

Environmental benefits and mitigation of wildlife impacts

SUMMARY

Wind turbines have one of the lowest lifecycle environmental footprints of any electricity-generating technology. Their life cycle emissions are significantly lower than conventional power generation sources — and the direct impact on wildlife and natural habitats can be mitigated with careful management. Responsible planning, construction, operation and decommissioning can ensure that the local ecological impacts and cumulative effects are mitigated, while allowing Albertans to benefit from the lower-impact electricity that wind generation provides.



The environmental impacts of any type of electricity generation can include effects on air, water, wildlife and land. Understanding those impacts requires an examination of emissions, effluents or disturbance to water bodies, direct effects on wildlife, and surface and habitat disturbance.

Emissions

Generating electricity from any source results in emissions during the construction, operation, and decommissioning (i.e. the lifecycle) of the facility. Compared to other power sources, wind has negligibly low emissions of both greenhouse gases (Figure 1) and air pollutants such as nitrogen oxides, sulphur dioxide, particulate matter, volatile organic compounds, lead and mercury, which have adverse health and environmental impacts.¹ The manufacturing and construction of turbines creates limited emissions, and during operation wind energy is inherently emissions-free (except for emissions from staff vehicles) — leading to overall life-cycle emissions that are a fraction of those of conventional power sources.

Water

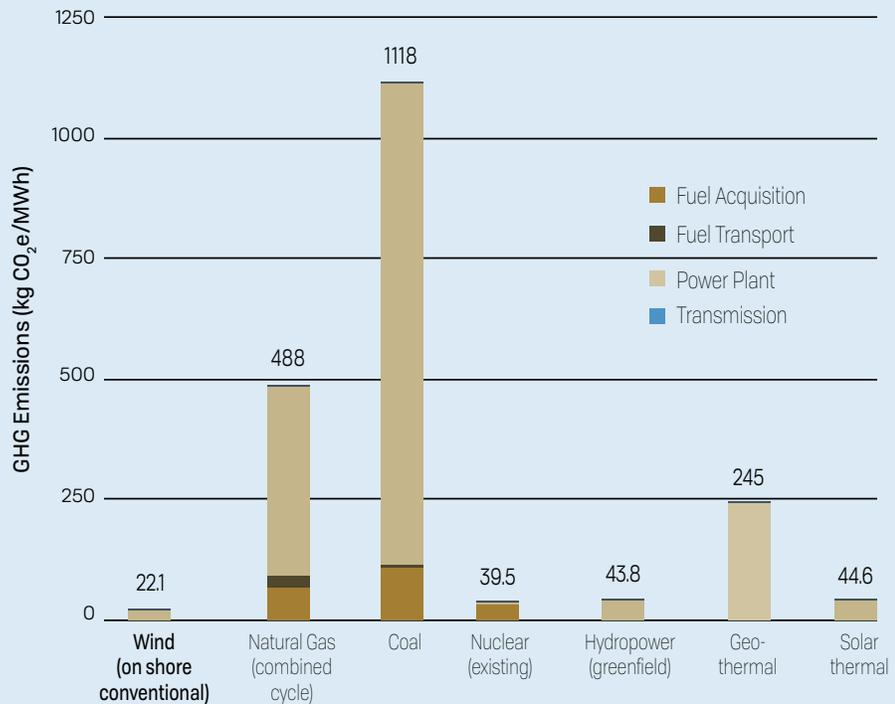
Since wind generation, unlike many conventional power sources, does not require water, wind facilities have no direct impact on water bodies during operation. However, the developer needs to be mindful of nearby water bodies during the construction phase and must plan activity and access to avoid contaminating the water.

Habitat and surface impacts

The construction of wind facilities is typically the most disruptive part of the wind development process in terms of land disturbance. If not appropriately managed, installation on intact native prairie and forested areas can cause adverse environmental impacts from vegetation clearing, habitat

Figure 1:

Life cycle greenhouse gas emissions for wind compared to other electricity generation



Data source: National Energy Technology Laboratory²

fragmentation, and increased accessibility of landscapes to vehicles. Adverse environmental impacts could include the loss of native grasslands and rare plant species, and other habitats important for wildlife. There is also the risk of introducing and spreading exotic or invasive plants along roads and construction sites. Proper management can mitigate these risks.

Protecting native prairie is an important environmental issue in Alberta, because intact native prairie is rare and sensitive habitat. One of the most important concerns for native prairies is habitat fragmentation, as many prairie species require large tracts of unspoiled native grassland to support their entire lifecycle.

Strategies for reducing impacts on habitat and native plant species include:

- Avoiding development in native prairie.
- Restricting or prohibiting wind development where environmentally sensitive areas would be adversely affected. If avoidance is not possible, then follow established guidelines such as pre-development surveys for rare species and communities.
- Siting wind turbines on cultivated lands and brownfield sites.
- Minimizing roadway construction that fragments habitats.
- Reducing disturbance by utilizing existing transmission or utility corridors and roadways where possible.
- Monitoring post-construction reclamation activities to ensure effectiveness.

Wind farms can also support native prairie protection by providing an additional source of income that can reduce the financial incentive to subdivide and sell land for residential or recreational development.

Wildlife

All types of energy development can impact wildlife through direct effects (e.g. collisions with facilities and associated structures), as well as through habitat loss, degradation, fragmentation and disturbance. In the case of fossil fuels, these effects also include air pollution, water pollution and the impacts of water use. Increased human activity, particularly during construction, may result in decreased productivity for certain wildlife, and can cause wildlife avoidance of the local habitat.

For wind development, the biggest wildlife risks are for birds and bats. These can be mitigated through siting and operations considerations.

Alberta's rules for wind development and wildlife primarily address migrating and resident bats, raptors, grassland birds, greater sage grouse³ and sharp-tailed grouse, migrating songbirds, and shore birds.⁴ Birds and bats may be killed through collisions with wind turbine blades or towers. Bats may also be killed by air pressure changes associated with spinning turbine blades. Bat mortalities are of specific concern as bats have relatively long lifespans and low reproductive rates, and the majority of bats killed by wind turbines are adults.⁵

Fatality rates for birds and bats are highly variable across technologies, sites and regions. In terms of their relative contribution to bird fatalities, wind turbines rank fairly low compared to buildings and windows, electricity transmission lines and even cats.⁶ It is important to note, however, that as wind turbines grow in number, so too could their contribution to bird mortality. For that reason, it is important to ensure that wind development is carried out responsibly and with due diligence.

There are several mitigation strategies for impacts on avian species. Regulations and directives require the following:

- Care should be taken in the siting of turbines. The Alberta Wildlife Directive sets this as a standard: “Wind turbines, wind energy infrastructure, and temporary works spaces must be sited to avoid or minimize their occurrence in important wildlife habitats or areas that attract or funnel birds or bats. [...] Such areas include native grasslands, old growth forest stands, mapped Wildlife Sensitive Layers, named water bodies, valley breaks (including coulees), valleys of large permanent watercourses and the Eastern Slopes region.” Similar requirements are made for several wildlife zones for species such as the caribou and grizzly bear.
- Facility approvals require comprehensive bird and bat studies.⁷
- Pre-construction and post-construction monitoring is also required. This provides critical information on the impacts and the success of mitigation strategies — allowing a measure of impacts and identification of changes that must be made in future development.

The following measures are not required, but provide other important mitigation options:

- Restricting the operation of turbines at certain times of year (e.g., spring and fall bird migration) and during certain weather conditions when adverse effects on birds and bats are more likely. Curtailing operations during high-risk periods may substantially reduce bat fatalities.
- If mortality is due to attraction to lights, other lighting options may need to be considered. An evaluation of other options for lighting at the site may be required in co-operation with Transport Canada and the Canadian Wildlife Service. It may be possible to reduce the amount of lighting or even to turn lights off during periods of high risk (e.g., foggy nights during the peak of the passerine migration period).⁸

In addition, there is an opportunity for a regional planning approach by either incentivizing development in areas with low conflict or prohibiting wind development in particularly



sensitive areas. Existing regional land use plans such as the South Saskatchewan Regional Plan should also be taken into consideration.

Existing protection mechanisms

Existing provincial and federal laws, regulations, and guidelines can encourage wind development with minimal impact.

- **AUC application process:** The process requires facilities to complete and submit an environmental evaluation of the project and obtain sign-off from Alberta Environment and Parks.⁹
- **Wildlife Directive for Alberta Wind Energy Projects:** The directive provides standards and best management practices to help identify sources of risk to wildlife and avoid the impacts.
- **Environmentally Significant Areas (ESAs):** These are places in Alberta that are important to the long-term maintenance of biological diversity, soil, water, and other natural processes.¹⁰ The Government of Alberta keeps a register of ESAs. ESAs are not a regulatory tool.
- **Federal acts:** Relevant acts include the Species at Risk Act and the Migratory Birds Convention Act.
- **Provincial acts:** Relevant acts include Alberta’s Wildlife Act.



Questions for consideration

The following questions are proposed for further discussion:

- What information is most important to community members and municipalities when considering habitat and wildlife impacts? Where are the best information sources?
- Which strategies have helped to reduce the impacts of energy development on wildlife and wildlife habitat?
- What gaps exist in current regulations and directives?
- What measures (regulations, best practices, provincial/regional policy) will address these gaps?
- What type of regional planning (if any) would be effective in Alberta?
- How should cumulative effect issues be considered as Alberta's wind power fleet grows?

¹ Environment and Climate Change Canada, "Criteria Air Contaminants and Related Pollutants," April 24, 2013. <https://ec.gc.ca/air/default.asp?lang=En&n=7C43740B-1>

² National Energy Technology Laboratory, Power Generation Technology Comparison from a Life Cycle Perspective, 2013, Figure 4-24. Note that these figures are for the U.S. and can change based on several factors including fuel quality, distances traveled for fuel and construction materials, maturity of the industry, plant efficiencies, and so on. However the magnitudes and relative differences will remain similar. <https://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Life%20Cycle%20Analysis/Technology-Assessment-Compilation-Report.pdf>

³ All sage grouse areas in Alberta and Saskatchewan are protected by the Emergency Order for the Protection of the Greater Sage-Grouse from the Minister of Justice.

⁴ Alberta Environment & Parks, Wildlife Directive for Alberta Wind Energy Projects (2017), 3. <http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/WildlifeWindEnergyDirective-Jan27-2017.pdf>

⁵ Alberta Government, Bat Mitigation Framework for Wind Power Development (2013), 1. <http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/WildlifeGuidelines-BatMitigationFramework-Jun19-2013.pdf>

⁶ Wallace P. Erickson, Gregory D. Johnson, and P. David Jr., "A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions," in Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference, 2002 March 20-24; Asilomar, California, Volume 2 General Technical Reports, ed. C. John Ralph and Terrell D. Rich (U.S. Dept. of Agriculture, Forest Service, 2005). <https://www.fs.usda.gov/treesearch-beta/pubs/32103>

⁷ Wildlife Directive for Alberta Wind Energy Projects, 5.

⁸ Environment Canada, Wind Turbines and Birds: A Guidance Document for Environmental Assessment (2006), 39. http://www.bape.gouv.qc.ca/sections/mandats/eole_matane/documents/DB15.pdf

⁹ Alberta Utilities Commission, Rule 007: Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments, 12. <http://www.auc.ab.ca/acts-regulations-and-auc-rules/rules/Documents/Rule007.pdf>

¹⁰ Fiera Biological Consulting, Environmentally Significant Areas in Alberta: 2014 Update Final Report, prepared for Government of Alberta (2014). <http://open.alberta.ca/dataset/91444b6b-395b-4c83-ba37-a2e07ffbe69e/resource/21f22275-ae8e-4976-9caa-f5be09a11fec/download/2014-esa-final-report-april-2014.pdf>

APRIL 2017

FOR MORE INFORMATION:

This paper is one in a series prepared for **Wind Energy in Alberta: Sustainable Communities, Sustainable Environment** initiative, a project to gain input from stakeholders on responsible growth of this renewable resource in the province. This series includes the following papers: Benefits to local economies; Communities, neighbours and wind energy facilities; Environmental benefits and mitigation of wildlife impacts and Local government capacity and wind energy.



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