# Wind farm risk assessment overview

## Climate Capital

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# 1. Introduction

Wind farms exhibit a range of risks across the project lifecycle from development through to operation. In the early stage, risks are typically project site-specific and relate to the quality of the resource, site access and local environmental risks which cannot be contracted away from the developer.

However, given the long-term nature of project operating cashflows, risks can typically be contracted away from the project developer, which include:

1. Revenue, which is purchased by an offtaker at a fixed price for a long-term period (typically 10 – 20 years);
2. Turbine performance, which is covered by warranties negotiated with the supplier;
3. Operational and maintenance expenses, which are long-term fixed rate contracts with wind farm operators; and
4. Site access, which is typically governed by long-term leases (30 years + and option to extend for another 30 years) and charged as a royalty on revenue (Typically 1% - 5%).

The table below details a project's typical lifecycle from origination to operations and where key risks can arise.

FIGURE 1 **TYPICAL DEVELOPMENT LIFECYCLE ACTIVITIES**

| Early stage | Late stage | Construction | Operation |
|---|---|---|---|
| • Project rights | • Detailed wind study | • Construction | • Operation and maintenance |
| • Geological study | • Detailed design | • Commissioning and practical completion | • Technical and commercial management |
| • Resource study | • Procurement and reservation contracts | • Updated business case analysis | • Investment evaluation |
| • Preliminary business case analysis | • Updated business case analysis | | • Repowering or decommissioning |
| • Project design | • Financial consent | | |
| • EIA | • Final investment decision | | |
| • Community engagement | | | |
| • Landowner agreements | | | |
| • Building application | | | |
| • Grid connection application | | | |

# 2. Development risks

## 2.1.1 Resource validation

Of fundamental importance is determining whether a viable wind resource exists at the project site. At the earliest stage of origination, this is determined by consulting wind maps and physically appraising the site for evidence of a resource.

At a later stage, physical measurement apparatus will be installed on a site. The data captured from these physical installations will be used to analyse and validate to wind resource which will feed into the expected generation capacity and turbine selection. In Australia, local banks require physical measurement apparatus to support project debt financing. On this basis, it is imperative that the measurement apparatus is accurately calibrated.

The energy yielded from the wind resource is a function of the quality of the resource and the appropriate turbine assessment. Inaccurate resource validation can lead to sub-optimal turbine selection and thus lower generation output later once the project is operational. It is therefore imperative that an accurately calibrated resource assessment is made from the outset of project development.

### 2.1.2 Land access

Securing land access requires long-term land leases or options over the land. Often agreements are a two stage process. The first stage allows access to the land for feasibility studies to determine if the project will go ahead, and the second stage involves an agreement to lease the land for the life of the project if the project is found to be viable.

Failure to secure land in a commercial manner may later hinder development approval processes or project financing if it cannot be demonstrated that the project special purpose vehicle has exclusive right to lease the land over which a project may encumber.

Other factors including the size and usage of contiguous properties need to be considered when assessing whether the project will require a noise buffer.

### 2.1.3 Community and stakeholder engagement

Community engagement on wind farm projects relates to the process through which a developer interacts with the community to inform the decision-making process of a project. The key communication and consultation groups for project developers to consider are:

1. Local planning authorities;
2. Local communities; and
3. State and Commonwealth authorities.

The feasibility of a project in Australia is dependent on a communities' level of acceptance as much as it is on the physical and technical factors of the project. Given the geographic location of much of Australia's best wind resources, wind farms are typically located near small, remote communities who may initially have mixed views about such projects.

A strong focus on community engagement can have a range of benefits and reduce related risks further along the development lifecycle by allowing developers to address issues early and avoid potential challenges that might result from rising project costs, timing delays or dismissals of planned projects.

Importantly, strong and early community engagement can reduce opposition as a result of misunderstandings or lack of information, and thus planning approval risks. It also demonstrates to regulators the developer's commitment to decisions and activities that benefit the broader community.

It is important to consider broader stakeholders beyond the immediate community and their engagement during the early development stage including indigenous Australian landowners, network service providers and energy regulators, emergency services and local infrastructure agencies.

### 2.1.4 Environmental

Environmental risks can be wide ranging from the obvious flora and fauna disruption to geological as well as broader risks such as impact on conservation and recreational areas, cultural heritage, aircraft safety and restricted use areas.

Despite the wide ranging nature of environmental risks a project may be subject to, much of the information required to inform the development and decision making process will be available from the local planning authority from which copies of strategic development plans and/or town planning schemes can be obtained.

Additional information from relevant organisations and amenities (for example; regional airports, major industrial energy users or farms) should be gathered to consider any potential impact a new development may have on existing operations. The typical range of issues to investigated in an environmental impact assessment include:

- Landscape and visual assessment
- Noise assessment
- Shadow flicker
- Flora and fauna
- Socio-economic
- Heritage assessment
- Transport impact assessment
- Electromagnetic interference assessment
- Aircraft safety assessment
- Hydrological assessment
- Emergency and incident management

### 2.1.5 Electrical connection

The local existing electricity transmission and distribution system needs to be considered and, depending on its proximity to a project, can represent a meaningful proportion of development capital expenditure and therefore impact a project's technical and economic feasibility.

To assist with the initial connection enquiry, an indication of the potential generation capacity of the site will be required to be provided to the Network Service Provider ["NSP"]. Connection studies are governed by the National Electricity Rules and require NSP's to respond to connection enquiries in a reasonable timeframe and with adequate information.

The NSP's response will typically include indicative milestones for connection, technical requirements relevant to the development, an information request to complete the study and the likely connection study fees to be paid. The NSP may also be able to provide a range indication of the likely capital cost of connection.

## 3. Construction risks

Construction stage risks range from technical considerations to environmental. Australia also has strict occupational health and safety legislation which adhere to global standards.

It is imperative that correct turbine selection is made based on the measured resource and other resource-specific factors including wind speed and turbulence. Turbine selection must also consider turbine availability and delivery timing to meet construction (and development approval) timelines to avoid cost overruns. Once turbines have been selected, the final micro-siting of the turbines can occur which relates to the final ground siting of turbines to ensure compliance with development approval conditions and to ensure appropriate spacing between wind turbines as well as identifying any irregular local environmental features which may adversely impact energy generation at the site.

The construction phase also includes the construction of associated project infrastructure including access roads, hardstands for turbine construction and turbine foundations as well as control and monitoring infrastructure, electrical infrastructure and site offices and sheds. Of paramount importance is accurate geotechnical assessment of the project site to support the turbine foundations which may adversely impact the operation of the project.

As wind farm developments are considered to be a workplace, compliance with the relevant occupational health and safety legislation is necessary. Developers are required to put in place safety management plans in accordance with the relevant regional legislation however, if development is undertaken by a contractor, it is the contractors responsibility to develop such plans.

## 4. Operational risks

Wind farm operators are required to ensure all wind turbines are adequately maintained over the operating life of the wind farm.

Wind farm developers will typically operate a wind farm for 2 years from practical completion to ensure the selected turbines are meeting or exceeding name plate generation capacity. This is the highest immediate risk once operational as generation underperformance will result in sub-optimal returns. Related risks include the terms of turbine warranty should the turbines not meet name plate capacity as well as operation and maintenance conditions. Poor contract structuring and warranties with turbine suppliers can further result in unexpected costs to rectify these issues.

In addition, ongoing performance monitoring of the impact of the wind farm on the electricity grid connection is required by the NSP and Australian Energy Market Operator.

Noise compliance testing may also be required for the project and turbines depending on the project's proximity to populations. Noise compliance also forms a key warranty component and should be considered during the turbine selection phase.