LOW CARBON INVESTMENT PLAN FOR SOUTH AUSTRALIA

Strategy Paper

Towards $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

"Our aspiration is for Adelaide to be the world's first carbon neutral city."

Hon Jay Weatherill
Premier of South Australia

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A message from the South Australian Government

The overarching economic vision for South Australia is as a place where people and businesses thrive.

The South Australian Government's 10 Economic Priorities support this vision, with *Unlocking the full potential of South Australia's resources, energy and renewable energy assets* a key priority.

South Australia has led the nation in renewable energy assets by setting policy frameworks and regulatory and approvals processes to provide greater consistency, transparency and certainty needed by investors.

We are capitalising on opportunities by providing quality information to inform investment, demonstrating use of our own assets and sponsoring uptake by others, and facilitating projects that leverage funding and support from external sources.

Our performance to date places us alongside the world leading jurisdictions for levels of market or per capita penetration in renewable energy.

We have generated 39 per cent of our electricity from renewable energy, which translates into $6.6 billion in investment in renewable energy generation in South Australia. Around 40 per cent, or $2.4 billion, of this was realised in regional areas.

As well as job creation and regional economic development, our low carbon investment is also creating flow-on benefits such as lowering the intensity of our electricity emissions and contributing to our goal for Adelaide to be the world's first carbon neutral city.

In order to build on our position of strength, the South Australian Government has set an investment target of $10 billion in low carbon generation by 2025.

This Strategy Paper sets out how this target could be achieved through a series of case studies, drawing on examples of initiatives and projects where the South Australian Government has a role. It also seeks feedback from stakeholders on new initiatives to support investment with a focus on future technologies that are innovative and cost competitive.

I invite you to respond to this Strategy Paper and contribute to developing a low carbon investment plan for South Australia.

Hon Jay Weatherill
Premier of South Australia

Hon Tom Koutsantonis MP
Minister for Mineral Resources and Energy

1. Why a Strategy Paper?

This Strategy Paper is intended to stimulate discussion about the strategies and initiatives that will allow us to achieve our investment target of $10 billion in low carbon generation investment by 2025.

They will also help us to achieve the complementary target of increasing the proportion of electricity generation from renewable energy sources to 50 per cent by 2025.[1] This paper is a commitment under Priority 1 of the South Australian Government's 10 economic priorities: *Unlocking the full potential of South Australia's resources, energy and renewable energy assets.*[2]

At the same time, this paper complements and links to the State Government's ambitions for a carbon neutral Adelaide and a new climate change strategy for South Australia. A steady reduction in emissions in Adelaide has been achieved over the last eight years, despite a significant increase in new office space and high population growth over the same period. A significant factor in this reduction is the declining emissions intensity of the electricity grid as a result of our low carbon investment. This demonstrates the flow-through effect of investing in low carbon generation to a low carbon city.

The Strategy Paper is the first step in a targeted engagement strategy with industry, investors, community and the research sector on finalising a low carbon investment plan for South Australia. Using a case study approach, our key focus is to obtain feedback from stakeholders on initiatives that support new investment and use future technologies that are innovative and cost competitive.

The aim of this Strategy Paper is to:

- outline the major outcomes and benefits to date of attracting low carbon generation investment to South Australia and the government's policy commitments in the area (Section 2)
- assist in developing a shared understanding of opportunities for the industry, taking into account the policy direction at the national level (Section 3)
- ensure consistency of any new initiatives with the South Australian Government's strategic and economic priorities (Section 4)
- obtain stakeholder feedback to develop a low carbon investment plan, incorporating plans and commitments by industry and community, that will assist in achieving the state's investment target of $10 billion in low carbon generation by 2025 (Section 5).

Section 4 of this Strategy Paper outlines important criteria in considering new initiatives and projects. It also provides case study examples of initiatives and projects currently being implemented, and for each one, identifies links to the key criteria.

Case studies 3,9,10 and 14 are examples of possible new initiatives that are not currently funded and do not represent current government activity. These initiatives are conceptual and have been included as examples of new initiatives that could be possible subject to support and available funds.

The South Australian Government's low carbon investment plan will be finalised following consultation on this Strategy Paper.

1. Low carbon defined as generation with emission intensity of less than 400kg of carbon dioxide equivalent per megawatt hour, which includes generation from most efficient gas-fired technologies, co-generation and tri-generation and renewable energy.
2. Available at *http://economic.priorities.sa.gov.au/priorities/resources,_energy_and_renewable_assets*

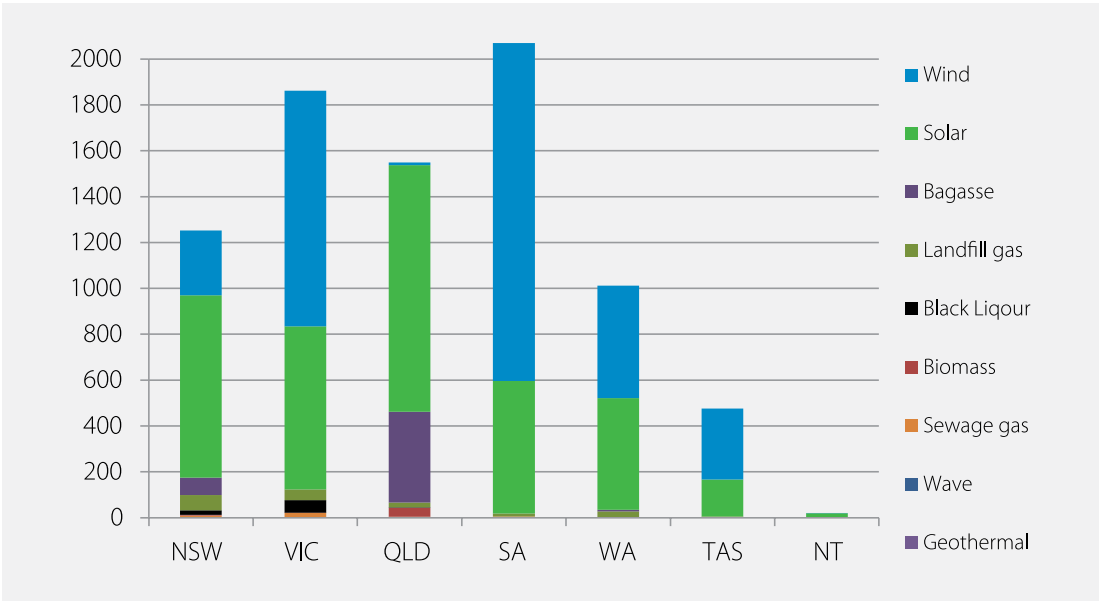
SEPT 2015	ENDING 18 OCT 2015	DEC 2015
Strategy Paper released	Stakeholder consultation and targeted sessions	Low Carbon Investment Plan for South Australia released

2. Current leadership

South Australia is a national leader in renewable energy levels. Since 2001, it has transitioned from negligible levels of renewable energy capacity to having greater capacity than any other state (Figure 1).

Although New South Wales and Tasmania have significant renewables-based hydroelectric generation, the plant includes largely historical installations built in the 1950s and 60s. In contrast, South Australia's investment in new renewable energy, primarily wind and solar, has largely been made in the last decade.

Figure 1 - Total renewable energy capacity in 2014 by state, in MW, excluding hydro

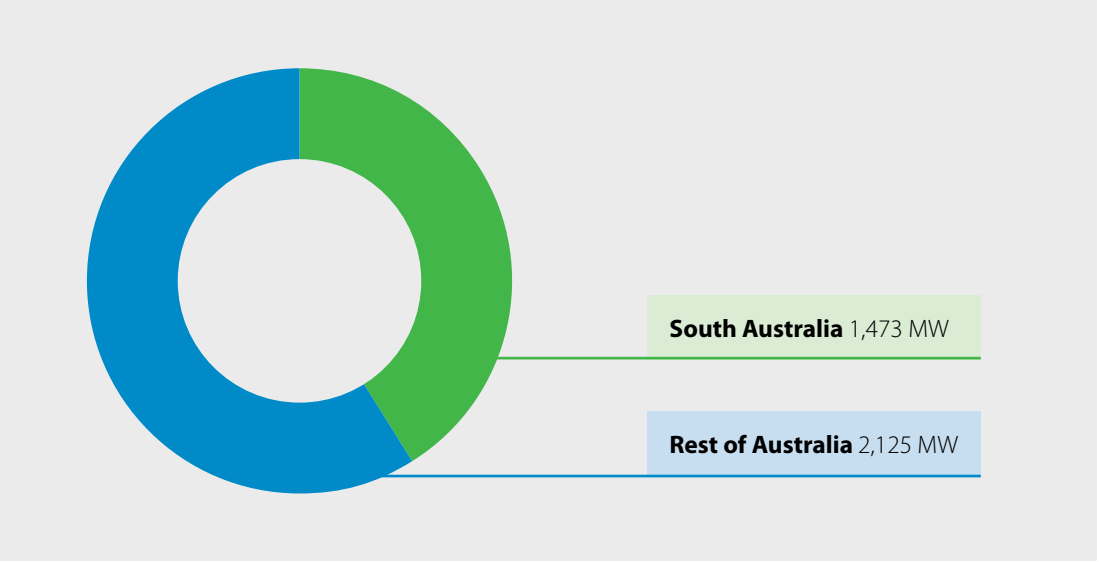


Notes: Hydro excluded. NSW figures include ACT.
Source: Bureau of Energy Economics 2014, Clean Energy Council 2013 and RenewablesSA.

Wind

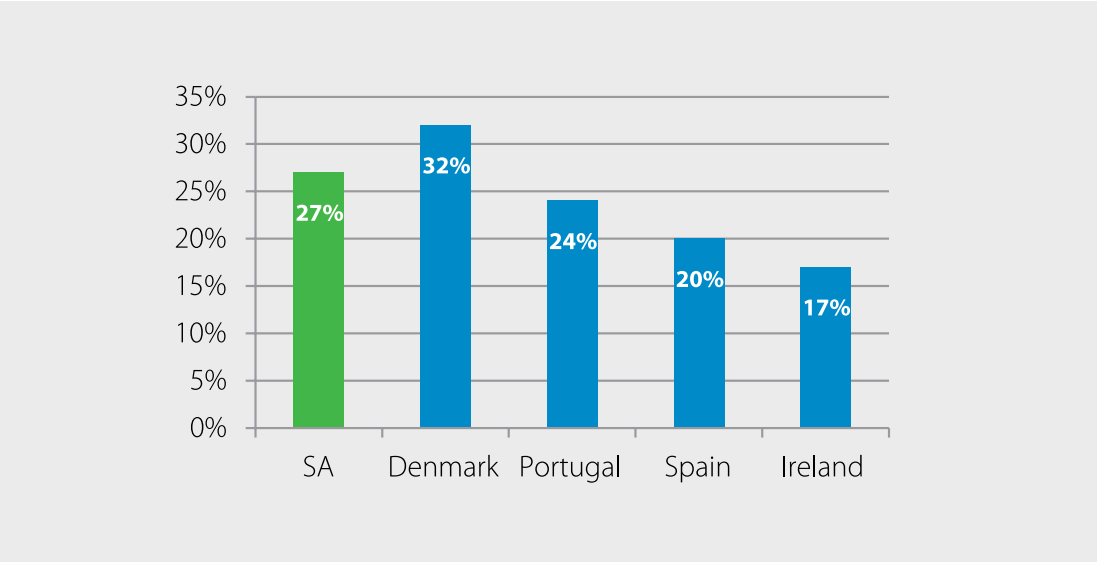
South Australia leads the country in wind energy production, with 41 per cent of the nation's operating wind farm capacity (Figure 2). In 2012-13 and 2013-14 respectively, wind supplied 27 per cent and 33 per cent of the state's total electricity generation. Current levels of market penetration in wind as a proportion of total electricity generation are competitive with leading international jurisdictions such as Denmark and Portugal (Figure 3).

Figure 2 –Wind installed capacity in SA and Australia



Note: Installed capacity in South Australia and Australia as at December 2014.
Source: Department of State Development 2014

Figure 3 – Share of electricity generation from wind, 2012-13



Note: in 2013-14, wind contributed to 33 per cent of total electricity generation in the state.
Source: Department of State Development 2014, IEA 2014: World energy balances cited in BREE 2014, Energy in Australia

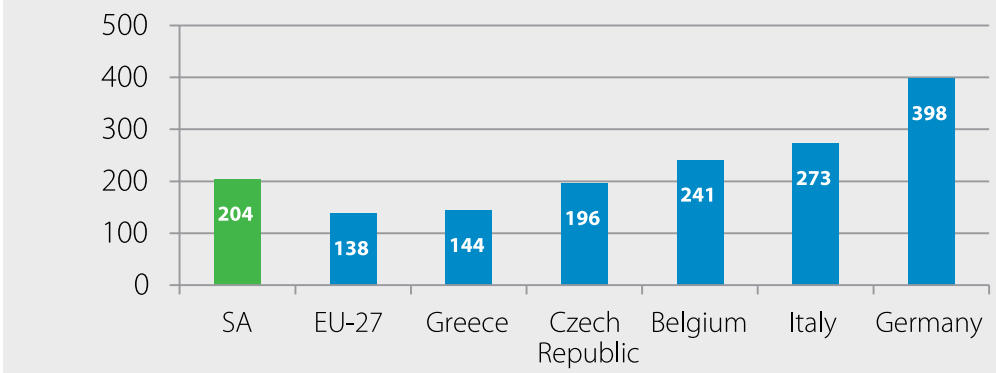
Solar

South Australia is a national leader in market penetration of solar energy, with one in four households having installed solar and a total of 565 megawatts (MW) of installed capacity. In 2013-14, solar contributed 6 per cent of the state's electricity generation, which is a significant amount when compared with other leading international jurisdictions.

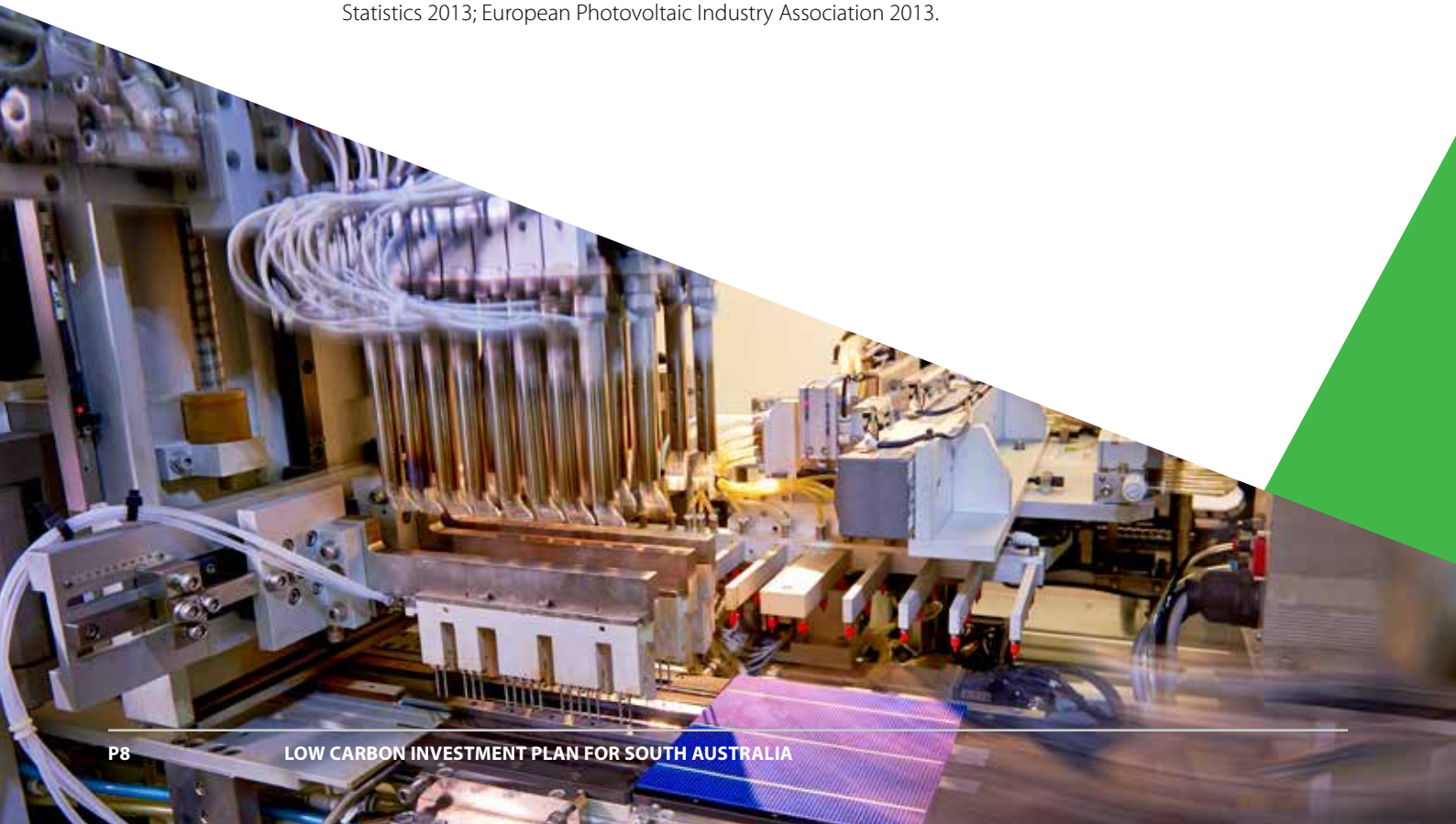
On a per person basis, South Australia's levels of solar installed are comparable with other high solar penetration countries in Europe, such as Germany, Italy and Belgium (Figure 4).

South Australia is a leading jurisdiction for domestic installation of solar. However, a large scale solar project is yet to be built.

Figure 4 - Installed watts of solar photo-voltaic per person, 2012



Note: Top five European countries for solar PV watts per person and EU-27 shown. South Australia has 337 watts per person installed as at 2014, which is not shown on the graph for comparison purposes as the latest data from EPIA is for installed capacity as at 2012.
Source: Clean Energy Council 2013; Australian Bureau of Statistics 3101.0 Australian Demographic Statistics 2013; European Photovoltaic Industry Association 2013.

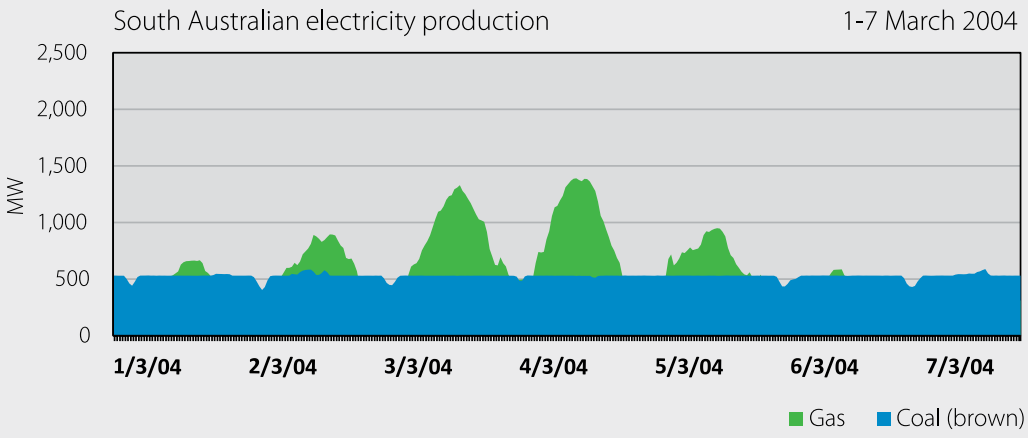


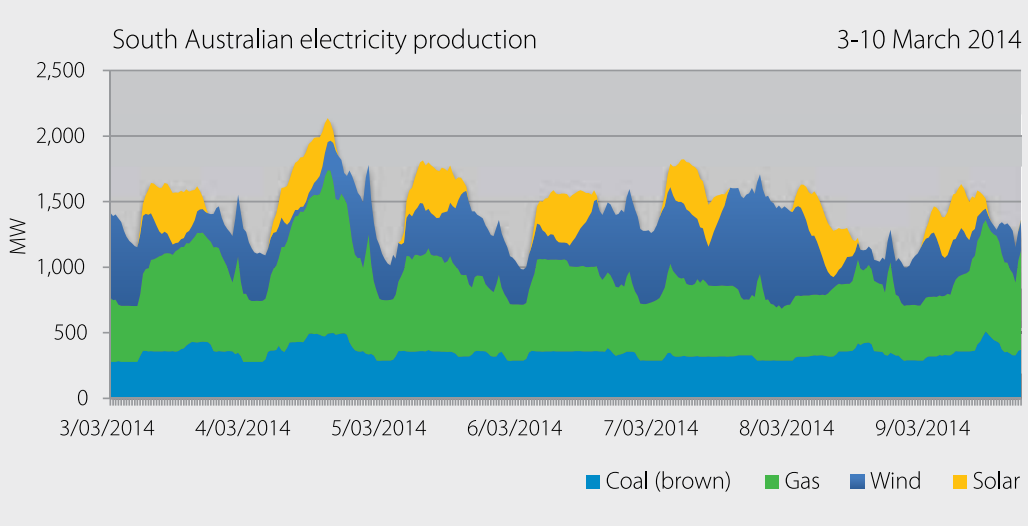
2.1. Electricity production – changes in a decade

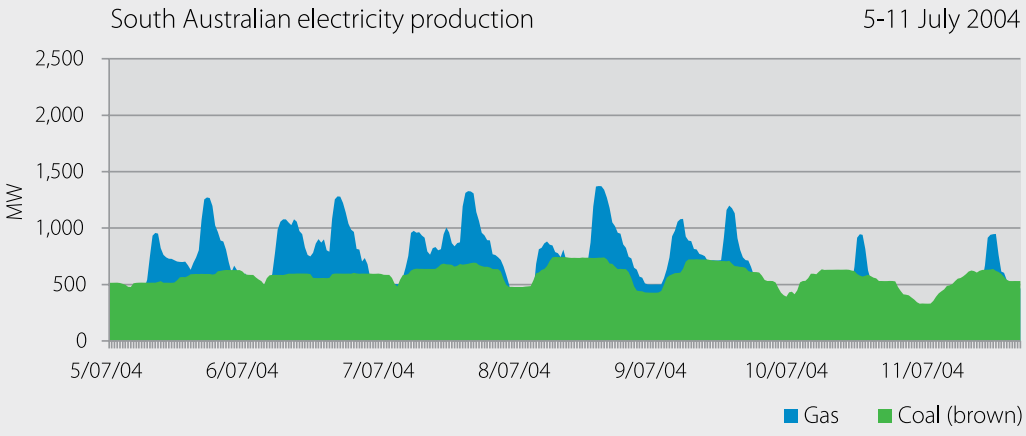
High levels of wind and solar in South Australia have dramatically changed the state's electricity generation by fuel type. In 2004, coal and gas were the predominant fuel source for electricity generated in the state. By 2012, wind generation had overtaken coal to become the second most predominant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

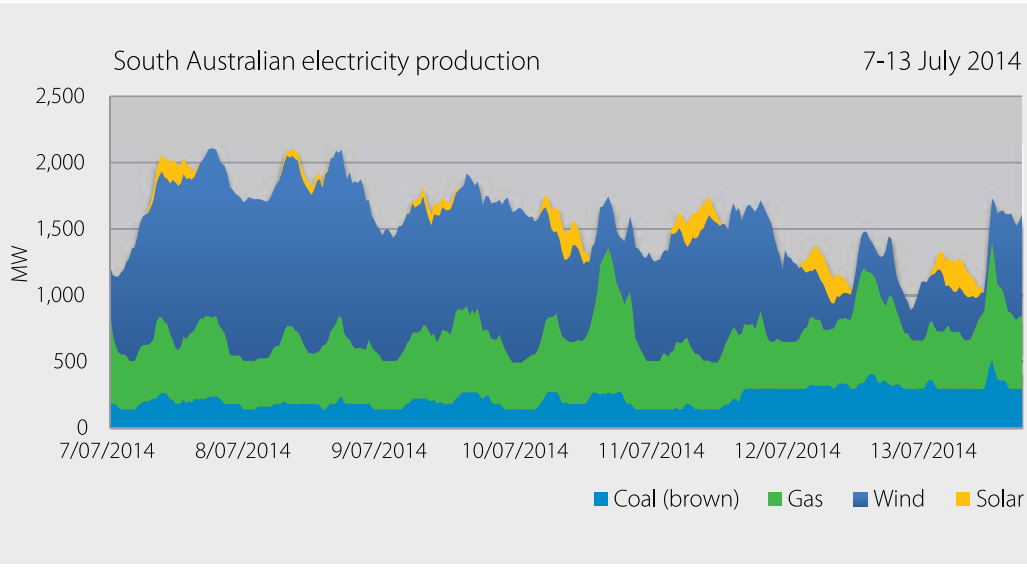
An analysis of electricity generation by fuel type for a random week during a low wind/high solar month (March) and high wind/low solar month (July) shows the materiality of these changes (Figure 5). While this analysis is for a single week during a year, it shows that in July 2014, renewable energy contributed to more than 50 per cent of electricity generation in one week.

Figure 5 – Changes in electricity fuel generation mix, 2004 and 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.

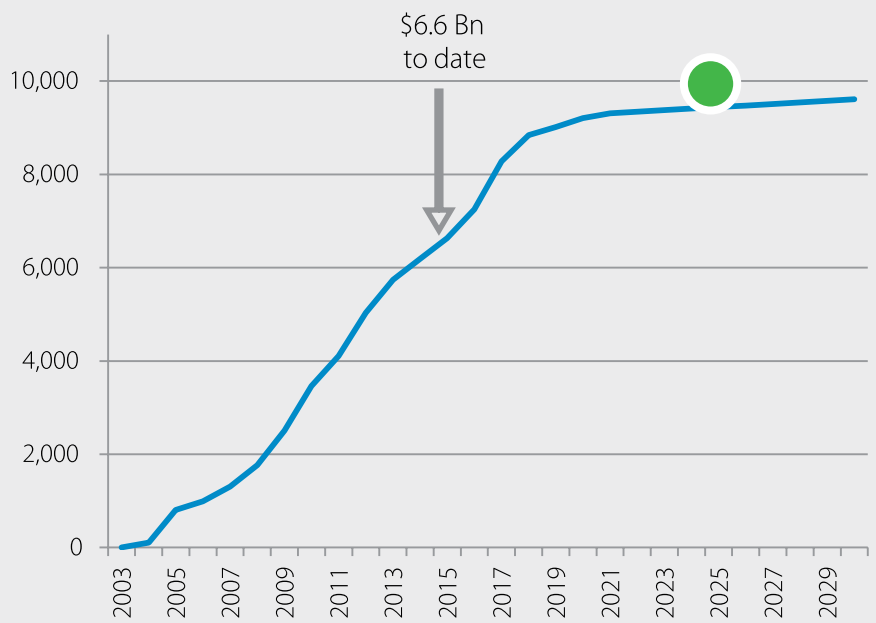
"In order to build on our position of strength, the South Australian Government has set an investment target of $10 billion in low carbon generation by 2025."

2.2. Benefits of low carbon investment

Economic and regional benefits

South Australia's significant level of installed renewable energy capacity has translated into economic benefits for the state and its regions. For the period 2003-2015, Jacobs assessed there has been $6.6 billion in investment in renewable energy generation in South Australia, with around 40 per cent or $2.4 billion realised in regional areas (Figure 6).

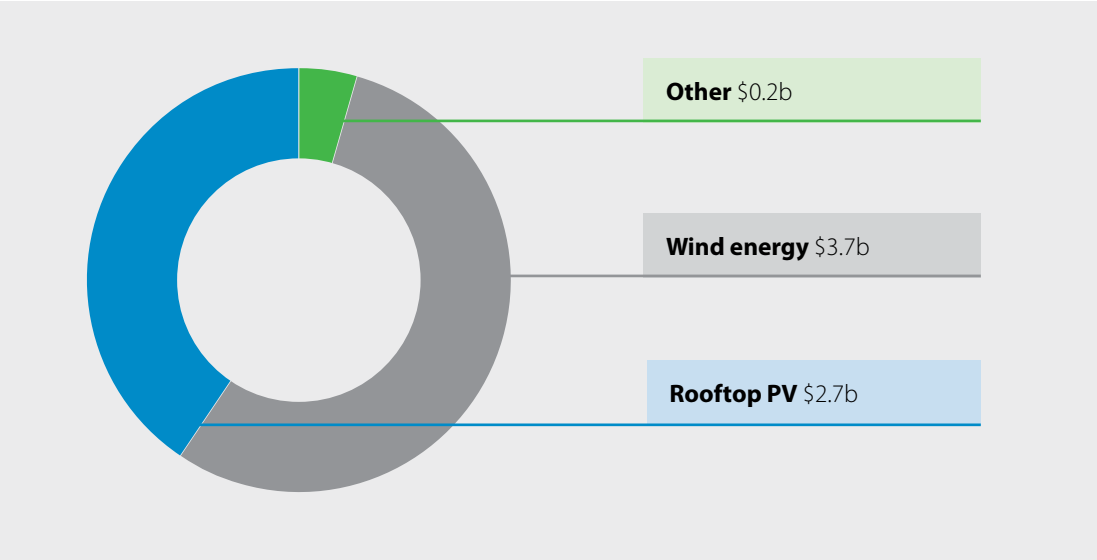
Figure 6 – Investment in renewable energy ($m)



Note: Under a national RET of 33,000 GWh.
Source: Jacobs 2015, Low emission and renewable investment modelling

By 2015, large scale renewable energy, in the form of wind farm projects, accounted for $3.7 billion of total investment. Domestic rooftop solar accounted for $2.7 billion.

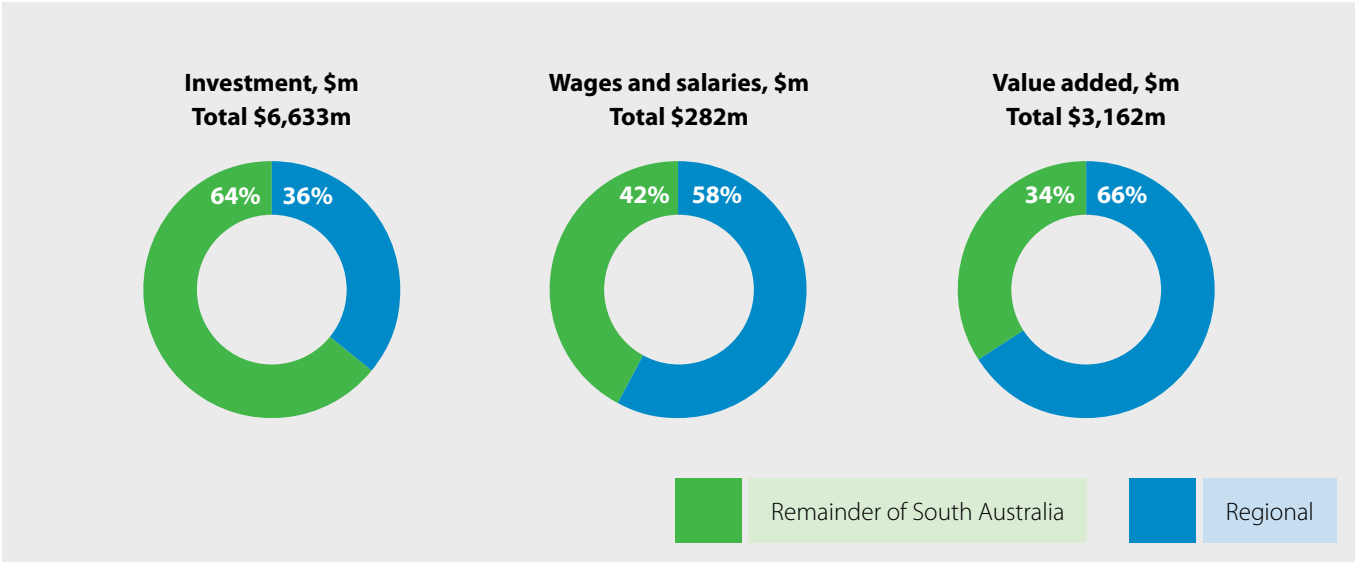
Figure 7 – Total investment in renewable energy as at 2015 ($6.6 billion) by technology type



Note: "Other" comprises solar hot water ($212 million) and embedded renewables ($9 million). Embedded generation includes any generating system installed within a distribution network or by industry to meet its own electricity needs.
Source: Jacobs 2015, Low emission and renewable investment modelling

Renewable energy projects have created local employment, usually in close proximity to where projects are constructed or installed. Regional areas have benefited significantly in terms of contribution to regional incomes and wages/salaries from direct employment (Figure 8).

Figure 8 – Renewable energy, regional and state indicators



Note: Value added is a measure of contribution to state/regional income and includes profits, wages and capital depreciation. Value added and total investment is not equivalent in dollar terms, as they are different measures. Wages and salaries relates to direct employment.
Source: Jacobs 2015, Low emission and renewable investment modelling

The investment outcome to date provides the context for the South Australian Government's commitment to a $10 billion target for low carbon generation by 2025.

Currently, the renewable energy sector supports 1,330 jobs (direct full-time equivalent) in the state, which represents 11 per cent of national levels.[3] For every direct construction and maintenance job created in the wind industry, two indirect jobs are created.[4]

Grid intensity benefits

As a result of low carbon investment, South Australia has the lowest greenhouse gas factor for electricity out of all mainland Australian states. At the same time, 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.

At 0.61 kg carbon dioxide equivalent per kilowatt hour, South Australia's emissions per kilowatt hour of electricity purchased from the grid are 15 per cent lower than the national average. This means the associated emissions for a South Australian company consuming 100,000 kWh in electricity purchased from the grid is 61 tonnes of carbon dioxide equivalent, compared with more than 100 tonnes for a counterpart in Victoria.

Figure 9 – Emissions per kilowatt hour of electricity purchased from the grid

Source: Department of Environment 2014, National Greenhouse Account Factors

These outcomes also support the legislated target under the South Australian *Climate Change and Greenhouse Emissions Reduction Act 2007* to reduce emissions by 60 per cent by 2050.

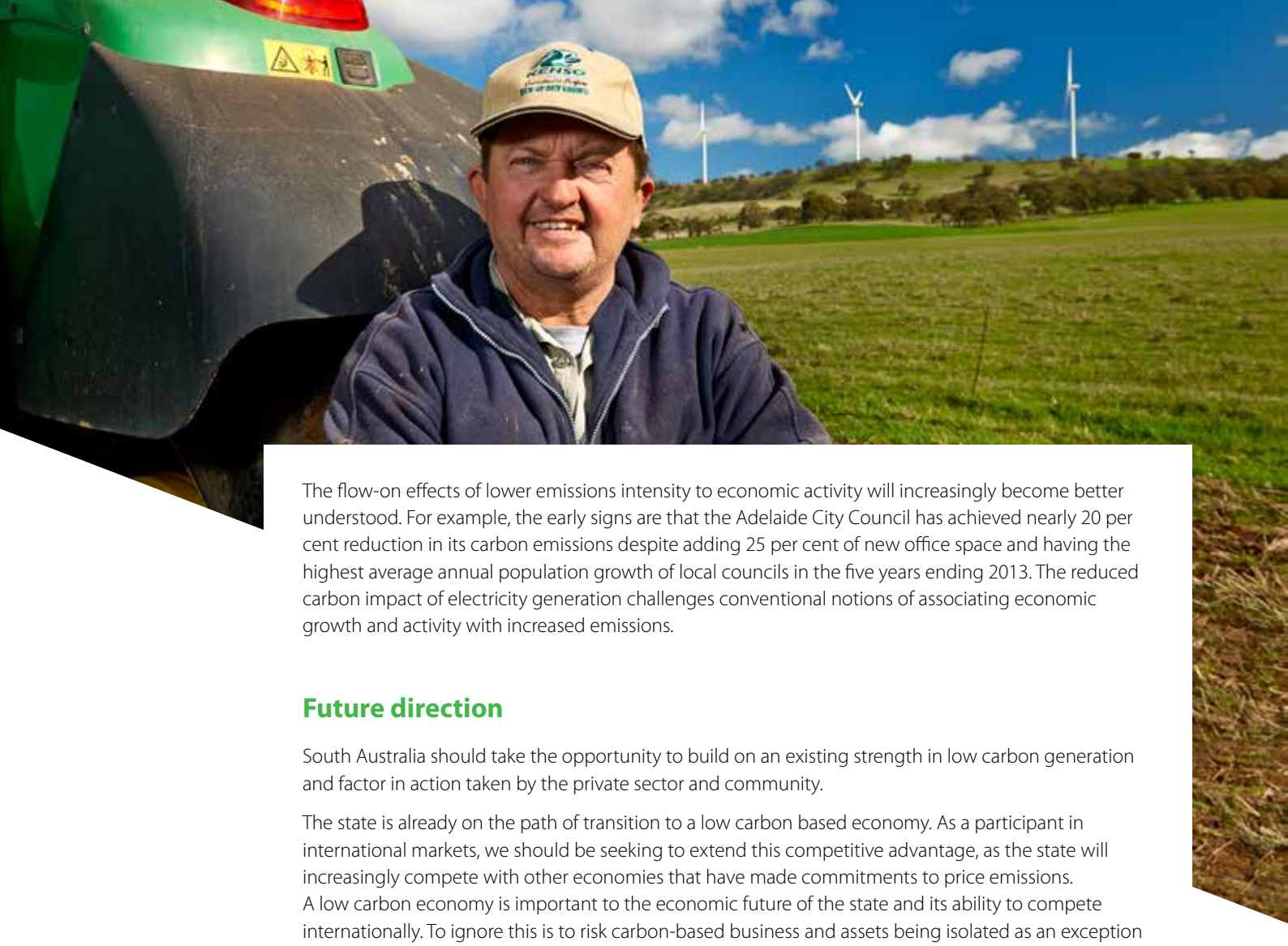
Lower grid intensity

Contributes to carbon neutral Adelaide

Flow on benefits to households, community and the economy

Analysis obtained from NATSEM[5] shows that when carbon price mechanism was operational, the flow-on cost impact was lower for households in South Australia than any other state, due to the low emission intensity of our generation.

3. ABS 4631.0 2013-14, Employment in Renewable Energy Activities, Australia.
4. SKM Wind Farm Investment, Employment and Carbon Abatement, 2012.
5. National Centre for Social and Economic Modelling, 2012.



The flow-on effects of lower emissions intensity to economic activity will increasingly become better understood. For example, the early signs are that the Adelaide City Council has 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.

Future direction

South Australia should take the opportunity to build on an existing strength in low carbon generation and factor in action taken by the private sector and community.

The state is already on the path of transition to a low carbon based economy. As a participant in international markets, we should be seeking to extend this competitive advantage, as the state will increasingly compete with other economies that have made commitments to price emissions. A low carbon economy is important to the economic future of the state and its ability to compete internationally. To ignore this is to risk carbon-based business and assets being isolated as an exception to a broader international trend to low carbon action.

The Premier's Climate Change Council has outlined a vision for a low carbon South Australia.[6] This low cost, affordable future acts as insurance against the carbon premium and incorporates a broad portfolio of technologies and innovations with the prospect to be cost competitive. It includes energy efficient and enabling technologies such as energy storage, electric vehicles, smart grids, fuels, demand management and grid stabilising technologies, wireless applications to enable low carbon technology, and other innovations not yet conceived.

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 are then re-used by industry to carbonate drinks and to treat waste water and public swimming pools.

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 prices as our imperative, we can sustain community support for our vision and the initiatives that support it.

To develop a resilient approach, we need to collaborate with other states where possible and maintain a local emphasis that builds independence from Federal Government actions and strategies. 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 challenge is to maximise local participation as much as possible from low carbon energy projects and investment.

6. Available at *https://www.sa.gov.au/topics/water-energy-and-environment/climate-change/tackling-climate-change/premier-s-climate-change-council*

3. National policy frameworks

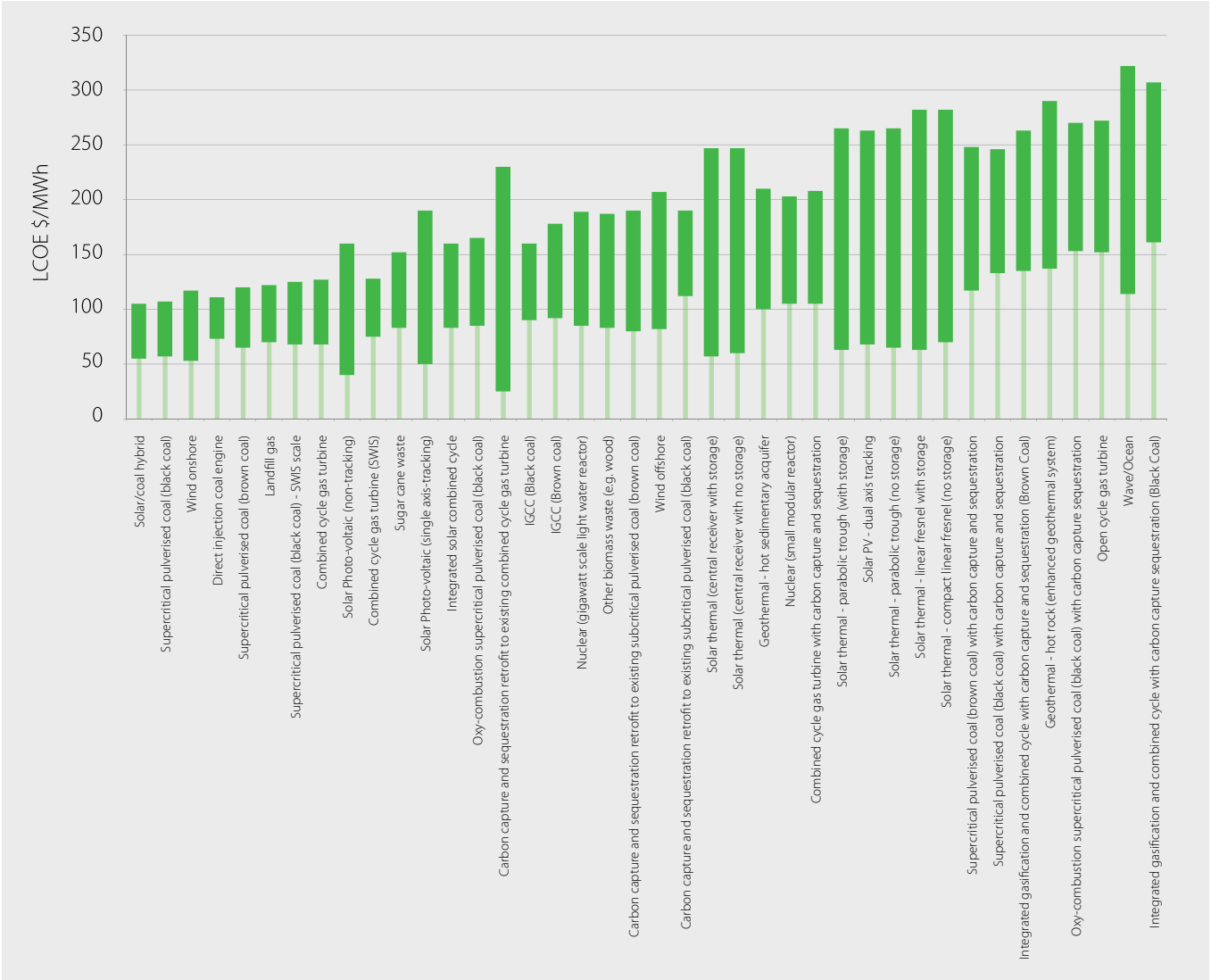
The Federal Government has indicated it intends to take a different policy direction to the framework implemented through the 2011 Clean Energy legislative package. The implementation status of changes to date are summarised below.

Legislation / scheme	Status	Commentary
Clean Energy Act 2011	Repealed	The legislation was introduced in 2012-13 to provide a long term price for carbon emissions using a market mechanism following a fixed price period. As a result of the repeal, 2013-14 is the final year in which liable entities from large business and industrial facilities with emissions from electricity generation, stationary energy, landfills, wastewater, industrial process and fugitives are to acquire certificates for carbon emissions produced each year.
Renewable Energy Target scheme	Amendment passed Parliament	The Federal Government has passed legislation in the Parliament reducing the target from 41,000 gigawatt hours to 33,000 gigawatt hours. Changes are to be implemented by the Clean Energy Regulator as the administrator of the scheme.
Clean Energy Finance Corporation Act 2012	Remains operational	The CEFC is the $10 billion entity established in legislation to overcome capital market barriers that hinder the financing, commercialisation and deployment of renewable energy, energy efficiency and low emissions technologies. A Bill to repeal the entity has been voted down by the Upper House of national Parliament twice and a draft directive has been issued by the Federal Government to alter the investment mandate. The entity continues to operate in accordance with its legislated mandate.
Australian Renewable Energy Agency 2011	Remains operational	ARENA was established originally with a $3.2 billion budget to improve the competitiveness of renewable energy technologies and increase the supply of renewable energy in Australia. Legislation reducing ARENA funding by $435 million passed the Parliament in July 2014. A Bill to abolish ARENA and return its functions to the Department of Industry and unspent funding to unconsolidated revenue was tabled in the Federal Parliament in September 2014. A Senate Committee has reported on the Bill, supporting the repeal. Pending the passage of the Bill by the Senate, ARENA's programs remain open and assessment of existing applications is continuing in line with its legislated mandate.
Emissions Reduction Fund	Legislation proclaimed and first auction April 2015	The fund is to make direct purchases of least cost emissions abatement using an auction process and enter in contracts for abatement projects. The first auction has occurred under the $2.55 billion Emission Reduction Fund and awarded about a quarter of the budget. An average price per tonne of abatement of $13.95 was the result, mainly to sequestration and landfill projects.

At the same time, 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[7] 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 are low carbon, indicates a portfolio including wind onshore, landfill gas, nuclear, solar photo-voltaic 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, and 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 10).

Figure 10 - Levelised cost of energy generation technologies at 2030 ($AUD)



Note: Excludes carbon price, includes where relevant CO2 transportation costs, plant capital costs, owners and finance costs, fixed and variable operating costs, fuel costs and escalation factors.
Source: BREE 2013, Australian Energy Technology Assessment Model Update

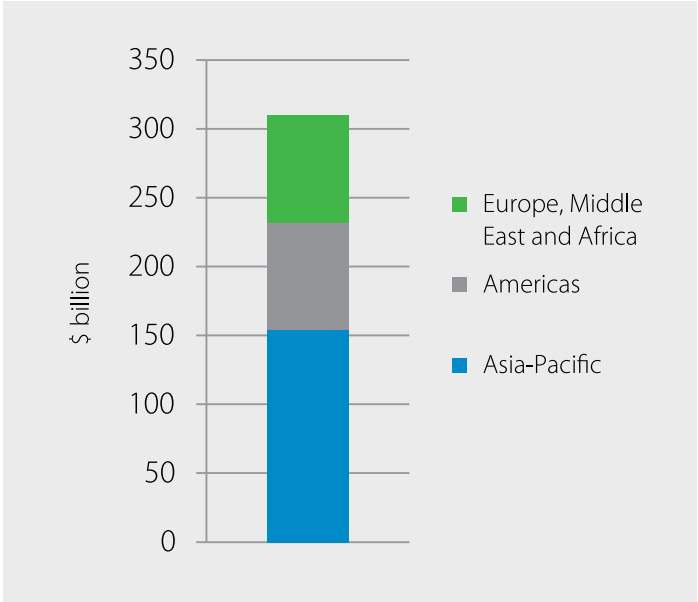
7. Levelised cost of energy is the minimum cost of energy at which a generator must sell its output in order to achieve an economic rate of return.

8. REN 21, Renewables 2014 Global Status Report, not including hydro.

Internationally, the general trend has been toward greater investment in clean energy, with total investment rising from $60 billion in 2004 to $310 billion in 2014. The proportion of this investment realised in the Asia-Pacific region has increased over this period, reaching $154 billion or 50 per cent of total investment in 2014. China and India are now placed in the top five countries for total installed capacity of renewable energy.[8]

Figure 11 – Investment in clean energy by region

Source: Bloomberg New Energy Finance, 2015, Global Trends in Clean Energy Investment



4. 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. The first priority is 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 State Government committed to establish Adelaide as the world's first carbon neutral city, and the strategies and initiatives that form a low carbon investment plan will be consistent with these priorities and commitments.

In view of this, the following criteria will be used to assess new initiatives.

Low carbon economy

Sustains the state's pre-existing competitive advantage of transitioning to a low carbon economy, which is important to our long term economic future.

Low carbon energy portfolio

Contributes to a wider portfolio of low carbon technologies that have 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.

Carbon neutral Adelaide

Either contributes directly by displacing emissions associated with Adelaide city[9] or indirectly through reducing the grid intensity of emissions.

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.

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.

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).

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.

Job creation

Leads to the creation of jobs for South Australians.

9. 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.

4.1. Clear policy and efficient regulatory environment

The State has set clear targets to increase renewable energy and was one of the first jurisdictions in the world to legislate a target under its *Climate Change and Greenhouse Emission Reduction Act 2007*. The original target of 20 per cent of electricity production from renewable energy sources by 2014 was increased to 33 per cent by 2020. With that target exceeded in 2014, a new target of 50 per cent of electricity production from renewable energy by 2025 was announced.

To supplement clear policies, the South Australian Government has been proactive in providing and maintaining a competitive, certain and expeditious environment for investment. South Australia was the first state to introduce a regulatory framework specifically tailored to the geothermal industry in 2000.

Our land use planning system is recognised by the wind industry as the fairest, most transparent and most expeditious in Australia.

It was the first state to introduce land use planning guidelines for wind farm developments in 2002, at a time when the first deployment of wind farms was occurring in Australia. South Australia was the first jurisdiction in Australia to introduce a feed-in tariff in 2008 to support and encourage solar energy uptake by households and small business.

In 2012, in response to uncertainty caused by a court decision, all council development plans in the state were amended to provide greater certainty in areas where wind farms can be expected, and articulate specific guidelines in relation to visual amenity. South Australia was Australia's first and only government to provide payroll tax relief specifically for renewable energy projects.[10]

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

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 being available, there may be role for government policy to increase uptake and drive down production costs.

10. 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 – Access to pastoral Crown land

The *Pastoral Land Management and Conservation (Renewable Energy) Amendment Act 2014* has been drafted to provide a form of tenement for wind farm developers to exist in parallel with an existing pastoral lease. The Bill will also fast-track access to portions of pastoral land for commercial scale solar development.

When proclaimed, South Australia will be the first state to introduce legislation which specifically allows for the coexistence 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 passed Parliament in 2014 and the next step for the South Australian Government is proclamation by the Governor to give effect to the legislative amendments.

Criteria links:
Low carbon economy, resilient approaches, support industry development, job creation

Lead agency: State Development (RenewablesSA)

Supporting agencies: DPTI, DEWNR

Case Study 2 – Investment attraction and case management

A dedicated investment attraction agency will work to attract capital, establish new head offices of international firms and facilitate investment into industries in strategic strengths. A key role for the agency will be to work with the private sector to break down barriers, navigate regulatory and approvals 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.

The Government continues to make available to eligible proponents its case management services to streamline and coordinate processes for obtaining development approval and other licensing required for major projects.

Criteria links:
Resilient approaches, industry Development, job creation

Lead agency: State Development (Investment, Trade and Immigration and RenewablesSA)

Supporting agencies: DPTI, PIRSA

Case Study 3 – Electric vehicle incentives

Electric vehicles (EVs) 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. A package of initiatives could accelerate take up of EVs and provide opportunity for local industry development.

Incentives could include purchase price subsidy, parking privileges, preferential traffic treatment, stamp duty or other tax exemptions, mandates, installation of charge points, energy retailer discounts, changes to electricity tariffs to provide customers with opportunity to charge at low off-peak rates, education/demonstration events and government purchase.

Criteria links:
Low carbon economy, industry development, job creation

Lead agency: State Development (Energy Markets and Programs, RenewablesSA) and DPTI

4.2. Information to inform investment

Another effective role for the Government is to create and disseminate high quality information that assists potential investors with project decisions.

RenewablesSA was established in 2009 to commission and provide information to potential investors seeking detailed information on State Government renewable energy resources, policies and processes. Specifically, this includes:

- irradiance maps and data on the state's wind and solar resources and high resolution spatial planning information important to the selection of 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 photo-voltaic 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 existing diesel generators in the state to assess the opportunity to offset use of diesel with solar and batteries as the cost of these technologies continues to decline.

More recently, in response to interest from potential investors, the South Australian Government commissioned a guide to the development, planning, regulatory approvals and grid connection process for commercial scale solar projects in South Australia (September 2014).

As part of this role, the Government has previously supported significant feasibility studies for project assessment (listed in Appendix 1).

The Government recognises the impact that quality information can have on investment, and that lack of such information can be a source of market failure.

In South Australia, the bio-energy sector is at a nascent stage with some interest. The potential resource and ability to translate into projects across the state is not well understood. Bio-energy projects often require commitments from multiple feedstock producers acting in concert to create markets.

The South Australian Government's role in the bio-energy sector is twofold: 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.

Case Study 4 – Bio-energy Roadmap

Bioenergy is a largely untapped resource in South Australia, as understanding of the feedstock and technology potential is limited. However, the opportunity is large for heat and electricity, with increasing gas and electricity prices.

The Bio-energy Roadmap is a way to break through some 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 and industry on the potential
- providing opportunities for those who understand the technology to build projects.

The Bio-energy Roadmap will comprise three stages:

- Stage 1 is to map the state for 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: State Development (RenewablesSA)

Supporting agencies: PIRSA, ZWSA

Case Study 5 – Diesel Data Directory

In 2013, a directory with information about existing diesel generating plants (off-grid, on-grid and used in mini-grids) in the state 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 a 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 are becoming worthwhile to investigate, with cost of diesel generation rising and cost of renewable/hybrid solutions falling.

The aim is to provide up-to-date information to providers of renewable energy and hybrid energy solutions and to add to this stock of information over time.

An update of the directory is planned for 2015-16.

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

Lead agency: State Development (RenewablesSA)

4.3. Sponsoring uptake and wider market deployment

In the past, the South Australian Government has led by example by being an early adopter of technology, including 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) and Adelaide Airport, and mandating solar panels on new and refurbished government buildings in 2009.

The South Australian Government has also sponsored uptake of new technologies, such as supporting research, development and demonstration of a solar thermal air-conditioning prototype for residential application, and contributing $500,000 toward an innovative solar and electric vehicle project on Kangaroo Island.[11]

As only one of 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.

11. This project comprises a 50 kilowatt dual axis photo-voltaic solar tracking system on Kangaroo Island and electric vehicle and a six station charging network (powered by solar at the Airport and Council offices.

The South Australian Government has looked to support new models that have the potential for broader roll-out without government subsidy, including 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. Shares will be offered, non-transferable for the life of the cooperative, and at the end of the cooperative the asset will be transferred to Council. Council will lease the system at a price equivalent to on-site modelled energy demand. The project has support from ARENA, the Local Government Association of South Australia, City of Campbelltown Council and Bendigo Bank, and the Department of State Development has contributed $35,000.

The community ownership model can allow individuals in a community to participate in the ownership of installations, where it would otherwise be impractical for them to do so (e.g. individuals in rented properties and apartments). From an equity perspective, a broader cross section of the community can benefit from solar power generated locally, regardless of their housing situation.

Community-led action can often tackle challenges more effectively than government alone, developing solutions to meet local needs, and involving local people. 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.

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 Federal 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 11 regional towns (Port Augusta, Port Pirie, Whyalla, Saddleworth, Peterborough, Jamestown, Laura, Gladstone, Melrose and Burra).

In 2014, the South Australian Government released a tender to test the market's ability to provide an innovative commercial model for solar installation at the old Mitsubishi Main Assembly Building at Tonsley Park. It is intended for a company to build and own the system and retail the electricity generated by the array of up to three MW to businesses within the development. The Government is currently negotiating with Origin Energy as a preferred tenderer identified in the first stage of a tender process.

As noted in Section 2, while South Australia is a leading jurisdiction for domestic installation of solar, a large scale solar project is yet to be built. One option that could be explored is a reverse auction which could be designed in a way that delivers the state's first large scale solar project without cost to South Australian consumers through electricity bills.

Another role for the Government is to support projects that will 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. There is also a more general need to build confidence that high levels of intermittent generation can be managed. There are challenges for integrating high levels of renewable energy in distribution and transmission networks, particularly with the rapid and continued growth of solar energy at household level shifting the timing of maximum demand to later in the day. Strategies for managing integration include coherent and flexible energy systems, active control of demand, and smart grid applications. Energy storage could come in the form of electric vehicles or battery systems and could potentially be game-changing technology, allowing intermittent generation to be stored and dispatched according to demand.

Case Study 6 – Mobile energy storage test facility

The University of Adelaide has been actively developing a proposal for an independent testing facility for energy storage systems since 2012. The facility is to comprise 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. The unit is to 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 a more than $3 million project that has attracted $1.4 million from ARENA and leverages $550,000 in financial support from SA Power Networks, local company Solar Storage and Energy Networks Association of Australia, along with $100,000 from the South Australian Government. Local companies ZEN Energy and Power and Drive are providing in-kind support.

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

Lead agency: State Development (RenewablesSA, Energy Markets and Programs)

Case Study 7 – Battery storage in government buildings

The SA 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. There is an opportunity to showcase emerging battery storage technology and demonstrate potential cost savings opportunities from battery storage.

The South Australian Government has issued an expression of interest seeking information from potential suppliers to supply and install battery storage systems in SA 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: State Development (Energy Markets and Programs)

Case Study 8 – 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 that is 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: DEWNR

Supporting agency: State Development

Case Study 9 – Reverse auction

A reverse auction could be designed in a way that delivers the state's first large scale solar project without cost to South Australian electricity consumers. A PV plant is scalable and in light of the carbon neutral Adelaide agenda could be scaled to wholly or partially meet the Government's demand for electricity in the Adelaide CBD. The proposal could be based on solar PV as there is already significant wind energy installed in SA. The tender documentation could specify a requirement for a plant to be built at Port Augusta, if required. It would then meet dual requirements of supporting the Port Augusta community and assisting in achieving a carbon neutral Adelaide.

Criteria links:
Low carbon energy portfolio, resilient approaches, driver for advanced manufacturing, contribute to carbon neutral Adelaide

Lead agency: State Development (RenewablesSA, Energy Markets and Programs)

Case Study 10 – Collective power purchase contract

A campaign could be facilitated by the South Australian Government to aggregate a significant number of electricity consumers within the Adelaide coverage zone to purchase renewable energy for their electricity needs. The collective purchasing power of residents and businesses in Adelaide's central business district could drive competitive prices for a contract.

Criteria links:
Resilient approaches, contribute to carbon neutral Adelaide

Lead agency: State Development (Energy Markets and Programs, RenewablesSA)

4.4. Facilitating projects to leverage funding and support

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

The South Australian Government is positioning itself to take full advantage of the opportunities expected to flow from these mechanisms by supporting projects that leverage Federal funding and funding from other sources.

Case Study 11 – Sundrop farms R&D facilitation

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

Sundrop Farms are 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). In 2014, Sundrop Farms attracted private capital backing from global investment firm Kohlberg Kravis Roberts (KKR) and finalised a ten year contract with Coles Supermarket, further catalysing finance support. 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 commenced case management support to the project in 2009 and is continuing to provide these services in its expansion stage.

Criteria links:
Low carbon economy, low carbon energy portfolio, job creation

Lead agency: State Development (Investment, Trade and Immigration, RenewablesSA)

Supporting agencies: DPTI

Case Study 12 – Coober Pedy renewable energy project facilitation

In July 2014, Energy Developments Limited (EDL) was awarded up to $18.5 million funding from the Commonwealth Government through ARENA to build a hybrid renewable energy plant. The proposed plant will incorporate solar photo-voltaic 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 for the provision of electricity to the township.

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

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

Supporting agencies: DEWNR

Case Study 13 – High penetration renewable energy power station at Marree

The Department of State Development has identified an opportunity for renewable energy and battery storage to offset diesel usage in Marree, an off-grid community located in South Australia's far north region. A system designed for a high penetration renewable energy input 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 is utilising private capital to contract an independent power producer to build, own and operate the plant, with the Government offering a long term contract for purchase of 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 capability and industry expertise, driver for advanced manufacturing

Case Study 14 – Enhanced stage 3 of Bio-energy Roadmap

This initiative could strengthen Stage 3 of the existing Bio-energy Roadmap (Case Study 3) by providing support to specific projects on a matched industry funding basis.

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

Lead agency: State Development (RenewablesSA)

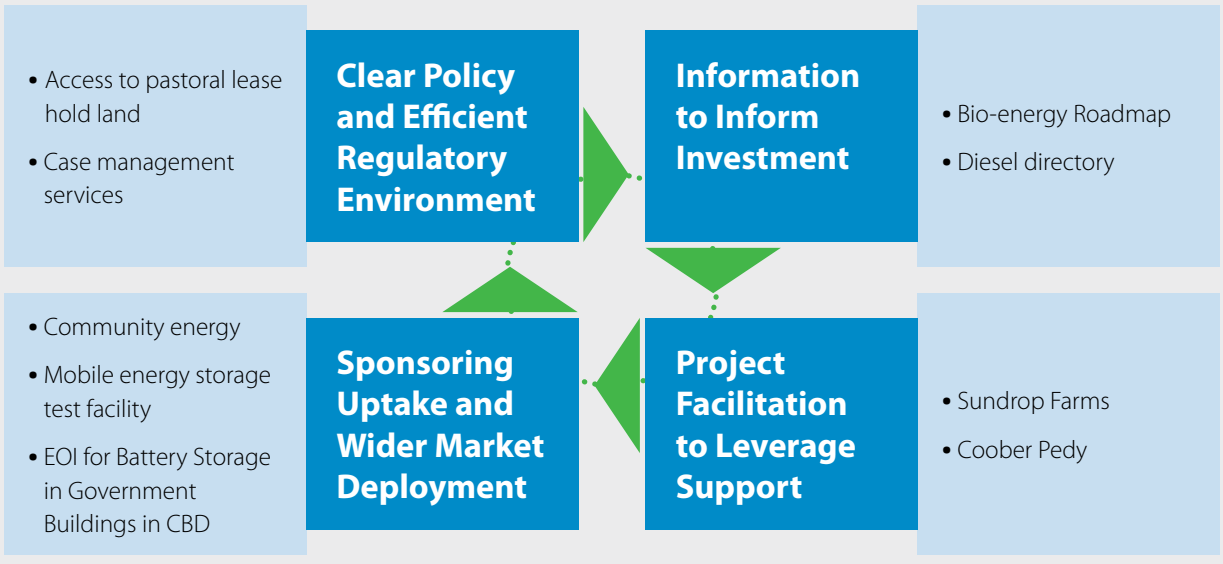
5. Stakeholder questions

a) What plans and/or commitments do industry and communities have that would help to achieve the $10 billion investment target for low carbon generation? Do stakeholders have case studies or success stories that highlight the major outcomes and benefits to date of attracting low carbon generation investment to South Australia?

b) The South Australian Government is interested in working in partnership with the private sector, research sector and community to harness a shared commitment to the state's target for low carbon investment. What opportunities and/or barriers are there with respect to partnership approaches?

c) In this Strategy Paper, case studies of projects and initiatives have been provided as examples that future initiatives could be modelled on. Possible new initiatives include Case Study 3 - Electric vehicles incentives, Case Study 9 – Reverse auction, Case Study 10 – Collective power purchase contract and Case Study 14 – Enhanced Stage 3 of Bioenergy Roadmap. What feedback do stakeholders have on possible new initiatives? Are there further ideas that would be consistent with the South Australian Government's priorities and criteria in Section 4?

Written comments are due by 18 October 2015 to DSDRenewablesSA@sa.gov.au



Appendix 1 – Detailed summary of information commissioned

The following lists significant commercially relevant research and information previously commissioned by the South Australian Government to inform investment and policy development in renewable energy in South Australia.

Green Grid Study (2010)

Macquarie Capital Advisors, Worley Parsons and legal firm Baker & McKenzie examined the business case for large scale grid investment to unlock the renewable energy potential of the Eyre Peninsula. WorleyParsons quantified the wind energy potential across the region. This was based on geographic information system analysis using sophisticated mapping analyses. It considered not just the wind resource but also included consideration of constraints such as social, engineering and land use and tenure. WorleyParsons designed and optimised a transmission network solution to unlock these zones, including integration into the existing grid. The analysis considered a wide range of solutions, including energy storage and very long HVDC connections, but eventually established and costed almost 1000km of new 500kV transmission assets. Macquarie Capital Advisors used this information to develop and present a business case for such grid investment. This result indicates that under certain regulatory and resource conditions the strategic investment in purpose designed transmission solutions to unlock the best renewable resources is a better alternative than more organic renewable energy growth.

Energy storage options for South Australia (2011)

WorleyParsons and Sinclair Knight Mertz were commissioned to examine the economic potential for energy storage technologies in South Australia. This involved screening technologies, reviewing geological data to assess large scale storage locations, modelling the South Australian transmission network to determine best large scale storage scheme locations from a network perspective, and assessing storage options in view of its interchangeability with transmission investment. The study identified Eyre and Yorke Peninsulas and the Riverland network as candidate locations for large scale storage, which could be used to defer new transmission infrastructure. The storage technology type and locations are:

- sea water pump storage in the Eyre Peninsula, in particular to the east and west of Port Lincoln to support future wind farm development in the area
- underground compressed air storage in the South East
- compressed gas storage in the SEA gas pipeline between Adelaide and the Otway Basin in Victoria.

Commerciality of solar resources in South Australia (2010)

ROAM Consulting was commissioned to examine the commerciality of South Australia's solar resources compared with three other states, taking into account marginal loss factors, the losses associated with transporting electricity over distances. The study examined generation and revenue forecasts for a number of solar technologies in a number of locations for the financial year 2015-16. The technologies investigated were:

- concentrating PV
- tilted plate solar photo-voltaic (PV)
- solar thermal parabolic trough without storage.

Solar insolation maps (2010)

The maps show the average daily direct normal irradiance (DNI) and the average daily global horizontal irradiance (GHI) on an annual and monthly basis for the state. An animation is also available. Data for the maps is based on hourly irradiance data averaged for each month and provided by the Bureau of Meteorology's National Climate Centre 1998 – 2007. The gridded data covering Australia (for which the colour map is a graphical representation) has resolution intervals at 5 km. The maps and data are relevant to prospective investors of solar projects. DNI is relevant for the siting of concentrated solar power systems and GHI is relevant for flat plate solar collectors, typically non-concentrating photo-voltaic panels and solar hot water systems.

Solar modelled time series data
(csv files and typical meteorological year files in the TMY2 data format)

3TIER was commissioned to provide solar insolation and weather data for four key sites in South Australia. Potential investors can use this data to run design simulations and find the likely electricity output a solar power station would produce at each location. The four modelled sites are Pimba, Port Augusta, Neuroodla and North West Bend. For each site a report is provided that gives an overview of the analysis and a time series comma separated value (CSV) file including hour-ending mean data for global horizontal irradiance, direct normal irradiance, diffuse irradiance, zenith angle, azimuth angle, wind speed at 10m, wind direction at 10m, air temperature at 2m, and relative humidity at 2m. The solar insolation data has been interpolated from the past 10+ years of half hourly high-resolution visible satellite imagery, and the wind, temperature and relative humidity have been determined from 10+ years of simulated data.

Projected carbon intensity for South Australia (2010)

McLennan Magasanik Associates was commissioned to assess the projected carbon intensity of South Australia's electricity generation with the achievement of the 33 per cent target for the state's electricity production by renewable energy sources by 2020. The report found the carbon intensity of South Australia's electricity generation would fall to 0.53 tonnes of carbon dioxide equivalent per megawatt hour by 2020. This is two thirds the projected result for the rest of Australia by 2020 of 0.79 tonnes of carbon dioxide equivalent per megawatt hour by 2020. The findings were used to inform the setting of target 66 emissions intensity under the South Australian Strategic Plan.

In October 2013, South Australia committed to an investment target of $10 billion in low carbon generation by 2025.

Potential for renewable energy in South Australia (2009)

In June 2009, South Australia committed to increasing its renewable energy production target to 33 per cent by 2020. To inform the setting of the new target, expert advice was obtained from McLennan Magasanik Associates (MMA) and the National Institute of Economic and Industry Research (NIEIR). The reports identify a wealth of cost-competitive potential projects in South Australia. They have differing views on the impacts of constraints, specifically the maximum level of wind power that can be fed into the South Australian electricity grid without affecting grid stability. The MMA analysis provides some confidence in the feasibility of a 33 per cent target, as it identifies the factors that need to come to fruition for 40 per cent to be achieved. The availability of transmission infrastructure to connect and transfer power to load centres in other states is the other key factor affecting the realisation of the higher target identified by the MMA analysis. At the same time, there are a number of offsetting factors, including an increased rate of growth in local demand (e.g. associated with mining) and potential developments in energy storage to maximise the potential for renewable energy.

Commerciality of new wind in South Australia (2011)

ROAM Consulting was commissioned by ElectraNet to model how much new wind capacity could be accommodated on the existing transmission network and remain commercially viable. RenewablesSA sponsored the study by making a small contribution towards the cost, and was involved in developing the scope of work and finalising the report. The study has found that up to 1050MW of additional new wind development is likely to be commercially profitable (approximately 2300MW in total) if connected to the existing electricity transmission network in areas with high-quality wind resources and available transmission network capability (e.g. the mid north region of South Australia).

The study revealed that the most significant other factor that would act to significantly increase the potential for additional profitable wind generation in South Australia is increased interconnection capacity between South Australia and Victoria. Additional retirement of coal-fired generation and energy storage technologies in South Australia would also increase the potential for more wind generation.

Diesel mapping (2013)

RenewablesSA commissioned IT Power to survey and collect information about existing diesel generation plants (off-grid, on-grid and used in mini-grids) in the state. This includes plants used by mining, pastoral stations, businesses and towns in South Australia. The project is to provide information, where consent has been given to make publicly available, on the location of plant specific information, such as the number of generators, size, age, owners/operators and use, etc. The intent is to identify sites so that proponents can assess the opportunity to offset use of diesel with solar battery as the cost of these technologies continues to decline. The geographic information systems (GIS) strategy delivered for the project is a Google map application and an information layer to the infrastructure channel of the South Australian Resource Information Geoserver (SARIG), for those proponents interested in supply in view of mining projects.

New investment target for low carbon generation (2013)

In October 2013, South Australia committed to an investment target of $10 billion in low carbon generation by 2025. To inform the setting of the new target, expert advice was obtained from Sinclair Knight Merz (SKM). For South Australia, SKM assessed the historical investment to date in low carbon and renewable energy generation and also forecast investment for both sectors to 2030. For the state and regional economies, where possible, SKM also assessed a number of economic indicators, including wages and salaries, value added and investment. This analysis was subsequently updated in 2015 by Jacobs.

Waste biomass opportunities map for the south east of South Australia (September 2014)

This study was commissioned by Zero Waste SA and the South East Biomass Group to identify the locations and aggregate amounts of waste biomass occurring in the south east region of South Australia and potential commercial opportunities for improved utilisation. The four key source categories were crop residues, manufacturing and processing residues, animal wastes, and residential and commercial organic waste, including sewage waste. The report also provides high-level overviews of energy and water infrastructure present in the region, important to the siting of any potential waste biomass resource recovery facility.

Regional organic waste mapping in South Australia (2012)

Zero Waste SA commissioned Blue Environment to survey and identify organic waste materials generated and processed within three local council areas in South Australia, viz. Adelaide Hills, Barossa and Mt Barker. The objective was to develop a detailed understanding of the current and potential future supply of organic waste material that would be suitable for recycling and resource recovery within the area. The survey responses accounted for more than 22,000 tonnes per year of solid organic waste and more than 1,000 ML per year of liquid waste. Of the three council areas, Barossa experienced the largest waste stream (around 10,500 tonnes per year), due mostly to grape marc waste generated by wineries in the area. The organic waste stream generated in both the Adelaide Hills and Mt Barker council areas was around half of the Barossa total, with around 5,200 tonnes per year and 6,300 tonnes per year generated respectively.

This Strategy Paper is the first step in a targeted engagement strategy with industry, investors, community and the research sector on finalising a low carbon investment plan for South Australia.

Further information

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Photograph acknowledgements

Cover: Waterloo wind farm
P8: Tindo Solar, Mawson Lakes, South Australia
P14: Waterloo wind farm
P17: Production of wind towers, Kilburn, South Australia
P20: Royal Adelaide Showgrounds
P22: SAGE Automation, Melrose Park, South Australia.
Image used with the permission of Bushlight
P26: Dual axis solar tracker and electric vehicles, Kangaroo Island
Inside of back page: Waterloo wind farm

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