



# Comparative Air Emissions Of Wind and Other Fuels

Wind energy's most important environmental benefit is its lack of emissions of both air pollutants and greenhouse gases when compared with alternative methods of generating electricity.

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The American Wind Energy Association (AWEA) has developed a set of statistics to quantify the comparative emissions of wind and other fuels, based on data gathered by the U.S. Department of Energy's Energy Information Administration (EIA)[1], which collects information on the U.S. utility industry.

This, and similar fact sheets, can be found online at <http://www.awea.org/pubs/factsheets.html>.

**For carbon dioxide (CO<sub>2</sub>), the leading greenhouse gas associated with global warming, comparative emissions during electricity generation are as follows:**

Fuel	CO <sub>2</sub> Emitted Per Kilowatt-hour (kWh) Generated (in pounds)	KWh Generated, 1997 (billions)	CO <sub>2</sub> Emitted, Total Generation (billion pounds)
Coal	2.13	1,788	3,807
Natural Gas	1.03	283.6	291
Oil	1.56	77.8	122
U.S. Average Fuel Mix [2]	1.52	3,494	5,313
Wind	--0--	3.4	--0--

**For sulfur dioxide (SO<sub>2</sub>), the leading precursor of acid rain:**

Fuel	SO <sub>2</sub> Emitted Per Kilowatt-hour (kWh) Generated (in pounds)	KWh Generated, 1997 (billions)	SO <sub>2</sub> Emitted, Total Generation (million pounds)
Coal	0.0134	1,788	24,028
Natural Gas	0.000007	283.6	2
Oil	0.0112	77.8	870
U.S. Average Fuel Mix [2]	0.0080	3,494	27,914
Wind	--0--	3.4	--0--

**For nitrogen oxides (NOx), another acid rain precursor and the leading component of smog:**

Fuel	NOx Emitted Per Kilowatt-hour (kWh) Generated (in pounds)	KWh Generated, 1997 (billions)	NOx Emitted, Total Generation (million pounds)
Coal	0.0076	1,788	13,668
Natural Gas	0.0018	283.6	504
Oil	0.0021	77.8	162
U.S. Average Fuel Mix [2]	0.0049	3,494	17,112
Wind	--0--	3.4	--0--

A single 750-kilowatt wind turbine, operated for one year at a site with Class 4 wind speeds (winds averaging 12.5-13.4 mph at 10 meters height), can be expected to displace a total of 2,697,175 pounds of carbon dioxide, 14,172 pounds of sulfur dioxide, and 8,688 pounds of nitrogen oxides, based on the U.S. average utility generation fuel mix.[3]

AWEA has prepared a spreadsheet which permits calculations based on these and other air emissions statistics and which can be e-mailed to researchers on request.

**NOTE**

1. Emissions data in this fact sheet are based on statistics provided in the EIA's *Annual Energy Review 1998*. (Washington, D.C.: Energy Information Administration, DOE/EIA-0384 ((98)), July 1998.) The Annual Energy Review can be accessed on the Web at <<http://www.eia.doe.gov/aer>>.
2. The numbers for kilowatt-hours generated and emissions for "Coal," "Natural Gas," and "Oil" are based on U.S. electric utility generation. The numbers for kilowatt-hours generated and emissions for "US Average Fuel Mix" and "Wind" are the totals for all U.S. generation, including nonutility plants."
3. Estimate derived by AWEA using data from *Renewable Energy Technology Characterizations*, published by the U.S. Department of Energy and the Electric Power Research Institute, December 1997.



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