

## Wind power stations – contra birds & the environment.

Opponents of wind farms raise a number of arguments of their harmfulness, including increasing the mortality of birds and bats. Research on this subject was carried out a few years ago in the USA, where the number of wind turbines is the largest in the world, just behind China. Their results surprised even some ornithologists who turned from opponents of wind farms into their ardent supporters.

Research shows that the biggest bird killers are buildings and their windows, then power lines and... cats.

Wind turbines account for only 0.003% of bird mortality.!

The results of these tests are presented in the diagram below.



Resource: Erickson 2005, Summary of Anthropogenic Causes of Bird Mortality

It should also be taken into account that these studies were carried out over 15 years ago on farms with thousands of close-up small windmills with a tower height of 18 m and a rotor diameter of 18 m, rotating at high speed - up to 60 revolutions per minute. Modern wind based power farms are significantly different from those from years ago and are much more bird-friendly. The wind turbines are separated from each other by about 400 - 1000 m, the turbine towers are 90 - 120 m high and the rotor rotates in them at a maximum speed of 18 revolutions per minute.

In Poland, the foundation of even a single wind turbine requires at least 12 months of ornithological and chiropterological observation, which would assess the nature of the occurrence of bats and rare bird species near the location of the future power plant.

Wind farms are also not set up at bird migration sites, or near water reservoirs where they land. Therefore, it can be concluded that currently constructed wind farms are highly environmentally friendly also in terms of bird and bats safety.

It is undeniable that propeller-type wind farms have increased the real threat to birds and especially bats due to collisions with propellers and negative pressure braids created by moving propellers, resulting in damage to internal organs. The high linear

speed of the propeller tips can result in noise and infrasound.

## **The impact of wind farms on birds and bats - a report by Monitor Leśny 2017.**

The average number of birds killed is 5 to 10 per power plant windmill type and per year. The report was prepared in collaboration with the Swedish Naturvårdsverket (equivalent to GDOS) and the Swedish state energy office, Energimyndigheten, and was developed by scientists from the Swedish University in Lund

### **Noise**

The criterion of the permissible noise level in the environment for protected functions is determined on the basis of the Regulation of the Minister of the Environment of June 14, 2007 on permissible noise levels in the environment (Journal of Laws No. 120 item 826 + appendix). According to all reports, the noise level from large wind farms has not been exceeded.

In the case of a small Urban Wind Power Station (UWPS - [www.urbanwind.pl](http://www.urbanwind.pl)) with a low linear speed of the turbine tips and significantly smaller dimensions, noise may only occur temporarily, e.g. due to damage to e.g. bearings, which usually results in the turbine stopping.

### **Infrasound**

According to the Polish standard PN-86 / N-01338, infrasound is defined as sounds or noise whose frequency spectrum ranges from 2 Hz to 16 Hz. According to ISO 7196, infrasound is a sound or noise whose frequency spectrum ranges from 1 Hz to 20 Hz.

With regard to infrasound of artificial origin, there is a concept of infrasound noise and low-frequency noise, which covers the frequency range from about 10 Hz to 250 Hz.

Infrasound, which is a component of infrasound noise, is perceived in the body through a specific auditory pathway (mainly by the hearing organ). Their audibility depends on the sound pressure level. However, a large individual variability in auditory perception of infrasound was found, especially for the lowest frequencies.

The thresholds of hearing infrasound are the higher, the lower their frequency are, for example: for the frequency of 2 Hz it is approximately 120-140 dB, for the frequency of 6 ÷ 8 Hz it is approximately 100 dB, and for the frequency of 12 ÷ 16 Hz it is approximately 90 dB.

Apart from a specific auditory pathway, infrasound is perceived by vibration sensing receptors. The thresholds of this perception are 20 ÷ 30 dB higher than the hearing thresholds.

When the sound pressure level exceeds 140 dB, infrasound can cause permanent, harmful changes in the body.

Then, the phenomenon of resonance of internal structures and organs of the organism

is possible, subjectively felt from 100 dB as an unpleasant feeling of internal vibration. Apart from pressure in the ears, it is one of the most common symptoms found by people exposed to infrasound.

However, the dominant effect of infrasound on the body is their nuisance, occurring even at slight exceeding of the hearing threshold.

This action is characterized by subjectively defined states of excessive fatigue, discomfort, somnolence, balance disorders, psychomotor disorders and disorders of physiological functions.

Objective confirmation of these states are changes in the central nervous system, characteristic of a decreased state of wakefulness (according to the information on the website of the Central Institute for Labor Protection - [www.ciop.pl](http://www.ciop.pl)).

In the case of propeller high wind turbines, infrasound is generated when the turbine blade is incorrectly profiled and the rotational speed is not selected properly. In the early stages of wind turbine development, they were indeed a nuisance to the neighborhood. However, legal restrictions and rapid development in this field have resulted in the construction of structures that almost do not emit infrasound.

On the basis of numerous studies (Ingielewicz, Zagubień 2004, Leventhall 2005, Rogers 2005, Chouard 2006) it can be concluded that:

- infrasound noise levels measured in the immediate vicinity of propeller wind farms are very low;
- • the level of G sound of infrasound generated by turbines, measured at a distance of 500 m, is practically at the level of the acoustic background and is imperceptible to humans. For example, according to the measurement results (Ingielewicz, Zagubień 2004) for the Jankowice Wielkie WF (in Olszanka and Skarbimierz communes, Opolskie Voivodeship), the G sound level of infrasound generated by turbines together with the acoustic background was in the range of 56.4 dB for 2 Hz to 78, 4 dB for 16Hz, while the G noise level of the background noise after switching off all turbines was 55.8 for 2 Hz to 76.1 dB for 16 Hz;
- • infrasound with a G sound level lower than 90 dB does not cause any proven negative effects on the human body;
- • infrasound with a sound pressure level lower than the above-mentioned hearing thresholds do not cause a hearing sensation and are not perceptible by humans.

To sum up, currently constructed propeller wind based power farms emit infrasound at a very low level, much below the values that may negatively affect human health.

Cylindrical UWPS power plants ([www.urbanwind.pl](http://www.urbanwind.pl)) with dimensions much smaller than the above-mentioned industrial propeller power plants and lower fin tip speeds, therefore, cannot emit infrasound at a level harmful to health.

### **The impact of wind farms and associated infrastructure in terms of electromagnetic radiation emissions.**

In Poland, the matter of permissible levels of electromagnetic fields in the environment and the methods of checking compliance with these levels are regulated by the Regulation of the Minister of the Environment of October 30, 2003 on permissible levels of electromagnetic fields in the environment and methods of checking

compliance with these levels (Journal of Laws No. 192, item 1883) The following limits are given in the regulation:

- missible value of the electric field 50Hz for areas accessible to the public –10kV / m;
  - permissible value of the electric field for areas intended for housing development – 1kV / m;
  - the permissible value of the magnetic field of 50Hz in the environment -60A / m.
- These values are given for a height of 2 m above the ground or other surfaces where people may stay.

In accordance with the Regulation of the Council of Ministers of November 9, 2004 on the determination of types of projects that may have a significant impact on the environment and detailed conditions related to the qualification of projects for the preparation of an environmental impact report (Journal of Laws of 2004, No. 257, item 2573 as amended), MV cable connections (connecting the power plant complex with the transformer station) and the wind farms themselves (generators) are not significant sources of electromagnetic radiation.

**This also applies to the UWPS - small wind based power station.**

## **Impact on the landscape**

Landscape specificity of wind farms

Aesthetic assessments of wind farms are subjective, depending on individual feelings and preferences, and as a result extremely diverse - from negative, due to the nature of large technical structures, alien to the landscape, to positive, with an indication of a refined, simple and modern shape. In fact, it is not important whether they are ugly or pretty, but whether they significantly transform the landscape.

The visual specificity of large, propeller wind farms is that (Przewoźniak 2007):

- these are high objects, up to 200 m in the raised wing condition;
- in training camps, due to the distance between the individual gyms of 300-450 m, they create a landscape barrier at different levels;
- towers are set up in sets according to two basic patterns: -
  - regularly - linearly or in the arrangement of the vertices of triangles, which has the hallmarks of spatial order but strongly geometrizes the landscape;
  - irregularly, in adaptation to the terrain and other conditions, which introduces a physiognomic mess but is closer to the "curve" of nature;
- the propellers are in motion most of the year, which draws attention, catches the eye and can cause a strobe phenomenon;
- rotating rotors may cause light reflections periodically, with a certain position of the sun and the propellers in sunny weather;
- gym structures cast periodically a constant and moving shadow, depending on the height of the Sun

- power plants are not visible at night (except for night obstacle marking - red lamp at the top of the tower).

**But the above-mentioned features do not apply to small, cylindrical UWPS wind based power plants placed also on the roofs of buildings, especially with a height of up to 3 m above the roofs. UWPS power plants, especially in the version closed in the cylinder of diffuser panels, may constitute an attractive element of the urban landscape among, for example, television and relay antennas. Rather, they resemble the outlets of ventilation terminals led out onto roofs.**

In urbanized space around the world, attempts have been made to build wind farms on tall buildings:

Razor Building (Strata bSE1 skyscraper) in London with three 19kW propeller type wind turbines built into the roof structure, Bahrain World Trade Center in Bahrain with three propeller type wind turbines located between the two towers of the skyscraper, and Oklahoma Medical Research Foundation in Oklahoma City, USA with 18 4.5kW propeller type wind turbines each. They were all built with care for the natural environment. Research has shown that both the noise level and other hazards are below the accepted standards and the so-called the wind turbine syndrome does not occur.

The so-called the syndrome of wind turbines may occur in the case of large, propeller wind based farms and not with UWPS turbines (up to 20kW), which can be used in construction and more broadly - in urban areas.

**In the case of Urban Wind Power Station devices, their rotor, i.e. the movable part, is hidden inside the diffuser panels, which creates a compact external housing - visible to birds and bats.**

**Field research - on open golf courses proved that even golfers passing by did not notice UWPS power plant, and field workers saw numerous birds resting on branches close to growing bushes and trees.**

**The outer casing can also be prepared in such a way as to positively fit into the landscape environment.**

**Author: Jerzy Czaplejewicz,**

initiator and coordinator of the construction of a prototype of a small wind farm UWPS - Urban Wind Power Station as part of the LIFE-UrbanWind.PL project ([www.urbanwind.pl](http://www.urbanwind.pl)), N-E-T Expert