new zealand wind energy association

www.windenergy.org.nz

Practical constraints associated with developing a wind farm

The merits of any wind farm site, design, and overall feasibility will be driven by the developer's own assessment of various commercial, technical, and environmental considerations. For each of these considerations a number of practical constraints will apply regardless of the location or scale of the project.

Practical constraints associated with developing and operating a wind farm have been summarised by the New Zealand Energy Efficiency and Conservation Authority (EECA) in The National Policy Statement for Renewable Electricity Generation Technical Guide[1]. These practical constraints all relate to *the ability to physically harness the wind energy resource to generate electricity* and then *export the electricity to the local distribution network or the national grid.*

Physically harnessing the wind energy resource to generate electricity

Practical constraints associated with physically harnessing the wind energy resource to generate electricity relate to the suitability of:

1. wind speeds
2. available equipment
3. land and access.

Wind speeds

Wind farms typically require a consistent and good average wind speed. The following characteristics are often key technical considerations for assessing the wind resource at any particular site:

- average hub height wind speed
- turbulence
- extreme wind speeds
- wind shear
- flow conditions.

The wind turbine selected for a particular wind farm will depend on these key considerations plus the availability of turbine technology and various commercial considerations, both of which are highly time dependent.

It is not always practical for a developer to stipulate the exact turbine characteristics prior to seeking consent approval. This is largely because different-sized turbines require different spacing to avoid "wake" effects that can influence the utilization of the available and suitable land area. A thorough commercial evaluation and tender process is required to examine the above issues and identify the final model after all the necessary regulatory consents are obtained. Accordingly, a developer might seek flexibility in the turbine design and location and might identify a number of potentially suitable wind turbine models. In such cases, the "worst case scenarios" of the environmental effects would need to be assessed. Some technical assessments, for example, noise in accordance with NZS6808:2010, require actual turbine models to be stipulated to allow accurate modelling.

National Policy Statement for Renewable Electricity Generation Activities

Policy C1 of the NPSREG requires decision makers to have particular regard to the practical constraints associated with the development of wind farms. Policy C1 lists the following constraints associated with renewable electricity generation activities:

a) *the need to locate the renewable electricity generation activity where the renewable energy resource is available;*

b) *logistical or technical practicalities associated with developing, upgrading, operating or maintaining the renewable electricity generation activity;*

c) *the location of existing structures and infrastructure including, but not limited to, roads, navigation and telecommunication structures and facilities, the distribution network and the national grid in relation to the renewable electricity generation activity, and the need to connect renewable electricity generation activity to the national grid;*

d) *designing measures which allow operational requirements to complement and provide for mitigation opportunities; and*

e) *adaptive management measures.*

1 Refer pages 48-49 in The National Policy Statement for Renewable Electricity Generation Technical Guide, 2013. Available from EECA's website: www.eeca.govt.nz/resource/national-policy-statement-renewable-electricity-generation

Available equipment

Wind turbine technology is advancing at a very high rate. Developers need to ensure that resource consents enable the newer more efficient technologies to be used rather than being tied in to older technology that may have been considered initially.

Most wind turbines are manufactured overseas and developers compete in an international market when purchasing wind turbines. This means the international exchange rate has a significant influence on the cost and availability of wind turbines.

Importing wind farm components from overseas can introduce additional logistical hurdles. For example components for a single wind turbine may be manufactured in numerous factories in different countries. In some cases ancillary equipment may also need to be imported. For example a 600 tonne crane was shipped to New Zealand from Denmark especially to construct the Te Uku wind farm.

Land and access

Access to land is a critical component of accessing the wind resource. Land access constraints can include:

- compatibility of the project with existing land uses and securing legal access to the land and access routes
- understanding the suitability of the ground conditions and civil engineering requirements including the size of the land area and topography to accommodate the turbines, and the construction of low grade roads required to transport wind farm components and heavy construction vehicles (e.g. cranes, concreting trucks)
- accessibility to existing transport infrastructure, such as ports or wharves for receiving shipped components and public roads suitable for transporting heavy overload vehicles, is another consideration
- environmental considerations, including the logistics associated with assessing and managing environmental effects associated with each component of a proposal
- securing legal access to use the land, and a determination from the Civil Aviation Authority, including all necessary resource consents.

The ability to export the electricity to where it may be used

Once harnessed, electricity generated from a wind farm needs to be connected to the national grid or the local distribution network so that it can be transported to end users.

Electricity from a wind farm can be sold:

- on the spot electricity market;
- as part of an electricity retailer's portfolio; or
- directly to a consumer.

Practical constraints associated with transmitting and selling the electricity revolve around:

- the ability of the electricity generator to secure legal and physical access rights for the transmission
- the capacity of the electricity transmission network to accommodate the additional generation
- the ability of the electricity generator to sell electricity over a long term.

These practical constraints are often heavily influenced by the distance between the wind farm and the point of connection to the national grid and/or distribution network in relation to the demand centre. For example, a high transmission cost close to a demand centre may be more acceptable compared to a low transmission cost located away from a demand centre.

Wind farm developers and electricity generators that do not have an existing retail function need to enter into a long term power purchase agreement with an electricity retailer or sell on the spot market.

Securing an off-take/power purchase agreement can be a significant determinant as to whether or not a wind farm project will proceed.

Te Uku

More Information

Find out more about wind energy and wind farms in New Zealand at www.windenergy.org.nz.

NZ Wind Energy Association

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The New Zealand Wind Energy Association (NZWEA) is an industry association that works towards the development of wind as a reliable, sustainable, clean and commercially viable energy source. We aim to fairly represent wind energy to the public, government and the energy sector. Our members include 80 companies involved in New Zealand's wind energy sector, including electricity generators, wind farm developers, lines companies, turbine manufacturers, consulting firms, researchers and law firms.

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