



Government
of South Australia
Department for
Energy and Mining

OFFSHORE RENEWABLE ENERGY GENERATION



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INTRODUCTION

South Australia's abundant wind and solar resources have supported a rapid expansion of renewable energy generation in the past two decades.

Wind power is the fastest growing source of energy in the world today and is poised to play an even greater role in future energy systems.

While offshore wind provides a tiny fraction of global electricity supply, this source of renewable energy is expected to expand strongly.

In 2020, more than 75 per cent of the global installed offshore wind capacity was located in the United Kingdom, China and Germany.

The European Union is aiming for a fivefold increase in offshore wind capacity during the next decade.

Transformational growth in electricity demand in South Australia is conceivable towards the end of the decade, making offshore wind farm development a potential reality.

HISTORY OF RENEWABLE ENERGY FROM WIND RESOURCES IN SOUTH AUSTRALIA

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- 1898** ○ First power station in South Australia lights up Port Adelaide.
 - 1953** ○ ETSA investigates feasibility of wind generation.
 - 1980s** ○ ETSA conducts surveys to identify the strength and frequency of prevailing winds in South Australia to determine best locations for wind farms.
 - 2001** ○ For the first time, Australia sets a mandatory renewable generation target of 4 per cent.
 - 2003** ○ First wind farm in South Australia opens at Starfish Hill near Cape Jervis.
 - 2007** ○ South Australia sets a renewable energy target of 20 per cent by 2014.
 - 2012** ○ South Australia introduces wind farm guidelines to help designers, engineers, and planning authorities to issue the impact of new developments.
 - 2017** ○ Hornsdale Power Reserve links “big battery” to wind farm to provide energy storage to wind generation for the first time in Australia.
 - 2019** ○ South Australia generates more than half of its electricity from wind and solar energy.
 - 2020** ○ South Australia sets a target of net 100 per cent renewable generation by 2030s.
 - 2020** ○ New Planning and Design rules for wind and solar farms in rural areas comes into effect.
 - 2021** ○ In 2021, South Australia produced 62 per cent of its electricity from renewable energy resources, of which 41% came from wind resources.



WHAT IS AN OFFSHORE WIND FARM?

Offshore wind farms are usually constructed in bodies of water, such as the ocean, to harvest wind energy to generate electricity. Faster, steadier wind speeds are available offshore compared to on land, making offshore wind farms capable of producing more electricity per amount of capacity installed.

Offshore wind turbines can be very tall and very large which allow them to capture the abundant wind resources available offshore, offshore turbines can be over 200m and larger turbines means more electricity.

Electricity produced by offshore wind turbines travels back to land through a series of cable systems.

Offshore wind turbines are either fixed or floating platforms in deep waters.

Most offshore wind farms employ fixed-foundation wind turbines in relatively shallow water.

Further advancements are allowing for offshore wind projects to be built further off the shore where wind availability is higher. Floating wind turbines for deeper waters are in the early phase of development and deployment.

WHY IS THERE GROWING INTEREST IN OFFSHORE WIND PROJECTS?

Wind power is one of the fastest-growing renewable energy technologies worldwide, in part because costs are falling.

Global installed wind-generation capacity onshore and offshore has increased by a factor of 75 in the past two decades, jumping from 7.5 gigawatts (GW) in 1997 to 564 GW by 2018, according to International Renewable Energy Agency data.

While many regions around the world have strong wind speeds, offshore wind resources are often abundant and have the potential to deliver large amounts of clean, renewable energy. The coastal regions of continents at mid to high latitudes, which includes the coastal regions of South Australia, are generally characterised by high, relatively constant wind conditions, with average wind speeds in excess of 6 metres per second (m/s) and, in places, more than 9 m/s.

Offshore winds are typically stronger during the day. Whereas most land-based wind resources are stronger at night when electricity demands are lower.

The cost of offshore wind power has historically been higher than that of onshore wind generation, but costs have been decreasing rapidly in recent years.

The added advantage of locating wind turbines offshore is that the wind is much stronger and wind farms can be located close to the load centres along the coast, eliminating the need for new long-distance transmission lines.

The falling cost of generation combined with the higher performance of the turbines offshore make offshore wind farms a competitive source of electricity in the transition toward a decarbonised global energy system.

TYPES OF OFFSHORE WIND TURBINES

Fixed foundation offshore wind turbines are generally considered viable in areas with water depth less than 50 metres and average wind speeds over 7 m/s

Types of underwater structures include monopile, tripod, and require different types of bases for stability, according to the depth of water.

Most foundations are monopile base, six metres in diameter, and used in waters up to 30 metres. Tripod piled structures, are used in water 20–80 m deep.

For locations with depths over about 60–80 m, fixed foundations are uneconomical or unfeasible, and floating wind turbines anchored to the ocean floor are needed.

The world's first full-scale floating wind turbine was installed in the North Sea off Norway in 2009, and in October 2017 the first operational floating wind farm with a capacity of 30 MW was commissioned.

WHY IS SOUTH AUSTRALIA BEING TARGETED FOR INVESTMENT?

The South Australian Government has jurisdiction to regulate offshore wind farm developments in South Australian gulf waters and offshore “state coastal waters” (waters seaward from the low water mark to three nautical miles (nm)).

South Australia has a unique marine environment whereby the gulf waters may provide an opportunity to construct offshore wind farms in South Australian coastal waters but greater than 3 nm from the coast.

Certain areas of South Australia's coastal waters have been identified as having strong wind resources. Locations that are relatively close to key infrastructure, such as transmission lines, and have suitable sea bed profiles, may provide good opportunities for wind farm development. Offshore wind in South Australia is expected to have relatively low correlation with onshore wind, therefore increasing the overall availability of renewable energy in the state.

HOW ARE OFFSHORE WIND FARMS ASSESSED AND REGULATED IN AUSTRALIA?

The assessment and regulation of offshore wind farms is new in Australia with the *Offshore Electricity Infrastructure Act 2021* and the Offshore Electricity Infrastructure (Regulated Levies) Act passing both houses of the Commonwealth Parliament on 25 November 2021.

The Acts provides a regulatory framework to enable the construction, installation, commissioning, operation, maintenance, and decommissioning of offshore electricity infrastructure in the Commonwealth offshore area.

The Commonwealth offshore area is defined as the waters beyond three nautical miles, to the outer edge of Australia's Exclusive Economic Zone.

Under this framework, offshore infrastructure activities must be done in a way that does not adversely impinge on existing marine users.

Declared areas

This Act empowers the Minister to declare a specified area suitable for offshore infrastructure activities. In determining whether an area is suitable,

the Minister will consider the existing uses of the area and seek to identify where potential interactions between offshore infrastructure activities and other marine uses may occur. Areas will be excluded where uses are considered incompatible. The responsibility for managing interactions in a declared area rests with any future licence holders, consistent with the principle of shared use of the marine environment.

Licensing scheme

The framework provides a licensing scheme to allow for offshore infrastructure activities, research, and demonstration of emerging offshore electricity generation technologies.

Licences under this framework are limited to the Commonwealth offshore area. There may be additional state/territory requirements for licensing of infrastructure in coastal waters, connection to onshore transmission/distribution infrastructure and participation in the National Electricity Market.

HOW ARE OFFSHORE WIND FARMS ASSESSED AND REGULATED IN **SOUTH AUSTRALIA?**

Potential offshore wind energy developments in South Australian coastal waters are governed by state legislation.

The *Planning, Development and Infrastructure Act 2016 (SA)* is the primary statute under which environmental assessment of a proposed offshore wind farm must be undertaken, and development authorisation must be obtained. Development authorisation must be obtained for construction of the turbines on the seabed, laying cables, and construction of any substation on land.

For an offshore wind farm proposed to be in South Australian coastal waters, tenure would need to be secured through a lease or license over the seabed issued under the *Harbors and Navigation Act 1993 (SA)*. An electricity generation license issued by the Essential Service Commission of SA (ESCOSA) is also required to operate in the electricity market.

WHAT ENVIRONMENTAL CONCERNS ARE TAKEN INTO CONSIDERATION WHEN ASSESSING NEW PROJECTS?

Common environmental concerns to be assessed when determining offshore wind developments would include:

- The risk of seabirds being struck by wind turbine blades or being displaced from critical habitats
- The underwater noise associated with the installation process of driving monopile turbines into the seabed
- The physical presence of offshore wind farms altering the behaviour of marine mammals, fish, and seabirds with attraction or avoidance
- The potential disruption of the near-field and far-field marine environment from large offshore wind projects
- The risk of invasive species introduction when towing foundations from port to site
- Fishing and aquaculture
- Visual and aesthetic impacts
- Shipping and navigation risk
- Collision risk (marine life and birds)
- Benthic habitats & reefing patterns
- Noise - vibration/electromagnetic fields
- Water quality impacts - sedimentation impacts
- The risk of chemical spills (hydraulic fluids).



WHAT ARE THE JOBS, SKILLS AND TRAINING AND SUPPLY CHAIN OPPORTUNITIES THAT FLOW FROM OFFSHORE WIND GENERATION?

Offshore wind farm development in South Australia would provide employment opportunities and stimulus to the state.

The manufacturing and installation of offshore wind farms requires a labour force skilled in marine construction and may provide employment opportunities for South Australia.

The manufacturing and installation of offshore wind turbines require significant areas of land near ports to allow for lay down areas etc. South Australia has several suitable areas, near large existing industrial hubs.

Wind turbine manufacturing in Australia is limited, representing an opportunity for South

Australia to utilise its expertise in marine construction and suitable port areas, to progress a new industry.

Offshore wind farms could be constructed close to industrial centres which allows for electricity to be generated close to the demand point, eliminating transmission upgrades and costs.

Offshore wind farms may prove beneficial in the providing green energy to important industrial hubs in South Australia and allow for the expanded manufacturing of hydrogen and green steel.



Growth and Low Carbon

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South Australian Resources Information Gateway (SARIG)

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Acknowledgement of Country

The Department for Energy and Mining acknowledges Aboriginal people as the First Nations Peoples of South Australia. We recognise and respect the cultural connections as the traditional owners and occupants of the land and waters of South Australia, and that they continue to make a unique and irreplaceable contribution to the state.



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