

EcoLogo^{CM} Program Criteria Review Certification Discussion Document

CCD-003: Electricity-Renewable Low-Impact
(I) WIND-POWERED ELECTRICITY



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1 Instructions

EcoLogo^{CM} is inviting stakeholders to participate in the review of CCD-003: Electricity-Renewable Low-Impact. This standard is being revised to assure that the current requirements continue to define environmental leadership for renewable low-impact electricity.

Currently, both the scope and the criteria statements found in CCD-003 determine what the EcoLogo^{CM} Program considers to be environmental leadership amongst all types of electricity production in North America. During this review, the EcoLogo^{CM} Program will re-examine both the scope and the criteria statements. As such, leadership will continue to be defined by first determining what types of electricity can be considered as “renewable low-impact” (i.e. scope), and second what requirements should be established to assure that facilities which produce these types of electricity are following best environmental practices according to the market (i.e. criteria statements).

Stakeholder contributions play a pivotal role in the EcoLogo^{CM} standards development process.

To begin your participation and register for the review process:

- Send a request to forums@ecologo.org and specify your name (first and last name), indicating your affiliation, and your wish to participate in the CCD-003: Electricity-Renewable Low-Impact.

While the EcoLogo^{CM} Standard Development Forum is the main tool for compiling comments, the EcoLogo^{CM} program will also accept comments by e-mail and fax. These comments may also be posted to the online forum and will be viewable by all registered forum participants involved in the discussion.

This stakeholder consultation period will be open for 52 days beginning Nov 18, 2008. Comments must be received by January 9, 2009.

Your time and input in helping us to establish the most stringent environmental standards are very much appreciated. We will send you a reminder as our closing date for comments approaches.

Sincerely,

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2 Introduction

Wind-powered electricity is currently considered in the EcoLogo^{CM} certification criteria document (CCD) for Electricity – Renewable Low-Impact and 49 wind-powered generating facilities amounting to a total capacity of 815 MW have already been third-party certified by the EcoLogo^{CM} Program.

Wind-powered electricity products can sometimes offer considerable environmental benefits and meet strict requirements for *inter alia* species and soil conservation.

The purpose of this Certification Discussion Document is to provide you with broad market information for wind-powered electricity in Canada and the U.S., and to open up a discussion with you about which criteria the EcoLogo^{CM} Program should review to ensure that our wind-powered electricity generating facilities still represent environmental leadership as “renewable low-impact electricity” generating facilities.

The EcoLogo^{CM} Program is designed to support a continuing effort to improve and/or maintain environmental quality by reducing energy and materials consumption and by minimizing significant life cycle environmental impacts. Life cycle review is an ongoing process and as such, EcoLogo^{CM} CCDs are regularly updated. Products are also re-audited regularly to ensure certified products continue to offer significant environmental benefits.

3 Description

CCD-003 currently defines “wind-powered electricity” as electricity generated from a wind turbine that converts the kinetic energy of the wind into electricity.

According to Pollution Probe (2003), there are two primary designs for wind turbines:

- *Horizontal turbines : This is the most common type of windmill in Canada. It is mostly composed of 2 to 3 rotor blades, a nacelle or casing (containing a gearbox, brake and generator), a tower and a foundation.*
- *Vertical axis turbines: This less common turbine is composed of rotor blades that are attached at the top and close to the bottom of the tower and bulge out in the middle. The bottom of the structure houses a gearbox and generator in a protective structure. It also contains a tower and a foundation.*

According to Nalukowe, Liu, Damien, & Lukawski (2006), the model of a wind turbine can be composed of steel, iron, copper, plastics and glass fibers, concrete, epoxy and aluminum.

4 Market Overview

4.1 Canadian Market

In 2007, the Canadian installed capacity of wind power was at 1,846 MW with the addition of 386 MW of new energy projects that year. It now produces enough energy to power more than 560,000 homes (Canadian Wind Energy Association, 2007).

4.2 American Market

In the U.S., in 2006, the installed capacity of wind power was of 11,329 MW. Also, that year, the net electricity wind generation was of 26,589,137 thousands of KWh representing 7.5% of the U.S renewable energy sector (Energy Information Administration, 2008).

5 Other Eco-label Standards

The Green-E National Standard Version 1.5 (2008) includes wind power as an eligible source of green-power. However, Green-E does not specify specific criteria for its wind power sources.

6 Life Cycle Research Findings

6.1 Life Cycle Definition

The potential life cycle impacts for wind generating facilities most discussed in the literature according to our preliminary research include those that may occur during the resource extraction, manufacturing and transportation life cycle stages. At this point, the EcoLogo^{CM} Program recognizes that more research is needed and is seeking input from the public to help define the scope and boundaries of the life cycle analysis. In other words, we need to determine what environmental impact categories and related stressor need to be further investigated.

6.2 Summary of Major Environmental Impact Categories and Related Stressors

Below you will find some of the major environmental stressors associated to wind-powered electricity as well as specific wind stressors associated with offshore and land-based powered generating facilities.

Stage of the life cycle	Environmental Stressors (numbers in the table refer to specific sections in the document) according to various Life Cycle Stages and Impact Categories					
	Energy	Resources	Emissions to			Other
	Renewable/ Nonrenewable	Renewable/ Nonrenewable	Water	Air	Soil	
Resource Extraction	6.3.1.1, 6.3.2.6	6.3.2.2, 6.3.2.6, 6.3.3.1		6.3.2.1, 6.3.2.2, 6.3.2.3		6.3.2.2, 6.3.2.4
Production	6.3.1.1			6.3.2.1, 6.3.2.3		
Distribution	6.3.1.1			6.3.2.1		
Use	6.3.1.1		6.3.3.2, 6.3.3.3	6.3.2.1	6.3.2.8	6.3.1.2, 6.3.2.5, 6.3.2.8, 6.3.3.2, 6.3.3.3
Disposal	6.3.1.1	6.3.3.1		6.3.2.1, 6.3.2.3		

6.3 Discussion Points on Major Environmental Impact Categories and Related Stressors

This section draws attention to the major environmental impact categories and stressors the EcoLogo^{CM} Program intends to address in its revision of CCD-003. Each section below contains questions pertaining to the environmental impact categories and stressors under investigation.

6.3.1 Current Broad Environmental Impact Categories and Related Stressors under Review for Wind-Powered Electricity

6.3.1.1 Efficiency

According to Nalukowe, Liu, Damien, & Lukawski, 2006, the energy generated is 20,24 times bigger than the energy consumed over the life time of the wind power generating facility. However, according to Boyle (2004), "over its working lifetime, a wind turbine is able to generate some 80 times the energy required to produce it".

6.3.1.2 Visual Pollution

According to Schleisner (2000), visual pollution can be a public concern for wind power. It is a much larger concern for land-based wind power.

6.3.2 New Broad Environmental Impact Categories and Related Stressors for Wind-Powered Electricity

6.3.2.1 NO_x, SO_x, CO and Particulate Matter Emissions

According to Nalukowe, Liu, Damien, & Lukawski (2006), NO_x and SO_x emissions are one of the four most significant impacts for wind power when the whole life cycle of the product is considered. However, these life cycle emissions as well as CO and PM emissions are very small compared to the life cycle emissions of other energy sources in general (TerraChoice Environmental Services Inc., 1999).

- 1.Q) Do you think that the EcoLogo^{CM} Program should identify emissions thresholds for NO_x, SO_x, CO and PM emissions for wind power generating facilities even though they are already the environmental leaders for these emissions when they are compared to other energy sources? If so, why? If not, why not?

6.3.2.2 Impacts due to Energy Use

According to Nalukowe, Liu, Damien, & Lukawski (2006), the environmental impacts related to fossil fuel usage such as those due to resource mining, the release of greenhouse gases and respiratory inorganics emissions, and the production of carcinogens, is one of the four most significant impact categories for wind power production when the whole life cycle of the product is considered. According to their Life Cycle Assessment, wind mills produced from oil had the biggest negative impact on the environment. Coal-based wind power led to slightly smaller impacts. Wind from wind and wind from hydro had very minor environmental impacts compared to wind from the two conventional sources of power above. Also, according to Schleisner (2000), "Nearly all of the damages from an offshore wind farm are related to the production of the materials for the wind farm". This is echoed by Nalukowe, Liu, Damien, & Lukawski (2006), who have shown that the manufacturing stage (from the extraction to the erection of the turbine including the production processes and all the transportation needs) of the life cycle of a model wind turbine is the stage that yields the greatest environmental impacts. Most of these impacts are due to the type of electricity used for the production of the wind turbine as well as the energy used during transportation during that stage.

- 2.Q) Do you think that certain wind power plants in Canada and the U.S. have demonstrated environmental leadership due to the source of energy used during their manufacturing stage? If so, should the EcoLogo^{CM} Program establish criteria that regulate energy sources used in the manufacturing stage? If so, how and why, and if not, why not?

6.3.2.3 Greenhouse Gas Emissions

According to Nalukowe, Liu, Damien, & Lukawski (2006), greenhouse gases emissions may be considerable from the wind power electricity sector when the whole life cycle of the product is considered. However, according to Ministry of Natural Resources of Ontario (2008), "from 'start to finish' wind power facilities produce very little greenhouse gas emissions for every kilowatt hour of electricity that is produced. Most of the greenhouse gas emissions are produced during the manufacture, construction and disposal stages of the equipment and materials. There are almost no emissions during the actual process of making the electricity. In fact, wind power ranks number 1 as the cleanest source of electricity. "The fact that greenhouse gas emissions are comparatively low for wind power technologies is echoed by Dey & Lenzen (2006). They demonstrated that three studies have shown greenhouse gases to range between 34 kg of CO₂/kWh and 125 kg of CO₂ eq/kWh for wind power technologies compared to conventional sources which range from a minimum of 418

CO_{2eq}/kWh_{el} for fuel cell cogeneration to a maximum of 1033 CO_{2eq}/kWh for coal. Emissions of greenhouse gases vary if offshore instead of land-based wind farms are used to produce electricity. In fact, according to Schleisner (2000), offshore wind farms emit higher CO₂ emissions due to materials used for their foundation and sea cables.

- 3.Q)** Do you think that the EcoLogo^{CM} Program should identify emissions threshold levels for greenhouse gas emissions (CO₂ eq) for wind power generating facilities even though they are already the environmental leaders for these emissions when they are compared to other energy sources? If so, why and how? If not, why not?

6.3.2.4 Carcinogens (Arsenic, Benzene, Cadmium, Other Unspecified Metals)

According to Nalukowe, Liu, Damien, & Lukawski (2006), this category falls under the four most significant category of impacts for wind power when the whole life cycle of the product is considered. They state that "electricity from coal contributes most to the carcinogenic effect, followed by steel production and copper production. The reduction of carcinogens in recycling steel and iron is larger than the production of reinforcing steel."

- 4.Q)** Should the EcoLogo^{CM} Program establish criteria to ensure that wind power generating technologies achieve lower emissions of carcinogens? If so, why and how? If not, why not?

6.3.2.5 Impacts on Bats

According to Science Daily (2008), bat fatalities from wind are larger than for birds. Bats can be crucial for the control of insects, especially crop pests. According to Arnett et al. (2007), bat fatalities consistently peak in late summer and fall. Also, the number of bat fatalities does not differ whether turbines are equipped with lighting equipment or not.

- 5.Q)** Do you know of technologies or methods currently being used to prevent bat fatalities due to wind turbines? If so, what are they and how effective are they?

- 6.Q)** Should the EcoLogo^{CM} Program address bats fatalities in CCD-003?

6.3.2.6 Recyclability of Materials

Nalukowe, Liu, Damien, & Lukawski (2006) recommend that materials be recycled at the end of the life of a wind turbine to greatly reduce the negative environmental impacts associated to wind power generation. For instance, they state that "the recycling of steel and iron from the wind turbine has positive impact on climate change, since it substitutes production of 334 tons of iron with a reduction in energy consumption. "They also show that 90% of the copper in wind turbines could be recycled." Their wind turbine model, however, is composed of glass fiber and plastics that are incinerated and concrete that is fully land-filled. Schleisner (2000) also shows that aluminum in wind turbines can be recycled while PVC and rubber are burned at waste power plants. He also states that "if the materials from the turbine should be used for construction of a new turbine, 80% of the materials could be reused" and that "94% of the materials used for construction of a wind turbine may be recycled."

- 7.Q)** Should the EcoLogo^{CM} Program specify in its criteria that wind turbines should be made of a certain percentage of recycled steel, iron, and copper to ensure environmental leadership? If so, what should this percentage be and why? If not, why not?

- 8.Q) Are there other materials used in the manufacture of wind turbines that could reasonably substitute PVC, fiberglass, concrete and rubber that would reduce the environmental impacts of wind power further?

6.3.2.7 Water Use

According to the U.S. Department of Energy (2008), "wind energy does not require the level of water resources consumed by many other kinds of power generation."

6.3.2.8 Land Use

According to Ontario Power Authority & SENES Consultants Limited. (2005), wind power uses a significant amount of land compared to other sources of energy during the operation phase: between 0.10 and 0.21 km²/MW.

- 9.Q) Do you think that the EcoLogo^{CM} Program should specify a threshold level for land use for wind power? If so, how and why? If not, why not?

6.3.3 New Specific Environmental Impact Categories and Related Stressors for Offshore Wind-Powered Electricity

6.3.3.1 Impacts related to Sea Cables

According to Schleisner (2000), an offshore wind farm with a 5 MW capacity uses sea cables that are made of significant amounts of copper, lead, steel and smaller amounts of PEX. These create indirect impacts during their resource extraction, manufacturing and disposal stages.

- 10.Q) How large and significant do you think the impacts of sea cables are for offshore wind power and do you think that the EcoLogo^{CM} Program should address these impacts within CCD-003? If so, how and why? If not, why not?

6.3.3.2 Impacts on Fish and Shellfish

According to the Centre for Environment, Fisheries and Aquaculture Science (2004), the construction, development and use of an offshore wind farm can potentially affect fish and shellfish resources, including spawning, overwintering, nursery and feeding grounds, and migratory pathways.

- 11.Q) How could the CCD-003 address the protection of fish and shellfish from offshore wind farms?

6.3.3.3 Impacts on Marine Mammals

According to the Centre for Environment, Fisheries and Aquaculture Science (2004), certain potential disturbances that might negatively affect marine mammals include:

- Noise

- *Vibration*
- *Physical intrusion*
- *Visual intrusion*
- *Interruption of known used routes*
- *Disturbance due to maintenance access during operation*
- *Potential barrier effect*

12.Q) How could the EcoLogo^{CM} address the protection of marine mammals from offshore wind farms?

6.3.4 Specific Environmental Impact Categories and Related Stressors for Land-Based Wind-Powered Electricity

6.3.4.1 Noise

According to Schleisner (2000), the noise generated by wind-powered electricity generating facilities can be problematic. This is a much larger problem for land-based wind farms. However, according to Boyle (2004), the noise level of wind turbines at 350m is of 55dB(A). To put this in perspective, the noise level of a car going 64 km/h is of 55 dB(A) and the one for a quiet bedroom is of 20 dB(A).

13.Q) Should the EcoLogo^{CM} Program establish a noise threshold level for wind-powered farms? If so, how and why? If not, why not?

6.4 General Considerations

14.Q) Do you think that all of the potential significant environmental impact categories and related stressors for wind-powered electricity have been properly addressed in this Certification Discussion Document? If not, which impact and/or stressor do you think is missing and why?

15.Q) The literature shows that some environmental impacts can vary between onshore and offshore wind technologies. Do you think that the differences are significant enough to warrant the development of separate criteria for these? If so, why and how? If not, why not?

7 Performance Testing

16.Q) Do you know of performance tests the EcoLogo^{CM} Program should be aware of for wind-powered generating facilities?

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