[646]	APA	45km pipeline from Poolaijelo (VIC) to Ladbroke Grove, near Penola (SA)) The pipeline supplies gas to the Envestra owned south east pipeline network around Mt Gambier, Penola and Millicent. Gas enters the Pipeline via the SEA Gas Pipeline	-	2005	No

The gas flows into SA from the MAP and SEA Gas Pipelines is illustrated in Figure 10.3. In 2008/09, about 61% of the gas entering the distribution system was sourced from the Moomba to Adelaide Pipeline (MAP), while 37% came from the SEA Gas Pipeline.[647]

Figure 10.3: Gas flows into SA[648]



During periods of high demand, reserves can be injected into the MAP from the underground storage facility at Moomba and into the SEA Gas Pipeline from the Iona Underground Gas Storage facility. The compressed gas in the pipelines also provides a reserve, known as linepack, which can be drawn upon during high demand, then recharged during periods of low demand. Within SA, there are no significant gas storages close to the main load centres.[649] In November 2009, AGL announced it would be building a gas storage facility as part of its upgrade to the Torrens Island Power Station. This facility will store gas in a liquefied state, which can be used directly in the power station or re-injected into the gas distribution system when needed.[650]

None of the transmission pipelines are *covered*, meaning that access to the pipeline by third parties is not covered under the *National Gas Law* and consequently, access arrangements are individually negotiated between gas providers and pipeline owners.

Distribution

SA's gas distribution system consists of 7,568km of pipelines and is concentrated in the metropolitan area of Adelaide (7,043km of pipelines). The SA distribution networks and their size in terms of customers are listed in Table 10.2.

Table 10.2: Gas distribution networks (as of June 2009)[651]

Network	Customers
Adelaide, including Virginia, Waterloo Corner and Two Wells	370,661
Whyalla	3,515
Port Pirie	5,048
Mount Gambier	7,743
Peterborough	65
Nuriootpa	608
Angaston	283
Berri/Glossop	68
Murray Bridge	95
Freeling/Wasleys	24

The distribution assets are owned by Envestra Ltd. Envestra was formed in 1997 when the natural gas distribution networks of the former South Australian Gas Company (SAGASCO), Gas Corporation of Queensland (GCQ) and Centre Gas Pty Ltd (in the Northern Territory) were combined into one organisation and floated on the Australian Securities Exchange. Envestra's major shareholders are the APA Group and Cheung Kong Infrastructure Holdings Ltd.[652] In July 2007, Envestra contracted APA Asset Management to operate, maintain and expand its distribution networks.[653] The arrangement between the related companies is detailed in an Operating Agreement.[654] Before 1969, Adelaide and some regional centres were receiving a town gas blended from coal gas, LPG and other hydrocarbons.[655] With the completion of the MAP, supply was converted to natural gas. Some of the gas pipelines laid at that time are still in service, and today, some 18% of Envestra's network is cast iron, 27% steel and 55% polyethylene.[656] As cast iron pipes are a major contributor to gas leakages, Envestra is progressively replacing these pipes, with the annual replacement rate detailed in Table 10.3.[657]

Table 10.3: Gas distribution pipelines replaced by Envestra, 2004/05 – 2008/09[658]

Pipe material	2004/05	2005/06	2006/07	2007/08	2008/09
Length of cast iron, unprotected steel and other gas distribution pipelines replaced	43km	86km	75km	102km	65km

Investment in gas network infrastructure over the last decade is shown in Figure 10.4.

Figure 10.4: Gas distribution network infrastructure investment[659]

Major capital works are undertaken from time to time, the latest being the duplication of an existing transmission main in River Road, Port Noarlunga, expected to be completed by winter 2010.[660] This project is designed to improve security and reliability to Adelaide's southern suburbs.

The SA gas distribution network is a regulated network, and the current regulatory period runs from 1 July 2006 to 30 June 2011. A determination at the beginning of the regulatory period sets the price increases over that period, access terms and conditions, tariffs and services, extensions, expansions, trading, capacity management and tariff policies that third parties (retailers) may access. With the commencement of the *National Gas Law* on 1 July 2008, responsibility for economic regulation was transferred from ESCOSA to the AER.

Retail

The SA gas retail market became fully contestable on 28 July 2004,[661] meaning that customers can choose their gas supplier. Retail gas prices are not regulated, except for the Standing Contract provided by the host retailer. SA has 11 licensed gas retailers with four active in the residential and small business market.[662] The market share of each of these suppliers is seen in Table 10.4.

Table 10.4: Market share for residential and small business gas retailers[663]

Retailer	Residential (%)	Small business (%)
Origin Energy (Standing Contract as host retailer)	33	78
Origin Energy (market contract)	23	6
AGL SA	21	4
TRUenergy	15	10
Simply Energy	8	2

Demand

There are three main markets in SA. They are:

- **Electricity generation.** About 50 to 60% of total gas sales in SA is used for electricity generation. In Adelaide, gas is used for electricity generation in the Pelican Point, Torrens Island, Quarantine, Dry Creek and Osborne power stations. There are also natural gas fired electricity generators at Mintaro and Hallett in the State's mid-north and at Ladbroke Grove in the Limestone Coast Region.[664] Gas fired generation accounts for 54% of the State's installed capacity for electricity generation. In 2008/09, gas fired generation supplied 51% of the State's electricity requirements.[665] For 2008/09, it took approximately 62% of the natural gas supply into the State to generate approximately 51% of the State's electricity needs.[666]
- **Industrial/commercial.** Gas is used extensively by commercial and industrial organisations in food production, paper manufacturing, automotive, glass and cement manufacturing, metal smelting, and tyre production[667] A number of large customers also use gas for cogeneration, producing onsite power and process heat.
- **Domestic sales.** Gas is used extensively for residential space and water heating, as well as cooking.

The numbers in each customer group are detailed in Table 10.5.

Table 10.5: SA gas customer numbers[668]

Customer numbers (June 2009)	2004/05	2005/06	2006/07	2007/08	2008/09
Residential gas customer	361,348	360,800	365,077	360,642	370,820
Small business gas customer	7,204	7,193	7,340	7,344	7,403
Large gas customer	806	849	839	813	797

Gas sales figures are seen in Table 10.6.

Table 10.6: SA gas distribution sales figures[669]

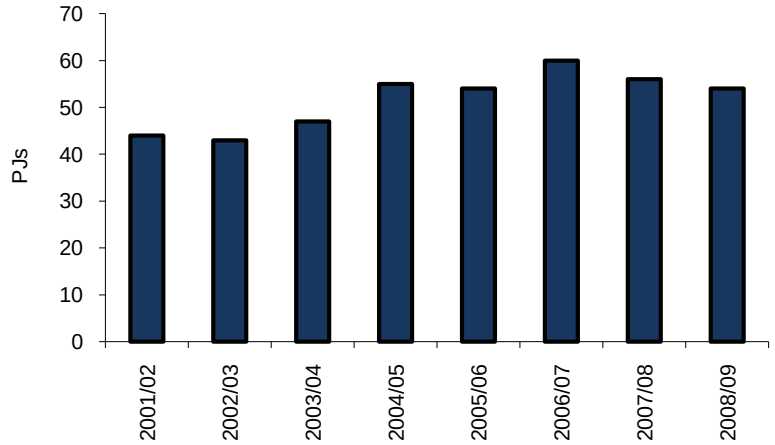
Gas sales (TJ)	2004/05	2005/06	2006/07	2007/08	2008/09
Residential gas sales	7,827	7,968	7,853	7,533	8,302
Small business gas sales	1,210	1,279	1,197	1,346	1,612
Large gas sales	33,539	29,121	29,335	24,578	24,084
Total	42,576	38,368	38,385	33,457	33,998

Residential demand has remained relatively constant over the last decade. The key driver of residential demand is winter temperatures. The winter of 2009 was colder than average and contributed to a 10.2% increase compared with the previous year.[670]

Summer and winter peak day demands are of a similar magnitude in SA.[671]

Figure 10.5 illustrates the gas consumed for electricity generation in SA in the last few years.

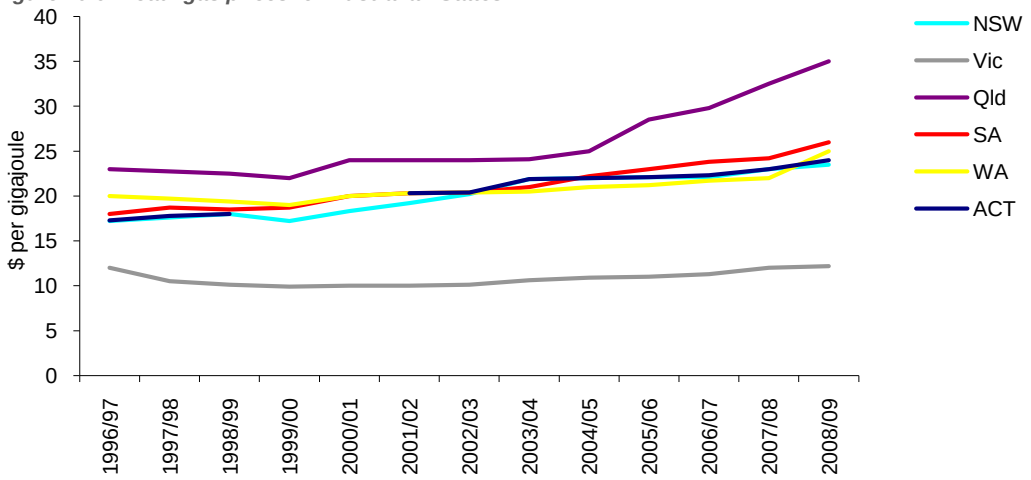
Figure 10.5: Gas consumed for electricity generation in SA from 2001/02 to 2008/09[672]



Prices

SA's retail gas prices were the second highest in Australia in 2008/09 as seen in Figure 10.6. It is not possible to assess the prices paid by industrial and large commercial customers as price information is generally not publicly available. This is because these customers sign confidential, long-term take-or-pay contracts, which can last for up to 30 years, but now more commonly last for 10 to15 years.

Figure 10.6: Retail gas prices for Australian States[673]



Note: Data after 1998-99 are estimates based on inflating AGA data by the CPI series for gas and other household fuels for the capital city in each state.

Gas prices in SA are made up of two components:

- Network charge, which is the cost of distributing gas through low pressure pipelines
- Retail charge, which is the operating costs of the retailer, wholesale gas costs, and the costs of transporting the gas through transmission pipelines.

The network charge is currently determined by ESCOSA. The retail charge has been unregulated since full retail contestability was introduced in July 2004.[674] The one exception is the Standing Contract for residential and small business customers. The retail component of the Standing Contract is set by ESCOSA. The current price determination runs from 1 July 2008 to 30 July 2011 and cost increases are listed in Table 10.7.

Table 10.7: Retail Component of Gas Standing Contract Price[675]

Customer type	1 July 2008 (% increase)	1 July 2009 (% increase)	1 July 2010 (% increase)
Residential customers	8.25%	CPI+1.0%	CPI+1.0%
Small business customers	15.00%	CPI+0.8%	CPI+0.8%

For the average residential customer, real prices (ie. after being adjusted for inflation) have increased by 12.9% between 2003/04 and 2008/09. For a small business customer, the increase has been 2.5%. A major reason for the greater increase in residential prices compared with small business prices has been the removal of cross subsidies paid by small business to residential customers.[676] Part of the reason for this is that while initially there was a significant discount between unregulated gas retail prices and Standing Contract prices, the available discount in recent years is between 2 and 6%.[677]

10.2.2 Policy and governance

The SA gas network is part of an interconnected south east Australian network. The overarching regulatory framework for this network is provided through the *National Gas Law* and *National Gas Rules*, which took effect on 1 July 2008. The NGL governs third party access to natural gas pipeline services and some broader elements of natural gas markets. The NGRs cover:

- Operation of the National Gas Market Bulletin Board,[x] which publishes pipeline capacity, forecasts of demand and market information, and
- The future operation of the Short Term Trading Market, which sets a daily wholesale price for natural gas.[678]

Planning for gas infrastructure is principally the responsibility of the owners of the infrastructure, rather than the SA Government. To assist owners in developing plans, the Australian Energy Market Operator (AEMO) produces the *National Gas Statement of Opportunities* (NGSOO). This is an annual document that provides demand and supply data so that owners are better able to develop capital investment plans.

The roles of the SA and Australian Governments are limited as their previous controlling powers have been transferred to independent regulators and authorities within a market framework. However, they can indirectly influence costs and demand through applying a price to carbon and encouraging energy efficiency.

Key SA gas legislation is the:

- ***Gas Act 1997*.** The Act requires that the owners and operators of gas infrastructure ensure that the relevant safety and technical standards are followed to ensure the safe, secure and reliable supply of gas to customers in SA.

[x] The National Gas Market Bulletin Board facilitates trade in gas and tracks capacity flows on all major gas production fields, major demand centres and natural gas transmission pipeline systems.

- ***National Gas (South Australia) Act 2008.*** This Act establishes a framework to enable third parties to gain access to certain natural gas pipeline services, through the NGL and NGR.
- ***Essential Services Commission Act 2002*****.** This Act established ESCOSA. [679]

10.2.3 Sector trends

Uncertainty about supply and demand

While both total gas consumption and gas consumption by each class of customer over the last few years have been relatively stable, this may not be the case in the future because of:

- **Changes in residential customer usage.** Demand per customer is likely to reduce in winter due to an increased use of solar water heating, an increase in the efficiently of appliances and the reduction in space heating due to climate warming.
- **Changes in SA gas powered generation (GPG).** Future gas demand is uncertain, for while an increase in electricity demand may result in increased gas consumption by power plants, the increase in wind farms may supply much of this additional electricity demand. The introduction of a carbon pricing regime may lead to the replacement of some of the older, less efficient GPG plants with more efficient plants, thus reducing gas consumption per unit of energy produced.
- **Increasing international demand for gas.** Demand for gas worldwide is increasing and exports of natural gas are expected to increase from Queensland. With the development of a gas grid connecting gas fields in the eastern and south-eastern States, increases in overseas prices will result in flow-on price increases for domestic gas.

AEMO in its assessment of future gas demand for SA considers that over the next decade, growth will be about 1.6% per year, assuming medium economic growth. It estimates that by 2011, there will be a drop in winter peak day gas consumption due to renewable generation displacing GPG. The summer peak demand will be more volatile due to summer electricity demands.[680]

10.3 Performance

10.3.1 Transmission

The asset quality of the SEA Gas Pipeline is high, having only been completed in 2003. The QSN Link pipeline was constructed in 2008 and has an estimated remaining life in excess of 40 years. The MAP is now over 40 years old but monitoring and inspection work has found no evidence of the stress corrosion cracking identified in the Moomba to Sydney Pipeline in 2004. Technical assessments made in 2004 and 2006 concluded that the remaining life of the asset is in excess of 20 years with good maintenance, while Epic Energy management's view is that the asset life expectancy is in excess of 35 years.[681]

The Australian Energy Market Operator considers that "*combined capacity on the MAP and SEA Gas Pipeline is sufficient under winter and summer 1 in 20 peak day Probability of Exceedance conditions to 2019*."[682]

For gas fired generation, the Electricity Supply Industry Planning Council considers there is "*adequate physical capacity in both gas sources and pipeline infrastructure to meet the SA electricity industry's demands for fuel for base-load power*."[683]

10.3.2 Distribution

In assessing the performance of a gas distributor network, it is necessary to consider multi-year trends rather than single years. This is because gas distribution infrastructure is sensitive to environmental conditions, such as heavy rain entering low pressure pipes, and because renewal programs tend to increase planned interruptions in the short-term, but reduce them significantly in the medium to long term.

Two key factors in assessing the quality of a gas distribution network are reliability and network integrity.

Reliability is measured in terms of the average frequency and duration of supply interruptions, which can be either planned or unplanned. Planned interruptions occur when a supply is deliberately disconnected to undertake maintenance or construction work. Unplanned interruptions mainly occur because of leakages or damaged pipes requiring immediate repair. Unplanned outages are often caused by third parties damaging pipes, or by water entering low pressure pipes.[684] Key reliability measures are:

- **System Average Interruption Duration Index (SAIDI).** SAIDI measures the total minutes, on average, that a customer could expect to be without gas over the reporting period. Total SAIDI comprises both planned and unplanned minutes-off-supply.
- **System Average Interruption Frequency Index (SAIFI).** SAIFI measures the number of occasions per year when each customer could, on average, expect to experience an interruption. It is calculated as the total number of customer interruptions, divided by the total number of connected customers averaged over the reporting period.[685]

Planned interruptions are mainly due to mains replacements. Unplanned interruptions are due to third party damage, infrastructure failure and inadequate maintenance/installation.

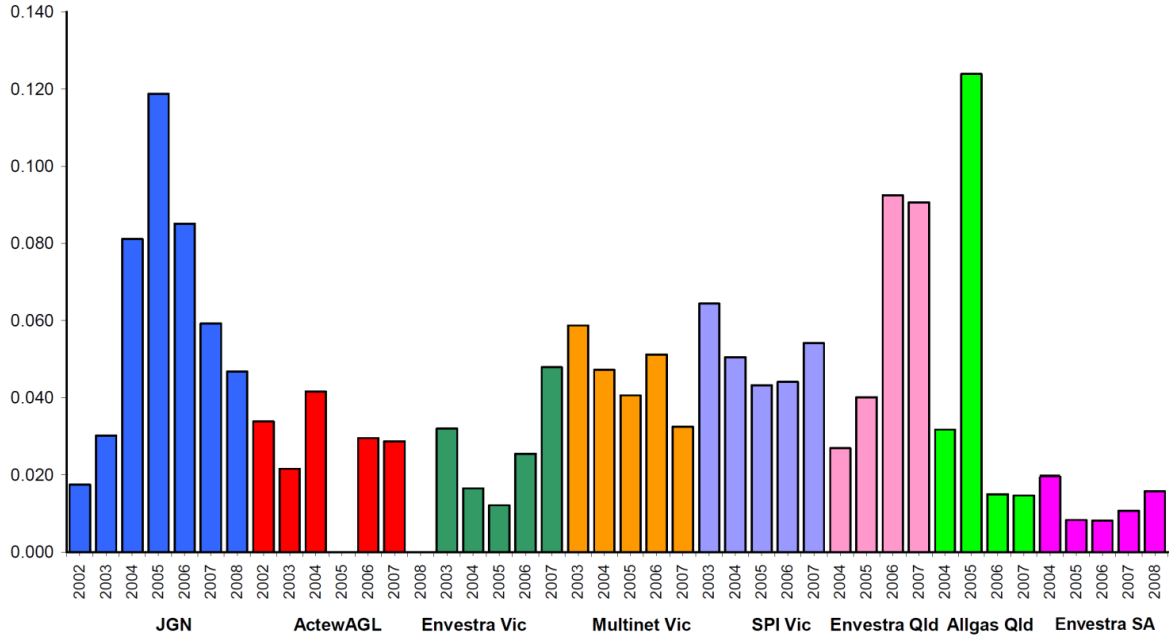
In 2007/08, there were 64 unplanned interruptions across the Envestra network and in 2008/09 there were 70.[686] Major interruptions (those affecting more than 5 consumers) in the recent past consisted of:

- Mitchell Park, where 40 consumers were affected for approximately 12 hours, when water entered the gas mains via a corroded gas inlet service
- Seaford, where 20 consumers were affected for approximately eight hours, when a gas contractor made a mistake during installation work
- Whyalla, where more than 3300 domestic, commercial and industrial customers were affected for approximately 2 to 3 days, due to a failure at the Epic Energy owned and operated City Gate station on16 May 2008.[687]

Figure 10.7. compares SAIFI figures of Envestra's network to other distribution networks around Australia.

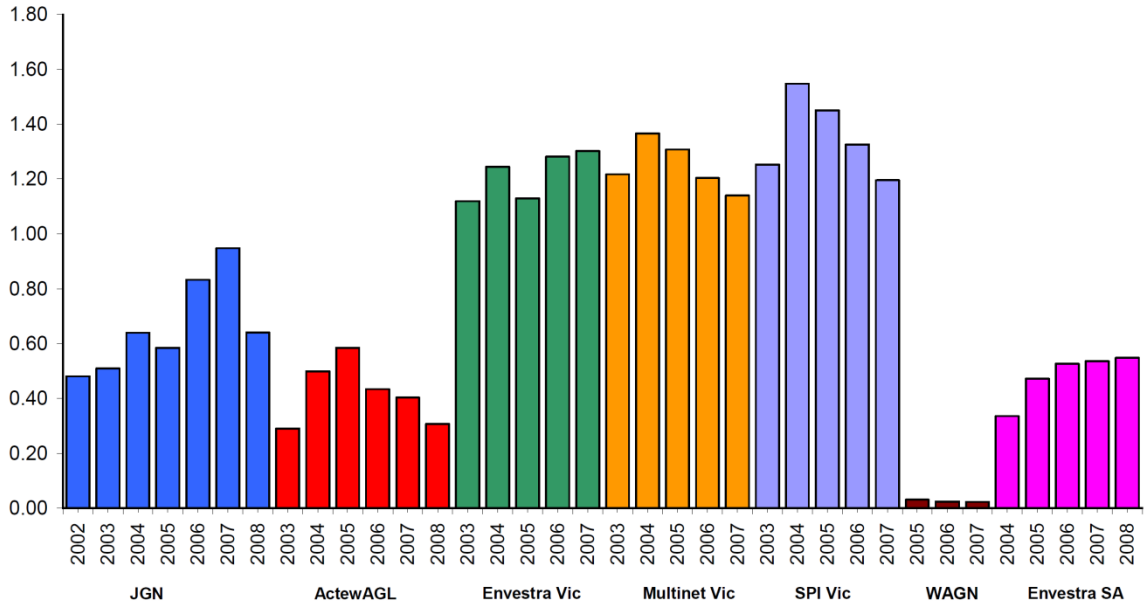
The number of unplanned interruptions has increased over the last few years and Envestra claims that this reflects more third party damage and better collection of statistics.[688]

Figure 10.7: SAIFI for distributors around Australia[y]



Network integrity can be measured by the quantity of leaks (loss of containment) and 'unaccounted for gas'. Their levels generally reflect the distributors' quality of operational and maintenance activities. Figure 10.8. compares all leaks per kilometre of mains for distributors around Australia.

Figure 10.8: All leaks per km mains for distributors around Australia [689]



Unaccounted for gas (UAFG) is a measure of the difference between the gas entering the system and the amount delivered. This difference indicates how much of the gas injected into the network is lost in transit. This can be due to system leaks, theft, inaccurate meters, differences in times that meters are read, accounting errors, gas compressibility factors, temperature or heating value discrepancies, line pack differences and losses in commissioning of new or replacement pipes.[690] It is estimated that approximately 80-90% of the UAFG can be attributed to gas leakage.[691] Table 10.8 identifies the volume of unaccounted for gas for Envestra's network and it shows that the volume is increasing.

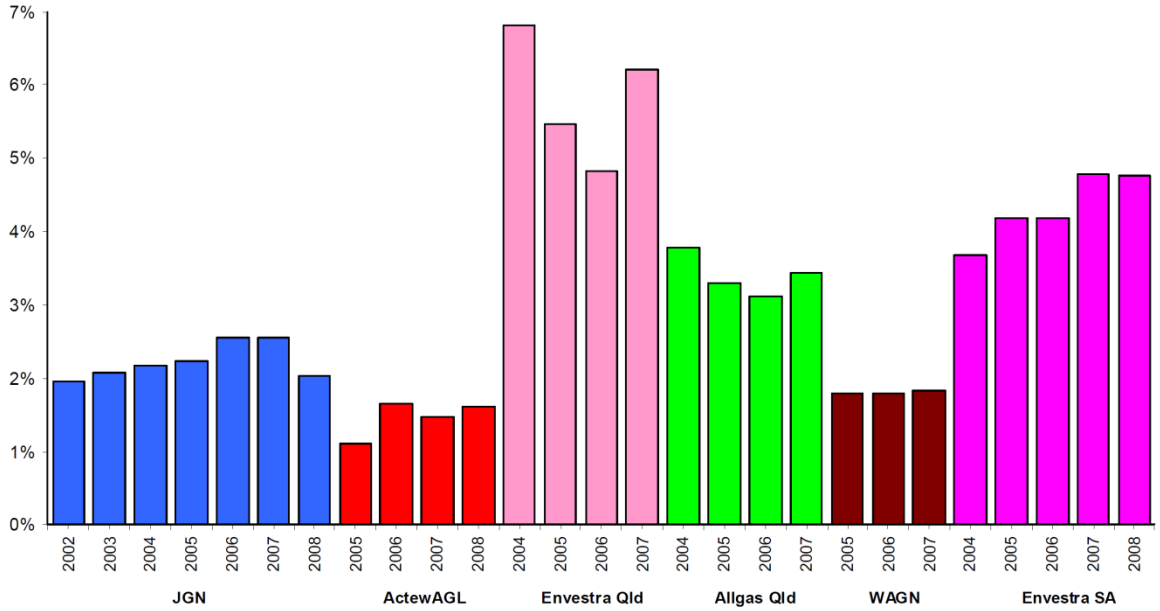
[y] Figures based on unplanned outages for greater than or equal to five customers per 1000 customers. Adapted from ActewAGL, 2009, *ActewAGL Gas Network Performance Benchmark Study FY2000–FY2008*, p. 33.

Table 10.8: Quantity of gas entering Envestra's distribution system and unaccounted for gas[692]

Measurement	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Gas entering distribution system (TJ)	39,564	37,983	38,917	38,412	37,720	38,003
Unaccounted for gas (TJ)[z]	1,493	1,592	1,630	1,834	1,799	2,009
Percentage (%)	3.8	4.2	4.2	4.8	4.8	5.3

Figure 10.9. compares UAFG for distributors around Australia.

Figure 10.9: Unaccounted for gas for distributors around Australia [693]



The high volume of UAFG in SA can be related to the proportion of cast iron pipes in the network, and their quality. In the case of Envestra, despite the program of replacement of cast iron pipes, which has seen some 950km replaced out of a total of 2400km between 1999/00 and 2008/09,[694] leakage volumes are still increasing. This may indicate that the remaining pipes are corroding more quickly.[695]

Envestra's Second Access Arrangement, approved by ESCOSA in 2006, identified that 100km of pipe per year would be replaced. Envestra failed to achieve this in 2008-09.[696] Envestra has advised ESCOSA that it will be increasing its level of mains replacement such that it expects to exceed the targeted length of mains replacement by the end of the current Access Arrangement period.[697]

10.3.3 Environmental sustainability

Natural gas as an energy source has significant environmental benefits compared with electricity generated from coal. For example, black coal used in producing electricity generates 80% more carbon dioxide emissions than natural gas used in a gas closed cycle gas turbine.[698]

Envestra is actively promoting the environmental benefits of natural gas, referring to it as the most environment friendly fossil fuel. Over 2008/09, Envestra marketing activities to highlight the environmental benefits of natural gas reduced significantly "*in recognition of the fact that governments appreciate the environmental benefits of natural gas and have over the past few*

[z] UAFG is the difference between gas entering the distribution system and gas delivered to customers (as metered). Envestra advise that, prior to 2005/06, this estimate was made for the 12 month period to the end of April as this was the month when billing factors had least influence. Since 2005/06, UAFG has been calculated by REMCo for the 12 month period to the end of June.

years implemented energy polices that promote the use of gas".[699] The company anticipates that it will need to increase the promotion of natural gas as a fuel of choice in the medium term as it now has to compete with green energy.[700]

Gas companies have also sought to minimise the risks of their operations, and in particular to reduce their environmental risk. Examples of this include:

- Minimising ground disturbance by using common trenching with other utilities, and directional boring to prevent damage to the root systems of trees
- Using long-life materials to minimise the need for future maintenance activities
- Minimising line purging operations and, if necessary, using flaring to minimise environmental impacts.

10.4 Future challenges

The challenges to achieving improvements in gas infrastructure are:

- **Reducing the quantity of unaccounted for gas.** The escalating level of UAFG from the Envestra distribution networks needs to be addressed for safety, financial and environmental reasons.
- **Expanding the distribution network.** Currently, certain areas of Adelaide, such as the Adelaide Hills, are not connected to the reticulated gas network.[aa] Due to the demand for gas, some greenfields property developments, such as such one in the Bluestone Mt Barker precinct,[701] are constructing their own self-contained reticulated networks supplied by large LPG tanks. Connection of these to the distribution network and expansion of the network to brownfield sites in the medium term may require government intervention.

10.5 Report Card Rating

Infrastructure Type	SA 2010	SA 2005	National 2005	National 2001
Gas	B+	B+ Overall B+ Transmission A- Distribution B+ LP Gas	C+	C

Based on considerations of planning, funding, and infrastructure capacity and condition, SA's gas infrastructure has been rated B+. This rating recognises that the two transmission pipelines provide security of supply, and the distribution network is in adequate condition.

Positives that have contributed to the rating are:

- Two transmission pipelines providing greater security of supply, reflected in the fact that the majority of Adelaide suburbs served by Envestra's distribution network now receive a mixture of gas from the MAP and SEA Gas Pipeline
- Good condition of transmission pipelines
- Adequate condition of distribution networks
- Ongoing replacement of aged pipelines
- Connection of SA network to Queensland gas reserves via the QSN Link.

Negatives that have contributed to the rating are:

- High rates of unaccounted for gas
- Decline in SA gas reserves.

[aa] The reason for this is that the provision of the network rests with the gas distribution network owner and expanded provision will only be made if there is sufficient demand to make it economically viable.