Interrelationships of onshore wind farms with tourism and recreation: lessons from international experience for countries with an emerging wind energy sector

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1 Introduction

The interest in harnessing wind energy is increasing worldwide due to its positive contribution to the mitigation of global warming. Infrastructure for production of wind power does not require any fuel for operating, consequently it produces zero emissions of greenhouse gases or any harmful substances (Jaber, 2013). However, it comes with various environmental impacts, such as bird fatalities due to collisions with wind turbines, deforestation, land erosion, visual and noise pollution (Marques et al., 2020; Nazir, Ali, Bilal, & Iqbal, 2020). The impacts on the surrounding landscape often lead to public opposition and conflicts related to which locations are most suitable for placing the wind turbines (Pasqualetti & Smardon, 2017; Rand & Hoen, 2017; Wolsink, 2007b). This is especially relevant for onshore wind turbines, since they are usually located in the vicinity of the areas used for tourism and recreation, as well as residential, agricultural, or other land use areas (Felber & Stoeglehner, 2014). Moreover, with rapidly evolving technology wind turbines keep increasing in size. Over the last 20 years the tower height of wind turbines more than doubled to over 160 meters, followed by relative increase in blade diameter (Enevoldsen & Xydis, 2019). Higher visibility of wind turbines might negatively affect perceived compatibility of wind farms with other land uses.

Despite issues related to the public opposition to onshore wind power infrastructure development, onshore wind power constitutes a majority of the global wind power market. In 2019 the global total renewable power capacity reached 2,588 GW. Around 1,150 GW came from hydropower, 651 GW came from wind power (621 GW of which was onshore), solar PV reached 627 GW, bio-power 139 GW and geothermal 13.9 GW (Figure 1) (REN21, 2020). The total increase of onshore wind power capacity in 2019 reached more than 54 GW compared to 6 GW offshore (REN21, 2020). Higher reliance on onshore wind power is mainly due to its lower cost (Hevia-Koch & Klinge Jacobsen, 2019), although the importance of the offshore wind power in the global market is increasing (REN21, 2020).

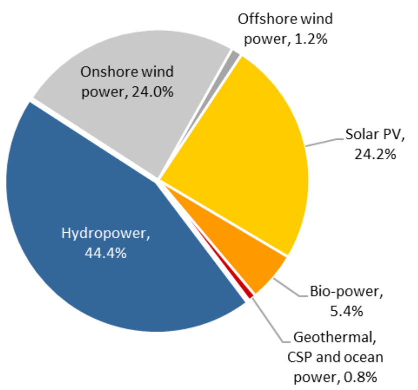

Figure 1. Global renewable power capacity 2019. Based on data from REN21 (2020).

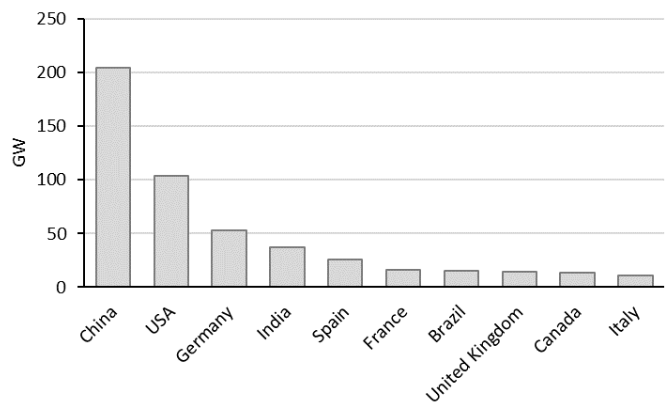

Figure 2. Countries with highest onshore wind energy capacity in 2019. Based on data from IRENA (2020).

Among the countries containing the highest onshore wind energy capacity in 2019 were China (204.5 GW), USA (103.6 GW), Germany (53.3 GW), India (37.5 GW), Spain (25.5 GW), France (16.3 GW), Brazil (15.4 GW), United Kingdom (14.2 GW), Canada (13.4 GW) and Italy (10.8 GW) (Figure 2) (IRENA, 2020).

However, when discussing the social and landscape impacts of onshore wind power infrastructure, the density of wind power infrastructure in each country might be a better indicator for potential conflicts. The countries with the highest density of wind power infrastructure are Germany (152.6 MW per 1000 km^2), Denmark (105.2 MW per 1000 km^2), The Netherlands (104.1 MW per 1000 km^2), Belgium (73.4 MW per 1000 km^2), Ireland (60.2 MW per 1000 km^2), United Kingdom (58.6 MW per 1000 km^2), and Portugal (57.0 MW per 1000 km^2) (Figure 3) (IRENA, 2020). Thus, while some countries have a long-lasting experience with the use of onshore wind farms for renewable energy generation, this type of energy infrastructure is relatively new in other countries and not widely applied. This might lead to differing attitudes and perceptions of wind turbines, since, as existing research has shown, previous experience with wind power infrastructure affects people's attitudes (Ladenburg & Krause, 2011). Moreover, countries where onshore wind power development is in the early stages could largely benefit from the international experience while identifying the locations most suitable for onshore wind farm development.

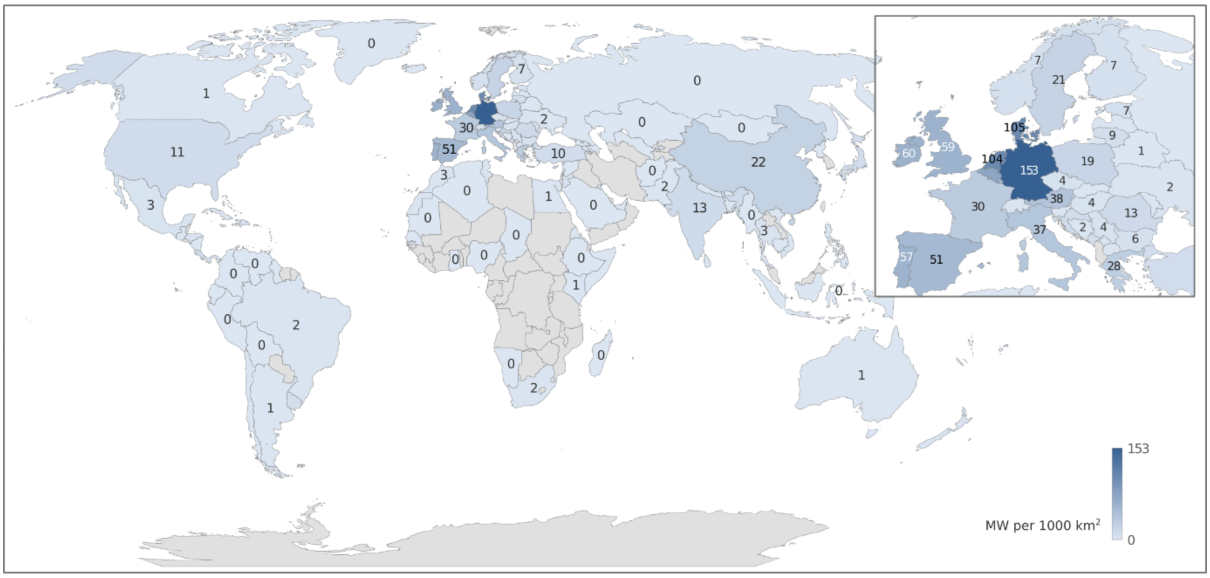

Figure 3. The geographical distribution of onshore wind energy (MW per 1000 km^2). Based on data from IRENA (2020).

The present literature review was conducted with the aim to summarize existing academic knowledge on the issues related to wind farm development and tourism and recreation, as well as to identify potential research gaps. It focuses on the interrelationships between onshore wind energy infrastructure and tourism and recreation, on the ways wind turbines can impact tourism and recreation, and the factors influencing the scale of these impacts. Since these impacts are closely related to issues concerning social acceptance and landscape changes due to wind power production, the state of knowledge on both social acceptance and landscape impacts of wind energy infrastructure is presented before discussing the results of this literature review. Such knowledge is expected to facilitate the interpretation of the results related to the impacts of wind energy infrastructure on tourism and recreation and help identify the differences and similarities between perceptions of tourism stakeholders and the general public.

The search for relevant articles was conducted in three online databases of scientific research literature: Scopus, Web of Science, and Science Direct. The terms used for the search were 'wind energy/turbine*/farm*/infrastructure AND touris*/recreation*'. Articles containing these terms in the title, abstract, keywords or topic heading were included in this literature review. During the search no time limit was applied for the publishing date of the articles. Furthermore, the bibliographies of relevant papers were examined to identify other papers related to the topic of this review.

2 State of knowledge

2.1 Social acceptance of wind energy infrastructure

Public attitudes towards wind energy have been shown to be generally positive (Rand & Hoen, 2017). While they are an important factor predicting the public support for local wind farm development (Johansson & Laike, 2007; Molnarova et al., 2012; Walter, 2014), specific proposed wind farms often meet strong local opposition. To explain this discrepancy the NIMBY (not-in-my-back-yard) term is often used, which involves individuals' support of developments like wind energy production, but not in their own locality (Dear, 1992; Wüstenhagen, Wolsink, & Bürer, 2007). This approach has been criticized by numerous researchers (Petrova, 2013; van der Horst, 2007; Wolsink, 2006) for not identifying the actual causes of opposition. Wolsink (2007b) investigated this support gap and concluded that the main factor explaining public opposition are visual impacts on landscape value, while NIMBY inclination is often related to fairness and equity in decision-making. People who perceive the distribution of economic benefits and environmental costs/risks as not fair are more likely to oppose a wind energy project in their proximity. Devlin (2005) pointed to the fact that while the benefits of the wind energy development are felt globally, the costs are mostly carried at a local level due to the loss of surrounding environmental quality. Therefore, the acceptance of wind energy development can be increased by providing opportunities to also benefit from wind power infrastructure for those carrying the costs emerging due to the degraded quality of the environment. In line with that various studies showed that higher public participation, community ownership and local economic benefits, as well as increased fairness related to benefit distribution increase public support for wind power development (Bauwens & Devine-Wright, 2018; Devine-Wright, 2005; Devlin, 2005; Toke, 2007; Warren & McFadyen, 2010).

The studies investigating the effects of proximity of residence to wind energy infrastructure on public opposition have shown mixed results. A study by Swofford and Slattery (2010) showed that acceptance of wind energy was the lowest among those living closest to wind farms, while with increasing distance the support increased. Warren, Lumsden, O'Dowd, and Birnie (2005), on the other hand, have observed an 'inverse NIMBY syndrome' meaning that residents living closest to the wind farms (0-5 km) are the most supportive of them. Some elements of NIMBY-ism were though observed in the study by Warren et al. (2005), such as the preference to locate wind farms in uninhabited areas and offshore. However, these preferences were stronger in the areas with proposed wind energy infrastructure compared to existing wind turbines. Similarly, to the results of Warren et al. (2005), in a study of Hoen et al. (2019) residents living at a distance of up to 1.6 km from wind turbines were significantly more positive towards wind projects than the residents living further away. On the other hand, several studies (Johansson & Laike, 2007; Wolsink, 2007b) found no relation between proximity of the residence of the respondent and the intention to oppose wind energy infrastructure. Furthermore, a study by Molnarova et al. (2012) showed that residents living in a distance of up to 3 km from a wind farm are less sensitive to the landscape type and quality while evaluating the suitability of a wind farm in a certain landscape, while attitudes towards wind power in general play a more important role. A study by Jones and Eiser (2010) aiming to estimate 'how big is the backyard' with regard to NIMBY syndrome showed that the increase of support for wind energy development with distance from residence was not linear, indicating that other factors, especially site visibility and impacts on landscape, play an important role for support of wind energy projects.

According to Wolsink (2007b), public attitudes towards wind farms are not static and develop in a U-shape. People are very positive towards wind power until specific projects in their neighborhood are announced. Then their attitudes become more critical, but turn back to more positive within a year from the construction of the wind energy infrastructure if the environmental impacts of this infrastructure are properly addressed (Wolsink, 2007b). Thus, familiarity and prior experience with the wind energy infrastructure might affect the acceptance of wind turbines (Ladenburg & Krause, 2011). In line with the results of Wolsink (2007b), a study conducted by Warren et al. (2005) focusing on the views of local residents in Scotland and Ireland, showed that visual and noise impacts anticipated before the construction of a wind farm often turned out to be lesser than expected. Furthermore, the existing wind farms were even perceived as attractive, which lead to increased support for wind energy infrastructure in the areas already containing wind farms. This is partly supported by the study of Eltham, Harrison, and Allen (2008). Although their study did not identify a significant increase of support for the existing wind farm among the residents, possibly due to high support both before and after the construction, a higher proportion of residents perceived the wind turbines as visually attractive after the construction (Eltham et al., 2008). Ladenburg, Termansen, and Hasler (2013), on the other hand, observed that whether participants could view wind turbines from their residence or not, did not have any effects on their attitudes towards wind turbines, but in combination with seeing more than five wind turbines daily it negatively affected people’s attitudes towards wind energy infrastructure. Thus, with increasing number of wind turbines the acceptance of wind energy infrastructure might decrease. Jones, Orr, and Eiser (2011) conducted a study in Humberhead Levels in northern England, which are characterized by a flat, low-lying landscape. Their results showed that the perceived maximum number of wind turbines the region can support varied greatly among the respondents. A total of 89% of respondents stated that the region had a capacity for more wind energy development. The biggest proportion, 21% believed that the region could support 1-25 additional wind turbines, around 15% thought it could support 26-50 wind turbines, the same proportion thought it could support 76-100 turbines, while almost 14% thought the region has a capacity for 151 wind or more turbines. The study further showed that main factors affecting the estimated capacity of the region included perceived regional suitability, fairness and equity, and visual attractiveness of wind turbines. Moreover, perceived knowledge of the existing and proposed wind energy projects in the region was positively related to acceptable number of wind turbines, that is higher perceived knowledge lead to more wind turbines perceived as acceptable. Similar tendencies were observed regarding environmental values (higher value score – more wind turbines acceptable). Community attachment, on the other hand, was negatively related to the acceptable number of wind turbines: respondents with higher community attachment accepted less wind turbines (Jones et al., 2011). Thus, perceptions of how many wind turbines are too many are very subjective and depend on various factors.

Warren et al. (2005) suggest that public opposition could partly be explained by NIABY, or ‘not-in-anybody’s-backyard’. By that they mean that disapproval of wind energy development can also be rooted in the perceived importance of preserving the wilderness and naturalness of rural areas due to their value for recreation and relaxation, or due to other environmental reasons (Meyerhoff, Ohl, & Hartje, 2010; Petrova, 2013).

Next to the perceived visual impacts on the landscape, and environmental and socioeconomic concerns, other factors affecting attitudes towards wind power projects include: perceived need for wind energy (Devlin, 2005), procedural concerns and divergent perspectives on the desirable project outcome (Aitken, 2010; Mills, Bessette, & Smith, 2019), noise pollution (Hoen et al., 2019; Rand & Hoen, 2017) and concerns about potential impacts on health (Baxter, Morzaria, & Hirsch, 2013). The relationships between the attitudes towards wind energy development and the factors affecting them, however, can be bidirectional: negative attitudes towards wind power and higher perceived visual impacts can lead to higher noise annoyance (Klæboe & Sundfør, 2016; Pedersen & Waye, 2004), and consequently to lower mental health, as well as reduced life quality for residents living close to wind turbines (Jalali et al., 2016).

2.2 Landscape impacts of wind energy infrastructure

Numerous researchers (Pasqualetti & Smardon, 2017; Suškevičs et al., 2019; Warren et al., 2005; Wolsink, 2007b) have pointed out that the visual impacts of wind turbines are among the main factors for both public opposition and public support of wind power infrastructure. Perceived visual impacts on the landscape, however, might differ strongly depending on various factors and are closely related to perceived suitability of the wind energy infrastructure in the landscape (Johansson & Laike, 2007).

Thus, the type of landscape in which a wind energy project is to be placed plays an important role for the perception and acceptance of wind turbines. A study by Wolsink (2007a) conducted by the Wadden Sea in the southeastern part of the North Sea showed that industrial and military areas were perceived as the most suitable siting of wind turbines, while areas located in a nature reserve or other natural scenic areas, as well as recreational areas, were perceived as the least suitable. Molnarova et al. (2012) compared respondents' visual preferences for wind farms in three types of landscapes in the central region of the Czech Republic. The participants were shown the photographs of these landscapes without wind turbines and were asked to evaluate their aesthetic value using 5-point Likert Scale. The area ranked as the most attractive had a distinctive morphology with mountains in the background, contained mostly natural elements and had little impact of human activity; the second area consisted of an agricultural and forest landscape, while the least attractive landscape was a lowland landscape heavily exploited for agricultural uses with visible factory infrastructure in the background. Participants were shown pairs of photographs without and with wind turbines and were asked to rate them using the 5-point Likers Scale where 1 meant significant deterioration of the landscape and 5 – significant improvement. Wind turbines in the least attractive landscape were perceived as the least negative additions to the landscape, with 8% perceiving wind turbines as a significant improvement to the landscape and 5% as a significant deterioration. At the same time wind turbines in the most attractive landscape were perceived as a significant deterioration of the landscape by 35% of the respondents, and 1% perceived wind turbines in such landscape as a significant improvement. Similarly, a study by Lothian (2008) showed that in the coastal areas the reduction of the scenic quality due to wind farms was perceived as the highest in the areas rated as the most scenic. Furthermore, in the inland areas of lower scenic quality wind farms were perceived as positive additions to the landscape (Lothian, 2008).

Another factor affecting perceived visual impacts of wind turbines on the landscape is the distance between the observer and the wind turbines. Molnarova et al. (2012) showed that photographs with wind turbines located at a distance of 1.5 km received significantly lower rating compared to the photographs with wind turbines at 4.5 km and 8.0 km. Betakova, Vojar, and Sklenicka (2015) further investigated the same landscape types and found that increasing distance reduced the negative impact of wind turbines most effectively in more attractive landscapes (with major reduction occurring at the distances between 7.5 and 10 km), while in the least attractive landscape increasing distance reduced the negative impact of the wind turbines much less (with more evident reduction at the distance between 3 and 5 km). Since the rating of all landscapes with one wind turbine (105 m high, 90 m blade diameter) at a distance of 10 km and further was similar to landscapes without wind turbines, Betakova et al. (2015) set the visual threshold distance for one wind turbine in landscapes of higher aesthetic quality at 10 km, and in lower quality landscapes at around 5 km. Interestingly, when a wind turbine was located at the distance of 750 m, all three types of landscape were rated similarly since the wind turbine dominated the landscape and eliminated its scenic qualities. These strongest impacts lasted up to 1.5 km from the wind turbine. Bishop (2002) estimated the threshold of visual impacts of a wind turbine (50 m high tower, 26 m long blades) by taking into account the contrast with the surrounding landscape and atmospheric scattering and the movement of the blades. He concluded that in transparent weather conditions the visual impact of a wind turbine might reach up to 30 km, but in worse viewing conditions this distance is likely to be shorter. Sullivan et al. (2012) estimated the maximum limit of visibility of approximately 90-120 m high wind turbines. According to them, it reaches 58 km in optimal viewing conditions. The limit of casual visibility, meaning that visual impacts of wind turbines are moderate in normal viewing conditions, they set at 32 km, and limit of visual preeminence, when wind turbines are a major focus of attention and have a large visual impact, at 16 km. In the western U.S. landscapes, which are characterized by wide open views Sullivan et al. (2012) suggested using a 48 km limit while conducting viewshed analyses of the 90-120 m high wind turbines. Similarly, Scottish Natural Heritage (2017) recommended using the distance of 40 km for 131-150 m high wind turbines and the distance of 45 km for wind turbines higher than 150 m while estimating the zone of theoretical visibility.

Effects of different characteristics of wind turbines have also been investigated in various studies (Lothian, 2008; Molnarova et al., 2012; Tsoutsos, Tsouchlaraki, Tsiropoulos, & Serpetsidakis, 2009). The number of wind turbines seems to affect their perceived suitability in the surrounding landscape. In a study by Molnarova et al. (2012) respondents preferred a landscape with one wind turbine over four wind turbines. In a study of Ek (2006) smaller wind farms (less than 10 wind turbines) were preferred over bigger wind farms (between 10 and 50 wind turbines), as well as over separately located wind turbines. Bergmann, Colombo, and Hanley (2008) showed that respondents preferred smaller onshore wind farms (30 wind turbines) over larger onshore farms with 80 wind turbines, while large offshore farms (100 turbines) were perceived as the most acceptable. On the other hand, in the study by Lothian (2008), where the number of wind turbines varied between six and thirteen, no significant differences in perceived landscape quality were observed. Lothian (2008) assumed that it might be due to a rather small range of wind turbines. A study by Meyerhoff et al. (2010) showed divergent preferences regarding the height of the wind turbines. While planning new wind energy development Ladenburg et al. (2013) suggest to take into consideration the function of the number, height and distance of wind turbines from residential areas in order to identify the most socially acceptable options. In a study by Lothian (2008) white, grey or blue (depending on the landscape) were preferred colors of wind turbines over tan and rainbow. Wolsink (2007a), however, emphasizes, that the characteristics, such as number and height of the wind turbines are of much lesser importance for the acceptance of wind energy infrastructure than the type of landscape.

Baynard et al. (2017) calculated landscape disturbance footprint of wind turbines in Colorado's Pawnee National Grasslands by including roads, transmission lines, easement lines, turbine pads and substations. The calculated direct disturbance footprint for each wind turbine reached 0.01 km^2 or 1 ha. Such results, according to the authors, are in line with the estimates of the World Bank showing that the landscape footprint due to cleared vegetation for the wind turbine pads and for road construction for wind energy development reaches 1-2 ha/MW (Ledec, Rapp, & Aiello, 2011). Baynard et al. (2017) emphasize that while direct impacts on land surface of the wind turbines are relatively small, the visual impacts are far reaching.

Due to their visual and aural impacts wind farms might negatively affect tourism and recreation in surrounding areas. If tourists perceive wind energy infrastructure negatively, they might stop visiting the area. That might lead to economic losses in the regions, especially for the nature-based tourism industry, which depends on the high quality of the natural landscape for their business (Fredman & Tyrväinen, 2010). Thus, in regions which rely heavily on nature-based tourism it is important to know the opinion of both visitors and the local population. Public perception of these impacts plays an important role in the decision-making on wind energy development. Public opposition to wind energy development and, furthermore, lack of local support, might become a major hindrance for the implementation of wind farms. Their opinion is of fundamental importance as they retain political power through voting, for instance when it comes to giving permits for a wind power development (Toke, 2005; Toke, Breukers, & Wolsink, 2008). In order to ensure effective decision-making, it is important to ensure a good overview of identified impacts of wind energy infrastructure on tourism and the factors affecting their scale, which the present paper aims to deliver.

3 Tourism and wind energy infrastructure

3.1 Perceived impacts of wind energy infrastructure on tourism and recreation

While wind energy seems to have slightly lower acceptance rates among tourists compared to other renewable energy sources (Sæþórsdóttir, Ólafsdóttir, & Smith, 2018), studies focusing on wind energy development and tourism (Brudermann, Zaman, & Posch, 2019; de Sousa & Kastenholz, 2015; Silva & Delicado, 2017) show that tourists and the tourism industry's opinions about wind energy are mostly positive. It is perceived as renewable, green, clean and sustainable (de Sousa & Kastenholz, 2015; Silva & Delicado, 2017). However, the views of tourists and other tourism stakeholders become more divergent, and acceptance levels tend to drop when discussing wind energy projects in specific locations. A quantitative study conducted by Brudermann et al. (2019) in the Austrian Alps compared the visitors' acceptance level for wind energy as generation technology at four locations. The support for the four locations differed significantly with the highest being the support for the wind energy in general (mean acceptance level 4.57 on the 5-point scale), followed by wind farms in the lowlands (4.26). The acceptance of the wind farms existing in a locality was lower, but interestingly the acceptance of the wind farms in the Alps was even lower (4.04) compared to the locality (3.82). Brudermann et al. (2019) offered a potential explanation for that: it might be that participants compared the existing wind farms in the locality with the potential wind farms that would be built in the untouched landscapes of the Alps. The authors here point to the phenomenon of "status quo bias" (Samuelson & Zeckhauser, 1988), when people tend to prefer the current situation over changes and are more likely to accept the status quo because they cannot change it. This tendency was observed also in the study conducted by Sæþórsdóttir et al. (2018) in the Southern Highlands of Iceland. Almost half of the visitors to the area who noticed the two already existing wind turbines were positive towards them, while 16% were negative. When discussing a proposed wind farm in the area, however, around 40% of visitors were negative, 25% were neutral and 36% of visitors were positive. Frantál, Bevk, Van Veelen, Hărmănescu, and Benediktsson (2017) discussed the same Búrfell wind farm proposed in the Southern Highlands of Iceland with a group of 'expert tourists' interested in renewable energy development. The results of their study showed that 48% of respondents approved of the proposed farm, while around 36% rejected it. The attitudes towards the proposed power plant were highly correlated with the perceived compatibility of the proposed power plant with the landscape of the area. The few respondents that perceived the proposed wind farm as not compatible with the landscape but still approved it, did so due to their support for renewable energy in general. The few that perceived it as compatible but still rejected it, chose to do so because they perceived this project as redundant in the Icelandic context (Frantál et al., 2017).

Hence, among the main negative impacts identified by visitors and local tourism stakeholders of wind farms on tourism are the visual impacts on the landscape and its character (de Sousa & Kastenholz, 2015; Frantál & Kunc, 2011; Lenz, 2004; Ólafsdóttir & Sæþórsdóttir, 2019). Wind farms are perceived as especially unsuitable in natural areas where pristine nature is the main element of visitor experience (de Sousa & Kastenholz, 2015; Ólafsdóttir & Sæþórsdóttir, 2019; Sæþórsdóttir & Ólafsdóttir, 2020). However, while the acceptance of wind turbines in scenic natural areas tends to be lower, the views of visitors are divergent. A study conducted by Lenz (2004) in the recreational region of Eifel, Germany, revealed that 45% of the visitors stated that the movement of wind turbine blades and noise produced by them negatively affected the recreational value of the landscape of the area, and around half of the respondents thought that the wind turbines were too outstanding to harmonically suit the landscape of Eifel. On the other hand, 63% of the respondents thought that wind turbines should be built in recreational areas such as Eifel if the wind conditions for that are suitable. The research by Frantál and Kunc (2011) conducted in two mountainous areas in the Czech Republic showed that only 27% of the respondents thought that the wind turbines significantly affected the landscape character of the areas. This might be related to the fact that the study areas were affected by dams, reservoirs and activities of coalmining, and only 8% of the visitors identified wild nature without traces of human activity as the most important factors for the choice of this destination.

Other areas perceived as not suitable for wind energy development are historic heritage sites. Silva and Delicado (2017) conducted a qualitative study in a Portuguese historic village called Sortelha, in the close vicinity of which two wind farms have been constructed. One contains 17 wind turbines (85 meters high) and is located about two kilometers away from the citadel of Sortelha. The other wind farm is around 800 meters away from the citadel and contains eight wind turbines (same height). As the results show, 42 out of 68 visitors interviewed for the study were concerned about visual impacts, especially as modern wind farms were thought to not suit the medieval architecture of the village. On the other hand, 43 out of 68 visitors participating in the study accepted the wind turbines in the village since they perceived wind energy as environmentally friendly and clean. Furthermore, the vast majority stated that the wind farms did not affect their choice of destination. Interviews with the residents revealed that 14 out of 21 interviewed residents were against the existing wind energy facilities in Sortelha. Like the visitors of Sortelha, the interviewed residents perceived that the wind farms as modern constructions do not fit the historic village, and that this anachronism caused by the visual intrusion of the wind turbines might negatively affect tourism. According to the residents opposing the wind farms, such constructions have negative impacts on medieval characteristics of the village and thereby might spoil the unique attractions that differentiate the village from other places and reduce its international competitiveness as a tourism destination. The residents admitted that the existing wind farms did not have negative effects on tourism demand. However, they believed that the wind farms have strong negative impacts on visitor experience due to the contrast of modern wind turbines and medieval architecture of the village. Other reasons for opposition among residents were related to the issues of fairness of process and justice in allocation of economic benefits of the wind farms, and they felt excluded from the decision-making process.

Noise disturbance and potential health issues were also often brought up by the visitors and residents as impacts negatively affecting visitor experience in the area (de Sousa & Kastenholz, 2015). In this regard Watts and Pheasant (2015) point to the importance of tranquil environments and recreational areas for the health and well-being of humans. Watts and Pheasant (2015) created a model for estimating the impacts on tranquility by various constructions, which takes into consideration noise and visual impacts, and applied it to a wind farm in Ovenden Moor, in West Yorkshire, UK. According to the model, in tranquil areas where no major roads causing noise pollution are located within 2 km, to restore the previous tranquility of a countryside area for a line of wind turbines (11 turbines) a distance of 950 m – 2250 m might be required, depending on the noisiness of the wind turbines. The authors emphasize that natural areas with low levels of human-made infrastructure tend to have high levels of tranquility and provide calming and pleasant experiences, pointing to the need of protecting such areas. The importance of protecting tranquil areas due to their recreational and amenity value has been emphasized in the UK National Planning Policy Framework (Ministry of Housing, Communities and Local Government, 2019). Furthermore, a study by Olafsdottir et al. (2018) conducted in Iceland showed that walking in a natural area (the largest recreational area in Reykjavik), walking on a treadmill inside a gym, and viewing videos of nature on TV significantly decreased cortisol levels in participants of the study. However, walking in nature helped restore cortisol levels more effectively than viewing nature on TV in participants going through stressful situations (exam period). Participants also reported significantly higher mood improvements after walking in nature compared to exercise in a gym or nature viewing (Olafsdottir et al., 2018). Hence, wind power projects might not only affect visitor experience and lead to reduction of recreational opportunities in natural areas, but also negatively impact their restorative functions by causing visual and aural disturbance.

Tourism service providers discussing a proposed wind farm in the Southern Highlands of Iceland also emphasized that light pollution caused by wind turbines is likely to negatively impact visitor experience, especially the ones participating in northern light tours in winter (Ólafsdóttir & Sæþórsdóttir, 2019).

Main positive impacts of the wind farms pointed out by visitors included contribution to sustainable energy production, while locals mentioned economic benefits to their communities (de Sousa & Kastenholz, 2015). A quantitative study by Brudermann et al. (2019) showed that positive perception of benefits and reliability of wind energy, favourable attitudes towards renewable energy, and lower levels of scepticism and annoyance caused by the wind energy infrastructure lead to higher acceptance of wind farms among visitors.

3.2 Effects of wind farms on decision-making to visit the area and their economic impacts

Negative attitudes towards wind farms can lead to avoidance of areas with wind power infrastructure and to visitor displacement. Most existing studies show rather low effects of wind farms on tourists' decision-making to visit the area. A visitor survey conducted by Frantál and Kunc (2011) in the Czech Republic revealed that a vast majority (90%) of the participants in a study area with a proposed wind farm stated that the construction of this new infrastructure would not impact their future visits to the area. In another study area with an existing wind farm 95% of visitors stated that the wind farm did not affect their decision regarding present and future visits to the area (Frantál & Kunc, 2011). This is supported by the results of the qualitative study by Silva and Delicado (2017) where almost all interviewed visitors stated that wind farms do not affect their choice of destination. In a study by Warren and McFadyen (2010) around 90% of visitors to the coastal area of Scotland containing several onshore wind farms stated that the wind farms would not affect their decision to come back to the area, 5% stated that they would avoid areas with wind turbines, while other 5% would be interested in visiting wind turbines. The proportions were somewhat different in the study conducted by Sæþórsdóttir et al. (2018) in Iceland. Here over 60% of visitors stated that they would still visit the area if a proposed wind farm would be built, 31% would not visit or be less likely to visit, and 8% would be more likely to visit the area because of the wind farm. Moreover, almost 51%

of participants stated that they tend to avoid travelling in an area with wind turbines and over 66% thought that wind turbines negatively affect the attractiveness of an area for tourists (Sæþórsdóttir et al., 2018).

Importantly, even low levels of avoidance can have significant impacts on local economies as shown in the study conducted in Scotland by Riddington, McArthur, Harrison, and Gibson (2010). They used a GIS model to estimate how many tourists would be exposed to the wind farms in the accommodation and on the roads. In their study they included the wind farms that already exist, have been permitted, or are in the application process. Additionally, the economic impact of wind farms on tourism was calculated considering a potential reduction in visitor numbers and reduction in accommodation prices. An intercept survey was conducted which investigated the likelihood to return to the areas with wind farms and willingness to pay for the scenery. Around 93% of participants in the study stated that they would not change their plans. Based on that and on the GIS results it was estimated that the reduction in visitor numbers and expenditure related to that in each area would be around 1.5%. Then participants were asked how much they would pay for a hotel room to upgrade to the view with a natural scenery and a scenery with wind energy infrastructure (pictures provided to participants). To calculate the total economic impact, based on the change in expenditure, the change in direct expenditure, total change in output, and the associated changes in income and employment were calculated. At the area level a maximum total loss reached from 1.89% up to 5.77%, but since it was assumed that most tourists would relocate to other areas of Scotland which are less impacted by wind farms, the maximum estimated economic impact at the national level was estimated to be less than 0.1% of the estimated employment in tourism (Riddington et al., 2010). Thus, economic impacts of tourism are more significant at a local level and should be taken into consideration while planning wind power development.

This is supported by the study conducted by Broekel and Alfken (2015) which showed that the presence of wind turbines around German inland municipalities (up to 10 km from municipalities' centre) had negative impacts on tourism demand in these municipalities. Moreover, the study showed that with 1% increase in wind turbine capacity in 10 km vicinity of the municipality the occupancy rate in the accommodation provided in the municipality decreases by 0.01% in the same and in the following years. Furthermore, the study of Broekel and Alfken (2015) showed that wind farm capacity is a more important dimension affecting the tourism demand than the number of wind turbines, which means that besides the number of wind turbines their size also plays a role while choosing a tourism destination. In line with that a study conducted by Gardt, Broekel, Gareis, and Litmeyer (2018) in the state of Hessen, Germany, showed a weak negative effect of the presence of wind turbines on number of overnights in the surrounding areas, but this effect becomes weaker with years. Therefore, Gardt et al. (2018) point to the need of further research looking into the effects of getting used to the wind energy infrastructure and the limits at which high numbers of wind turbines would lead to strong reduction in overnights.

Avoidance of areas in the vicinity of wind farms might also lead to reduction of the recreational property value. A study conducted by Fast, Mabee, and Blair (2015) on the Wolfe Island in Lake Ontario, Canada, containing 86 wind turbines, showed that higher proportion of recreational properties and properties located at the distance of 2 km to 5 km from the wind turbines exhibited price reductions compared to properties located more than 10 km away from the wind turbines. Based on the interviews Fast et al. (2015) concluded that recreational users of the properties prefer to invest in other areas due to negative landscape impacts of wind turbines in the areas.

Mordue, Moss, and Johnston (2020) conducted a survey among tourism-related businesses in Northumberland County, UK, focusing on the impacts of wind farms on rural tourism. Around 37% of respondents of the survey stated that onshore wind farms negatively impacted their business. The main impacts included reduced tourist satisfaction, leading to lower visitor numbers and lower income due to blighted landscape in the areas of high scenic value. Moreover, 33% of the businesses stated that wind farms were likely to affect their future investment decisions, since business owners were not willing to invest in the areas where natural beauty was negatively affected by wind turbines. Mordue et al. (2020), however, pointed out that such results were not in line with the responses about business turnover and visitor numbers, showing rather neutral impacts of wind farms on tourism in the county, as well as with the statistical data showing that tourism in the county has been increasing in the last years. Therefore, Mordue et al. (2020, p. 1892) concluded that "claimed impacts of windfarms on tourism are often social constructions of risk rather than objective facts". According to the authors, individuals' relationship with the surrounding landscape and thereby perception of wind turbines is shaped by the context. Furthermore, it strongly depends on people's interests, perspectives and activities undertaken in these landscapes.

3.3 Effects of visitor characteristics and travel behavior on attitudes towards wind farms

According to various studies (Brudermann et al., 2019; Frantál & Kunc, 2011; Lenz, 2004) gender and education do not affect attitudes of visitors towards wind turbines. Regarding age, a study by Frantál and Kunc (2011) showed that younger groups between 18 and 39 years old tend to be more positive than older groups up to 60 years old, while the support of people over 60 becomes higher again. In a study by Sæþórsdóttir, Björnsson, and Ólafsdóttir (2015) significant differences between age groups were observed while discussing the attitudes towards wind turbines in Icelandic nature and in the Central Highlands: opposition tended to increase with age. However, there were no significant differences between age groups regarding attitudes towards a proposed Búrfell wind farm in the Southern Highlands of Iceland. A study conducted by Lenz (2004) showed no effects of age on the support for wind energy infrastructure. Hence, as in the research focusing on public attitudes towards wind turbines (Rand & Hoen, 2017), demographics do not seem to explain much of the variation in the attitudes of tourists towards wind turbines, and further research is needed to investigate these relationships.

First time visitors tend not to have strong opinions towards existing wind farms in the areas they visit, while repeat and periodical visitors have more polarized attitudes (Frantál & Kunc, 2011). Furthermore, visitors with more positive attitudes towards renewable energy tend to be more supportive of wind energy infrastructure in recreational areas than those with rather negative attitudes. On the other hand, fears about potential negative impacts of wind turbines on animals and people reduce the support for wind turbines (Lenz, 2004). Users of a recreational area living in the same region tend to be more opposed to the wind farms in this area compared to visitors from other regions (Frantál & Kunc, 2011). Visitors coming from the areas that are environmentally degraded due to coalmining, heavy industry, or chemical industry tend to be more positive towards the wind turbines since they are a clean source of energy (Frantál & Kunc, 2011). A study conducted by Frantál et al. (2017) in Iceland showed that visitors from countries having more wind energy infrastructure (Germany, Netherlands, United Kingdom) were more supportive of the proposed Búrfell wind farm in the Southern Highlands than participants from other countries. The sample of this study, however, was rather small (30 participants) and included a specific group of visitors related to renewable energy development. A study by Sæþórsdóttir et al. (2015) based on an on-site survey of 1351 visitors to the area of the same proposed wind farm showed opposite results. Visitors from Germany, Benelux countries, United Kingdom and Ireland were the most negative towards wind turbines in Icelandic nature, in the Central Highlands of Iceland, and towards the proposed Búrfell Wind Farm. Based on these results it can be concluded that visitors coming from countries containing relatively high number of wind turbines prefer not to see them at the gateway into the Icelandic Highlands during their visit.

Residents that are directly or indirectly involved in the management of the wind farms, for example as the owners of rented lands, or their relatives, tend to view them rather positively, also in the context of tourism (de Sousa & Kastenholz, 2015; Silva & Delicado, 2017). Their arguments for support include neutral impacts of the wind farms on landscape and tourism, as well as economic benefits from the energy production (Silva & Delicado, 2017).

3.4 Potential of wind farms as tourist attractions

Various studies point to the potential of wind farms as energy tourism destinations. A study conducted by Frantál and Kunc (2011) in the Czech Republic showed that 65% of respondents would be interested in visiting the wind farms in the study areas if they would contain information centers. Beer, Rybár, and Kaľavský (2018) also pointed out that visitor and educational centers can help combine renewable energy infrastructure, including onshore wind farms, with tourism and increase visitation in the area. A study by Liu, Upchurch, Curtis, and Lusby (2016), analyzed the posted comments and pictures of Chinese domestic tourists visiting wind farms. Their results showed that the characteristics/aspects playing the most important role in engaging tourists in wind energy tourism were (1) aesthetic appeal, (2) educational appeal, (3) opportunities for socialization, such as visits on a special occasion or public holiday, (4) sustainability energy factors, (5) ecological impacts, and (6) policy and planning concerns. In line with previous results, Liu, Upchurch, and Curtis (2016) identified four types of Chinese tourists visiting wind energy infrastructure, based on the content analysis of wind farm pictures posted online. The first type included 'educational tourists', which according to their interests were further divided into 'technology tourists' and 'sustainable tourists'. The second group was 'holiday tourists', which were divided into 'leisure tourists' coming to the area for appreciation of the surrounding landscape, and 'family tourists' combining family engagement with landscape experience. The third type was classified as 'romantic tourists' and included, among others, visitors coming during their wedding ceremony. The fourth and the last category included 'nature tourists' visiting exclusively for fauna and flora, as well as natural landscapes of the area. According to the authors, philosophical ideas of Chinese culture influence local tourists' experience of wind farms and can help explain their perceptions. For example, in Taoist philosophy land is perceived as living and "filled with energy" (Liu, Upchurch, & Curtis, 2016, p. 2), which might lead to higher perceived compatibility of wind farms with natural landscapes. Liu, Curtis, and Upchurch (2019, p. 50) further investigated the intent of Chinese residents to visit a wind farm by applying the theory of reasoned action and concluded that "enculturation of beliefs, the need for personal affiliation, and intellectual intrigue strongly influence a person's pursuit of wind farm experiences". A study by Liu and Upchurch (2020) conducted among undergraduate Chinese students by using eye-tracking technology and post-experimental questionnaires showed that wind farms located in prairie and mountainous landscapes were the most appealing as tourism destinations, while wind farms in coastal areas and deserts were perceived as less appealing. Overall, the study showed rather strong interest of Chinese students in visiting a wind farm. Next to the reasons identified by the previous study (Liu, Upchurch, Curtis, et al., 2016) the authors pointed out that based on Chinese fengshui locals believe that spinning turbines bring wealth and good luck, which might also lead to higher visitation of wind farms among Chinese residents (Liu & Upchurch, 2020).

Liu, Upchurch, Curtis, et al. (2016) stress that energy and tourism policies should support each other to ensure the highest benefits to all stakeholders and the nation as such. This is supported by Frantál and Urbánková (2017) emphasizing the importance of cooperation between energy companies and regional/local governments which might not only increase the acceptance of wind energy but help branding a region and thereby support local tourism. According to their study conducted in the Czech Republic among visitors attending a Dragon Kite Festival located under wind turbines, main motivational factors to visit the event included interest in wind power technology (63%), interest in energy in general (37%) and spending time out of usual places (29%). The study furthermore showed that around 27% of respondents became more positive towards wind power, the attitudes of 76% of participants remained unchanged, while 2% of participants became more negative (Frantál & Urbánková, 2017). Thus, visits to wind farms might positively affect people's attitudes towards wind power, and energy tourism activities can be effective marketing tools.

The studies discussed above focus mainly on domestic tourists, which supports the conclusion of de Sousa and Kastenholz (2015) that since wind turbines are standardized, and their appearance is very similar in most countries, wind farms have a potential of a 'one visit' attraction, which is likely to be visited in a home country. According to de Sousa and Kastenholz (2015), when travelling abroad tourists tend to seek unique settings and experiences in tourism destinations. Silva and Delicado (2017) further add that the potential of wind farms to become tourist attractions strongly depends on the specific characteristics of the area. Wind farms are more likely to become tourist attractions and symbols of progress and green energy in already industrialized landscapes containing little or no cultural or natural heritage.

3.5 Best design and locations for wind turbines

While discussing the most appropriate design of the wind farms, around 60% of participants of the study by Frantál and Kunc (2011) preferred several smaller wind farms consisting of 3 to 5 wind turbines over large wind parks containing 80-100 wind turbines, which were preferred by 10% of the respondents. The results of the study conducted by Riddington et al. (2010) in Scotland contradicted these findings and showed that participants of their internet survey preferred to see fewer but larger wind farms. In the study by Sæþórsdóttir et al. (2018) over 29% of participants agreed with the statement that 10 wind farms with 10 wind turbines are preferable to one wind farm with 100 wind turbines, while almost 39% disagreed with this statement.

As already mentioned above, height of the wind turbines affects tourists' perceptions of them. According to the results of the study by Sæþórsdóttir et al. (2018), at the distances of 1.5 km and 4 km the wind turbines reaching 80 m are perceived more negatively compared to the wind turbines reaching the height of 64 m. However, at the distance of 4 km 87 smaller turbines were perceived more negatively compared to 66 larger turbines. Hence, while smaller wind turbines are perceived more positively than the larger ones, larger but fewer wind turbines in a wind farm are perceived more positively compared to the higher number of smaller wind turbines (Sæþórsdóttir et al., 2018).

Various studies (Arnberger et al., 2018; Brudermann et al., 2019) looking into visitor perceptions show that distance plays a role in the social acceptance of the wind farms among visitors: the further away the wind farm, the higher its acceptance by visitors. Distance was identified as an important factor for the acceptability of a proposed wind farm also among tourism service providers in a study of Ólafsdóttir and Sæþórsdóttir (2019). However, further research with more specific data is needed with regards to effects of distance on the wind farms' impacts on tourism and recreation.

According to a study by Frantál and Kunc (2011), construction of wind turbines in agricultural areas was preferred by 70% of visitors, while 5% preferred wind turbines in pristine natural areas. Similar results were revealed by the study of Sæþórsdóttir et al. (2018), where 65% of visitors preferred seeing wind turbines in agricultural land rather than wilderness areas, and 12.5% preferred wilderness areas for such development. In line with that a study conducted among tour operators in Iceland (Sæþórsdóttir & Hall, 2019) showed that wind farms were perceived as more positive in the lowlands compared to the highlands, which is an unpopulated interior of Iceland. In the study of Frantál and Kunc (2011), on the other hand, wind turbine construction in the highland areas was preferred by 58% of the respondents, while 12% preferred to see such infrastructure being built in the lowlands and plain fields. According to Frantál and Kunc (2011), such results contradict the preference to build wind turbines in agricultural landscapes which are located in the lowlands. A study by Ek and Persson (2014) conducted among general public in Sweden showed that in general mountainous areas were perceived as less suitable for wind turbines compared to offshore. Moreover, people were much more against the presence of wind farms in the environments which they visit for recreation than in the environment in which they live. Thus, people owning summerhouses or regularly visiting mountainous areas for recreational purposes were less willing to accept wind turbines in mountainous areas. The same applied for open and coastal landscapes. This is in line with the findings of Johansson and Laike (2007) which showed that the impacts of wind turbines on recreational opportunities were a more important factor when predicting the opposition to a wind farm than its impacts on quality of daily life.

Visual landscape characteristics also play an important role: over 63% of visitors in the study by Sæþórsdóttir et al. (2018) agreed with the statement that wind turbines should be prohibited in beautiful landscapes, with 55% stating that wind turbines spoil the landscape irrespective of their location. Furthermore, wind turbines were perceived as rather negative features in the Central Icelandic Highlands. They were also perceived more negatively in picturesque landscapes, such as landscape containing the volcano Hekla, compared to more homogenous and desert-like landscapes (Sæþórsdóttir et al., 2018).

Regarding the placement of wind turbines within or nearby protected areas, over 80% of the participants of the study by Sæþórsdóttir et al. (2018) agreed that wind turbines should be prohibited in national parks and other protected natural areas. This is supported by the study conducted by Arnberger et al. (2018) in the Bavarian Forest National Park, where both local recreationists and tourists disliked the hypothetical wind turbines within or close to the national park borders.

A study by Sæþórsdóttir and Ólafsdóttir (2020) showed differences in the perceptions of wind farms by tourists and residents. Landscapes without wind turbines were perceived as more beautiful by tourists compared to residents, while residents perceived the landscapes with wind turbines as more beautiful than tourists. Thus, the perceived loss of beauty of the landscape was bigger for the tourists than for the residents. Similar trends were observed with power lines in various landscapes. Moreover, while tourists preferred to see wind turbines in agricultural landscapes, residents perceived wilderness areas as more suitable for wind energy development (Sæþórsdóttir & Ólafsdóttir, 2020). This points to the need to include tourism stakeholders into the decision-making when planning wind energy infrastructure development.

3.6 Lifespan and further development of wind farms

The lifespan of wind turbines is relatively short, 20-25 years. While wind turbines are often assumed to be reversible (Jaber, 2013), experience from the United States shows that until 2017 only a few wind projects, reaching a total of 43 MW have been fully decommissioned without later repowering (AWEA, n.d.). Thus, full decommissioning of wind farms is rather rare. Higher proportion of wind farms are refurbished, re-bladed or repowered, meaning that the old turbines are removed and replaced by more powerful, often higher, new turbines. This is due to the economic reasons: full dismantling of a wind farm and restoration of a site is costly and does not produce any economic benefits. If the old wind turbines are not sold to emerging markets, which is becoming more difficult, the treatment of waste materials can be complicated. While up to 80% of the waste materials of the wind turbines can be recycled, glass or carbon fibers used for the production of blades are not recyclable. Furthermore, even though concrete used for the foundations of the wind turbines can be recycled and reused, the removal and further treatment of the concrete foundations might be arduous (Tazi, Kim, Bouzidi, Chatelet, & Liu, 2019). Therefore, more often old wind farms are repowered, since wind farms are usually placed in sites with great wind conditions and the necessary infrastructure to transport the energy, and repowering of the wind farm ultimately leads to economic benefits (Castro-Santos, Vizoso, Camacho, & Piegiari, 2016; Lantz, Leventhal, & Baring-Gould, 2013). Moreover, permissions for repowering an old wind farm might be easier to obtain than for constructing a new wind farm (Szumilas-Kowalczyk et al., 2020). When developing such infrastructure, it is important to plan the strategies for later decommissioning or repowering of a wind farm in advance. As stressed by Szumilas-Kowalczyk et al. (2020), continuous repowering of wind farms is likely to negatively impact the surrounding landscape, both due to the increasing size of the wind turbines and the design of the new turbines, which might not fit the old wind turbines still working in the area. However, Szumilas-Kowalczyk et al. (2020, p. 557) point out that some areas with high level of wind energy development are highly visited by tourists, and conclude "that perception of a place by potential observers depends a lot on the purpose of their stay in the area".

4 Discussion and conclusions

The present literature review has revealed several tendencies related to the impacts of onshore wind energy infrastructure on tourism and recreation and to their compatibility, which are summarized below:

- General acceptance of wind energy by visitors tends to be higher compared to specific wind energy projects located in tourism destinations (Brudermann et al., 2019);
- Visual impacts on the landscape and its character are identified as the most important impacts of wind turbines on tourism by visitors and local tourism stakeholders (de Sousa & Kastenholz, 2015; Lenz, 2004; Ólafsdóttir & Sæþórsdóttir, 2019);
- Natural areas with high wilderness value, areas containing cultural heritage, protected natural areas, as well as recreational areas are perceived by visitors as less suitable for wind energy development, while agricultural areas are perceived as more suitable (Ek & Persson, 2014; Frantál & Kunc, 2011; Sæþórsdóttir et al., 2018; Silva & Delicado, 2017). Moreover, visitors perceive wind turbines as less suitable in picturesque landscapes compared to more homogenous landscapes (Sæþórsdóttir et al., 2018);
- Wind farms have a potential as tourist attractions and can positively affect visitors' attitudes towards wind power (Frantál & Urbánková, 2017). However, their potential attraction for tourists is higher in industrialized landscapes of low natural and cultural value (Silva & Delicado, 2017). Moreover, wind farms are likely to be a 'one visit' attraction and are more likely to be visited in a home country due to their standardized appearance (de Sousa & Kastenholz, 2015);
- The effects of wind energy projects on tourists' destination choice tend to be rather low (Frantál & Kunc, 2011; Warren & McFadyen, 2010). However, even low avoidance

levels can have significant impacts on local economies (Broekel & Alfken, 2015; Riddington et al., 2010);

- Socio-demographic characteristics such as gender, education and age of visitors do not seem to have strong effects on their attitudes towards wind energy development, although some differences between various age groups might appear (Frantál & Kunc, 2011; Sæþórsdóttir et al., 2015). Previous experience of wind energy infrastructure, on the other hand, might have some effects (Frantál & Kunc, 2011). Visitors coming from countries with higher density of wind turbines, such as Germany, Netherlands, United Kingdom or Ireland seem to prefer not to see onshore wind farms in natural areas visited during their travel (Sæþórsdóttir et al., 2015).
- Existing wind energy projects in tourism destinations tend to have higher acceptance than proposed ones (Sæþórsdóttir et al., 2018), which is likely to be due to status quo bias (Brudermann et al., 2019);
- Visitor preferences regarding the number and height of the wind turbines seem to be divergent while distance tends to decrease negative impacts on visitor experience. Therefore, the most suitable combination of height, number, colour and distance from main tourist attractions and viewpoints should be identified for each specific project and location;
- Full decommission of old wind turbines and restoration of a site is costly, therefore wind farms are more often repowered than removed. Moreover, due to rapidly evolving technology old wind turbines are usually replaced by higher and more powerful turbines, which impact the landscape even more (Szumilas-Kowalczyk et al., 2020). Decommissioning/repowering strategies should be planned in advance and taken into consideration while evaluating proposed wind energy projects.

When discussing specific wind energy projects certain level of opposition is likely to be encountered. As concluded by Frantál et al. (2017, p. 243), "Landscape perception and experience is a highly subjective and relative phenomenon, influenced by the perceiver's motivations, values and cultural background and their situation in life, as well as the time spent in a place and level of place attachment". Consequently, perceived suitability of wind energy infrastructure also might differ strongly among tourism stakeholders, as shown by the study conducted by Sæþórsdóttir and Hall (2019) on renewable energy. Moreover, Lenz (2004) pointed out that acceptance is a dynamic unit which might change due to new information or personal experiences.

As emphasized by Silva and Delicado (2017), inclusion of the stakeholders in the management, ownership, establishment and decision-making processes plays a crucial role in increasing their support for wind farm development and positively affecting perceived impacts on tourism. Mordue et al. (2020, p. 1898), however, raised awareness that such approach might "over rely on a narrowly rationalist view of democratic consensus building at the local level which is in danger of continuously rehearsing the kind of dualisms upon which pro- and anti-onshore-windfarm discourses persistently pivot". Mordue et al. (2020) offer a relational approach considering the complexity of space and taking collective responsibility for the management of natural resources. As emphasized by the authors, open political decisions need to be made based on expert knowledge facilitating best mitigation of potential impact and on the debates of topics such as ownership or procedural justice in the process of siting of the wind turbines. As the study by Wolsink (2007a) showed, even in highly debated regions there are areas perceived as suitable for wind energy development by the majority of stakeholders. Therefore, in order to ensure the lowest possible impacts of wind energy infrastructure on tourism and recreation it is important to take into consideration the preferences of tourism stakeholders as early as possible, i.e. already while choosing the most suitable locations for wind energy development. Once the most suitable locations are identified, the selection of the most appropriate characteristics of wind energy infrastructure, such as the number of wind turbines, their height and color are likely to reduce perceived impacts of the wind farm on visitor experience and thereby to minimize the perceived and actual impacts of wind energy infrastructure on tourism.

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