# Frequently Asked Questions

## HOSTING A WIND FARM

VOYAGER RENEWABLES

**Hosting renewable energy projects** provides local landholders a long-term, stable and guaranteed revenue stream.

**This document intends to answer Frequently Asked Questions around wind project development, design, construction, operation and end-of-life, as well as provide some insights around wind technology.**

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# 1

## What is a meteorological mast

A meteorological mast (met mast) is a measurement tower equipped with instruments that are used to measure the wind and weather conditions at a project site.

It is crucial that we understand the wind conditions at a site, as it will determine which models of turbines can be used, how many turbines can be safely fit within the available land, where to install the turbines and how much energy they are likely to produce.

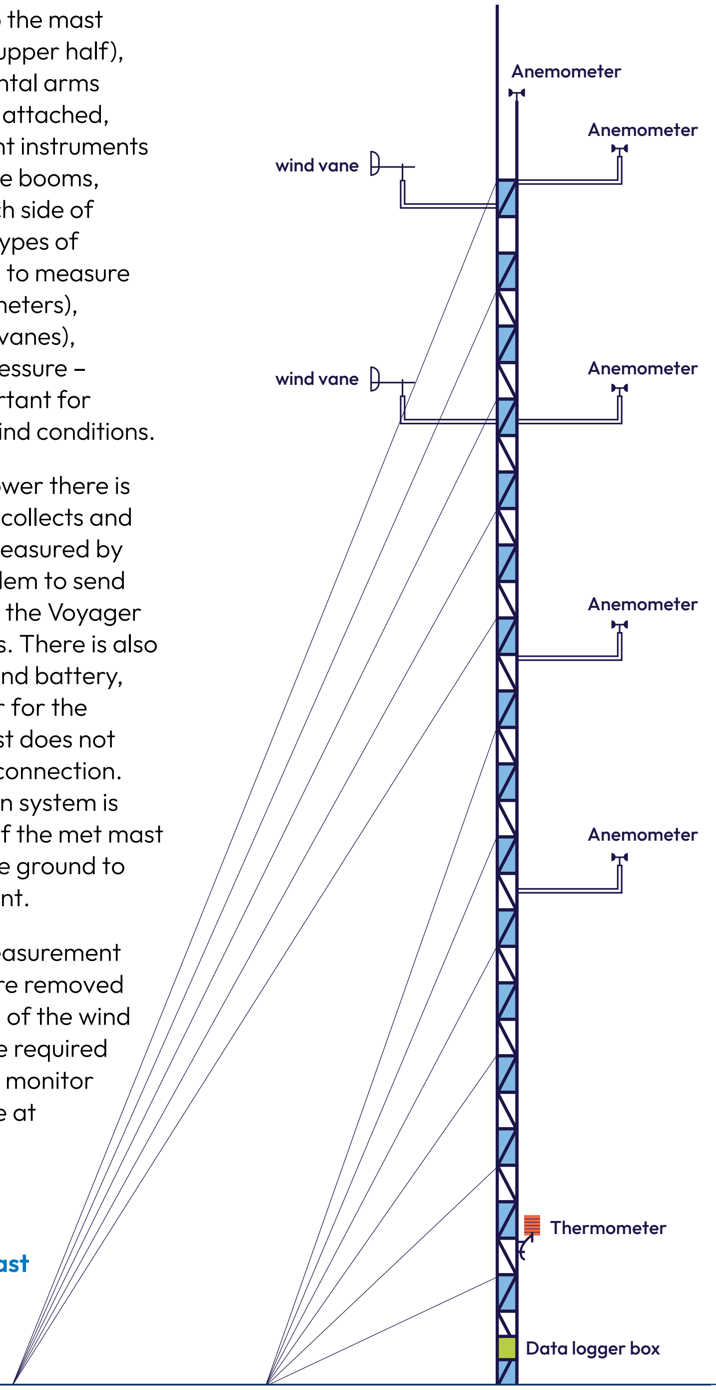
Before installing a met mast, its location is agreed with the landowners, the aviation agencies and other relevant local groups (e.g. airstrip users).

The mast itself is a steel lattice structure, only about 0.5 metres (m) wide, that typically ranges from 100-150m high. They are this height so that we can collect measurements up to the height of the turbine blades. The mast is supported by guyed wires that extend out to the ground in usually three or four directions, making the structure safe for landowners and their livestock. Due to their height, met masts sometimes require a Development Approval (DA), though this depends on the local jurisdiction and the intended mast height.

At several heights up the mast (usually 4 or 5 in the upper half), 3-meter-long horizontal arms (called "booms") are attached, and the measurement instruments are mounted on these booms, extending out on each side of the mast. Different types of instruments are used to measure wind speed (anemometers), wind direction (wind vanes), temperature, and pressure – all of these are important for understanding the wind conditions.

At the base of the tower there is a data logger which collects and stores all the data measured by the mast, and a modem to send the live data back to the Voyager team on a daily basis. There is also a small solar panel and battery, which provide power for the instruments; the mast does not need a main power connection. A lightning protection system is installed at the top of the met mast and connected to the ground to protect the equipment.

At the end of the measurement period, met masts are removed prior to construction of the wind farm. New masts are required during operations to monitor turbine performance at different locations.




**Schematic chart of a meteorological mast and its equipment**

# 2

## What is a LiDAR

Light Detection and Ranging (LiDAR) is a technology that collects the same wind measurement data as a met mast, but using only a small, ground-level device, which is non ground disturbing.

A LiDAR device uses a vertical laser pulse to measure wind movement above the unit. It aims a laser beam upwards into the atmosphere, and detects that beam as it is reflected back by moving particles in the atmosphere. By analysing the reflected beam the LiDAR can accurately determine the wind speed and direction at various heights.

The LiDAR units that Voyager use come mounted on a small trailer. Also on the trailer are a solar panel and battery, to provide power to the unit; the trailer does not need a mains power connection. The laser is invisible to the human eye and harmless to humans and wildlife.

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## How many masts and LiDAR units will be located, and for how long?

The advantage of LiDAR is that they are portable and can be moved around the site – this allows us to gain a better understanding of the wind conditions across the project site. The advantage of met masts is that they are considered the “gold standard” and collect the most accurate data, which we require in order to get the best possible understanding of the project’s wind resource. Therefore, Voyager will typically uses a mix of masts and LiDAR.

Typically we start by locating a LiDAR in a central part of the project site. This first deployment will collect data for 6-12 months, to provide an initial check on the wind speeds. If the measurements look promising, then the next step is to install a met mast next to this initial LiDAR. This is an important step, in which we validate that the mast and LiDAR are recording consistent results with one another. Once that validation is successful (typically takes about 3 months), the LiDAR unit(s) will be moved around the project site, generally staying in each location for approximately 6-9 months.

Overall, we need to collect measurements at the site for at least 2-3 years, and ideally longer.

The wind is always varying, hour by hour and week by week, therefore it’s important to collect data over multiple seasons.  This ensures we have the best possible understanding of the wind conditions, and can design the project to operate successfully.



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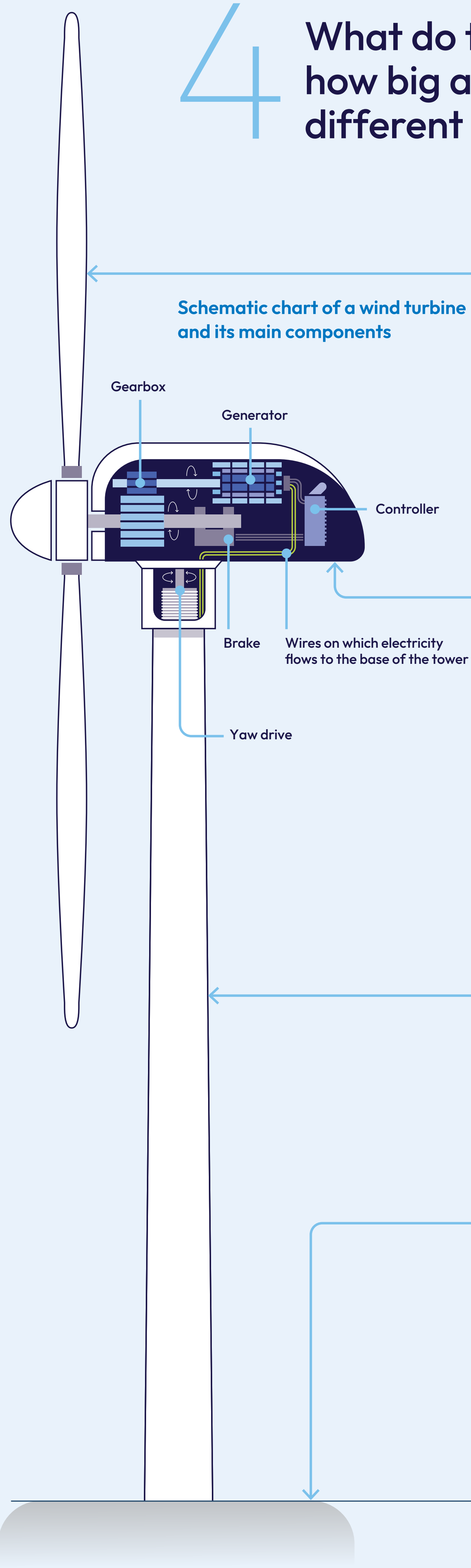
## What do the turbines look like, how big are they and what are the different components of a turbine?

Schematic chart of a wind turbine and its main components




**A wind turbine consists of several key components:**

### ROTOR & BLADES

Modern wind turbines have three long, thin blades that resemble an airplane propeller. The rotor is designed to face directly into the wind, and each blade can be up to 100 m long. The blades capture the energy of the wind and turn it into rotational force. The blades are mounted on the “hub” (nose of the wind turbine) and automatically rotate along their axis (“pitch”) depending on the wind speed to optimise their capture of the wind energy.

### NACELLE

This is the housing at the top of the tower that contains the generator, gearbox, and other mechanical and electrical components. The nacelle is connected to the rotor and blades. The nacelle is mounted on the tower and automatically rotates along the vertical axis (“yaw”) to face the main wind direction. The equipment inside the nacelle takes the power generated by the rotor and converts it into electricity. The average state-of-the-art wind turbine generator has a nominal capacity of 6 to 7 MW.

### TOWER

Made from tubular steel, the tower supports the structure of the turbine and elevates the blades to capture stronger winds at higher altitudes. Towers are typically around 100-150 m tall. During construction, towers are typically coming in 5 to 7 sections depending on height.

### BASE/FOUNDATION

The base of the turbine is usually a large concrete foundation that anchors the structure to the ground. Almost all of the foundation is buried underground, so once construction is complete you can’t see it. The foundation needs to be large – around 20 m in diameter and 3-5 m thick – to support the weight of the turbine.

## 5 Will I be able to hear the turbine from my house? What does it sound like?

Wind turbines generate noise, mainly from the spinning blades but also from the nacelle mechanical and electrical equipment. The noise is loudest right next to a turbine, and fades as you move away from the turbines.

During the development process, detailed noise studies including flow modelling will be undertaken to make sure the audible noise at surrounding dwellings will remain under the legal day and night thresholds and will not disturb any residents.

The noise emergence depends on the wind turbine models, locations, hub heights as well as terrain topography, background noise and wind speed and direction.

There is also a minimum distance between each wind turbine and any impacted dwellings, under which no planning permit will be granted. Therefore, special focus will be given to noise impact assessment during the development phase to ensure that noise predictions are accurate and that nearby residents will not be adversely affected by noise.



## 6 What cables are required? Do they run under ground or over head?

Wind farms include a complex electrical system to safely transfer electricity from the wind turbines into the power grid.

**The key components are:**

### CABLING

The project will include a medium-voltage network of cables that connect the wind turbines to each other, and ultimately connect to the project substation. These cables are typically buried underground, and once construction is complete the land along their path can typically be restored to full agricultural use.

### SUBSTATION

The substation is the central point where the electricity from all the turbines is collected. Here, the voltage is typically stepped up to higher levels for transmission to the grid.

### TRANSMISSION LINE

For projects which are not located next to the electricity grid, a high-voltage transmission line is needed to transfer the electricity from the project substation to the selected grid connection point. Transmission lines are typically overhead, with a range of designs available depending on the size of the project and the local grid voltage.

# 7 How are turbines transported to my property and will upgrades to the existing road network be needed?

Modern wind turbines are very large structures, so transporting them is a complex and carefully coordinated process. Due to their large size and weight, turbines are broken down and transported as individual main components: blades, tower sections, and the nacelle.

Specialised trucks and trailers are used to transport the components. Blades are so long that they need to be carried on special extendable trailers that can accommodate their length. The radius of road curves on the route to site will also need specific attention. Tower sections and nacelles are transported on heavy-duty trailers that can accommodate their weight; the roads' weight-bearing capacity will be investigated to make sure the loads can be safely supported. Overall, around 10 over-size truck loads will likely be needed to transport each turbine to the site.

Detailed route planning is essential to avoid obstacles like low bridges, tight turns, and weight restrictions. This involves coordinating with police and local authorities. It is common that upgrades or modifications to the local roads are required: these upgrade works will be funded by the project developer and will benefit the local community too.

Once the components arrive at the wind farm site, they are reassembled using cranes and other heavy machinery which require specific platforms to be built in terms of size, slope and bearing capacity.

Wind farm transport is closely managed by road authorities and highly coordinated by specialist engineering transport operators. Temporary road closures for component transport are closely managed by police escorts and pilot vehicles engaged by the Project owner.

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## What activities will be conducted during the development phase?

**The pre-construction phase is usually split into two stages: the initial assessment and feasibility study, then development and planning phase.**

STAGE

1

### INITIAL ASSESSMENT AND FEASIBILITY STUDY

**This phase typically lasts for 2 to 3 years, depending on site complexity, transmission network options and community sentiment.**

It is covered by an Access Licence from a land point of view.

During this phase, we will conduct preliminary assessments to determine the feasibility of the wind farm. This includes:

- wind resource analysis,
- environmental impact studies including site surveys for avifauna and flora, as well as heritage mapping,
- grid studies,
- preliminary design, including turbines layout
- early-stage stakeholder engagement.

STAGE

2

### DEVELOPMENT AND PLANNING

**This phase can realistically last from 4 to 7 years, depending on the planning approval process, grid connection timeframes and community sentiment.**

It is covered by an Option to Lease from a land point of view.

If the initial assessment and feasibility study are positive, this second phase involves:

- detailed environment (including noise and visual impact assessments) and heritage studies,
- technical studies such as topography, hydrology and geotechnical,
- detailed design,
- planning: securing permits and approvals,
- grid connection agreement,
- active community engagement and consultation,
- offtake strategy,
- finalising the project financing.

Upon satisfactory completion of the above phases, the lease will be signed to cover the construction period (2-3 years) and the operation and maintenance duration (30-35 years).



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## What are the typical community benefits?

Local community benefit is at the heart of Voyager's project development approach.

Community benefit sharing is about sharing the outcomes of renewable energy development with local communities and relies on creating a positive and long-term connection with the hosting area. It is designed to be community-specific by understanding the community need, flexible, transparent and mutually beneficial; Voyager abides by Best Practice Charter by the Clean Energy Council.

**Some examples of community benefits (including neighbours) are:**

- Sponsorship and grant initiatives
- Legacy initiatives such as housing or community halls
- Local jobs during construction but also during the 30+ year operations and maintenance, Local training (including local education) and local procurement
- Local contracts to support long-term business growth, with electrical and civil work companies for instance
- Working to the improve cost and reliability of electricity for affected communities
- Local electricity supply via power purchase agreement
- Community Fund with its independent governance
- Enhancement of Cultural Heritage jointly with Traditional Owners
- Biodiversity offset

While the world is moving away from fossil fuels, Australia is committed to Net Zero by 2050 and regional Australia will play a critical role in hosting large-scale renewable infrastructure development needed to power Australia's future clean energy demands.

Voyager is always looking to identify innovative ways to bring benefits to communities based on what each community needs and wants. An important part of project co-design is listening to concerns and issues of the local community and finding ways that we, as a project developer, can support local communities.

The energy transition needs to happen with community interests front and centre.

# 10 How are the wind turbine locations decided and do I have a say?

Engagement with landowners is a key success factor in all our projects to understand the existing farming operations and make sure the wind farm development, construction and operation can coexist with the current use of the land.

Deciding the locations for turbines in a wind farm involves several key factors to ensure optimal energy production with minimal environmental and land impacts. Here are some of the main considerations, beyond the existing land activities and internal access routes:

1 **WIND RESOURCE**: This is the most critical factor. We want turbines to be located in the windiest places on the site, as this will maximise the electricity that is produced. To identify which areas of the site are windiest, we will measure the wind resource at multiple locations across the site, as described in this document.

2 **TERRAIN:** The terrain affects wind flow, with the wind typically flowing fastest over hills and at the top of steep slopes. However, the wind farm also needs to be practical and economic to construct. Flat areas are generally easier for construction, whereas complex terrain like steep hills and rocky outcroppings can be very difficult for construction. Therefore we need to carefully assess the terrain, to ensure the turbine locations and connecting roads can all be safely and economically built.

3 **SPACING:** As a turbine spins and generates electricity from the wind, it creates a turbulent wake that disturbs the air downwind from it. Proper spacing allows the wind to recover and smooth out before reaching the next turbine; it is proportional to the blade length. Typical distance in the prevailing wind direction is one kilometre or more considering today's wind turbines size. It could lower down to 500m perpendicular to the main wind direction.

4 **ENVIRONMENTAL, WILDLIFE, AND HERITAGE IMPACTS:** When designing the project, Voyager aims to minimise the impact on local wildlife, ecosystems and heritage sites. We will conduct detailed surveys of bird and bat flight patterns, flora and fauna, historical sites, etc. to ensure we avoid conflicts.

5 **GROUND CONDITIONS, WATERWAYS:** Modern wind turbines are very large and heavy, and require a large concrete foundation that is designed specifically for the site. We will need to assess the ground conditions (e.g. soil type, rock) across the site through geotechnical investigations, which typically involve boring test holes at a sample of locations. We will also study waterways and flooding risk, to site turbines away from water courses.

6 **SET-BACKS:** For safety reasons, turbine locations will always be set back an appropriate distance away from roads, overhead electrical lines, railways, etc.

7 **PROPERTIES:** Turbines will be set back an appropriate distance from properties (both within the project area and on neighbouring land) to ensure that noise and visual impacts experienced at those properties are within acceptable limits.

**Wind farm design is a complex, iterative process. While Voyager aims to maximise the electricity produced by every project, we understand the importance of working with our landowners to ensure the final layout works for everyone involved in the project.**

**Food and fibre production co-exist very well with renewable energy projects; sun and wind can be harvested to make farms more sustainable.**

# 11 What happens at the end of life of the wind turbines?

Wind turbines are designed to operate for up to 30 years. At that time, a review would be undertaken either to re-furbish the existing turbines, re-power the site with new turbines, or to decommission the site.

Under a decommissioning scenario, all wind turbines, overhead cables, hardstands and access tracks are removed, with the land reinstated as far as reasonably practical to its original condition.

Decommissioning of projects is closely managed by state and federal authorities and a detailed Decommissioning and Rehabilitation Plan is required under the project environmental approval. These plans are developed in close consultation with the landowner to ensure that all project infrastructure is appropriately removed and land reinstated to its pre-existing condition, at the cost of the project owner.

Some landowners elect to retain specific infrastructure (usually access tracks) as it supports the property management; this would be specifically discussed as we approached the wind farm end of life.

**We’d love to hear from you.**
Please reach out if you have any questions or need more information.

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**Our goal is to ensure a transparent and mutually beneficial partnership with landowners** over the life of the project from inception to decommissioning.

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