Chapter 6

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Environmental and Spatial Effects of Constructing a Wind Power Plant

1. Introduction

The wind power industry is one of the power sectors in which the energy produced is considered to be ecologically clean. Power generation in a wind power plant is not related to the combustion of any fuel and, therefore, no contaminations which could negatively affect the condition of the environment are produced. Many wind parks have been recently constructed in Poland. This results from the fact that Poland, being a member of the European Union, is committed to ensuring natural environment protection and energy security. Consequently, Poland has set targets for the percentage share of renewable energy sources in the total energy balance of the country will at 7.5% in 2010, 14% in 2020 and 20% by 2030.

Discussions concerning wind power plants, as well scientific studies on the results of their construction, both in the aspect of their environmental and spatial impact, as well as their financial and social effects, have been carried out. Establishment of wind farms involves a long-term planning procedure, with potential locations requiring the involvement of many institutions responsible for monitoring and assessing the natural and cultural environment and human health and safety.

The aim of the article is to indicate and to determine environmental and spatial effects (negative and positive) related to the construction of a wind park. The results of the construction are related to, among others, changes in the landscape aesthetics, reduction of a biologically active area, noise emission, optical interference, the impact on fauna within the area of the investment, on underground and surface waters and other effects. The opinions on the impact are largely divided, especially as regards the effect of noise on the environment.

Will people understand and support advantages of constructing and operating wind power plants? Are wind power plants the beginning of a new era – the era of a pro-ecological attitude, independence and self-sufficiency of countries?

In Poland, a significant increase in the number of newly-constructed wind plants has been observed in recent years. They are not only more numerous, but also of a higher technological level. However, due to the complexity of the problem of determining developmental possibilities in using wind power to obtain electricity, it seems justified to apply a comprehensive approach to this issue. However, in Poland, there is no reliable wind atlas prepared for the wind power sector, there is no information or studies concerning the possibilities of connecting wind farm systems to the national electricity transmission system and one can observe a shortage of scientific and research staff in the field of the wind power industry.

However, the production potential of wind power engineering has met with numerous restrictions as to its use – physical, technical and legal. These factors include: low wind speed over a specified area, but also the occurrence of extreme speeds, i.e. very low or very high, the distance from the power distribution system /…/; the presence of various forms of environmental protection; the occurrence of bird migration routes, air corridors used by civil or military aviation, the proximity of houses /…/; the occurrence of other obstacles disturbing the free flow of air /…/ or an alternative use of the area, e.g. for transport infrastructure or industry (Juchnowska, Olech 2006).

The territory of Poland is characterized by very good wind conditions. However, before 2000, wind power was not used on an industrial scale as an energy source. At the beginning of the 21st century the situation changed significantly; from 2000-2010 the number of constructed power plants increased 166 times. An additional factor accelerating the progress in the area of wind power engineering is the membership of Poland in the European Union structures, and EU requirements and directives related to it, such as the issue of the Climate Pact. Poland is one of the European countries with the most attractive, and therefore the most efficient, possibilities of wind power application and location of wind farms. Besides Germany and Spain, it has a chance of becoming a leader in the field of generating wind energy electricity.

On 23 August 2001, the Sejm of the Republic of Poland adopted the most important national document concerning the use of energy from renewable sources, known as "Development Strategy of the Renewable Energy Sector". This document defined the strategic aims to be met, namely, "The strategic aim is to increase the share of energy from renewable resources in the fuel and energy balance of the country to 7.5% in 2010 and to 14% in 2020 in the structure of consumption of primary carriers" (Development strategy of renewable energy sector 2000).

The construction of a wind power plant is a huge and expensive enterprise. Its implementation involves both positive and negative effects, both for people and for the environment. However, despite the high costs of its construction, subsequent operating costs are minimal; therefore, investments of this type have aroused growing interest. The proper location of the investment can bring about significant economic and ecological benefits. The efficiency of wind power plant

largely depends on its proper location. The ideal location is a flat area of uniform roughness, without any field obstacles which could disturb the flow of air masses. Field obstacles cause changes in wind speed and turbulences, which has a negative effect on the construction durability and efficiency. In the case of wind farms, an important element of planning the complex is to properly maintain the distance between individual wind turbines, which involves occupation of large areas by this type of investments.

Advantages of wind power plants include:

- no emission of hazardous chemical compounds to the atmosphere,
- saving fossil fuels, and avoiding expenditures for their mining and transportation,
- no waste produced during electricity production,
- satisfying the growing demand of the economy for electricity,
- the possibility of supplying electricity to remote places,
- stimulating, activating and revitalizing degraded and sparsely populated areas,
- minimum impact on farming areas and the possibility of continuing their previous use,
- no need to construct complicated connections to the network, which significantly reduces transfer losses,
- improvement of energy security of the country (no need for strategic energy resources),
- simplicity of operation and maintenance,
- short time of construction and installation,
- improvement or reaching sustainable development.

Significant disadvantages of wind power plants include:

- efficiency and dependency of electricity generation on the weather (uneven energy supply in time),
- possible emission of waves which can cause interference to radio and television signal reception,
- emission of troublesome noise,
- creation of the so-called shadow flicker effect,
- interference to the natural environment of animals and plants,
- a negative impact on birds,
- occupation of large areas by wind farms,
- a negative impact on natural environment and space,
- high costs of the investment in relation to the power obtained.

The construction of a wind farm is undoubtedly related to the generation of a series of various spatial effects. The impact of a farm is visible not only in the space, but also in the environment, and in view of the fact that consequences of the impact are interrelated and mutually permeate, these should be described as environmental and spatial effects. The uniqueness and limited character of the space forces the user to use it in a way that is proper, efficient, and complies with environmental protection standards. Space management is realized at three levels:

national, regional and local. At each of them, to the same extent, the management should take into consideration the needs of investors, owners and inhabitants; and the investments cannot contribute to deterioration of the landscape and environmental quality. Wind power plants result in strengthening the potential of the space, but they cannot have a negative effect on health and interests of inhabitants in their neighbourhood. The policy followed at the commune level should take into consideration the interests of the investor, but not at the cost of the interests of local communities.

According to Cymerman (2008), the construction of a wind power plant should be treated as a human activity of significant impact, therefore its effects on the area in which it is located is subject to analyses.

2. Environmental and spatial effects of constructing a wind power plant

The effects considered by many researchers in this field as the most significant are presented below.

2.1. Use of space

It is undeniable that farms of wind power plants occupy significant areas. 40-60 m high masts are installed in the first stage of the investment, which is wind measurement in the area of the potential project. Devices equipped with sensors used for measuring wind speed and direction are installed on the masts. The installations remain in the field for at least 12 months.

Exclusion of the area, e.g. from agricultural production, also occurs during implementation of the investment. Areas that are necessary for the construction of technical service roads, vehicle manoeuvre yards, construction of the Main Power Supply Point, earthworks and placement of wiring systems of electrical and telecommunication installations are temporarily occupied.

Another problem concerns location of individual wind turbines. The proper distance between turbines should be maintained, which in order to ensure most favourable operating condition for turbines should be equal to 5-8 rotor diameters. The actual area occupied by wind turbines is the area occupied by foundations, and it usually fits within the limits of a square of a 20-25 m side length. About 500-700 m^3 of concrete and 40-60 tons of steel are used for constructing the foundations.

However, the space occupied by the wind turbine is not only a space in the horizontal, but also in the vertical dimension. The entire structure is 150 m high. A lot of space is occupied by not only by the rotor, usually composed of three blades, the length of which cannot exceed 50 m. This must be accompanied by a tower reaching 100 m, in the form of a steel pipe, with a 20-30 m^2 section topped with a gondola.

Therefore, is seems unquestionable that the construction and operation of a wind farm means a significant interference in space.

2.2. Impact on the landscape

The location of wind farms is related to strong interference in the landscape. Each landscape has its own identity, harmony, charming places and beauty spots. The introduction of dominant features, which wind turbines of significant height – often reaching 150 m certainly are, into the scenery, undoubtedly affects the aesthetics of the landscape, destroying its old identity, and at the same creating a new one. Treating the landscape as a market element can prove very risky, and consequently contributes to the emergence of irreversible changes. Opinions on the impact of wind turbines on the landscape are divided. People directly involved claim that wind turbines are an element enriching the landscape, adding dynamics and dignity, while others say that they do not fit into the landscape, introduce disharmony and spoil it. They treat wind turbines as "electrical trees", a symbol of brutal interference of man into the natural landscape.

The research concerning the impact of the Suwałki Wind Park on the landscape, carried out in 2010 (Radzewicz 2010) found, among others, that:

a) although wind turbines change the landscape, they indirectly protect it. They protect the area against other investments that could have a higher impact on the environment and reduce atmospheric pollution,
b) the inhabitants of the Suwałki region like wind turbines present in the landscape, since they are an interesting example of technical devices,
c) after the operation of the Suwałki Wind Park is completed, all elements will be removed and no signs of them will remain in space,
d) wind turbines give dynamism to the space and the landscape.

Spatial planners should play an important role in locating wind power plants. These are the persons responsible, to the large extent, for maintaining the landscape values of a given area, and of the individual character of the place. Protection of historical urban and spatial layouts requiring scenic protection demands particular attention.

In the era of computerization and informatization, it seems appropriate to prepare photographical visualisation of the wind farm. As part of social consultations, the inhabitants could be presented with the impact of the investment on the landscape from available view points and against the panorama of the locality. While creating the space, one must make people aware about spatial planning, since all changes in the space can have a real impact on the health, life and income of the inhabitants. People have the right to maintain the personal identity of the place in which they live, together with positive elements of the landscape.

2.3. Reduction of biologically active areas

Biologically active areas are reduced mainly in the phase of the wind plant construction. As a result of constructing access roads, Main Power Supply Points, foundations, storing materials and moving earth masses, areas are temporarily

excluded from agricultural production. After the works are completed, the area is cleaned and returned to the owner. For the period of the power plant operation, the area under the Main Power Supply, under foundations of wind turbines as well as some access roads is excluded from agricultural use.

During the operation, the surface occupied for wind turbines and for supporting infrastructure is small; however, it is excluded for a long term, often 25-30 years. The land within the impact zone of the wind park is suitable for farming use.

After the period of operation, the wind turbine is dismantled, the foundations are removed and their place is filled up with an appropriate layer of humus. The area can be used again for plant cultivation and for animal breeding. The biologically active area remains the same as before the investment.

2.4. Noise emitted by the rotor

It is an undeniable fact that during the operation of the wind turbine, the rotor blades produce a noise. The level and propagation of the noise depends in the height of the tower, the type of device, coverage of the area surface of with plants, natural field obstacles which absorb the noise, wind speed and direction, propagation of sound waves in the air and the method of the turbine arrangement. The noise produced fits within the ranges of audible noises and noises of low frequency. American scientists (e.g. Oguz A. Soysal, PhD), measured the level of audible noise within 750 m of the wind farm made of 20 wind turbines. The research indicated that the level of audible noise (weighted type A) ranged from 50 to 60 dB, while the audible noise and low-frequency noise (type C) from 65 to 70 dB. To compare, the noise level of 65-70 dB is the noise level of a hair dryer or a washing machine. In Poland, the acceptable level of noise in the environment is specified in the Regulation of the Minister of Environment (Dz. U. No. 120, item 826 of 2007), and for homestead development area, it ranges from 45 to 60 dB, depending on the source of noise and the time of the day.

Wind turbines produce a noise with a particular rumbling and pulsating nature. The noise is heard mainly at night, when it spreads to high distances in the stable atmosphere. It was proven that in a flat or slightly hilly area, it can be heard within 2,000 m.

According to a publication in the scientific magazine, Journal of Anxiety Disorders (Balaban, Thayer 2001), such symptoms as headaches and vertigos, anxiety, depression, sickness frequently occur in people living in the neighbourhood of the installation. These are typical neurological symptoms caused by the influence of the audible noise of low frequency on the human body.

The authors of the publication entitled "Tinnitus and vertigo in healthy senior citizens without a history of noise exposure" demonstrated that elderly persons living in the neighbourhood of wind turbines suffer from sleeping problems and balance disturbances. The authors documented that in the group of healthy people aged 57 to 91, 29% suffered from disorders caused by wind turbine operation (Sataloff 1987).

In the context of the research into the negative effects of wind turbines on the health of persons living in the neighbourhood of wind farms, the following questions should be posed:

- Whose interests does it serve to expose the inhabitants of such areas to the permanent risk of falling ill with chronic diseases?
- Why does the commune not respect basic rights of the inhabitants which include health protection, although they pay taxes to the commune?

It cannot be the case that the investor and the commune would make money, consciously exposing the inhabitants to health damage. Certain instruments should be established, requiring the investor to create a reserve fund before the construction permits are issued. The means reserved on such a fund would ensure liquidation of the wind farm (removal of turbines, towers and underground foundations made of reinforced concrete) and restoring the initial status of the area (from before the investment). Additionally, the fund would have to ensure means for compensation for the inhabitants for the loss of health, loss of property value and life quality in the neighbourhood of the wind farm, provided that such losses are established (Pierpont 2008).

Based on the research of American specialists, licensed by the Institute of Noise Control Engineering, the location of a wind farm should be in such relation to the neighbouring housing development, that the noise in the nearest house should not exceed 5 dB above the level which existed in this locality before launching turbines (Kampeman, James 2008). In his studies, Kampeman pays a specific attention to the turbine arrangement. It is particularly disadvantageous for inhabitants to place the turbines in a row, along a single line. Such a layout makes the turbines a linear source of noise, acoustically burdening the inhabitants living even at a significant distance from the source. Doubling the distance between the housing development and the turbines results in noise reduction by 3 dB, while for one turbine, it is a reduction by 6 dB.

At a distance from the wind farm, the inhabitants do not hear individual turbines, but from 3 to 4 km, they can hear, every second, the thudding of varied characteristics, caused by the change of the phases between the turbines and by changes of the sound speed on the way between the turbine and the flat (Kampeman, James 2008).

There are also studies and opinions which do not confirm a negative effect of the emitted noise on human health. A negative effect of wind power plants on health and well-being of people is in many cases is caused by the so-called nocebo effect (the opposite to the placebo effect). The feeling of anxiety, depression, insomnia, headaches, nausea, or problems with concentration are symptoms commonly observed in each person, and there is no evidence that the frequency of their occurrence clearly grows among persons living in the vicinity of wind farms (causing the so-called "wind turbine syndrome"). The nocebo effect links the occurrence of this type of symptoms not to the potential sources of feeling of such discomfort (in this case a wind farm), but to a negative attitude towards it and the lack of acceptance of its presence (Colby *et al.* 2009).

The reception of the noise depends on what we think about its source – a negative attitude to the noise source makes us more "exposed" to its effects (Noble Environmental Power).

On the other hand, Leventhall (2004) claims that a very low level of the noise of low frequencies and infrasounds is not a cause of health problems. If such problems really emerge, they rather do not result from the noise itself, but most probably from the emotional state of the given person (e.g. if such a person was stressed and anxious even before the wind farm was constructed).

As also follows from the foreign research, persons living nearer turbines, but deriving economic benefits of the wind farm located in their neighbourhood, did not complain about inconveniences.

As regards the impact of noise or infrasounds on human health, most researchers agree that there is no evidence proving that wind power plants have a negative effect on health or well-being. The noise which can be generated during the turbine operation should be thoroughly analysed at the stage of planning and designing a wind farm, while the acceptable noise levels precisely specified in legal regulations are intended to protect the inhabitants of the adjacent areas against any excessive volume.

2.5. The stroboscopic effect and the shadow flicker effect

The stroboscope effect, which consists in reflection of sun rays in the surface of rotor blades, has been practically completely eliminated. This was achieved by matting the surfaces or covering them with special paints that reduce the risk of light reflection, or totally eliminate it.

The shadow flicker effect is related to the situation when turning rotor blades cast a shadow over the surrounding area. This is particularly visible in the morning and afternoon hours, and in the winter period, when the sun is low over the horizon behind the turbine. Then shadows cast by rotor blades are significantly lengthened. A rotor moving at the speed of 50 revolutions per minute can evoke an effect that is bothersome for people. However, the rotation speed for modern rotors is 12-20 revolutions per minute. The intensity of the phenomenon depends on many factors, such as the height of the tower and the diameter of the rotor, the distance from the wind turbine, the season of the year, clouds, the presence of trees between the turbine and the "observer", lighting inside the building and orientation of windows.

2.6. Ice throw risk

Unfavourable weather conditions, mainly in autumn and winter, can result in icing of the rotor blades. As a result of the centrifugal force, pieces of ice can detach from the surface of the blades and can be thrown 200-300 m away. The risk of being hurt is minimised at the distance of 300-500 m. Modern blade constructions do not allow ice setting; therefore this phenomenon has been almost completely eliminated.

2.7. Interference to radio and television signal

Wind turbines, like chimneys or telecommunication masts, belong to the group of high buildings. Buildings of this type can contribute to interference in the reception of electromagnetic signals, used in telecommunication, radar equipment, navigation and radio and television devices. In the case of wind power plants, the elements causing the interference include: the generator, revolving rotor blades and the tower. The gondola of the generator can be covered with insulation, thus limiting the effect of the generator on propagation of electromagnetic waves. A modern rotor with blades made of synthetic material instead of metal ones generally does not affect mobile communication transmitters. In the case of radio and television waves, the problem with reception of proper quality waves can appear in some households, located in a short distance from the wind farm.

If the signal is transmitted by satellite, then the wind farm has no significant effect on reception interference. Wind farms functioning in the Western Europe countries have not had any problems related to the reception of radio and television waves (Environmental Impact Report, Gołdap).

2.8. Electromagnetic field emission

Wind power plants, just like any other electric devices, produce an electric and magnetic field. The devices that generate electromagnetic waves (the generator and the transformer) are placed in a shielded gondola of the rotor.

Acceptable values of physical parameters of electromagnetic fields are specified in the Regulation of the Minister of Environment of 30 October 2003, on maximum admissible levels of electromagnetic fields in the environment and methods of checking adherence to these levels (Dz. U. No. 192, item 1883). Pursuant to the provisions set forth in the Regulation, acceptable levels of electromagnetic fields for areas intended for housing development, for the frequency range of the electromagnetic field equal to 50 Hz, are: 1 kV/m for the electrical component and 60 A/m for the magnetic component. The research demonstrated that in case of a wind power plant, the resulting intensity of the electrical field 1.8 m above the ground level is about 9 V/m, and the resulting magnetic field about 4.5 A/m. Those values are much lower than the values specified in the Regulation and even lower than conditions occurring naturally (120 V/m at normal weather, 16-56 A/m). Therefore, it can be claimed, on the basis of the research carried out so far, that wind power plants do not have a negative effect on human health through electromagnetic field emissions.

2.9. The impact of wind turbines on birds

The range of a direct impact on wind turbines on the environment is assessed to be about 2 km (Ludowicz 2010).

It is unquestionable that wind turbines have a negative effect on birds. They force birds to change the route of their flight and to leave their previous feeding grounds, habitats and breeding areas.

This is confirmed by Robert Kamieniarz, PhD, from the University of Life Sciences in Poznań, who conducts research on the black grouse. In Austria, tooting of this bird ended after a wind turbine was erected in the neighbourhood. This has been confirmed by the research carried out e.g. in Denmark and Austria by other scientists (Ludowicz, 2010).

To determine the effect of wind farm on birds, a document entitled "Guidelines on the impact assessment of the wind power plants on birds" (PSEW 2008) has been issued. This study should be treated as recommendations suggested by specific professional groups, environmental protection institutions and industry organizations. This is a set of good practices, providing the persons assessing the impact of wind farms on birds with high certainty that the application of rules specified in this document has been accepted by a wider group of experts, and therefore it is possible to achieve better results for the planned investment, taking care, at the same time, about the environment in its vicinity.

It is highly important to properly choose the location of the wind farm in relation to the routes of bird flight, particularly near water courses and within a few kilometres from them, and arrangement of wind turbines in relation to each other. A wind park is a large obstacle of significant height, which birds can omit without major problems. Threat to birds emerges during night flights or in limited visibility conditions, such as fog. A risk can result from locating wind turbines within the feeding or nesting grounds of birds. An unsuitable location can cause losses in avifauna and affect the reduction of breeding possibilities, which consequently can result in reduction of the survival rate of some species.

In spite of many state-of-art research studies out all over the world, no universal models have been developed, by means of which the mortality rate resulting from collisions with wind turbines could be assessed.

2.10. The impact on bats

A negative impact of wind power plants on bats is unquestionable. The research carried out in many countries demonstrates that losses in the population of bats caused as a result of collisions with wind turbines can be significant. The highest number of collisions with fatal results are recorded in July, August and at the beginning of September, and the lowest in March and May. Young bats most often fall victims to collisions. Places of the highest risk of collision are located near forests and in areas densely covered with trees, while no such cases have been recorded under installations in the open area.

Bats are not able to determine the dimensions of the rotor or its speed using their echo-location system. It was found that the risk of impact increases with the use of rotor blades with diameters exceeding 80 m, and the distance between the rotor and the ground surface lower than 30 m. The number of collisions also depends on the wind speed.

In their research, Bach and Rehmel (2006) prove that bats avoid certain fragments of space due to the movement of the rotor and turbulences. Thus, certain "partial surfaces" are created, on which bats do not hunt.

In spite of advanced research work concerning the issue of bat collisions with wind turbines, no forecast concerning the actual fatality rate of bats near investments of this type has been prepared so far. However, it should be assumed that on the areas where those mammals are highly active, the risk of fatal collisions with turbines will occur.

2.11. The impact on the climate and microclimate

The research carried so far on the existing wind farms clearly shows that they have no effect on the climate and microclimate.

The operation of a wind power plant does not affect the elements of the climate (Environmental Impact Report, Brodnica).

Purely theoretical studies carried out in 2004 by researchers from the Maryland University in the USA (Barrie, Kirk-Davidoff 2007) prove that 10% coverage of the Earth's surface with wind farms could result in cooling of the climate in the polar areas and warming in the so-called moderate zones. They also observed that a wind park of the size equal to a half of the area of the USA would result in slowing down the speed of the air masses by 3 m/s, which in effect will contribute to the occurrence of waves of characteristics different from other air masses, and will evoke, a few days later, changes in atmospheric conditions in areas situated a few hundred kilometres from the farm.

2.12. The effect on underground and surface waters

Wind power turbines can affect underground and surface waters mainly due to the construction of massive foundations of the tower. The foundations often reach 3-4 m inside the ground and can collide with the first water-bearing stratum. It also restricts infiltration of rainwater to the ground. Therefore it is necessary to carry out geo-engineering and hydro-geological studies to choose the best place for foundations. In particular cases, drainage of earthworks is required.

During the operation, there is a risk of a leak of significant amounts of oil or grease over the external area of the foundations, from where those substances can be washed with the rain into the soil.

No technological sewage is created during the operation of the wind park.

During the use of the wind turbine, its technical condition is monitored by specialised service companies.

2.13. The effect on the Natura 2000 areas

Natura 2000 is the ecological network covering the entire European Union, including almost 26,000 habitats in 27 states. The aim of creating the Natura 2000 protected areas is to protect places of high biological diversity, using them in a sustained way and ensuring the survival of the most valuable and threatened habitats. This means that the economic development should be carried out in an environmentally-friendly way.

Janez Potočnik, the EU Commissioner for Environment, said: "*These new guidelines will give Member States and industry clarity regarding the undertaking of wind energy development activities in accordance with Natura 2000 requirements. There is no change of legislation or policy, but merely guidance on existing law. Our aim is to ensure that renewable energy targets are met while fully respecting EU law on species protection"* (EC Press Release IP/10/1450, 2010).

In Poland, at the stage of wind farm planning, it is necessary to prepare special documentation referred to as an environmental impact assessment. It contains, among others, a specific description of the environmental condition, description of individual variants with justification for the choice of the variant applied, the assessment of the effects of the planned investment and the proposal of solutions aimed at protection of habitats and species, for which the area covered by the programme has been determined.

Improperly located and designed wind power plants could have a negative effect on specific species and habitats; therefore it is very important to ensure an individual attitude to the Natura 2000 protected areas by preparing objective expert analyses and the development of natural protection plans.

3. Summary

The construction and operation of wind power plants is undoubtedly a huge interference in the natural environment. Therefore, it seems very important to apply a multi-aspect, interdisciplinary and reliable assessment of the impact of the investment on the environment, landscape and space. In view of the fact that the wind power sector is a relatively new branch of human activity, the knowledge on its effects on the environment is limited. Despite advanced research carried out in various parts of the world, it is difficult to develop universal models concerning specific issues or methods of solving them. At many research levels, the scientists are unanimous, but there still remain multiple areas in which opinions are divided. Many negative aspects of a wind power plant could be removed by developing and applying new technologies and planning concepts. Nevertheless, the problems related to each newly-constructed wind farm should be approached in an individual manner, bearing in mind the well-being of inhabitants, the environment and the limited space available.

Due to the complexity of the problem, this article only highlights the most important effects related to the construction of a wind farm. Improperly situated wind power plants can significantly contribute to degradation of the environment.

Do negative effects of constructing wind power plant prevail over the positive ones? Is the landscape without wind turbines more important than the "clean Earth"? What is the real effect of infrasounds originating from wind turbines on the human health? How to optimally use space? The answer to these and to other questions should also be addressed in the future.

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