GEOGRAFICKÝ ČASOPIS / GEOGRAPHICAL JOURNAL 62 (2010) 3, 183-199

FACTORS OF THE UNEVEN REGIONAL DEVELOPMENT OF WIND ENERGY PROJECTS (A CASE OF THE CZECH REPUBLIC)

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Factors in the uneven regional development of wind energy projects (the case of the Czech Republic).

The paper deals with the initiation, localization and realization factors of wind energy development in the Czech Republic and analyses the relationship between the spatial distribution of this phenomenon and selected socio-economic, environmental and political-institutional indicators. The authors regard the development of wind energy as a process of spreading of a new technology in space and time or as an innovation diffusion which is in principle regionally uneven. The regional differences in the implementation of wind energy projects can be caused by a wide spectrum of interrelated factors, validity and significance of which in the conditions of the Czech Republic, is tested and interpreted. Emphasis is also put on the motivation factors and risk perception that induce the process of adoption or rejection of wind energy projects at the level of municipalities.

Key words: wind energy, diffusion of innovation, social acceptance, regional development, Czech Republic

INTRODUCTION

A growing concern about global climate change, future energy sustainability and security has led to increasing interest in developing domestically available renewable energy sources (Barroso 2008). Currently the obligation of a gradual increase of energy production from renewable sources has been officially determined for all member states of the EU[1]. The wind energy development turned out to be the most dynamic but also the most controversial phenomenon in this respect. On the one hand, the construction of wind turbines represents an effective means of declared and state-aided support for renewable energy, an object of entrepreneurial interest for investors and developers, a potential source of income for municipalities involved (often from peripheral rural areas), and on the other hand the opponents regard it a violation of the landscape and a green-lobby futility unable to compete without economic subsidies.

Although it may seem that the spatial distribution of implemented wind energy projects is determined only by the efficient physical-geographical and technical (infrastructural) conditions of the area (the wind potential, the capacity of local transmission grid, and the absence of limiting factors and regulations concerning the landscape planning and protection), foreign research studies

[1] According to the directive of the European Commission (No.2009/28/ES) the share of renewable energy sources (wind, solar, biomass and water) in the total energy consumption should rise to 20 % on average for the whole EU by 2020; the Czech Republic expects the share about 13% (at present it is about 6%).

ISSN 0016-7193

(Wolsink 1994 and 2006, Agterbosch et al. 2007, Van der Horst 2007, Wüstenhagen et al. 2007, and others) as well as the current Czech practice (e.g. Přikryl 2007) proved that social, cultural, economic and political-institutional factors and barriers are also crucial for the implementation of projects. Thus other variables beyond the quantity of wind resources and landscape patterns have to be examined to explain different outcomes of the implementation of wind energy projects in different countries (Toke et al. 2008) and/or different regions within a country (Usha and Kishore 2009).

The wind energy development in the Czech Republic as well as in neighbouring Slovakia has lagged behind in comparison with the majority of EU countries and their realizable wind potential is still far from being utilized. In consideration of our obligations to EU directive, global energy trends and regardless of the current technical problems with the capacity of national transmission grids we can expect further expansion in the future. Wind energy is both a very topical and a controversial issue in the Czech-Slovak space; nevertheless it still remains more or less a matter of everyday policy and practice (being encompassed with a lot of ambivalences and myths) rather than a subject of serious and focused scientific research. This is in contrast to other European countries or USA where the issue has been a subject of interdisciplinary research for more than two decades; some speak even about the constitution of new sub-disciplines: wind power meteorology (e.g. Petersen et al. 1997) and wind power geography (e.g. Rodman and Meentemeyer 2005).

Some partial aspects of wind energy development are investigated mostly from technical or economic points of view (i.e. technology innovation, capacity of transmission system, economic return, etc.) in the Czech Republic. The realizable wind potential has been a research topic for the Institute of Atmospheric Physics of the Academy of Sciences of the Czech Republic (ASCR) since the 1990's (Hanslian et al. 2008). The Environment Centre of the Charles University in Prague occupied with the problems of the economic evaluation of externalities of wind energy (Melichar and Ščasný 2010). Few landscape ecologists deal with the most controversial aspect of wind turbines, namely their impacts on the charakter of landscape (Buček 2007, Culek 2008, Cetkovský and Nováková 2009). The Institute of Geonics ASCR has been studying the spatial dynamics of wind energy development since 2008. This can be regarded as the first step towards a more complex and social-geographically oriented investigation of the issue that has been lacking so far.

In this article the authors deal with the assessment of the initiation, localization and realization factors of wind energy development in the conditions of the Czech Republic and they try to identify correlations between the spatial diffusion of the phenomenon and selected primary environmental, socio-economic and political-institutional indicators. The development of new, alternative energy sources or specifically the development of wind energy can be regarded as a process of diffusion of a new phenomenon in space and time, or as an innovation diffusion. Such an approach is not prevalent in the connection with wind energy and it has been used in analyses of this kind only most recently (e.g. Buen 2006, Kamp et al. 2004, Usha and Kishore 2009). Nevertheless, the authors find the concept very inspirational for statistical testing, evaluation and interpretation of the given issue.

THEORY OF INNOVATION DIFFUSION: ANALYTICAL AND INTERPRETATIVE FRAMEWORK

Today, innovation or the diffusion of innovation is one of the most cited concepts in the social sciences (Sveiby et al. 2009). The roots of the theory of innovation diffusion can be traced back to the turn of the 19th and 20th centuries. The study entitled "The Laws of Imitation" by Gabriel Tarde (1903/1969), a representative of the "early sociology", is considered a pioneering work. Elements of the theory of innovation diffusion progressively gained importance in sociology (in the connection with transmission of cultural and social patterns), in economics (theory of innovation cycles) and later also in the spatial science. In the context of modern geography the concept is connected mainly with the name of Torsten Hägerstrand and his work "Innovation Diffusion as a Spatial Process" (Hägerstrand 1968). Within the Czech-Slovak scope there have been only a few personalities dealing with innovation diffusion; from the few names we could point out Valenta (1969) in economics, Tauberová (1971) in sociology, and Siwek (1979) in geography. Apart from Szczyrba et al. (2007) or Kunc et al. (2009) there have been no other geographers, who would significantly draw upon their works so far.

According to a classical definition by Rogers (2003) the innovation diffusion is a process by which an innovation (idea, technology, product, commodity, behaviour mode, etc.) is communicated through certain channels over time among the members of a social system. Four basic elements identifiable in every diffusion process are *(ibid)*: (1) innovation – an idea, practices, or objects that are perceived as new by an individual or another unit of adoption; (2) communication channels – the means by which messages get from one individual to another; (3) time – which has three dimensions: (a) the innovation-decision process in which an individual adopts or rejects the innovation, (b) the relative lateness or earliness by which the innovation is adopted, (c) the innovation's rate of adoption in a system being measured as the number of members of the system who adopt the innovation in a given time period; (4) social system – a set of interrelated units that are engaged in joint problem solving to accomplish a common goal.

While the diffusion process takes place at the level of the social system, the innovation-adoption process takes place at the level of individuals or groups, and is linked with the decision-making process. Rogers (2003, p. 38) distinguishes between three types of decisions: (1) optional innovation decisions (choices to adopt or reject an innovation that are made by an individual independently of the decision of other members of the system; (2) collective innovation decisions (made by consensus among the members of a system); and (3) authority innovation-decisions (made by relatively few individuals in a system who possess political power, social status or technical expertise). In reality the given types of decisions often overlap.

For the process of wind energy development the second type of decisions (by local communities and municipality councils) and especially the third one (by regional and local authorities and opinion leaders) are essential. The decision-making process of adoption or rejection of the given innovation (i.e. wind energy projects) is influenced by public foreknowledge, previous practice, positive or negative references, economic profits, environmental risk perception, rate of innovativeness, government initiatives, media propaganda, etc. According to their degree of innovativeness we can further divide individuals or units of social-spatial system (municipalities, regions and countries) into groups of innovators, early adopters, early majority, late majority, and laggards (Rogers 2003).

The spatial-temporal development of wind energy has been directly or indirectly influenced by a large number of factors which are summarized in the diagram (Fig. 1). The correlation between the rate of implementation of wind energy projects and selected location or area indicators will be tested in an other chapter.

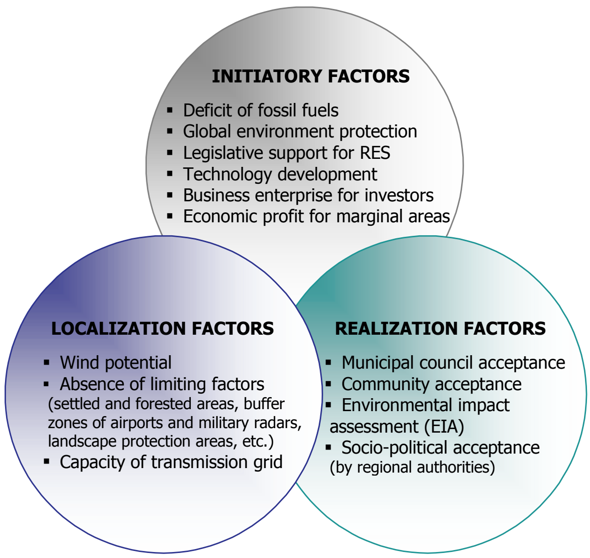

Fig. 1. Primary factors of wind energy development
(Source: own compilation)

THE DEVELOPMENT OF WIND ENERGY IN THE CZECH REPUBLIC: A TEMPORAL ASPECT

The process of innovation diffusion could be characterized as having four fixed temporal stages (Hägerstrand 1952, cit. in Hagett 1972): (1) the primary or initial stage (initiation – innovation is discovered), (2) the second or diffusion stage (dynamization – the beginning of the diffusion process marked by a fast rate of adoption in innovation centres and by a reduction of distinct regional contrasts), (3) the third or condensing stage (condensation – the innovation is adopted more or less evenly in the whole area, (4) the fourth or saturation stage (the process of diffusion slows down until it comes to an end).

The element of time in the process of innovation diffusion enables us to classify the categories of adopters and depict the diffusion curve in a graph. The cumulative rate of adoption of an innovation in time usually follows the S-shaped (Sigmoid) curve. The rate of adoption differs according to various innovations.

The diffusion rates of the same innovation can also vary across countries or regions where the innovation is introduced. For the purpose of our analyses, we consider the cumulative number of realized wind energy projects or total installed capacity of wind energy as a cumulative rate of innovation adoption. The diffusion of innovation can be limited by physical-geographical barriers as well as by social-cultural, economic or political barriers. It may be forwarded (or retarded/suppressed) by the level of public awareness and rate of innovativeness, governmental subsidies, media propaganda or technology improvement; as a consequence some diffusion processes can even create the multiple S-curve. This is the case with wind energy development in the Czech Republic (Fig. 2).

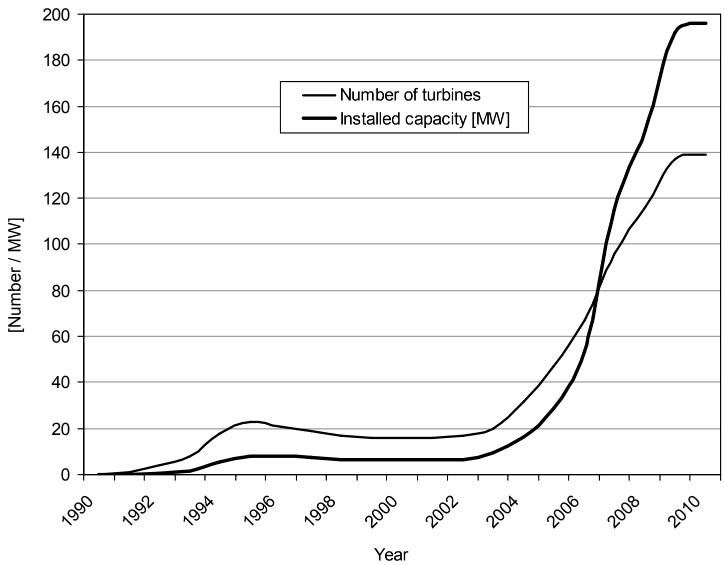

Fig. 2. Cumulative diffusion of wind energy innovation in the Czech Republic
(Data source: CSVE 2010; own processing)

The development in the Czech Republic proceeded in two relatively individual stages and was induced by specific political, social and economic factors (Štekl 2008). The mass boom of wind energy in Denmark and Germany, the establishment of a free entrepreneurial environment and the offer of Czech-made turbines (almost 30% cheaper than foreign products) which motivated many new entrepreneurs to start a business led in the years 1990-1995 to the construction of the first 24 wind turbines (with total installed capacity of 8 MW).

However, the period was accompanied by a negative epiphenomenon which led to a break in the development process: (1) the Czech turbines did not go through the test operation and proved defective and noisy in many cases, (2) the installations were often carried out in unsuitable locations with insufficient wind potential, (3) the industry branch did not have any professional and legal background, and lacked economic subsidies (cf. Štekl 2008). The period of 1996-2002 thus represents a total stagnation of the branch. In this period several functionless turbines were removed (and not replaced by construction of new ones) and the total installed capacity decreased (it was the worldwide unique case which was repeated in Slovakia in 2009).

A motivating factor of the second stage of development was the price decision of the Czech Energetic Regulation Office in 2003 that led to significant increase of the guaranteed redemption prices of electric energy from the wind (so called feed-in tariffs). The second positive aspect was the ratification of the "Act on Promotion of Use of Renewable Sources" (No. 180/2005 Coll.) that assumed a share 8% of electric energy production gained from the renewable sources by 2010. Thanks to these stimuli the number of realized projects started to increase during the last six years. Nevertheless the realizable wind potential of the country, estimated at circa 2 500 MW of the installed capacity according to Hanslian et al. (2008), is still far from being utilized, and the spatial distribution of realized wind projects is distinguished by strong regional disparities.

The curve of innovation diffusion shows the increase in the number of adopters of the innovation over time (in our case it is represented by the cumulative number of realized projects or the cumulative installed capacity). From the shape we can identify three types of curves (Coleman 1964, cit. in Siwek 1979): (1) the source type – anticipates the existence of a source which influences the whole region. In the beginning the number of recipients increases at a faster rate, then declines and the number of the innovation adopters reaches asymptotically the upper level, namely the full saturation of the system; (2) the contact type – corresponds to the increase of innovations via mutual contacts of the members of the society. The number of those who have already adopted the innovation increases slowly only to decrease again slowly. And finally (3) the source-contact type which is of transient character; its curve is made up of the combination of the previous two types. From the beginning, the number of innovation adopters increases at a faster rate due to the influence of the source and interpersonal contacts. Later the rate even increases and only in the end does it start decreasing.

The case of wind energy development is likely closest to the contact type, even though at present the diffusion process seems to be far from its condensing or saturation stage. It is possible that due to external factors (some changes in the legislation, a more favourable attitude from regional authorities, etc.) there will again be a recurring increase and dynamization of the diffusion process.

THE SPATIAL DIFFUSION OF WIND ENERGY INNOVATION: A REGIONAL ASPECT

The realization of local wind energy projects is determined not only by the suitability of physical-geographical conditions, but mainly by limits and regulations concerning the territorial development, land-use planning and landscape conservation. The main localization factors for development are sufficient wind potential and at the same time the absence of limiting factors such as the presence of settled areas, forested areas, stretches along roads and waterways, buffer zones of airports and military radars, nature-protected areas (national parks, protected landscape areas, bird corridors, Natura 2000) and so on. The vicinity and capacity of the electric transmission grid is also a vital aspect. In term of the wind potential the most suitable areas can be found mostly in areas with insufficient capacity of the transmission system, namely mountainous and submontane peripheral rural areas. Apart from the objectively (physically, technologically and legislatively) given limits the realization is also conditioned by the "soft factors", that is social and political acceptance at the local and regional levels (Přikryl 2007 and Prchal 2009).

The "mortality rate" of projects (for the reasons of local community opposition, disclaimer opinion by regional or local authorities, negative outcome within the EIA process, or similar) is very high in the Czech Republic. It exceeds 90% in comparison with most of the European countries (e.g. 80% in the Netherlands, 60% in England/Wales, 20% in Spain or even lower in Germany or Denmark (cit. in Toke et al. 2008)). In the Czech Republic, altogether 199 planned projects were administered in the EIA process between 2003 and 2008 (within the "second stage" of wind energy development) from which 28% got concurrent decisions but only 8% of projects were finally implemented (Janeček 2008). The remaining projects were intercepted or suppressed for various reasons; a discordant opinion from the side of involved municipal offices or regional authorities (arguing with proclaimed negative impacts of turbines on the local landscape character) were the most frequent reasons.

Fig. 3 shows locations (i.e. municipality cadastres) of all hitherto implemented projects of wind power plants and also the projects that were suppressed without realization (during 2003-2009). It is evident the realization of projects is regionally differentiated and the locations of projects of the same status generate certain clusters at specific areas. As it has been verified using statistical analyses and by means of questionnaire surveys with the key social actors at municipal level (mayors and residents), the current status of wind energy development and the spatial distribution of realized projects reflect not only objective wind potential and physical-geographical limits of the area but also (and maybe especially) political-institutional factors taking effect in the administrative process of the project permitting system.

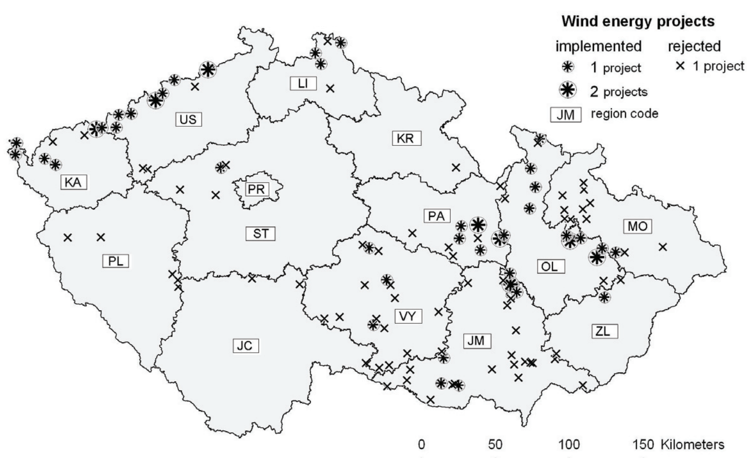

Fig. 3. Spatial distribution of implemented and rejected wind energy projects
(Data source: CENIA 2009, CSVE 2010; own processing; codes of regions in Tab. 1)

The basic types of the diffusion of innovation have been known for a longer period of time (Hägerstrand 1968 and Hagget 1972). The means of the transmission of innovation are delimited by two basic types of diffusion: (1) expansive (the innovation is spread via contacts between individual members of the society, while they remain stationary) and (2) relocational (the innovation is spread via the movement of its bearers). The second significant aspect is the means of adopting the innovation. We distinguish between (1) the contact (infectious) type (the innovation diffusion permeates the whole population regardless of its structure and distribution) and (2) hierarchical type (the diffusion concerns only selected segments of the population and hierarchical levels of the system of municipalities). In reality we hardly ever see the given types in their "pure" forms; on the contrary we much more frequently encounter their combinations.

The case of wind energy development is probably closest to the expansive hierarchical diffusion. Regardless of the primary political decisions or strong financial lobby on the side of developing companies the diffusion takes place via contacts between the innovation bearers (representatives of municipalities) which gain information through various information channels and decide to adopt a new technology (innovation). Other prospective adopters get in touch with the bearers, they communicate with one another, judge the information and references, make decisions and either accept (adopt) or reject the innovation. The bearers of innovation thus "move" in space, yet they remain stationary. The diffusion of wind energy innovation has a selective character. It does not concern the whole population and the whole system of municipalities, and beyond the human or social factors (decision making process about the innovation adoption) it is limited by a large number of "hard" (physical-geographical) barriers.

According to the rate of innovation adoption or the extent of implementation of the wind energy projects at the level of regions, we can make a spatial hierarchization of the area. The total installed capacity of wind power plants (in megawatts) has been used as a basic comparative indicator of the wind energy development in different countries or regions. However, the indicator does not fully correspond to the relative rate of innovation adoption, since individual regions differ depending on both the overall realizable wind potential and the exposure of the interest of investors/developers (as innovators). Therefore the authors introduce and calculate the *Index of innovation adoption (In_a)* according to the following calculation formula:

$$In_a = \left(\frac{C}{P}\right) \times \left(\frac{N_i}{\left(N_i + N_r\right)}\right) \times 100,$$

where C is the actual installed capacity, P is the realizable potential, N_i is the number of implemented projects, and N_r is the number of rejected projects.

The values of the estimated realizable wind energy potential of all regions according to the "mean scenario" (considering not only the gross wind potential but also physical-geographical, landscape-protection, and other barriers) assessed by Hanslian et al. (2008, p. 24), the database of the realized projects and their actual installed capacity (ČSVE 2010), and the database of rejected projects compiled by the authors themselves served as the source data for the calculations. The comparison of the regions' realizable wind potential and actual installed capacity is reported in Tab. 1. The results of the innovation adoption analysis with values of the indexes are graphically presented on the map (Fig. 4). Hypothetically speaking, the maximum value of the index is 100; the higher is the value, the higher is the rate of innovation adoption. Values close to zero indicate a high rate of rejection of innovation.

Tab. 1. The regions' realizable potential and actual installed capacity of wind energy

Region	Code	Realizable potential [MW]	Installed capacity [MW]
Prague – the capital city	PR	n/a	0.0
Central Bohemian Region	ST	221	6.0
South Bohemian Region	JC	189	0.0
Plzeň Region	PL	116	0.0
Karlovy Vary Region	KA	121	17.5
Ústí Region	US	366	82.8
Liberec Region	LI	71	4.3
Hradec Králové Region	KR	64	0.0
Pardubice Region	PA	161	19.2
Vysočina Region	VY	428	11.7
South Moravian Region	JM	339	8.3
Olomouc Region	OL	156	37.1
Zlín Region	ZL	44	0.2
Moravian-Silesian Region	MO	260	4.0
Czech Republic (in total)		2534	191.0

Data source: Hanslian et al. 2008, CSVE 2010 (installed capacity to December 31, 2009)

Two regions can be seen as the "leading innovators" – Olomouc Region and Ústí Region. The current strongest opponents of wind energy projects are: Moravian-Silesian Region, South-Moravian Region, Vysočina Region and Plzeň Region. It is important to compare not only the status of regions according to their installed capacity but especially to a relative exploitation rate of their realizable potential and the rate of rejection of the proposed projects. While the levels of Ústí Region, Olomouc Region, Karlovy Vary Region and Pardubice Region correspond with one another according to both criteria, the levels of other regions significantly differ. A very low value of the index of innovation adoption of Vysočina Region, South-Moravian, and Moravian-Silesian Regions (actually three of four Czech regions with the biggest realizable wind potential) indicate a very low exploitation rate of their wind energy potential and that they obstruct the proposed projects.

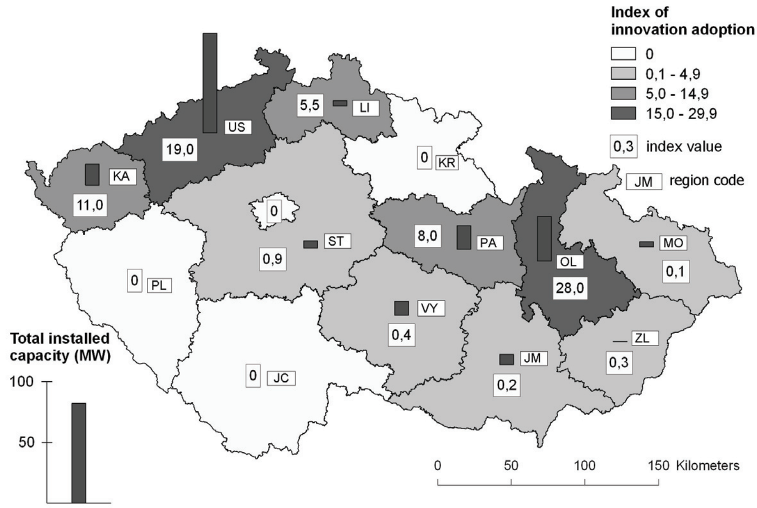

Fig. 4. Regional differentiation according to the rates of wind energy innovation adoption
(Data source: CENIA 2009, CSVE 2010, Hanslian et al. 2008; own processing; codes of regions in Tab. 1)

FACTORS OF PROJECT REALIZATION: LOCATION VARIABLES

In further reference to the previous calculations the authors carried out a statistical analysis of the correlation between the rate of implementation of wind energy projects and selected location/area indicators (social, economic and environmental). A database of 118 territorial units (i.e. municipalities) was created representing: (1) locations of all hitherto realized projects (altogether 43; on the cadastre of some municipalities more than one project was already implemented), (2) locations of projects which were suppressed without realization during the last eight years (altogether 75). The reasons for suppression of projects were the adverse statements within the EIA process, disagreement on part of the regional authorities or the municipalities with extended power or rejection by the local communities themselves.

We used the registry of the Czech Wind Energy Association (CSVE 2010) as the source of realized projects. In the case of the projects that were suppressed we applied the archive of submitted intentions of the EIA Information System (CENIA 2009); whereas the current status of projects was verified by checking the projects' investors or the local councils. As the number of implemented projects as well as the number of projects currently in the decision making process and the number of projects being rejected by negative decisions are very dynamic variables, the aim was not to create a comprehensive list of projects but to gain an adequate database for statistical analysis. Therefore the database includes only the projects suppressed and terminated without realization (and not all the proposed, so far non-realized but still active projects without a final decision).

The status of the projects represents a dependent variable which can take values (1 = realized, 0 = not realized). Altogether 10 independent variables relating to the location of projects (whose data were available for the level of municipalities or at least for the level of municipalities with extended power) have been tested. These are as follows: (1) affiliation of the municipality (as the location of the project) to the region, (2) affiliation to the municipality with extended power, (3) the population of municipality, (4) the budget of municipality (as the average for the last three years), (5) proximity of the project location to the nearest protected landscape area or national park, (6) natural attractiveness of the area, (7) tourism potential of the area, (8) recreational areas ratio, (9) air pollution of the area (amount of main pollutant emissions), (10) ageing index of the area. The variable of wind potential was not tested because it is presupposed that all projects were located in areas of sufficient wind potential. The data for variables (3, 4, 9, 10) were processed from the Czech Statistical Office's database; the data for variables (6, 7, 8) were processed from The Atlas of Tourism of the Czech Republic (Vystoupil et al. 2006).

Since in the case of dependent and independent variables we worked with the combination of nominal, ordinal and cardinal variables, the *Goodman and Kruskal tau* and *Somers' d* were chosen as adequate correlation coefficients (e. g. Leech et al. 2007). Higher positive or negative values (from –1 to +1) signify a higher rate of correlation (or association in the case of nominal variables) among the variables; the correlation rates were interpreted according to the usage in social sciences (De Vaus 2002). The results are listed in the table (Tab. 2).

Tab. 2. Correlations between location variables (independent) and project implementation (dependent)

Location variables	Correlation value	Approximate significance
Belonging to municipality with extended power	0.68 *	0.002
Belonging to region	0.39 *	0.001
Air pollution of the area	0.31 **	0.008
Population	- 0.25 **	0.001
Recreational areas ratio	0.24 **	0.008
Tourism potential index	0.18 **	0.047
Natural attractiveness of the area	0.17 **	0.050
Ageing index	0.12 **	> 0.050
Municipality's budget	- 0.11 **	> 0.050
Proximity to landscape protected area	0.10 **	> 0.050

The independent variables are listed according to descending value of correlation
Correlation coefficients: *Goodman and Kruskal tau; **Somers' d
Data source: Czech Statistical Office, Vystoupil et al. 2006; own calculation

It is evident that from the variables, which have the strongest influence on whether the project will or will not be implemented, the affiliation to the region and its affiliation to the municipality with extended power are the most decisive ones. In other words the projects in some districts or regions had a higher probability to be implemented than in other districts. Specifically the municipalities with extended power of Jihlava, Znojmo, Bruntál, Krnov and Rýmařov can be regarded as the biggest opponents of wind energy projects according to our analyses. On the other hand the proposed projects have got the highest rate of acceptance in Aš, Teplice, Šumperk, Svitavy, Liberec and Kadaň.

The projects planned in small municipalities were generally more successful (in municipalities of up to 100 inhabitants there were 50% of successful projects, in municipalities with 100-500 inhabitants there were 40%, in municipalities with over 1000 inhabitants there were only 20% of successful ones). It was also often the case that projects in poorer municipalities (managing lower budgets) were more successful; however such correlation was not significant.

The highest rate of project implementation was proved in the districts with higher air pollution. These findings coincide with the results of similar studies from Great Britain cited by Van der Horst (2007, p. 2709) which report a relationship between the industrial or environmentally stricken character of an area and the more sensitive and positive attitudes of local communities and policymakers towards alternative energy technologies.

The analysis has shown that there is no statistically significant relationship between the implementation of projects and the proximity to protected landscape areas or national parks. On the contrary, paradoxically the projects were more often implemented in areas of more attractive nature (at the level of districts) and in areas of higher potential for tourism and recreation (at the level of municipalities). To summarize these findings, we can say that the decision-making process is often a matter of subjective attitudes and political decrees rather than being an issue of objective assessment. The arguments of negative impacts of wind turbines on the landscape character or local tourism development are often used just expediently and without a deeper justification as has also been reported by some foreign studies (e.g. Bosley and Bosley 1988).

FACTORS OF PROJECT ADOPTION OR REJECTION: PERSPECTIVE OF LOCAL COMMUNITIES

The last part of the paper sums up the main results of questionnaire surveys which were aimed at exploring the basic motivation factors and barriers to the implementation of wind energy projects from the perspective of local actors themselves (i.e. mayors of municipalities and their inhabitants).

According to the survey (Frantál 2010) with mayors of municipalities where wind energy projects were proposed (sample of 81 municipalities, 32 with implemented and 49 with rejected projects) we can say that the most dominating motivation factor (voted by 95%) for the project adoption is the economic contribution to municipalities (either the one-time financial contribution or regular proportional yields paid by the investor of projects). Support to renewable energy sources, it means the environmental protection aspect was the second principal reason (given by a third of respondents) and the third was (also quoted by a third of respondents) the improvement of the municipality's image and promotion of tourism. By contrast, the most frequent reason for rejection of projects (in 90% of cases) was definitely the opposition from local residents (being afraid of negative impacts on landscape, noisiness, or other aspects). For every fifth municipality a significant matter for rejecting the project was also the small financial contribution to the budget or the protests of neighbouring municipalities which would not gain any benefits (usually only the municipality with the turbines in its cadastral area profits from the projects).

As reported in another survey conducted among inhabitants living in areas with planned and already constructed wind power plants (Frantál et al. 2008) people's decision to oppose projects can have various motivations and hidden reasons: from questions and concerns about noise, negative impacts on the character of the local landscape and human well-being, fear of a decrease in real estate value to protests against wind turbines as a demonstration of opposition against groups involved in the projects (politicians, developer company or foreign investor). Little information about the issue, myths and prejudices, local opinion leaders, opposition groups and media campaigns, but also faults in planning schemes and general local context of the project can have an impact on oppositional behaviour. Factors increasing the acceptance of projects are the level of foreknowledge about the given issue, including the "good practices" (i.e. positive functional models from other localities), transparent project planning, open communication from the municipality and investors, and public participation in the decision-making process. A crucial aspect determining the public attitudes towards renewable energies in the Czech Republic is again the economic benefit for municipalities; whereas for example in neighbouring Austria the support for "clean" energy, climate protection and priority over nuclear power are dominant factors for supporting renewable energy development (cf. Frantál and Kučera 2009).

DISCUSSION AND CONCLUSIONS

The principal aim of this paper was to empirically assess the relative significance of various environmental, socio-economic and political-institutional factors in the process of wind energy development in conditions in the Czech Republic. The authors realized that the phenomenon cannot be regarded a classical innovation diffusion in space and time within the population and the system of municipalities. It has specific features and there are objective limits (physical-geographical, technical and legislative) to its spatial diffusion. Nevertheless the human factor plays a key role in the decision-making process about an innovation, in this case whether to adopt or reject local wind energy projects.

At present, the authority innovation-decisions type (i.e. decisions made by experts and/or political authorities at the hierarchically higher levels, such as municipalities with extended power or regional authorities) seems to have the most significant influence in the decision-making process, in defiance of positive acceptance of innovation by local communities (i.e. municipal councils and residents). This finding was confirmed by the statistical data analysis, questionnaire survey with municipality mayors, and by the reports of some representatives of the developing companies (Prchal 2009). The current spatial distribution of implemented projects reflect not only the realizable wind potential of the regions and their objective physical-geographical barriers but also (and maybe especially) political decisions (e.g. Tošenovský 2005) and administrative obstructions from the side of regional and municipal authorities. It is most evident in the cases of the Vysočina Region, South-Moravian and Moravian-Silesian Regions.

Generally, the main barriers to a more dynamic and spatially proportional diffusion of wind energy innovation can be defined as legislative, administrative, informational and social-communicative barriers. More concretely they are as follows: (1) the backwardness, intricacy and inconsistency of the decision-making process in which different regional authorities interpret the national energetic strategy differently and apply wilfully the correlative legislation norms (Act 183/2006 Coll., on town and country planning and building code; Act No.114/1992 Coll., on nature conservation and landscape protection; and Act No.100/2001 Coll., on environmental impact assessment), (2) the absence of positive planning criteria, that is the absence of definite regional "zonation" plans with areas explicitly labelled as suitable or acceptable for construction of wind turbines, (3) the persisting state-controlled and monopoly traditional energy industry (based on the coal-fired and nuclear power plants) lobbying at the Ministry of Industry and Commerce and other governmental resorts (see e.g. Köpke 2003), and finally (4) the low level of "public awareness", political representation and officials, a lack of positive and authentic information from credible media and local/regional authorities, and a spread of many myths at the expense of open discussions based on facts and independent monitoring.

The predominant reason for rejecting the projects by municipalities themselves was the opposition from local residents which is induced by subjective perception of potential negative impacts of wind turbines on the local landscape and human well-being in relation to the proposed economic benefits for the municipality. The oppositional behaviour can be markedly moderated by sufficient information, credibility and consistency of information sources, and public participation in the planning and decision-making process. For developers and planners a relevant item should be that people living in the areas that are already environmentally stricken (by mining activities, by smokestack or chemical industry, etc.) are more likely to be open-minded to accept new, alternative (innovative) energy technologies and facilities (even if they are constructed in their own backyards); so that the building schemes should be headed to these localities as preferred. Projects located in less populated areas also have a bigger probability to be implemented.

This paper verified that the spatial diffusion of wind energy innovation is not limited only by objective limits but its barriers have more structural, contextual, political-institutional and social-psychological natures. The spatiotemporal dynamics of the oppositional behaviour of people in different local and regional contexts deserves to be an object of more detailed and comparative analysis in further multidisciplinary research.

The paper was researched with support from the Grant Agency of the Academy of Sciences of the Czech Republic for the grant project No. KJB700860801 "Use of wind energy: evaluation of spatial relations, environmental aspects and social context by the means of GIS".

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Bohumil F r a n t á l, Josef K u n c

FAKTORY NEROVNOMERNÉHO REGIONÁLNEHO ROZVOJA PROJEKTOV VYUŽITIA VETERNEJ ENERGIE (PRÍKLAD ČESKEJ REPUBLIKY)

Článok sa zaoberá hodnotením iniciačných, lokalizačných a realizačných faktorov rozvoja projektov využitia veternej energie v Českej republike a analyzuje vzťah medzi priestorovým rozšírením tohoto fenoménu a vybranými sociálno-ekonomickými, environmentálnymi a politicko-inštitucionálnymi indikátormi. Na rozvoj veternej energetiky sa pozerá ako na proces šírenia novej technológie v priestore a čase alebo ako na proces difúzie inovácie, ktorý je v princípe regionálne nerovnomerný. Regionálne rozdiely v realizácii projektov výstavby veterných elektrární pritom môžu byť spôsobené širokým spektrom vzájomne súvisiacich faktorov, ktorých validita a signifikantnosť v podmienkach Českej republiky sa testuje a interpretuje. Dôraz je kladený tiež na analýzu motivačných faktorov a vnímanie rizík, ktoré ovplyvňujú proces prijatia či odmietnutia projektov veterných elektrární na úrovni obcí (teda z perspektívy starostov obcí a ich obyvateľov).

Z analýzy vyplýva, že fenomén rozvoja využitia veternej energie nepredstavuje klasickú difúziu inovácie v priestore a čase v rámci populácie a systému sídelných jednotiek. Má špecifické atribúty a jeho priestorové rozširovanie je do značnej miery limitované objektívnymi (fyzicko-geografickými, technologickými, infraštruktúrnymi a právnymi) obmedzeniami. Napriek tomu kľúčovú úlohu v rozhodovacom procese o prijatí či odmietnutí inovácie (teda o realizácii lokálnych projektov výstavby) zohráva ľudský faktor. V súčasnosti sa zdá, že v rozhodovacom procese o tejto technologickej inovácii či novej idei má najvýznamnejší vplyv tzv. autoritatívny typ rozhodovania – teda rozhodovanie expertov či politických autorít na hierarchicky vyšších úrovniach (t. j. na úrovni krajských úradov a orgánov obcí s rozšírenou pôsobnosťou) – bez ohľadu na pozitívnu akceptáciu či toleranciu projektov zo strany lokálnej komunity. Toto zistenie sa potvrdilo rovnako analýzou dát, ako aj v rámci dotazníkového výskumu medzi starostami obcí.

Súčasné priestorové rozšírenie už realizovaných projektov veterných elektrární nereflektuje len veterný potenciál regiónov a objektívne fyzicko-geografické bariéry, ale tiež (a možno hlavne) politické postoje a administratívne obštrukcie zo strany krajských úradov a úradov obcí s rozšírenou pôsobnosťou. Vo všeobecnej rovine tak za hlavné aktuálne prekážky dynamickejšieho a priestorovo rovnomernejšieho rozvoja využívania veternej energie v Českej republike možno označiť právne, administratívne a sociálno-komunikačné bariéry. Hlavným dôvodom odmietnutia projektov zo strany samotných obcí býva opozícia miestnych obyvateľov, ktorá je spôsobená mierou percepcie potenciálnych negatívnych vplyvov veterných elektrární na miestnu krajinu či kvalitu života vo vzťahu k očakávanému ekonomickému prínosu pre obec. Opozíciu možno významne obmedziť dostatočnou informovanosťou a dôveryhodnosťou zdrojov, pozitívnymi príkladmi z iných lokalít a aktívnym zapojením verejnosti do rozhodovacieho procesu. Okrem iného sa ukázalo, že otvorenejšími voči novým technológiám a obnoviteľným zdrojom energie sú ľudia žijúci v oblastiach, ktoré sú istým spôsobom environmentálne „postihnuté". Väčšiu pravdepodobnosť realizácie majú tiež projekty plánované v redšie osídlených lokalitách.