A LOW CARBON INVESTMENT PLAN FOR SOUTH AUSTRALIA

Achieving $10 billion investment in low carbon energy generation by 2025 and 50 per cent of electricity production by renewable energy by 2025

SOUTH AUSTRALIA

Government of South Australia

COVER PHOTO: Visible Solar Installation and Electric Vehicle Network, Kangaroo Island PHOTO: Pacific Hydro, Clements Gap Wind Farm

MESSAGE FROM THE SOUTH AUSTRALIAN GOVERNMENT

Earlier this year, the State Government committed to establish Adelaide as the world's first carbon neutral city. This bold commitment complements our economic priority to unlock the full potential of South Australia's resources, energy and renewable energy assets and our vision to make the state a place where people and businesses thrive.

This plan stands alongside South Australia's Climate Change Strategy, which outlines the State Government's aspirations for a low carbon, resilient economy.

We want South Australia to be a truly international economy. We want to be innovative and we want to engage with the world by supporting new industries and jobs as we progressively move towards a low carbon future.

By attracting investment, creating opportunity for local industry participation and new jobs, we believe South Australia can maximise the benefits of a low carbon energy transition. We believe we can establish Adelaide as a showcase city for economic development and innovation.

South Australia has earnt an international profile for its early focus on our low carbon strengths, which has provided a platform for a broad portfolio of complementary and cost-competitive technologies and innovations.

We want to achieve $10 billion of investment in low carbon energy generation by 2025 and we want 50 per cent of our electricity production to be by renewable energy by 2025. We're already well on our way towards achieving this goal.

The foundation of our approach, for a clear policy and efficient regulatory environment; information to inform investment; sponsoring uptake and wider market deployment and facilitation of projects to leverage funding and support, have already seen us achieve a $6.6 billion investment in renewable energy of which 40 per cent has been realised in our State's regions.

This plan sets out how we aim to achieve an investment target of $10 billion by 2025 by drawing on examples of initiatives and projects where the South Australian Government has had a role.

We would like to take this opportunity to thank the stakeholders who contributed to this important investment plan.

Jay Weatherill

Hon Jay Weatherill
Premier of South Australia

Hon Tom Koutsantonis MP
Minister for Mineral Resources and Energy

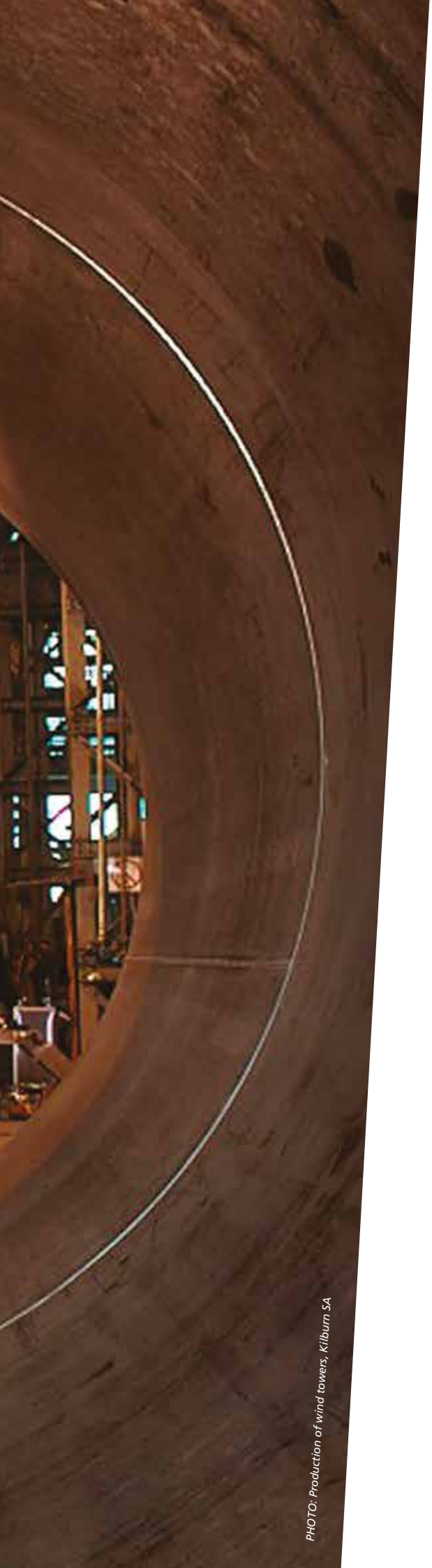

PHOTO: Production of wind towers, Kilburn SA

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PHOTO: Solar PV, Adelaide Showgrounds

INTRODUCTION

South Australia is unique in its endowment of world class resources. We have the opportunity to capitalise on these natural resources to work towards a low carbon future.

Renewable energy, generation from most efficient gas-fired technologies, co-generation and tri-generation all generate low carbon energy with emission intensity of less than 400kg of carbon dioxide equivalent per megawatt (MW) hour.

South Australia's success in drawing low carbon energy investment is not just the product of its natural resources. The State Government moved early to gain an advantage in the development of renewable energy sources by leading the nation in setting policy frameworks and regulatory processes to provide greater consistency, transparency and the certainty that investors need to capitalise on these outstanding resources.

During September and October 2015, the South Australian Government consulted on a Strategy Paper for low carbon investment and held workshops and consultation sessions in regional and metropolitan areas (refer Appendix A).

This document incorporates feedback from the consultation process with reference to the South Australian Government's policy objectives (refer Appendix B).

In general, stakeholders were supportive of a progressive approach to low carbon transition with a broader focus to include low emission gas. Stakeholders highlighted the opportunity for the government to lead by example by using its procurement process to support broader market uptake and the potential for new and enabling technologies to complement the low carbon transition. A number of stakeholders considered electric vehicles as an opportunity with an increasingly de-carbonised electricity generation sector.

This plan sets out 14 case studies under four key strategies that will help us to achieve our target for $10 billion investment in low carbon generation by 2025.

PHOTO: Solar Thermal Demonstration, Sundrop Farms

SUMMARY OF STRATEGIES AND CASE STUDIES

CLEAR POLICY AND EFFICIENT REGULATORY ENVIRONMENT

The South Australian Government has:

1.1 implemented the *Pastoral Land Management and Conservation (Renewable Energy) Amendment Act 2015* to allow wind farms, pastoral activity and resource exploration to co-exist on Crown land used for pastoral purposes and also expedite solar developments

1.2 created an Investment Attraction Agency to attract new businesses and head offices of international firms to the state

1.3 established the Office of the State Coordinator-General to coordinate and streamline approval processes for private sector development above $3 million in investment value.

INFORMATION TO INFORM INVESTMENT

The South Australian Government:

2.1 is undertaking a bio-energy roadmap to lay the groundwork for new bio-energy projects in South Australia

2.2 will commission further updates to its existing diesel data directory to allow proponents to assess more opportunities to offset diesel use with renewable or hybrid energy projects.

SPONSORING UPTAKE AND GOVERNMENT PROCUREMENT TO SUPPORT WIDER MARKET DEPLOYMENT

The South Australian Government:

3.1 is supporting Adelaide's first electric car share initiative, incorporating solar photo-voltaic (PV) and battery storage whilst also progressing with an Expression of Interest for its own vehicle fleet

3.2 has supported a new financial and legal model for a community cooperative for energy efficiency and renewable energy on local council buildings

3.3 is supporting a mobile energy storage testing facility by the University of Adelaide in partnership with SA Power Networks and several local providers for battery technology and integration to performance test systems integrated with energy infrastructure

3.4 is assessing the opportunity to showcase emerging battery storage on its own buildings in the Adelaide CBD area

3.5 is progressing legislation for building upgrade finance to allow building owners to access loans for energy, water and environmental efficiency for existing commercial buildings

3.6 has invited interested parties to respond to an Expression of Interest for provision of low carbon electricity supply and services to meet up to 100 per cent of the Government's electricity needs.

FACILITATING PROJECTS TO LEVERAGE FUNDING AND SUPPORT

The South Australian Government:

4.1 has facilitated and provided case management support for the Sundrop Farms development for a 20 hectare greenhouse expansion at Port Paterson (near Port Augusta) showcasing sustainable horticulture in an arid environment, including a solar thermal facility to generate electricity, desalinate water and warm the greenhouse

4.2 is supporting the Coober Pedy wind and solar hybrid project by facilitating approvals for land access and providing a subsidy to enable the Coober Pedy Council to enter into a power purchase agreement for electricity

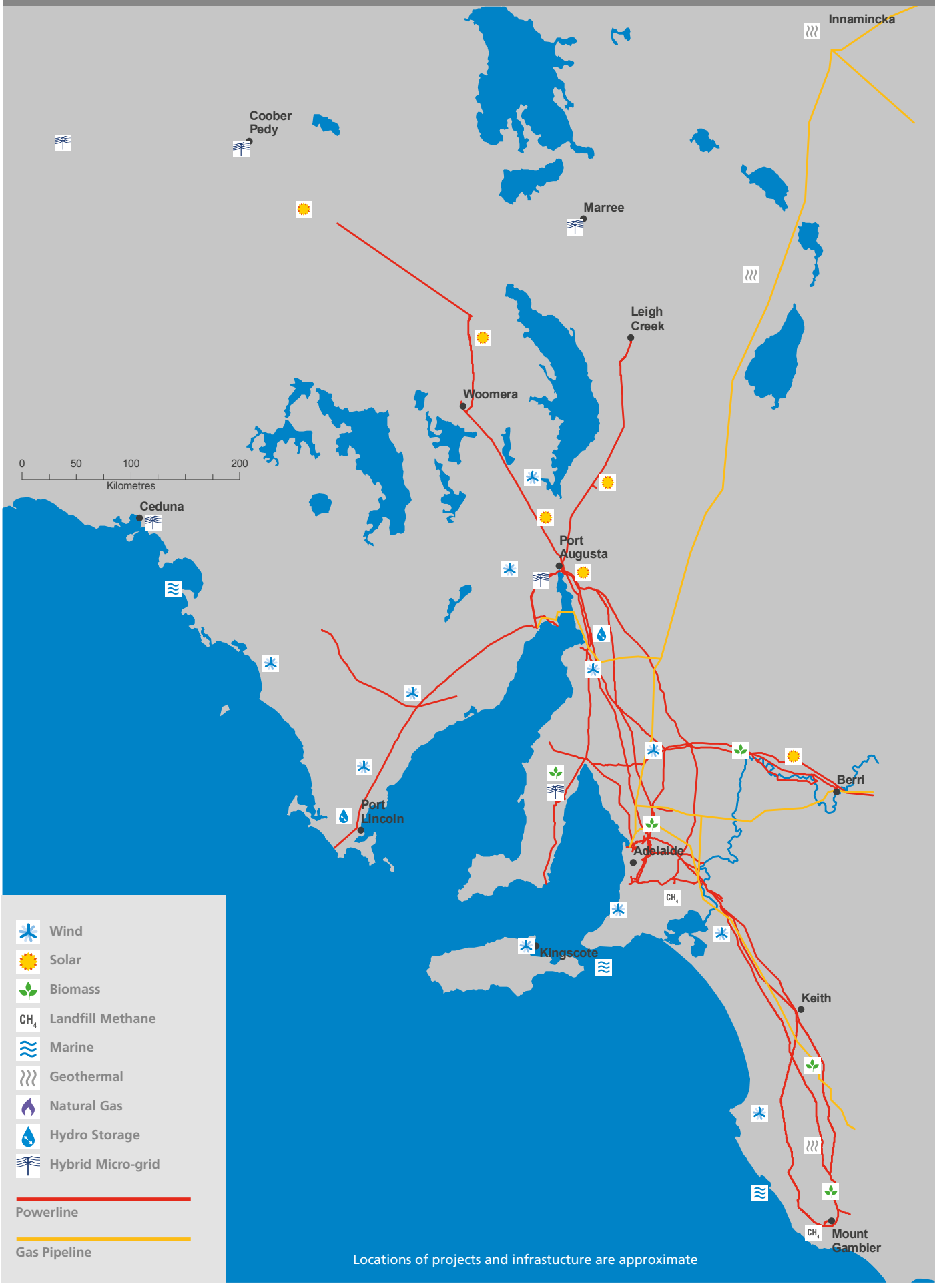
4.3 is investigating an opportunity for a high penetration renewable energy and battery storage power plant integrated with diesel for Marree, as a benchmark project for an off-grid community in South Australia's far north.

FIGURE 1: **EXISTING** AND **PROPOSED** LOW CARBON ENERGY PROJECTS IN SOUTH AUSTRALIA

Locations of existing and proposed low carbon energy projects in South Australia

FIGURE 2: **POTENTIAL** ZONES FOR LOW CARBON GENERATION, SOUTH AUSTRALIA

The State's potential zones for low carbon generation in relation to the State's electricity & gas transmission facilities



PROJECT DEPLOYMENT

South Australia is highly prospective for low carbon energy investment, with its natural endowment of resources with potential for development.

PHOTO: Wind Farm, Snowtown

WIND

- To date around $3.7 billion has been invested in wind generation, resulting in 35 per cent of the nation's installed wind capacity from 16 operational wind farms, representing 1,473 MW of power.
- From a global context, South Australia is one of the leading jurisdictions in the world for wind power. If South Australia was a nation state it would have the second highest market penetration of wind in the world, second only to Denmark.
- South Australia is the destination of choice in part due to its land use planning system, which is often regarded as national best practice for accommodating wind farms.
- The assessment of the wind resource on the Eyre Peninsula by Macquarie Capital revealed significant areas with wind speeds above eight metres per second (considered excellent for wind energy generation).

SOLAR

- The South Australian Government has installed solar panels on prominent government buildings and established a requirement for panels to be installed on all new and refurbished government buildings.
- The irradiance levels at Roxby Downs in the north of the state are world class and have been recorded at 2,500 kilowatt hours per square metre (kWh/m^2) per annum[1]. This compares favourably to Spain, southern Europe, northern Africa and the Middle East, which have recorded levels of 2,000-2,300 kWh/m^2 per annum. The levels in south-east USA are also in that range, with some exceptional sites estimated at up to 2,600 kWh/m^2 per annum.

MARINE

- South Australia is a prospective location for marine energy project development, with two projects built in South Australia. The South Australian coastline could play a part in the future energy mix by providing an abundant source of energy.

GEOTHERMAL

- South Australia was the first state to introduce a regulatory framework specifically tailored to the geothermal industry.
- South Australia represents Australia as the Contracting Party to the International Energy Agency's Geothermal Implementing Agreement (IEA GIA).
- The Vice Chairman of the Executive Committee for the IEA GIA, based within the South Australian Government, is providing leadership for processes that increase worldwide knowledge and information sharing to foster progress in the Australian geothermal industry.

ENERGY STORAGE

- With pre-existing high levels of renewable energy, South Australia is well placed to support deployment of energy storage technologies. For example, AGL, ElectraNet and WorleyParsons are jointly undertaking an Energy Storage for Commercial Renewable Integration project part funded by the Australian Renewable Energy Agency (ARENA) to explore the role of grid-scale battery storage in South Australia.
- The South Australian Government is currently exploring opportunities for energy storage on its own buildings in the Adelaide CBD where PV is installed.

LOW EMISSION GAS

- In June 2015 South Australia became the first state in the nation to host an innovative project capturing carbon emissions from a power station for the carbon market in Australia. The multi-million dollar recovery plant, to be built and operated by Air Liquide at the AGL Torrens site, will capture and purify up to 50,000 tonnes of carbon emissions from the power station each year. The captured emissions will then be re-used by industry to carbonate drinks and treat waste water and public swimming pools.
- There is potential for low emission gas to act as an enabler for intermittent renewable energy in hybrid energy projects.

ELECTRIC VEHICLES

- The South Australian Government has contributed $500,000 toward an innovative 50 kilowatt dual axis PV solar tracking system on Kangaroo Island with electric vehicles and a six station charging network (powered by solar at the airport and council offices, which is creating a significant point of interest for the island's eco-tourism credentials).
- The South Australian Government has supported a hybrid-electric car share project provided by Australia's largest car share company GoGet, which comprises a charging station coupled on-site with a 10kW solar PV installation and battery storage facility.

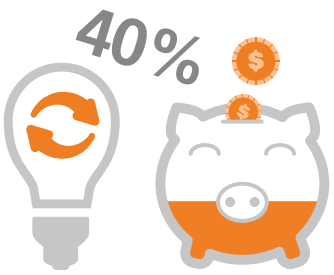
OFF-GRID

- As South Australia's off-grid communities are primarily reliant on diesel, there is the opportunity for benchmark projects to achieve reliable, secure, cost-competitive and quality power supply and reduce exposure to diesel fuel price changes.

[1] *Weather station data for May 2009-April 2010, CSP Services*

CURRENT POSITION

REGIONAL INVESTMENT



of renewable energy investment occurred in regional South Australia

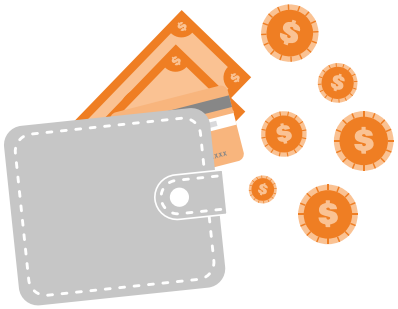
Jacobs, May 2015

COMMUNITY BENEFITS

Community funds benefit regional communities

Jacobs, May 2015

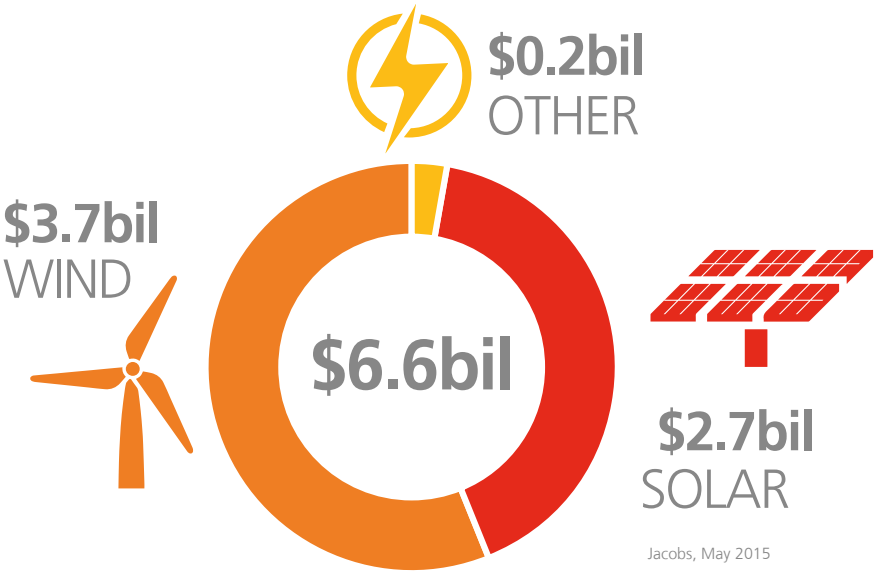
REGIONAL DEVELOPMENT



58% income and salaries in regions

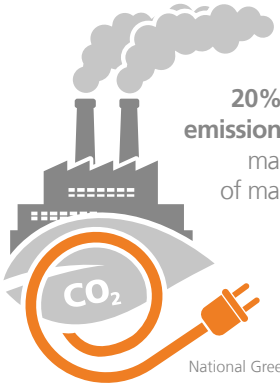
Jacobs, May 2015

INVESTMENT



Jacobs, May 2015

LOW EMISSIONS



20% lower grid emissions than other mainland states of mainland states

National Greenhouse Accounts, August 2015

EMPLOYMENT

1330 direct jobs

ABS 2013-14

EMPLOYMENT

1 direct job = 2 indirect jobs

SKM 2012

PHOTO: Solar Thermal Demonstration, Sundrop Farms

WIND

16x

South Australia has **16 operating wind** farms totaling **1,473 MW**

RenewablesSA

South Australia has a total of **559 wind turbines**

RenewablesSA

Wind contributed to

34%

of electricity generated in South Australia in 2014-15

RenewablesSA, Australian Energy Market Operator, 2015

SOLAR

663MW

663 MW of PV panels on household roof tops

Australian Energy Market Operator, 2015

1 in 4 households use solar energy

RenewablesSA, Australian Energy Market Operator, 2015

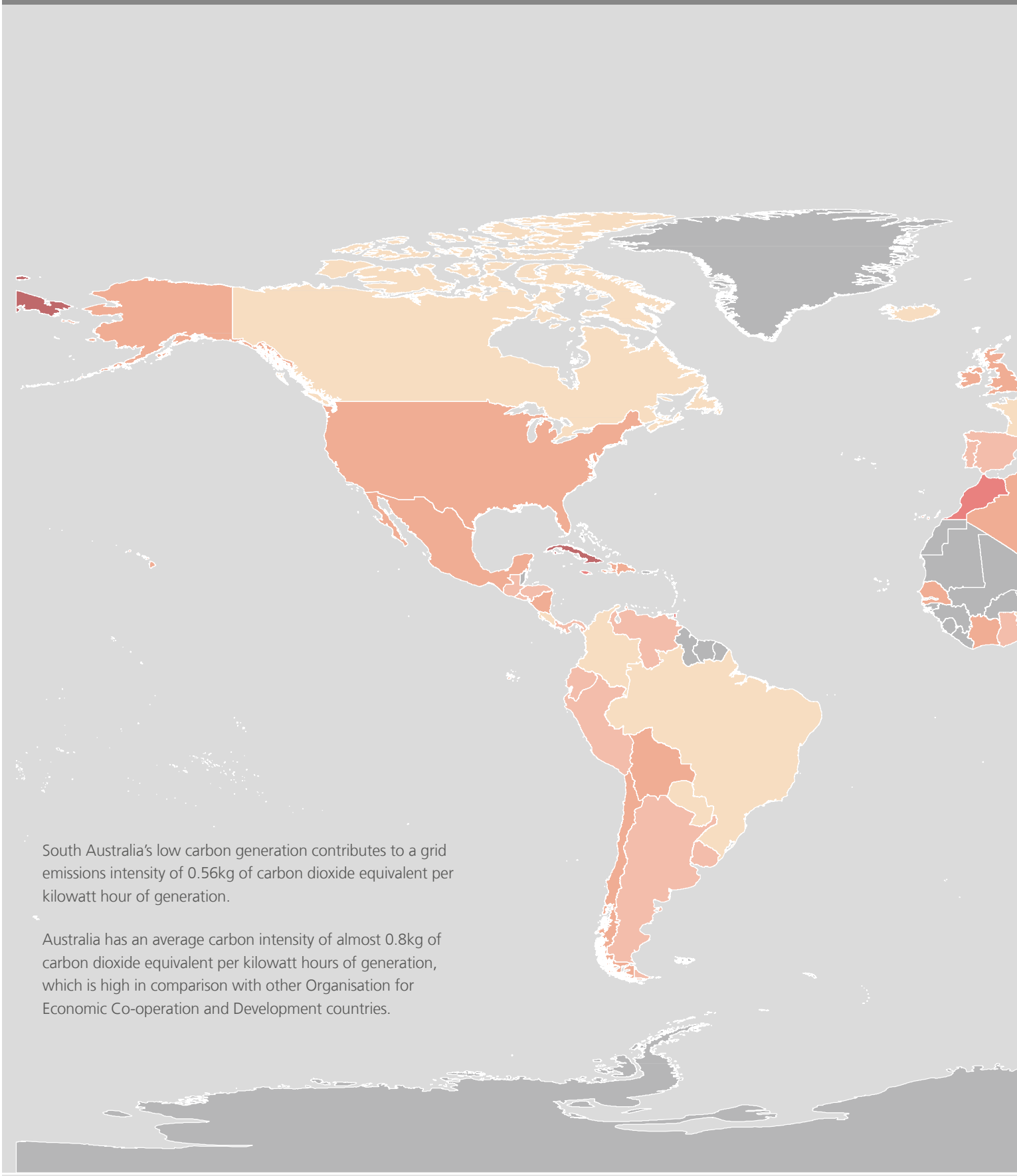
Solar contributed to

7%

of electricity generated in South Australia in 2014-15

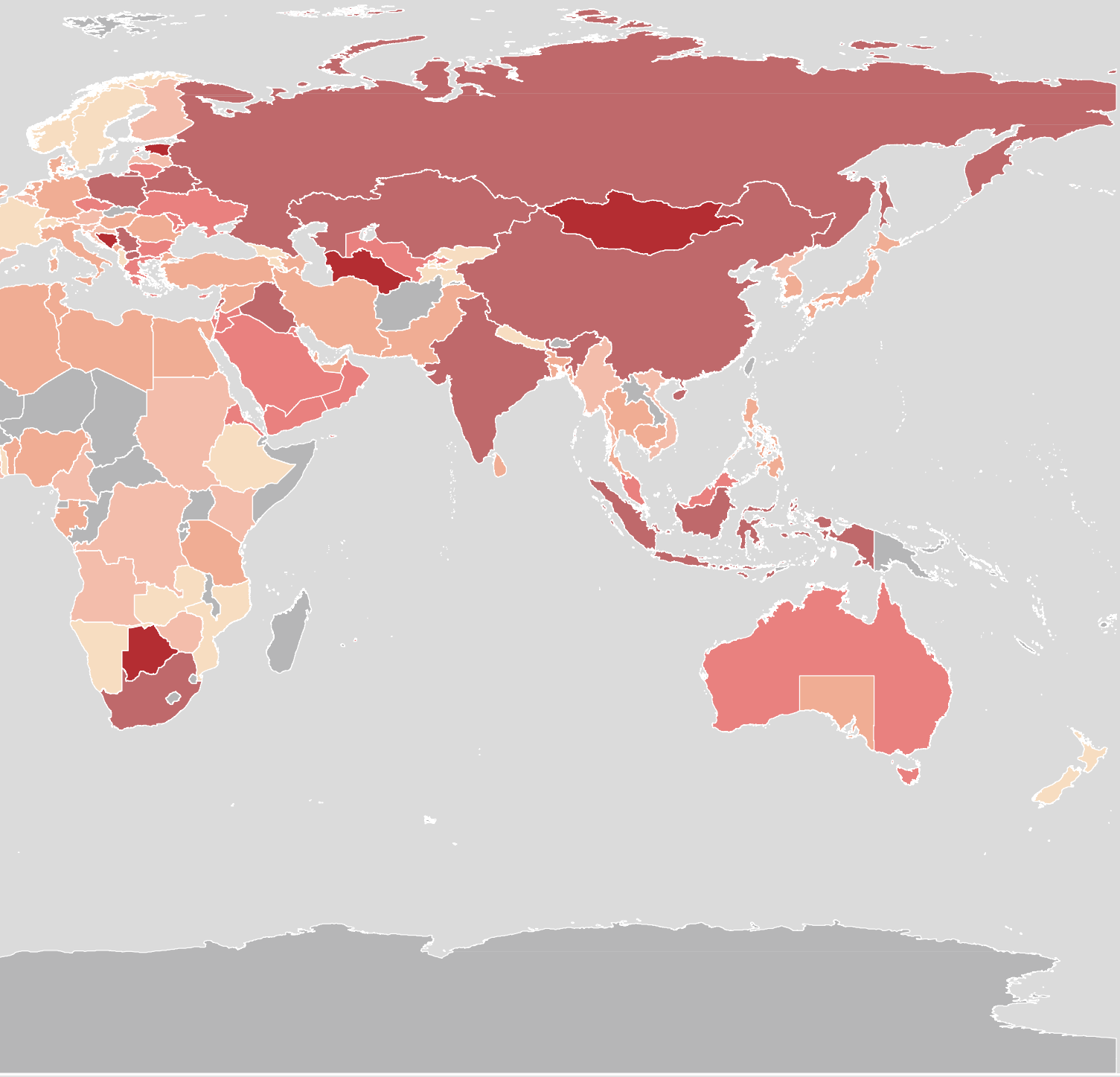
Australian Energy Market Operator, 2015

FIGURE 1 - CARBON INTENSITY OF ELECTRICITY GENERATION: GCO2/KWH



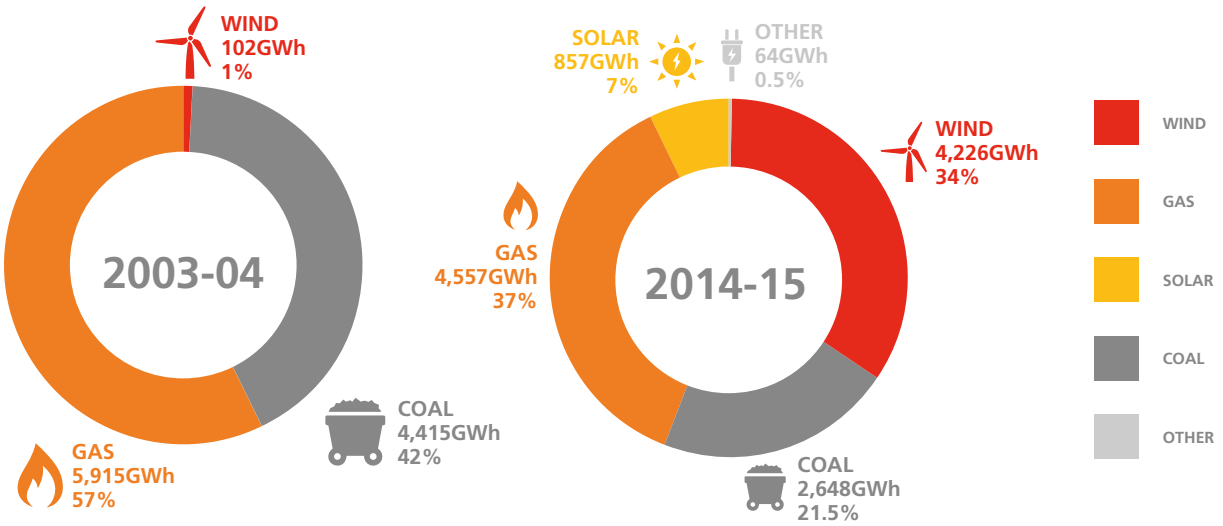
South Australia's low carbon generation contributes to a grid emissions intensity of 0.56kg of carbon dioxide equivalent per kilowatt hour of generation.

Australia has an average carbon intensity of almost 0.8kg of carbon dioxide equivalent per kilowatt hours of generation, which is high in comparison with other Organisation for Economic Co-operation and Development countries.



Source: Carbon Intensity Data: 2012 Data from 2014 report of IEA CO2 Emissions from Fuel Combustion

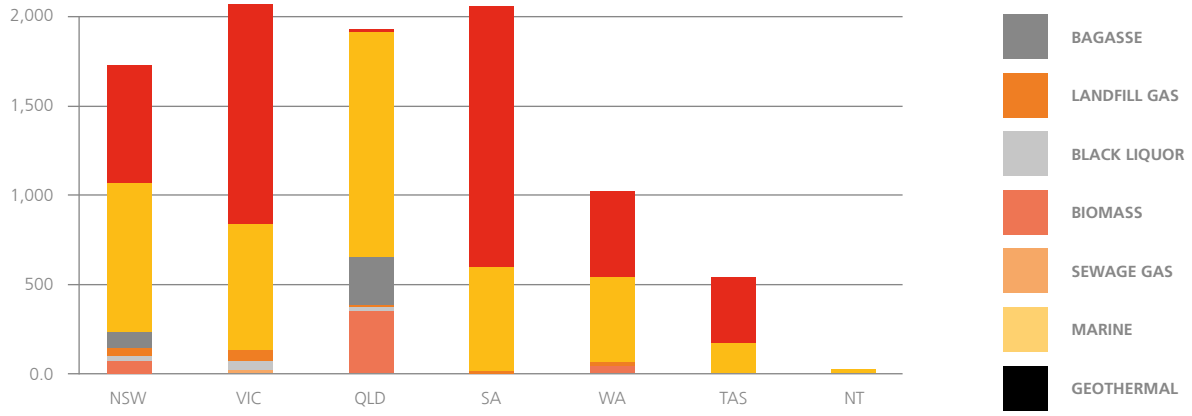
FIGURE 1 - CHANGES IN ELECTRICITY OUTPUT BY FUEL IN SOUTH AUSTRALIA



Note: 'Other' includes generation from small diesel, landfill methane and hydro generating systems.
Source: Various AEMO reports.

FIGURE 2 - TOTAL RENEWABLE ENERGY CAPACITY IN 2014 BY STATE, IN MW, EXCLUDING HYDRO

South Australia has been one of the nation's leading jurisdictions in renewable energy and investment in new renewable energy, primarily wind and solar, in the last decade.

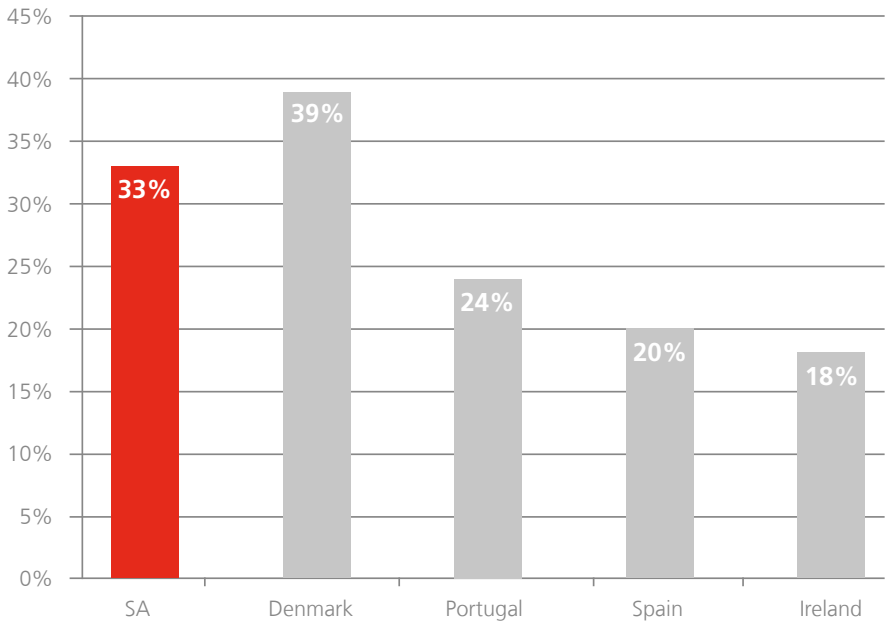


Notes: Hydro excluded. NSW figures include ACT.
Source: GHD analysis in 2015 based on various sources.

FIGURE 3 –WIND INSTALLED CAPACITY IN SA AND AUSTRALIA

Source: Australian Energy Market Operator (AEMO), Regional Generation Information, 13 August 2015 and Clean Energy Australia Report, 2014.

FIGURE 4 – SHARE OF ELECTRICITY GENERATION FROM WIND, 2014



SOUTH AUSTRALIA AND OTHER INTERNATIONALLY LEADING JURISDICTIONS FOR RENEWABLE ENERGY

On a per capita basis, South Australia's performance is internationally significant. Current levels of market penetration in wind in South Australia, as a proportion of total electricity generation, are competitive with leading international jurisdictions such as Denmark and Portugal (Figure 4).

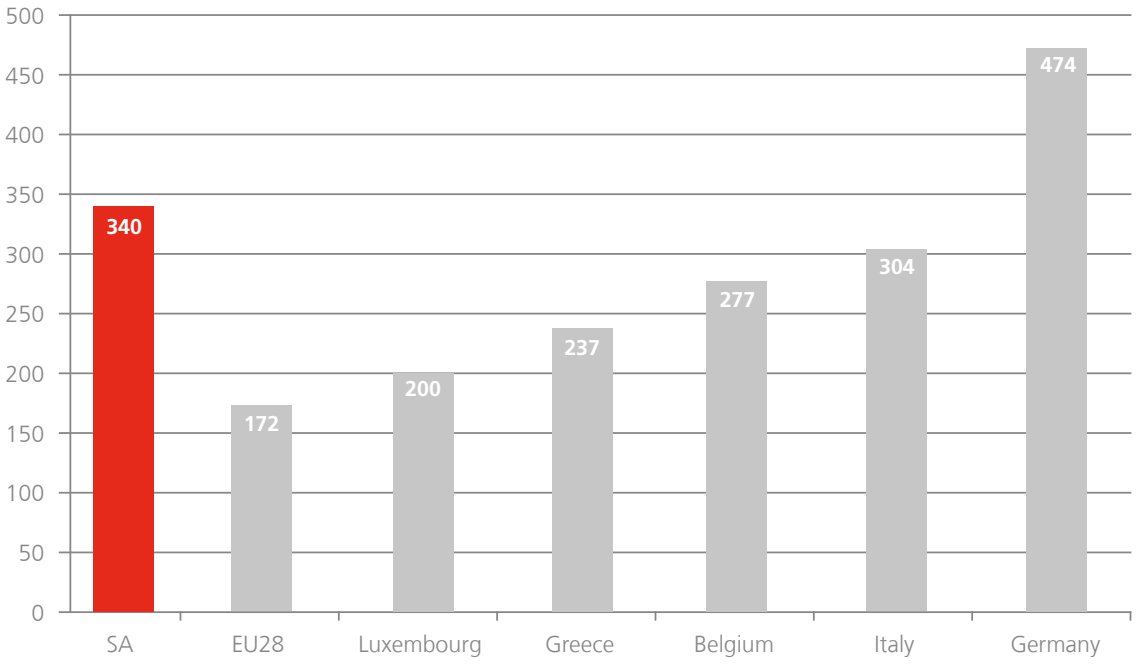
Note: In 2014-15, wind contributed to 34 per cent of total electricity generation in the state.

Source: IEA (International Energy Agency), Wind Annual Report for 2014, August 2015 and AEMO (Australian Energy Market Operator), South Australian Fuel and Technology report, January 2015.

FIGURE 5 - INSTALLED WATTS OF SOLAR PV PER PERSON, 2014

On a per person basis, South Australia's levels of solar installed are comparable with other high solar penetration countries in Europe, such as Germany, Italy and Belgium (Figure 5).

South Australia is a leading jurisdiction on a per capita basis for domestic installation of solar. A large scale solar project is yet to be built.



Note: Top five European countries for solar PV watts per person and EU-28 shown.

Source: IEA (International Energy Agency), 2014 A Snapshot of Global PV, 3rd Edition, 2015; ABS (Australian Bureau of Statistics) 3101.0 Australian Demographic Statistics 2015 and CIA (Central Intelligence Agency) The World FactBook.

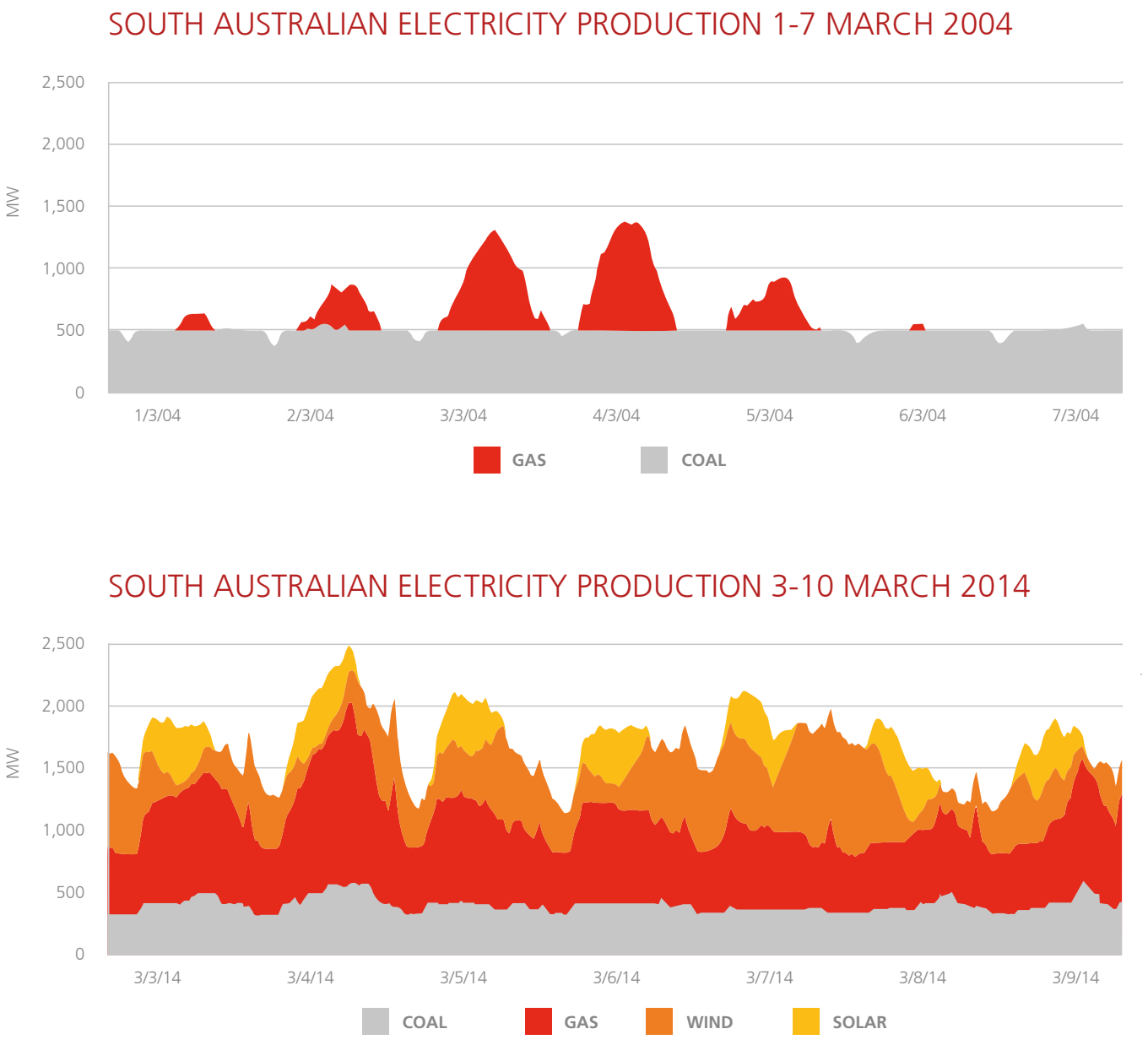
ELECTRICITY PRODUCTION – A CHANGING MIX

High levels of wind and solar in South Australia have dramatically changed the fuel mix for the state's electricity generation. In 2004, coal and gas were the predominant fuel sources for electricity generated in the state. By 2012, wind generation had overtaken coal to become the second most predominant fuel source for electricity generation and by 2014, solar energy had begun to make a material impact.

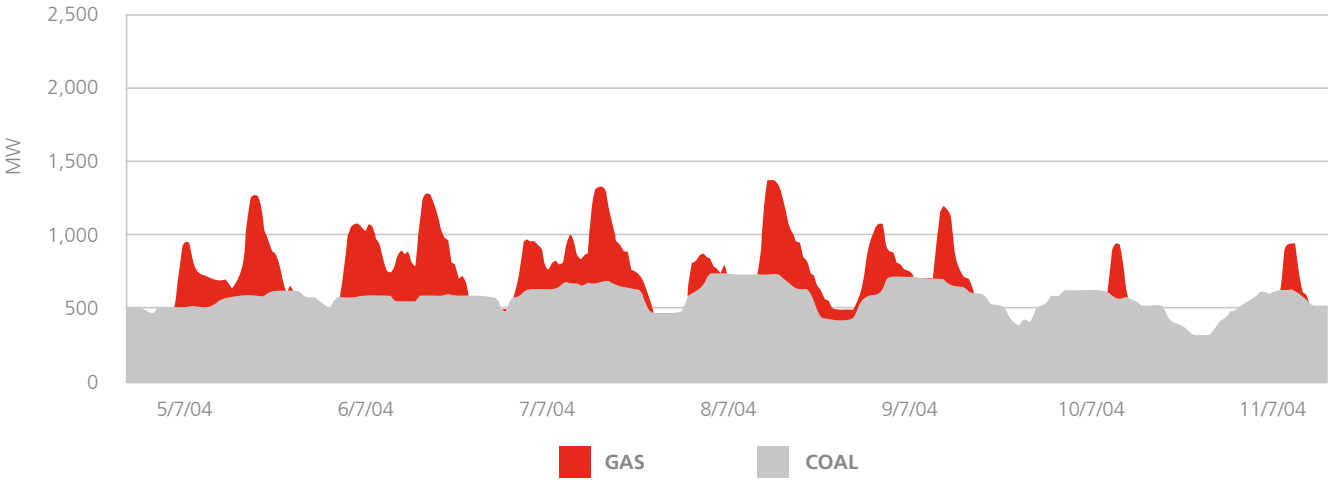
An analysis of electricity generation by fuel type for a random week during a low wind/high solar month (March) and high wind/low solar month (July) shows the materiality of these changes (Figure 6). While this analysis is for a single week during a year, it shows that in July 2014, renewable energy contributed to more than 50 per cent of electricity generation in one week.

The South Australian energy market will continue to undergo change with coal generation withdrawing from the market in the next few years.

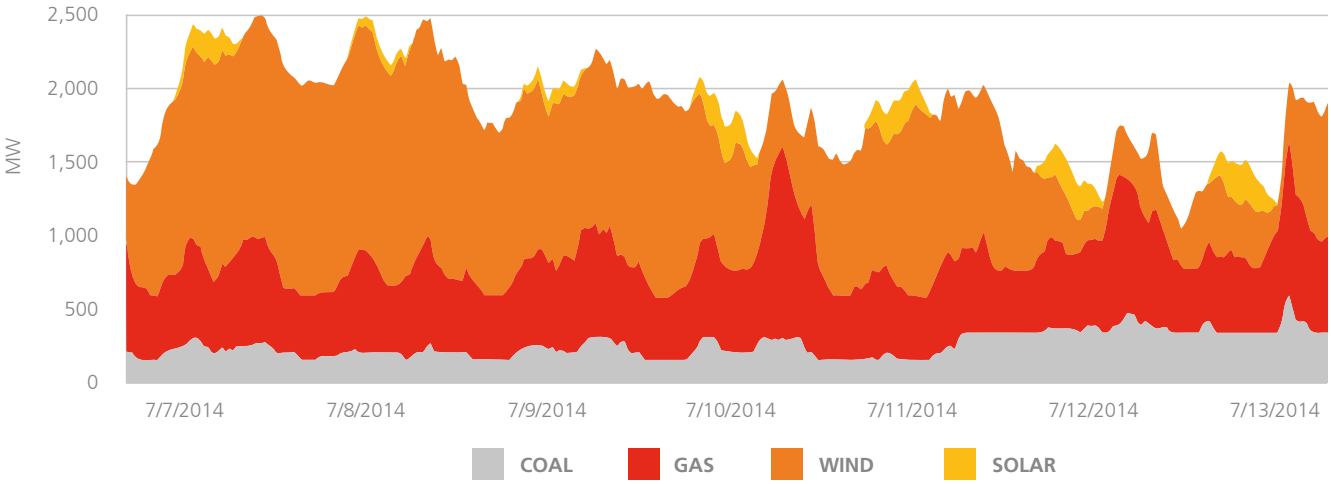
FIGURE 6 – CHANGES IN ELECTRICITY FUEL GENERATION MIX, 2004 AND 2014



SOUTH AUSTRALIAN ELECTRICITY PRODUCTION 5-11 JULY 2004

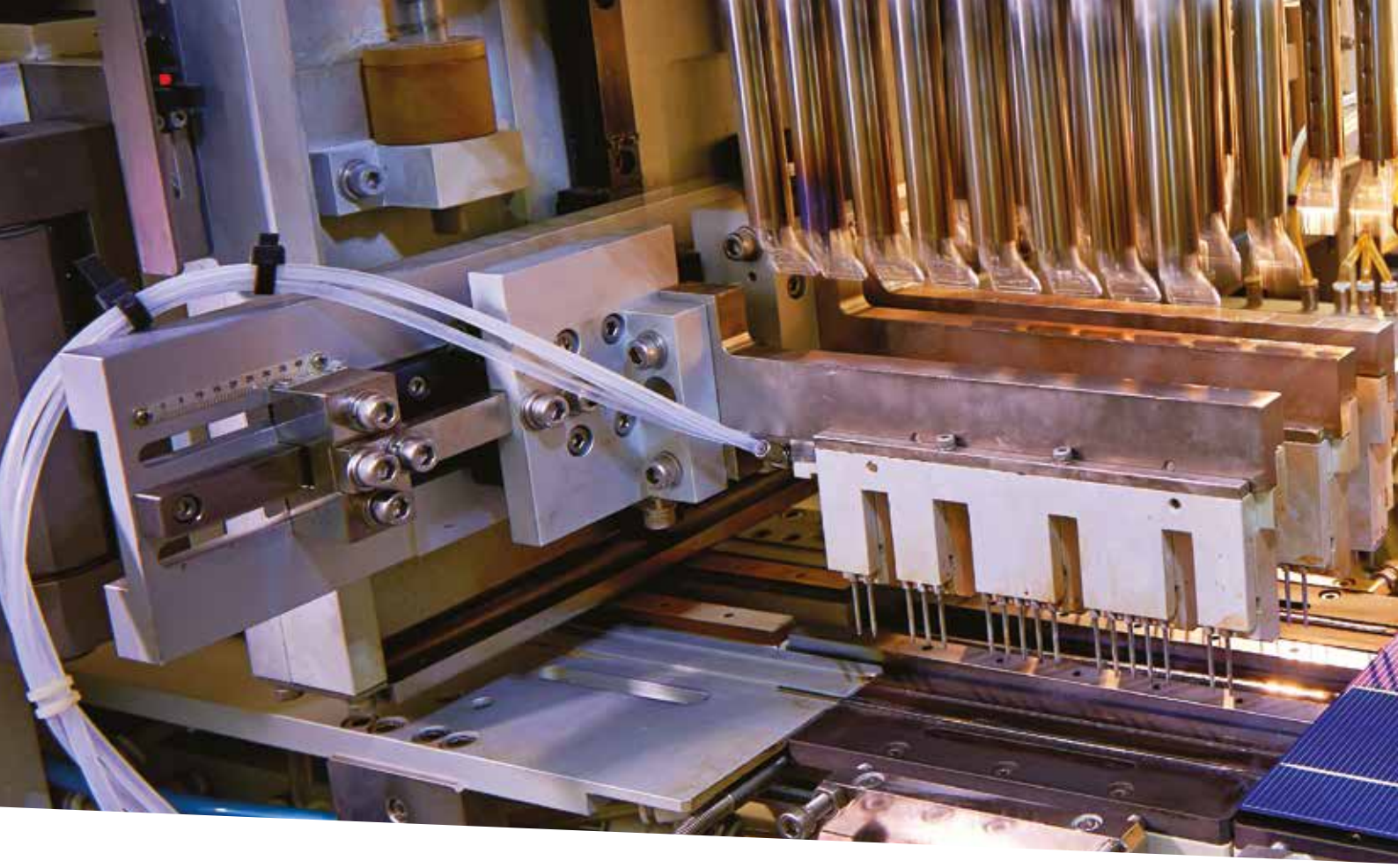


SOUTH AUSTRALIAN ELECTRICITY PRODUCTION 7-14 JULY 2014



Source: NEM-Review, AEMO data

Note: Solar output data is estimated by AEMO, as output is not measured. The remaining data is from NEM-Review software, which uses half-hourly data for generation dispatch data from AEMO.



FUTURE DIRECTION

The flow-on effects of lower emissions intensity to economic activity are emerging in South Australia's economy. For example, the Adelaide City Council has already achieved nearly 20 per cent reduction in its carbon emissions despite adding 25 per cent of new office space and having the highest average annual population growth of local councils in the five years ending 2013. The reduced carbon impact of electricity generation challenges conventional notions of associating economic growth and activity with increased emissions.

It is recognised that energy efficiency is a complementary action that has a link to the Government's focus on affordability and it increases the competitiveness of South Australian businesses and ambitions for a carbon neutral Adelaide.

Jurisdiction with high levels of renewable energy face a common need for strategies in managing the integration of high levels of intermittent renewable energy into energy grids, including transmission interconnection, demand management and flexible energy systems, distributed generation, smart technologies, energy storage and other enabling technologies.

The future brings the possibility of a broad portfolio of complementary and cost-competitive technologies and innovations as well as integrated internet and digital-based applications to enable more efficient and informed use of new technology.

South Australia is already undergoing an energy transition. The future outlook shows the de-carbonisation of the

PHOTO: Production of solar panels, Tindo Solar

electricity sector will be assisted by relative changes in cost competitiveness of generation technologies (refer Appendix C). Opportunity exists for greater diversification of renewable energy technology.

The South Australian Government supports developments in the energy sector that do not adversely impact the wholesale electricity market and deliver a competitively-priced, reliable and secure supply of energy to consumers.

South Australian producers are helping to shape a sustainable, low carbon future by supplying uranium and producing gas from unconventional sources to both developing and developed nations. The Nuclear Cycle Royal Commission is examining whether a greater involvement in the nuclear cycle could leverage the state's comparative advantages.

With competitive long-term pricing, low carbon based economic activity and security of supply as our imperatives, South Australia can sustain community support for our ambition and the initiatives that support it.

Opportunities exist in innovative, high value goods and services that are highly relevant to the South Australian economy as it transitions to an advanced manufacturing base. The future challenge is to maximise local participation from low carbon energy projects and investment.

STRATEGIES

PHOTO: Wind Farm, Waterloo

1. CLEAR POLICY AND EFFICIENT REGULATORY ENVIRONMENT

To supplement our target of $10 billion in low carbon investment and 50 per cent of electricity production by renewable energy by 2025, the South Australian Government has been proactive in providing and maintaining a competitive, certain and expeditious investment environment.

South Australia was the first state to introduce a regulatory framework specifically tailored to the geothermal industry in 2000 and the first to introduce land use planning guidelines for wind farm developments in 2002, at a time when the first wind farms were being deployed in Australia. Our land use planning system is recognised by the wind industry as the fairest, most transparent and most expeditious in Australia.

In 2012, in response to uncertainty caused by a court decision, all the state's council development plans were amended to provide greater certainty in areas where wind farms can be expected and articulate specific visual amenity guidelines.

South Australia was Australia's first and only government to provide payroll tax relief specifically for renewable energy projects[2].

To support the uptake of solar energy, South Australia was also the first jurisdiction in Australia to introduce a feed-in tariff in 2008 for households and small businesses.

The Government has worked to make its own land holdings as accessible as freehold land to wind and solar investors. In October 2014, legislation passed the Parliament to allow renewable energy investors to access Crown-owned land leased for pastoral purposes to expedite solar projects and to enable wind farms and mining interests to co-exist under a multiple land use framework.

[2] From 1 July 2010 to 1 July 2014, investors have been able to have the payroll tax expense incurred in the construction phase of their projects rebated to them to a maximum of $1 million for wind farms and $5 million for solar farms.

CASE STUDY 1.1
ACCESS TO PASTORAL CROWN LAND

The *Pastoral Land Management and Conservation (Renewable Energy) Amendment Act 2015*, the first legislation of its type in Australia, provides a form of tenement for wind farm developers to exist in parallel with an existing pastoral lease. The Act also fast-tracks access to portions of pastoral land for commercial scale solar development.

South Australia is the first state to introduce legislation to specifically allow for the co-existence of wind farm development and the activities of pastoralism and resource exploration on Crown land.

The intent is to not only attract renewable energy investment to the state, but to enable people with an interest in pastoral lease land, particularly near transmission lines, to gain financially from this form of development.

The Act took effect on 19 September 2015 after being proclaimed by the Governor of South Australia.

Criteria links: Resilient approaches, industry development, job creation

Lead agency: Department of State Development (DSD) (RenewablesSA)

Supporting agencies: Department of Planning, Transport and Infrastructure (DPTI), Department of Environment, Water and Natural Resources (DEWNR)

CASE STUDY 1.2
INVESTMENT ATTRACTION AND CASE MANAGEMENT

A dedicated and newly formed Investment Attraction Agency will proactively work to attract new businesses and establish new head offices of international firms to South Australia. A key role for the agency will be to work with the private sector to break down barriers, navigate regulatory and approval processes and facilitate projects.

The South Australian Government's case management services will continue to be available to eligible proponents to streamline and coordinate development assessment processes and legislative requirements relating to environment, heritage, native title and land rights.

Criteria links: Resilient approaches, industry development, job creation

Lead agency: Investment Attraction Agency

Supporting agencies: Department of Planning, Transport and Infrastructure (DPTI), Primary Industries and Regions SA (PIRSA), DSD (RenewablesSA, Investment, Trade and Immigration)

CASE STUDY 1.3
APPROVAL PROCESSES FOR PRIVATE SECTOR DEVELOPMENT

The South Australian Government has established the Office of the State Coordinator-General to coordinate and streamline approval processes for private sector development over $3 million in investment value, including providing a process for considering unsolicited proposals which have not been formally requested by the government.

Criteria links: Resilient approaches, industry development, job creation

Lead agency: Department of the Premier and Cabinet (DPC)

Supporting agencies: Department of Planning, Transport and Infrastructure (DPTI) and DSD (RenewablesSA)

PHOTO: Bio-gas Generator, Glenelg

2. INFORMATION TO INFORM INVESTMENT

The Government has created and disseminated high quality information to assist potential investors with project decisions. Information commissioned and made publically available to potential investors includes:

- irradiance maps and data on the state's wind and solar resources and high resolution spatial planning information to assist with selecting a suitable site
- modelled solar insolation data for four key sites in South Australia that can be used by potential investors to run design simulations and estimate the likely electricity output that a solar thermal or solar PV power station would produce
- full year weather station data confirming the world class quality of the solar resources in the north of the state
- mapping of the state's existing diesel generators to allow proponents to assess the opportunity to offset diesel use with solar and batteries as the cost of these technologies continues to decline
- a guide to the development, planning, regulatory approvals and grid connection processes for commercial scale solar projects in South Australia.

Recognising the impact that quality information can have on investment, the Government has previously supported significant feasibility studies to support project assessment (listed in Appendix D).

Bio-energy is a largely untapped resource in South Australia, with little understanding of feedstock and technology potential and the ability to translate possible resources into projects across the state. Bio-energy projects often require commitments from multiple feedstock producers acting in unison to create markets.

The South Australian Government's role in developing the bio-energy sector is to provide information so the market can understand the value of the resource and discover new potential feedstocks for bio-energy production and to provide opportunities for those who understand the technology to build projects. Heat and electricity present a significant opportunity with increasing gas and electricity prices.

The bio-energy roadmap is a way to break through barriers to investment and lay the groundwork for new projects by:

- providing information to increase understanding of the value of the resource
- discovering new feedstocks for bio-energy production
- collaborating with local community & industry on the potential
- providing opportunities for those who understand the technology to build projects.

CASE STUDY 2.1
BIO-ENERGY ROADMAP

The bio-energy roadmap will comprise of three stages:

- Stage 1 is to map the state's bio-energy potential, including an analysis of conversion technologies, local demand, types and quantities of feedstock, which may include new energy crops. This stage will identify two to three localised areas for further investigation.
- Stage 2 specifically assesses these localised areas through convening local community and industry groups to investigate potential collaboration in providing feedstocks, utilising energy outputs and assessing the feasibility of options.
- Stage 3 is to build specific projects.

Criteria links: Low carbon energy portfolio, resilient approaches, industry development

Lead agency: DSD (RenewablesSA)

Supporting agencies: Primary Industries and Regions SA (PIRSA), Zero Waste SA (ZWSA)

CASE STUDY 2.2
DIESEL DATA DIRECTORY

In 2013, a directory with information about the state's existing diesel generating plants (off-grid, on-grid and mini-grids) was released. The directory is based on survey data and contains information about the location and characteristics of plants, such as the number of generators, size, age, owners/operators and use. It is accessible via spatial mapping on a Google interface on the RenewablesSA website and on the South Australian Government's resource information geoserver (SARIG). A report by IT Power accompanied the release of the data and detailed economic modelling of thresholds at which certain technology options become economic.

The directory was commissioned at a time when the economics of projects were highlighted as becoming worthwhile to investigate due to the rising cost of diesel generation and the falling cost of renewable/hybrid solutions.

The directory provides up-to-date information to renewable energy providers and hybrid energy solutions and will be added to over time. An update of the directory is planned for 2016.

Criteria links: Low carbon energy portfolio, resilient approaches, advanced manufacturing

Lead agency: DSD (RenewablesSA)

PHOTO: Electric Vehicle, Kangaroo Island

3. SPONSORING UPTAKE AND WIDER MARKET DEPLOYMENT

As an early adopter of technology, the South Australian Government has a history of leading by example. Examples include installing solar panels on major public buildings on the North Terrace precinct and Parliament House, supporting solar installations on the Adelaide Showgrounds (at 1 MW, it was at the time the largest in Australia), Adelaide Airport and mandating solar panels on new and refurbished government buildings in 2009.

Electric vehicles are known to offer a number of benefits, yet a range of cost, consumer awareness and infrastructure barriers have meant that their uptake has been limited.

As the electricity sector progressively de-carbonises, it will increase the abatement potential for electric and hybrid vehicles.

Norway and California have relatively high rates of electric vehicle uptake compared to the rest of the world. In these jurisdictions, clear policy and regulation have played a key role. With more models becoming available in the market in the last two years and the prospect for lower cost vehicles, there may be a role for government policy to increase uptake and drive down production costs.

CASE STUDY 3.1
ELECTRIC VEHICLE DEMONSTRATION AND FLEET

The South Australian Government has supported a hybrid-electric car share project, which comprises a charging station coupled on-site with a 10kW solar PV installation and battery storage facility. The vehicle would be a plug-in electric hybrid (PHEV) provided by Australia's largest car share company GoGet.

The aim is to provide people with an experience driving an electric vehicle, demonstrate Adelaide's first electric car share and to improve awareness and acceptance of electric vehicles. The project will support energy storage deployment by demonstrating technical performance when paired with intermittent renewable energy supply. The vehicle will be charged using solar PV and any stored power from excess generation from the PV installation, together with power from the grid when the other means are not available. This project will also showcase local industry capability for the solar installation work.

The Government of South Australia is seeking Expressions of Interest for reducing emissions from the government fleet. The South Australian Government Financing Authority (SAFA) is investigating opportunities to convert the existing government motor vehicle fleet to low or zero emission vehicles that meet operational requirements.

Criteria links: Industry development, job creation

Lead agencies: DSD (Energy Markets and Programs, RenewablesSA), Department of Planning, Transport and Infrastructure (DPTI) (electric car share)

Supporting agencies: DSD, Department of Treasury and Finance (DTF) (Fleet EOI)

CASE STUDY 3.2
COMMUNITY COOPERATIVE FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY ON LOCAL COUNCIL BUILDINGS

The South Australian Government has supported a new financial and legal model for community ownership of solar and efficiency projects. Under the model, a cooperative is established and capital raised to fund solar installations on local council buildings. The project has support from ARENA, the Local Government of South Australia, City of Campbelltown Council and Bendigo Bank.

Criteria links: Low carbon energy portfolio, resilient approaches

Lead agency: DSD (RenewablesSA)

The community ownership model can allow individuals within a community to participate in the ownership of installations and provide the basis for building community understanding of renewable energy. It also allows a broader cross section of the community to benefit from solar power generated locally, regardless of their individual housing situation.

Community-led action can often tackle challenges more effectively than government alone, develop solutions to meet local needs and involve local people as stakeholders in the low carbon transition. Putting communities in control of the energy they use can help maintain energy security and tackle climate change, help people save money on their energy bills and contribute to wider social and economic benefits.

Renewal SA, the agency providing an integrated approach to urban development on behalf of the South Australian Government, will pilot a solar panel scheme in public housing to reduce electricity bills for tenants. Up to 200 homes will be selected for the trial and the scheme will be introduced more broadly if successful.

Lochiel Park is a model green village within South Australia and is home to more than 150 residents enjoying sustainable living using the best technologies available. All homes within Lochiel Park achieve a minimum 7.5 star energy efficiency rating and use solar PV cells and solar hot water, resulting in a reduction of 64 per cent energy consumption when compared with a typical house in 2014.

South Australia's first zero carbon home was completed at Lochiel Park in 2013. The carbon dioxide produced by the home over its 50 year life will be offset within 32 years through cutting-edge sustainability systems. The house features solar power, indirect evaporative cooling, bio-fuel heating, energy efficient appliances and passive solar principles.

In 2014, the South Australian Government released a tender to test the market's ability to provide an innovative commercial model for a solar installation at the Main Assembly Building at Tonsley Park.

Negotiations are progressing on a delivery agreement with the preferred proponent to retail the electricity generated by the array of up to a three MW system size to businesses within the Tonsley precinct.

The Government is also supporting projects to give the private sector confidence in the performance of technologies at an early stage of deployment or when the technical performance in the field is not well established.

We need to build confidence that high levels of intermittent generation can be managed and integrated in distribution and transmission networks, particularly with the rapid and continued growth of household solar energy shifting the timing of maximum demand to later in the day. Strategies for managing integration include smart grid applications, coherent and flexible energy systems and actively controlling demand.

Energy storage could come in the form of potentially game-changing electric vehicles or battery systems, allowing intermittent generation to be stored and dispatched according to demand.

CASE STUDY 3.3
MOBILE ENERGY STORAGE TEST FACILITY

The University of Adelaide, in partnership with SA Power Networks and several local battery technology and integration providers, are currently building a mobile energy storage testing unit for on-grid and off-grid use to enable simulation and performance testing of energy storage systems under a range of environmental conditions. The facility would be available for industry use on a user-pays basis for a range of storage technologies. The objective is to support deployment by demonstrating technical performance in the field when integrated with existing energy infrastructure. It will assess the potential for batteries to defer network augmentation and provide network support.

The unit will be based at the University of Adelaide's existing Clean Energy Research precinct in Thebarton, when not deployed in the field, to simulate operational testing of systems with various fuel sources as inputs.

The mobile energy storage testing facility is more than a $3 million project that has attracted $1.4 million from ARENA and leverages $550,000 in financial support from SA Power Networks, local providers and the Energy Networks Association of Australia, with $100,000 from the South Australian Government.

Criteria links: Research and industry expertise, advanced manufacturing, low carbon energy portfolio, industry development

Lead agencies: DSD (RenewablesSA, Energy Markets and Programs)

CASE STUDY 3.4
BATTERY STORAGE IN GOVERNMENT BUILDINGS

The South Australian Government owns a number of buildings within the City of Adelaide with solar PV installed. These include buildings in high profile areas, such as the North Terrace precinct, Parliament House, the Adelaide Railway Station and public schools. We have the opportunity to showcase emerging battery storage technology and demonstrate potential cost-saving opportunities from battery storage.

The South Australian Government issued an Expression of Interest in June 2015 seeking information from potential suppliers to supply and install battery storage systems in South Australian Government buildings, up to a value of $1.1 million.

Criteria links: Research and industry expertise, advanced manufacturing, low carbon energy portfolio, industry development, job creation

Lead agency: DSD (Energy Markets and Programs)

CASE STUDY 3.5
BUILDING UPGRADE FINANCE

Building upgrade finance is a mechanism to help building owners access loans to improve the energy, water and environmental efficiency of existing commercial buildings. The loan is tied to a property rather than a property owner and loan repayments are collected via a local government charge levied on the property and passed on to the financier. If there is a transfer in ownership of the property, the loan can remain with the property if the purchaser agrees. In this event, the obligation to make the repayment transfers to the new owner (along with the benefit of reduced utility costs).

The *Local Government (Building Upgrade Agreements) Amendment Bill 2015* was introduced to the upper house of the South Australian Parliament in February 2015.

Criteria links: Low carbon energy portfolio, job creation

Lead agency: Department of Environment, Water and Natural Resources (DEWNR)

Supporting agency: DSD (Industry and Innovation)

CASE STUDY 3.6
LOW CARBON ELECTRICITY SUPPLY AND SERVICES

In November 2015, the South Australian Government released an Expression of Interest for low carbon electricity supply and services. Proposals were sought for energy supply and energy productivity to meet up to 100 per cent of the Government's electricity needs.

The Government's objectives for the procurement are to explore innovative and cost effective electricity supply options which can reduce emissions and drive economic development in the State. The Government has used the Expression of Interest to inform possible alternatives to current arrangements where the Government purchases standard grid electricity from a retailer.

Criteria links: Carbon neutral Adelaide, job creation, industry development

Lead agency: DSD (RenewablesSA, Energy Markets and Programs)

PHOTO: Off-grid Power Station, Kingoonya

4. FACILITATING PROJECTS TO LEVERAGE FUNDING AND SUPPORT

A key strategy for the South Australian Government is to influence Australian Government policy frameworks and work with companies to develop proposals that take advantage of Federal support. This includes funding and finance available from ARENA, the Clean Energy Finance Corporation and the Emission Reduction Fund.

The Government is positioning itself to take full advantage of the opportunities expected to flow from these mechanisms by working with proponents and providing support to projects that leverage Federal funding and funding from other external sources.

The South Australian Government has supported a project to broaden participation in solar ownership, including to people who would otherwise be precluded by virtue of financial means and housing tenure. Leveraging private and Australian Government investment, the South Australian Government contributed $100,000 towards a project by Unity Housing Company to enable people in low income housing to participate in a pilot to reduce electricity costs. In late 2014, the pilot delivered 1.5 kilowatt systems for 80 new houses in a number of regional towns (Port Augusta, Port Pirie, Whyalla, Saddleworth, Peterborough, Jamestown, Laura, Gladstone, Melrose and Burra).

As one of only seven cities in the world and the only in Australia to achieve status as a Cisco Lighthouse City, Adelaide is gaining recognition as a smart digital city through its leadership in deploying free outdoor wireless network technology. The South Australian Government and Adelaide City Council have already taken steps to develop this recognition by entering into a Memorandum of Understanding with global technology company Cisco to use digital technologies to enhance performance and well-being, reduce costs and resource consumption and more effectively engage with citizens. The intent is to leverage this further through greater use of digital technologies to drive connectivity and knowledge infrastructure. Adelaide, as a smart digital city, can contribute to the Government's ambitions for a carbon neutral Adelaide and the target for low carbon investment.

CASE STUDY 4.1
SUNDROP FARMS PROJECT FACILITATION

In the experimental phase of this development the South Australian Government, through RenewablesSA, provided $345,000 towards the pilot of the solar thermal demonstration in 2011.

Sundrop Farms is currently constructing a 20 hectare greenhouse expansion at Port Paterson (near Port Augusta) showcasing sustainable horticulture in an arid environment, including a solar thermal facility to generate electricity, desalinate water and warm the greenhouse. The development will create around 300 ongoing jobs, mainly for greenhouse operations. Construction of the facility has commenced and is scheduled for completion in 2016.

In 2013, the Clean Energy Finance Corporation announced debt-financing of the expansion project ($40 million in contracted value) and in 2014 Sundrop Farms attracted private capital backing from global investment firm Kohlberg Kravis Roberts (KKR) and finalised a 10 year contract with Coles Supermarket. The Government has further supported the expansion project and jobs growth in regional South Australia through a $6 million allocation from the state's Regional Development Fund.

The South Australian Government has been providing case management support to the project since 2009 and continues to provide these services in its expansion stage.

Criteria links: Low carbon energy portfolio, job creation

Lead agency: DSD (Investment, Trade and Strategic Projects, RenewablesSA)

Supporting agency: Department of Planning, Transport and Infrastructure (DPTI)

CASE STUDY 4.2
COOBER PEDY RENEWABLE ENERGY PROJECT FACILITATION

In July 2014, Energy Developments Limited (EDL) was awarded up to $18.5 million funding from the Australian Government through ARENA to build a hybrid renewable energy plant. The proposed plant will incorporate solar PV panels and wind turbines with the existing diesel generators, reducing the township's reliance on diesel and delivering an input of 70 per cent renewable energy through both wind and solar power.

The South Australian Government has supported the development by facilitating approvals for land access and continuing the subsidy for electricity to enable the local council to enter into a Power Purchase Agreement with EDL to provide electricity to the township.

Criteria links: Resilient approaches, low carbon energy portfolio, job creation

Lead agency: DSD (RenewablesSA, Mineral Resources Division, Energy Markets and Programs)

Supporting agency: Department of Environment, Water and Natural Resources (DEWNR)

CASE STUDY 4.3
HIGH PENETRATION RENEWABLE ENERGY POWER STATION AT MARREE

The Department of State Development is investigating an opportunity for a high penetration renewable energy and battery storage generation project to offset diesel usage in Marree, an off-grid community located in South Australia's far north region. A system designed for high penetration renewable energy into a remote generation site prone to extreme weather conditions in a hot and dry desert climate would set a valuable benchmark for future projects in regional Australia.

One model being investigated utilises private capital to contract an independent power producer to build, own and operate the plant, with the Government offering a long term contract to purchase the power.

Such an approach could have the combined effect of both reducing the cost of the new build through the competitive tension created in the tender process and creating a workable structure for future sites, ideally with no requirement for an upfront capital contribution.

Criteria links: Low carbon energy portfolio, resilient approaches, research and industry expertise, driver for advanced manufacturing

Lead agencies: DSD (RenewablesSA, Energy Markets and Programs)

APPENDICES

PHOTO: Wind Farm, Snowtown

APPENDIX A – CONSULTATION SESSIONS AND SUBMISSIONS RECEIVED

Acknowledgements: Stakeholder feedback was gathered through the following consultation sessions including, as part of the South Australian Government's consultation, on its Climate Change Strategy:

- Port Lincoln, 15 September 2015
- Port Augusta, 16 September 2015
- West Beach, 18 September 2015
- Gawler, 22 September 2015
- Marion, 23 September 2015
- Modbury, 29 September 2015
- Mount Barker, 30 September 2015
- Adelaide, 1 October 2015
- Clare, 7 October 2015
- Adelaide, 8 October 2015
- Victor Harbor, 12 October 2015
- Mount Gambier, 16 October 2015

Submissions were received from:

- AGL Energy Ltd
- Australian Gas Networks (AGN)
- Australian Industry Greenhouse Network (AIGN)
- Australian Industry Group (AIG)
- Central Region of Councils, Regional Development of Yorke and Mid North and the Northern Yorke Natural Resources Management Board (the Regional Alliance)
- City of Campbelltown
- Clean Energy Council
- Energy Supply Association of Australia
- ElectraNet
- Embark
- Origin
- Renewables for all Project Partners
- South Australian Chamber of Mines and Energy (SACOME)
- Tim Kelly

A number of related submissions were also provided through the Climate Change Strategy consultation process. For a full list, refer to the RenewablesSA website.

APPENDIX B – STATE PRIORITIES

In 2014, the South Australian Government's Economic Priorities outlined an overall vision for South Australia as a place where people and businesses thrive, including the priority to Unlock the full potential of South Australia's resources, energy and renewable assets.

These priorities complement the state's existing strategic priorities to:

- give our children every chance to achieve their potential in life
- keep our communities safe and our citizens healthy
- build our reputation for premium food and wine
- grow advanced manufacturing as the way for the future
- realise the benefits of the mining boom for all
- create a vibrant city that energises and excites
- keep our high quality of life affordable for everyone.

In February 2015, the Government committed to establish Adelaide as the world's first carbon neutral city. The strategies and initiatives that form part of this low carbon investment plan will be consistent with these priorities and commitments. In view of this, the following criteria apply to initiatives:

Local Industry development: Maximises local participation by suppliers as much as possible from low carbon energy projects and investment (e.g. utilises local capabilities such as the production of wind towers, solar panels, solar panel frame manufacturing, solar thermal componentry and in services such as control systems integration, automation, engineering procurement and construction).

Job creation: Leads to new jobs for South Australians.

Advanced manufacturing opportunities: Fosters further development of innovative, high value goods and services that help transition South Australia's economy so it can become a participant on the global stage.

Carbon neutral Adelaide: Either contributes directly by displacing emissions associated with the Adelaide city[3] or indirectly through reducing the grid intensity of emissions.

Research capability and industry expertise: Further develops research capability, industry expertise and workforce skills, which are important to an innovation-driven approach that seeks competitive prices in the long term. In particular, strives to host nationally significant research expertise in emerging capability areas, such as energy storage, and enhances national and international links to leverage funding, equipment and expertise.

Low carbon energy portfolio: Contributes to a wider portfolio of low carbon technologies with the prospect to be cost-competitive. The future portfolio is supported by energy efficient and enabling technologies such as energy storage, electric vehicles, flexible grids, fuels, demand management, internet-based and grid stabilising technologies.

Resilient approaches: Represents an approach that sustains support from the community and does not have an energy price impact on end consumers, given the priority for affordable living.

[3] The project area for carbon neutral Adelaide is the Adelaide City Council area, which includes the central business district, North Adelaide and the surrounding parklands.

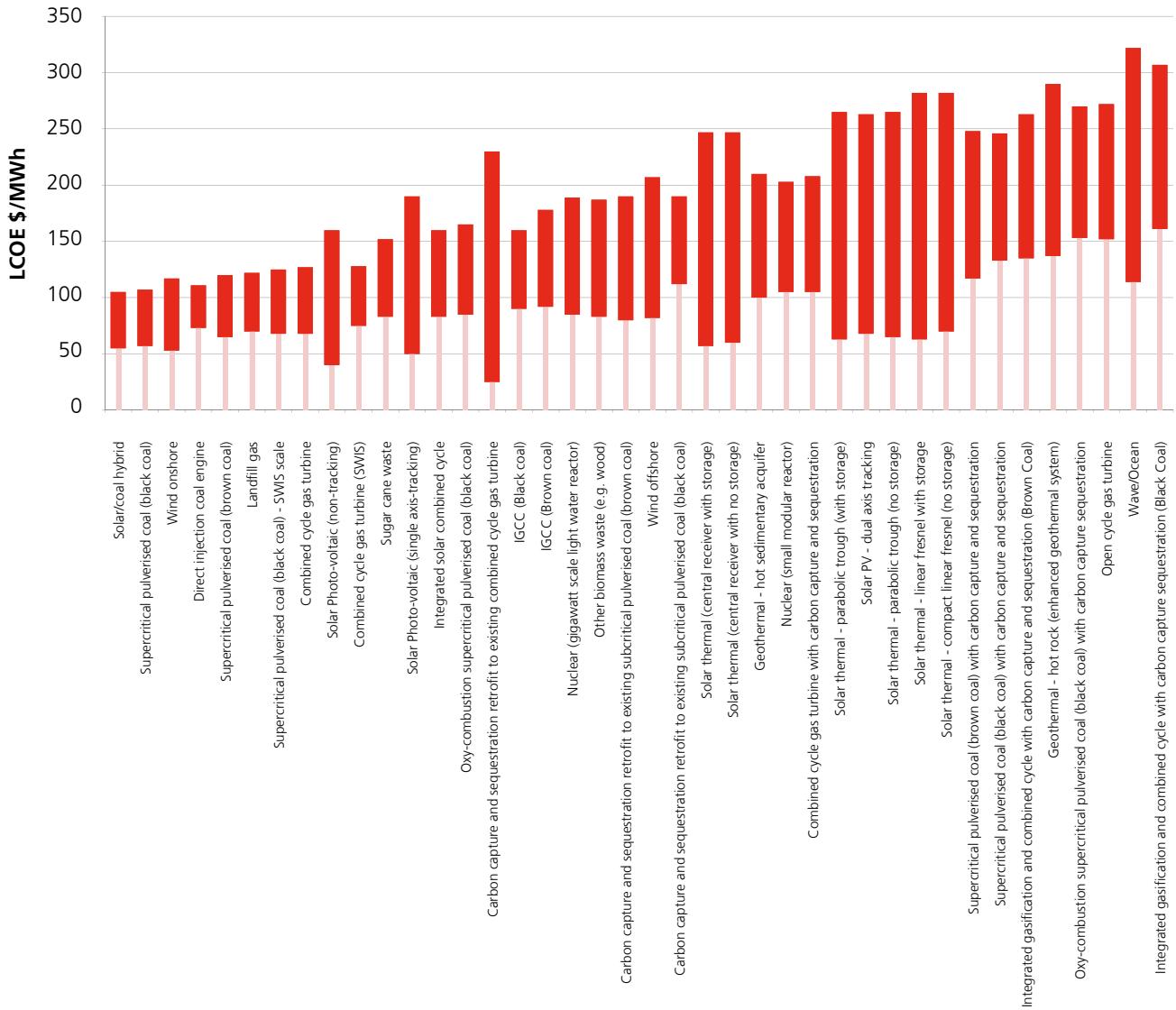
APPENDIX C – COST COMPETITIVENESS OF GENERATION TECHNOLOGIES

The future outlook for Australia is a portfolio of cost-competitive generation technologies significantly different to that of today. The Federal Bureau of Resources and Energy Economics (BREE) has estimated the levelised cost of energy[4] for 40 electricity generation technologies at 2030 under Australian conditions and current policy settings (RET, no carbon price) in order of least cost.

RenewablesSA's assessment of the technologies in the lower 50th percentile for levelised cost of energy, and which is low carbon, indicates a portfolio including wind onshore, landfill gas, nuclear, solar PV tracking and non-tracking, biomass and integrated solar combined cycle. The same assessment for the upper 50th percentile reveals the possible higher cost options include the various solar thermal technologies, geothermal hot sedimentary aquifer/hot rock and wave and ocean technologies.

BREE's assessment shows levelised cost of energy of supercritical black coal at around $60-$110MWh and combined cycle gas turbine at around $75-125/MWh by 2030, demonstrating that the cost of new build, low carbon generation could be competitive with traditional generation by 2030 (Figure 7).

FIGURE 7 - LEVELISED COST OF ENERGY FOR LOW CARBON GENERATION TECHNOLOGIES AT 2030 ($AUD)



Note: Excludes carbon price, includes where relevant CO2 transportation costs, plant capital costs, owners & finance costs, fixed & variable operating costs, fuel costs & escalation factors.

Source: BREE 2013, Australian Energy Technology Assessment Model Update

[4] Levelised cost of energy is the minimum cost of energy at which a generator must sell its output in order to achieve an economic rate of return.

APPENDIX D – SUMMARY OF INFORMATION COMMISSIONED AND INVESTOR RESOURCES

Policy development:

- MMA – Potential for renewable energy in South Australia
- National Institute of Economic Industry Research – The future prospects for renewable energy in South Australia
- Projected carbon intensity for South Australian renewable energy target in 2020

Investor resources:

- Green Grid Study (2010)
- Energy storage options for South Australia (2011)
- Commerciality of solar resources in South Australia (2010)
- Solar insolation maps (2010)
- Solar modelled time series data
- Projected carbon intensity for South Australia (2010)
- Potential for renewable energy in South Australia (2009)
- Commerciality of new wind in South Australia (2011)
- Diesel mapping (2013)
- New investment target for low carbon generation (2013)
- Waste biomass opportunities map for the south east of South Australia (September 2014)
- Regional organic waste mapping in South Australia (2012)

Streamlining regulatory process and competitive charging:

- Land-use planning guidelines for wind
- Statewide windfarm development plan Amendment
- Legislation on accessing pastoral land
- Payroll tax rebate for renewable energy projects (ceased in 2014)
- *Petroleum and Geothermal Energy Act 2000*
- Case management services
- Unsolicited bid, State Coordinator-General

Using government procurement levers:

- Expression of Interest for electricity purchase
- Expression of Interest for low emissions fleet

PHOTO: Wind Farm, Snowtown

Further information

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Published December 2015

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SOUTH AUSTRALIA

Government of South Australia