



# Responding to Concerns about Wind Energy

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**canwea**

CANADIAN WIND  
ENERGY ASSOCIATION

ASSOCIATION CANADIENNE  
DE L'ÉNERGIE ÉOLIENNE

# Addressing concerns about wind energy

- **The wind industry takes these very seriously:**
  - It is natural that people will ask questions about a technology that is relatively new to the social and political landscape
  - The industry welcomes an open discussion on wind and we encourage the public to get the facts on wind
  - As an industry, our responsibility is to provide answers to any questions raised on the basis of factual, independent, peer-reviewed knowledge
  - During the discussion, it is very important to distinguish between:
    - Peer-reviewed studies that are subject to rigorous review and criticism through a formal process involving experts in relevant fields, and;
    - Speculation that represents one or more individuals' *opinions*
  - The former holds more weight than the latter

# Addressing concerns around wind

- **About this presentation:**

- Provides answers to some common questions and concerns raised about wind energy (one issue per slide)
- Provides references for further reading on each issue (see reference section at end)

- **Other useful resources:**

- Detailed “CanWEA Papers” addressing areas of particular concern: a) Sound from Wind Turbines, and b) Wind and Human Health
- CanWEA website:
  - [www.canwea.ca](http://www.canwea.ca)
- CanWEA Fact Sheets:
  - [canwea.com/wind-energy/windfacts\\_e.php](http://canwea.com/wind-energy/windfacts_e.php)
- CanWEA Case Studies on wind projects across Canada:
  - [www.canwea.ca/municipalities/municipalities\\_casestudies\\_e.php](http://www.canwea.ca/municipalities/municipalities_casestudies_e.php)

# Addressing concerns around wind

- **The issues:**

- Sound from wind turbines
- Wind turbines and human health
- Impacts on birds
- Impacts on bats
- Impacts on property values
- Impacts on agricultural practices
- Visual effects
- Safety
- Interference with radar and telecommunications
- Turbine lighting
- Shadow flicker
- Stray voltage
- The reliability of wind-generated electricity
- Emission reductions from wind energy
- The economics of wind energy

# Sound from wind turbines

- **What concerns are raised:**
  - “Turbines emit a horrendous noise that makes it impossible to live anywhere near them”
- **What we know:**
  - Wind turbines do produce sound (“swoosh” of blades)
  - Actual sound level is influenced by many factors including the type of turbine, wind speed and surrounding topography
  - Sound is often masked by surrounding environment (e.g. rustling leaves)
- **How we address these concerns:**
  - All projects must meet regulatory requirements for sound
  - CanWEA Best Practices based on acceptable sound outside dwelling: 40 dBA at 4 m/s rising to 53 dBA at 11 m/s
  - Acceptable separation distances for sound are generally 300 to 600 m; at these distances, sound from the wind turbines is similar to a whisper
  - Encourage those with concerns to visit an actual wind farm: “Hearing is believing”

# Wind turbines and human health

- **What concerns are raised:**
  - “Wind turbines can have a negative impact on human health”
- **What we know:**
  - Wind turbines do not produce infrasound at a level that is detectable by humans or that has been shown to have any impacts on health
  - Tens of thousands of people in North America live and work in proximity to wind turbines – very few have claimed that their health has been negatively impacted
  - All peer-reviewed scientific literature has found no evidence linking wind turbines to human health concerns
- **How we address these concerns:**
  - Insist that debate considers peer-reviewed evidence rather than assertions that do not have a valid scientific foundation
  - Refer to independent, peer-reviewed studies by experts who specialize in low frequency sound and related human health impacts

# Impacts on birds

- **What concerns are raised:**
  - “Wind turbines are a major threat to local and migratory birds”
- **What we know:**
  - Wind turbines can potentially have impacts on birds through collisions and habitat disruption – average is < 2 bird kills per year per turbine
  - Impact is much less than that of buildings, house cats or the climatic changes that are impacting many bird habitats
  - For these reasons, the National Audubon Society has stated that it “strongly supports wind power as a clean alternative energy source that reduces the threat of global warming”
- **How we address these concerns:**
  - The key is proper windfarm siting and understanding avian behaviour
  - All wind farms have to undergo an environmental assessment (at the provincial and, in some cases, federal levels) - these ensure that any potential impacts are minimised

# Impacts on bats

- **What concerns are raised:**
  - “Wind turbines are a major threat to bats”
- **What we know:**
  - Wind industry sponsored a recent study that looked into high number of observed migratory bat fatalities at one windfarm in Alberta
  - This study indicated that bats may suffer from *barotrauma* when flying through low pressure areas in a wind turbine’s wake
  - Higher than normal number of fatalities have been seen at two windfarms in North America – elsewhere, bat fatalities are very low
- **How we address these concerns:**
  - Mitigation strategies can greatly reduce impacts – one study showed a 52% reduction in bat fatalities when the cut-in wind speed of the turbines was increased
  - Wind industry a part of the Bat and Wind Energy Cooperative that is pursuing research on bat behaviour and mitigation techniques

# Property Values

- **What concerns are raised:**
  - “Wind turbines will reduce the value of nearby homes”
- **What we know:**
  - Comprehensive study by Renewable Energy Policy Project (REPP) looked at results of property value impacts of many wind farms across the United States. It concluded that there was *“no evidence that property values decreased as a result of wind farms [...] for the great majority of projects the property values actually rose more quickly in the view shed than they did in the comparable community. Moreover, values increased faster in the view shed after the projects came online than they did before.”*
  - In some cases, local impacts of increased tourism and economic stimulus from windfarms can actually drive up property values
- **How we address these concerns:**
  - CanWEA undertaking a project of similar scope looking at Canadian installations

# Impacts on agricultural practices

- **What concerns are raised:**
  - “Wind turbines interfere with crop dusters and otherwise disrupt how farmers use their land”
- **What we know:**
  - Turbines occupy less than 4% of the land, leaving the rest for traditional uses (growing crops, raising cattle etc.)
  - Income from turbines helps support farmers – this is why wind is supported by several agriculture federations in the U.S. and Canada
  - Crop dusters are able to operate in and around wind farms with little difficulty, as has been demonstrated at several Canadian windfarms
- **How we address these concerns:**
  - Encourage wind developers to act proactively with farmers and crop dusters to facilitate crop dusting when and where appropriate
  - Provide case studies that show how windfarms serve to diversify and boost landowner incomes

# Visual impacts

- **What concerns are raised:**
  - “Wind turbines will be a blight on the landscape”
- **What we know:**
  - “Beauty is in the eye of the beholder” – this is an aesthetic issue
  - Early consultation and engagement are key – concerns are often tied to concerns around other issues (e.g. sound, property value etc.)
  - There are many tools available to assist a developer and community in designing a wind farm to minimize visual impacts, and preserve viewscapes of importance to the community
  - Surveys show that community acceptance of windfarms actually increases once the windfarm has been built
- **How we address these concerns:**
  - Encourage early and frequent consultations between developers and communities using tools to assist visualisation
  - Encourage those with concerns to visit existing windfarms and talk with leaders in those communities

# Safety

- **What concerns are raised:**
  - “Turbines represent a hazard due to ice shedding and blade loss”
- **What we know:**
  - When ice builds up on a blade, the efficiency of the blade drops considerably – the turbine’s control system detects this and shuts down the turbine until the ice melts or drops to the base of the turbine
  - Some accidents have occurred with older turbines when proper maintenance procedures were not followed
  - It is extremely rare for a blade (or fragment) to be shed from a turbine
  - If a blade does fail (most often from a lightning strike), it is designed to remain attached while the turbine shuts down
- **How we address these concerns:**
  - Ensure that proper maintenance procedures are carried out on the turbines at regular intervals (blade inspection, system checks)
  - CanWEA recommends setbacks from roads and public access areas of blade length + 10 metres

# Interference with radar and telecom

- **What concerns are raised:**
  - “Wind turbines interfere with radar systems and television reception”
- **What we know:**
  - In certain circumstances, wind turbines can negatively affect radio, telecom, radar or seismoacoustic systems within a certain distance
  - Must consult at an early stage with relevant authorities to ensure that any potential impacts are either avoided or mitigated
  - Experience in Europe and U.S. has shown that wind turbines can easily and safely coexist with all types of radar and radio installations
  - Very few documented cases of interference with television or telephones
- **How we address these concerns:**
  - CanWEA and the Radio Advisory Board of Canada (RABC) issued guidelines to help determine early in the process if a potential site may interfere with any of these installations
  - Mitigation measures can be effective if interference occurs

# Turbine Lighting

- **What concerns are raised:**

- “There will be lots of lights on the turbines, blinking incessantly and ruining the view”

- **What we know:**

- As with all tall structures, turbines must be properly lit according to Transport Canada standards
- Lighting has to a) provide sufficient warning to pilots, b) not attract birds, c) not hinder night sky viewing and d) not be a visual nuisance

- **How we address these concerns:**

- CanWEA worked with Transport Canada and others - pilots association, Canadian Wildlife Service, skywatcher groups - to develop standard that addressed wide range of concerns
- Result was CAR 621.19 Standard that requires red flashing lights spaced at least every 900 metres on turbines around the perimeter of the windfarm
- System ensures pilot safety, minimal bird impacts and minimal impacts on stargazers, while remaining unobtrusive for communities

# Shadow Flicker

- **What concerns are raised:**
  - “The sun flashing through the rotating blades will act like a strobe light and cause a disturbance in nearby houses”
- **What we know:**
  - Turbines rotate at 16-18 revolutions per minute so flashes only occur once per second for a three-blade turbine – it is not a “strobe light”
  - Effect occurs only when a) sun is low enough, b) the turbine shadow falls on a residence, and c) it is not cloudy
  - Easily modeled as part of the wind farm siting process
  - No evidence that this has any health impact on humans or animals
  - No guidelines currently in place in Canada, but common practice follows German model that allows for 30 hours of incidence per year under real conditions
- **How we address these concerns:**
  - Promote awareness of issue and encourage consultations between promoters and adjacent landowners

# Stray voltage

- **What concerns are raised:**
  - “Stray voltage from the windfarm will affect my equipment & appliances and adversely impact my livestock”
- **What we know:**
  - Most cases of “stray voltage” occur when there is either:
    - **Improper grounding of on-site equipment (in which case it is an issue with on-site wiring) or;**
    - **A change in current patterns on the distribution line, from generation or load, that exposes a preexisting condition (in which case it is an issue with the distribution utility, not with the generator or load)**
  - The turbines are therefore not the root of the problem, but if they are visible they may be mistaken as the reason that the problem occurs
  - Turbines must fully comply with utility requirements to ensure that the electricity they supply is compliant with grid standards
- **How we address these concerns:**
  - Requires on-site inspection for grounding problems, or examination of power quality issues with distribution utility

# Reliability

- **What concerns are raised:**
  - “Wind energy is an intermittent energy source that we cannot count on as part of a reliable electricity system”
- **What we know:**
  - Wide geographic dispersal of wind farms, along with good wind forecasting, smoothes fluctuations and makes it easier to integrate wind
  - In most cases, variations in the wind-generated supply are smaller than those in the demand for electricity
  - Wind works well as part of an integrated electricity grid, particularly if it has substantial hydroelectric generation
  - Wind farms must adhere to strict “grid codes” that ensure they contribute to overall grid stability and reliability
  - Consensus: we can integrate at least 20% without significant impacts
- **How we address these concerns:**
  - Work with utilities on grid codes and wind integration techniques
  - Sharing utility experience and knowledge gained from grid integration studies in Canada and the U.S.

# Emission reductions from wind

- **What concerns are raised:**
  - “Wind requires an equal amount of fossil fuel backup power so it doesn’t do anything to reduce greenhouse gas (GHG) emissions”
- **What we know:**
  - Wind has been shown to provide reliable power with small ancillary service requirements (i.e. “backup power” sources including spinning reserve and regulation reserve)
  - Presence of wind on the grid means that utilities can avoid use of “marginal generation” sources such as gas or coal
  - The GHG emissions incurred in construction of a turbine are offset after only 6 months of the turbine’s operation
  - The International Energy Agency concluded in 2008 that a “huge investment “in wind energy would be required over the next 10 to 20 years to meet the IPCC’s call for a 50 percent GHG reduction by 2050
- **How we address these concerns:**
  - Key is to understanding how electricity systems operate and how wind “backs out” need for thermal generation

# Economics

- **What concerns are raised:**
  - “Wind energy is much more expensive than other generation sources”
  - “Wind energy receives undue subsidies from government”
- **What we know:**
  - Current prices range from 8 to 11 cents / kWh for large wind projects - already cost-competitive with some conventional generation sources
  - Costs of environmental and health impacts of conventional technologies are not factored into price – this results in an uneven playing field
  - Incentives for wind (e.g. ecoEnergy) help to level the playing field as markets for environmental attributes (e.g. carbon markets) emerge
  - Other economic benefits linked to long-term cost trends (wind costs are decreasing) and cost certainty (a wind project’s generation costs do not fluctuate with changes in fuel prices)
- **How we address these concerns:**
  - Encourage putting a value on wind’s environmental attributes (e.g. generation of offset credits)
  - Providing info on current wind project pricing

# Summary

- **Concerns (and misperceptions) are inevitable**
  - Relatively new technology to the landscape
  - In absence of facts, misperceptions grow easily
- **Debate on wind is a good thing**
  - Need to base decisions on solid, peer-reviewed facts
  - In many cases, the real concern is hidden (e.g. visual impact concerns often stem from worries around property value)
  - Open communications can resolve many issues
- **Concerns often linked to “getting used to wind”**
  - Familiarity breeds comfort – surveys attest to this fact
- **Industry’s responsibility**
  - CanWEA and members working to establish sound basis for debate, and create effective communications tools

# References

- **Audible sound**

- “Wind Turbines and Sound: Review and Best Practice Guidelines”, HGC Engineering, February 2007 - [http://www.canwea.ca/Environmental\\_Issues.cfm](http://www.canwea.ca/Environmental_Issues.cfm)
- CanWEA Fact Sheet: “Visual and sound - The sights and sounds of wind” [http://www.canwea.ca/Fact\\_Sheets\\_eng.cfm](http://www.canwea.ca/Fact_Sheets_eng.cfm)
- For detailed information, see *CanWEA Paper: Addressing concerns about sound*

# References

- **Wind turbines and human health**

- “Infrasound from Wind Turbines – Fact, Fiction or Deception?”  
Geoff Leventhall, Vol. 34 No.2 (2006) Canadian Acoustics  
[www.wind.appstate.edu/reports/06-06Leventhall-Infras-WT-CanAcoustics2.pdf](http://www.wind.appstate.edu/reports/06-06Leventhall-Infras-WT-CanAcoustics2.pdf)
- “Health impact of wind turbines”, Municipality of Chatham-Kent Health Unit. <http://www.chatham-kent.ca/NR/rdonlyres/CA6E8804-D6FF-42A5-B93B-5229FA127875/7046/5a.pdf>
- “*Research into Aerodynamic Modulation of Wind Turbine Noise*”, University of Salford, UK, July 2007  
[http://usir.salford.ac.uk/1554/1/Salford Uni Report Turbine Sound.pdf](http://usir.salford.ac.uk/1554/1/Salford_ Uni_Report_Turbine_Sound.pdf)
- For a complete list of references: see *CanWEA Paper: Addressing concerns about wind turbines and health*

# References

- **Impacts on birds and bats**

- “Wind Turbines and Birds: A Guidance Document for Environmental Assessment - Final Document and Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds”, Canadian Wildlife Service,  
[http://www.cws-scf.ec.gc.ca/publications/eval/index\\_e.cfm](http://www.cws-scf.ec.gc.ca/publications/eval/index_e.cfm)
- “Minimal effects of wind turbines on the distribution of farmland birds”, Claire Devereaux et al, Journal of Applied Ecology, 2008  
<http://www.ncl.ac.uk/press.office/press.release/content.phtml?ref=1222791170>
- CanWEA Fact Sheet: Wildlife: Birds, bats and wind energy  
[http://www.canwea.ca/Fact\\_Sheets\\_eng.cfm](http://www.canwea.ca/Fact_Sheets_eng.cfm)

# References

- **Property Values:**

- “The Impact of Wind Facilities on Residential Property Values: What We Know And What We Don’t Know”, *Preliminary Results*. Ben Hoen & Ryan Wiser, Lawrence Berkeley National Laboratory  
[www.energywv.org/101408HoenWiser.pdf](http://www.energywv.org/101408HoenWiser.pdf)

- "The Effect Of Wind Development On Local Property Values"  
Renewable Energy Policy Project, May 2003 -  
[http://www.crest.org/articles/static/1/binaries/wind\\_online\\_final.pdf](http://www.crest.org/articles/static/1/binaries/wind_online_final.pdf)

- **Safety:**

- “Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario”, Garrad Hassan, May 2007  
[http://canwea.com/images/uploads/File/GH-RiskAssessment-38079or01a\(1\).pdf](http://canwea.com/images/uploads/File/GH-RiskAssessment-38079or01a(1).pdf)

# References

- **Interference with telecommunications**

- “Technical Information on the Assessment of the Potential Impact of Wind Turbines on Radio Communication, Radar and Seismoacoustic Systems”, Radio Advisory Board of Canada (RABC) and CanWEA, April 2007

[http://www.canwea.ca/Standards\\_and\\_Technical.cfm](http://www.canwea.ca/Standards_and_Technical.cfm)

- **Lighting**

- “Obstruction Marking and Lighting Standards”, Standard CAR 621.19, Transport Canada , Chapter 12: Wind Turbines and Wind Turbine Farms. Contact Eduard Alf : [eduard.alf@tc.gc.ca](mailto:eduard.alf@tc.gc.ca)

- **Shadow flicker**

- Overview of shadow flicker and relevant standards:

<http://www.windpower.org/en/tour/env/shadow/index.htm>

# References

- **Reliability:**

- "Utility Wind Integration and Operating Impact State of the Art," IEEE Transactions on Power Systems, Vol. 22, No. 3, August 2007, <http://www.nrel.gov/docs/fy07osti/41329.pdf>
- Analysis of the Impacts of Large-Scale Wind Generation on the Ontario Electricity System, April 2005; [http://www.uwig.org/IESO\\_Study\\_final\\_document1.pdf](http://www.uwig.org/IESO_Study_final_document1.pdf)
- For a listing of utility wind integration studies prepared by the Utility Wind Interest Group (UWIG): <http://www.uwig.org/opimpactsdocs.html>
- See CanWEA WindVision 2025 Backgrounder: Section 8 - *Wind Energy is a Reliable Source of Energy* [canwea.com/images/uploads/File/Windvision\\_backgrounder\\_e.pdf](http://canwea.com/images/uploads/File/Windvision_backgrounder_e.pdf)

# References

- **Emission reductions:**

- See CanWEA WindVision 2025 Backgrounder: Section 3 - *Wind Energy and Climate Change*

[canwea.com/images/uploads/File/Windvision\\_backgrounder\\_e.pdf](https://canwea.com/images/uploads/File/Windvision_backgrounder_e.pdf)

- **Economics:**

- See CanWEA WindVision 2025 Backgrounder: Section 2 - *Wind Energy is Cost-Competitive*

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