POSSIBILITIES OF WIND ENERGY USAGE IN THE CENTRAL TRANSDANUBIAN REGION

Béla Munkácsy
Ph.D. of earth sciences
Eötvös Loránd University, Faculty of Science

POSSIBILITIES OF WIND ENERGY APPLICATIONS IN THE CENTRAL TRANSDANUBIAN REGION

Among the renewable resources wind energy was the first in Hungary that initiated intense discussion and brought the mistakes and insufficiency of Hungarian regulation and strategic planning to the surface. In this article we examined the possibilities that wind energy offers for the Central Transdanubian Region, also we compared its current situation and possible ways of development until 2010 to Hungarian and international trends. The examinaton covered the effects of the above mentioned planning problems on Hungarian wind energy sector. Instead of focusing on solely scientific aspects our main motivation was to draw attention, give information and deepen the knowledge of decision makers and energy experts. The special toolkit of geography can open new perspectives for Hungarian regional development and energy planning.

ANSWERS OF WIND ENERGY TO ENERGY MANAGEMENT'S CHALLENGES

It sounds a bit strange but the production of power and heat are among the most polluting activities of mankind. There are several problems with the extraction of energy resources just as with the phases of processing or transportation. So, the pollution of the power and heat generation itself is just only the tip of the iceberg. Unfortunately these deficiencies are generally missing from the considerations of our decision makers. Therefore the technologies which based on fossil and nuclear fuels work with enormous amount of external costs. What is more they derive benefits from significant state subsidies. The result is that the energy is a relatively cheap resource today therefore its usage is prodigal and unadvised. In consequence of the inadequate energy applications the signs of global ecological crisis have appeared. We do not have other possibility just the change of paradigm in energy management. Its basic elements are the energy saving, the high energy efficiency and the intensive usage of renewable energy sources such as wind energy.

Although the power generation technology which is based on the utilization of kinetic energy of wind appeared in 1887, this method was able to achieve a significant role in the end of the 20th century. Its importance in several geographical region is the same as the significance of fossil and nuclear fuels. The total wind energy capacity was 74 223 MW in december of 2006. 69,3% of this turbine capacity was established in Europe. The total growing rate was 25% in 2006 and this rapid expansion has been taking place for 10 years (Cameron, A. 2007). The significance of wind energy is depend on the responsiveness and consciousness of politics. This is the reason that some places with moderate wind climate the share of wind energy in the net energy consumption can be 20-40% (Denmark – 25% [Jones, J. 2004]; Saxony-Anhalt – 37,5%; Schleswig-Holstein – 34,9% [Ender, C. 2007]).

WIND ENERGY IN HUNGARY

In spite of the extremely fast growing of the last three years Hungary is in the rearguard in the field of renewable energy installation among EU member states. In December 2005 the wind energy capacity was 17,25 MW (MEH 2006), in September 2006. it was 36,3 MW (Bíróné Kircsi A. 2006), while in September 2007 the capacity reached 63,3 MW (MSZET 2007). These figures show just the nominal capacity, but under the Hungarian wind climate the efficiency can be just around 20-24%. It means that if we make a comparison these wind turbines have similar capacity as a coal fuelled power station with 12-15 MW. Its share reaches just some ‰ in our power generation. Therefore the concern of system operators for system reliability seems to be unfounded, since this rate can be 80% at night in Denmark (Jensen, J. K. 2002), but the power system can work normally. According to engineers of the Hungarian Energy Agency our power system can receive 330 MW wind turbine capacity until 2010 (MEH 2006), which is similar to a 65-80 MW regular power station capacity (this also means that the turbines' power generation can be 250-300 MW and 0 MW as well). A study of the Ministry of Economy and Transport declares that wind turbines need to produce 1110 GWh/year electricity until 2025 (Giber, J. et al. 2005). This amount of power can be reached with 520-530 MW wind turbine capacity, in other words their plan consists of around 200 MW more wind power development in this period.

In the near future the modern renewable energy sources are not going to reach considerable rate in energy production in Hungary. According to the Kyoto Protocol their share should be just 3,6% in Hungary until 2010. In the opinion of Ministry of Economy and Transport our purpose can be 7,2% until 2025 (Giber, J. et al. 2005). This rate is not enough is we consider the challenges of global climate change and biodegradation. In the next chapters we examine the possibilities of the more intensive use of wind energy.

WIND ENERGY APPLICATIONS IN THE CENTRAL TRANSDANUBIAN REGION

The Central Transdanubian Region is very interesting from the wind energy's point of view as our first wind turbines were erected in this area. (Inota 250 kW [2000-ben], Kulcs 600 kW [2001-ben]). This is the region of Hungary where the first multi-megawatt wind turbines have appeared. (Szápár - 1800 kW [2005-ben]; Csetény – 2x2000 kW [2006-ban]). And with these four projects we completed the list of wind turbines in the Central Transdanubian Region. Its wind power capacity was 6650 kW on 31 July 2007. (MSZET 2007), which is one tenth of the whole in Hungary.

As for the development of the next years the permissions of the Hungarian Energy Agency enable the appearance of wind turbines in Komárom-Esztergom County and their capacity can reach 102,5 MW until 2010. This capacity is equivalent with 30% of the whole, and this county can be the second most important in Hungary in this field.

Table 1.

Proposed wind turbine capacity until 2010
according to permissions of Hungarian Energy Agency

Project area	**Nominal capacity (MW)**
Nagyigmánd	36,0
Kisigmánd 1	48,0
Kisigmánd 2	2,0
Bábolna	15,0
Ács	1,5

Komárom-Esztergom County	**102,5**
Bakonycsernye	1,8
Csősz	0,8
Fejér County	**2,6**
Dáka	0,8
Zirc-Olaszfalu	25
Pápakovácsi	1,8
Veszprém County	**27,7**
Together	**132,8**

As for the long term planning the counties do not have strategies. Unfortunately none of the counties have energy management programs and neither their land use plans contains any information about renewable energy sources. The counties' environmental programs do not contain sufficient information about renewables. The most detailed one is the environmental program of Veszprém County in which 3 paragraphs deal with wind energy. Unfortunately there is just one paragraph which puts objects: *„According to a detailed research there is a 20 km^2 area around Bakonynána, Dudar, Olaszfalu and Nagyesztergár which seems proper for a large wind energy park. In this area 38 Vestas type wind turbines 3 MW respectively with 100 metres mast height and 50 metres long rotor blades. The nominal capacity of the wind park is going to be 114 MW… The authorization process of the wind park is in progress and the construction phase is going to start in the end of 2007."* As the Table 1. shows these ideas do not fit to the strategy of Hungarian Energy Agency. Instead of the 114 MW project the Agency gave permission just for a 25 MW wind park in this area.

The environmental program of Komárom-Esztergom County deals with wind turbines just in two sentences, but does not contains concrete plans. Fejér County does not have an environmental program at all.

Wind energy potentials of the research area

Before any kind of planning project it is crucial to get information about possibilities. Its first step must be the surveying of **technical wind energy potential**. Our examination has been accomplished only for one of the three counties, Komárom-Esztergom. The results were extrapolated to the whole region.

In the first step we had to determine the possible areas for wind energy projects. In this work we used such documents as the commitment of the Ministry of Environment and Water (KvVM-TVH, 2005) and we applied GIS softvers as ArcView 3.2. We used a 1:50000 scale map to locate the elements of the infrastructure (as roads, railways, airports) and other limitation objects (as the protected natural areas in national and international level, the protected landscape areas, the Environmentally Sensitive Areas, forests, water bodies and settlements). In the next step, due to the GIS application, we could easily outline buffer zones. Finally we summed all these forbidden areas. After this phase we found that the possible areas for wind energy projects is 241,4 km^2 in Komárom-Esztergom County. This area is almost 10,7% of the whole territory of the county.

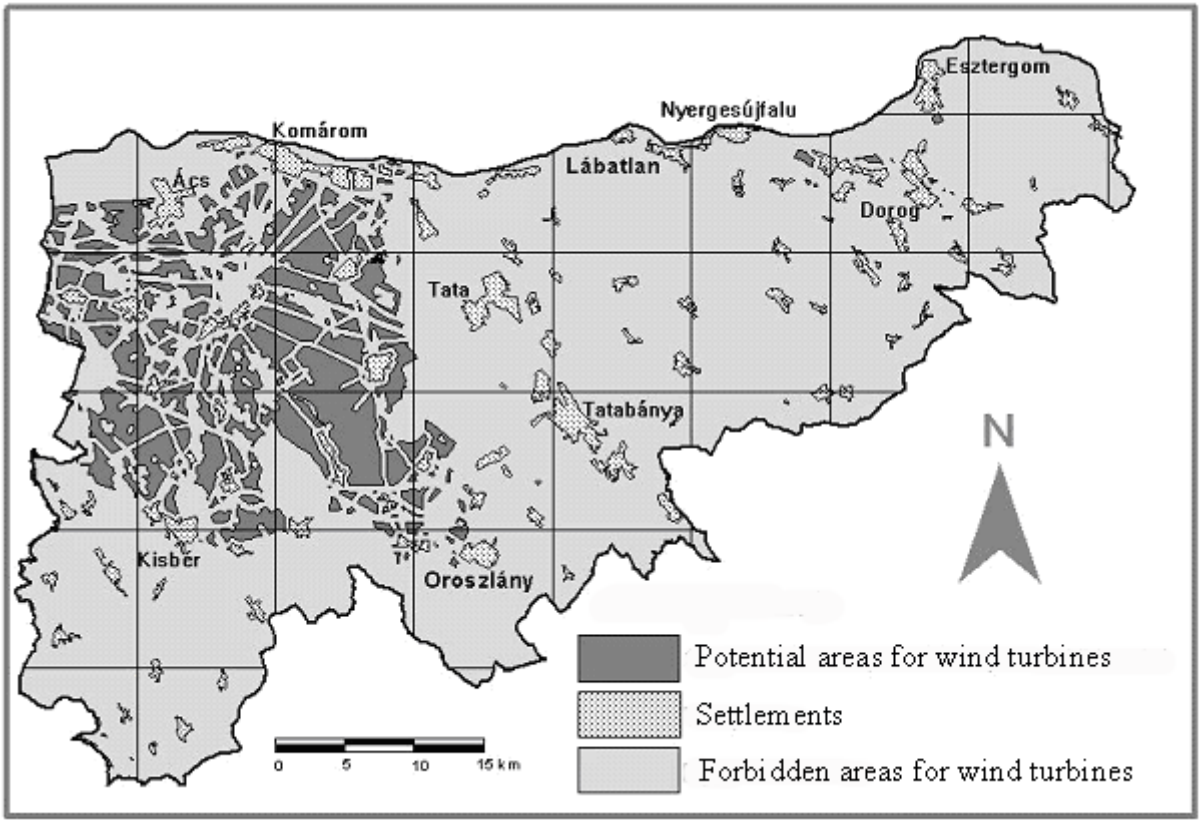

Figure 1. Potential and forbidden areas for wind energy projects
in Komárom-Esztergom County.

The other factor is the theoretically maximum capacity of a unit area (in this case it was 1 km^2). To determine this figure, we reviewed the special literature and found that there are big differences in this field between 3 and 20 MW/km^2. If we use an average value (6-7 MW/km^2) and multiply it by the possible area (241,4 km^2), we get 1500 MW capacity for Komárom-Esztergom County. We need to remark that this value is changing from year to year as the technology is developing.

As for Fejér and Veszprém County we can calculate with the 4 358,76 km^2 and 4 612,59 km^2 total area respectively and the 10% average possible area and the results are 2800 and 3000 MW. So, the technical wind energy capacity of the whole Central Transdanubian Region is 7300 MW.

To get a more realistic potential, the so called **socio-economic wind energy potential,** we made comparisons in international level. We found that a German state, Saxony can be the best for this purpose as there are important similarities for example in the field of wind climate (Table 2.).

Table 2.

Comparison between the wind energy sector
of Saxony and the Central Transdanubian Region

	Saxony	**Central Transdanubian Region**
Area	18 416 km^2	11 236 km^2
Wind climate	Wind Class 1.	Wind Class 1.
Launch of wind energy	1990	2000

Wind turbine capacity after the first 10 years	300 MW (in 2000)	**~183 MW** (in 2010) planned 133 MW – 11,83 kW/km^2
Capacity/area indicator after the first 10 years	16,3 kW/km^2	16,3 kW/km^2
Climate policy	Active	Passive
Wind turbine capacity in 01. 2007.	769 MW	6,6 MW
Capacity/area indicator in 01. 2007.	**41,8 kW/km^2**	**0,59 kW/km^2** Hungary: 0,66 kW/km^2 (61 MW)

Considering the development of the wind energy sector of Saxony, the wind turbine capacity can reach 183 MW until 2010 in the Central Transdanubian Region.

Summary

There is a third kind of potential, the **implementation/program potential.** It is based on the wind energy strategies and plans. According to the permissions of the Hungarian Energy Agency, the Region is going to have a 133 MW wind turbine potential (Table 1.) which can be considered as a program potential of the area. It is a remarkable fact, that the socio-economic potential and the program potential have very similar values. Moreover, the proposed wind turbine sites are overlapping the potential areas of our Figure 1. It means that the proposed development is fast enough and site setting is also well-founded in the Central Transdanubian Region.

REFERENCES

1. Bíróné Kircsi A. (2006): Szélerőművek Magyarországon. - www.mszet.hu (web site of the Hungarian Wind Energy Association)
2. Cameron, A. (2007): Growth on all fronts – The BTM wind market update. – in Renewable Energy World 10. 4. pp. 50-59.
3. Ender, C. (2007): Windenergienutzung in Deutschland - Stand 31.12.2006. – in DEWI Magazin, Nr.30. pp. 20-32.
4. Giber, J. et al.(2005): Az új magyar energiapolitika tézisei a 2006-2030 közötti időszakra. – 12. fejezet: A megújuló energiaforrások szerepe a energiaellátásban. 60 p.
5. Jensen, J. K.(2002): A balancing act. – Renewable Energy World 5. 5. pp. 56-69
6. Jones, J. (2004): Onward and upward – Trends in BTM's World Market Update. – Renewable Energy World, 7. 4. pp. 58-73.
7. KvVM-TVH (2005): Tájékoztató – A szélerőművek elhelyezésének táj- és természetvédelmi szempontjairól. Környezetvédelmi és Vízügyi Minisztérium, Budapest, 26 p.
8. MEH (2006): A szélenergiából villamos energiát termelő erőművek engedélyezése. Magyar Energia Hivatal, Budapest, 5 p.
9. MSZET (2007): web site of the Hungarian Wind Energy Association – www.mszet.hu (2007. szeptember 2.)