



## THE INFLUENCE OF WIND POWER PLANT ON ENVIROMENT IN THE CZECH REPUBLIC

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### ABSTRACT

*The wing power used for power generation is a still a new technology especially in the Czech Republic. But this kind of power has today the highest potential from all renewable sources for power generation.*

### 1. INTRODUCTION

Wind energy same all other kinds of energy has negative impact on our environment. If we confront the generation of electrical energy by the means of wind power plant with the generation of non renewable sources, the wind power has minimal negative impacts. At the state level we can consider as a benefit, that the wind power plant has small emission of polluting matter (NOX, SO<sub>2</sub>, dust) and also small emission of greenhouse gas (CO<sub>2</sub>), last but not least it also gives opportunity to new kind of business.

New wind power plants have positive impact on fulfilling our agreement, that in the year 2010 we will have as a republic 8% of raw energy generated by renewable sources.

### 2. WIND POWER ENGINEERING IN THE CZECH REPUBLIC

In past ten years there was increased demand for wind power plants (WPP). The number of WPP grown five times in last five years and total installed capacity is grown nine times. Even after this rapid growth the capacity in MW is still far beyond other countries in middle Europe. According to the studies the total installed capacity in the year 2010 could be 400 MW and the annual generation could be about 615 GWh. There is expected growth in years 2012-1018, where could be the installed capacity about 800 - 900 MW and annual production about 1400 - 1700 GWh.

Without any doubts the highest rate in power generation in the Czech Republic have wind power plants in Ústecký region, which have about 58 % of the installed capacity in the whole Czech Republic. In the Czech Republic there is about 50 wind power plants with out put over kilowatts. The biggest wind park is Kryštofovy Hamry in Ústecký region, where the electricity is produced by 21 vanes with total output of 42 MW. In last year of field tests this park has generated about 94 GWh of electrical energy.

Location of individual wind power plants are in Picture 1. The overview of power plants with output higher than 100 kW is in Table 1.

- WPP in operation
- WPP out of order
- WPP with output under 100 kW



Picture 1 – Location of wind power plants in the Czech Republic

Power plants with output higher than 100 kW				
Location	Type of VE	Number of turbine	Output over 60kW	Year of construction
Mladoňov	Vítkovice VE 315-1,2	1	315 kW	1993 - 1995
Mravenečník	W-2500, EWT 315, EWT 630	3	630 kW	1993 - 1996
Poutní vrch Svätý Hostýn	Vestas V27	1	225 kW	1994
Velká Kraš	V29	1	225 kW	1994
Ostružná	Vestas V39	6	6 x 500 kW	1994
Boží Dar- Neklíd	EWT 315	1	315 kW	2001
Protivanov I	FL 100	1	100 kW	2002
Protivanov II	MD77	2	2 x 1,5 MW	2006
Jindřichovice pod Smrkem	ENERCON E - 40	2	2 x 600 kW	2003
Nová Ves v Horách	MD 77	2	2 x 1,5 MW	2003 - 2004
Loučná	DeWind D4	3	3 x 600 kW	2004
Lysý vrch	Tacke TW 500	5	5 x 500 kW	2005
Potštát	Bonus	2	2 x 150 kW	2005
Břežany - Lopatov	Vestas V52	5	5 x 850 kW	2006
Hraničné Petrovice	Vestas V52	1	850 kW	2005
Hraničné Petrovice II	Nordex N54	2	851 kW	2006
Petrovice - Tisá	ENERCON E - 70	2	2 x 2 MW	
Pavlov	Vestas V90 - V52	4	2 x 2 MW, 2 x 850 kW	2006

Čížebná - Nový Kostel	Vítkovice VE 315, Tacke TW 500	1 + 3	1 x 315 kW, 3 x 510 kW	2004/ 2006
Podmílešská výšina- Rusová	Nordex N80	3	3 x 2,5 MW	2006
Drahany	V90	1	2 MW	2006
Větrný park Oderské vrchy - Veselí - Odry	Vestas V90	2	2 x 2 MW	2006
Anenská Studánka	FL 250	2	2 x 250 kW	2006
Anenská Studánka 2	DeWind D6	4	4 x 1250 kW	2007
Pohledy u Svitav	FL 250	1	250 kW	2004
Gruna - Žipotín	De Wind D4	2	600 kW	2006
Horní Guntramovice	ENERCON E - 70	1	2,0 MW	2007
Nové Město - Vrch Tří pánů - Bouřňák	ENERCON E - 70	3	3 x 2 MW	2006
Boží Dar - Neklid	ENERCON E - 33	3	3 x 330 kW	2006
Kámen	Vestas V90	1	2 MW	2007
Měděnec - Mědník - Kryštofovy Hamry	ENERCON E - 70	21	21 x 2 MW	2007
Pchery	WWD-3	2	2 x 3MW	2007
Maletín	Vestas V90	1	2 MW	2008
Lipná	Vestas V90	1	2 MW	2008
Bantice	Vestas V90	1 (6)	1 (6) x 2 MW	2008
Nová Ves - Hora Svatého Šebestiána	Enercon E-40	3	2 x 600 kW, 1 x 1,8 MW	2008

Table 1 – Power plants with output higher than 100 kW in the Czech Republic

### 3. Examination of WPP influence on environment

If we want to do the examination of WPP influence, we must consider following factors:

- noise caused by WPP,
- influence of WPP build up in the view of landscape,
- influence of WPP on fauna, flora and ecosystems,
- influence of WPP on radiofrequency and TV signal,
- influence on soil, surface and subterranean water,
- influence of WPP on pollution production,
- other influences.

#### 3.1 Noise caused by WPP

Acoustic emission of WPP is under great surveillance. When the WPP is in operation there are two kinds of noise. First of all it is a mechanical noise, which is caused by engine (generator including van, gear unit, steering mechanism). In connection with construction design the noise should be diminished near future. But nowadays we must still count with it. The other noise is aerodynamic noise caused by the interaction of agitated air and surface of blade and liberation of whirlwind over the edge of a blade. This kind of noise is derogated by the modern design of blades and by the type of rotor.

Government order Nr. 502/2000 Sb. about health protection from adverse reaction of noise and vibration sets the highest allowable level of acoustic pressure in exterior area for the day (6–22 o'clock) 50 dB and for night 40 dB.

In context of noise it is not recommended to put the WPP nearer than 200 m from the closest building. When it s a farm of WPP the zone of noise protection should be at least 300 – 400 m.

### **3.2 *Influence of WPP build up in relation to landscape***

When the WPP is built there are laws that must be expected. One of these laws is Nature security law Nr. 114/92 Sb. there is written that in national parks, wilderness areas, and protected landscape areas of first zone and in the proximity of national monuments there is not allowed to build. But in coincidence these areas have a great wind potential (about 60-70%).

Common disputed point is the visual character of landscape. There is something true – as in all matters of technical building. The aesthetics is an individual perception. Nevertheless there are examples from other countries, where people got used to WPP in their proximity.

### **3.3 *Influence of WPP on fauna, flora and ecosystems***

Several researches at the area of wind park have proven, that the WPP don't influence or violate birds or animals. There are also new findings that suggest that animals banished from the area of WPP have adapted and came back.

By careful location plan we can decrease the impacts of WPP on environment of birds and animals. In areas of nature protection (protected landscape areas) and areas of birds protection there is no build up.

Build up of WPP are in most of the cases situated out of structural parts of territorial system of ecological stability, out of higher ecological stability areas, or more precisely out of areas where are ecosystems like in nature. Also the impact on extraordinarily protected areas and on biotopes with protected animals is minimal. In order to avoid negative impacts on flora and fauna it is best to work out a biological evaluation of intended areas.

### **3.4 *Influence of WPP on radiofrequency and TV signal***

On principle there could be an interference caused by reflection effect, dispersion and diffraction of electromagnetic wave. Research showed that the interference between the WPP and source of signal is significantly lowers that interference beyond the WPP from the point of view of the source. The number of interference is dependent on technical parameters of the WPP (rotor proportion, the design and geometry of blades, the rotation speed).

This issue could appear if the WPP would be built in the proximity of transmitter. The general operation of radiofrequency and TV signal is not hampered as well as a GSM network for cell phones.

### **3.5 *Influence on soil, surface and subterranean water***

The influence on surface and subterranean water isn't expected but it is important to observe all precautions. But we must see to it, that during the build up of infrastructure and the WPP we won't damage of influence drainage and therefore there won't be any erosion. We must also limit a contamination and choke of soil into river channel during the build up.

### **3.6 *Influence of WPP on pollution production***

If we deal with the amount of waste products created from generating of kWh from coal, then according to aboard journals if we generate this 1kWh in WPP we will decrease the emission of CO<sub>2</sub> on 750 g to 1250 g, NO<sub>X</sub> on 3 to 6 g, SO<sub>2</sub> on 5 to 8 g and dust and ash on 40 to 70 g. we must point out, that the data differs author to author. We can say, that if we build up more WPP in the Czech Republic we would significantly help the atmosphere. For example if we build 150 WPP with total output 300 MW in Krusné mountains, the emission and pollution would be decreased for over 3600 t NO<sub>X</sub>, 750 000 t CO<sub>2</sub>, 420 000 t dust particles and 42 000 t scoria and ash.

### **3.7 Other influences**

In the winter time there could be a situation when an ice is flying from the blades. In design of new WPP it was taken into consideration and these WPP will have a sensor, that will alert the operator. There are also some different ways how to abolish this issue (such as warming out the blade).

During sunny days there were light glimpe on the blades. These glimpe were only rare and hardly recognizable. This was caused by surface of blades, which was solved by putting the flat paint on blades.

## **4. Conclusion**

The development of wind power engineering in the Czech Republic depends on the level of wind potential and also on political force and will to encourage this development. The political will is not only the obligatory buy-out of wind energy but also a price fixing for at least 15 years or other legislature means that take into consideration the preparation and realization of individual projects. It is for example to set the energetic supply of wind energy by the means and methods on the highest level of expertise with aboard experience, evaluation of WPP impact on environment and others.

One of the most important parameter in WPP evaluation is the ratio of energy given on generation and maintaining the power and the energy that a device is able to produce. If we have the newest design WPP and enough wind power, this ratio would be leveled in one or two years. In next years this WPP would generate 20 times more energy than it was necessary for build up.

And last but certainly not least there are climatic changes which are one of the greatest threads. It is mainly caused by CO<sub>2</sub> and other greenhouse gases, which are produced during the combustion of fossil fuels. The main part of primary need fall on the petroleum and gas, but the supply can be diminished in next few decades. At the same time the need for electrical energy grows. From this point of view we must reengineer our power system so it will serve next generation. One of the most important things is energy saving and effective using.

Other possibility is to use more of renewable sources such as biomass, wind and water energy, solar energy and geothermal energy. Wind energy has so far the highest potential for generation of ecological energy. If we use wind as a “fuel” there are no pollutions or waste. The energy consumed on the building the WPP will redeem and the final disassembly is part of the building license and funding.

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