*Energy at a Glance*

# Wind Energy Primer: Wind and the Environment

By Linnea Lueken

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Wind turbines do not produce any direct carbon dioxide emissions during operation, however, they do produce a variety of negative environmental impacts that merit attention.

### Land Use, Mining

When considering the environmental effects of wind energy, one must consider the space taken up by, or footprint of, wind power plants. Although individual towers have a relatively small footprint, studies suggest the total land use and environmental impact of wind farms throughout the county is significant.

For instance, a 2017 study[7] by Strata Policy finds the amount of space required to produce 1,000 megawatts (MW) from an industrial wind facility typically exceeds 133 square miles of land, compared to just 1.3 square miles needed for an equivalent nuclear power plant.

The same study shows that wind turbines require enormous amounts of rare earth elements like neodymium magnets, around 377 pounds of neodymium per MW capacity. The mining for these kinds of resources destroys huge amounts of land and requires heavy machinery that emit massive amounts of carbon dioxide. The land use of transmission lines was found to be 10.362 acres per MW in 2015.

Wind turbine blades cannot be recycled[8], therefore most end up in landfills. One estimate predicts[9] industrial wind facilities will produce 43 million tons of blade waste throughout the world by 2050.

Reasonably, the most viable locations, where winds blow relatively constantly at desired speeds, are used for initial wind installations. Because the best locations are filled, for new wind facilities to produce comparable amounts of energy, even more land and turbines are needed. Larger fields of turbines, however, reduce wind flow between turbines. The power output of wind facilities that are downwind neighbors of other wind power plants can be reduced by 20 percent or more due to a "braking effect."[10]

Large wind power facilities have also been found to disrupt radar stations[11] and make flying aircrafts nearby hazardous.

### Effects on Humans and Wildlife

In the United States, as long as certain requirements are followed, the federal government has granted wind companies special permission to kill Bald

## Quick Bullets

- The issue of land use is a major sticking point for the growth of industrial wind facilities in the United States, with local governments resisting encroachment[1] in rural areas throughout the country.
- Every year, 75 to 110 Golden eagles are killed by turbines at just one wind turbine facility in California[2]. As many as 4,700 birds are killed annually at this site alone.
- In 2012, an estimated 573,000 birds were killed by wind turbines in the United States[3], with 83,000 being raptors, when there were thousands fewer turbines than today.
- Some experts estimate that by 2030, 1.4 million birds[4] could be killed by wind facilities every year.
- Wind turbines kill an estimated 128,000 bats[5] of a single species every year, and up to 888,000[6] total bats per year.

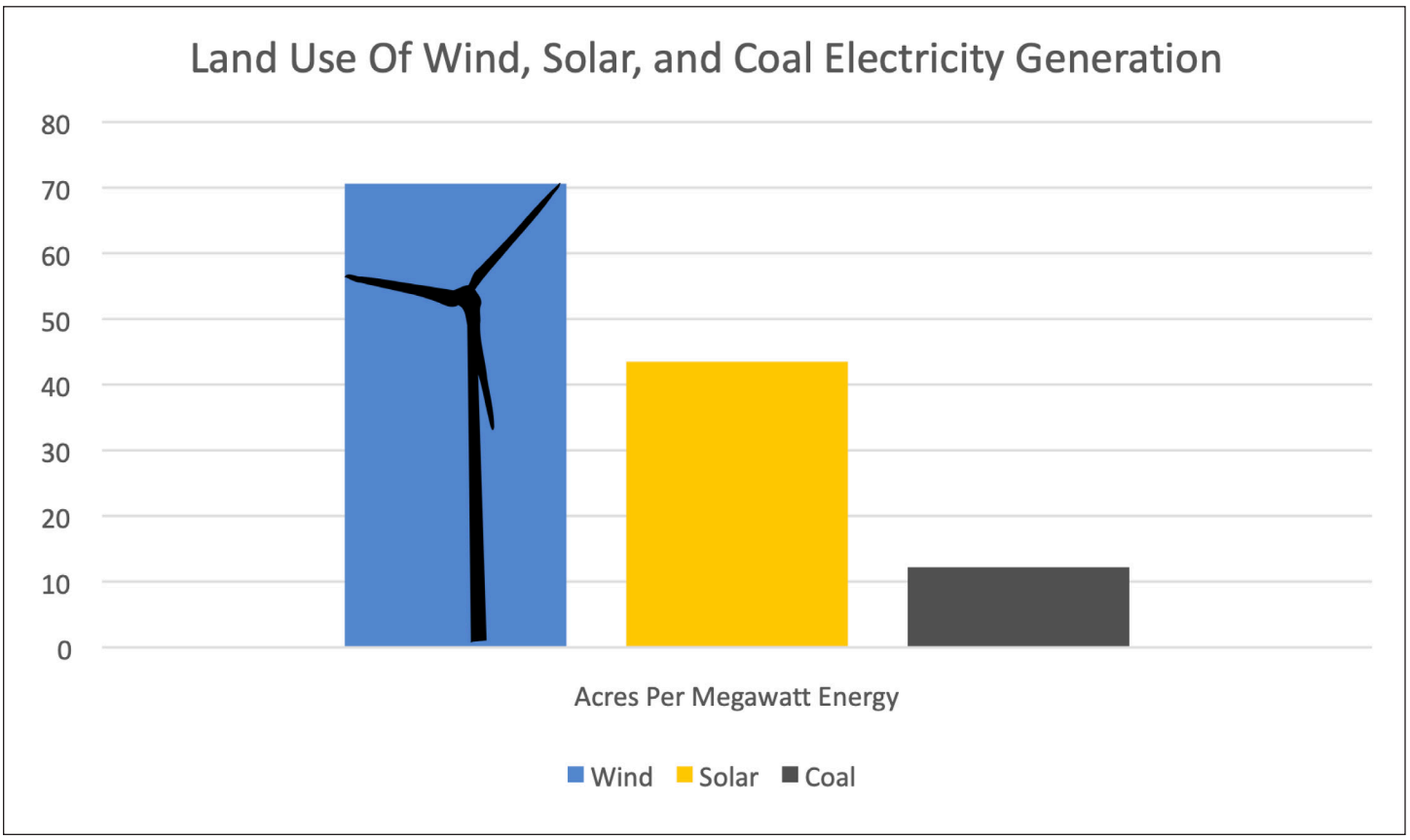


*Figure 1: Land use in acres per megawatt energy produced for wind, solar, and coal generated electricity. Data from Strata (2017) The Footprint of Energy: Land Use of U.S. Electricity Production. Strata.org, accessed via Wayback Machine 13 September 2022.*

eagles[12], Golden eagles, and other raptors, which are normally protected under various federal laws. The U.S. Fish and Wildlife Service updated these "take limits" in February 2022, increasing the number of eagles the wind industry can kill by more than four times[13] its original limit.

Bats are also victims of turbine blades; the Hoary bat alone is estimated by one study[14] to lose 128,000 individuals to turbines every year. The same study predicts that the species may lose 90 percent of its population over the next 50 years due to wind turbine impacts.

Migratory birds are also at increased risk of harm from wind facilities because the best sites for power generation are typically located along their migration routes.

In terms of human health effects, the constant infrasound and low frequency noise produced by wind turbines, while not always audible, can cause health issues[15] including sleeplessness and even heart problems, if appropriate setbacks are not maintained. Infrasound likely has a similar effect on animals[16] living too close to turbines, including migrating whales[17].

## Endnotes


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