

Summary of Wind Policies and Recommendations by Country:

Companion Summary Chart to “International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences”

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Country	Setback Distance from Residences	Noise Standard	Shadow Flicker Standard	Are the setback distances and/or standards requirements or recommendations?	Notes and Rationale
Germany and Provinces	None	35- 50 dB(A) noise limit for night, and 45- 65 dB(A) noise limit for day, depending on area	Maximum 30 min/day and 30 hr/ year worst case scenario, 8 hr/year actual exposure	Requirements	Noise, shadow flicker concerns
Saarland	550- 850 m setback from residences			Recommendations	Noise, shadow flicker concerns
Lower Saxony	1000 m setback from residences			Recommendations	Noise, landscape concerns
Thuringia	1000 m setback/ potential conflict area for residences & recreational areas			Recommendations	Noise, shadow flicker concerns
Hesse	1000 m setback from residences, with greater distances for healthcare settings and smaller distances from individual homes			Recommendations	Noise, visual impact, shadow flicker, pollution, and spatial development concerns
Rhineland-Palatinate	400 m setback from individual homes, 1000 m setback from residential areas			Recommendations	Noise, landscape, shadow flicker concerns, based on court case and then became guideline
Berlin	None			None	Too developed, one wind turbine only
Bremen	200-500 m setback from residences			Recommendations: General result of going by German noise and shadow flicker regulations	shadow flicker concerns, consideration for neighbors

Schleswig-Holstein	300 m setback from areas with 1 < 4 residences, 500 m setback from rural residential areas, and 1,000 m setbacks from towns and vacation areas			Requirements	Tourism, historical areas, and landscape concerns
Hamburg	300 m setback from individual dwellings, 500 m setback from residential areas			Requirements	Unknown
Saxony	1x height of turbine setback from everything, 300 m setback from one turbine, 500 m setback from wind farms			Recommendations	Environment, landscape, shadow flicker, and noise concerns
Spain	500 m setback from residences	45-50 dB(A) noise limit		Recommendations	Noise, safety, visual impact concerns
Italy	None			None	None found
France	500 m setback from residences	25 dB noise limit inside nearby residences		Requirements	Noise, landscape, visual impact concerns
Canada	None			None	Provinces decide
Yukon	None			None	Sparsely populated
Prince Edward Island	Setback of 3x the total height of turbine from neighboring residences or 1x the height from developer's homes			Requirements	Environmental and public health and safety concerns
New Brunswick	500 m or 5x turbine height setback from all residences/ recreational areas if turbine is located on crown (state) land	40-53 dB(A) noise limit at all homes within 1 km		Requirements	Noise, visual impacts, safety concerns
Nova Scotia	Unknown			Unknown	None Found
British Columbia	None	40 dB(A) noise limit		Requirements	Noise concerns
Alberta	None	40 -56 dB(A) L_{Aeq} (usually 40 -46 dB(A) L_{Aeq}) night noise limit at most affected residence within 1.5 km, day noise limits 10 dB(A) higher		Requirements	Noise concerns, Rule of Alberta Utilities Commission

Manitoba	500-550 setback from residences	40-53 dB(A) noise limit		Noise requirements, setback recommendations	Noise concerns, municipalities determine setbacks ranging from 300-800 m, Manitoba recommends 500 m
Ontario	550 m setback distances from homes, workplaces, & recreational areas	40-51 dB(A) noise limits		Requirements	Noise, shadow flicker concerns
Newfoundland/ Labrador	Unknown			Unknown	None found
Quebec	None			None	Municipalities determine setbacks, with 500 m being the most commonly used setback distance
UK / England	350 m setback minimum	35-45 dB(A) noise limit, or max 5 dB(A) above background noise, whatever is higher		Recommendations	Noise concerns
Scotland	2 km setback from cities, villages, and towns			Recommendations	Visual impact concerns
Wales	500 m setback from residences			Recommendations	Noise concerns
Portugal	200 m setback from residences	45-55 dB(A) noise limit by night, and 55-65 dB(A) noise limit for day		Noise Requirements, Setback Recommendations	Unknown
Denmark	4x turbine height setback from residences	39-44dB(A) noise limit		Requirements	Noise, shadow flicker, landscape concerns
Netherlands	4x hub height setback from residences	47 dB(A) noise limit by day and 42 dB(A) noise limit for night		Noise Requirements, Setback Recommendations	Noise, shadow flicker, safety concerns
Sweden	400-1000 m setback from residences	40 dB(A) noise limit, may be reduced to 30-35 dB(A) if in quiet area or produces tonality	German guidelines (see below)	Recommendations	Noise, shadow flicker, visual impact, safety

Australia	None			None	States decide, Senate recommends future review for stricter guidelines
New South Wales	None	L _{A eq, 10 min} 35 dB(A) noise limit, plus a 5 db penalty for tonality		Recommendations	Noise concerns
South Australia	None	L _{A90} 35-40dB noise limit, plus a 5 dB penalty for tonality	consideration of shadow flicker on all homes within 500m	Recommendations	Noise, shadow flicker concerns
Tasmania	None	5-10 dB penalty for tonality, impulsiveness, and modulation		Recommendations	Noise concerns
Victoria	None	L _{A95} 40 dB noise limit, plus a 5dB penalty for tonality, impulsiveness, and modulation	Shadow flicker limit of 30 hrs/year	Recommendations	Noise, shadow flicker concerns
Western Australia	1 km (1000 m) setbacks	L _{A eq, 10 min} 35 dB noise limit, plus a 5-15dB penalty for tonality, impulsiveness, and modulation		Recommendations	Noise, visual impact, shadow flicker concerns
Ireland	500 m setback from residences and noise sensitive areas,	35-45 dB(A) noise limit, or max 5 dB(A) above background noise, whatever is higher	Maximum shadow flicker 30 hr/year and 30 min/day	Recommendations	Noise, shadow flicker concerns
New Zealand	None	35-40 dB(A) noise limit, or max 5 dB(A) above background noise, whatever is higher		Requirements	Noise concerns

Note: This chart is a summary of the information found in the document “International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences: Setbacks, Noise, Shadow Flicker, and Other Concerns.” For more detailed information of wind energy requirements and recommendations, please refer to that document.

Reference for distance comparisons (rounded to the nearest foot):

50 m= 164 ft	250 m= 820 ft	450 m= 1476 ft	650 m= 2133 ft	850 m= 2789 ft
100 m= 328 ft	300 m= 984 ft	500 m= 1640 ft	700 m= 2297 ft	900 m= 2953 ft
150 m= 492 ft	350 m= 1148 ft	550 m= 1804 ft	750 m= 2461 ft	950 m= 3117 ft
200 m= 656 ft	400 m= 1312 ft	600 m= 1969 ft	800 m= 2625 ft	1000 m= 3281 ft

Reference for distance comparisons (rounded to the nearest mile):

0.5 km= 0.31 mi	1.0 km= 0.62 mi	1.5 km= 0.93 mi	2.0 km= 1.24 mi
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Wind Energy Terms

Note: Wind energy terms are not always used in the same way across various countries or sources. These definitions are based on how terms appeared to be most commonly used throughout countries and sources in this document.

Wind Energy: The provision of energy from wind, usually harnessed through wind turbines.

Wind Energy Requirement, Rule, Law, or Policy: A wind energy setback or limit required by a level of government.

Wind Energy Recommendation or Guideline: A wind energy setback or limit that is suggested or encouraged, but not required, by a level of government.

Wind Turbine: A system used to convert potential energy found in wind to mechanical energy to produce electricity. Wind turbines usually range in size from 9 to 200 meters (29- 427 feet), and may be located onshore or offshore.

Onshore Wind Turbine: A wind turbine that is located on land. Onshore wind turbines may range in size from small wind turbines producing 50 kilowatts of electricity a day, to large wind turbines producing up to 3 megawatts of electricity a day.

Offshore Wind Turbine: A wind turbine that is located in deep water such as seas or oceans. Offshore wind turbines are much larger than onshore wind turbines, producing up to 6 megawatts of electricity a day.

Vertical-Axis Wind Turbine: A wind turbine where the blades rotate around an axis that is perpendicular to the ground. Vertical-axis wind turbines are often described as resembling egg-beaters.

Horizontal-Axis Wind Turbine: A wind turbine where the blades rotate around an axis that is parallel to the ground. Horizontal-axis wind turbines are more common than vertical-axis turbines, and usually contain three blades.

Wind Energy Facility, Wind Power Plant, or Wind Farm: A group of three or more wind turbines operated together. A wind energy facility may include several hundred turbines.

Tower: The tall base that serves to raise and anchor the wind turbine blades.

Hub: The area the blades rotate around in a horizontal-axis turbine. The hub is parallel to the ground and contains the mechanical pieces including a gearbox and generator.

Blades: The sections of the wind turbine that the wind moves. There are typically three blades which rotate around the hub.

Turbine Height: The height from the ground to the top of the turbine. In a horizontal-axis turbine, it is the height from the ground to the top of the highest rotating blade.

Hub Height: The height from the ground to the center of the hub the blades rotate around on a horizontal-axis wind turbine.

Rotor Diameter: The diameter of the circular arc produced by the rotation of the blades. **Wind Turbine Mean Power Output:** The average amount of energy produced by a wind turbine or wind energy facility over a given period of time for an average wind speed, usually measured in megawatts or kilowatts.

Megawatts (MW): One million watts, or one thousand kilowatts of energy.

Kilowatts (kW): One thousands watts of energy.

Watts (W): The amount of energy used or produced by an object.

Mean Wind Speed or Velocity: The average rate over a period of time of the flow of wind with no blocking obstacles such as buildings or vegetation.

Setback: The minimum distance a wind turbine may be located from a designated location. Unless otherwise specified, setbacks refer to the minimum distance a wind turbine may be located from a residence. The term setback is also used to describe minimum distances from all buildings, property lines, or historically or environmentally important areas. Setbacks may be a set distance or based on turbine features including turbine height, hub height, rotor diameter, or blade length. Setbacks may also be referred to as a setback distance or separation distance.

Shadow Flicker: The pattern of alternating shadows and light caused by the changes in light when rotating blades cast shadows on an area or residence. Shadow flicker only happens when the sun is low in the sky and behind the rotating turbine blades.

Shadow Flicker Exposure: The amount of time a location experiences shadow flicker, measured in terms of the actual or the “worst-case” scenario.

Shadow Flicker Standard or Shadow Flicker Limit: The maximum exposure to shadow flicker allowed at residences near wind turbines.

Noise Terms

Sound: Vibrations conveyed through the air that may be heard.

Noise: Unwanted sound.

Noise Standard or Noise Limit: The maximum volume from wind turbines allowed in an environment. The noise limit may vary based on the time of day, size and number of turbines, and number of nearby residences or educational or work settings. Usually, the noise limit refers to the volume at nearby residences.

Background Noise: Sounds present in the environment on a regular basis. In terms of wind energy, usually refers to the sounds present before wind turbines are installed.

Residence, Dwelling, or Home: A place where people live.

Residential Area: An area with a number of residences, or an area where residences are the main features instead of commercial, service, industrial, or agricultural facilities.

Quiet Area: An area, usually residential or rural, with little existing background noise.

Wind Facility Neighbor or Receiver: Residences or businesses near to wind facilities, often close enough to call for measurement of sound or shadow flicker levels.

Decibel (dB): The unit used to measure the volume or intensity of a sound.

A-weighting or dB(A): A standard measure of sound volume that is widely used internationally, with sounds weighted more or less depending on their frequency. dB(A) is designed to measure how loud sounds appear to the normal human ear and generally weights sounds with higher frequency levels as appearing louder than lower frequency sounds.

C-weighting or dB(C): A standard measure of sound volume, with sounds weighted more or less depending on their frequency. dB(C) uses less weighting than dB(A) for especially lower frequency sounds, which are rated louder in dB(C) than in dB(A). C-weighting is less widely used than dB(A), but is used when there is concern about the amount of lower frequency sounds from equipment or power sources.

Frequency: The number of oscillations per second of sound waves, measured in Hertz (Hz). Humans can normally hear sounds with frequencies ranging from 20-20,000 Hz.

Infrasound: Sounds at frequencies below 20 Hz that humans cannot hear.

Low Frequency Sound: Sounds at frequencies from 20-200 Hz that humans can usually hear.

Modulation: Regular, audible fluctuations in the sound volume.

Tonality: A sound at a specific, discrete frequency rather than a range of frequencies that produces a distinct tone, like a hum.

Impulsiveness: A repeated short sound, such as banging.

Sound Pressure: The difference in the local air pressure caused by a sound wave.

Sound Pressure Level (SPL): The measure of the sound pressure, or the difference in the local air pressure caused by a sound wave, relative to a standardized value at a distance from a source of a sound.

$L_{A90, 10 \text{ min}}$ or L_{A90} : The sound pressure level in dB(A) that is equaled or exceeded for 90% of the time measured, often a 10 minute interval.

$L_{A95, 10 \text{ min}}$ or L_{A95} : The sound pressure level in dB(A) that is equaled or exceeded for 95% of the time measured, often a 10 minute interval.

$L_{A \text{ eq}, 10 \text{ min}}$, $L_{A \text{ eq}}$ or L_{eq} : The average sound level over a period of time in dB(A), or the continuous sound level that would equal the average of multiple sound pressure levels for a fluctuating sound.

$L_{A \text{ max}, 10 \text{ min}}$ or $L_{A \text{ max}}$: The highest sound pressure level in dB(A) that occurs within the time measured, often a 10 minute interval.

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