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Landscape Factors that Influence the Planning of the Renewables. The Case of Wind Energy Utilisation in Slovenia

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Abstract

The meeting of the climate targets largely depends on the successful expansion of the renewable energy (RE) production facilities. While technical solutions are available and political support is prevailingly secured, the main limiting factors seem to be social; either the competition for space with other land uses, or the opposition of local communities to host a renewable energy facility. The change of landscape is one of the more often used arguments for this opposition. Using the example of wind power plants in Slovenia as a case study, this paper identifies the landscape factors which should and could be considered, and discusses

how these could be employed in planning the RE facilities. While certain factors seem to be unambiguously concluded from the literature as well as the presented cases, such as adapting the scale of the facility to its environment, or using the already degraded or poorly used sites; others are too diverging to allow any concluding guidelines. Nevertheless, the process factors, such as a transparent and trustful governance of the process and a fair distribution of cost and benefits as perceived by the local community, seem to prevail over the adequacy of planning and design solutions.

Key words

Renewable energy; wind power plants; landscape change; Slovenia

1. Introduction

Being one of the main climate change mitigation pillars, the production of energy from renewable resources gained considerable political support in the last decade(s). The *European Union* (for example the *EU Renewable Energy; Council Directive 2009/28/EC*) and its member states have set ambitious targets regarding the share of energy produced from renewable resources, supported by (mostly financial) instruments. For *Slovenia*, this means a 40% share of RE in the electricity production by 2020 (AN OVE, 2010; ELES, 2012). Currently, the share of the renewable energy sources represents 33% in the Slovenian energy production, and the majority of that is secured by hydro power. As most possibilities for the hydroelectric power production in the country have already been exploited, the bets for the future are largely on solar, biomass and wind energy. The highest increase in the period 2009–2014 has been in solar power (243 MW of new installations), followed by biomass, while the new wind energy facilities have been marginal with 3 MW. Although, the first initiative for a wind power plant dates back in 2000, only two turbines (at different locations) have been put in operation since. The dynamic of the expansion of solar plants can be almost entirely explained by economic motives

(level of subsidies). On the contrary, the reasons for the slow development of wind power production are more complex. The main factors to be considered are: a lack of resource (wind), conflicts with other users (including nature conservation), bad management and policy implementation, and (lack of) public support (EKINS, P. 2004).

The contemporary definitions of good governance (including planning) involve criteria such as a sound evidence (knowledge) base, in addition to accountability, transparency and participation. The role of experts to provide these is significantly different, and not always effective. If we focus on the role of planners, STEINITZ, C. (2012), provides the framework of different *models* representing the type and form of knowledge, used in different stages of the planning process (*Figure 1a* and *1b*).

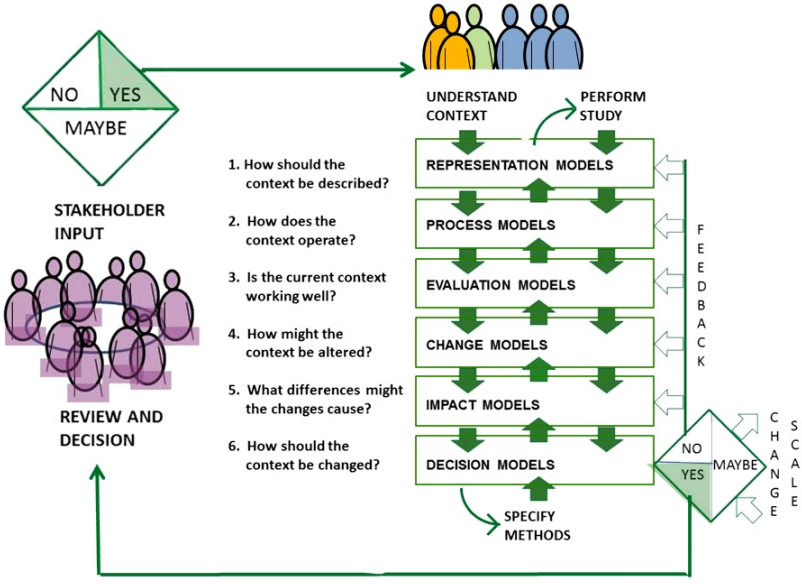

Figure 1a – Planning process and knowledge inputs
Source: STEINITZ, C. (2012)

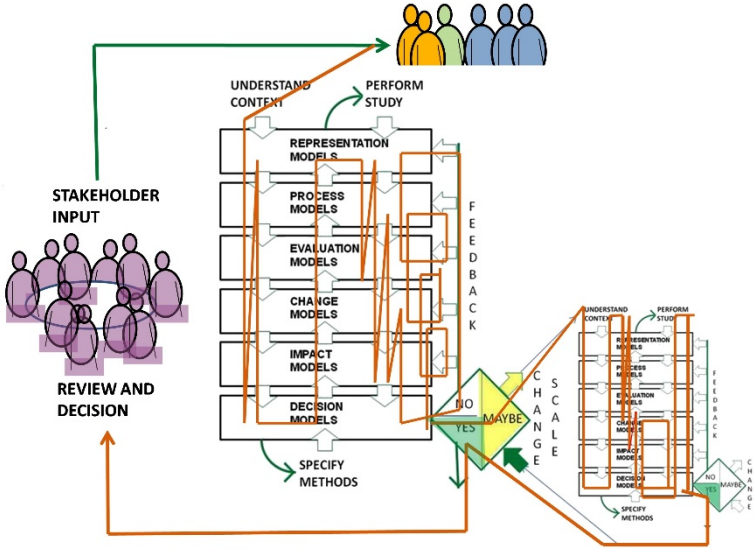

Figure 1b – Planning process and knowledge inputs

Source: STEINITZ, C. (2012)

These steps and models require several iterations *(Figure 1a)* and, in reality, often feedbacks, skips and repetitions of certain steps *(Figure 1b)*. The second ('scoping') loop, which is critical for designing the planning process, should be taken from the bottom up, starting with decision models. In this stage, the process designer (team) should answer the following questions: How is the decision taken? By whom? Is there more than one decision-maker? What are their attitudes, are they conflicting? What will be their decision based on? What will they need to know? (STEINITZ, C. 2012). The set of studies, defined by answering these questions may be quite different from the set based on what experts think is important from the perspective of their expertise.

2. Knowledge support for wind power planning

In terms of planning the wind energy production facilities (wind power plants, WPPs), the first question is the presence of the natural resource

(representation and process models) and its quality (evaluation models). Although, the wind power technology has considerably advanced in the last decades, the amount of wind is still the limiting factor. In Slovenia, the highest and most stable speeds of wind are along the mountain ridges, and these areas are presently the only ones with any reasonable wind potential *(Figure 2)*.

Although these sites have considerable natural limitations (altitude, difficult access, steep slopes, landslides and erosion), their estimated energy potential by 2050 is 600 MW or 1,000 GWh (AN OVE, 2016).
The construction of WPP involves considerable changes in landscape due to the wind turbines as well as the electricity transmission lines. The information on the anticipated changes can be provided by the change and impact models. The restrictions due to the conservation of (other) natural resources such as the agricultural land, forests, visual amenities or water resources, are examples of such models which indicate that the impacts exceed the thresholds. Change of landscape is often (among) the main concerns as it abruptly interferes with place attachment of local communities and visitors (McPartland, S. 2012).

In the case of WPP in *Slovenia*, the biodiversity concerns and the (protected) habitats present important restrictions. The restrictions for development as designated by the nature conservation areas (national, regional and landscape parks corresponding to UNESCO level II–V) are not very high with a 13% share of the total area. On the other hand, the share of the protected habitats by the *Natura2000* is the highest in the *EU*. It covers almost 38% of the land, a fair share of which are the internationally important bird areas. A comparison of these areas *(Figure 3)* with the areas of high wind potential, shows a high overlap and indicates a potential for conflict.

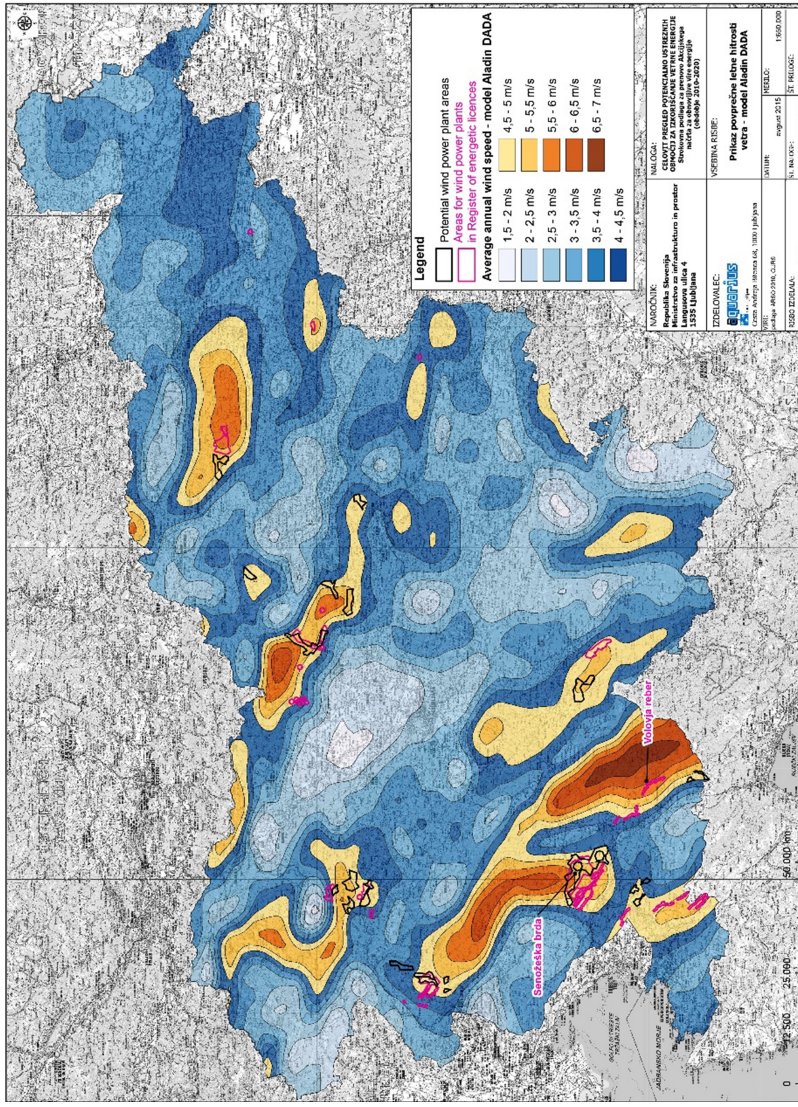

Figure 2 – Map of wind potential with identified suitable areas for wind energy production (yellow)

Source: MLAKAR, A. et al. (2011)

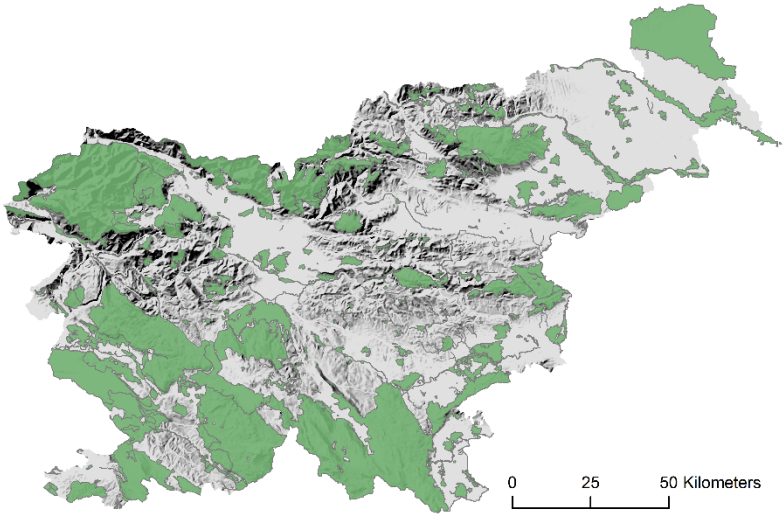

Figure 3 – Nature2000 areas in Slovenia
Source: NATURA2000.SI (2013)

At this point knowledge support ends by providing sound, evidence-based, objective information. However, the information can be interpreted in a variety of ways, depending on how the decision is taken, by whom, what are the decision makers' attitudes, and whether these are conflicting.

The implications of the answers to these questions for the planning process will be discussed, by using a meta-analysis of the documentation related to the wind power planning in *Slovenia*, for example the surveys of general public attitudes, and the two concrete examples of the (failed) WPP projects.

3. Governance and public perception issues of WPP planning: review of the case studies' documentation

Similar to elsewhere in the *EU*, the general attitude of the Slovenian public is rather in favour of the wind power. According to the *Eurobarometer poll 2006*, *Slovenia* is the fifth among the compared countries

with 81% of respondents in favour of, 16% indifferent and only 2% opposing to the wind energy. Similar results are reported by GOLOBIČ, M. – MARUŠIČ, J. (2001) in their survey in *Primorska region*, which has the highest wind potential in *Slovenia*. After solar, hydro and small hydro, wind power was assessed as the third most suitable for *Slovenia*, with a score 3.7 out of 5. Interestingly, these results differed between lay and professional respondents, the latter scoring wind (3.3) as well as hydro, and especially small hydro power, much lower than lay public. On the other hand, the experts' scores for biomass, gas and nuclear power were higher *(Figure 4)*. A survey on a smaller sample in the part of the same area (VOLK, T. 2016), also positioned wind energy as a rather or very suitable.

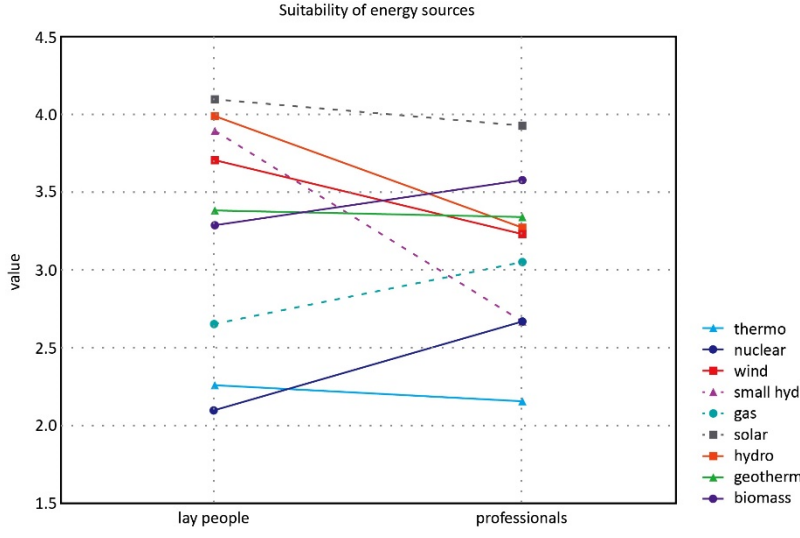

Figure 4 – Suitability of different sources of energy for Slovenia as assessed by the respondents from Primorska region and spatial planning experts

Source: BREČEVIČ, D. et al. (2012)

Nevertheless, this general support changes when particular projects come into question. The following part will discuss, whether the

reason behind this is a typical NIMBY (not in my back yard) effect, or there are other, more complex factors to be considered.

3.1. Case I: Volovja reber

The first wind power plant initiative began in 2001, when the distribution company *Elektro Primorska* considered 8 potential sites in *Primorska region*. They commissioned a comprehensive study on evaluating the potentials and restrictions for the wind power development in the area (BREČEVIČ, D. *et al.* 2001). The study involved assessment of the proposed sites from the different aspects: infrastructure availability, energy potential, wind speed, availability of space, nature conservation, natural resources, noise, and visual impacts. The sites which performed best in terms of their potential (*Golič*, *Vremščica* and *Volovja reber*), were at the same time least favoured in terms of the environmental acceptability and consequently, not recommended. Nevertheless, the developer decided to pursue one of these sites, namely *Volovja reber (Figure 5)*.

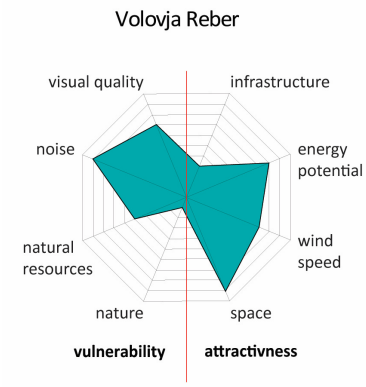

Figure 5 – The assessment of Volovja reber site from the various aspects
Source: BREČEVIČ, D. et al. (2001)

Volovja reber is a high plateau with distinct karst formations in the south of *Slovenia*. The surface is a rather rocky dry grassland and pas-

tures *(Figure 6)*. Rare vegetation is present throughout the area. Due to high density of karst landforms and well preserved nature the area is considered a highly valuable landscape (MARUŠIČ, J. 1998a).

Figure 6 – The area of proposed WPP on Volovja reber
Photographed by ZERDIN, M. (2005)

The landscape guidelines (MARUŠIČ, J. *et al*. 1998a) for the area include: conserving the pristine remote areas, unfragmented forests on slopes, especially on visually exposed locations, and karstic and dynaric geomorphologic features. Because of these features, the site was proposed for *Natura2000*, but was excluded from the designated area due to the demand of the *Ilirska Bistrica Municipality*. However, 60% of the municipalities' total surface was still included in *Natura2000* network.

In the process, the project was downsized from 88 to 29 turbines due to the demands from the forestry and nature conservation administrations, archaeology requirements, and land ownership *(Table 1)*.

Table 1 – The chronology of the process for Volovja reber WPP
Source: VOLK, T. (2016)

2003
- The idea is presented by the developer to the local community;
- Conflicting attitudes form: Municipal council shows support, Birdwatchers asks for the formal protection status of the area

2004
- The coalition of 24 civil organisations for *Volovja reber* collects 2400 signatures under the petition against the WPP
- Municipal council adopts the spatial plan for WPP,
- Decree on *Natura* sites is adopted, *Volovja reber* is excluded from the categorisation on the demand of the municipality
- An agreement between the developer and the mayor on the compensation is made. The money is to be used for the primary school in *Ilirska Bistrica*
- The process for obtaining the permits begins, including the various demands of the institutional and civil stakeholders.

2005–2006
- The *Birdwatchers Society* fights for the right to become a party to legal proceedings
- The National parliament's committee for the environment supports the WPP

2007
- Developer **gets the building** permit for 29 turbines
- The *EU* warns *Slovenia* because of the unjustified exclusion of the proposed WPP area from the *Natura2000* sites

2008
- The building permit is **revoked** because of the procedural mistakes in the environmental impact assessment process (the formal role of the birdwatchers' society is recognised)

2009–2010
- Internal negotiations between the developer and the birdwatchers
- The previous environmental assessment and the **building permit are confirmed**

2011
- The administrative court **revokes the building permit** based on the birdwatchers' society complaint

2012
- The environmental **consent** for 33 turbines **is being granted** and contested immediately by the birdwatchers' society.

2013
- The Environmental **consent is revoked** by the Ministry for the environment. The process is stopped.

In 2010, the public opinion survey among the 268 inhabitants of the municipality (VOLK, T. 2016) showed, that 61% supported and 25% opposed the project. The highest support was in the villages close to the proposed site. Their opinion was not uninformed, as the survey results proved that people were well knowledgeable about the renewable energy and about the *Natura2000* sites. Two thirds also said that they had sufficient information on the proposed project. Their main sources of the information were either friends and neighbours, or public meetings.

As it can be concluded from the project's chronology, the main 'battle' was fought about the stakeholders' roles in the process. As it was clear from the beginning the civil societies, based on the nature conservation (mainly birds) arguments, were strictly against the project, while the local community supported it, mainly due to the benefits agreed with the developer. After the responsible bodies their decisions 4 times, and the further finial rejection of the environmental permit, the developer finally gave up the project.

3.2. Case 2: Wind park Senožeška Brda

The proposed WPP was to be located east and west along the highway between *Ljubljana* and the coast, in the municipality of *Divača*. The WWP should consist of (up to) 40 wind turbines with altogether 120 MW, access roads, connecting and transport electricity lines, and the transformation station *(Figure 7)*. The area is between 400 in 800 m above sea level, consisting mainly of forested hills and ridges. The landscape guidelines (MARUŠIČ, J. *et al.* 1998b) for the area focus on preventing the forest overgrowth and conserving the typical botanic grassland features. The choice of the site was based on the study "Comprehensive evaluation of potential sites for the use of wind power" (MLAKAR, A. *et al.* 2011), which was an input to the National energy program 2010–2030 (URADNI LIST, 2004). This study identifies *Senožeška Brda* as one of the 14 potentially suitable sites in *Slovenia*, as it complies with the conservation (distance from the existing settlements, and the *Natura2000* sites—specifically, the wildlife migration

corridors) as well as the development criteria (wind potential, geomorphology, the accessibility of roads and existing electricity power lines). An adequate wind speed was confirmed by the on-site wind monitoring.

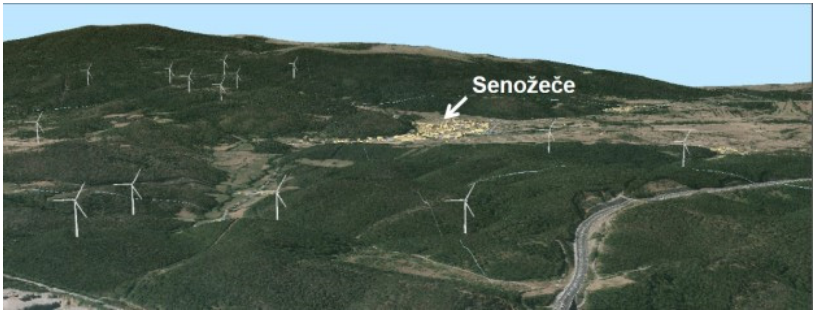

Figure 7 – The proposed WPP in Senožeška Brda
Source: VEPA (2013)

The project was presented in 2013. The developer informed the public about the project by using several ways of the information provision: roundtables, field presentations, info points, meetings with inhabitants. On the other hand, the civil group against the project, *The Protection of Senožeška Brda*, organised the expert presentations on the negative impacts of wind turbines.

In 2014, the initiative for the national land-use plan was submitted and the environmental report for the *Strategic Environmental Assessment* (SEA) was prepared. The number of turbines was downsized from 75 to 40 (120 MW) due to the environmental constraints, and further on to 15–20 (50 MW) due to the economic considerations (for example, reduction of the subsidies). The local community negotiated a minimal 800 m distance from the houses, and a share (3%) of the total income to be paid to the community, including the rents for the landowners, compensations for the affected individuals, and participations into the municipality budget.

That year, a non-binding referendum was organised in the municipality, resulting in the 57% (of around 60% attendance) of votes against the project. Furthermore, an opinion poll, conducted in the local community in the same year, resulted in 50% of the locals supporting the project, and 29% opposing, others were undecided. A survey on a small sample of inhabitants in 2016 (OBLAK, Š. 2016) showed, that despite all the information and surveys, people don't feel well informed about the project. Only 6% said they have a good knowledge, 64% thought they have the basic knowledge, while 30% claimed to have no knowledge about the project at all. Furthermore, 42% did not know which site is being proposed, 33% of those who knew, approved of the site, and the rest disapproved either of the site or the WPP in general.

The project is presently pending due to the financial issues of the developer as well as the uncertainties related to the noise legislation, which needs to be adapted to the technical specifics of the wind turbines.

4. Results and discussion

4.1. The role of the impact on landscape in approving/disapproving the WPP

The impact of the RE facilities on the appearance of the landscape is most often perceived negatively by the public. This perception depends on the landscapes' characteristics of a particular site as well as the social factors, such as the attachment to, and the identity value of the landscape (GRAHAM, J. B. *et al*. 2009; TORRES-SIBILLE *et al.* 2009; MCPARTLAND, S. 2012; MOLNAROVA, K. *et al.* 2012; VECCHIATO, D. 2014; BETAKOVA, V. *et al*. 2015). The summary of different surveys in the *Primorska region* (BREČEVIČ, D. *et al.* 2001; OBLAK, Š. 2016; VOLK, T. 2016) shows, that the health and well-being concerns (for example noise, EMR) are less important than nature and landscape *(Figure 8)*. The birds are of highest concern, while the visual impacts, in both cases assessed as medium (3 or slightly less on a 1–5 scale), were placed second. While the scenic values have been mentioned a few times in

the debates at both sites, they never came to the front of the discussions. Typical quotes from the discourses are shown below, putting wildlife (birds in particular) in front of the discussion in the *Volovja reber* case, and health (noise and EMR) in the *Senoženska Brda*.

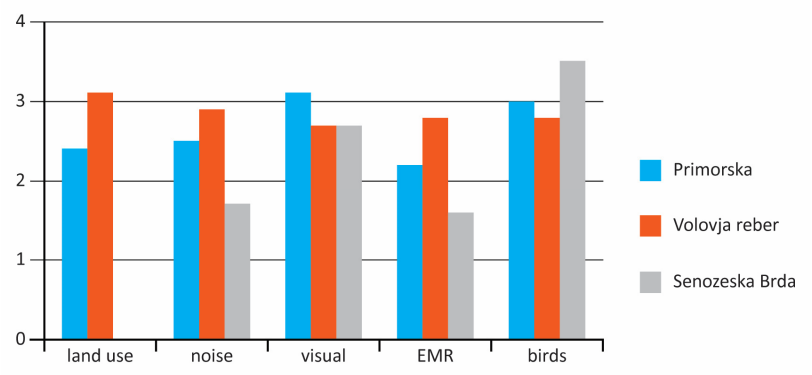

Figure 8 – Importance of different impacts; comparison of the results from three different surveys

Source: BREČEVIČ, D. et al. (2001); OBLAK, Š. (2016); VOLK, T. (2016)

"The proposed areas are a part of a complex of highland karstic ridges of high nature conservation importance and exceptional scenic value. They are the sites of endangered flora, habitats of big carnivores, and migration corridors for vultures and other internationally protected birds. Building the wind turbines in this area would be a rude and permanent disruption, which would degrade the areas' nature conservation value" (from the "petition against the WPP on Volovja reber).

"... on Volovja Reber there is nothing but old grass and a few rocks and bushes here and there, the same on Vremščica, only a few sheep in addition. So, what would the wind turbines disrupt there? The sheep would still graze and the birds would still fly" (the internet forum about the Volovja reber).

"The existing turbine on Griško polje disclosed another reason for opposing the project: The turbine emits sounds, which are detrimental for health and can be heard through closed windows and are especially disturbing during the night time. The forest of wind turbines around our settlements does not only destruct the landscape but also our living environment." (The civil initiative to protect Senožeška Brda)

The relative importance of the landscape's scenic value can also be concluded from the answers to the question where the WPPs *should* be. The responses are mainly very rational. The main criteria involve the wind potential (in terms of the landscape characteristics) and the appropriate distance of the industrial or degraded areas from the settlements (GOLOBIČ, M. 2005; VOLK, T. 2016), which is consistent with the findings in literature (LOTHIAN, A. 2008; BETAKOVA, V. 2015).

In terms of the individual landscape features, the results of public surveys are not consistent. When asked about the suitability of different landscape types for WPP, the respondents choose the *above the timber line* and *agricultural land* as the most appropriate (with scores between 3 and 3.5 on a 1–5 scale), followed by the *visually exposed*, *forested* and *settled areas* (GOLOBIČ, M. 2005). The areas of cultural and natural heritage were evaluated as least suitable (scores less than 2).

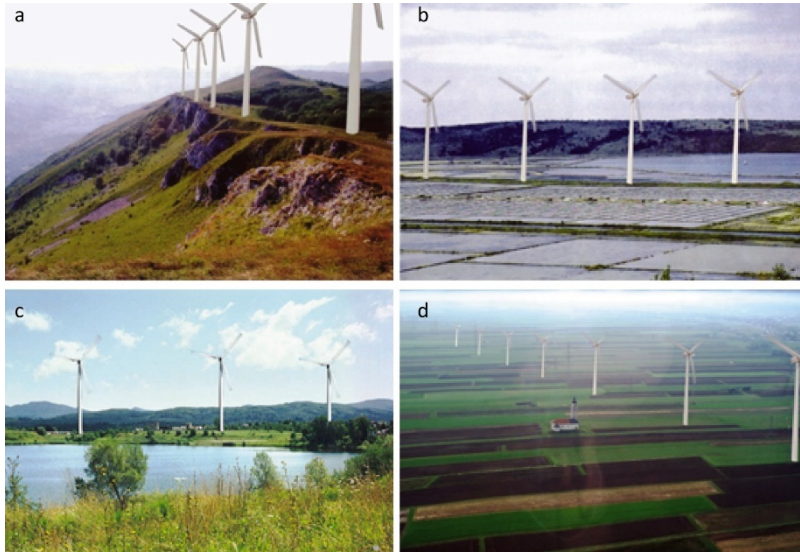

Figure 9 *– a) The landscape assessed as the most visually sensitive to wind turbines. b, c and d) The landscapes assessed as the least visually sensitive to wind turbines*
Source: GOLOBIČ, M. (2005)

However, when using the photo surveys to assess the baseline (without turbines) and modelled (with turbines) sceneries against a set of the landscape quality criteria, the results were just the opposite. The largest degradation was perceived in the natural (above the timber line, visually exposed) landscape (photo *a* in *Figure 9*), and the smallest in the cases of the *Sečovlje* salt fields (cultural and natural heritage site, photo *b* in *Figure 9*), settled countryside (photo *c* in *Figure 9*), and agricultural land with cultural heritage (photo *d* in *Figure 9*).

In general, plains are a preferred setting for wind turbines as opposed to hilly landscapes. This may be related to the natural vs. cultural image of the landscape. The facilities for the use of renewable energy sources (RES), as markedly anthropogenic structures, disrupt 'the natural' which negatively affects the landscape's appearance, a finding which is in line with some other studies (BROWN, G. – BRABYN, L. 2012). On the other hand, the presence of cultural elements (church for example) does not seem to reduce the acceptability (GOLOBIČ, M. 2005).

The most consistent are the findings showing that the wind turbines are less attractive from up close than from a distance, regardless of the surrounding landscape. Additionally, partial hiding by other elements (for example shrubs and trees) increases the visual acceptance (*Figure 10*—photo *a* preferred over photo *b*).

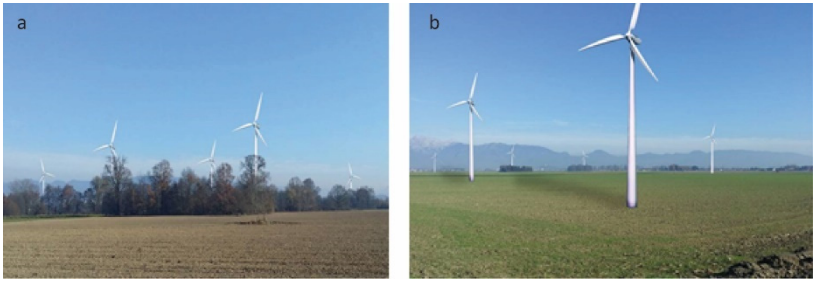

Figure 10 – Impact of landscape feature on visual acceptability of wind turbines, 'a' preferred over 'b'
Source: OBLAK, Š. (2016)

4.2. NIMBY or a lack of process governance?

The difference between the general acceptability of the WPP and the opposition to the projects in a local neighbourhood is often explained by the NIMBY effect. The surveys in both case studies are also ambiguous in confirming this hypothesis. In the case of *Volovja reber*, 38% of the inhabitants would accept the turbines closer than 1000 m from home *(Table 2)*, a distance, which was, for example, required as a minimum in the case of *Senožeska Brda*.

Table 2 – Acceptable distances of wind turbines from home

Source: VOLK, T. (2016)

m	< 100	100–500	500–1,000	1,000–5,000	5,000–10,000	> 10,000	other	sum
%	20	11	7	20	9	13	20	100

On the other hand, the distances obtained in the survey among the three different local communities (one of them was to host the proposed *Senožeška Brda* WPP) were much larger—the WPP should be 7 km (!) away from home (*Figure 11* top).

These distances hardly seem rational, in particular when taking into account the dispersed settlement pattern in *Slovenia*. It is interesting, however, that the required distance for the WPP was significantly higher in the hosting community—more than 20 km (*Figure 11* bottom), then in the other two (the accaptable distances were higher for the objects proposed inthese communities, for example an electric power line and a waste disposal facility).

Trying to summarise the success or failure factors of the wind energy projects, the following main groups were identified *(Table 3)*: characteristics of the object (for example scale, environmental compliance, innovation potential), characteristics of the site (for example peripheral, degraded, industrial), compliance and synergy with other uses, and (perceived) local economic benefits and governance of the process (trust, transparency, etc.).

From the perspective of the factors which are often considered as the most important, for example the process governance and perceived economic benefits for the local community (BREUKERS, S. – WOLSINK, M. 2007; JOBERT, A. *et al.* 2007; WUSTENHAGEN, R. *et al.* 2007) both projects did fairly well. Nevertheless, other reasons caused their hindrance and possibly failure.

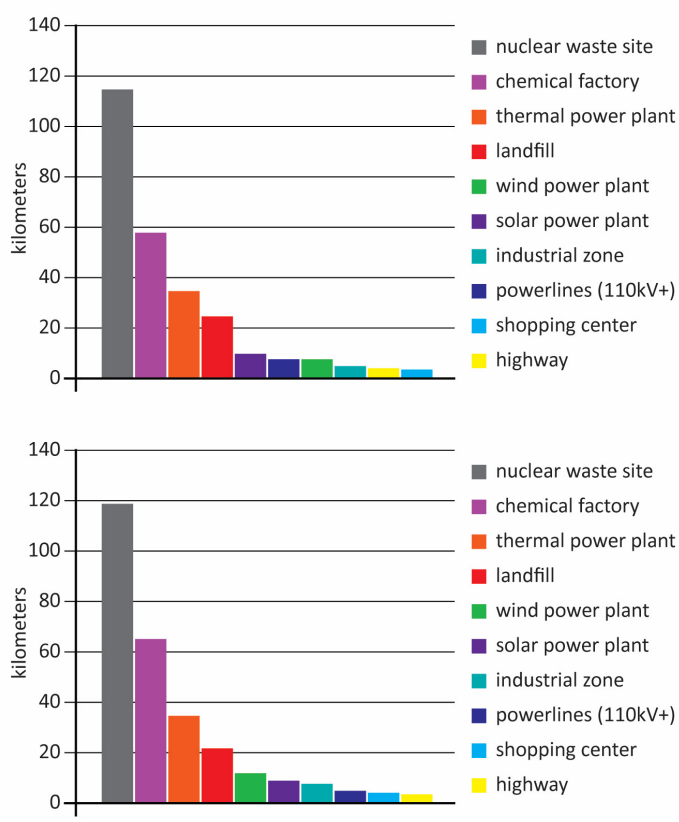

Figure 11 *– Required distance for different facilities by respondents in the three different communities (top) and the community hosting the proposed WPP Senožeška Brda (bottom)*
Edited by VOLK, T. (2016)

Table 3 – Success factors of wind energy projects

Edited by GOLOBIČ, M. (2005)

	Volovja reber	Senožeška Brda
Characteristics of the object		
Small scale (deconcentrated energy, small visual and other impacts, pilot or experimental projects) –	–	–
Unambiguous compliance with environmental standards	–	**(+)**
Characteristics of the area		
Peripheral area (rural, less populated, no land use conflict)	**+**	**+**
Reuse, multipurpose (infrastructure, industry)	–	–
Compatibility & synergy		
Use for tourism, recreation and education	–	–
Local economic benefits		
Energy independence, shareholding, economic profits	**(+)**	**(+)**
Process governance		
Embeddedness in higher level document (strategy, programme	–	**+**
Trust in manager of the process/developer, perception of fair distribution of burdens and benefits	**+**	**(+)**

5. Conclusions

Maybe more than other contemporary processes, the RE development has the potential to create the vital modern landscape, and thus contribute to the palimpsest of heritage landscapes, created by past land use practices and technologies. However, present discussions raise a question whether the current management and spatial planning approaches are capable of simultaneously achieving the RES objectives and ensure the quality of the landscape.

So, what is the role of experts (and our knowledge) in planning WPP? Traditionally, we would be asked to provide independent scientific studies about the environment and impacts. However, as the ex-

amples above show, the roles became more diversified. Providing knowledge support for the developer (optimisation of project) became an important one, especially with the formalisation of the (strategic) environmental impact assessments. Additionally, with the recognition of public participation, providing knowledge support for civil groups (empowerment) came up front. Therefore, not surprisingly, the participants of the LeNotre RELY e-lecture from all across *Europe* quite equally recognised as important all of the three roles.

The Slovenian national documents in preparation, partly acknowledge the attitude of people as important for achieving the objectives of the RE. The national action plan for RE resources (AN OVE, 2010) highlights the 'information and awareness' as important for achieving the goals, and provides the measures for informing the actors (consumers, builders, architects, etc.) about the benefits, cost and energy efficiency of devices, systems, and electrical energy from the renewable sources, and for stimulating the activities of the non-governmental organisations operating in the public interest in the energy sector. However, these measures aim to increase the general public support for RE, which is already high, and will not help in solving the problems that the current projects are facing. The new energy concept for *Slovenia* (MINISTRSTVO ZA INFRASTRUKTURO, 2015), goes a little closer to the point by aiming to achieve 'the social agreement on the siting of infrastructure'; however, it does not provide any instruments for that.

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