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Adelaide Wind Farm timeline

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The life-cycle of a wind farm

Nov 2006 – April 2011

The Development Phase:

- Site selection and land acquisition
- Wind measurement
- Environmental & technical studies
- Financial appraisal
- Permitting & approvals
- Supply agreements with the Ontario Power Authority
- Interconnection agreements with independent electricity system operator
- Securing debt and equity finance - over $200 Million for the Adelaide project
- Sourcing and purchasing wind turbines
- Procuring construction services and materials supply contracts

April 2011 – Dec 2011

The Construction Phase:

- Construction or upgrading of access roads
- Preparation of temporary facilities and work areas
- Erection of turbines and ancillary equipment
- Construction of transformer substation and planned interconnection line

Dec 2011 – 2041

The Operations Phase:

- Expected to last approximately 20-30 years
- Scheduled visits for maintenance
- Scheduled monthly service for each turbine
- Routine annual maintenance
- Unscheduled visits for emergencies (wind turbines have a reliability of 97%)

2041 – 2041

The Decommissioning Phase includes:

- The removal of turbines
- Dismantling of cabling systems systems (underground/overhead lines and poles)
- Removal of substation and associated equipment
- Access roads removed and covered (depending on the needs of the landowner)
- Foundations dug back to 1 m below existing ground level
- Ground returned to its previous condition

Where possible, all materials will be recycled where existing technologies are readily available

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Adelaide Wind Farm
how it works

Wind turbines operate on the simple principle of converting the wind's kinetic energy into electricity

As the wind moves across the three large, propeller-like blades it causes lift - the same effect employed by aircraft wings. As the blades rotate they turn the main drive-shaft, which via a gearbox spins a generator to create electricity.

The turbines are generally mounted on tall towers to take advantage of faster and less turbulent wind and to capture the most energy.

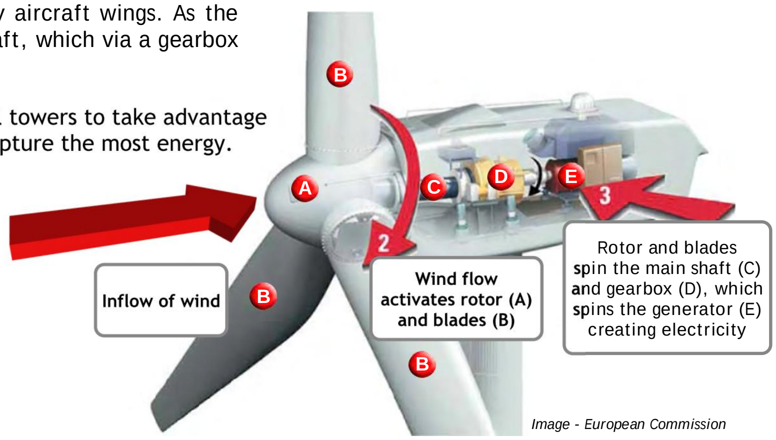

Image - European Commission

FACT PANEL

The Adelaide Turbines

Rotor Diameter:	90 m
Hub Height:	95 m
Overall height:	140 m
Rotation speed:	9 - 14 rpm
Min wind speed:	3 m/s or 6.7 mph
Max wind speed:	25 m/s or 56 mph

Rotor and Blades	Converting the wind's energy into rotational shaft energy
Nacelle (housing turbine and gearbox)	Housing the drive train, gearbox and generator
Tower	The tower raises the blades into the optimum wind conditions
Foundation and transformer housing	Electronic equipment, controls, cables ground support and interconnection equipment. These can also be contained within the tower itself.

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Adelaide Wind Farm
an overview

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The benefits of wind power

Wind power is a clean, sustainable and future-proof source for electricity. Once constructed, a project has almost a zero fuel requirement. As the technology and design improves, wind power is becoming more and more cost-efficient when compared to traditional fossil-fuel generation and as wind power development expands it will also help stimulate the Canadian manufacturing and service industries at local and national levels.

Clean and Efficient Technology

- Wind energy is clean and green and reduces dependence on other forms of electricity generation that may contribute to greenhouse gas emissions and reduced air quality
- Modern wind power generating equipment is efficient and highly reliable
- Wind energy is a valuable form of electricity generation for rural areas and can easily coincide with agricultural land uses
- Wind turbines do not need water as a cooling source, unlike most other types of electricity generation
- Wind farms are low impact projects

Energy Price Stability

- Renewable energy helps stabilize the cost of power
- Virtually zero fuel costs associated with wind energy
- The costs of fossil fuels vary widely because of political and market turmoil
- Wind power can be produced domestically and contribute to the economy at many levels

Supply

- The wind will always be there - the perfect renewable energy resource
- Wind power contributes to a diverse energy generation for Ontario

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Adelaide Wind Farm regulations

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Regulatory requirements

The project is subject to screening under Ontario's Environmental Assessment Act. TCI Renewables is required to prepare an Environmental Screening Report - known as an ESR. This must be consistent with the Ontario Ministry of Environment's *Guide to Environmental Assessment Requirements for Electricity Projects (2001).*

In addition to this, we are preparing an Environmental Impact Statement (EIS), which conforms with the Canadian Environmental Assessment Act.

The ESR and EIS reports are combined to meet the regulatory requirements of both processes in a single, harmonized document.

We have ensured that the project is consistent with Ontario's Provincial Policy Statement, the County of Middlesex Official Plan and the Township of Adelaide Metcalfe Official Plan.

Once the environmental assessment process is complete any other necessary permit applications will be submitted and approvals acquired before construction begins.

Images on the right and below are taken from the web sites of some of the statutory agencies and organizations with whom we must consult during the assessment process.

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Adelaide Wind Farm assessment

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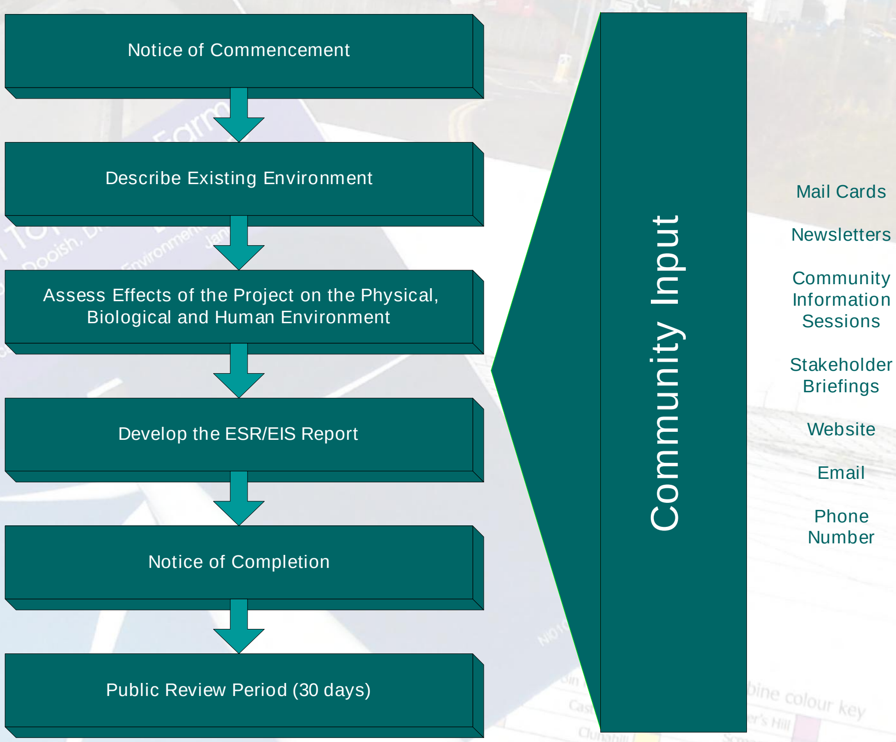
The Environmental Assessment Process

- **Assessment**
  - Determination of the project works and activities and how they could interact with the environment
  - Baseline condition studies completed to understand the existing physical, natural and human environment in the site area
  - Likely effects on the environment are predicted and assessed
  - Mitigation measures are developed to address potential adverse effects
  - Significance of residual adverse effects is determined

- **Reporting**
  - Findings of the Environmental Assessment set out in report
  - Report includes a summary of comments received from stakeholders (public, agencies, First Nations) and how they have been addressed

- **Public Review**
  - Once the report has been finalized, we will publish a Notice of Completion
  - Public and agencies are given 30 days to review the report and make comments
  - If no request for elevation are made, a Statement of Completion is submitted to the MOE and the project will proceed (subject to any other required approvals)
  - If requests are received, the Ministry of the Environment will decide on further process



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Adelaide Wind Farm
detailed studies

The physical, natural and human environments

The environmental assessment includes a review of the effects on the physical, natural and human environments by the wind farm project. A series of detailed studies are undertaken by Air Energy TCI and commissioned specialist consultants to ensure the feasibility and success of the project. These include:

- Landscape
- Surface Water
- Soils and Groundwater
- Archaeology

- Wildlife
- Flora
- Aquatic ecology

- Noise
- Visual Impact
- Health
- Socio-economics





Photomontage view looking west from School Road overpass

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Adelaide Wind Farm birds

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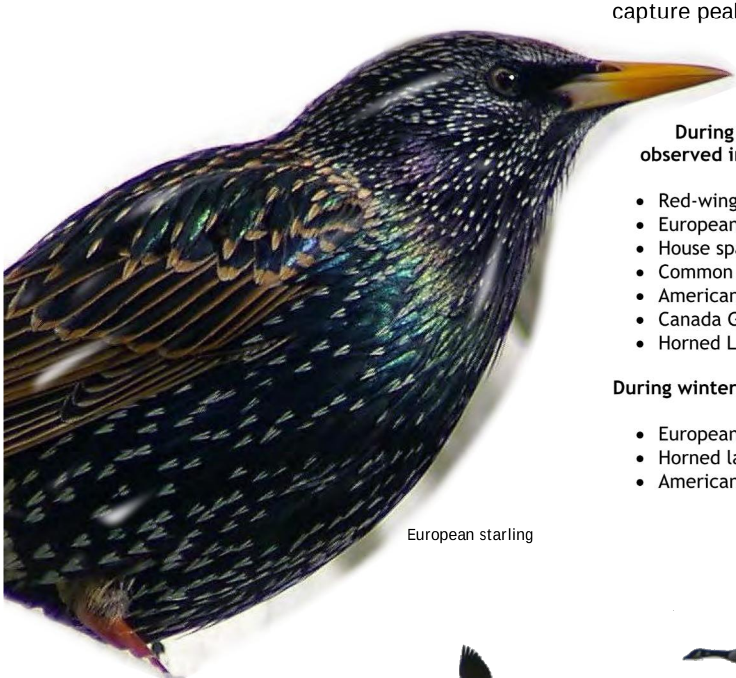
Field studies

Field surveys were completed during all four seasons to capture peak activity of migratory and non-migratory species



European starling

During the spring, summer and fall, the species most often **observed in** the Site Study Area (SSA) were:

- Red-winged blackbird (Agelaius phoeniceus)
- European starling (Sturnus vulgaris)
- House sparrow (Passer domesticus)
- Common grackle (Quisculus quiscula)
- American crow (Corvus brachyrhynchos)
- Canada Goose (Branta canadensis)
- Horned Lark (Eremophila alpestris)

During winter, the species most often observed in the SSA were:

- European Starling (Sturnus vulgaris)
- Horned lark (Eremophila alpestris)
- American crow (Corvus brachyrhynchos)

Overall, around 87% of all birds detected during the surveys were passerines (songbirds), followed by waterfowl (nearly 10%) and raptors (just over 1%).

Almost 82% of all flying birds were observed above or below the height to be within the sweep of the rotor blades (50 – 140 m above the ground).

Levels of potential bird strikes were reduced primarily by siting turbines away from woodlots and through the use of lighting and markings.

Based on observations of current use and mortality data from other wind power projects in eastern North America, avian mortality is expected to be low (fewer than two birds-per-turbine-per-year) and no residual effects to regional bird populations are anticipated.

The horned lark

Adelaide Wind Farm bats

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Field surveys

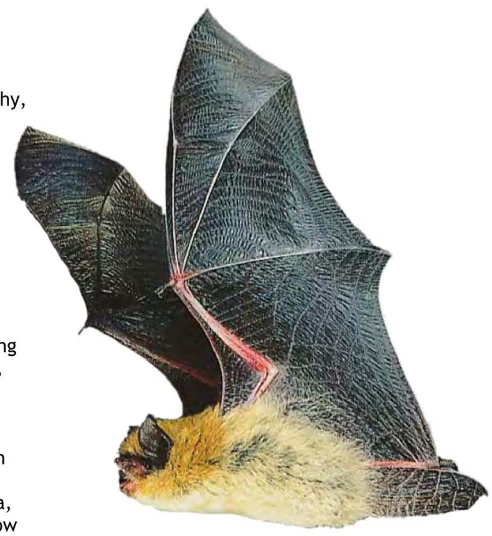
Bat field surveys were conducted during the late swarming season and fall migration using ultrasonic bat detectors at stations distributed throughout the site study area.

The study area is flat in topography, with a few river valleys where bats might congregate, but the area is primarily agricultural with limited bat habitat.

Results showed bat activity to be relatively low compared to other reference sites in Ontario.

Once again, levels of potential strikes have been reduced by siting the turbines away from woodlots, wetland areas, watercourses and buildings.

Based on the collated information and data from other wind power projects in eastern North America, bat mortality is expected to be low at 0-4 bats per turbine throughout the year.



Bat detector

Data from other wind power sites in Ontario would indicate that over the lifetime of the Adelaide project, there would be very limited residual effect on the bat population at these low mortality rates.

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Adelaide Wind Farm noise studies

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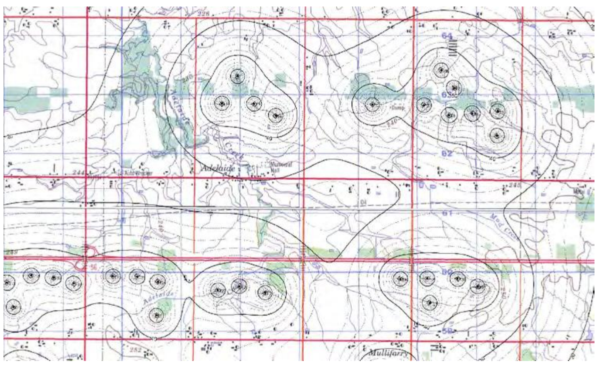
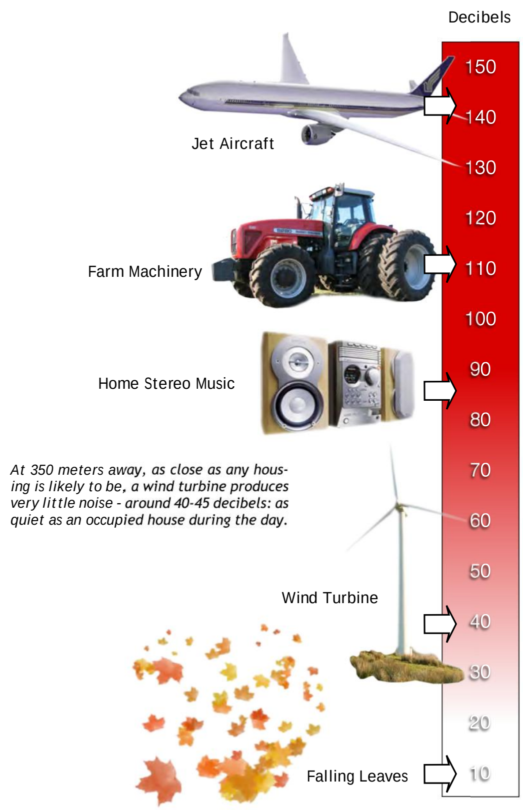
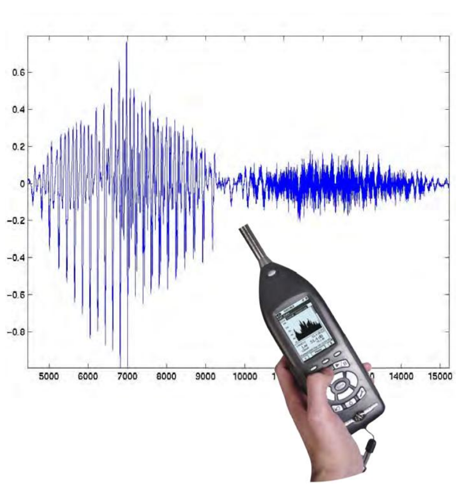
Predictive noise modelling



Noise levels were assessed for all potential residences within 1.5 km of the wind farm, in accordance with the most recent MOE guidelines, using a site-specific model. Vacant lots were included in the study as potential future receptors. The sound power levels of the turbines were provided by Vestas, the turbine manufacturer.

Predictive noise modelling was used, in conjunction with other siting parameters, to create an optimized site layout, which keeps noise levels at identified residences within the minimum requirements of the MOE noise guidelines.





FACT PANEL

Did you know that decibel levels (dBAs) are not added linearly, but logarithmically?

So, 60 dBA + 60 **dBA is not 120 dBA** but is **equal to** 63 **dBA**

In other words, doub**ling the noise energy** levels adds a **3 dBA increase**

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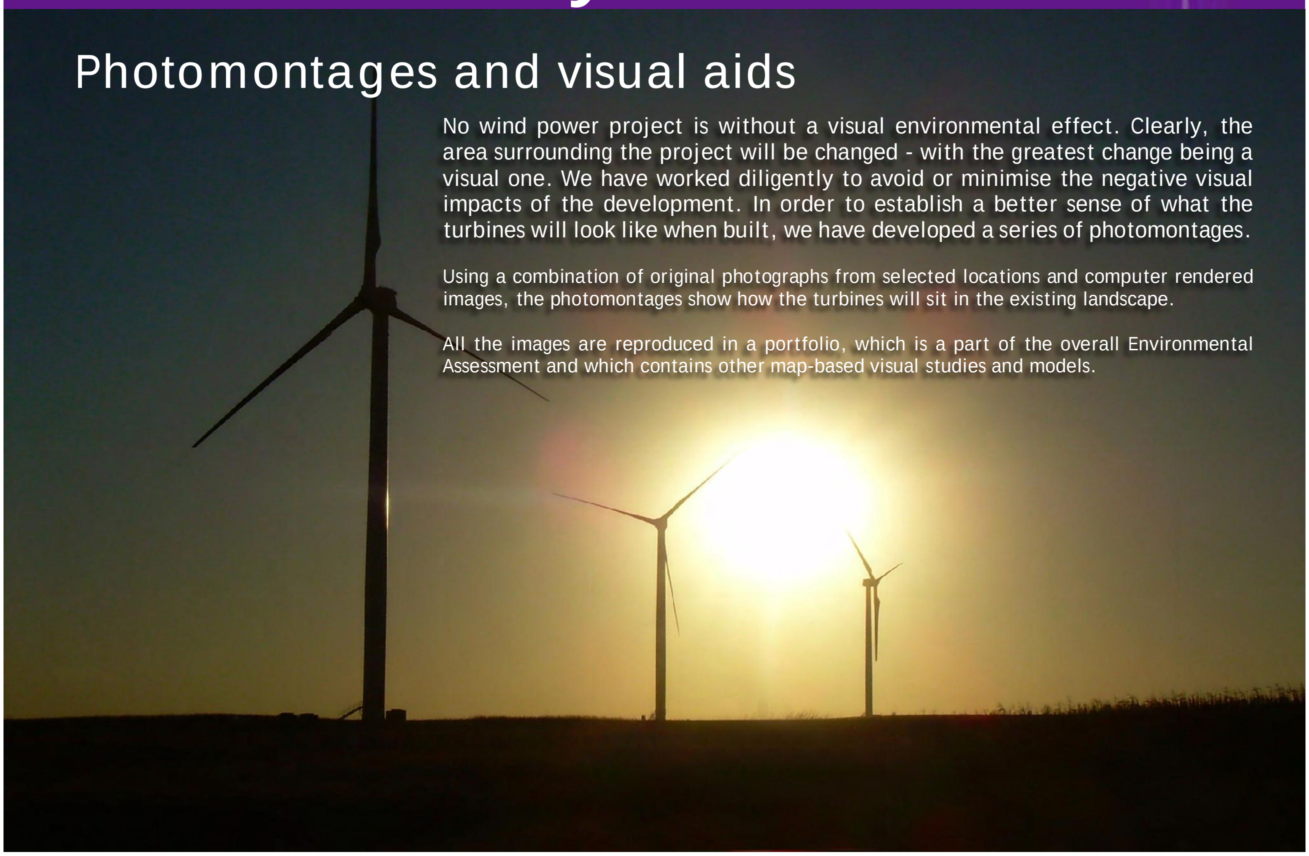
Adelaide Wind farm visual analysis

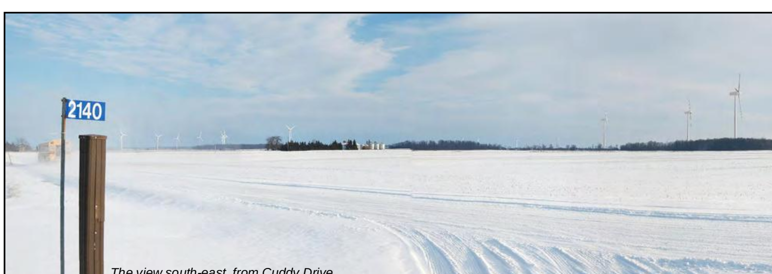


Photomontages and visual aids

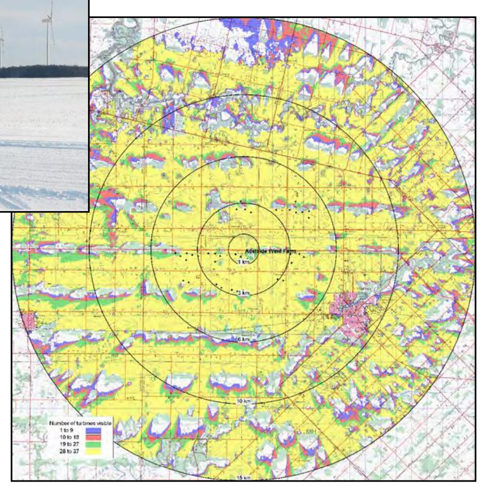
No wind power project is without a visual environmental effect. Clearly, the area surrounding the project will be changed - with the greatest change being a visual one. We have worked diligently to avoid or minimise the negative visual impacts of the development. In order to establish a better sense of what the turbines will look like when built, we have developed a series of photomontages.

Using a combination of original photographs from selected locations and computer rendered images, the photomontages show how the turbines will sit in the existing landscape.

All the images are reproduced in a portfolio, which is a part of the overall Environmental Assessment and which contains other map-based visual studies and models.



The view south-east from Cuddy Drive



The photomontage, above, is created in an industry-standard software programme using a combination of an original panoramic image and computer-generated turbines.

The shaded areas on the ZTV map (right) indicate the areas of potential visibility of the turbines. For the EA report, the Zone of Theoretical Visibility is measured out to 30 km from the wind farm centre.

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Potential effects on health and safety

Several areas were identified as having a potential effect on health and safety conditions associated with wind farms.

- Health and safety issues during construction (working from heights and operation of heavy machinery)
- Ice throw (potential ice build-up on turbine blades that could be thrown by the motion of the blades)
- Shadow flicker (alternating changes in light intensity caused by moving blades)
- Noise (noise created by turbine operation)
- Turbine malfunction (collapse of turbine or blade detachment)

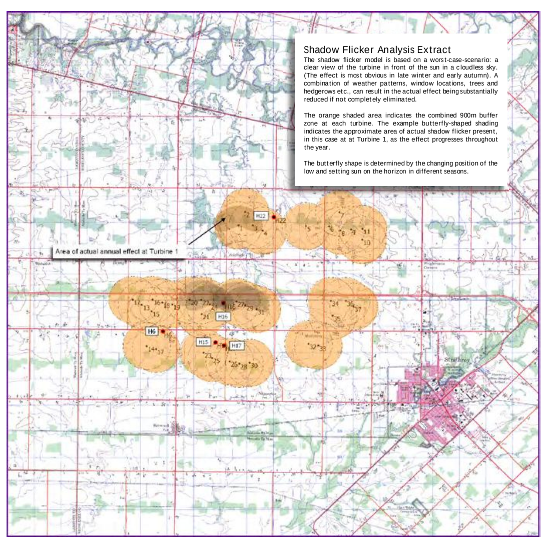
However, examinations of peer-reviewed journals and government agency materials suggest that these effects will be minimal at worst - based upon a low probability of occurrence. Almost all of these potential impacts can be minimized by careful location of the turbines and the application of standard health and safety measures.

"... as long as the Ministry of Environment Guidelines for location criteria of wind farms are followed, it is my opinion that there will be negligible adverse health impacts on Chatham-Kent citizens. Although opposition to wind farms on aesthetic grounds is a legitimate point of view, opposition to wind farms on the basis of potential adverse health consequences is not justified by the evidence."

Chatham-Kent's Acting Medical Officer of Health, Dr. David Colby

Mitigation measures

- A safe working environment which meets or exceeds applicable labour regulations.
- Detailed noise studies to ensure compliance with Ministry of Environment Guidelines.
- Applying minimum set-backs of turbines of at least 600 m from the nearestoff-site residences - that's 200 m in excess of the municipal requirement
- Ice detection and auto-shut-down on turbines; incidents of icing in SW Ontario are less frequent than other parts of the province. Modern wind turbines shut down when icing occurs or when wind speeds reach levels that could cause issues.
- Shadow flicker modelling incorporated into layout design to ensure the effect is kept within international industry guidelines.
- Maintenance of a call-in number for local residents to report problems or complaints about the wind farm or its operation.



Please ask one of our staff if you would like to see the Shadow Flicker analysis read out for the Adelaide Wind Farm

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