STAR OF THE SOUTH

OFFSHORE WIND TURBINES

CATCHING THE WIND

Offshore wind turbines harness powerful ocean winds to generate electricity.

Each structure has two key parts:

- The **foundation** is made up of a monopile and transition piece. It provides a stable footing for the turbine.
- The **offshore wind turbine** is made up of a tower, nacelle, hub and three blades. It catches wind energy and converts it into electricity.

MORE THAN **13,000** ALREADY POWERING HOMES WORLDWIDE

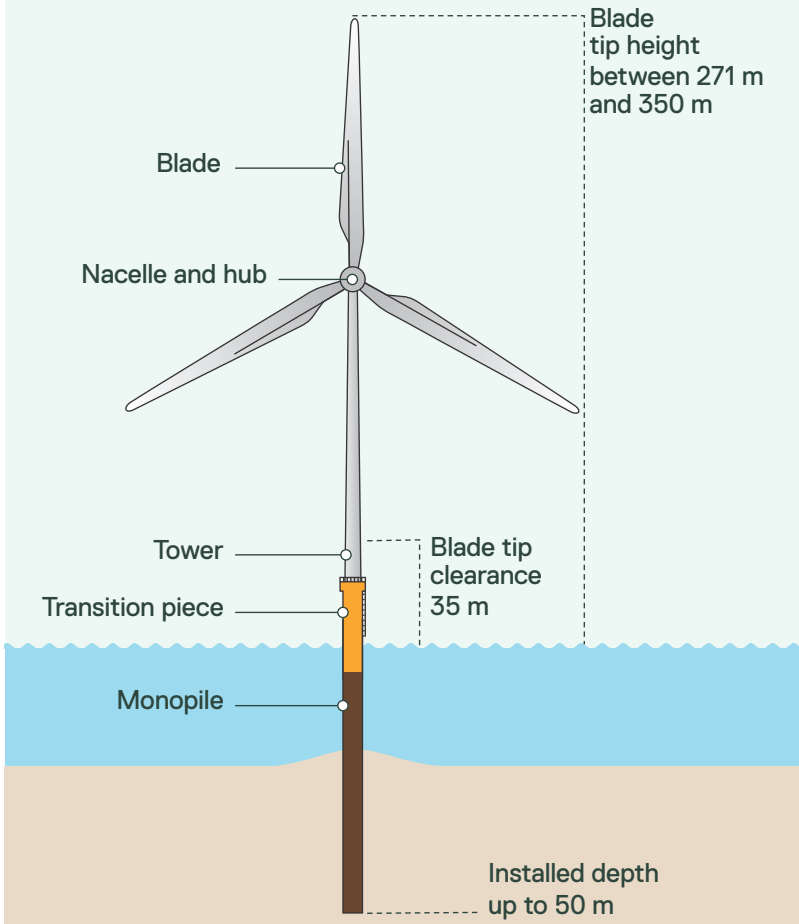
OPERATE IN WINDS UP TO **110 KM/H**

ONE SPIN CAN POWER AN AUSTRALIAN HOME FOR 2 DAYS

90% RECYCLABLE

30 YEAR LIFESPAN - OR MORE WITH GOOD MAINTENANCE

FIRST USED IN DENMARK IN **1991**



OFFSHORE WIND TURBINES

If Star of the South is built to its maximum potential of 2.2 GW, it will include up to 147 turbines.

This is based on a 15 MW turbine with a blade tip height around 270 m, which is common for new offshore wind projects today. Star of the South is expected to use turbines in the 15-20 MW range, with a maximum blade tip height of up to 350 m. If a larger turbine is used, fewer will be needed.

Selecting a turbine

We'll select and order a turbine after detailed design and investigations are complete.

When selecting a turbine, we'll consider:

MANUFACTURER'S ADVICE
Which turbine is available and recommended for the local conditions?

WIND PROFILE
Which turbine can catch the most wind at this site?

QUALITY
Does the manufacturer have a strong quality and safety track record?

COMPLIANCE
Does the turbine meet all approval, environment, safety and other requirements?

How they work

Modern wind turbines use smart technology to capture more energy, more efficiently.

The whole turbine rotates so it always faces the wind. The blades adjust their angle to catch as much wind as possible. They also speed up or slow down depending on wind conditions, to maximise power generation while reducing wear. In extreme winds, turbines can be paused for short periods to prevent damage.

Because they're far from homes and land, offshore wind turbines can be larger and more powerful than those onshore. This means they capture more wind, especially higher up where the wind is stronger and more consistent.

Offshore wind turbines are made for the marine environment. They can handle strong winds, waves and currents, and the salt water and air.

Installation

In good weather, turbines can be installed in as little as one day.

Turbines are the last component to be installed.

Parts are assembled at a construction port, then taken to site on a specialised installation vessel. The tower is installed first, then the nacelle, hub and blades are lifted into place. As each turbine is installed, it is connected, tested and put into operation.

Scan the QR code to see how turbines are installed at sea.

Maintenance

Good maintenance keeps turbines running smoothly and can extend their 30-year lifespan.

We'll monitor and operate the turbines from a Gippsland Operations Base.

Sensors track turbine health and performance in real time, helping to spot any issues early for quick resolution.

Maintenance crews will inspect and service the turbines annually and undertake repairs or replacements as needed.

FOUNDATIONS

Turbines will be installed on monopile foundations – the most common foundation type supporting 72% of all offshore wind turbines globally.

Selecting a foundation

We studied all available foundation options - monopile, jacket, gravity base, suction and floating – finding monopiles are the most suitable option for Star of the South.

Monopiles offer a range of advantages including:

- Suitable for local seabed conditions
- Proven design and installation track record
- Safe and reliable
- Smaller seabed footprint
- Available supply chain
- Suitable size for ports to handle.

To make this decision, we considered:

SITE CONDITIONS
Which foundation is technically feasible for the local seabed, ocean and wind conditions?

ENVIRONMENT AND OTHER USERS
Can foundation choice help reduce impacts on the environment and other users of the ocean?

LOGISTICS
Are there suppliers, vessels and port space available?

TRACK RECORD
Has this foundation been proven and tested internationally?

LOCAL JOBS AND MANUFACTURING
Which option creates more local manufacturing and job opportunities?

SUSTAINABILITY
Which options are most sustainable in the long-term?

COST
How do the costs for each option compare?

Detailed findings are available in the Foundation Options Assessment report on our website.

Installation

Each monopile takes around 2-3 hours to install on average.

They are piled or drilled into the seabed. This involves using a hydraulic hammer to drive the monopile into the seafloor. In around 5% of cases, the ground may be too hard for piling alone and relief drilling may be used to assist installation.

Finally, a transition piece is installed on top and scour protection placed around the base to prevent erosion from waves and currents.

Managing underwater noise

We're taking steps to keep piling noise to a minimum and protect marine life from its effects, including:

- Using **trained marine fauna observers and underwater monitors** to ensure the area is clear of whales, dolphins, seals and turtles before piling starts
- Using a **'soft start'** to deter marine life from the construction zone at the start of installation
- Enforcing a **noise level limit** that meets Australia's strict environmental regulations
- Using proven **noise reduction systems**, such as 'bubble curtains' to reduce the volume and distance noise travels underwater
- **Stopping work** if marine fauna is detected in the construction zone, where safe to do so.

SUSTAINABILITY

Wind energy is one of the most sustainable ways to generate electricity.

Carbon generated in the manufacturing, shipping and construction of Star of the South is expected to be offset in around 6 months of operations, with the project avoiding around 7 million tonnes of carbon emissions each year during operations.

Up to 90% of turbine materials can be recycled. The main components are made of steel and aluminium which have established recycling processes.

Recycling turbine blades is an ongoing area of research and development. Offshore wind turbine manufacturers are investing in this to achieve 100% recyclable turbines by 2040.

FREQUENTLY ASKED QUESTIONS

Where will turbines be located?

We'll position turbines so they generate as much electricity as possible, balancing environmental protection, safety and coexistence with other users of the ocean. Turbines must be within the Star of the South licence area and will be positioned at least 1 km apart. A wind farm layout will be refined during the detailed design phase in consultation with stakeholders and regulators.

Can they be manufactured in Australia?

There are only a handful of offshore turbine manufacturers worldwide, all based in established offshore wind markets overseas. While they aren't being made in Australia today, we've identified over 300 opportunities for local supply and manufacturing worth billions of dollars.

Do you need concrete to stabilise the turbines?

We're proposing to use a monopile turbine foundation which does not require any concrete for reinforcement.

When will you order the turbines?

Turbines have a long lead time and are in high demand globally, so it's best to get in as early as possible. We talk to suppliers regularly and will secure a manufacturing slot during the procurement phase – if Star of the South is approved and secures a government contract to supply electricity.

How often are they spinning?

Offshore wind is the most reliable source of variable renewable energy. Turbines operate in 10-110 km/h wind speeds. According to Blue Economy Cooperative Research Centre, offshore wind projects in Gippsland will have a high 'capacity factor' around 45-54%. Wind data collected in the Star of the South area shows a capacity factor closer to 70% on very hot days when electricity demand is high.

A PROJECT BY
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We acknowledge the people of the Gunaikurnai nation as the original custodians of Country and pay respect to Elders past and present.