new zealand
wind energy association

www.windenergy.org.nz

Wind Energy and Your Community

Wind farm developers are investigating sites throughout New Zealand. Like any other form of development, wind farm development creates both effects and benefits for the local community and environment.

Before seeking resource consent for a wind farm, developers will consult with the local community and undertake detailed studies into the effects of the proposed development. This factsheet describes what makes a good wind farm site, discusses some of the effects and benefits of wind farms and answers some frequently asked questions.

WHAT MAKES A GOOD WIND FARM SITE?

New Zealand is particularly well suited to generating electricity from the wind, lying as it does across the prevailing westerly winds in an area referred to by sailors as the 'Roaring Forties'. The strength of this wind resource is such that New Zealand wind farms are among the best performing in the world.

Sites with the following characteristics are good for wind farms:

- strong and consistent winds, which are often found on elevated sites such as hills and ridges
- open land without current or future obstacles to the wind flow
- proximity to a suitable transmission line or substation
- suitable terrain, usually relatively gentle without overly steep slopes
- suitable ground conditions for access tracks and turbine foundations
- good access for construction and maintenance

Developers will tend to avoid sites with features that will significantly slow down the wind or increase its turbulence, as this will have a negative impact on energy yield and on wind turbine wear and tear. Undesirable features include steep slopes, dense forests, scattered trees, windbreaks and buildings. Developers may also seek to avoid steep, complex terrain, as this makes the construction of roads, hardstands and foundations more difficult and expensive.

Wind farm developers will also take into account the cultural, heritage, landscape and ecological values associated with a site. They will tend to avoid areas that councils have identified in their plans as having very high conservation or landscape values, such as national parks and iconic landscapes.

Wind farm sites often have important but unprotected conservation values. Developers can enhance the ecology of these sites by protecting and actively managing areas that are regenerating or are home to native plants and birds.

WHAT WILL A WIND FARM CONTRIBUTE TO MY COMMUNITY?

The construction and operation of a wind farm brings with it considerable economic activity, which provides many opportunities for local people, business and the environment.

Locals often become involved with construction and ongoing maintenance work. The construction of Stage 3 of Tararua wind farm in 2006-07 created 100 full-time equivalent jobs in the Manawatu region – many of which were filled by locals. Local companies provided earthworks, trenching, surveying, fencing and site security. Many other companies supplied equipment and services to contractors working on site. And hotels, restaurants, rental car companies and the airport all benefited as people travelled to and from, and worked at, the site. The ongoing operation of Stage 3 injects roughly $4 million per year into the regional economy, through rates, royalties to land owners and t he purchase of supplies and equipment from local companies.

At Te Uku wind farm, in the Waikato, Ngati Mahanga has used the construction of a wind farm to spur a business opportunity at the same

Did you know?

New Zealand's wind farms are amongst the best performing wind farms in the world. A wind turbine in New Zealand will, on average, produce nearly twice the electricity as an equivalent turbine overseas.

time as improving the local environment. Ngati Mahanga set up a native plant nursery which supplied 40,000 plants for planting in regionally significant wetland areas. The planting will help to improve water quality down stream, and the nursery is now in a good position to supply plants for other initiatives in the Waikato.

Wind farms provide farmers with improved farm access and fencing and an additional income stream. These help to improve the productivity and financial viability of their farming activities, creating further opportunities for local rural suppliers.

BALANCING WIND SPEED WITH LANDSCAPE CONCERNS

Wind farms are built on hills and ridgelines as that is usually where the wind is strongest. New Zealand wind farms do not receive any form of subsidy, so wind speeds at a site are a critical factor in determining the commercial viability of a wind farm. As a result of this economic driver, New Zealand wind farms are amongst the best performing in the world.

However, locating wind farms on elevated sites means they often become a very visible feature in the landscape. This 'visual effect' and the appropriateness of a development within a landscape are often the most debated, and emotive, aspects of proposed wind farms.

Some people may view the visual effects of a wind farm as acceptable because the effects are out weighed by benefits such as renewable and emissions-free electricity generation, enabling farming operations to continue, and opportunities for locals. Others may weigh the effects and benefits differently.

The visual effects of a wind farm are assessed on a case-by-case basis through the resource consent process, taking into account factors specific to a site. Although the visual effects of wind farms are often not considered significant or out of place with other rural activities, how people feel about being able to see a wind farm is ultimately a matter of personal preference.

WHAT ARE THE OTHER EFFECTS WIND FARMS?

If you live near a proposed wind farm, the developer will talk to you about how it will affect you and your community. There are some common concerns that many people share, which are discussed here.

NOISE

Modern wind turbines are quiet when they operate. Even so, New Zealand's wind farms must comply with strict noise-related resource consent conditions. These conditions ensure that while wind turbines may be audible at times, the level of sound heard at a nearby house will not be out of place with other sounds in the environment.

In New Zealand, wind farms are designed to comply with New Zealand Standard for wind farm noise (NZS6808). Since the Standard was released in 1998 it has formed the basis for all noise-related resource consent conditions placed on wind farms. A revised edition of the Standard was released in 2010.

NZS6808 specifies that sound from a wind turbine outside a nearby dwelling is to be no more than the greater of 40 decibels (dBA) or 5dBA above background sound levels. 40 decibels is about the same level of sound in a quiet room.

The appropriate distance between a wind farm and nearby houses will be assessed on a case-by-case basis. This is because the sound levels at locations within or around a wind farm vary considerably depending on a number of factors such as the layout of the wind farm, the turbines, the topography or shape of the land, and the speed and direction of the wind. The Standard takes these factors into consideration.

INFRASOUND AND VIBRATION

Infrasound is sound energy in the frequency range below 20 Hertz (Hz). Almost all sound in the environment has components in this region although they are of such a low level that they are not significant and cannot be heard.

Over the past decade it has been repeatedly shown, by research undertaken in the UK, Denmark, Germany, Australia and the USA, and accepted by experienced noise professionals in New Zealand and overseas, that the levels of infrasonic noise and vibration radiated from modern wind turbines are at a very low level; so low that they usually lie below the threshold of perception. It is generally accepted that when infrasound is below the level of perception it does not pose a concern for human health.

A study recently undertaken in Australia compared infrasound measurements from two operating wind farms with measurements in the Adelaide central business district and suburbs, at the beach, on a coastal cliff, inland from the coast and at a gas-fired power station. The results confirmed that the levels of infrasound in the vicinity of the two wind farms are:

- well below the perception threshold
- of the same order as that measured from a range of sources including the beach, the Adelaide Central Business District and a power station.[1]

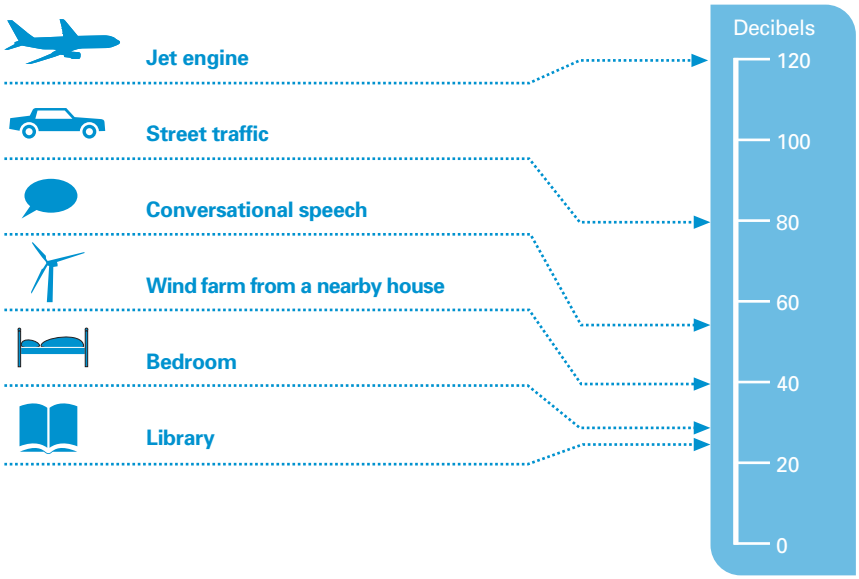
HEALTH EFFECTS

Concern about the health effects of wind farms usually relates to noise and vibration.

In 2009 an international panel of experts released a report based on a review of a large body of scientific literature on sound and health effects, and specifically with regard to sound produced by wind turbines. After extensive review, analysis and discussion, the panel concluded:

- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
- The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.
- The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the

How loud is a wind turbine?



1. Infrasound Measurements from Wind Farms and Other Sources, prepared by Sonus Pty Ltd for Pacific Hydro Pty Ltd. View online at: http://www.pacifichydro.com.au/media/192017/infrasound_report.pdf

sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.

The Panel also reaches the conclusion that: 'The evidence indicates that 'wind turbine syndrome' is based on misinterpretation of physiologic data and that the features of the so-called syndrome are merely a subset of annoyance reactions. The evidence for vibroacoustic disease (tissue inflammation and fibrosis associated with sound exposure) is extremely dubious at levels of sound associated with wind turbines.'[2]

VIEWS

Wind farm developers usually prepare photo simulations to provide local residents with an indication of how a wind farm will look. The best way to gain a clear perspective of how a wind farm will look is to view the simulations in the context of the landscape – for example standing at the location the photo was taken and comparing the view with the simulations.

SHADOW FLICKER

Shadow flicker occurs when rotating turbine blades come between you and the sun, causing a moving (flickering) shadow. The effects of shadow flicker are not noticeable beyond a distance of ten times the diameter of a turbine's blades. Shadow flicker can be predicted and managed as developers can plot when and for how long the sun will appear to be directly behind a turbine from a given location.

FARMING

Wind farming is popular with farmers because it creates additional income and the land can continue to be used for agriculture. Once a wind farm is constructed, its turbines, roads and associated buildings typically use 1 to 3% of the land area in a wind farm. The remaining land can continue to be farmed. Once construction is complete, sheep, cows and horses are not disturbed by wind turbines. In fact they usually enjoy the shelter that turbine towers can provide from the wind and the sun.

CLIMATE CHANGE

Wind farms don't emit greenhouse gases as they generate electricity, whereas coal and gas power stations do. In addition, in New Zealand wind farms work together with hydro generation to reduce our need for coal or gas generated electricity. When the wind is blowing, hydro generation can be reduced and the water saved for use to meet peaks in demand or to cover the natural fluctuations of wind generation. Essentially, every unit of electricity produced by a wind farm is one unit that does not have to be produced by a coal or gas station.

Overseas studies have shown that the lifecycle emissions (including manufacturing of components, construction, operation and decommissioning) from wind farms are about 1% of emissions from thermal generation. In addition, within six months a wind farm will produce more energy than it uses in its entire lifetime.[3]

SOME COMMON QUESTIONS AND THE ANSWERS

WHY ARE WIND TURBINES SO TALL?

Wind speeds increase with height above ground level. In addition, electricity output rises dramatically with blade length. Taller towers are used to elevate the blades into faster and less turbulent wind and also to allow for proportionally larger blades.

However, large turbines are more difficult to construct and require better site access than smaller turbines. A wind farm developer will consider these factors when choosing a turbine for a given site.

WHY DO WIND FARMS OCCUPY SO MUCH LAND?

Wind farms may use quite large areas of land as turbines need to be well spaced out to make optimum use of the wind as well as to reduce their visual and environmental impacts. However, the physical footprint of an operating wind farm – or the land that is physically taken up by the turbine towers, access roads, transformer stations and other related buildings once construction is complete – is typically about 1 to 3% of the wind farms total land area. The remaining 97 to 99% of the land area can continue to be used for existing purposes, which is usually farming.

2. Wind Turbine Sound and Health Effects: An Expert Panel Review. View online at http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf

3. Windstats Newsletter vol 20, no2, 2007.

Wind farming, unlike most other methods of electricity generation, shares the land it requires and is compatible with many other activities including grazing, cropping, port break-waters and sometimes even forestry.

WHAT OTHER ISSUES IMPACT WIND FARM SIZE AND LAYOUT?

Major factors that influence the layout and size of wind farms include local terrain, noise constraints, aesthetic appearance, local electricity network and grid capacity constraints, and avoidance of areas of important native vegetation and sites of cultural and archaeological significance. Impacts on local amenities, such as airports, must also be considered when siting a wind farm.

Developers use sophisticated three-dimensional computer modelling tools to help plot the many complex and often competing issues, such as turbulence and wake effects, involved in positioning turbines within a wind farm. The layout of a wind farm will usually go through much refining before construction begins.

WHY NOT BUILD OFFSHORE WIND FARMS?

Turbines in an offshore wind farm are individually fixed to the seabed (most commonly by means of steel piles). There are not yet any commercially available floating wind turbines. From a practical perspective this means that offshore wind turbines need to be located in water depths of less than 60 metres.

New Zealand's continental shelf tends to be steeply sloping and narrow. As a consequence the water gets very deep, very quickly. As a result the potential sites for offshore wind farms in New Zealand are limited despite the fact that we have one of the longest coastlines relative to our land area of any country in the world.

In addition, the cost of offshore wind farms is two to three times the cost of onshore wind farms. Many of the same issues that arise in the development of land-based wind farms, including visual impact and ecological sensitivity, also occur with offshore sites. This is not to say that we will not have offshore wind farms in the future; it is simply that their development in the short term is unlikely.

DO WIND FARMS GET CARBON CREDITS?

In 2003 and 2004 some wind farms were awarded carbon credits through the Ministry for the Environment's Projects to Reduce Emissions Scheme. Since the final round of this scheme, in 2004, wind farms have not been eligible for carbon credits. Wind farm developers will not receive a free allocation of carbon credits under the Governmentís Emissions Trading Scheme.

THE RMA CONSENT PROCESS

Wind farm developers need resource consents from the relevant district and regional councils to build a wind farm, as wind farming is typically considered a "discretionary activity".

The consent process provides a way for the council, developer and local community to discuss the pros and cons of a proposal, to decide if it should be allowed to proceed and, if so, how its effects are to be managed.

The consent authority can exercise full discretion as to whether or not to grant consent for discretionary activities and as to what conditions to impose on the consent if granted. If consent is needed from more than one council, the councils will usually consider the application together.

After investigating a site, a developer will submit a resource consent application to the local council. This application will describe the project, its positive and negative impacts, and the mitigation measures the developer feels appropriate. Along with the application, the developer will usually submit assessments of environmental, construction, landscape, visual, traffic, noise, cultural and archaeological effects.

The council and the developer will make this information available to the public and seek public submissions on the proposal.

WHY SHOULD YOU MAKE A SUBMISSION?

You should make a submission so that the council has the opportunity to find out how you feel about the project. There is a common misconception that a submission on a resource consent application is a submission against the proposal. While it is important to express any concerns you have about the proposal, it is equally important that the council hears from people who are happy for the proposal to proceed.

Any person, organisation or company can make a submission on a resource consent application. There is no requirement that you be a resident in the area of the proposed development.

COUNCIL HEARING AND DECISION

Once the council has received the submissions and the council officers have prepared a report about the proposal, a resource consent hearing will be held. At the hearing the applicant and submitters can speak in support of their submission. The hearing's commissioners will consider all the submissions it receives, together with the application, and then make a decision about whether or not to grant the resource consent. The commissioners will typically focus on evaluating the actual and potential effects on the environment of allowing the activity outlined in the application.

If the consent is approved, it will often have conditions attached to it such as the number of turbines that can be built or mitigation measures the developer must undertake.

Consent decisions can be appealed to the Environment Court. The applicant or any person who made a submission on the application can appeal the decision. The appeal must be lodged within 15 working days of receiving the decision. Environment Court decisions can be appealed to the High Court only on a point of law.

CALL IN

Some applications for a wind farm will be 'called in' to be heard by a Board of Inquiry or the Environment Court. While these proposals will not be heard through the local authorities' normal consent process, you can still have your say by making a submission.

The procedures used by a Board of Inquiry and the Environment Court are similar; a hearing is held, submitters have an opportunity to be heard and cross examination may be permitted. The decision reached by a Board of Inquiry or the Court can be appealed only on a point of law to the High Court.

Want to know more about the RMA?

You can find out more about the RMA at:

- **www.rmaguide.org.nz**
- **www.mfe.govt.nz**

www.windenergy.org.nz

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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