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Phases of Wind Energy Project Development

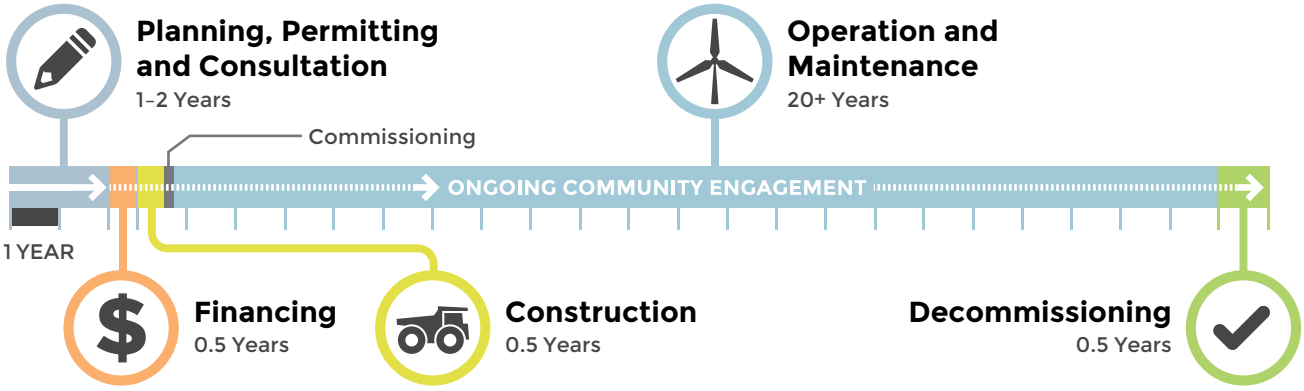
SOURCE: CRAIG NORRIS **Above Photo: Amherst, Nova Scotia**

How long between project planning and generating electricity?

It usually takes three to four years from initial project planning until the wind energy project is "commissioned", that is, generates electricity for its owner and/or the grid. The timeline depends on factors ranging from the size of the project to financing and availability of wind turbines. Once the project is commissioned, it can be expected to operate for 20 years or more.

Smaller wind turbines, 50 kW for example, are generally quicker to plan and install; costs and logistics are simpler, and consultation with communities and stakeholders need not be as extensive.

Community engagement should be part of initial wind energy project planning and be maintained through commission, operation, maintenance and eventual decommissioning of the facility. Early and sustained involvement with the local community is essential to creating a successful project.




SOURCE: NATURAL FORCES

Digby, Nova Scotia


SOURCE: CRAIG NORRIS

Amherst, Nova Scotia

What is involved in planning and permitting?

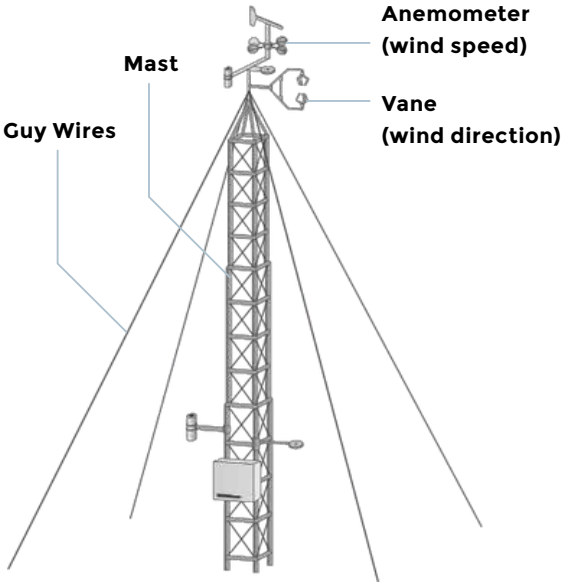
For any proposed wind energy project, large or small, the first step is a preliminary review to identify any known "deal breakers", conditions that could prevent success of the project, whether ecological, financial or social. The goal is to limit risk, because the planning and permitting for a wind energy project are expensive, especially for larger projects.

Risk Assessment

Once obvious deal breakers are eliminated, the feasibility of the proposed project is reviewed in greater detail. This includes negotiating land control, completing a wind resource assessment, analyzing site constraints, beginning the process of grid connection with the utility, and undertaking preliminary engineering design for turbine pads and access roads. The process entails an estimate of costs and revenue over the project's lifetime; it must be demonstrated that the project is economically viable in order to secure financing.

Wind Resource Assessment

Wind resource assessment is a crucial component of project planning. The measured wind speeds on a site may be much more or less than the Nova Scotia Wind Atlas's computer models indicate. Meteorological towers must be installed to gather a year or more of wind speed data; this information also informs site planning, as wind speeds can vary across the site.



Environmental Assessment

Environmental permitting is often completed concurrently with a wind resource assessment. A Class I Environmental Assessment (EA) is required in Nova Scotia for any wind energy project 2 MW or greater. This is a public process and includes 30 days of public review within a 50-day regulatory review period. Guides are available to explain the EA process.[1] After consideration of public comments and other factors, the Minister of Environment will approve the project with conditions, require more review, or reject the project.

EA reports are publicly available[2] and extremely detailed, involving numerous studies and analyses. Some of the components analyzed for wind energy projects appear in the table below. Studies of these components are factored into site planning to minimize environmental and social effects. Site planning includes placement of turbines, along with related infrastructure like site roads and electrical lines.

Table 4A: Valued Ecological Components and Socio-Economic Issues

PHYSICAL	BIOPHYSICAL	SOCIO-ECONOMIC
Ambient Air	Wetlands and Watercourses	Land Use
Ground and Surface Water	Fish and Fish Habitat	Resources: Aboriginal and Archaeological
Ambient Noise	Migratory and Breeding Birds	Vehicular Traffic
Ambient Light	Flora	Telecommunications
	Fauna	Health and Safety
	Rare and Endangered Species	Local Economy

Depending on the site and the project, other permits may be required; these applications are made after a successful EA process. Some examples are: a Special Move Permit from the Department of Transportation and Infrastructure Renewal to transport a large turbine to the site, or a Watercourse Alteration Approval from the Department of Environment if an access road needs to cross a stream. Municipal permits, if needed, involve a process separate from the EA.

EA approvals almost always include conditions to be met by the project; for example, follow-up monitoring for effects on birds and bats, and possible monitoring of sound from the turbine.

1 *http://www.novascotia.ca/nse/ea/docs/EA.Guide-Proponents.pdf*

2 *http://novascotia.ca/nse/ea/projects.asp*

Get to Know Wind Energy

Consultation with stakeholders like municipal government, regulators, local businesses, residents, and the Mi'kmaq of Nova Scotia is an important part of planning.

Early, meaningful and ongoing engagement of the community and the Mi'kmaq is crucial in the success of wind energy projects, even if the project is smaller than 2 MW and an EA is not required.

Boularderie, Cape Breton

Boularderie, Cape Breton

Get to Know Wind Energy

Here are some statistics related to construction of large-scale wind turbines:

As many as 40 to 45 concrete trucks may be needed for one large-scale turbine foundation. Ten to fifteen additional trucks may be needed to transport turbine components.

Turbine towers are usually transported in three pieces on special trailers; each piece may be 25 or 30 m in length. To accommodate the trailers, roads must be five or six metres wide, perhaps up to twelve metres.

Ideally, turbines are placed to best capture wind energy; usually a minimum distance of six to ten times the rotor blade length separates turbines. Placement must also consider site specifics like topography, wetlands, distances from homes, etc.

How long will construction take and what should I expect?

Significant investment, sometimes millions of dollars, is needed for the construction phase of wind energy projects. The work is complex; it includes everything from procuring the turbines to preparing the access roads to connecting the turbines to the grid before the project can be commissioned.

Generally, construction of a larger scale wind energy project takes six months, beginning with surveying and clearing the site (which may be done in winter to minimize ecological damage, like disturbance of nesting birds). Building the footprint includes access roads and pads for the turbine and crane, which need a firm base when the turbines are assembled. Electrical works must be constructed within the site and to connect to the grid. Finally, the site is stabilized to prevent erosion.

Table 4B: Typical Timing of Large Wind Energy Project Construction

	Typical Schedule In Months					
	1	2	3	4	5	6
Surveying and Siting Activities	■					
Access Road and Crane Pad		■	■			
Crane Pad & Turbine Foundation			■	■		
Electrical Works				■	■	
Wind Turbine Assembly and Installation				■	■	
Removal of Temporary Works and Site Restoration						■

Residents will experience truck traffic for short intervals over a few months. Good project planning can accommodate a community's specific needs, for example, school hours. As with any construction project, noise and dust may be generated; mitigations should be in place to minimize disruption to residents and the local environment.

SOURCE: NATURAL FORCES

Glen Dhu, Nova Scotia

SOURCE: BRIAN LAMB, CC BY 2.0

Seaport Market (Roof), Halifax

What can I expect from an operating wind turbine?

Wind energy projects, large and small, are generally planned to function for 20 years. With proper maintenance and repairs, they often operate much longer.

Turbine Control Mechanisms

Wind turbines have various control mechanisms. Nacelles rotate to make sure the blades are facing the prevailing wind – this is called "yawing". A blade pitch mechanism adjusts the angle of the blades. Sometimes the turbine blades don't move, even with a light wind blowing; this is because turbines have a "cut-in speed" and it is inefficient for them to operate below this wind speed.

Rotor brakes and sensors allow turbines to shut down in response to ice buildup on the blades or very high gale winds. At ideal wind speeds, from about 12 to 25 m/s, a turbine can operate at its nameplate capacity; at average annual wind speeds, a turbine operates at about one third of this capacity. A Supervisory Control and Data Acquisition (SCADA) system is usually installed within the turbine to enable remote monitoring and control.

Maintenance, Monitoring and Repairs

Routine procedures like performance monitoring, maintenance and follow-up environmental surveys occur during a turbine's operational lifetime. Over a 20-year period, turbine components may break down and need repair or replacement. In the first years of operation, work is often completed by the turbine manufacturer's technicians, who can train local staff to take over operation and maintenance tasks. Small amounts of oil and lubricants are used for maintenance.

Environmental surveys often check the area around the turbines for bird and bat carcasses. Regular maintenance reduces complaints associated with mechanical sound from a turbine in need of service. Nearby residents should be given contact information for the wind energy project operator, in case there are questions or complaints.

Get to Know Wind Energy

What about small wind turbines? The phases in a wind energy project (as shown on page 1 of this Fact Sheet) are the same for small wind turbines, but the complexities, costs and benefits are scaled down.

For a very small wind turbine located on an existing building, one year may be sufficient to obtain financing, complete Nova Scotia Power's interconnection agreement, procure engineering, and purchase/install the turbine.

Most small wind turbine projects, between 10 to 50 kW of capacity, do need direct wind measurements to predict output and secure financing. Up to a year of meteorological data may be necessary to ensure that the site has good wind. Because small wind turbines are closer to the ground, the effect of obstructions, like buildings, on the wind regime has to be considered.

The four 2 kW turbines on the roof of the Halifax Seaport Farmers' Market are an example of a very small wind energy project that provides electricity directly to its owner.

Light and Sound

From a distance, larger turbines are seen, rather than heard. In any community, opinions on the aesthetics of wind turbines vary. Project planning for larger wind energy projects often includes a visualization to give residents an idea of how the completed project will look. The nacelle will be lit – usually with a red light – in accordance with Transport Canada requirements.

Functioning wind turbines do produce sound. The amount depends on factors like turbine type, local topography and environmental conditions, wind speed, and humidity. As part of an environmental assessment (EA) or to comply with a municipal by-law, predictive modeling can demonstrate minimal effects on local communities in keeping with environmental and health guidelines. Project planning considers size of project, separation distance from dwellings, and turbine siting to minimize the effects of sound.

"Shadow flicker", which occurs when rotating blades are positioned directly between the sun and the viewer, is another potential effect that will be minimized during project planning. Site planning and signage will be used to minimize risks of "ice throw", a rare buildup of ice on turbines that may be shed near the tower during operation.

What happens 20 years after construction?

At the end of a turbine's operating life, it can be refurbished for further use. If this is impractical, the turbine is disassembled and removed. The site could be re-powered with new wind turbine technology; if not, it would be decommissioned and the land reclaimed. Land reclamation is usually negotiated as part of land agreements. Because of their economic value, turbines are not abandoned. A well-maintained turbine often operates beyond 20 years, but when it reaches the end of its operating life, valuable parts and materials can be recovered.