



**Nature-based Tourism in
Renewable Energy Landscapes**
Attitudes of Tourism Stakeholders

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Faculty of Life and Environmental Sciences
University of Iceland
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Dissertation submitted in partial fulfillment of a
Philosophiae Doctor degree in Tourism Studies

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Abstract

With increasing renewable energy infrastructure (REI) developments and growing nature-based tourism (NBT), their encounters are becoming more likely. To facilitate sustainable development of both, it is important to gain more knowledge on the complex interrelationships between NBT and REI, which is the overarching aim of this thesis. The thesis provides an overview of existing knowledge on interrelationships between REI and tourism by conducting a review of relevant academic literature. It furthermore investigates the NBT-REI nexus by using a case study approach with a focus on the Icelandic Central Highlands, which contain vast wilderness areas and are important for both NBT and renewable energy harnessing. The primary data for this thesis was collected by employing questionnaire surveys, semi-structured interviews, open-ended diaries, and participant observation. The results reveal low compatibility of present-day NBT and REI, especially in areas perceived by tourism stakeholders as wilderness. Tourists view proposed REI as highly unsuitable in wilderness areas due to its negative impacts on wilderness experience. Correspondingly, tourism service providers prefer to limit REI developments in natural areas of the Central Highlands. According to tourism service providers, proposed wind farms are more suitable in areas with few tourists, limited attractions, low degree of naturalness, limited visibility of wind turbines, and urgent local need for energy. Notably, tourism service providers tend to perceive the impacts of proposed REI on NBT as more negative compared to existing REI. The perceived spatial extent of these impacts varies among tourism service providers. It depends on the reasoning used while estimating the impact areas, which falls into three categories: visibility of REI, tourist mobility, and changes in travel patterns and tourism demand due to REI. These findings suggest that tourism destinations should be viewed as elements of larger tourism networks, which are likely to be impacted by REI. Tourism service providers view the Central Highlands and its wilderness as a valuable resource that should be protected from further REI developments. However, issues such as ensuring access to the area might lead to conflicts between NBT and nature conservation and hinder preservation of wilderness. The findings of this doctoral thesis demonstrate that the context surrounding each REI project, namely various factors related to its location, REI itself and the perceptions and preferences of tourism stakeholders play a crucial role in shaping potential impacts of REI on NBT. Therefore, they should be taken into consideration when planning REI developments in natural areas.

Útdráttur

Samfara aukinni uppbyggingu mannvirkja til framleiðslu endurnýjanlegrar orku og vaxandi náttúruferðamennsku aukast líkur á árekstrum á milli þessara greina. Til að stuðla að sjálfbærri þróun beggja greinanna er mikilvægt að afla aukinnar þekkingar á flóknu samhengi á milli greinanna og er það meginmarkmið þessarar ritgerðar. Í ritgerðinni er með ítarlegri heimildarýni gefið yfirlit yfir það sem er nú þegar vitað um tengsl orkumannvirkja og ferðapjónustu. Enn fremur var gerð tilviksrannsókn á miðhálandi Íslands sem ætlað er auka enn frekar við þekkingu á tengslum náttúruferðamennsku og orkumannvirkja þar sem miðhálandið er bæði mikilvægt fyrir náttúruferðamennsku og fyrir framleiðslu á endurnýjanlegri orku. Rannsóknin byggist á gögnum sem safnað var með spurningalistakönn-unum, hálfstýrðum viðtölum, dagbókum og þátttökuathugun rannsakanda. Niðurstöðurnar sýna að sú náttúruferðamennska sem stunduð er á svæðinu nú á tímum fer ekki vel saman við virkjunarmannvirki, sér í lagi á svæðum sem hagsmunaaðilar í ferðapjónustu líta á sem víðerni. Ferðamenn telja fyrirhuguð orkumannvirki ekki henta á óbyggðum svæðum vegna neikvæðra áhrifa mannvirkjanna á það hvernig þeir upplifa víðerni. Í samræmi við viðhorf ferðamanna vilja ferðapjónustuaðilar takmarka uppbyggingu orkumannvirkja á náttúrusvæðum, sér í lagi á miðhálandinu. Að mati ferðapjónustuaðila eru fyrirhuguð vindorkuver talin viðunandi á svæðum sem hafa takmarkað aðdráttarafl fyrir ferðamenn og fáir ferðamenn fara um. Að mati þeirra eiga vindorkuver einnig betur við á byggðum svæðum en náttúrulegum, auk þess sem ákjósanlegra þykir að þau sjáist ekki víða að. Ferðapjónustuaðilar voru þó umburðarlyndari gagnvart vindorkuverum ef brýn staðbundin þörf var talin á aukinni orkuframleiðslu. Almennt telja ferðapjónustuaðilar að fyrirhuguð orkuver komi til með að hafa neikvæðari áhrif en þau orkuver sem fyrir eru hafa haft. Munur er á mati ferðapjónustuaðila á umfangi þessara áhrifa og fara röksemdirnar sem notaðar eru við það mat einkum eftir þrennu: sýnileika orkumannvirkjanna, hreyfanleika ferðamanna og þeim breytingum sem verða á ferðamynstri og eftirspurn ferðamanna vegna orkumannvirkja. Niðurstöðurnar benda til þess að það verði að horfa á ferðamannastaði sem einstaka þætti í heildarkerfi ferðapjónustunnar sem líklegt er að verði fyrir áhrifum af orkumannvirkjum. Ferðapjónustuaðilar líta á miðhálandið og víðerni sem þar eru sem dýrmæta auðlind fyrir ferðapjónustuna sem ætti að vernda fyrir frekari uppbyggingu orkumannvirkja. Hins vegar gætu atriði eins og bætt aðgengi inn á svæðið leitt til árekstra milli náttúruferðamennsku og náttúruverndar og staðið í vegi fyrir verndun víðerna. Niðurstöður þessarar doktorsritgerðar draga fram mikilvægi þess að skoða heildstætt áhrif hversrar virkjunar fyrir sig ásamt því að greina hvaða áhrif hagsmunaaðilar í ferðapjónustu telja orkumannvirki geta mögulega haft á náttúruferðamennsku.

To my family

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Abbreviations

DSP – Dominant Social Paradigm

GHGs – Greenhouse Gases

IEA – International Energy Agency

IRENA – International Renewable Energy Agency

ITF – International Transport Forum

NBT – Nature-based Tourism

NEA – Icelandic National Energy Authority

NEP – New Ecological Paradigm

OECD – Organization for Economic Cooperation and Development

PGIS – Participatory Geographical Information Systems

REI – Renewable Energy Infrastructure

SDGs – Sustainable Development Goals

UNEP – United Nations Environment Programme

UNWTO – World Tourism Organization

List of Papers

- Paper I Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (forthcoming). The interrelationships between renewable energy infrastructure and tourism: A thematic literature review. (*Submitted to Land Use Policy*).
- Paper II Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (2019). Renewable energy in wilderness landscapes: Visitors' perspectives. *Sustainability*, 11(20), 5812. <https://doi.org/10.3390/su11205812>
- Paper III Sæþórsdóttir, A. D., Wendt, M., & Tverijonaitė, E. (2021). Wealth of wind and visitors: Tourist industry attitudes towards wind energy development in Iceland. *Land*, 10(7), 693. <https://doi.org/10.3390/land10070693>
- Paper IV Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (2022). How close is too close? Mapping the impact area of renewable energy infrastructure on tourism. *Energy Research & Social Science*, 90, 102574. <https://doi.org/10.1016/j.erss.2022.102574>
- Paper V Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (forthcoming). Wilderness: a resource or a sanctuary? Tourism service providers' views on development of the Icelandic Central Highlands. (*Accepted with revisions in Scandinavian Journal of Hospitality and Tourism*).

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Author Contributions

- Paper I Edita Tverijonaitė conducted the literature search and review and wrote the paper under the guidance of Prof. Anna Dóra Sæþórsdóttir, Prof. Rannveig Ólafsdóttir and Prof. C. Michael Hall.
- Paper II Edita Tverijonaitė together with Prof. Anna Dóra Sæþórsdóttir developed the research idea and decided on the methodology of the paper. Edita Tverijonaitė collected the data, conducted analysis of the qualitative data, and prepared the draft of the manuscript. Þorkell Stefánsson conducted quantitative data analysis. Prof. Anna Dóra Sæþórsdóttir, Prof. Rannveig Ólafsdóttir and Prof. C. Michael Hall reviewed the manuscript and provided comments and suggestions.
- Paper III Prof. Anna Dóra Sæþórsdóttir and Margrét Wendt decided on the concept and methodology of the study, Margrét Wendt and Edita Tverijonaitė conducted semi-structured interviews and wrote the literature review. Margrét Wendt conducted the data analysis and prepared the manuscript. Edita Tverijonaitė, Prof. Anna Dóra Sæþórsdóttir and Margrét Wendt reviewed and edited the manuscript draft.
- Paper IV Edita Tverijonaitė together with Prof. Anna Dóra Sæþórsdóttir developed the research idea and decided on the methodology of the paper. Edita Tverijonaitė and Margrét Wendt conducted semi-structured interviews. Edita Tverijonaitė conducted analysis of the qualitative data from the semi-structured interviews, analysis of the GIS data, made the maps presenting the results and prepared the draft of the manuscript. Prof. Rannveig Ólafsdóttir and David Ostman provided guidance and assistance during GIS data analysis and preparation of the maps. Prof. Anna Dóra Sæþórsdóttir, Prof. Rannveig Ólafsdóttir and Prof. C. Michael Hall reviewed the manuscript and provided comments and suggestions.
- Paper V Edita Tverijonaitė together with Prof. Anna Dóra Sæþórsdóttir developed the research idea and decided on the methodology of the paper. Edita Tverijonaitė conducted data collection and analysis and prepared the draft of the manuscript. Prof. Anna Dóra Sæþórsdóttir, Prof. Rannveig Ólafsdóttir and Prof. C. Michael Hall reviewed the manuscript and provided comments and suggestions.

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1 Introduction

1.1 Nature-based tourism and renewable energy infrastructure

With growing worldwide interest in nature-based tourism (NBT) and ever-increasing renewable energy infrastructure (REI) developments, encounters between the two are becoming more likely. REI generally changes landscapes and thereby is likely to impact NBT, which relies on natural landscapes as a resource. Thus, such encounters might lead to land use conflicts, especially in countries highly reliant on the harnessing of renewable energy and NBT.

Various definitions of NBT exist in the academic literature. In this thesis, the definition of NBT put forward by Fredman and Margaryan (2021, p.15) is used, describing NBT as “activities by humans occurring when visiting nature areas outside the person’s ordinary neighborhood” (see also Fredman & Tyrväinen, 2010). Thus, NBT covers a wide range and high diversity of activities, serving as an overarching term for many tourism labels, such as wilderness tourism, adventure tourism, wildlife tourism, geotourism and ecotourism (Fredman & Margaryan, 2021). NBT has been increasing globally over the last decades (Balmford et al., 2009; Mehmetoglu, 2007; The International Ecotourism Society, 2019). Furthermore, the COVID-19 pandemic seems to have raised interest in NBT activities which has resulted in increased visitors to some natural areas (Fredman & Margaryan, 2021).

Similarly, renewable energy developments continue to increase globally due to their significant role in climate change mitigation, combatting air pollution, addressing the growing energy demand, and contributing to Sustainable Development Goals (SDGs). The importance of expanding clean power generation and reducing the use of fossil fuels to lower carbon dioxide emissions to net zero by 2050 was emphasized by the Glasgow Climate Pact, adopted at the United Nations Climate Conference (COP26) in November 2021 (UNFCCC, 2021), and reemphasized by the Sharm el-Sheikh Implementation Plan that resulted from COP27 in November 2022 (UNFCCC, 2022). Furthermore, the global energy crisis which started in the second half of 2021, and was then aggravated by the Russian invasion of Ukraine, pointed to the crucial role of renewables in advancing energy security and creating energy sovereignty (REN21, 2022). Global renewable power capacity has steadily grown in recent years, reaching 3,146 GW in 2021 (REN21, 2022). However, as stressed by the IEA (2021), investments in clean energy need to triple by 2030 to effectively curb climate change. Thus, REI developments are expected to continue to increase worldwide, stressing the need for more knowledge on the interrelationships between REI and NBT.

In response, academic interest in the nexus between tourism and renewable energy keeps increasing, resulting in a growing number of published studies on the topic. However, these studies reveal divergent results, pointing to the need for a systematic review of

existing knowledge on the interrelationships between REI and tourism. While NBT requires settings which are to some degree ready for tourism consumption, sensitivity to human induced landscape changes has also been demonstrated (Margaryan, 2018; Sæþórsdóttir, 2010b; Stefánsson et al., 2017). This stresses the importance of increasing knowledge concerning how and where to develop REI in order to preserve the values, meanings and resources important for NBT. To achieve this, research providing insights into the factors affecting the character, scale, severity, and spatial extent of the impacts of REI on NBT is needed.

Iceland is a global leader in renewable electricity production per capita and has the largest renewables share in total final energy consumption (REN21, 2022). In 2021, up to 70.4% of all electricity produced in Iceland derived from hydropower, 29.6% from geothermal power, 0.03% from wind power and 0.01% from non-renewable energy sources (NEA, 2022). The country has relied on hydro- and geothermal power for several decades, while in recent years opportunities for harnessing abundant wind energy resources have been considered (Gíslason, 2016; Pétursdóttir, 2021; Sæþórsdóttir & Saarinen, 2016a). Iceland is also among the countries which experienced rapid tourism growth in the last decade, with tourism becoming the largest export sector before the COVID-19 pandemic (Statistics Iceland, 2022). The tourism industry is steadily recovering after the pandemic, with the number of international visitors to the country increasing rapidly (Icelandic Tourist Board, 2022a). The vast majority of visitors to the country state that the Icelandic nature is the main reason for their visit (Icelandic Tourist Board, 2020). Furthermore, travel restrictions related to the COVID-19 pandemic have led to the growth of domestic tourism, and interest in outdoor recreation in Icelandic natural areas has increased among locals (Icelandic Tourist Board, 2022b; Wendt et al., 2022). Thus, Iceland provides a great case for studying the interrelationships between REI and NBT. The Icelandic Central Highlands were selected as a case study area for this research. They provide resources for a significant portion of electricity produced in the country (NEA, 2021), while also containing vast wilderness areas which serve as a playground for tourists and outdoor recreationists.

1.2 Research objectives and structure

The overarching aim of this doctoral thesis is to increase knowledge on the complex interrelationships between NBT and REI. The thesis seeks to answer the following research questions:

RQ1. What is the existing knowledge on the interrelationships between REI and tourism and the factors affecting them?

RQ2. How compatible are REI and NBT according to tourists and tourism service providers? What factors affect their perceived compatibility?

RQ3. How do tourism service providers perceive the spatial extent of the impacts of REI on NBT? What factors affect the shape and size of perceived impact areas of REI on NBT?

RQ4: How do tourism service providers prefer to manage and develop the Icelandic Central Highlands? How do these preferences relate to their environmental attitudes?

This thesis consists of the synopsis and five original papers aiming to answer the posed research questions. The synopsis presents theoretical framework, methods, research settings, and main results of this doctoral research, together with discussing the findings and their implications. Paper I addresses the first research question through a systematic literature review examining the findings of original research papers focused on the interrelationships between REI and tourism (Figure 1). The themes and research gaps identified in the literature review guided the direction of this thesis. The aim of Paper II is to answer the second research question by exploring tourist attitudes toward a proposed hydropower plant, while Paper III addresses the same research question by focusing on the attitudes of tourism service providers toward five proposed wind farms and the factors affecting the perceived suitability of each of the proposed wind farm locations. While contributing to the second research question, Paper IV explores the third research question, aiming to map the impact area of REI on tourism as perceived by tourism service providers. The final paper in this thesis, Paper V, addresses the fourth research question and provides an overview of tourism service providers' preferences for the future management and development of the Icelandic Central Highlands. Papers II-V cover an investigation of interrelationships between REI and NBT, which employed various approaches to place, and these are described in more detail in chapter 2. The main approaches to place used in this research include the phenomenological approach (Tuan, 1977), which was used to study the subjective place meanings assigned to the study areas by tourists and tourism service providers, and the relational approach, viewing places as meeting points of multiple relations (Massey, 2005).

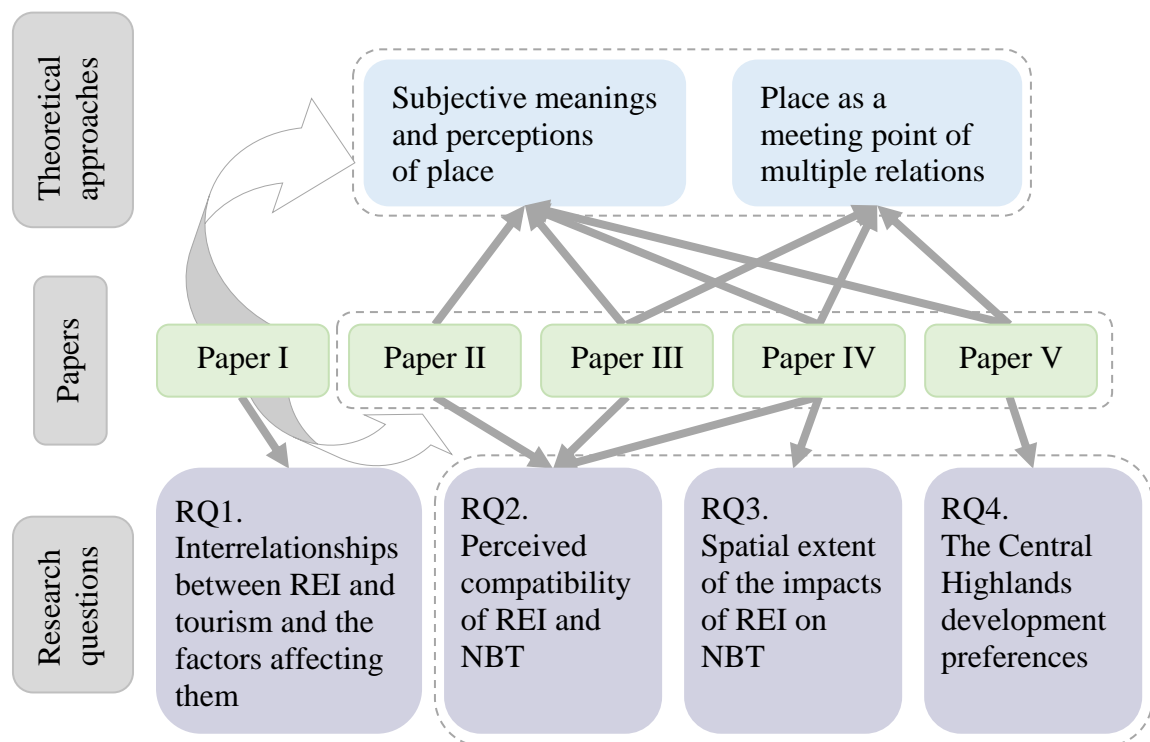


Figure 1. Research structure. The findings of Paper I guided the design of other papers, the research questions of the thesis and selection of theoretical approaches.

In addition to constituting part of this doctoral thesis, the findings of the studies conducted for Papers II, III, IV and V were also presented in the reports prepared for the Expert Committee 2 of *the Icelandic Master Plan for Nature Protection and Energy Utilization* (Sæþórsdóttir et al., 2021; Sæþórsdóttir, Tverijonaite, et al., 2018; Tverijonaite & Sæþórsdóttir, 2021; Wendt & Sæþórsdóttir, 2020). *The Master Plan* is a project that has been carried out by the Icelandic government for over two decades with the aim “to reconcile the often competing interests of nature conservation and energy utilization on a national scale and at the earliest planning stages” (Government of Iceland, n.d.-a). It consists of the steering committee and four expert committees, which assess power plants with the estimated capacity of at least 10 MW proposed by the energy companies and rank them based on their impacts. The committees of *the Master Plan* group energy proposals into three categories. The ‘energy utilization’ category means that the construction of the proposed REI should be permitted. The ‘on hold’ category contains proposed REI projects for which more data is needed, while the ‘protection category’ is comprised of REI which should not be constructed. Expert Committee 2 assesses the impacts of proposed power plants on tourism and outdoor recreation among other uses, such as fishing or grazing (Ministry of the Environment Energy and Climate, n.d.). The research conducted for this thesis allowed for the inclusion of the perceptions of tourists and tourism service providers in natural resource planning.

2 Theoretical and contextual framing

2.1 Engaging with place to understand the interrelationships between NBT and REI

The interrelationships between NBT and REI largely depend on places. Places traveled from, through, and to by tourists, places constituting tourism networks, lived and wild places, as well as places surrounding REI. Perceptions, meanings and ideas assigned to places strongly affect what humans perceive as suitable in certain settings and contexts, while human activities change how places are viewed (Cresswell, 2013). Thus, as stressed by Massey (2005, p. 9), “spatial is political,” and the ways we think of space and place can affect how political arguments are addressed and what decisions are taken. Therefore, in this doctoral thesis various approaches to place are employed. Place, however, is highly complex and contested (Castree, 2009; Massey, 1994; Urry, 1995). As noted by Cresswell (2015), what makes it complicated is that place can be an object that can be looked at, but also a way of looking at the world. Thus, it involves ontological and epistemological processes. While the concept of place is important and relevant in various disciplines, this thesis mainly builds on approaches used in human geography, to which the concept of place is central (Cresswell, 2015).

In this doctoral thesis natural and wilderness places where REI has been proposed or constructed are approached from the perspective of tourism stakeholders, namely tourists and tourism service providers. Therefore, the interrelationships between NBT and REI are investigated by examining the place meanings assigned to natural and wilderness areas by tourism stakeholders, as well as by analyzing what tourism processes, relations and mobilities affect these areas as places and their compatibility with REI as perceived by tourism stakeholders (Figure 2).

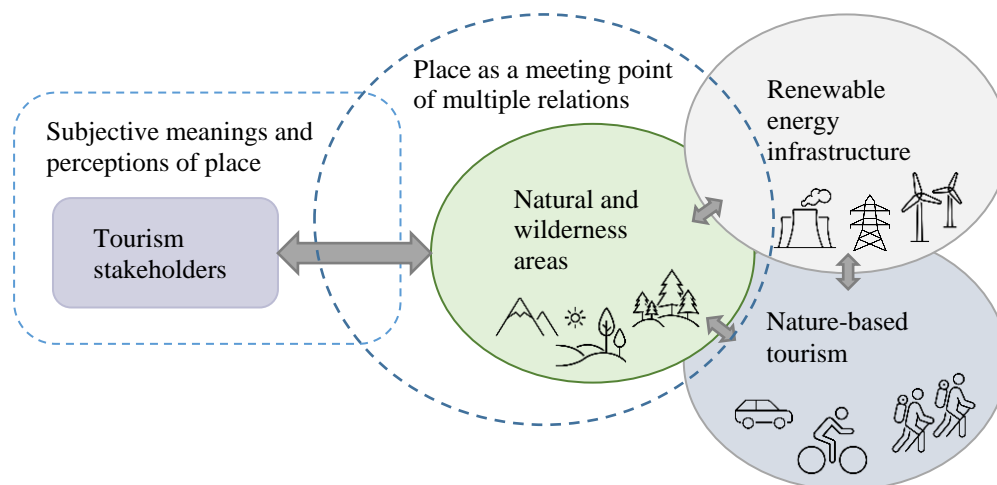


Figure 2. Employing the concept of place to investigate the interrelationships between NBT and REI.

2.1.1 The evolving concept of place

The history and evolution of the concept of place is described in detail by Cresswell (2008, 2014, 2015), whose work guides this sub-chapter. The idea of place has been discussed already in early Greek philosophy (Casey, 2013), pointing to the importance of treating place both as a philosophical and as a geographical concept (Cresswell, 2015). In geography, the word 'place' has a long history of use. However, Cresswell (2008, p. 135) argued that "[g]eographers have always been interested in places but not in 'place'." The concept of place started receiving increasing attention relatively recently, in the 1970s, with the rise of humanistic geography (Castree, 2009; Cresswell, 2008, 2015). Humanistic geographers (Buttimer & Seamon, 1980; Ley, 1974; Relph, 1976; Tuan, 1977) challenged the positivist approaches of the 1950s and 1960s to human geography as an objective spatial science and emphasized the importance of investigating how humans relate to the surrounding environment and to the world through experience (Holloway & Hubbard, 2001; Johnston & Sidaway, 2015). They argued that place is subjectively perceived, that meanings assigned to places can differ among individuals but can also be shared among groups, and gave rise to the concepts such as 'sense of place' and 'genius loci', which are important in academic literature (Simonsen, 2008).

The phenomenological approaches of humanistic geography were accompanied by more radical approaches of critical cultural geography stemming from Marxism, feminism and poststructuralism (e.g., Forest, 1995; Harvey, 1973; Harvey, 1996), which critically investigated the relationships of socially constructed place and power and focused on issues such as class, gender, sexuality and race (Cresswell, 2015; Johnston & Sidaway, 2015). As emphasized by Cresswell (2015), for cultural critical geographers, place was not a result of the processes related to these issues, but rather a tool in shaping these social processes and relations. As noted by Castree (2009), while humanistic geographers were preoccupied with the subjective experience of particular places, they overlooked wider processes linking and changing these places. Marxists, on the other hand, focused on what places had in common and did not pay enough attention to the differences existing between places (Castree, 2009). It was relational geographers such as Massey (1984, 2005), who showed that global interconnections and processes lead to production of geographical difference (Castree, 2009).

Based on the evolution of the concept of place, Cresswell (2015) identified three main approaches to place, which represent different levels of depth and are partly overlapping: (1) the descriptive approach, focusing on particularities of specific places, (2) the social constructionist approach, which looks at places as instances of multiple social processes participating in the construction of place, and (3) the phenomenological approach focusing on human existence in place. Cresswell (2015) further stressed that research can employ all three approaches to studying place, as previous work has done (e.g., Ogden, 2011; Price, 2004).

2.1.2 Place meanings

Humanistic geographers (e.g., Relph, 1976; Tuan, 1977) generally viewed place as a space containing subjective meanings. As stated by Tuan (1977, p. 6), “[w]hat begins as undifferentiated space becomes place as we get to know it better and endow it with value.” Extensive later research further investigated how through experiences, social processes, and interactions relationships with a place are created that make a place meaningful (e.g., Eisenhauer et al., 2000; Kyle & Chick, 2007; Manzo, 2005). Special bonds with places are created also while engaging in tourism and recreational activities (Eisenhauer et al., 2000; Hammitt et al., 2006; Moore & Scott, 2003). The meanings ascribed to places during such activities shape people’s preferences and behavior intentions. Thus, investigating place meanings and the processes creating them helps understand the politics of tourism places and of leisure places in general (Stokowski, 2002). As pointed out by Smale (2006), employing the concept of place can help better understand processes related to leisure, but also investigate how through leisure experiences the meanings of place are created. Similarly, various scholars (Cheng et al., 2003; Eisenhauer et al., 2000; Smith et al., 2011; Williams & Stewart, 1998) have argued for using the concept of place to investigate the issues related to natural resource planning and management. The usefulness of applying the place perspective to investigate local attitudes toward REI developments has also been shown by several studies (Chappell et al., 2020; Devine-Wright, 2011; Vorkinn & Riese, 2001). This suggests that looking into place meanings assigned to the natural areas by tourism stakeholders can provide deeper insights into the relationships between REI and NBT.

Cheng et al. (2003) stated that place meanings comprise utilitarian as well as intangible values, such as connection to place, appreciation of its beauty, and spiritual experiences. They further stressed that people’s encounters with places are highly subjective, resulting in a multiplicity of meanings assigned to places. The same place therefore can mean different, sometimes competing, things to different people depending on their experience of the place, their relationship to it and numerous factors shaping the construction of place (Duncan & Duncan, 2001; Smith et al., 2011; Stedman, 2003; Stokowski, 2002). The individual and group meanings ascribed to places constantly evolve, and are renegotiated and challenged by personal direct and indirect experiences as well as social and cultural processes (Davenport & Anderson, 2005).

Various researchers (Kyle & Chick, 2007; Stokowski, 2002) have focused on the importance of the social context, discourses, and interactions in the creation of place meanings. Stedman (2003), however, stressed that empirical research tends to overemphasize the role of social and cultural processes in creating place meanings but neglects the role of the physical environment. While Stedman (2003) used the terms ‘physical environment’ and ‘physical landscape’ interchangeably, Campelo (2015) noted that physical environment and landscape are not the same. “Landscape is a meaningful social and cultural construction connecting and mediating relations between people and physical environments. It is through the landscape that people experience the place” (Campelo, 2015, p. 56). Thus, the type and character of the physical environment affect how people engage with the surrounding landscape (Campelo, 2015). In line with that, Cheng et al. (2003) emphasized the importance of approaching landscapes as places, as meeting points of social, political, cultural, but also biophysical processes and attributes.

The concept of sense of place has been used by various researchers to study human relationships with places. However, as summarized by Campelo (2015), sense of place has been defined differently by different scholars. Kyle and Chick (2007, p. 211) noted that the various labels used to describe the human relationship with the place put the emphasis on emotional bonds with place, which are created through experiences and interactions with the place in a social context. As revealed by Stedman (2003), characteristics of the physical environment serve as a base for creating place meanings which affect place attachment and place satisfaction constituting a sense of place. Hence, while socially constructed place meanings can remain unchanged for some people even if the physical environment is altered (Sæþórsdóttir & Hall, 2018; Sæþórsdóttir & Saarinen, 2016b), the increasing gap between the two is likely to threaten the existing place meanings and consequently result in changes in sense of place (Davenport & Anderson, 2005; Stedman, 2003).

Meanings ascribed to places are likely to influence how people prefer to manage and to use them (Davenport & Anderson, 2005; Eisenhauer et al., 2000; Smith et al., 2011). Therefore, they should be taken into consideration when planning the use of land and natural resources (Cheng et al., 2003; Jacquet & Stedman, 2014; Kil et al., 2012). If REI developments in natural areas used for tourism are likely to threaten the place meanings assigned to the area by tourists and tourism service providers, they are less likely to receive support and can result in land use conflicts between the energy and tourism sectors. This emphasizes the importance of taking into consideration the meanings assigned to natural areas by tourism stakeholders while planning REI developments. More than two decades ago, Williams and Stewart (1998, p. 23) noted that “[v]irtually any resource or land-use planning effort is really a public exercise in describing, contesting, and negotiating competing senses of place and ultimately working out a shared future sense of place.” This still seems to be relevant today. Using the place perspective allows inclusion of complex, diverse, and meaning-loaded human connections with landscapes and natural resources into planning, and thereby contributes to more sustainable use of natural resources (Cheng et al., 2003).

This doctoral research besides studying socially created meanings assigned by tourists and tourism service providers to natural areas also investigates how these place meanings relate to the physical environment. Furthermore, it examines how compatible the changes brought by REI to the physical environment of natural areas are with the place meanings ascribed to these areas, and how by changing the place meanings, REI is likely to impact tourism stakeholder perceptions and experience of the area and consequently change other tourism processes.

2.1.3 The throwtogetherness of place

Massey (2005, p. 130) differentiated space and place by using relational approach and stated:

If space is rather a simultaneity of stories-so-far, then places are collections of those stories, articulations within the wider power-geometries of space. Their character will be a product of these intersections within that wider setting, and of what is made of them. And, too, of the non-meetings-up, the disconnections, and the relations not established, the exclusions.

Places, according to Massey (2005, p. 130), can be defined as “spatio-temporal events”, as meeting points of multiple relations. She (1991, p. 28) stressed that a significant part of these relations exceed the places as we define them, and argued for the “global sense of place.” Places are not static, they keep changing and could be described as processes (Massey, 1991, 2005). They are unique, contain multiple identities, internal conflicts, and are constantly reshaped by local and wider social relations and the history of the place, which is also shaped by complex linkages with the inside and the outside (Massey, 1991). Thus, place is not contradictory to mobility, and mobility does not lead to inauthentic placelessness and erosion of place as stated by, for example, Relph (1976). Quite the opposite, it contributes to creating places (Simonsen, 2008). This throwtogetherness of place, the ongoing negotiation of ‘here and now’, of human and non-human, contribute to the specificity and uniqueness of place (Massey, 2005).

Places, as articulated by Massey (1991), are open and do not need boundaries to be conceptualized. Still, identifying boundaries of places might be needed in certain contexts, such as, for example, research or legal contexts. When setting boundaries, they should not be against the outside, but rather as a linkage to the outside, a part of the place itself (Massey, 1991). Attempted place boundaries, according to Massey (2005), generally do not include everything, only certain filtered aspects, the meanings of which keep being renegotiated. Moreover, they can be described as “attempts to stabilize the meaning of particular envelopes of space-time,” (Massey, 1994, p. 5) and require careful insight into what is being considered.

As emphasized by Callard (2011), terms such as mobility, flow, openness, and differential power relations have become essential in human geography thanks to Massey’s research. They have proven useful in tourism research (Johannesson & Baerenholdt, 2008), as well as in investigating energy developments in natural areas (Benediktsson, 2008). In this doctoral thesis, relational approaches to place were employed to improve the understanding of the interrelationships between REI and tourism and to investigate the factors affecting the spatial extent of the impacts of REI on NBT.

2.1.4 Tourism places

Tourism and place are strongly related. Tourism is a place-based activity, it relies on tourism destinations and depends on their characteristics. Through tourism processes places are produced and consumed. As such, tourism activities impact places and cause changes in them. Continuous global tourism growth has resulted in increasing visitation in various places and consequent changes in social, cultural, political, economic, and environmental processes within and between these places (Saarinen, 2004). Tourism reinvents places and transforms them into tourism destinations by creating symbolic meanings ready for tourism consumption (Young, 1999). Urry and Larsen (2011) noted that for a place to become a tourism destination numerous processes have to be involved, which include complex mobilities of humans, capital, objects and information. Tourism places keep constantly evolving and embody multiple and diverse interests and meanings attributed by a wide range of stakeholders (Lichrou & Panayiotopoulos, 2021). As emphasized by Saarinen (2004), while a tourism destination can contain physical boundaries for administrative purposes, such boundaries are likely not to have any meaning to tourists and other non-local tourism stakeholders.

Notably, place meanings of tourism destinations are created not only via direct experience, but also before the actual visit to the area through the media, marketing, advertising, word of mouth, and in recent years, increasingly through social media (Lichrou & Panayiotopoulos, 2021; Urry & Larsen, 2011). According to Skinner (2011), the place brand consists of three sets of elements: (1) physical environmental elements, (2) political, social, cultural and historical elements, and (3) symbolic and sensory elements. Increasing visual consumption of landscapes in part due to popularity of tourist photography and more recently also video content puts emphasis on the importance of the physical environment for tourism (Bærenholdt et al., 2004; Sharpley, 2021). As specified by Urry and Larsen (2011), this is highly applicable also to NBT: while physical activity here plays an important role, all the senses are still organized around the visual sense.

Tourists often come to a destination with a certain set of expectations which affect their experience in the area. While visiting tourism places tourists generally seek extraordinary experiences that differ from their daily life (Young, 1999). The image of extraordinary tourism places is often created through signifiers in the landscape (Lichrou & Panayiotopoulos, 2021). Consequently, physical changes in tourism destinations are likely to change the place meanings assigned to the areas by tourism stakeholders (Davenport & Anderson, 2005; Zakariya et al., 2015). As noted by Young (1999), place meanings are socially constructed on a macro level by various stakeholder groups, for example, the tourism industry, as well as on a micro level by individual tourists, and depend on the perspectives and motivations of the tourism stakeholders. To avoid potential inconsistencies between visitor expectations and their experience at a destination, it is important to ensure that place meanings promoted by the national or regional tourism organizations and place-making strategies used to attract visitors to the area are in line with the tourist experience on-site and with the place meanings attributed to the area by the locals and by the tourism industry (Dredge & Jenkins, 2003; Saarinen, 2004). This is especially relevant for NBT, since visitors to natural areas often have expectations related to limited human interference (Cole & Hall, 2008; Hall, 2001; Sæþórsdóttir, 2010b).

2.2 Nature-based tourism in wilderness areas

While wilderness implies absence of traces of human activities (Nash, 1967), it is increasingly managed by people and often includes certain types of uses (Saarinen, 2005). The views on the uses acceptable in a wilderness area might differ strongly among stakeholders depending on their interests, objectives, and values (Hall et al., 2008). Saarinen (2021) therefore described wilderness as a value-bounded place and stated that our understanding of wilderness represents our relationship to it. The different perceptions of acceptable uses and levels of use in wilderness might be contradictory and competing (Saarinen, 2005). Thus, wilderness is a highly contested concept, and even official definitions used for management and conservation purposes differ somewhat among the countries (Hall et al., 2008; Saarinen, 2021). In the Icelandic Nature Conservation Act No. 60/2013 (Alþingi, 2013), unbuilt wilderness (*i. Óbyggt víðerni*) is defined as an uninhabited area of at least 25 km² in size, where it is possible to enjoy solitude and nature without disturbance of human-made structures or motorized vehicle traffic and which is at least 5 km away from human-made structures and other technical traces such as power lines, power plants, reservoirs, and built-up roads.

NBT is often viewed as an activity which is more compatible with wilderness conservation compared to extractive land uses (Hall et al., 2008; Sæþórsdóttir & Saarinen, 2016a). Therefore, with rapidly increasing interest in visiting natural areas, NBT provides an economically viable justification for protecting wilderness areas from infrastructure developments, including REI. NBT thus has challenged traditional uses of wilderness and brought new values to wilderness discourses (Hall et al., 2008; Saarinen, 2005; Sæþórsdóttir et al., 2011). However, increasing use of wilderness for NBT tourism comes with a range of issues. Growing tourist numbers in wilderness areas result in increased likelihood of land use conflicts (Saarinen, 2005; Sæþórsdóttir, 2014; Sæþórsdóttir & Ólafsdóttir, 2017). They lead to degradation of the natural environment, including qualities essential for wilderness experience, and to increasing demand for tourism infrastructure in wilderness areas (Saarinen, 2019; Sæþórsdóttir, 2004; Tverijonaite et al., 2018), thereby suggesting that tourism management in wilderness areas should be well planned.

People's attitudes toward wilderness have been changing over the centuries. Only in the nineteenth century was wilderness romanticized and considered a tourist attraction, which in the twentieth century became more accessible due to the increasing use of cars and construction of roads (Cronon, 1996; Saarinen, 2005; Sæþórsdóttir & Hall, 2021; Sæþórsdóttir et al., 2011). As noted by Saarinen (2021), while wilderness tourism generally tends to be individualistic, in recent decades a wide range of organized tourism activities contributed to tourism growth in wilderness areas. In the northern peripheries, such organized activities nowadays include, among others, backpacking, hiking, mountain biking, horse riding, skiing, snowmobiling, glacier hiking and climbing, as well as ATV and super jeep tours. These tendencies have various implications. Not only might they potentially lead to degraded wilderness experience due to conflicts between different users, they also result in a wider range of tourist motivations, perceptions and experiences (Saarinen, 2021).

Despite the diversity of perceptions related to wilderness areas, certain characteristics are viewed as essential for wilderness. Among key indicators of wilderness quality are primitiveness of the area and remoteness from settlements and from access points (Hall,

2007; Lesslie & Taylor, 1985). As argued by Lesslie (2016), wilderness quality is relative and exists on a spectrum of environmental conditions. On one end of the spectrum are highly developed urban and agricultural settings, while on the other end are natural environments without traces of human interference. This emphasizes the usefulness of the application of the wilderness continuum concept (Lesslie & Taylor, 1985), which is based on remoteness and primitiveness, for wilderness management.

While discussing the qualities related to wilderness experience, Johnson et al. (2005, p. 4) highlighted the difference between the concepts of wilderness and wilderness experience and defined the latter as “the overarching umbrella concept within which naturalness, primitiveness, remoteness, solitude, and freedom from confinement are all dimensions.” Similarly, Sæþórsdóttir (2010b) identified five main components of wilderness experience. Among the most important components mentioned by tourists was (1) experiencing unspoiled beautiful nature. Other components of wilderness experience identified by Sæþórsdóttir (2010b) included (2) opportunity to escape everyday worries and enjoy the freedom from daily constraints, (3) spiritual experiences, self-reflection and opportunities for learning, (4) solitude or enjoying the company of a few, and (5) challenge, which allows tourists to test the strength of their body and mind in wilderness settings. Wilderness experience, however, is highly subjective. It can be affected by various natural, social, and management conditions (Ólafsdóttir, Sæþórsdóttir, & Runnström, 2016), and is often shaped by previous experiences in the same or other wilderness places (Johnson et al., 2005).

Wilderness experience has been shown to be affected by human-made structures (Sæþórsdóttir, 2010b). The presence of tourism infrastructure and even more of REI is likely to lead to degraded wilderness experience for more purist visitors (Sæþórsdóttir, 2014; Sæþórsdóttir & Hall, 2018). Furthermore, improved access related to the construction of REI often leads to higher tourist numbers in wilderness areas and to crowding, which can result in spatial and temporal displacement of more purist visitors looking for peace and quiet (Ólafsdóttir & Haraldsson, 2019; Saarinen, 2021; Sæþórsdóttir, 2013). Tourists more sensitive to crowding are likely to choose less popular nature destinations, and be replaced by less sensitive tourists, for whom qualities related to wilderness experience are less important (Manning, 2003; Sæþórsdóttir & Hall, 2021). This suggests that overall visitor satisfaction is not always the most suitable tool to measure the quality of wilderness experience, since visitors annoyed by crowding or infrastructure developments might not be present in the area (Manning, 2003).

Touristic wilderness is generally marketed through images of scenic and exotic nature, solitude, adventure, and freedom (Saarinen, 2005). Since wilderness areas are highly sensitive to impacts of human activities, sustainable management of wilderness uses has to be ensured to preserve the resources valuable for NBT. Furthermore, as pointed out by Saarinen (2021), wilderness areas can be described as relational places containing porous boundaries, through which they connect to wider processes. Thus, systemic approaches to planning and management of natural resources in wilderness areas are needed, which include neighboring communities and a range of stakeholders likely to be affected by the processes going on in them (Saarinen, 2021).

2.3 Effects of renewable energy infrastructure on nature-based tourism resources

REI is generally developed in natural areas where renewable energy resources are available, but often also the resources used for NBT (Sæþórsdóttir, 2012). Hence, changes brought by REI to nature destinations are likely to affect the resources NBT relies on. Priskin (2001) identified four categories of NBT resources necessary for a nature destination to remain competitive: (1) attractions, which include a range of indicators covering various landscape and geological features, scenic and floral diversity, opportunities for recreation and adventure, vistas, and scientifically interesting features, (2) accessibility, (3) supporting infrastructure which enables visitors to stay in a natural area and enhances their experience, and (4) environmental quality of a natural area. Developing REI in a natural area might affect these resources in diverse and complex ways. The character and the scale of these effects depends on numerous factors, such as type of the resource, visitor preferences, as well as the social, cultural, economic, technological, and biophysical context.

REI reduces the environmental quality and naturalness of the surrounding areas. The vistas of natural areas are likely to be affected by the energy infrastructure development, since REI visually impacts the landscapes, although impacts of various types of REI differ (Sæþórsdóttir & Hall, 2018). Hydropower plants often, among numerous other impacts, cause depletion and diversion of rivers, reduced water flow in the waterfalls in the catchment area and altered water quality downstream (Moran et al., 2018; Rosenberg et al., 1997). Large scale hydropower plants generally contain reservoirs, the construction of which leads to loss of terrestrial habitats due to submersion of land. Furthermore, despite looking quite natural, reservoirs cover extensive areas and dramatically change landscapes. Water fluctuations in the reservoirs reveal previously inundated parts of the banks covered with silt, which not only have negative visual impacts but also contribute to erosion (Vilmundardóttir et al., 2010).

Geothermal power plants also affect surrounding areas by visually and aurally polluting the landscapes with extensive pipelines, noisy boreholes, and other infrastructure. The steam released by geothermal power plants not only interferes with the scenery but also contains various chemicals, such as hydrogen sulfide, arsenic, and mercury (Parisi et al., 2019). Specific odor of H₂S might degrade the experience of visitors using the surrounding areas. Moreover, geothermal energy harnessing might lead to drying up of hot springs (Arnórsson, 2004), which often are important tourist attractions.

Wind turbines not only result in severe visual impacts on the surrounding landscapes due to their height and flickering caused by moving blades (Pasqualetti & Smardon, 2017), they also cause noise pollution. Abbasi and Abbasi (2000) explained that wind turbines produce two types of noise. The noise released by the machinery can be reduced using acoustic insulation. However, the noise of the rotating blades is impossible to avoid and might be annoying to people nearby. Moreover, part of the noise released by the wind mills is infrasound, which is impossible to hear but causes vibrations in structures located nearby (Abbasi & Abbasi, 2000). Thus, people looking for peace in a nature destination might be disappointed with their experience in the area if a wind farm is located nearby.

REI is generally accompanied by road developments necessary for the construction and maintenance of REI (Gibson et al., 2017), accordingly demonstrating how the access resource benefits from REI developments. However, this may have complex effects on other tourism resources. Improved access often leads to higher visitor numbers in a natural area and higher environmental impacts, such as trampling, littering and erosion (Tverijonaite et al., 2018). Consequently, environmental quality of the area decreases, and negative impacts related to increased recreational use become visible and might negatively affect visitor experience in the area (Ólafsdóttir & Haraldsson, 2019; Sæþórsdóttir & Hall, 2021). Increased tourist numbers raise the demand for more tourism infrastructure to satisfy the demands of visitors and to manage environmental impacts of tourism (Tverijonaite et al., 2018). Consequently, the infrastructure resource available on-site might become insufficient and the need for new tourism infrastructure is likely to increase. All these processes, next to REI itself, degrade the attractions of the area, especially for visitors coming to natural areas for reasons related to wilderness experience, i.e., looking for escapism, solitude, challenge, or immersion in nature (Sæþórsdóttir, 2010b).

However, certain tourist market groups coming to the area might also benefit from the changes brought by REI. The interest and participation in energy tourism seems to be increasing and people with such interests might benefit from the opportunity to see or visit REI (Beer et al., 2018; Frantál & Urbánková, 2017). Furthermore, tourists preferring recreation in easily accessible destinations with a higher level of services might also perceive the changes brought by REI developments as positive. Therefore, how REI developments will affect tourism processes and visitor experience depends, among other factors, also on intentions, expectations and preferences of visitors (Priskin, 2001).

The perceived character and scale of changes brought about by REI might affect visitors' decision-making in choosing a destination (Frantál & Urbánková, 2017). Consequently, tourism service providers might change their marketing and business development strategies depending on perceived compatibility of the REI development planned in a natural area and perceived effects of such infrastructure on the resources essential for their business (Mordue et al., 2020; Sæþórsdóttir & Hall, 2019; Shepherd et al., 2014). Tourism companies that perceive REI as beneficial for their business might be more willing to invest into marketing or development of the area compared to the companies that perceive REI as a potential threat to their business. However, such perceptions are generally much more complex than dichotomous (Davenport & Anderson, 2005), and therefore, place-based management of natural resources, which includes place meanings attributed by the stakeholders to natural areas, should receive higher attention as a tool contributing to sustainable development. Furthermore, as pointed out by Saarinen (2004), besides the meanings and values, the issues related to the management of resources, land use, and economic development also might lead to conflicts due to differing views of stakeholders. To identify and mitigate these conflicts, it is critical to include stakeholders' perceptions while planning future use of natural resources (Saarinen, 2004; Waligo et al., 2013).

2.4 Stakeholder participation in natural resource management

Wicked problems (Rittel & Webber, 1973) related to sustainability and energy policies often comprise diverging place meanings, values, interests, and stakes. They can be approached from different angles and be accompanied by numerous uncertainties (Cuppen, 2012). Therefore, policies regarding complex environmental issues based only on technocratic expert knowledge are likely to be too narrow. They require inclusion of a diversity of knowledge, perspectives, and values, which can be achieved through stakeholder participation (Cuppen, 2012; Höfer & Madlener, 2020; Jasanoff, 2018). The importance of public participation for increasing transparency and accountability in decision-making related to environmental matters and for building up public support for decisions was emphasized in the *Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* (United Nations, 1998).

Due to the scope of this doctoral thesis this subchapter focuses on stakeholder rather than public participation and discusses the issues that should be addressed while using participatory approaches. Freeman (1984, p. 53), one of the originators of the stakeholder theory, defined stakeholders as “any group or individual who can affect or is affected by the achievement of an organization’s purpose.” Later numerous stakeholder definitions and classifications have been proposed in order to facilitate stakeholder identification (for an overview see, e.g. Miles, 2017). One of the most prevalent is the classification for stakeholder identification and salience by Mitchell et al. (1997). The authors identified three attributes to which managers pay attention while identifying stakeholders: power, legitimacy, and/or urgency. Based on the possession of these attributes, stakeholders fall into seven categories covering a range from highly salient definitive stakeholders to latent stakeholders, which might be not taken into consideration if the organization or company has limited resources (Mitchell et al., 1997). Sirgy (2002) identified three main stakeholder groups: internal stakeholders which include the various divisions of the company, external stakeholders with whom the company exchanges resources, such as suppliers, customers, creditors, media, local communities, and the environment, and thirdly, distal stakeholders, which comprise various bodies able to affect the company through influencing the external stakeholders, such as government agencies or environmental advocacy groups. While internal stakeholders in higher managerial levels are often responsible for the decision-making of the company, in some cases such power is held by external stakeholders, such as the public or the government (Brunet & Aubry, 2016; Derakhshan et al., 2019). Moreover, stakeholders might have several functions. Thus, they can influence and be affected by the company’s activities simultaneously, meaning that the classifications of stakeholders are often overlapping (Post et al., 2002).

This demonstrates the difficulty of setting clear boundaries between various stakeholder groups and their identification. In line with that, various researchers (Miles, 2012, 2017; Mitchell, 2012) stressed that the stakeholder concept is essentially contested. While the first level of meaning of the stakeholder concept comprises a clear set of ideas, at the second level, when it has to be applied in practice, contestability arises (Miles, 2017). Therefore, Miles (2017, p. 455) suggested that attention should shift “from continual debates around generic stakeholder definitions to more refined and focused definitional debates on the delineation of the boundaries of stakeholder identification which are aligned

to context.” Tourists and tourism service providers engaged in this doctoral project constitute only a part of tourism stakeholders and even smaller proportion of all stakeholders related to REI developments, but they could be defined highly salient stakeholders due to tourism industry’s high reliance on natural areas where REI has been constructed or proposed.

While discussing the benefits of stakeholder participation in environmental decision-making, Reed (2008) identified normative and pragmatic arguments for stakeholder engagement. Normative claims include benefits to the society and equity, such as reduced likelihood of marginalization of certain groups, increased public trust, and higher perceived fairness of decision-making as well as opportunities for social learning. Among the pragmatic claims Reed (2008) mentioned arguments related to the consideration of local interests which is likely to lead to higher stakeholder support and enhanced quality of the decisions and policies made by involving stakeholders. Stakeholder participation facilitates such outcomes through inclusion of a wide range of perspectives and narratives into the decision-making process and provision of more complete information regarding the social and environmental systems and processes (Lange & Cummins, 2021; Sorman et al., 2020). Local knowledge provided by stakeholders is not only essential for informing the planning of various developments, but can also guide the production of scientific knowledge through ‘problem-feeding’ (Persson et al., 2018), which refers to stakeholders informing the researchers about observed processes that require scientific investigation.

However, as emphasized by various researchers (e.g., Irvin & Stansbury, 2004; Reed, 2008; Strzelecka & Wicks, 2015), these claims do not always manifest in practice and participatory approaches have to deal with various challenges. Ensuring stakeholder participation in natural resource management planning and policies which would represent a wide range of views and reflect the whole picture requires effort, funding, and time (Baldwin, 2019; Irvin & Stansbury, 2004). Stakeholder apathy is likely to occur due to lack of knowledge on the issue, lack of trust in governance processes or if they do not think that their input makes a difference (Booth & Halseth, 2011). A multitude of processes going on at the same time which require stakeholder participation can lead to consultation fatigue among stakeholders who are often asked to participate in such processes (Reed, 2008). Moreover, stakeholders may focus on the issues that are the most relevant to them and not take into consideration all the values of the asset, which might lead to biased preferences (Reynaud et al., 2015). These potential issues have to be taken into consideration when planning participatory processes. Furthermore, while giving the voice to the stakeholders, it is important to take power relations into consideration and to ensure that the processes are not skewed by giving more power to already privileged groups, which might lead to ‘dysfunctional consensus’ (Booth & Halseth, 2011; Reed, 2008).

Therefore, to improve decision-making and increase stakeholder support, participatory processes have to be well designed and executed. Various frameworks and guidelines for best practice participation have been proposed in academic literature in natural resource management contexts (e.g., Eaton et al., 2021; Reed, 2008; Talley et al., 2016). With regard to development of specific projects, Davis (2014) emphasized that the perceived project success differs among the stakeholders depending on stakeholder interests and goals. Olander and Landin (2008) identified five factors affecting stakeholder support for a construction project, which should be considered while planning a project. Firstly, they stressed the importance of identifying the key stakeholders and addressing their concerns and needs as early as possible in the planning process. They furthermore highlighted the

importance of communicating benefits and negative impacts to the various stakeholders and proactively adjusting the design of the project according to the stakeholders' concerns. The third factor identified by Olander and Landin (2008) was analysis of alternative solutions which would be the best considering most aspects, including the impacts on various external stakeholders. The fourth and fifth factors included project organization, where sufficient resources are assigned and necessary conditions are created to involve stakeholders into the project planning, as well as active and open communication with the media, which in some cases can strongly influence external decision-makers. With regard to REI development, various researchers (Nasr et al., 2020; Stadelmann-Steffen & Dermont, 2021) pointed to the importance of enabling stakeholder participation as early as possible. As noted by Wolsink (2007), inclusion of the stakeholder preferences and opinions already in the selection of the most suitable locations for REI is likely to lead to greater acceptance. Besides the degree, nature, and timing of stakeholder engagement, numerous other factors, such as the suitability of the engagement approach for a specific context, existing power dynamics, as well as institutional arrangements, affect the success of participatory approaches to natural resource planning and management (Baldwin, 2019; Reed, 2008; Sterling et al., 2017).

3 Methods and research settings

The interdisciplinary character of the research topic of this thesis required multiple research methods. A systematic literature review focusing on the interrelationships between REI and tourism, providing an overview of existing research and knowledge, served as a basis for this doctoral project and guided further selection of methods. As revealed by the literature review, the interrelationships between REI and tourism strongly depend on the context and subjective perceptions of tourism stakeholders. This suggested the usefulness of studying the impacts of REI on NBT in the real-life context by employing a case study approach (Yin, 2017).

3.1 Case study approach

Embedded case study was conducted in this doctoral research. It allows the use of various methods and sources of information and inclusion of multiple units of analysis, and therefore is highly appropriate for studying complex and contextualized issues (Scholz & Tietje, 2002). The case study research design was rigorously developed as suggested by Yin (2017). However, some flexibility was left throughout the research to adjust to the new emerging knowledge, especially when collecting qualitative data (Taylor et al., 2016). Research questions were defined taking into consideration the findings of the literature review. Later the ‘case’ was defined, and its boundaries were set. As noted by Stake (2005, p. 443), choosing a case study is “not a methodological choice but a choice of what is to be studied” (see also Flyvbjerg, 2013). This case study looks into the relationships between REI and NBT mostly in the Icelandic Central Highlands from the perspective of tourists and tourism service providers.

While the Central Highlands served as the main case study area, different papers focused mostly on proposed and/or existing REI in the areas within or just outside of the Central Highlands, which can be considered as subunits of analysis in this case study. The study area of Paper II included an area of the proposed Hverfisfljót Hydropower Plant in the southern Central Highlands. Paper III compared the location of the proposed Búrfellslundur Wind Farm in the south of the Central Highlands with locations of four other wind farms proposed in natural areas outside of the Highlands. For Paper IV, six study areas within or at the border of the Central Highlands were selected: three areas where REI has been proposed and three areas containing existing REI. Paper V focused on the Central Highlands as a whole and studied tourism service providers’ preferences regarding future management and development of the area.

Flyvbjerg (2006, 2013) stressed that good social science research is driven by the problem, not by methodology, meaning that the methods most suitable for addressing the problem, achieving the research objectives and answering the research questions should be employed. Embedded case studies often comprise qualitative and quantitative methods, which contribute to the knowledge in different ways (Scholz & Tietje, 2002). While qualitative methods provide depth of knowledge, quantitative methods provide breadth and

help assess how widespread a phenomenon is in a population (Creswell & Creswell, 2017; Flyvbjerg, 2013). Using multiple methods in a case study provides further opportunities for data triangulation, which contributes to strengthening the construct validity of a case study (Yin, 2017). In this doctoral research the type of data to be collected, methods, and data analysis were decided based on research questions and the problematics of the selected case. According to Yin (2017), as many as possible sources of evidence should be used in a case study. Furthermore, the case study approach is compatible with other research methods. In this doctoral research, a systematic literature review was conducted to guide further research, while other methods included semi-structured interviews with tourists and tourism service providers, participatory mapping, participant observation, open-ended diaries, and questionnaire surveys conducted among tourists and tourism service providers (Table 1). The methods are described in more detail in the following subchapters.

3.2 Selection of methods

3.2.1 Systematic literature review

A systematic literature review was conducted with the aim to gain an overview of existing research on the interrelationships between REI and tourism, as well as to identify the type and character of these interrelationships and the factors affecting them. Since the existing research on the topic employs diverse research methods, systematic mixed studies review was conducted in seven steps, which include: (1) formulating review questions and objectives, (2) defining selection criteria, (3) conducting extensive literature search, (4) identifying potentially relevant studies, (5) selecting relevant studies, (6) quality appraisal of the studies, and (7) analyzing the studies and synthesizing the findings (Pluye & Hong, 2014). Two large databases were used for the literature search: Scopus and Web of Science. Original research articles with direct focus on the topic published in English in international peer-reviewed journals (61 articles in total) were selected for this review and analyzed. Data-based convergent synthesis design was used in this review, i.e., the same synthesis method was used for the analysis of all studies included in this review, and the findings of the analysis were presented together (Hong et al., 2017). Thematic synthesis of the findings was conducted, meaning that quantitative data was transformed into themes and categories. Findings were presented and discussed, while research gaps and opportunities for future research were identified. This literature review served as a basis for this doctoral project and guided further research.

3.2.2 Semi-structured interviews

Semi-structured in-depth interviews were employed in three papers of this doctoral thesis (Papers II, III and IV). As noted by numerous scholars (Longhurst, 2010; Lune & Berg, 2017; Taylor et al., 2016), semi-structured interviews allow for the development of a better understanding of participants perspectives, perceptions, attitudes, and subjective meanings assigned to certain phenomena. As a result, they are highly suitable for studying the attitudes of tourists and tourism service providers toward various proposed and existing REI, its perceived impacts on NBT and meanings assigned to the study areas and to renewable energy projects.

For the study presented in Paper II, semi-structured interviews with tourists visiting the study area where the Hverfisfljót Hydropower Plant was proposed were conducted to investigate their perceptions of the area and attitudes toward the proposed REI. This study area is very inaccessible and isolated due to rough landscape and limited road connection. The site is characterized by low visitation, which led to certain challenges during data collection, such as limited access to potential participants. By conducting primary research on tourism activities in the area, I found out about two backpacking tours crossing the study area organized in summer 2018, when the data for Paper II was collected. The first tour took place at the beginning of July and the second at the beginning of August. I joined both tours and interviewed tour participants, as well as independent visitors to the area, using a 4x4 track crossing part of the area, who were interviewed for three days at the end of July 2018. In total, 17 interviews with tourists visiting the study area were conducted. To address the issue of a relatively small sample due to low numbers of tourists visiting the area, multiple methods were employed and the data from the interviews with tourists were triangulated with the data from the participant observation, open-ended diaries, and on-site visitor survey to ensure the validity of the research.

For the studies presented in Papers III and IV, semi-structured interviews with tourism service providers were conducted. Paper III aimed to study potential impacts of five proposed wind farms on NBT as perceived by tourism service providers and identify the factors affecting the suitability of a location for wind energy harnessing with regard to tourism. To achieve these objectives, 47 interviews with tourism service providers were conducted between June and November 2020. Some of the interviews were conducted in person, but others were conducted online or on phone, because of social distancing regulations related to COVID-19 that started during the data collection time. Paper IV focused on estimating the impact area of REI on NBT as perceived by tourism service providers and factors affecting its shape and size. For this paper, 49 interviews with tourism service providers were conducted in May – August 2020. During the interviews participatory mapping software *Maptionnaire* was used, which allowed participants to map their perceived impact areas. All interviews for Paper IV were conducted in person to ensure that, if needed, the interviewer can assist with the use of the mapping software.

Purposive sampling was used when selecting interviewees for the studies presented in Papers III and IV. Tourism service providers operating in or nearby the study areas and representing a wide range of tourism businesses regarding the type of services provided, size and location of business and length of operation were selected. The interviews with tourism service providers were conducted until the data saturation point was reached, i.e., additional interviews did not yield new insights. For Paper II, however, limited access to participants affected the data collection process: all tourists encountered in the study area during the data collection period and willing to take part in this research were interviewed. Interviews for Papers II, III and IV were conducted using interview guides (Appendices A, C, and D), audio-recorded with the permission of participants, transcribed verbatim, and analyzed using inductive strategy based on grounded theory (Corbin & Strauss, 2015; Glaser & Strauss, 1967) in Atlas.ti software.

3.2.3 Participatory mapping

In the study presented in Paper IV, participatory mapping software *Maptionnaire* was used for mapping of the impact areas of REI on NBT as perceived by tourism service providers. The benefits of employing digital technologies for inclusion of stakeholders in tourism and natural resource planning have been pointed out by numerous studies (Kantola et al., 2018; Moore et al., 2017; Trunfio & Della Lucia, 2018). The use of participatory geographical information systems (PGIS) enables the measuring of the distribution of the place meanings and values as perceived by the stakeholders (Moore et al., 2017; Ruiz-Frau et al., 2011) and identification of areas of potential conflicts (Brown & Raymond, 2014; Brown et al., 2020). Brown and Weber (2013, p. 456) noted that during mapping “locations and meanings become fused graphically through place symbolization” creating a ground for conflict/agreement identification. The use of PGIS to map tourism service providers’ perceptions of the impact areas of REI on NBT facilitated inclusion of place-based approaches into the management of natural resources.

For mapping of perceived impact areas of REI on NBT, participants were provided a portable computer with the map containing several base layers to choose from as well as proposed and existing REI included in the study presented on the screen. While drawing the impact areas, participants were asked to explain the reasoning behind them. Participants mapped their perceived impact areas by drawing polygons, which have been shown by previous research to be highly suitable for mapping of place meanings and their boundaries (Klain & Chan, 2012; Lowery & Morse, 2013; Strickland-Munro et al., 2015). However, while participants could zoom in/out for preferred scale, their mapped impact areas were often generalized and contained ‘fuzzy’ boundaries, which should be taken into consideration when interpreting the maps. Out of 49 interviewed participants, 32 were willing to draw their perceived impact areas. Many participants estimated the impact areas for more than one renewable energy project, which resulted in 105 estimated impact areas in total. The GIS data was imported into ArcGIS software and analyzed in relation to the data from the interviews.

3.2.4 Participant observation

Participant observation was conducted for the study presented in Paper II as one of the methods used in the triangulation of data. As noted by Yin (2017), during participant observation, the researcher is not a passive observer but can assume a role in a fieldwork setting. Laurier (2010) even stressed the importance of actively engaging in the activities related to the case for gaining knowledge and know-how in order to produce a valuable commentary. One of the major benefits of participant observation, which was highly relevant for Paper II, is gaining direct access to the events, settings or groups that otherwise might be inaccessible (Laurier, 2010; Yin, 2017). I joined two organized five-day backpacking tours crossing the study area in July and August 2018. The first tour was joined by seven participants, and the second by eight participants. The tour route led through a natural area not containing any tourism infrastructure or other human interference.

Taylor et al. (2016) have identified three sets of activities to be conducted in the fieldwork: establishing a comfortable relationship and interaction with informants, eliciting data through strategies and tactics, and recording the data as field notes. Joining a five-day

backpacking tour in a demanding environment created a great opportunity for establishing a good connection with participants of the tour and for hearing their experience of the area, which they were willing to share. During the backpacking tours detailed fieldnotes were taken of the settings of the area, activities undertaken, behavior and interactions of tour participants and guides, experiences shared by tour participants, as well as my own experiences in the area. The confidentiality of all participants was ensured. The fieldnotes were accompanied by numerous photographs of the surrounding landscapes, settings, and tour participants in them, which were analyzed after the field trips.

3.2.5 Open-ended diaries

On the first day of the two backpacking tours that I joined to collect data for the study presented in Paper II, I asked participants of the tours if they would be willing to fill in the diaries focusing on the highlights of their experience in the area at the end of each day. I introduced the topic and purpose of the research to the participants and explained the importance of their participation. All participants agreed and were given small notebooks and pencils, which were collected on the last day of each tour. Open-ended diaries focusing on the self-reported experiences in the area provided opportunities for gathering insights into participants' perspectives and looking into things that stood out the most to each participant, since during diary writing participants could decide on what to report in their diaries (Alaszewski, 2006; Sheble et al., 2017). Daily diary recordings provided opportunities to write down things that otherwise could be forgotten and go unnoticed (Latham, 2010). Data gathered via open-ended diaries was analyzed and used in the triangulation of the data conducted in Paper II.

3.2.6 Questionnaire surveys

Quantitative questionnaire surveys were employed in two studies of this thesis, studies presented in Papers II and V, in order to gain knowledge on the trends in participant perceptions, attitudes and preferences (Bryman, 2016). Low visitation of the study area of Paper II required not only the use of multiple methods, but also multiple ways to reach the potential participants of the study. Participants of the two backpacking tours organized in the area were asked to answer the questionnaire survey, to which they all agreed, resulting in 15 filled in questionnaires. Additionally, participants who joined a mountain biking tour offered by a local company in the study area were surveyed, which produced four completed questionnaires. I also spent three days surveying and interviewing people driving the 4x4 track crossing the study area. The mountain track was used by two cars with four people in three days, which added four questionnaires and two interviews to the sample. In an effort to increase the sample, empty questionnaires with a map, description of the proposed power plant and a cover letter inviting to participate in the study were left in the mountain hut Miklafell situated in the study area for over two months, between the end of July and the beginning of October 2018. Nine questionnaires were filled in by the guests of the hut during this period. In total, 32 filled in questionnaires were collected. The data was analyzed using SPSS Statistics software and triangulated with the qualitative data collected for this study.

For the study presented in Paper V, an online questionnaire survey among travel agencies and day tour providers was conducted, focusing on their preferences for future management and development of the Icelandic Central Highlands. A list with the company

emails was provided by the Icelandic Tourist Board, and an email with the link to the online survey was sent to all companies, 984 in total. The survey was open for one month, November – December 2020. Online questionnaire surveys have numerous advantages, such as quick access to potential participants independent of their location (Dillman et al., 2014; Hung & Law, 2011; McLafferty, 2010). Their main disadvantage is relatively low response rates, which often do not exceed 30% (Shih & Fan, 2008). This issue was addressed by sending two reminder emails to the participants during the surveying period. The survey was answered by 382 tourism companies or about 40% of the contacted businesses. In Paper V, the questionnaire survey was used as a standalone method and the data was analyzed using SPSS Statistics software.

3.2.7 Overview of the methods used in the thesis

Table 1. Study areas, methods and data sources selected for this thesis.

Paper	Study area	Focus	Methods	Participants/data source
I	N/A	Overview of existing knowledge on the interrelationships between REI and tourism and factors affecting them	Systematic mixed studies review	Relevant research articles published in peer-reviewed international journals
II	The area around the proposed Hverfisfljót Hydropower Plant in the southern Central Highlands	Potential impacts of the proposed hydropower plant on tourist experience, their perceptions of the area and attitudes toward the proposed REI	Semi-structured interviews, participant observation, open-ended diaries, on-site visitor questionnaire survey	Tourists visiting the study area
III	Five areas within and outside of the Central Highlands where wind farms are proposed	Potential impacts of the proposed wind farms on NBT and factors deciding suitability of locations for wind farms as perceived by tourism service providers	Semi-structured interviews	Tourism service providers offering tours and/or other services in the study areas.
IV	Six areas within or just outside of the Central Highlands: three with proposed and three with existing REI	The spatial extent of the impacts of REI on NBT as perceived by tourism service providers and factors affecting it	Semi-structured interviews during which participatory mapping was used	Tourism service providers operating and knowledgeable about tourism in at least one of the study areas
V	The Icelandic Central Highlands	Future management and development of the Central Highlands as preferred by tourism service providers	Online questionnaire survey	Travel agencies and day tour providers operating in Iceland

3.3 Case study area

3.3.1 Icelandic Central Highlands

The Icelandic Central Highlands are an important venue for NBT (Icelandic Tourist Board, 2017; Sæþórsdóttir & Saarinen, 2016b), but also contain REI and abundant hydro-, wind and geothermal energy resources (Arnórsson, 2012; Ragnarsson et al., 2020). Therefore, the area is deemed highly suitable for investigating the interrelationships between REI and NBT. As defined in the Regional Plan (Ministry for the Environment & National Planning Agency, 1999), the Central Highlands cover around 40% of Iceland's surface and mostly consist of a 400-700 meters high plateau situated in the interior of the country. The area is characterized by high geological diversity and scenic landscapes shaped by the processes and interplay of volcanic activity and glaciers (Árnason, 2020). The Central Highlands are largely uninhabited, and more than 85% of their land, which stretches over 21 municipalities, is publicly owned (Bishop et al., 2022; Ministry for the Environment and Natural Resources, 2017; Óbyggðanefnd, n.d.).

During the 1100 years since the settlement of Iceland, the perception of the Central Highlands has consistently shifted (Sæþórsdóttir et al., 2011). From 930 the Central Highlands were mainly used for travels to the annual *Alþingi* (parliament) in Þingvellir. Later, approximately from the late thirteenth until the late nineteenth century, these travels over the Central Highlands decreased, resulting in the development of an image of the region as a land of mystical creatures and outlaws (Hastrup, 1990; Sæþórsdóttir et al., 2011). Only in the twentieth century did the visits for tourism and recreational purposes to the Central Highlands start increasing, facilitated by the introduction of motorized vehicles and improved access due to construction of roads and bridges partly for the first hydropower plants (Huijbens & Benediktsson, 2015; Sæþórsdóttir, 2004).

Renewable energy harnessing in the Central Highlands started with the construction of the Búrfell Hydropower Plant in the Þjórsá and Tungnaá Catchment Area in 1960s (Landsvirkjun, n.d.-c), when the first aluminum smelter, then owned by a Swiss company, was built just south of Reykjavík, which was using the electricity from the hydropower plant. Over the next several decades, six other hydropower stations were built in the Þjórsá and Tungnaá Catchment Area, with the latest addition, Búrfell II Hydropower Plant, being constructed in 2018 (Landsvirkjun, n.d.-b). These power plants served as the main source of electricity for aluminum smelters and ferrosilicon processing plants built in the twentieth century (Benediktsson, 2008). Other hydropower plant developments followed the first power plants of the Central Highlands. In 1991, Blanda Hydropower Plant was constructed at the northwestern edge of the Central Highlands (Landsvirkjun, n.d.-a). Later, in 2007, despite strong environmental opposition (Benediktsson, 2007, 2008), Fljótsdalur Hydropower Plant, using the water from reservoirs in the northeastern Central Highlands, was constructed, intended to provide electricity for an aluminum smelter in Reyðarfjörður, completed in 2008 (Landsvirkjun, n.d.-d). The power coming from the reservoirs located in the Central Highlands in 2020 contributed to over 60% of Iceland's electricity supply (NEA, 2021).

No geothermal power plants are present in the Icelandic Central Highlands, but Krafla Geothermal Power Plant is located just outside of their northeastern border. Currently no

wind farms operate in Iceland, but there are two experimental 2MW wind turbines located at the edge of the southern Central Highlands (Landsvirkjun, n.d.-e). However, there is a high interest among energy companies in harnessing wind energy in Iceland, and two proposed wind farms have been approved by the Icelandic Parliament (Alþingi, 2022). One of them, Blöndulundur Wind Farm, is to be located in the northwest of the Central Highlands, while the other, Búrfellslundur Wind Farm, in the southern Central Highlands. Furthermore, various other renewable energy projects proposed by energy companies, some of them in the Central Highlands, are being evaluated by the expert committees of *the Master Plan for Nature Protection and Energy Utilization* (Gíslason, 2016; Pétursdóttir, 2021).

While REI has affected almost 10% of wilderness of the Central Highlands (Árnason et al., 2017), and the area has some tourism infrastructure, the Central Highlands still contain vast wilderness areas (Ólafsdóttir & Runnström, 2011; Ostman & Árnason, 2020), which are of high importance for the tourism industry. The Central Highlands are visited by around one-third of all international tourists visiting Iceland in summer (Icelandic Tourist Board, 2017), who perceive the wilderness character of the area as an important attraction (Sæþórsdóttir, 2010b, 2014). Many of the natural areas located in the Central Highlands are characterized by relatively low traffic (Ólafsson & Þórhallsdóttir, 2019; The Icelandic Road and Coastal Administration, 2022; Þórhallsdóttir & Ólafsson, 2018) due to their remoteness and difficult access. They can generally be reached via gravel roads and smaller tracks without bridges, which are passable only during the summer months and only by four-wheel drive vehicles. However, roads related to existing hydropower plants generally are built-up, some of them paved, and have become ‘gateways’ to the Central Highlands. This resulted in some scenic natural areas becoming more accessible, as for example Landmannalaugar, which has become one of the most popular tourism destinations in the Central Highlands (Sæþórsdóttir, 2013; Sæþórsdóttir & Hall, 2021).

Increased visitation to more popular Central Highland destinations has resulted in higher perceived crowding, environmental impacts, higher demand for tourism infrastructure, and degraded wilderness experience in these areas (Ólafsdóttir et al., 2021; Sæþórsdóttir, 2010a, 2013, 2014; Sæþórsdóttir & Hall, 2021). The impacts related to tourism and REI developments contribute to the ongoing discussion on the future development of the Central Highlands and on nature conservation in the area. As an input to that debate, in December 2020 a bill on establishing a Central Highlands National Park, which would cover about 30% of Iceland’s surface, was submitted to the Icelandic Parliament by the Minister for the Environment and Natural Resources (Alþingi, 2020; Government of Iceland, n.d.-b). Partly due to increased opposition against the park after publishing the bill, it was later withdrawn from the Parliament (Capacent Gallup, 2011; Gallup, 2021; Samráðsgátt, 2019-2020; Social Science Research Institute of the University of Iceland, 2016). Currently existing protected areas in the Central Highlands cover over one-third of the area (Bishop et al., 2022), and include Vatnajökull National Park, various nature reserves, protected landscapes, and natural monuments (The Environment Agency of Iceland, n.d.-a). A few areas in the Central Highlands are protected from energy developments according to the Icelandic Master Plan for Nature Protection and Energy Utilization (The Environment Agency of Iceland, n.d.-b).

3.3.2 Existing and proposed renewable energy projects included in this research

Most of the existing and proposed REI projects included in this doctoral thesis are located within or just outside of the Icelandic Central Highlands (Figure 3). The only exception is Paper III, which investigated tourism service providers' attitudes toward wind farm development. Paper III focused on Búrfellslundur Wind Farm proposed in the southern Central Highlands, and on four wind farms proposed outside of the Highlands, in the west and north of the country (Vindheimar, Alviðra, Sólheimar, and Garpsdalur Wind Farms) (Table 2). Paper II focused on tourist attitudes toward the proposed Hverfisfljót Hydropower Plant in the south of the Central Highlands. Paper IV assessed the impact area of three existing power plants (Blanda Hydropower Plant, Krafla Geothermal Power Plant and seven hydropower plants in the Þjórsá and Tungnaá Catchment Area) and of three proposed energy projects (Hágöngur Geothermal Power Plant, Hrafnabjörg Hydropower Plant, and Búrfellslundur Wind Farm) on NBT. In Paper V, while discussing preferred future development and management of the Central Highlands, tourism service providers were asked about the impacts on tourism of existing REI located within or just outside of the Central Highlands: Blanda Hydropower Plant, Krafla Geothermal Power Plant, seven hydropower plants in the Þjórsá and Tungnaá Catchment Area, and Fljótisdalur Hydropower Plant. More detailed description of each renewable energy project selected for this thesis is provided in Table 2.

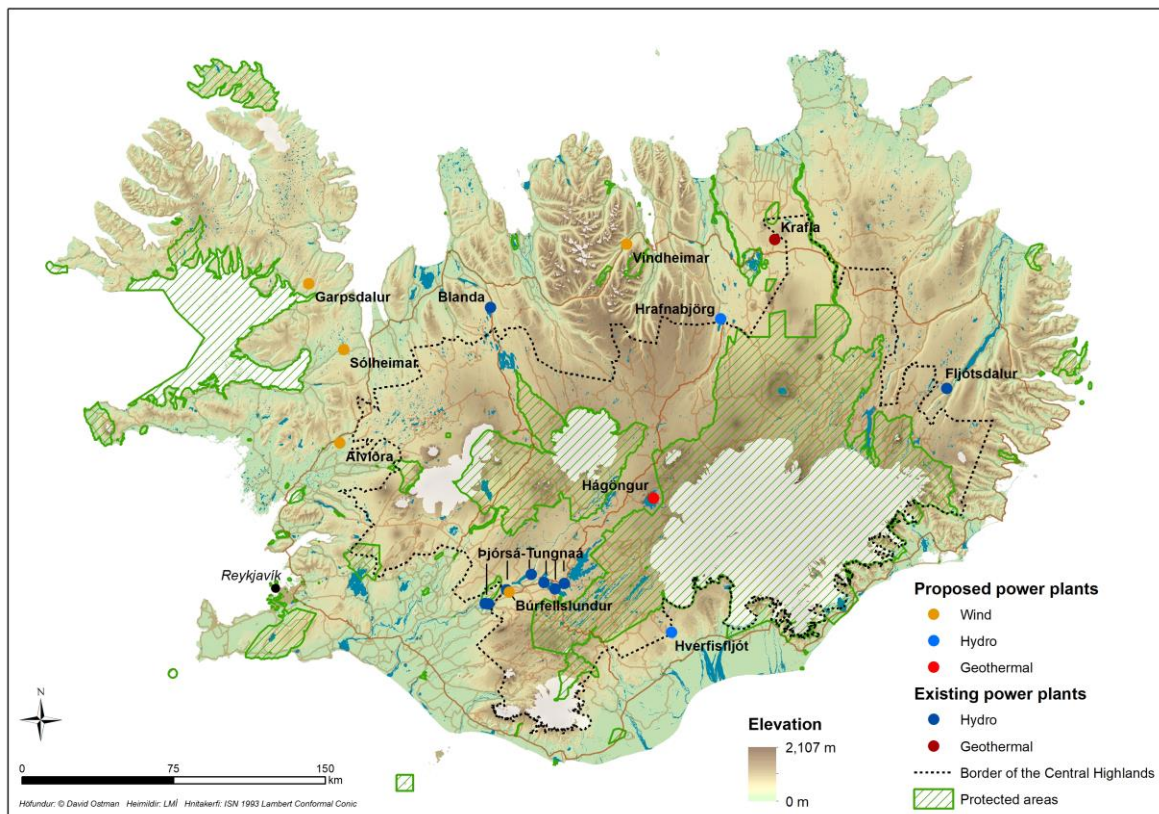


Figure 3. Existing and proposed REI selected for this thesis.

Table 2. Detailed description of existing and proposed REI selected for this thesis (Landsvirkjun, n.d.-f; Pétursdóttir, 2021).

Existing REI	Description	Installed capacity	Paper
Blanda Hydropower Plant	Underground power station, reservoir (57 km ²), intake reservoir (5 km ²), 5 dams, several canals and tunnels	150 MW	Paper IV Paper V
Krafla Geothermal Power Plant	2 steam turbines, 33 wells	60 MW	Paper IV Paper V
Seven hydropower plants in the Þjórsá and Tungnaá Catchment Area	7 power stations, 3 main supply reservoirs (32 – 92 km ²), 7 smaller reservoirs (0.6 – 20 km ²), 24 dams, numerous canals and tunnels	1035 MW	Paper IV Paper V
Fljótsdalur Hydropower Plant	Underground power station, 3 reservoirs (63 km ² , 7.5 km ² , 1km ²), 5 dams, numerous canals and tunnels	690 MW	Paper V
Proposed REI		Estimated capacity	
Hverfisfljót Hydropower Plant	Underground power station, 3 reservoirs (8.6 km ² , 2.2 km ² , 11.4 km ²) 4 dams, 2 canals and a tunnel	42 MW	Paper II
Hágöngur Geothermal Power Plant	Directly disturbed area would reach around 0.3 km ² , infrastructure specifics not provided	150 MW	Paper IV
Hrafnabjörg Hydropower Plant	Underground power station, reservoir (27 km ²), 1 – 2 dams, several canals and tunnels	Three versions: 88.5 MW 50 MW 36.5 MW	Paper IV
Búrfellslundur Wind Farm	30 wind turbines max. 150 m high	120 MW	Paper III Paper IV
Vindheimar Wind Farm	8-12 wind turbines max. 160 m high	40 MW	Paper III
Alviðra Wind Farm	6 wind turbines max. 150 m high	30 MW	Paper III
Sólheimar Wind Farm	27 wind turbines max. 200 m high	151 MW	Paper III
Garpsdalur Wind Farm	21 wind turbines max. 160 m high	88 MW	Paper III

4 Summary of papers

4.1 Paper I

Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (forthcoming). The interrelationships between renewable energy infrastructure and tourism: A thematic literature review. (*Submitted to Land Use Policy*).

With continuous tourism growth and increasing REI developments, potential impacts of REI on tourism have been increasingly used both while arguing for and against REI developments. Divergent results of existing studies pointed to the need for a systematic literature review on the interrelationships between REI and tourism and factors affecting them, which would provide a good overview of existing research. While this literature review was among the last papers to be submitted to a journal for publication, it was started at the beginning of the PhD project, was continuously updated, and served as a basis for further papers constituting this PhD thesis.

Objectives

The literature review aims to provide an overview of existing knowledge on the complex interrelationships between REI and tourism and the factors shaping them, which should be taken into consideration while planning REI. The specific objectives of the literature review are the following: (1) to review the present research on the interrelationships between REI and tourism, (2) to identify the type and character of these interrelationships, and (3) to identify the factors affecting them. The review furthermore identified existing research gaps and opportunities for further research.

Methods

Systematic literature review was conducted following the procedure for systematic mixed studies review (Pluye & Hong, 2014).

Main results

During the literature search and selection, 61 relevant research articles were identified and later analyzed. The first part of the results provided an overview of the reviewed studies, which revealed increasing academic interest in the topic, but limited geographic distribution of the research. It showed that onshore wind turbines receive the most attention, followed by offshore wind turbines and hydropower plants. More studies focus on proposed or hypothetical REI than on existing REI.

In the second part of the literature review the main themes emerging from the reviewed research related to REI and tourism were described in detail. The following themes were identified: (1) tourism stakeholders' attitudes toward REI, their perceived impacts, and potential changes in behavior due to construction of REI; (2) economic impacts of REI on tourism; (3) REI as a tourist attraction; (4) factors affecting the interrelationships of REI and tourism; and (5) tourism-related REI planning. The findings point to the heterogeneity of tourism stakeholder attitudes and multiple factors affecting them, with visual impacts of

REI being among the most prominent. Tourism stakeholder attitudes toward REI are likely to lead to changes in their behavior and consequent economic impacts, which, according to the reviewed studies, tend to be negative but relatively low. In some cases, however, REI can become a tourist attraction and generate increased tourism demand and positive economic impacts. The factors affecting the interrelationships between REI and tourism based on the findings of this literature review were divided into three categories: (1) factors related to REI, which include type and design of REI and accompanying infrastructure, meanings assigned to them and practical concerns related to REI; (2) locational factors, such as landscape diversity, its value and use for tourism, distance from tourist attractions, degree of naturalness of the area, and meanings assigned to places; and (3) factors related to tourism stakeholders, which, among others, include tourist motivations, expectations and activities, their values, beliefs, and concerns e.g. over climate change, previous experience of REI and of the area, country/region tourists are coming from, and type of information tourism stakeholders receive about REI. Thus, the interrelationships between REI and tourism are highly context-specific, which emphasizes the importance of taking the context and subjective stakeholder perceptions into consideration while planning REI projects.

The literature review identified various research gaps and opportunities for further research and guided the direction of this thesis. Identified research gaps included lack of studies conducting a comparison of the impacts of different types, designs and locations of REI, studies estimating the spatial extent of the impacts of various types of REI on tourism, longitudinal studies, and studies focusing on the effects of institutional factors such as REI planning strategies and policies for reducing the impacts of REI on tourism.

4.2 Paper II

Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (2019). Renewable energy in wilderness landscapes: Visitors' perspectives. *Sustainability*, *11*(20), 5812. <https://doi.org/10.3390/su11205812>

The importance of contextual factors in shaping the interrelationships between REI and tourism revealed by the literature review suggested potential benefits of investigating tourism stakeholder attitudes toward REI by looking into the place meanings assigned to the area and their compatibility with proposed REI. The case study presented in Paper II investigates the attitudes of tourists toward a hydropower plant proposed in a relatively undeveloped natural area.

Objectives

This paper aims to evaluate the potential impacts of the proposed Hverfisfljót Hydropower Plant on the tourist experience (1) by identifying the main attractions of the area to its visitors and (2) by investigating visitor perceptions, preferences, and attitudes toward renewable energy and other infrastructure development in the area around the proposed power plant.

Study area

This paper focuses on a relatively undeveloped natural area surrounding the proposed Hverfisfljót Hydropower Plant in the highlands of Skaftárhreppur municipality in South Iceland.

Methods

Since the study area is characterized by low visitation, mixed research methods were employed in this study. They included an on-site visitor survey, which resulted in 32 completed questionnaires, 17 semi-structured interviews with visitors to the area, 15 open-ended diaries filled in by visitors, and participant observation.

Main results

The main attractions of the study area for tourists included diverse landscapes, wilderness and its vastness, beautiful nature, geology and Hverfisfljót river and its waterfalls. Visitors came to the area to engage in various activities, which included hiking, trekking, backpacking, mountain biking and caving. They perceived the area as wilderness and sought environmental qualities that were in line with the components of wilderness experience identified by Sæþórsdóttir (2010b): unspoiled beautiful nature, escapism, solitude or companionship, challenge, and a spiritual experience. The preconceived image of the study area as wilderness was in line with the actual visitor experience, and their satisfaction with the stay in the area was high. Visitors were fascinated by vast unmodified natural landscapes, remoteness, and opportunities for solitude.

The proposed hydropower plant as well as other REI was perceived by most visitors as incompatible with the wilderness experience. Therefore, visitors preferred to protect the area from REI developments, which were perceived as more suitable in the more developed lowlands of the country. Most visitors also preferred very limited, if any, tourism infrastructure in the area, to ensure opportunities for wilderness experience. This study area is characterized by primitive settings and low visitation, which provide recreational opportunities for the most purist visitors. Such settings enable unique experiences which seem to contribute to increased perceived importance of protecting such wilderness areas from any developments. The meanings brought by REI to wilderness areas have been shown by this study to be incompatible with the meanings assigned to these places by visitors. This emphasizes the need for holistic approaches to energy development and the importance of identifying locations where REI would be the most and the least compatible with other land uses, including tourism.

4.3 Paper III

Sæþórsdóttir, A. D., Wendt, M., & Tverijonaitė, E. (2021). Wealth of wind and visitors: Tourist industry attitudes towards wind energy development in Iceland. *Land*, 10(7), 693. <https://doi.org/10.3390/land10070693>

Papers I and II revealed the importance of locational factors for the compatibility of REI and tourism and pointed to the need for increased knowledge on these factors. This need is addressed by Paper III, which focuses on the views of tourism service providers on wind farms proposed in five different locations in the Icelandic Highlands and lowlands and investigates their potential impacts on tourism and factors which make some locations more suitable for wind farm developments with regard to tourism than others.

Objectives

This paper aims to analyze (1) what impacts wind farms would have on NBT from the perspective of tourism service providers and (2) what tourism service providers consider as

the key factors that need to be taken into account when considering an acceptable location for a wind farm.

Study areas

The study areas selected for Paper III include five locations in Icelandic natural areas where wind farms have been proposed in the fourth phase of *the Master Plan for Nature Protection and Energy Utilization*. One of the proposed wind farms, Búrfellslundur, is at the edge of the southern Central Highlands, while other four wind farms are in the rural areas located in the lowlands of Iceland. Three of them, namely Alviðra, Sólheimar and Garpsdalur, have been proposed in West Iceland and Vindheimar in North Iceland.

Methods

Qualitative research methods were employed in this study, and 47 semi-structured interviews were conducted with tourism service providers offering tours and/or other tourism services in the areas of the proposed wind farms.

Main results

The study revealed that tourism service providers' attitudes toward the proposed wind farms were mostly negative. Their visual impacts, caused by the height of wind turbines and movement of the blades were among the main concerns shaping these attitudes. Wind turbines, according to the tourism service providers, would decrease the natural quality of the surrounding areas, change their image from natural to industrial and thereby reduce their attractiveness to tourists, since most tourists come to Iceland for unspoiled nature. They would negatively affect tourist experience, and lead to reduced tourism demand and economic losses. Wind farms, according to some participants, could change the image of the whole country as a tourist destination. However, in rural areas with perceived need for more electricity, there was somewhat higher support for wind energy harnessing. Some participants stressed that electricity produced by a wind farm could provide opportunities for new and existing businesses and strengthen rural communities, which is necessary for tourism in rural areas. They also pointed to the positive image of renewable energy, which could help mitigate negative impacts of wind farms on NBT.

Analysis of the interviews revealed that, according to tourism service providers, five factors define the suitability of the location for wind farm development with regard to tourism. Wind farms are likely to have the highest negative impacts on tourism in areas: (1) where wind turbines would be highly visible, (2) where number of tourists visiting or travelling through the area is high, (3) where (many or important) tourist attractions are present, (4) which are characterized by a high degree of naturalness, and (5) where perceived need for energy in the area is low. While these factors are expected to facilitate selection of locations for wind farm construction, their use is not unproblematic. As shown by this case study, the natural quality and appearance of the landscape are essential resources for NBT. For other types of tourism these resources might be different. Furthermore, people have different ideas of what constitutes unspoiled nature, leading to different attitudes toward REI. This emphasizes the importance of stakeholder inclusion into REI planning.

4.4 Paper IV

Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (2022). How close is too close? Mapping the impact area of renewable energy infrastructure on tourism. *Energy Research & Social Science*, 90, 102574. <https://doi.org/10.1016/j.erss.2022.102574>

While the research on the impacts of REI on tourism is increasing, there is still a gap in literature, identified in the Paper I, on the spatial extent of these impacts. The knowledge of the impact area of REI on tourism is of crucial importance for planning REI developments and for identification of the most suitable locations for REI. Therefore, the motivation for Paper IV was to contribute to this knowledge. Since the impacts of REI on tourism have been shown in previous research to strongly depend on subjective perceptions of tourism stakeholders, this paper approaches the impacts of REI on tourism by employing the concept of place and attempts to estimate the impact area of REI on tourism from the perspective of tourism service providers.

Objectives

This paper aims to: (1) map the impact area of REI on tourism as perceived by tourism service providers and (2) investigate the factors affecting the size and shape of the perceived impact area.

Study areas

Six study areas located within or at the boundaries of the Icelandic Central Highlands were selected for this study. They include three areas with existing REI and three areas where REI has been proposed but is not yet built. Existing REI selected for this study includes Blanda Hydropower Plant, Krafla Geothermal Power Plant and seven hydropower plants in the Þjórsá and Tungnaá Catchment Area. Proposed REI includes Hrafnabjörg Hydropower Plant, Hágöngur Geothermal Power Plant and Búrfellslundur Wind Farm. Such selection allows identification of potential differences in the perceived impact area of existing and proposed REI on tourism. Three types of proposed REI were included in this study: hydro-, geothermal and wind power. However, since currently only two experimental wind turbines are operated in Iceland, existing energy infrastructure includes two types of REI: hydro- and geothermal power.

Methods

Due to the exploratory nature of this study, qualitative research methods were employed, and 49 semi-structured interviews were conducted with tourism service providers operating and knowledgeable about tourism in at least one of the study areas. During the interviews participatory mapping software *Maptionnaire* was used, which allowed participants to draw their estimated impact areas.

Main results

Not all participants were willing to estimate the impact area of REI on tourism. Out of 49 interviewed participants, 32 drew their perceived impact areas and discussed the reasoning behind them. Notably, differences in the character of the perceived impacts were revealed: while some participants perceived the impacts of REI on tourism as negative, others perceived them as positive, mixed or neutral. Tourism service providers were more negative toward proposed REI compared to existing power plants. Besides concerns about potential impacts of such infrastructure on tourism, they questioned the need for and purpose of the new REI. Thus, a higher number of estimated impact areas of proposed REI

were negative, while impact areas of existing REI were perceived mostly as positive or mixed/neutral. As revealed by this study, the reasoning used by the tourism service providers which affects the shape and size of perceived impact areas falls into three categories: visibility of REI and of related environmental impacts; tourist mobility; and changes in tourism due to REI.

A total of 105 impact areas were estimated by the participants, 51 of which were perceived as negative. Around half of them, or 26, were estimated based on visibility of REI and related environmental impacts. Such impact areas were relatively small. Their size and shape depended, among other factors, on the type and design of the power plant, and the topography of the surrounding landscape, since these factors affected how far REI can be seen. A somewhat lower proportion, or 22 negative impact areas, were based on tourist mobility. Participants who mapped these impact areas emphasized that REI is likely to be perceived by visitors as not suitable in natural landscapes and lead to negative impacts on their experience, which are likely to last for an entire day or entire trip. Thus, REI can affect how visitors experience and perceive tourist destinations reached by traveling past REI. Such destinations were included by the participants in the estimated impact areas, as well as roads and hiking routes passing by REI. Three negative impact areas were estimated based on changes in tourism brought by REI. Participants stressed that construction of REI is likely to destroy or degrade tourist attractions and diminish attractiveness of surrounding areas, which might result in avoidance of these areas by tourists. Tourists traveling in the region would have fewer attractions to visit and spend less time in the area, which consequently would lead to reduced demand for tourism services and economic losses. Negative impact areas based on changes in tourism often included areas where tourism services are provided.

Out of 23 estimated positive impact areas, 17 were based on changes in tourism brought by REI. They included changes due to improved access resulting from road construction related to REI development, such as opening up new areas and increased use of natural areas for tourism, inclusion of Central Highland destinations in larger itineraries, and opportunities for winter tourism. Some impact areas were estimated based on changes in tourism due to REI becoming a tourist attraction, creating new tourist attractions, such as fishing opportunities, or due to their economic benefits which made some areas more competitive tourism destinations. Six positive impact areas were estimated based on visibility of REI. Participants stated that hydropower plant reservoirs look natural and add diversity to monotonous landscapes. They further noted that REI provides tourist guides opportunities to discuss renewable energy harnessing in Iceland with their customers.

A total of 31 mixed/neutral impact areas of REI on tourism were estimated. While some participants in the mixed impact areas included both positive and negative impacts of REI on tourism, others included impacts which can be perceived both positively and negatively. For example, improved access allows tourists to reach nature destinations safer and faster, but also leads to increased crowding and environmental pressure and consequently degraded visitor experience and image of the area. Eight mixed impact areas were based on visibility of REI, two on tourist mobility and 14 on changes in tourism that REI brings to the area. Some participants stated that the character of the impacts of REI on tourism depends also on the information visitors receive about REI: presented by the guides in a positive light as a contributor to sustainable development, REI can be perceived positively. Other factors affecting the character of perceived impacts mentioned by the participants included visitor preferences, expectations, familiarity with and interest in REI. All seven

neutral impact areas were estimated for existing REI. The arguments in these cases included well-designed hydropower plants that fit into the surrounding landscapes, and the natural appearance of their reservoirs. These impact areas were based on visibility. One neutral impact area was based on changes in tourism due to a geothermal power plant becoming one more stop on the way for tourists, but not a tourism destination.

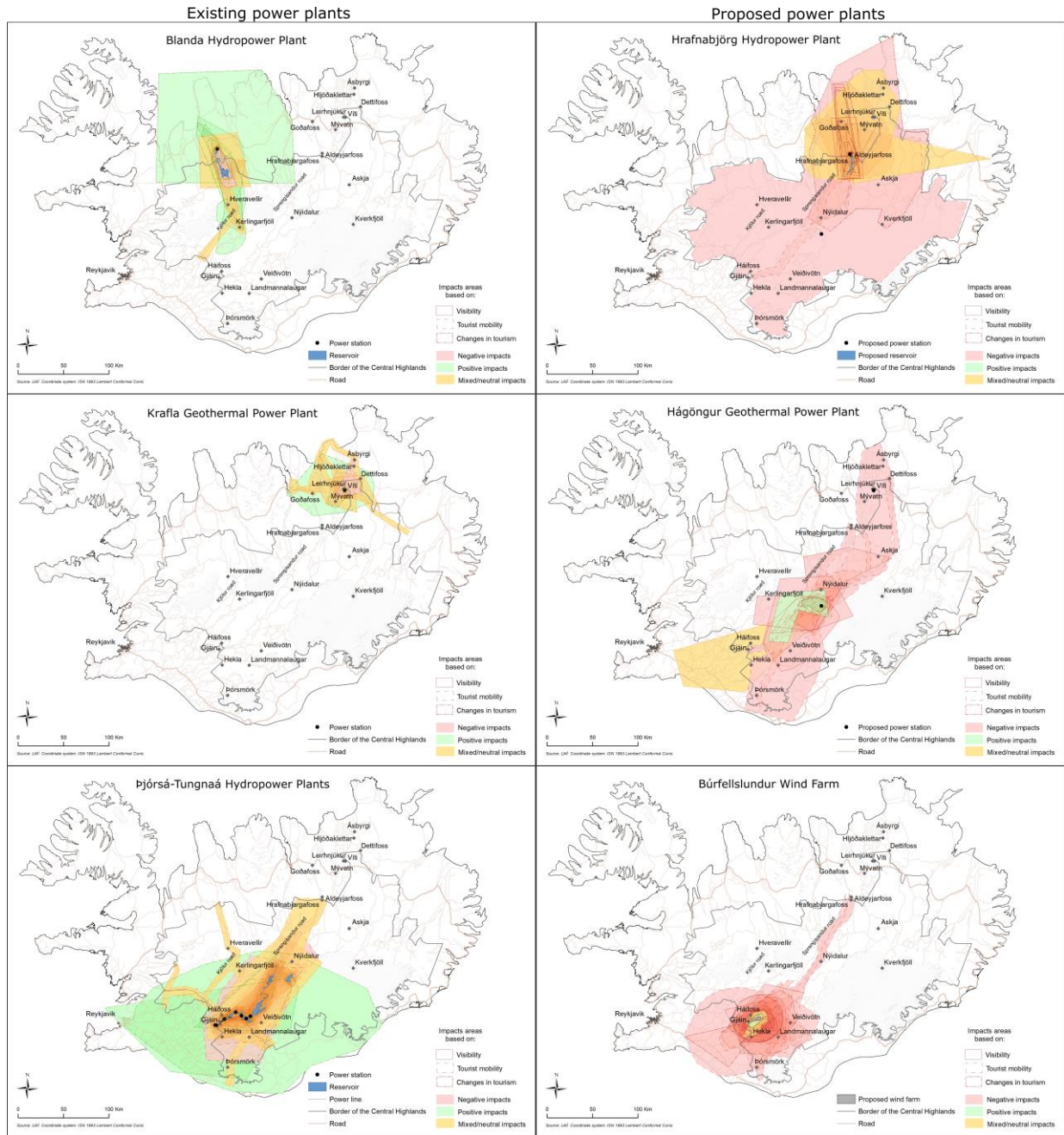


Figure 4. Perceived impact areas of all six energy projects. (Figure corresponds to Figure 5 in Paper IV).

As revealed by this study, the estimated negative, positive, mixed, and neutral impact areas are largely overlapping (Figure 4). This indicates that the perceived impacts of REI on tourism and their spatial extent are highly subjective and depend on tourism service providers' perceptions of place and its boundaries. The character, size and shape of the

impact areas of REI on tourism depend on various factors, which, similarly to the analysis in Paper I, can be categorized into three groups: (1) factors related to the landscape of the areas surrounding REI, such as topography, diversity, and uniqueness, which not only affect how far REI can be seen, but also how valuable and interesting these areas are for tourism; (2) factors related to REI, such as type, design, spatial distribution, and image; and (3) factors related to the tourism stakeholders, including tourist preferences and expectations, undertaken activities, type of tourism business, and meanings assigned by them to places surrounding REI.

The impact areas estimated in this study point to the importance of viewing natural areas used for tourism as elements of larger tourism networks when selecting locations most suitable for REI developments. Physical changes due to construction of REI in one area are likely to affect other tourist destinations connected via tourism relationships. The study further stresses the importance of tourism stakeholder inclusion into early stages of REI planning to ensure consideration of place values and meanings, which is critical for minimizing the impacts of REI on tourism.

4.5 Paper V

Tverijonaitė, E., Sæþórsdóttir, A. D., Ólafsdóttir, R., & Hall, C. M. (forthcoming). Wilderness: a resource or a sanctuary? Tourism service providers' views on development of the Icelandic Central Highlands. (*Accepted with revisions in Scandinavian Journal of Hospitality and Tourism*).

Papers I-IV revealed low compatibility of REI and NBT and pointed to the importance of preserving wilderness areas for ensuring high quality visitor experience. Since the most extensive wilderness areas in Iceland are located in the Central Highlands, the motivation for Paper V was to provide a better overview of the tourism service providers' preferences regarding management and development of the Central Highlands and to investigate how these preferences align with their environmental attitudes.

Objective and research questions

This paper aims to improve the understanding of tourism service providers' perceptions of wilderness and of its value for tourism, and to investigate how their environmental attitudes contribute to shaping tourism service providers' wilderness development preferences.

To achieve this objective, the following research questions were put forward: (1) How important are the Icelandic Central Highlands and the wilderness areas they contain for the tourism industry? (2) What future management and development of the Central Highlands is preferred by tourism service providers? (3) How do the preferences of tourism service providers regarding future management and development of the Central Highlands relate to their environmental attitudes? (4) What are existing and potential conflicts between nature protection, renewable energy harnessing, and tourism development in the Central Highlands? and (5) How can these conflicts be transformed into more collaborative relationships?

Study area

As the study area the Icelandic Central Highlands were selected, often placed among the largest European wilderness areas.

Methods

Quantitative research methods were used in this study and an online questionnaire survey was conducted among travel agencies and day tour providers licensed by the Icelandic Tourist Board. An email with the link to the survey was sent to 984 companies. A total of 32 companies were excluded while calculating the response rate, as they informed the research team that they stopped operating their business or a notification was received that the email was not delivered to their email address. The responses were received from 382 companies constituting 40.13% response rate.

Main results

The majority of surveyed tourism service providers perceived the Central Highlands and their wilderness areas as important for the tourism industry and thought that the value of the area will keep increasing in the next decade. When asked about the preferred amount of tourism infrastructure in the Central Highlands, a high proportion of participants expressed the need for basic infrastructure, such as toilets (83.4%), marked hiking trails (78.6%), and mountain huts (63.2%). Perceived need for hotels (22.8%) and food services (35.9%) was much lower and negatively related to environmental attitudes of participants, which were assessed by employing the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). Most participants preferred the roads of the Central Highlands to be better maintained or kept in their current state, while perceived need for building up, paving the roads, or bridging the rivers was much lower. Notably, a significantly higher proportion of tourism service providers currently not using the Central Highlands preferred the Highland roads to be improved compared to users. Keeping the roads difficult to drive was mentioned among the ways to limit tourist numbers in the Central Highlands. Limiting tourist numbers was perceived as somewhat important by 29.4% of participants, as important by 15.2% and as very important by 13.8%, and positively related to environmental attitudes of participants.

The effects of existing REI within or just outside of the Central Highlands on the tourism industry were perceived by around half of the participants as both positive and negative, while 18.6% perceived them as positive, 13.8% as negative, and 16.2% stated that REI had no effects on the tourism industry. However, attitudes of most participants toward future REI developments in the Central Highlands were negative and negatively related to their environmental attitudes. Attitudes toward future REI developments in the lowlands were significantly less negative than in the Highlands.

Attitudes toward the proposal of the Central Highlands National Park, which would cover most of the Central Highlands, were divergent, with 39.6% supporting the proposal and 44% being against it. Attitudes of users of the Central Highlands toward the proposal were significantly more negative compared to non-users. Environmental attitudes positively affected participants' attitudes toward the Central Highlands National Park proposal. Almost 80% of participants stated that if established, the national park should be managed by a body of various stakeholder representatives, such as the state, local municipalities, tourism, environmental NGOs, farmers, and recreational organizations. The most frequently mentioned issues that should be taken into consideration while establishing the national park included ensuring access to the area, nature protection, provision of

infrastructure and services for visitors, stakeholder opinions' inclusion in decision-making, and ensuring opportunities for a range of tourism activities.

The preferences of tourism service providers for simple tourism infrastructure and their willingness to protect the area from REI and road developments seem to be in line with sustainable wilderness management. This is supported by the analysis of environmental attitudes, which revealed that the attitudes of over 87% of participants were pro-environmental. However, the concerns of tourism service providers regarding access to the Central Highlands seem to hinder their support for nature protection in the area, as indicated by relatively low support for the Central Highlands National Park proposal. This points to the importance of tourism stakeholder inclusion into the management of wilderness areas, which not only allows identification of potential conflict areas and facilitates finding solutions addressing them but is also likely to increase the support of tourism stakeholders for management decisions.

5 Discussion

5.1 Insights from individual papers

This section discusses the findings of the five studies presented in papers constituting this thesis according to the following themes, which are based on the research questions posed in subchapter 1.2:

- Interrelationships between REI and tourism and the factors affecting them
- Compatibility of REI and NBT as perceived by tourists and tourism service providers and the factors affecting it
- Impact area of REI on NBT as perceived by tourism service providers and the factors affecting its size and shape
- Tourism service providers' preferences for future management and development of the Icelandic Central Highlands

5.1.1 Interrelationships between REI and tourism

Both energy and tourism sectors have an important role to play in contributing to climate change mitigation and in achieving the sustainable development goals set in the United Nations 2030 Agenda for Sustainable Development (UN General Assembly, 2015). REI is essential for ensuring access to affordable, reliable, sustainable and modern energy for all (SDG 7) (Fuso Nerini et al., 2018; United Nations, n.d.), while sustainable tourism can contribute to most SDGs, especially to SDG 8, focusing on decent work and economic growth, SDG 12 on responsible consumption and production, and SDG 14 on life below water (UNWTO & UNDP, 2017). Both sectors are expected to take urgent action to combat climate change and its impacts (SDG 13). Saarinen (2020), however, stresses that tourism growth based on neoliberal thinking is conflicting with some of the SDGs, such as SDG 13. Therefore, achieving these goals might require regulatory measures for tourism, since the sector “often seems to be primarily focused on sustaining the tourism economy and its rights to utilize natural and cultural resources in destination regions” (Saarinen, 2020, p. 4). Tourism is very vulnerable to climatic change and extreme weather events but is also a significant emitter of greenhouse gases (GHGs) causing global warming (Lenzen et al., 2018; UNWTO, n.d.; UNWTO & UNEP, 2008) The tourism sector is recovering rapidly after the COVID-19 pandemic, and global human mobility keeps increasing, contributing to CO₂ emissions and accelerating climate change (UNWTO, 2022a, 2022b). According to the UNWTO and ITF (2019) report, international tourist arrivals are expected to grow from 1.2 billion in 2016 to 1.8 billion in 2030, while domestic tourist arrivals are forecasted to rise from 8 billion in 2016 to 15.6 billion in 2030. Consequently, transport-related CO₂ emissions from tourism are projected to increase by around 25% between 2016 and 2030 against current ambition scenario (UNWTO & ITF, 2019).

Considering such trends, UNWTO and ITF (2019, p. 49) emphasize that the tourism and transport sectors have to work closely on decarbonization and furthermore stress that the tourism sector “must determine its own additional high ambition scenario beyond

transport; a scenario where tourism would transform and advance towards significantly decoupling growth from emissions in order to grow within the agreed targets.” To ensure that the tourism sector is in line with international climate goals, UNWTO (2021), in agreement with One Planet Sustainable Tourism Programme (2020), recommends for the tourism sector to take measures related to climate action which include monitoring and reporting CO₂ emissions from tourism operations, speeding up the decarbonization of tourism operations, and engaging the tourism sector in carbon removal. In order to reduce its CO₂ emissions of transport-related activities as well as emissions related to accommodation, food and tourism activities at a destination, tourism relies on REI, thereby contributing to the demand for its development (Beer et al., 2018; Callejas-Jiménez et al., 2021; Navratil et al., 2019). For effective mitigation of climate change more investment in REI developments is needed (IEA, 2021). With the growing tourism sector and new REI developments to meet climate goals, encounters between REI and tourism are increasingly likely.

Academic literature reviewed for Paper I of this thesis revealed that in some cases the encounters between REI and tourism can be beneficial to both sectors and lead to successful coexistence. For example, REI can become a tourist attraction in its own right, visits to which are likely to positively affect peoples’ attitudes toward REI (Beer et al., 2018; Frantál & Urbánková, 2017; Pavlakovič et al., 2021). Furthermore, developments related to REI construction, such as road improvements, can facilitate tourism by opening new areas for tourism activities (Rodriguez, 2012; Sæþórsdóttir & Hall, 2018; Smythe et al., 2020; Smythe et al., 2021).

This, however, is not always the case. More often REI tends to negatively impact tourism by transforming surrounding landscapes, changing the image of tourism destinations, degrading the quality of tourist experience, and consequently leading to decreased tourism demand and economic losses (Broekel & Alfken, 2015; Parsons et al., 2020; Sæþórsdóttir, Ólafsdóttir, et al., 2018; Voltaire & Koutchade, 2020). It is especially likely in places where meanings brought by REI are perceived by tourism stakeholders as incompatible with meanings ascribed by them to places surrounding REI and with tourist expectations. Such places often contain natural or cultural heritage, a high degree of naturalness, or other characteristics which are of high value for tourism and would be degraded by REI (de Sousa & Kastenholz, 2015; Michel et al., 2015; Sæþórsdóttir & Hall, 2019). Thus, presence of tourist attractions and high reliance of regional characteristics in tourism make REI developments more challenging due to the need to preserve the resources important for the tourism industry (Rizzo, 2017). Furthermore, in regions that rely highly on tourism, the economic impacts of REI in terms of gross value added tend to be lower (Schallenberg-Rodriguez & Inchausti-Sintes, 2021).

As revealed by the literature review presented in Paper I, the interrelationships between REI and tourism are complex and reciprocal and depend on numerous factors. In Paper I, a range of factors affecting these interrelationships were identified, which fall into three categories: (1) factors related to REI, (2) locational factors, and (3) factors related to tourism stakeholders (Figure 5). All identified factors have been shown to be highly context-specific. They should be taken into consideration while planning REI developments, but how they will affect tourism will depend on the context surrounding each REI project. Furthermore, as revealed by the findings of Paper I, the interrelationships between REI and tourism highly depend on subjective perceptions of tourism stakeholders, which affect their intentions and actions and consequently can shape how REI and tourism

will affect each other; therefore, they should be taken into consideration when aiming to predict potential impacts of REI on tourism.

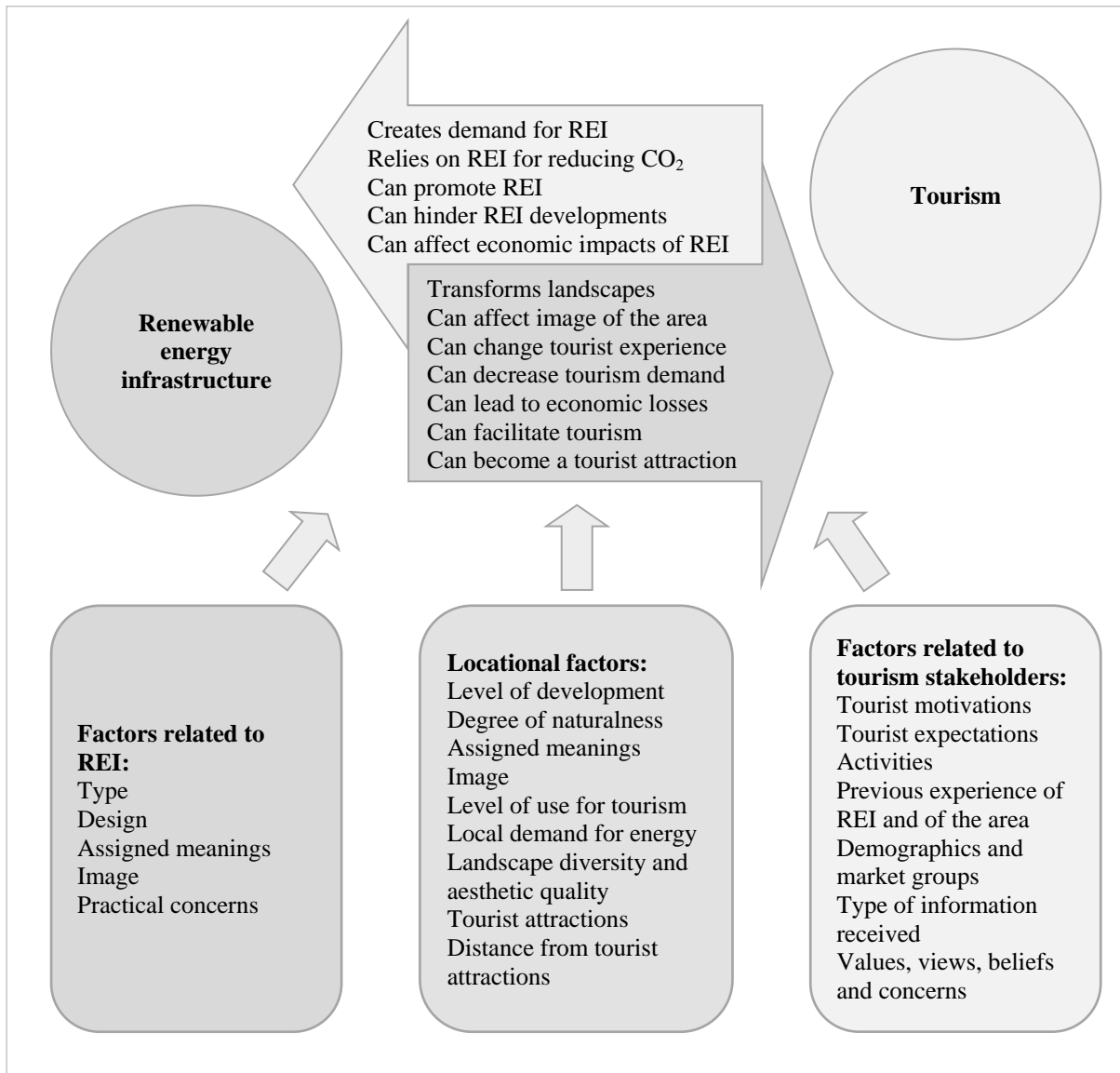


Figure 5. Interrelationships between REI and tourism and the factors affecting them. (Figure corresponds to Figure 5 in Paper I).

5.1.2 Compatibility of REI and NBT

Paper II investigated the compatibility of REI and NBT by examining the place meanings assigned by visitors to a highly natural area surrounding the Hverfisfljót river in the southern Central Highlands, together with their attitudes toward a proposed hydropower plant in that area. As revealed by the study, the expectations of these visitors related to experiencing wilderness. They sought unspoiled beautiful nature, escapism, solitude or companionship, challenge, and spiritual experience – the qualities identified as components of wilderness experience by Sæþórsdóttir (2010b). High visitor satisfaction with their stay and with the nature of the area suggests that their expectations were met. The study emphasizes that wilderness areas provide opportunities for unique and extraordinary

experiences and for connection to nature. With increasing urbanization and a reduction in people's interactions with nature in their everyday lives, which is also referred to as 'extinction of experience' (Gaston & Soga, 2020; Pyle, 1993), experiences in wilderness areas are becoming increasingly valuable. As stressed by various researchers (Frumkin et al., 2017; Olafsdottir et al., 2018; Soga & Gaston, 2016), direct engagement with nature is essential for human health and wellbeing and positively contributes to general environmental awareness. This emphasizes the importance of preserving wilderness areas and thereby the experiences they provide.

In line with previous research (Sæþórsdóttir, 2014; Sæþórsdóttir & Hall, 2018), REI were shown to be incompatible with the experiences visitors are seeking in wilderness areas. As revealed by this study, the proposed REI does not match the current character of the area, which provides recreational opportunities for visitors who wish to enjoy nature in its purest form. Construction of the proposed hydropower plant would transform the surrounding landscape and disrupt the place meanings that visitors currently assign to the area. Therefore, the power plant proposal received little support among visitors. These findings support the emphasis in Stedman's research (2003) concerning the importance of the physical environment in shaping place meanings and consequently the sense of place. While for some visitors the changes in place meanings caused by REI would lead to a degraded experience, for others it could result in displacement. Thus, REI infrastructure developments in relatively undeveloped and scenic natural areas used for tourism lead to a reduction in recreational opportunities for the most purist visitors seeking wilderness experience and an absence of human disturbances. Furthermore, some visitors stressed that with wilderness areas becoming scarcer globally, it is very important to preserve such areas, not only for the recreational opportunities they provide, but also for their intrinsic value.

Participants in the study, however, perceived REI developments to be more suitable in already developed and more environmentally degraded areas. Such findings are in line with previous research conducted in Iceland (Ólafsdóttir & Sæþórsdóttir, 2019; Sæþórsdóttir & Hall, 2019) and also with smart practices of REI development (Apostol et al., 2017; Frantál et al., 2018a, 2018b). However, when considering the construction of REI in more developed areas, it is important to take into consideration how such developments will affect other land uses and place values.

The results of Paper II thus emphasize the importance of locational factors for ensuring the compatibility of REI and NBT. While in some locations proposed REI is perceived as unsuitable, in others it can be seen as less impactful upon tourism. These locational factors were investigated in more detail in Paper III, which focused on the attitudes of tourism service providers toward wind farms proposed in five locations. The interviews with tourism service providers revealed five factors that should be considered with regards to tourism when evaluating the suitability of a location for an intended wind farm. Wind farms were perceived as less suitable in natural areas where they would be highly visible, where the number of tourists visiting or driving through is high, where tourist attractions are present, where the degree of naturalness is high, and where there is no perceived local need for more energy.

Notably, Paper IV revealed that tourism service providers were more negative toward proposed REI compared to existing one. While participants stated that they adapted their businesses to existing REI, in addition to discussing the potential impacts of the proposed REI they also questioned the need for it and its purpose. Tourism stakeholder attitudes

toward proposed REI that were more negative when compared to those concerning existing constructions were also revealed by previous research (Brudermann et al., 2019; Sæþórsdóttir & Hall, 2018; Sæþórsdóttir, Ólafsdóttir, et al., 2018). Brudermann et al. (2019), suggested that this tendency could be due to *status quo bias* (Samuelson & Zeckhauser, 1988), or a preference in favor of the present situation rather than change. Samuelson and Zeckhauser (1988) related such preference to the *loss aversion bias*, meaning people's preference for avoiding possible loss over new gains. Thus, the adaptation of the tourism industry to changes caused by REI to natural areas is likely to require time and resources. Furthermore, as stressed by Ingólfssdóttir and Gunnarsdóttir (2020), while tourism service providers generally tend to adapt their businesses to REI, such infrastructure developments are likely to result in lost opportunities for the 'transformative connection to nature' enabled by visits to natural and wilderness areas.

The findings of this thesis demonstrate a generally low compatibility between REI and NBT. High quality natural resources, which, among others, include the landscape and environmental quality of tourism destinations (Liberato et al., 2020; Priskin, 2001), are essential for NBT. Changes in the characteristics of these resources are likely to highly impact tourism operations and the NBT product (Fossgard & Fredman, 2019). However, the results of this research also show that the disruption in NBT caused by REI varies between natural areas. The impacts of REI on NBT are likely to be most severe in highly natural and wilderness areas containing scenic landscapes, tourist attractions and other resources valuable for NBT, since such infrastructure does not match the expectations of visitors to such areas, nor the place meanings ascribed to them by tourism stakeholders.

5.1.3 Impact area of REI on NBT

Knowledge on how far the impact area of REI on tourism reaches is essential for REI planning and for selection of the most suitable locations for REI developments. However, this topic is largely understudied. While the degree of visual impacts of REI plays an important role in shaping tourism stakeholder attitudes toward REI and consequently its impacts on tourism (Ólafsdóttir & Sæþórsdóttir, 2019; Voltaire & Koutchade, 2020), various research (Broekel & Alfken, 2015; Sæþórsdóttir & Ólafsson, 2010a, 2010b) suggests that the impacts of REI on tourism stretch far beyond visual impacts of REI. The study conducted for Paper IV contributed to existing knowledge by investigating how tourism service providers operating in Iceland perceive the impact area of REI on NBT. Interviews with tourism service providers revealed that participants perceived the character of the impacts of REI on NBT differently. While some thought the impacts to be positive, others described them as negative, mixed or neutral. Consequently, they mapped the impact areas of REI on NBT of different character, which were mostly overlapping. A high number of overlapping estimated impact areas of the same character (for example, negative) indicates the areas where the impacts of REI on NBT are likely to be the greatest (Figure 4). On the other hand, overlapping impact areas of different character (for example, positive and negative) point to the subjectivity of tourism service providers' perceptions related to the impacts of REI on NBT and their spatial extent.

As revealed by the findings of Paper IV, the perceived spatial extent of the impacts of REI on NBT depends on numerous factors, which can be related to the surrounding landscape, REI, and tourism stakeholders (Figure 6). Various landscape characteristics as well as characteristics of REI affect the severity and spatial extent of environmental, visual, and aural impacts of REI. These impacts together with tourism stakeholder expectations,

preferences, undertaken activities, and place meanings contribute to shaping the impacts of REI on the image and perception of the area, on visitor experience and on the tourism processes that take place in the areas and surrounding regions.

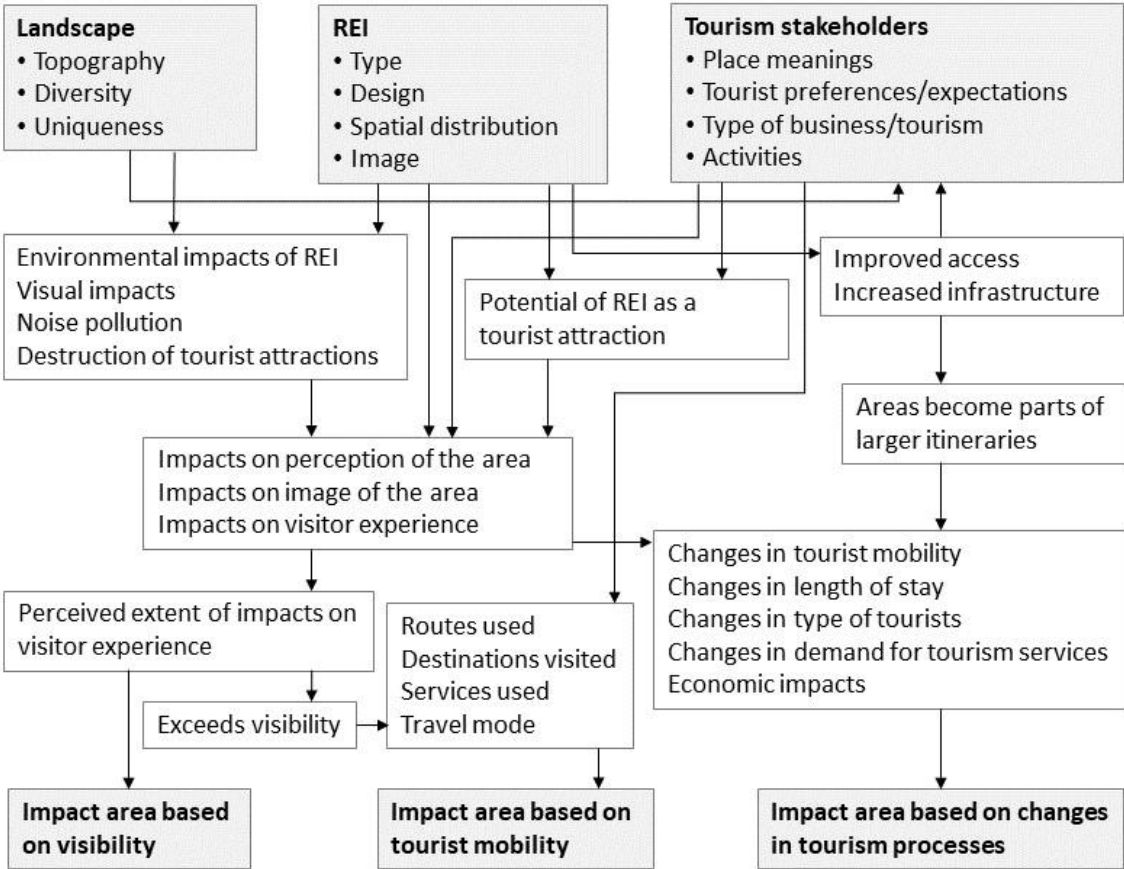


Figure 6. Factors affecting the spatial extent of the impacts of REI on tourism as perceived by tourism service providers. (Figure corresponds to Figure 6 in Paper IV).

The impact areas of REI on NBT estimated by tourism service providers varied largely in shape and size depending on participants’ subjective perceptions of place and its boundaries, on meanings ascribed to places by them and their customers, and on the reasoning used while estimating the impact areas. Based on the reasoning used, the estimated impact areas were grouped into three categories. To the first category belong the impact areas estimated by participants who thought the impacts of REI on tourism end with the visibility of REI and of related environmental impacts. The second category of impact areas exceeded visibility of REI and was estimated by taking into consideration tourist mobility. Participants who estimated these impact areas included routes used by tourists and destinations reached by traveling past REI, where visitor experience and image of the area would be affected due to a previous encounter with REI. These impact areas were estimated by taking into consideration the interrelationships of the area surrounding REI with other places connected through tourism processes. Similarly, the impact areas falling into the third category included areas where tourism processes are likely to change due to construction of REI. Such impact areas included, for example, areas opened up for tourism and areas where visitation increased due to improved access, but also areas where tourism

demand would decrease leading to economic losses due to degraded attractiveness of the area by construction of REI.

The findings of Paper IV emphasize that changes brought by REI affect not only tourism in the immediate vicinity, but also in much wider regions, in tourism destinations connected to the area surrounding REI via tourism relationships. These findings are supported by previous research (Broekel & Alfken, 2015; Parsons et al., 2020; Voltaire & Koutchade, 2020) showing changes in tourism demand in areas and regions neighboring the area where REI has been constructed. They stress the importance of taking into consideration tourism processes and relationships, which are likely to stretch over the boundaries of administrative units, and of involving multiple municipalities when planning REI developments.

5.1.4 Tourism service providers' preferences for future management and development of the Icelandic Central Highlands

The rapid tourism growth in Iceland over the last decade and the increasing importance of the tourism industry for regional development strengthened its position as an important stakeholder in the discussion on the use of land and management of natural resources in the country (Sæþórsdóttir & Hall, 2019). Paper V focused on the perceptions and preferences of tourism service providers regarding future management and development of the Icelandic Central Highlands. As noted by Fossgard and Fredman (2019, p. 8), “[a]lthough experiences are constructs in the minds of the guests, NBT providers are instrumental in facilitating extraordinary experiences.” When creating tourism products, tourism service providers rely on natural resources and their certain characteristics. If they perceive that these characteristics have been degraded by, for example, REI developments in a natural area, they are likely to change their business decisions accordingly, which will directly affect tourism development in the area. This highlights the importance of a deeper understanding of tourism service provider perceptions. Due to the high sensitivity of wilderness areas to human activities, including tourism, knowledge on the sustainability of the preferences of tourism service providers regarding the use of wilderness areas is also highly important. As revealed by the findings of Paper V, most participants perceive the Icelandic Central Highlands and their wilderness areas as important for the tourism industry. Accordingly, the majority prefer to protect the area from large infrastructure developments and see the need only for basic tourism infrastructure in the area.

In line with previous studies focusing on tourists (Sæþórsdóttir, 2010b; Sæþórsdóttir & Hall, 2018) and tourism service providers (Sæþórsdóttir & Hall, 2019), most participants of the study viewed further REI developments in the Icelandic Central Highlands as negative, and significantly more negative compared to REI developments in the more developed lowlands of the country. An observed negative relationship between participants' environmental attitudes and acceptance for REI contradicts the findings of previous studies (Ntanos et al., 2017; Ntanos et al., 2019) and suggests that the perceived negative impacts of REI in the Icelandic Central Highlands on the environment and wilderness value overshadow positive contributions of REI to climate change mitigation. Most tourism service providers preferred roads to be better maintained or kept in the current state, and around two thirds perceived limiting tourist numbers as at least somewhat important. This perceived importance was positively related to the

environmental attitudes of tourism service providers, which suggests that perceived importance of limiting tourist numbers is related to willingness to protect the area not only from the crowding, which is likely to degrade tourist experience, but also from the environmental impacts of tourism.

With the majority of visitors coming to Iceland for its nature (Icelandic Tourist Board, 2020), tourism is viewed by some as a more sustainable alternative to REI developments in wilderness areas, providing justification for preserving wilderness areas as a valuable resource for the tourism industry. As revealed by this study, tourism service providers' preferences for infrastructure developments seem to be in line with sustainable development of the area. This is supported by the mostly pro-environmental attitudes of participants.

The use of wilderness areas for tourism, however, is not unproblematic and has its own implications. As revealed by Paper V, tourism service providers' attitudes toward the proposed Central Highlands National Park were strongly divergent despite their positive relationship with environmental attitudes of participants. Among the most frequently mentioned concerns related to establishing the national park were possible access limitations for the tourism industry. Such findings suggest that concerns related to retaining access to the Central Highlands might impair tourism service providers' support for nature conservation in the area. This points to the tourism 'resource paradox': tourism relies on natural environments and at the same time exploits and degrades them (Williams & Ponsford, 2009). As emphasized by Higham (1998), wilderness areas are among the most sensitive tourism resources. Thus, ensuring access to wilderness for the tourism industry might threaten the resources tourism relies on. Unconstrained tourism growth in wilderness areas generally leads to negative environmental impacts, which, together with higher crowding are likely to degrade wilderness experience for more purist visitors and result in their displacement (Cole & Hall, 2008; Sæþórsdóttir & Hall, 2021; Tverijonaite et al., 2018). The growing attractiveness of wilderness and remoteness results in higher numbers of tourists with relatively little experience in such areas, which causes safety concerns (Mykletun et al., 2021). To address these issues more tourism infrastructure is needed, which on one hand benefits visitor safety and environmental protection but on the other hand transforms the natural environment and changes the visitor experience (Ólafsdóttir & Haraldsson, 2019). Thus, increasing tourism activities in wilderness areas pose a threat not only to the natural environment of these areas but also to tourism itself and the values wilderness contains for the tourism industry and for other stakeholders (Saarinen, 2021).

As stressed by Williams and Ponsford (2009), tourism activities resulting in various impacts often take place in ecologically fragile environments, where the activities of other industries are not permitted. Therefore, to facilitate symbiotic relationships between tourism and wilderness preservation, careful NBT planning is essential (Saarinen, 2021; Sæþórsdóttir, 2013). Such planning should include stakeholders and address their concerns to ensure their higher perceived environmental justice and support for nature conservation (Bishop et al., 2022; Dahlberg et al., 2010; Strzelecka et al., 2021). Furthermore, besides the utilitarian values, the protection of nature and wilderness for its intrinsic value is not less important and should be taken into consideration when planning tourism development in natural and wilderness areas (Tallis & Lubchenco, 2014).

5.2 Scientific contributions

The research conducted for this thesis has made several contributions to academic knowledge. The literature review focusing on the interrelationships between REI and tourism provided a needed overview of the existing knowledge and insights into the factors affecting these interrelationships. Furthermore, it identified various research gaps, some of which were addressed in later papers constituting this thesis, while others are to be addressed by future research.

The concept of place has been employed previously for researching people's connections to natural resources. Cheng et al. (2003, p. 95) stated: "it is clear that place is a powerful, integrating social science concept that offers unique perspectives on how social science research in general can continue exploring the connections between people, natural resources, and the environment as a whole." Several studies (Frantál et al., 2017; Mordue et al., 2020; Sæþórsdóttir & Hall, 2018; Sæþórsdóttir & Ólafsdóttir, 2020) have used place-based approaches to research the tourism - renewable energy nexus. In this thesis the suitability of the concept of place for research aiming to improve the understanding of complex relationships between tourism and REI was reemphasized. The thesis contributed to the theory of place by deconstructing and mapping the meanings ascribed to natural places by tourism stakeholders to identify the root causes of place-related conflicts between NBT and REI stemming from landscape changes from REI developments.

Moreover, this thesis expanded the use of various approaches to place by employing them to study the perceived spatial extent of the impacts of REI on NBT. Like the perceptions of REI and of places where they are (to be) constructed, perceived spatial extent of the impacts of REI on NBT seems to be highly subjective and depends on the people's perceptions of place, its boundaries, and its relationships with other places. Previous studies (Brown & Raymond, 2014; Brown et al., 2020; Moore et al., 2017) have shown that PGIS is useful for mapping place meanings and for identification of potential conflict areas. Therefore, as stressed by Brown and Kyttä (2018), its use in natural resource planning should keep increasing. The use of qualitative PGIS approaches for investigating potential land use conflicts and human-place relationships, however, is still relatively new and rare (Strzelecka et al., 2017). This research methodologically contributed to the existing knowledge by showing that employing PGIS during in-depth interviews is useful for gaining better understanding of the tourism stakeholder perceptions related to spatial extent of the impacts of REI on tourism.

In this thesis the preferences of tourism service providers were studied in relation to their environmental attitudes, which provided deeper insights into the sustainability of tourism service providers' preferences. Employing the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000) facilitated a better understanding of tourism service providers' preferences and possible reasons for them. For example, the negative relationship between attitudes toward REI in the Central Highlands and environmental attitudes revealed that such infrastructure is perceived as negatively impacting the surrounding environment rather than as a contributor to mitigating climate change. Such findings point to the usefulness of employing the NEP scale for investigating the interrelationships between tourism and REI, but also in other contexts.

5.3 Practical implications

The findings of this thesis have various practical implications for REI planning. As revealed by this research, the impacts of REI on NBT highly depend upon the complex context surrounding each renewable energy project (Navratil et al., 2019; Segreto et al., 2020; Smythe et al., 2020). The interplay between various contextual factors shapes human connections with the surrounding environment and natural resources, guiding their perceptions, attitudes, and consequent behaviors. As emphasized by Cheng et al. (2003, p. 99), “social and political behaviors and place meanings are not discernable by looking solely at biophysical attributes or individual inhabitants of the place; they emerge as [a] result of the interaction between biophysical attributes and social and political processes.” The findings of this thesis suggest that contextual factors related to the location, REI and the tourism stakeholders of each specific case should be assessed when planning REI developments in natural areas, since these are likely to shape the impacts of REI on NBT.

This research showed that a higher degree of naturalness of the area where REI development is considered is likely to lead to a higher perceived incompatibility of such infrastructure with place meanings assigned to the area by tourism stakeholders and with visitor expectations. Wilderness areas and the values they contain for NBT are especially sensitive to human disturbances. Therefore, as also stressed by previous research (Øian, 2013; Saarinen, 1998, 2019), consideration of contextual factors and discourses is of high importance when taking decisions related to wilderness management. However, natural and wilderness areas often become a meeting point of various interests and land uses which are often competing (Saarinen, 2005). They contain different meanings and values for different stakeholders, which continue to evolve and change over time (Hall, 2002; Saarinen, 2019). This complicates decision-making related to the management of such areas and the natural resources they contain. As emphasized by Williams (2002, p. 124), what makes resource management in wilderness areas difficult is that “the more tangible meanings and values have been easier to represent in resource assessments and inventories, and in the process the more subjective, diverse, and contentious cultural and symbolic meanings have been ignored.” In line with the findings of previous studies (e.g., Fossgard & Fredman, 2019), tourism stakeholders that took part in this research emphasized the importance of intangible values, such as appreciation of a scenic landscape, wilderness experience and unique extraordinary experiences, as essential for high quality NBT. Thus, as shown by this research, REI is likely to negatively impact both the tangible and intangible values and meanings that natural and wilderness areas contain for NBT, which needs to be taken into consideration when planning REI developments.

Tourism is a rapidly changing industry, especially in countries such as Iceland, which experienced unprecedented tourism growth before the COVID-19 pandemic (Icelandic Tourist Board, 2022a). Thus, the industry is likely to adapt to increasing REI developments. Adaptation strategies used by tourism service providers, revealed by this research, among others, included presenting REI developments encountered on the route as sources of green sustainable energy, as well as relocating the tour routes to avoid such infrastructure. However, REI developments in natural and wilderness areas which are of high value for NBT, are likely to result in the loss of important values and opportunities for unique, extraordinary and transformative experiences that only wilderness areas can provide (Ingólfssdóttir & Gunnarsdóttir, 2020). These values and opportunities should be considered when selecting locations for REI.

To facilitate identification and preservation of the values that wilderness areas contain for NBT and to minimize the likelihood of potential conflicts between REI and NBT, taking into consideration the perceptions and preferences of tourism stakeholders is critical. Knowledge of tourism stakeholder perceptions and preferences not only allows identification of the most valuable place characteristics for the tourism industry, but it also facilitates prediction of the potential impacts of planned REI on tourism. This is supported by previous research demonstrating that if tourists perceive REI as not suitable in a natural area, they might avoid this area, which will result in changes in tourism demand with related implications (Parsons et al., 2020; Voltaire & Koutchade, 2020). Similarly, tourism service providers' perceptions of REI are likely to affect their business investment decisions (Mordue et al., 2020). Thus, knowledge of tourism stakeholders' perceptions and preferences helps to identify and address potential conflicts and facilitate REI planning. Furthermore, tourism service providers are generally very knowledgeable about the natural areas they are using for their business. Such knowledge should be used in REI planning to ensure that valuable ecosystems and environmental features are not destroyed by REI developments. Tourism stakeholders should be involved in REI planning, and it should happen as early as possible, preferably at the stage when the location for REI is selected. As this research has shown, locational factors strongly affect the compatibility of REI and tourism. Tourism stakeholder participation in REI planning is likely to lead to higher stakeholder support for such developments (Smythe et al., 2020), and it could even positively influence the perceived impacts of REI on tourism (Silva & Delicado, 2017).

The results of the research conducted for this thesis were used to inform the decision-making of the Expert Committee 2 of *the Master Plan for Nature Protection and Energy Utilization*. This demonstrates that, if well planned and conducted, stakeholder participation can make a valuable contribution to the expert knowledge used in planning projects related to natural resource management. Consideration of multiple views, values, and perspectives, and incorporating the knowledge of tourism stakeholders and experts at the decision-making stage enables a better understanding of the issue and the processes related to it, together with facilitating more effective planning (Reed, 2008; Reynaud et al., 2015).

As revealed by this research, the impacts of REI on NBT extend beyond the visual impacts. Therefore, when selecting the most suitable locations for REI development, tourism processes connecting the area with other areas should also be taken into consideration. Such results are supported by previous studies showing that the construction of REI leads to changes in tourism demand, not only in the areas surrounding REI, but also in neighboring areas and regions (Parsons et al., 2020; Voltaire & Koutchade, 2020). Furthermore, these results are in line with the work of the Expert Committee 2 of *the Master Plan for Nature Protection and Energy Utilization*, which developed a method for assessing the impacts of proposed REI in Iceland on tourism and outdoor recreation and their spatial extent (Sæþórsdóttir & Ólafsson, 2010a, 2010b). The research points to the importance of using holistic approaches to REI planning and of cooperation between multiple municipalities, which was also emphasized by Broekel and Alfken (2015).

One of the contextual factors which seems to play an important role in shaping tourism stakeholders' attitudes toward proposed REI projects in Iceland is the perceived need for more energy. Many tourism service providers interviewed for this research questioned such a need in the Icelandic context, since almost 78% of electricity produced in the country in 2019 was used by international heavy industry companies, mostly by aluminum smelters

(NEA, 2020). Consequently, tourism service providers emphasized the importance of considering the purpose of harnessed energy. While some of the rural areas in Iceland would benefit from more secure energy sources, they did not support REI developments in natural areas if this led to further heavy industry developments in the country.

5.4 Limitations and further research

This doctoral research had to deal with limitations at various stages. The literature review presented in Paper I aimed to provide not only an overview of existing research but also a detailed in-depth picture of the interrelationships between REI and tourism and the factors affecting them. Therefore, only high-quality original research articles with direct focus on REI and tourism were included in the review. Many studies which were only indirectly related to the topic were excluded, such as, among others, studies assessing renewable resources for energy harnessing/electricity generation in tourism regions, studies investigating environmental impacts of REI which may eventually affect tourism, technical and feasibility studies, spatial modeling studies, studies applying multicriteria analysis for selection of the most suitable sites, and studies focusing on public/resident/expert attitudes toward REI with brief mention of the impacts on tourism among other discussed issues. While such a decision made the literature review feasible and focused, it also possibly resulted in losing some important knowledge which would have contributed to a more complete picture on the REI-tourism nexus. This, however, provides opportunities for future research.

In the study presented in Paper II, low visitation of the study area made it difficult to collect a big enough sample of quantitative data via onsite questionnaire surveys. Therefore, this data was analyzed only using descriptive statistics. This limitation was addressed by employing mixed research methods in the study, which allowed data triangulation. In Papers III and IV only qualitative research methods were employed, which provided in-depth knowledge on the factors affecting the compatibility of REI and NBT. However, quantitative research methods would allow for evaluating the representativeness of the findings and investigating statistical differences between the study areas within each study. Studies employing quantitative research methods could be conducted in the future.

While the primary data for Paper II was collected in Summer 2018, the data for Papers III, IV and V was collected in May-December 2020, during the COVID-19 pandemic. Travel restrictions related to the pandemic had detrimental impacts on the tourism industry globally, and Iceland was no exception (OECD, 2022). Tourism companies suddenly lost their income and had to take drastic measures to adapt to the changing situation and to rely on governmental support. These changes were taken into consideration during the data collection and discussed with the participants before/during interviews. The travel restrictions and related impacts, however, did not seem to have strongly affected the perceptions of tourism service providers regarding the impacts of REI on NBT. Participants believed that the tourism industry would recover, and Icelandic nature, as previously, would be an essential resource for the tourism industry. Furthermore, the characteristics of natural and wilderness areas such as remoteness and opportunities to avoid crowding were perceived by the participants as potentially even more attractive to tourists in light of the pandemic. Some participants also noted that the pandemic resulted in

Icelanders rediscovering their country's nature and the opportunities for recreational activities it provides. Despite the impacts of the COVID-19 pandemic, participants did not question the importance of the tourism industry for the Icelandic economy nor did the pandemic result in higher perceived importance of the energy sector, which could have affected the perceived dynamics between REI and NBT.

The research presented in this thesis focused on specific study areas in Iceland and on tourists and tourism service providers which were likely to be the most affected by REI developments in these areas. Consequently, only a relatively small proportion of the tourism industry is represented in this research. The tourism industry in Iceland is large and diverse. Other types of tourism businesses may have different preferences related to REI developments and management of the Central Highlands. These preferences should be further researched and taken into consideration when planning REI developments.

The Icelandic Central Highlands as a case study area have many unique features, such as a high degree of naturalness and vast wilderness areas with wide views. However, the findings of this research are potentially transferable to natural areas in other countries and regions with similar emphasis on NBT. This research emphasizes the importance of contextual factors identified in the conducted studies for predicting potential impacts of REI on NBT, which are relevant for REI planning in Iceland as well as in other countries or regions reliant on NBT and renewable energy. Due to the limited scope of this thesis, the findings of this research do not provide an exhaustive list of factors affecting the interrelationships between REI and tourism, the impacts of REI on NBT or their spatial extent. The results of the research contribute to the knowledge by identifying factors which are of high relevance, especially when planning REI in natural areas used for tourism, and by providing insights into the complexity of these factors. Further research contributing to the knowledge on the topic is highly needed.

This thesis identified other opportunities for further research. To predict how likely the impacts of REI on tourism are to change over time more longitudinal studies looking into the attitudes of tourism stakeholders toward REI would be needed, as well as studies investigating the attitudes before, during and after the construction of REI. More studies conducting a comparison of different types, designs and locations of REI would provide more insights facilitating REI planning. Using place approaches to investigate power relations related to the land use conflicts between renewable energy harnessing and tourism could provide deeper insights into the topic. While the results of Paper IV provided a good groundwork for the research investigating the spatial extent of the impacts of REI on NBT, extensive further knowledge on the topic is needed. Knowledge on the perceptions of tourists and other tourism stakeholders of the impact area of REI on tourism would facilitate the identification of locations most suitable for REI developments. Research focusing on other types of settings, such as urban or industrial landscapes, would also provide important contributions to the knowledge. International studies would allow investigation of potential differences in tourism stakeholder perceptions of what are the most important resources for tourism and NBT, which could potentially provide a better understanding of differences in tourism stakeholder attitudes toward REI in different case study areas.

6 Conclusions

This doctoral thesis aimed to increase the existing knowledge on the complex interrelationships between NBT and REI, which is highly needed for the mitigation of potential land use conflicts and for sustainable development of both, tourism and energy sectors. The systematic literature review on the interrelationships between REI and tourism identified the main themes and research gaps, which guided the further direction of this thesis. It revealed various factors affecting the attitudes of tourism stakeholders toward REI and thereby the interrelationships between REI and tourism, which were demonstrated to be highly context dependent.

In this thesis, the nexus between NBT and REI was researched from the perspective of tourists and tourism service providers by employing various approaches to place. The compatibility between NBT and REI was investigated by examining the place meanings assigned to natural and wilderness areas by tourism stakeholders. Moreover, these areas were approached as relational places constituting part of multiple processes. The research revealed low general compatibility between REI and NBT. REI infrastructure was viewed as especially unsuitable in wilderness areas due to its impacts on wilderness experience. The thesis identified various locational factors shaping the perceived suitability of wind farms in natural areas with regard to tourism. These factors included the degree of naturalness of the area, the visibility of wind turbines, the number of tourists, the presence of tourist attractions and the perceived need for more energy in the area.

By investigating the perceptions of tourism service providers regarding the spatial extent of the impacts of REI on NBT, this thesis further contributed to the knowledge on the interrelationships between the two. As revealed by this research, arguments related to the visibility of REI, tourist mobility, as well as changes in tourist travel patterns and tourism demand caused by REI developments were shaping the size of the perceived impact areas. These findings suggest that natural areas used for tourism should be viewed as elements of larger tourism networks, which are likely to be impacted due to the construction of REI. Therefore, while planning REI development, wider tourism processes connecting these areas with other places should be considered.

As shown by this research, some of the tourism businesses are likely to adapt to REI. However, the values that natural and wilderness areas contain for the tourism industry, and the opportunities for unique extraordinary experiences are likely to be diminished or even lost due to the construction of REI. With wilderness areas declining globally (Watson et al., 2016), opportunities to experience wilderness are a strong competitive advantage of the Icelandic tourism industry, which can be jeopardized by REI developments. To preserve the values that natural and wilderness areas contain for the tourism industry, it is essential to include tourism stakeholders into REI planning at the early stages. While this doctoral thesis focused on NBT and REI mostly in the Icelandic Central Highlands, the findings of this thesis are expected to be of high relevance beyond the Icelandic context and to facilitate decision-making related to REI planning in countries and regions reliant on NBT.

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Paper I



The interrelationships between renewable energy infrastructure and tourism: A thematic literature review

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Abstract:

Increasing demand for renewable energy and rapid growth of tourism point to the need for a better overview of the knowledge on the compatibility of renewable energy infrastructure (REI) with tourism, which is essential for identification and mitigation of potential land use conflicts. This study aims to systematically review existing research on the interrelationships between REI and tourism, to identify their type and character and the factors affecting them. Analysis of 61 original articles published in international peer-reviewed journals revealed five key themes: (1) tourism stakeholders' attitudes toward REI, their perceived impacts, and potential changes in behaviour due to construction of REI; (2) economic impacts of REI on tourism; (3) REI as a tourist attraction; (4) factors affecting the interrelationships between REI and tourism; and (5) tourism-related REI planning. Identified factors affecting the interrelationships between REI and tourism fall into three categories: (1) factors related to REI, (2) locational factors, and (3) factors related to tourism stakeholders. It is concluded that the character of the interrelationships between REI and tourism is highly context dependent. Thus, the identified factors should be considered while planning REI to ensure sustainable coexistence with tourism, but their role highly depends on the context surrounding REI.

Keywords: Renewable energy infrastructure; tourism; energy; interrelationships; impacts

1 Introduction

With ever-increasing renewable energy demand and a rapid tourism recovery worldwide after the lifting of COVID-19 travel restrictions, discussion about the interrelationships between renewable energy infrastructure (REI) and tourism is receiving renewed attention (IRENA, 2022; OECD, 2020; Riojas-Díaz et al., 2022). Negative impacts on tourism are among the main arguments used by the opponents of REI developments in areas with a high economic reliance on tourism (Brittan, 2001; Frantál & Kunc, 2011; Mordue et al., 2020). However, many studies (Beer et al., 2018; Frantál & Urbánková, 2017; Liu et al., 2019) have also pointed to examples of REI becoming successful tourist attractions. Furthermore, tourism activities contribute to energy demand and to global warming. Tourism's greenhouse gas emissions account for around 8% of global emissions (Lenzen et al., 2018). The majority of them are transport-related and are expected to keep increasing (UNWTO, 2019). Thus, tourism relies on renewable energy sources for reducing its carbon footprint and ensuring sustainable tourism development (Beer et al., 2018; Zolfani et al., 2015). Both, renewable energy harnessing and tourism require land, for which in some cases they have to compete. Hence, with increasing REI developments and rapid tourism growth, land use conflicts are foreseeable, raising fundamental public policy questions related to REI and tourism.

The ability to predict the potential impacts of REI on tourism is of crucial importance, especially in regions where tourism is economically important. However, an overview of existing knowledge on the complex interrelationships between REI and tourism and the factors shaping them, which should be taken into consideration while planning REI, is currently lacking. This study aims to address this research gap by systematically reviewing academic literature focusing on the topic. The present literature review focuses on the types of REI that require harnessing of renewable energy resources where they are available, such as hydro-, geothermal, wind and marine power plants, since such infrastructure is more likely to complicate its compatibility with tourism.

The specific objectives of this literature review are: (1) to review the present research on the interrelationships between REI and tourism, (2) to identify the type and character of these interrelationships, and (3) to identify the factors affecting them. The present review furthermore identifies existing research gaps and opportunities for further research.

Since the studies focusing on REI and tourism employ a wide range of methods, including qualitative, quantitative and mixed research methods, a systematic mixed studies review (Pluye & Hong, 2014) was conducted to provide a comprehensive overview and a thorough understanding of the complex and multifaceted interrelationships between REI and tourism.

2 Methods

This systematic literature review was conducted in seven steps, as suggested by Pluye and Hong (2014) for mixed studies review: (1) formulating review questions and objectives, (2) defining selection criteria, (3) conducting extensive literature search, (4) identifying potentially relevant studies, (5) selecting relevant studies, (6) quality appraisal of the studies, and (7) analysing the studies and synthesising the findings.

During the first two steps of the review, the review questions and objectives were set, and, based on them, the search terms, the databases and the selection criteria for the studies were defined. In the third step, the literature search was conducted by using two databases: Scopus and Web of Science, as they are among the largest databases for peer-reviewed scientific literature.

Since English is the main language of international academic publishing, only publications in English were included in this review. The keywords used during the search were the following: TITLE-ABS-KEY(("renewable energy infrastructure" AND touris*) OR (("wind power" OR "wind turbine*" OR "wind farm*") AND touris*) OR ((hydropower OR "hydro power" OR hydroelectricity) AND touris*) OR (("geothermal energy" OR "geothermal power") AND touris*) OR (("solar panel*" OR "solar power" OR "solar PV") AND touris*) OR (("wave power" OR "marine power" OR "marine energy") AND touris*)). The literature search aimed to identify the papers containing these keywords in the title, abstract or keywords.

No time frame was set to the literature search. To ensure that high quality publications are included in the literature review, only original research articles published in peer-reviewed international journals were included. The data search was conducted at the end of February 2022. The initial literature search produced 745 results in total: 437 in Scopus and 308 in Web of Science. After duplicates were removed, 502 articles remained to be assessed in the second step of the review (Figure 1).

The abstracts of the articles were read, and relevant papers were selected. During the selection, 44 articles were excluded from the review since they were published in languages other than English. A further 383 articles were excluded from this review since they were not directly related to the topic.

In the fifth step, the full texts of 75 articles were reviewed. After assessing the full texts, 21 articles were furthermore excluded from the review. Additionally, the reference lists of each paper were scanned, and seven articles were identified and added after assessing their full texts, resulting in 61 articles evaluated in this review. During the next step, the quality of the selected 61 articles was assessed.

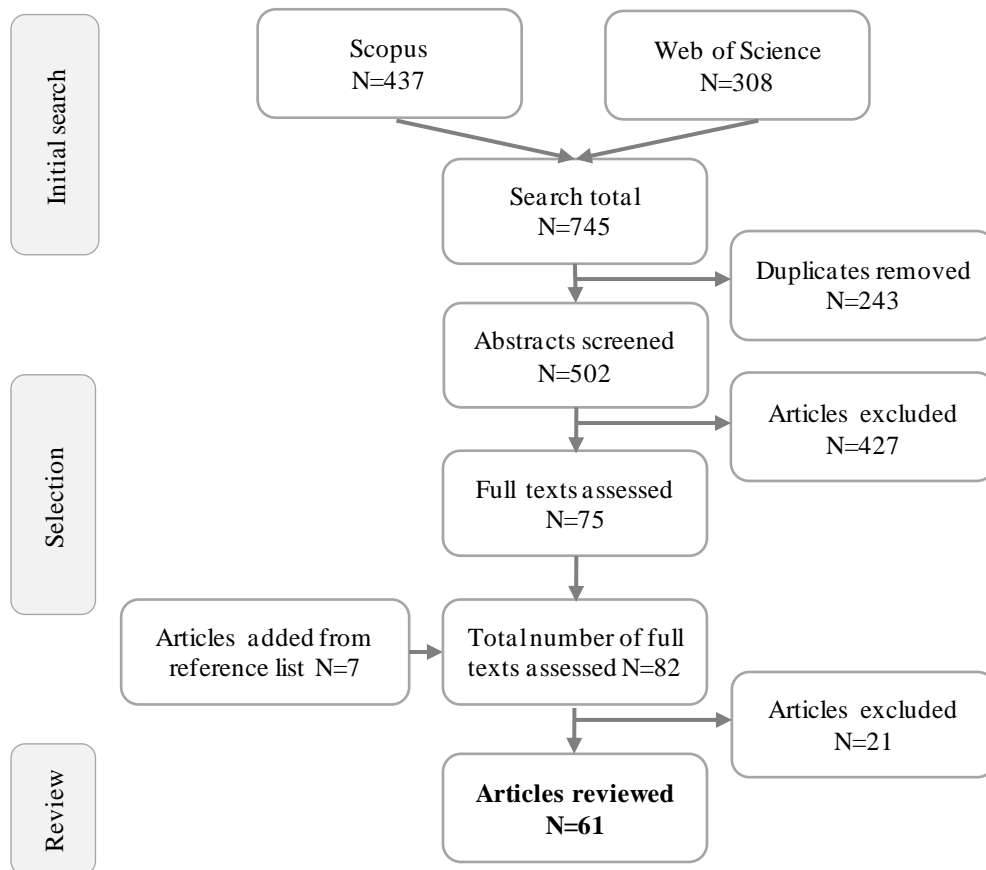


Figure 1. The steps of the literature review.

In the seventh step, the articles were grouped based on various factors, such as in which countries and in what types of settings the research was conducted, what types and character of the interrelationships between REI and tourism were identified, what were the factors shaping them, as well as what theoretical, practical, and/or management implications do the findings of the analysed papers have. The articles were further classified based on methods and sample used in each study. Data-based convergent synthesis design was selected for this review, meaning that all studies based on different methods were analysed by employing the same synthesis method and the findings were presented and discussed together (Hong et al., 2017). Thematic synthesis was further conducted by transforming quantitative data into themes or categories. Thematic synthesis is based on grounded theory (Corbin & Strauss, 2008) and was conducted in three steps: (1) coding the findings of the reviewed studies, (2) developing descriptive themes, and (3) generating analytical themes (Thomas & Harden, 2008). The findings of the review were discussed, and suggestions for future research were made.

3 Results

3.1 An overview of the reviewed articles

The results of the systematic literature review revealed a growing interest of the academic community in the interrelationships between REI and tourism. While this topic is relatively new, with only two reviewed articles published before the year 2000, the number of articles focusing on REI and tourism has been rapidly increasing during the last decade. However, in 2021 fewer articles investigating the interrelationships between REI and tourism were published, which might be related to the impacts of COVID-19 pandemic on both tourism and research (Figure 2).

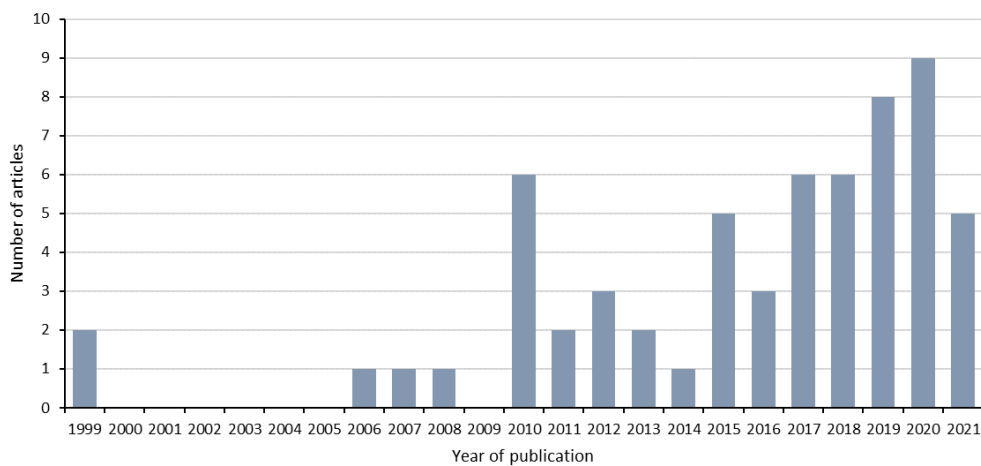


Figure 2. Number of reviewed articles by year of publication.

Geographical analysis of the distribution of the study areas showed that existing research is highly concentrated in several countries (Figure 3). Most articles focused on the interrelationships between REI and tourism in Iceland (17), 12 articles focused on study areas in the USA, seven in the United Kingdom, followed by Spain (4), France (3), China (3) and Czech Republic (3). Australia, Germany and Portugal were each the focus of two articles. Twelve countries were the focus of one article each. In total, 22 countries are represented in the literature. Three studies focused on multiple countries when discussing REI and tourism. It is significant to note that there is very limited research undertaken in less developed countries.

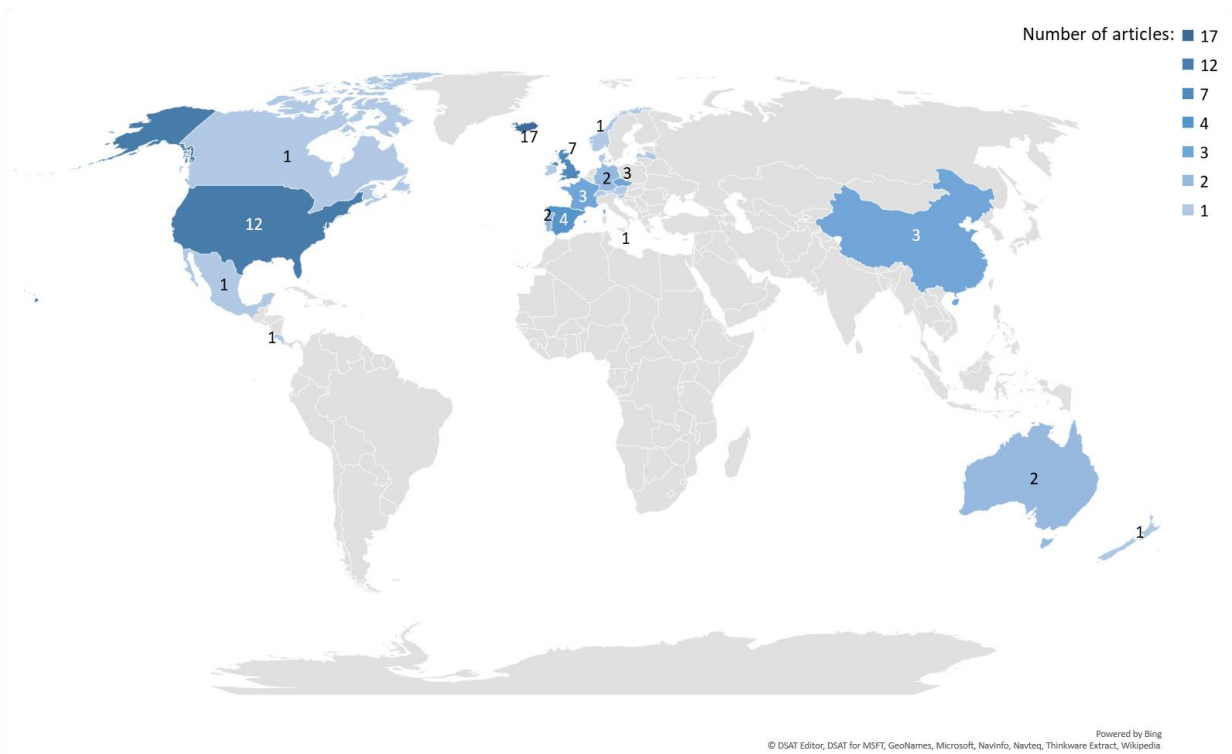


Figure 3. Geographical distribution of the study areas selected in the reviewed articles.

The reviewed research was published in 36 journals. Eighteen articles were published in journals with the main emphasis on energy, 17 articles were published in tourism journals, nine articles in policy or management journals, and 17 in journals focusing on other topics, such as sustainability, geography, or economics (Table 1). Based on their scope, some of the journals fall into several categories and were categorized according to their primary focus.

Table 1. Journals which published more than one article focusing on the interrelationships between REI and tourism.

Journal focus	Journal title	No. of studies
Energy	Renewable Energy	4
	Energy Policy	4
	Energy Research and Social Science	3
	Resource and Energy Economics	3
	Other Journals	4
Tourism	Journal of Sustainable Tourism	3
	Journal of Outdoor Recreation and Tourism	2
	Current Issues in Tourism	2
	Scandinavian Journal of Hospitality and Tourism	2
	Journal of Heritage Tourism	2
	Other Journals	6
Policy/management	Land Use Policy	3
	Marine Policy	2
	Ocean and Coastal Management	2
	Other Journals	2
Other	Sustainability	4
	Moravian Geographical Reports	2
	Impact Assessment and Project Appraisal	2
	Other Journals	9
	Total:	61

Regarding the type of REI, onshore wind turbines have received the most attention and were discussed in 23 of the reviewed articles (Figure 4). Of these, 10 articles discussed proposed or hypothetical wind turbines, nine articles focused on existing wind turbines and four included both existing and proposed or hypothetical onshore wind turbines. The number of articles discussing offshore wind turbines was slightly lower (20), hydropower plants were the focus of 16 articles, geothermal power plants were discussed in 10 articles, while solar power infrastructure was the focus of four articles. The articles discussing tidal, wave and ocean

currents power infrastructure focused on proposed/hypothetical infrastructure, and two articles discussed proposed/hypothetical biomass power plants. Two articles examined proposed/hypothetical REI and its interrelationships with tourism without specifying the type of infrastructure. Out of the 61 reviewed articles, 13 focused on several types of REI, with six papers discussing hydropower and geothermal power plants and tourism, two onshore wind turbines and solar power infrastructure, and one onshore wind farm, coal mine and nuclear power plant.

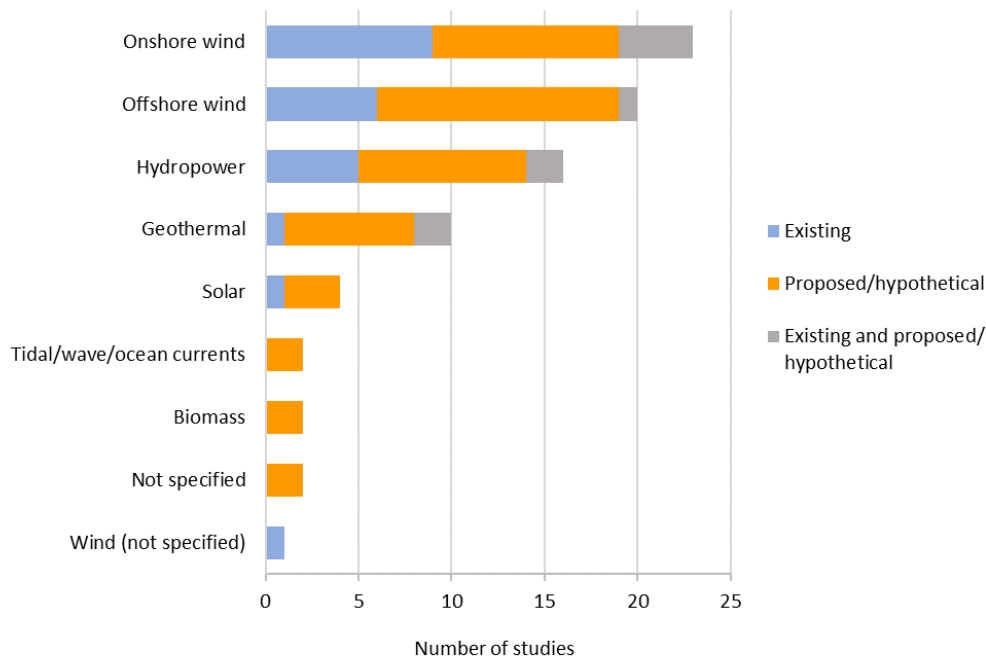


Figure 4. Type of REI discussed in the reviewed articles.

Out of the 61 reviewed studies, 55 were based on empirical data. Most studies (41) used primary data, five used secondary data, and nine used both (Table 2). Eight empirical studies used qualitative data, 29 used quantitative data and 18 used mixed data.

Table 2. Data used in the reviewed studies.

Data	N	%	Data	N	%
Primary	41	75	Quantitative	29	55
Secondary	5	9	Qualitative	8	15
Both	9	16	Mixed	18	31
Total:	55	100	Total:	55	100

Among the 41 studies that used primary data, the most prevalent data collection method were questionnaire surveys (used in 38 studies), followed by interviews (16) (Table 3). Focus group discussion and participant observation were each employed in three studies. Other primary data collection methods included diaries (2), field surveys (2) and experiments (2). Twelve studies used multiple data collection methods.

Table 3. Primary data collection methods

Primary data collection methods	N
Questionnaire survey	38
Interview	16
Focus group	3
Participant observation	3
Diary	2
Field survey	2
Experiment	2
Total:	66

3.2 The interrelationships between renewable energy infrastructure and tourism

Thematic analysis and synthesis of the articles revealed several emerging themes related to REI and tourism: (1) tourism stakeholders' attitudes toward REI, their perceived impacts, and potential changes in behaviour due to construction of REI; (2) economic impacts of REI on tourism; (3) REI as a tourist attraction; (4) factors affecting the interrelationships between REI and tourism; and (5) tourism-related REI planning. The themes are further detailed in the remainder of this chapter.

3.2.1 Tourism stakeholder attitudes toward REI, perceived impacts, and behaviour

The findings of the reviewed studies focusing on tourism stakeholders point to the heterogeneity of tourism stakeholder attitudes and preferences and to the multiplicity of factors affecting them (Frantál & Kunc, 2011; Landry et al., 2012; Navratil et al., 2019; Parsons et al., 2020; Voltaire & Koutchade, 2020). However, in line with the attitudes of the general public, tourism stakeholders tend to be more positive toward renewable energy and related infrastructure in general, but less supportive of specific REI projects (Brudermann et al., 2019; de Sousa & Kastenholz, 2015; Ólafsdóttir & Sæþórsdóttir, 2019). The negative attitudes of tourism stakeholders toward REI are often related to perceived or potential negative impacts

of REI on tourism. Visual impacts of REI on the surrounding landscape have been shown in numerous studies (de Sousa & Kastenholtz, 2015; Mordue et al., 2020; Ólafsdóttir & Sæþórsdóttir, 2019; Parsons et al., 2020; Sæþórsdóttir et al., 2021; Silva & Delicado, 2017) to be the main concern among tourism stakeholders. Such impacts, according to tourism stakeholders, are likely to lead to changes in the image and character of tourist destinations, reducing the quality of the tourist experience and decreasing tourism demand (Rudolph, 2014; Sæþórsdóttir & Saarinen, 2016b; Sæþórsdóttir et al., 2021). Concerns about visual impacts are especially prominent in studies focusing on wind energy infrastructure due to its high visibility (Brudermann et al., 2019; de Sousa & Kastenholtz, 2015; Ólafsdóttir and Sæþórsdóttir, 2019). With regard to the negative impacts of offshore wind turbines on tourism, Rudolph (2014) identified several storylines used by wind farm opponents including: visual disruption, disruption of local character and identity, disturbance of coastal recreational activities and environmental impacts.

However, visual impacts are not always perceived negatively. Offshore wind turbines off Block Island, USA, were perceived mostly positively by tourism stakeholders (Smythe et al., 2020; Smythe et al., 2021; Trandafir et al., 2020). Thus, the visibility of REI does not always equal perceived negative visual impacts. In areas where REI is regarded as compatible with the surrounding environment, it can be seen as a positive addition despite its high visibility (Frantál et al., 2017).

Tourism stakeholder attitudes toward REI are likely to lead to changes in their behaviour and consequently in tourism demand. They can be neutral when there is no or very little change in tourism demand due to the construction of REI (de Sousa & Kastenholtz, 2015; Frantál & Kunc, 2011; Silva & Delicado, 2017; Warren & McFadyen, 2010). However, REI can lead to avoidance of the areas where REI has been constructed and to reduced use of the nearby areas (Parsons et al., 2020; Sæþórsdóttir et al., 2018; Voltaire & Koutchade, 2020), but such infrastructure can also become a tourist attraction (Frantál & Kunc, 2011; Lilley et al., 2010; Liu et al., 2019; Smith et al., 2018; Smythe et al., 2020). Significantly, changes in visitation of areas affected by REI are not necessarily linear and can vary over time (Teigland, 1999).

REI construction is likely to affect the behaviour not only of tourists but also of tourism operators. In rural UK, 33% of surveyed tourism-related businesses by Mordue et al. (2020) stated that the existing or future onshore wind farm developments are likely to affect their future business investment decisions. Tourism service providers operating in Iceland stated that they would avoid onshore wind farms during their tours were they to be constructed (Sæþórsdóttir et al., 2021).

3.2.2. *Economic impacts of REI*

In line with the observed heterogeneity of tourism stakeholders in attitude studies, research investigating the economic impacts of REI on tourism showed diverging results with most studies, however, pointing to negative impacts on tourist demand and consequent economic losses. A study by Broekel and Alfken (2015), investigating impacts of onshore wind turbines on tourism demand in Germany, revealed that wind turbines around inland municipalities lead to lower occupancy rate in accommodations. A 1% increase in the installed wind turbine capacity within 10 km from a municipality centroid leads to 0.01% reduction in the occupancy rate of guest beds. The study also showed that coastal regions municipalities containing wind turbines experience lower occupancy rates, but in nearby municipalities tourist demand increases, which can be due to a displacement effect (Broekel & Alfken, 2015). Similarly, Riddington et al. (2010) estimated a total economic tourism loss due to implementation of onshore wind farms in Scotland to reach between 1.89% and 5.77% at area level. However, since most tourists are likely to relocate to other areas in Scotland containing fewer wind farms, the maximum estimated economic impact at the national level is likely to be less than 0.1% of the estimated employment in tourism (Riddington et al., 2010). Nevertheless, the results of Carr-Harris and Lang (2019), which used a hedonic valuation framework, contradict previously discussed findings. They estimated that during the peak months of July and August the construction of an offshore wind farm led to an increase in the number of reserved nights by seven nights/month and 19% increase in occupancy rates, resulting in \$3490 revenue increase in Airbnb properties located on Block Island in USA. During other months no significant differences with control areas were observed.

Studies that combined travel cost method with contingent behaviour and other methods mostly indicated economic losses due to construction of REI. Research conducted in Catalonia, Spain (Voltaire & Koutchade, 2020; Voltaire et al., 2017), revealed that construction of offshore wind turbines is seen as unfavourable by most beach users. None of the beach users reported intended increased beach use if wind turbines would be constructed, while around 34% stated they would visit the beach less or not visit at all (Voltaire & Koutchade, 2020; Voltaire et al., 2017). The trip loss was higher in the scenario of high number of wind turbines close to the shore and lower when a low number of turbines further away from the shore was discussed. The authors, however, highlighted that almost 90% of beach users who predicted reduced beach visitation due to the construction of offshore wind turbines stated that they would visit other beaches in Catalonia not affected by wind energy development.

Veidemane and Nikodemus (2015) estimated that in 2012 construction of an offshore wind farm could lead to a 600,000 euro average annual loss in revenues equal to 20% of the local municipal budget of Pavilosta, Latvia, depending on the location of the wind farm. Voke et al. (2013) investigated potential economic impacts of tidal and wave energy infrastructure around

St. David's, UK, and concluded that avoidance of the area due to implementation of marine energy development would be very low. Consequently, travel cost lost due to tourists not returning to the area after the development of marine energy infrastructure was estimated to reach £2784 and willingness to pay (WTP) £81, suggesting minor changes in the value of the area to visitors (Voke et al., 2013). Landry et al. (2012) conducted a survey among the households in North Carolina's Outer Banks region in USA and projected the future consumer surplus for beach trips under current conditions to be around \$1068 per year, which would be reduced to \$1051 if offshore wind turbines would be constructed, thus, the loss in consumer surplus is not statistically significant. In contrast, Hanley and Nevin (1999) found that the net percentage of visitors who would be less likely to visit an area if a biomass scheme were constructed reached 14.5%, for small-scale hydropower project it reached 9.3%, and 1.4% for onshore wind turbines.

Reviewed contingent valuation studies assessing nonmarket costs related to construction of REI also revealed divergent results. In response to being asked about activities with or without views of the existing wind farm offshore of Block Island, USA, 32.7% of tourists were indifferent, 5.7% always preferred activities with the view of wind turbines, while 19.4% preferred undertaking activities without the view of the wind turbines (Trandafir et al., 2020). The preferences of the remaining 42.2% of the respondents were shaped by the activity. However, average WTP was positive among all activities, with highest WTP for sightseeing, followed by fishing, boating, visiting beach and the lowest for birding/whale watching with views of the wind turbines. This suggests that the construction of the wind farm led to an improvement of tourist welfare (Trandafir et al., 2020). Furthermore, prior knowledge about the wind farm led to higher WTP by around 34 USD on average for enjoying the beach with the view of wind turbines (Trandafir et al., 2020). However, another American study, focusing on tourist preferences for hotel rooms with and without an onshore wind turbine, revealed that only 12.3% of the participants offered higher bids for hotel rooms with views of the wind turbine, while the WTP of other participants was higher for the rooms without wind turbine views (Fooks et al., 2017).

In a study conducted by Westerberg et al. (2015) on the beaches of Languedoc Roussillon in France, respondents required a 140 euro per week on average compensation for staying at a tourist resort with a wind farm located 5 km from the shore. Interestingly, in the same destination, (Westerberg et al., 2013, 2015) coherent environmental policies and recreational activities related to a wind farm were shown to outweigh the visual nuisance caused by the wind farm located at distances of 5, 8 or 12 km. Similarly, in a study by Vega and Alpizar (2011), construction of a hydropower project would decrease water flow in the river, which would cause reduction in visitor welfare (Marginal willingness to pay (MWTP)=3.17 USD). However, this reduction could be compensated by road improvements (MWTP=2.20 USD), pools (MWTP=2.81 USD) and huts (MWTP=0.81 USD) at the tourist centre (Vega & Alpizar,

2011). Schallenberg-Rodriguez and Inchausti-Sintes (2021) also showed that the positive economic impacts in terms of gross value added (GVA) of a floating wind farm to be constructed in a tourism region are likely to be lower and the employment demand is likely to be higher compared to more industrialised regions due to sectorial redistribution of resources in favour of services.

3.2.3. REI as a tourist attraction

Many of the reviewed studies point to the potential of REI as a tourist attraction. In some cases, the attracting effect can be stronger than the avoidance (e.g. Lilley et al., 2010). Studies have identified various motivational factors for tourist engagement in visiting REI. Such factors include eco-image, modern design, uniqueness and novelty of REI (Beer et al., 2018; Smythe et al., 2020). Interest in science and energy related issues, willingness to gain new knowledge, environmental consciousness, excitement, opportunities for socialization, for having fun and spending time away from more usual tourist places also have been identified as motivating factors to visit REI sites (Frantál & Urbánková, 2017; Liu et al., 2019; Liu et al., 2016; Pavlakovič et al., 2021).

Among the various types of REI, Beer et al. (2018) suggested geothermal power plants and wind farms tend to have highest potential for becoming tourist attractions. However, Pavlakovič et al. (2021) noted that people are more interested in visiting geothermal wells during spa visits, geothermal food production in greenhouses, educational visitor centres and trails, with interest in visiting geothermal power plants being lower (Pavlakovič et al., 2021).

Studies emphasised the importance of providing quality visitor services and information on REI for it to successfully function as a tourist attraction (Lilley et al., 2010; Smythe et al., 2020). Beer et al. (2018) noted that visits to REI combined with tourism services could be used for promotion of renewable energy and for increasing social acceptance of such infrastructure. This is supported by Frantál and Urbánková (2017), who showed that 27% of visitors who attended a kite festival under the wind turbines changed their attitudes toward wind energy more positively while the attitudes of 2% became more negative. Pavlakovič et al. (2021) also emphasised the educational potential of geothermal tourism attractions, however, they noted the danger of “preaching to the converted” since interest in geothermal tourism positively correlates with general attitudes toward geothermal energy. According to Pavlakovič et al. (2021), addressing the less positive attitudes toward geothermal energy is more likely to be effective in venues showcasing the direct use of geothermal energy for, e.g., food production or balneology.

Notably, in some cases REI can unintentionally provide better opportunities for tourism activities. For instance, artificial reefs created around the offshore wind turbines may attract fish sought by recreational anglers (Smythe et al., 2020; Smythe et al., 2021). After

constructing the dams and reservoirs for Blanda Hydropower Plant in northern Iceland, the downstream water of the glacial river became transparent, which created better conditions for salmon fishing (Sæþórsdóttir & Hall, 2018). The water released from a geothermal power plant created one of the most famous tourist attractions in Iceland, a thermal bathing attraction called the Blue Lagoon (Beer et al., 2018). Old hydropower plant infrastructure in the Encantats and Neouvielle massifs in the Pyrenees contribute to tourism development in the surrounding natural areas due to improved access and are also industrial heritage (Rodriguez, 2012). Older wind farms containing wind turbines of various models and ages can also be successfully transitioned into tourist attractions (Szumilas-Kowalczyk et al. (2020).

In terms of visitor profiles, some studies showed that REI is mostly visited by domestic tourists, usually during day trips (Frantál & Urbánková, 2017), and the majority of visitors are likely to take only one trip to the REI site (de Sousa & Kastenholtz, 2015; Parsons et al., 2020). This seems, as pointed out by de Sousa and Kastenholtz (2015), to be especially the case for wind turbines since they are rather standardised structures, which look similar in most countries and many international visitors can visit them in their home countries, while during international trips people may seek more unique experiences. Silva and Delicado (2017) suggested that wind farms are more likely to become tourist attractions in more industrialised areas containing little or no cultural or natural heritage, where such infrastructure can be seen as symbol of green energy and progress.

3.2.4. Factors affecting the interrelationships between REI and tourism

The review identified a range of factors affecting the attitudes of tourism stakeholders toward REI, and the character, scale and severity of the impacts of REI on tourism. These factors are divided into three main categories: (1) factors related to REI, (2) locational factors, and (3) factors related to tourism stakeholders. The factors belonging to each category are described below.

1) Factors related to renewable energy infrastructure

Different types of REI have been shown to differently impact tourism. However, different methods and settings selected in the reviewed studies make the results difficult to compare. Navratil et al. (2019), investigating visitor preferences toward different types of REI in ‘green’ hotels in Czech Republic, found that the most preferred were solar panels on the rooftops followed by wind turbines, heat pumps, green tariff energy and anaerobic digestion plants with the lowest acceptance being of solar panels on the ground. Similarly, Dalton et al. (2008) found that tourists were most positive towards solar panels on roof and on balconies of tourist accommodation, while wind energy conversion systems received somewhat lower support.

Regarding tourism stakeholder perceptions of REI in natural areas, in an Icelandic study by Sæþórsdóttir and Hall (2018), tourists were most positive toward geothermal power plants,

followed by hydropower plants and most negative toward wind turbines. Another study by Sæþórsdóttir and Hall (2019) focusing on tourism operators in Iceland revealed that they were most positive toward wind turbines, followed by geothermal power plants and most negative toward hydropower plants, especially where they would affect salmon rivers or destroy wilderness areas. With regard to REI offshore, Voke et al. (2013) showed that devices used for wave energy harnessing and other constructions located on the surface of the water as well as wave height reduction had a much stronger negative impact on visitors' enjoyment compared to underwater devices such as tidal stream turbines.

Design of REI is also an important factor, because it affects the visibility of REI and its impacts on the surrounding landscape. Most of the studies investigating how design of REI affects perceptions and attitudes of tourism stakeholders focus on wind farms, while studies looking into the preferences regarding the design of other types of REI are currently lacking. Regarding onshore wind turbines, a study by Sæþórsdóttir et al. (2018) showed that when the wind turbines were few, tourists preferred smaller wind turbines over higher ones, but they preferred a smaller number of higher wind turbines in case of a wind farm. In a study by Frantál and Kunc (2011), around 60% of tourists preferred several smaller wind farms (3 to 5 wind turbines), while only 10% of tourists preferred one large wind farm containing 80-100 wind turbines. In Riddington et al. (2010), however, the majority of participants preferred fewer but larger wind farms. Good design of REI not only can decrease negative impacts of such infrastructure on tourism, but can also transform REI into a tourist attraction as is the case for several award-winning design hydropower plants in Nordland County in Norway (Beer et al., 2018).

Landscape changes related to renewable energy harnessing are caused not only by REI itself, but also by accompanying infrastructure such as transmission lines and roads. The reviewed studies showed that tourism stakeholders are especially negative toward transmission lines in natural open landscapes since they are highly visible and impact large areas (Sæþórsdóttir & Hall, 2018; Sæþórsdóttir & Hall, 2019; Teigland, 1999). While construction of roads for power plants often results in better access of natural areas and thereby facilitates tourism development (Rodriguez, 2012), Teigland (1999) stressed that they do not necessarily lead to increased interest in nature experience but, especially in more environmentally sensitive areas, can lead to negative impacts on tourism and recreation. This is supported by Sæþórsdóttir (2010), who showed that tourist attitudes toward built up asphalted roads in the Icelandic Central Highlands were rather negative. Construction of roads can also lead to other developments, such as accommodation, food services, and/or petrol stations, which may further contribute to changes in the image of the area (Teigland, 1999).

The reviewed studies showed that the meanings assigned to REI by the tourism stakeholders shape their attitudes. If REI is perceived as a symbol of green energy that benefits the

environment, stakeholders are more likely to view such infrastructure positively (Carr-Harris & Lang, 2019; Frantál et al., 2017; Parsons et al., 2020; Smythe et al., 2021). This is reiterated by Lilley et al. (2010) who reported that 73.6% of tourists would visit the same beach if it contained a wind farm located 10 km offshore, while the proportion of tourists who would visit the same beach containing a coal power plant located 10 km inland from the beach would be lower (61.1%).

Reviewed articles focusing on the implementation of REI in tourist accommodation revealed practical concerns related to REI. In an Australian study by Dalton et al. (2007), a majority of tourism operators were interested in installing REI in their accommodations, however, most of them questioned the ability of REI to provide sufficient power to run a resort containing more than 10 rooms and the reliability of renewable energy supply. The proportion of tourism operators doubting the economic viability of renewable energy supply was much lower among operators who have REI in their accommodation, indicative of the need for consumer education (Dalton et al., 2007).

Several studies also showed that tourism stakeholders tend to perceive existing REI more positively compared to proposed or hypothetical REI (Brudermann et al., 2019; Sæþórsdóttir & Hall, 2018; Sæþórsdóttir et al., 2018). Various explanations have been put forward to explain this. As revealed by some studies, existing REI has created better opportunities for tourism and recreational activities (e.g., Smythe et al., 2021). Brudermann et al. (2019) proposed that the higher acceptance of existing REI compared to hypothetical REI reflects the phenomenon of status quo bias whereby people tend to prefer the current situation over change. Areas containing REI might also be visited by different types of tourists who are less sensitive to landscape changes brought by such infrastructure. Sæþórsdóttir and Hall (2018) found that in an area where a hydropower plant has been constructed the proportion of visitors with more purist wilderness attitudes was lower than in more natural areas.

2) *Locational factors*

Location of REI plays an important role in shaping tourism stakeholder attitudes toward REI and its impacts on tourism. One of the factors related to the location of REI is the level of development of the area surrounding the REI and its perceived naturalness. Various studies conducted in natural areas of Iceland (Burns & Haraldsdóttir, 2019; Sæþórsdóttir, 2010; Sæþórsdóttir & Saarinen, 2016b; Tverijonaite et al., 2019) showed that most tourists prefer to protect them from REI developments, since such developments would lower the perceived wilderness quality. In line with that, tourists perceive wind turbines as more suitable in agricultural areas rather than wilderness areas (Frantál & Kunc, 2011; Sæþórsdóttir & Ólafsdóttir, 2020; Sæþórsdóttir et al., 2018). With regard to offshore wind turbines, research conducted in eight beaches in Catalonia, Spain (Voltaire & Koutchade, 2020; Voltaire et al., 2017), revealed that people would be more likely to decrease their beach visitation if wind

turbines were to be built near natural beaches compared to more urbanised ones. Thus, developed areas are perceived by the tourism stakeholders as more suitable for REI developments, while relatively natural areas and areas containing natural or cultural heritage are perceived as rather unsuitable (de Sousa & Kastenholz, 2015; Sæþórsdóttir & Saarinen, 2016b; Sæþórsdóttir et al., 2021).

According to various studies conducted in Iceland (Ólafsdóttir & Sæþórsdóttir, 2019; Sæþórsdóttir & Hall, 2019), the country's image of pristine nature and wilderness is an important selling point for the tourism industry, therefore tourism operators do not support further REI developments in wilderness areas. Such preferences are likely to be related to the meanings assigned to areas and landscapes. In Michel et al. (2015), solar panels were perceived by tourists and residents more positively on industrial buildings compared to historical buildings carrying symbolic meanings and to open landscapes. Attitudes of tourists (Dalton et al., 2008; Navratil et al., 2019) and tourism operators (Dalton et al., 2007) toward REI in tourist accommodation are largely positive also because it helps reduce tourism's environmental footprint. However, the meanings ascribed to certain areas might differ among stakeholders and depend on various factors. Sæþórsdóttir et al. (2021) emphasised that the perception of an unspoiled natural area differs between tourism stakeholders: for some, such an area can contain farms and roads, while for others it should not contain any human-made structures. Such differences might lead to divergent opinions regarding the suitability of REI in a certain location. This is supported by Sæþórsdóttir and Hall (2018). In their study, the degree of naturalness of an area containing a hydropower plant was perceived differently by tourists depending on numerous factors, such as previous visits, the route tourists have taken to reach the area, mode of travel and country of origin.

The characteristics of the landscapes surrounding REI are also a critical factor in shaping tourism stakeholder attitudes. Diverse landscapes of high aesthetic quality as well as scenic areas containing tourist attractions are perceived as less suitable for REI developments compared to more homogenous and desert-like landscapes and areas described as 'drive-through' areas (Sæþórsdóttir et al., 2018; Sæþórsdóttir & Ólafsson, 2010b; Sæþórsdóttir et al., 2021). In contrast, Liu and Upchurch (2020) showed that the perceived attractiveness of hypothetical wind turbines was highest in prairies and mountain regions, followed by desert areas and locations offshore.

Distance of REI from tourist attractions and activities is also of high importance for tourist experience and tourism demand (Brudermann et al., 2019; Ólafsdóttir & Sæþórsdóttir, 2019; Veidemane & Nikodemus, 2015). As revealed by the two contingent behaviour studies identified in this review (Lilley et al., 2010; Parsons et al., 2020), the nearer the hypothetical offshore wind power infrastructure is to the shore, the higher the proportion of beachgoers reporting negative impacts of wind turbines on their experience and intention to change their

trip plans. Landry et al. (2012) showed significant negative utility effect on beach visitors when offshore wind turbines would be constructed at one mile offshore, but no significant effect at further distances or in estuaries. Greater distance of offshore wind turbines from the coast may not only increase the beach visitation probability, but also lead to longer stays in the area (Veidemane & Nikodemus, 2015). However, where tourism stakeholders perceive an offshore wind farm as a tourist attraction, they emphasise the importance of physical and visual access, thereby countering the commonly perceived need for placing wind turbines as far as possible offshore (Smythe et al., 2020).

With regard to placing wind turbines onshore or offshore, in a study in Latvia, Veidemane and Nikodemus (2015) found that tourists and residents were more in favour of developing a wind farm on land in the coastal areas than offshore. Similarly, in Dalton et al. (2008) 68% of tourists accepted a hypothetical wind farm on the coast compared to 40% of tourists who accepted a wind farm offshore. However, Lilley et al. (2010, p. 4) criticized the simulated offshore wind turbines as ‘elongated and otherwise disproportionate’ in comparison with the onshore wind turbine simulation. This might have contributed to more positive attitudes of tourists toward presented onshore wind turbines in the study.

Areas receiving a higher flow of tourists are seen as less suitable for REI developments by tourism stakeholders, while areas where local need for electricity is perceived high are considered to be more suitable (Sæþórsdóttir et al., 2021). Furthermore, countries and regions containing areas of high heritage value, attractions and landscapes that are a resource for tourism, have specific challenges in developing REI. These challenges can be addressed by choosing a type of REI that is less likely to impact tourism (e.g. solar PV over wind turbines), through participatory design approaches and by employing new approaches to aesthetics and landscape design (Rizzo, 2017). However, increasing tourism interest in natural areas might lead to a shift from utilisation approaches to more conservationist and sustainable resource use approaches in natural areas (Sæþórsdóttir & Saarinen, 2016a).

3) Factors related to tourism stakeholders

Various tourism stakeholder characteristics have been shown to affect the interrelationships between REI and tourism. The role of previous experience of tourists with REI in shaping their attitudes has been investigated by several studies. Frantál et al. (2017) found that tourists from more densely populated countries that contain numerous wind farms, such as Netherlands, Germany and United Kingdom, were more tolerant toward a proposed wind farm in the Icelandic Central Highlands. In a French study, tourists from Northern European countries that have more experience with wind turbines were more tolerant toward offshore wind turbines compared to domestic beach visitors (Westerberg et al., 2015). In Delaware, USA, Lilley et al. (2010) found a positive yet insignificant relationship between having seen a wind turbine previously and intention to visit a beach containing offshore wind turbines or another beach in

the same state. In Veidemane and Nikodemus (2015), no strong influence was observed of having seen offshore wind farms before on attitudes toward specific wind farm proposals.

Previous experience of an area is also important. Michel et al. (2015) found that repeat visitors were more negative toward planned solar installations, suggesting aversion to change and a preference to preserve their holiday places as they are. However, Voltaire and Koutchade (2020) showed that the more familiar people were with a beach the less likely they were to reduce their beach trip frequency if a wind farm is constructed offshore. In a study by Frantál and Kunc (2011), the attitudes of repeat visitors toward onshore wind farms were more pronounced both positively and negatively, while first-time visitors tended to be more neutral.

The distance between visitors' place of residence and a destination containing REI has also been shown to affect their attitudes. Voltaire and Koutchade (2020) showed that local tourists were less likely to reduce their beach visitation in case of construction of an offshore wind farm compared to tourists coming from other regions. However, in Frantál and Kunc (2011), tourists coming from the same region were more likely to oppose onshore wind turbines compared to tourists from other regions and larger cities. Similarly, in a study by Sæþórsdóttir (2010), Icelanders were more negative toward power plants in the Icelandic Central Highlands compared to foreign visitors. Tourists' country or place of origin might affect attitudes toward REI and behaviour due to other reasons. For example, as pointed out by Liu and Upchurch (2020), visiting wind farms is believed by Chinese natives to bring wealth and luck. In the Czech Republic, on the other hand, corruption scandals related to on-ground solar power plants might have led to lower support among Czech tourists (Navratil et al., 2019). In Frantál and Kunc (2011), tourists coming from environmentally degraded areas were more positive toward onshore wind turbines due to their preference for clean sources of energy. Studies showed divergent results regarding the influence of other demographic characteristics of tourists, such as gender, education or age and their attitudes toward REI (Frantál & Kunc, 2011; Lilley et al., 2010; Westerberg et al., 2015).

The types of activities the tourists are undertaking affect how they perceive REI and how likely they are to change behaviour. Parsons et al. (2020) reported that tourists involved in activities on water, such as boating, swimming or surfing are most likely to avoid the beach after the construction of an offshore wind farm, followed by visitors undertaking beach activities, such as sunbathing or reading. Avoidance likelihood is the lowest among visitors involved in boardwalk and similar activities (Parsons et al., 2020). Similarly, Lilley et al. (2010) found that visitors surveyed on a boardwalk were more likely to come back to the beach after the construction of offshore wind turbines or to visit other beaches in the Delaware state compared to the visitors surveyed on the beach, since they were more focused on shops and restaurants instead of the seascape. Westerberg et al. (2013) revealed that while in general offshore wind farm disamenity costs decline with increasing distance of the wind farm from the shore, visitors

coming for family or friends visits or cultural and historical attractions rather than beach tend to require lower compensation.

The type of information that tourism stakeholders receive about a planned or a hypothetical renewable energy project also has been shown to shape attitudes toward REI. A study by Teisl et al. (2018) revealed that visitors who were presented a virtual reality (VR) tool showing hypothetical floating offshore wind turbines tended to move away from 'neutral' responses to positive and negative extremes, with higher tendency to have more negative reactions compared to visitors who were presented traditional two-dimensional pictures.

With regard to different groups of stakeholders, Sæþórsdóttir and Ólafsdóttir (2020) demonstrated that tourists were more negative toward a proposed wind farm in the Icelandic Central Highlands compared to residents. The residents tended to perceive the landscape surrounding the proposed wind farm more critically, as less natural or less beautiful than tourists, while the tourists often estimated the deterioration of the landscape due to the construction of the wind farm to be more severe. On the other hand, in the study by Veidemann and Nikodemus (2015) in Latvia, residents were more negative than tourists toward the proposed wind farm developments irrespective of their location. Similarly, in a study by Silva and Delicado (2017), while being appalled by the close distance between wind turbines and medieval buildings, most tourists accepted onshore wind farms existing in the area and stated that they did not interfere with their destination choice. Attitudes of residents were more divergent with the majority opposing the wind farms. Silva and Delicado (2017) pointed out that economic benefits from wind power production and their inclusion in decision-making are important in shaping residents' attitudes toward wind farms and their perceived impacts on tourism. Such results are also reflected in de Sousa and Kastholz (2015) findings, which showed that while assessing the positive impacts of wind energy infrastructure on tourism, residents tended to mention benefits to their community, such as economic benefits, while tourists focused more on overall societal benefits. The attitudes of managers of large tourist accommodation providers also tend to be more positive toward REI implementation for their businesses than smaller ones (Dalton et al., 2007).

Various other factors related to tourism stakeholders have been shown to affect their attitudes toward REI. As Frantál and Kunc (2011) observed, visitors travelling alone or with friends were more critical toward onshore wind turbines compared to couples or families with children, which are likely to focus less on wind turbines and more on other destination attributes. Furthermore, as revealed by Westerberg et al. (2015), the welfare impacts experienced by the beach users in the vicinity of an offshore wind farm depended also on their environmental concerns and perceived cost-effectiveness of wind power. According to Westerberg et al. (2015, p. 175), "The results point to the fact that although we may think that we are eliciting preferences for 'objective' physical characteristics of a landscape, the elicited preferences are

inherently shaped by ‘political, technical, economic or ecological’ implications of the object or landscape under consideration.” Interestingly, Klain et al. (2018) showed that affectively-loaded impacts such as visual intrusion and effects on wildlife played a more important role in shaping the attitudes of a wide range of stakeholders toward a hypothetical offshore wind farm than impacts on tourism, which are more easily quantifiable.

3.2.5. *Tourism-related REI planning*

Energy planning in countries relying on nature-based tourism, where REI and tourism are likely to compete for the same resources, can benefit from tools ensuring sustainable use of natural resources. In Iceland, to solve the conflicts between energy development and other land uses, a governmental project initially called the Master Plan for Geothermal and Hydropower Development was started under the supervision of the Ministry of the Environment. Several reviewed Icelandic studies (Sæþórsdóttir, 2012; Sæþórsdóttir & Ólafsson, 2010a, 2010b) presented the work of an expert group which used systems approach and ranked proposed energy projects based on their impacts on tourism and recreation. For that, they assessed how each proposed REI project would affect the value of the surrounding regions based on 43 attributes falling into one of the following categories: experience, use, recreation opportunities, infrastructure and future value (Sæþórsdóttir & Ólafsson, 2010a, 2010b). However, as Callejas-Jiménez et al. (2021) revealed, tourism and renewable energy development can often coexist and do not always necessarily compete for the same natural resources. Their study conducted off the Cozumel Island showed that biotopes with high energy densities, which are the most suitable for harvesting of marine renewables, are generally located in areas that are of low value for tourism. In contrast, biotopes with low to intermediate energy densities are often associated with areas containing higher coral reef cover, which are of interest to tourism and are located within protected areas. Still, as Callejas-Jiménez et al. (2021) emphasised, it is also important to investigate how such REI is likely to impact marine organisms which may not be of direct interest to tourists but are of high ecological importance.

With regard to REI planning, Mordue et al. (2020) in a study on existing and prospect wind farms in Northumberland County, UK, stated that the perceived impacts of onshore wind farms on tourism by tourism businesses tend to be worse than their actual impacts. Therefore, the decision-making regarding the planning of REI should be conducted ensuring ‘manifold justice’ or equitable siting of wind installations through space and time (Mordue et al., 2020). Ingólfssdóttir and Gunnarsdóttir (2020) argued that REI might not lead to significant economic losses to tourism and, therefore, it should not be used as a political argument in decision-making, however, such infrastructure is likely to lead to the loss of important nature-based tourism experiences.

4 Discussion

4.1 Interrelationships of REI and tourism and factors affecting them

The results of this literature review demonstrate that REI and tourism affect each other in numerous ways. In societies worldwide, there is a growing need for renewable energy and increasing tourism is contributing to this need. The tourism industry is responsible for enormous CO₂ emissions and relies on REI for reducing its carbon footprint (Beer et al., 2018; Callejas-Jiménez et al., 2021; Navratil et al., 2019). REI has been shown to facilitate tourism due to improved access and by creating conditions for tourism activities (Rodriguez, 2012; Sæþórsdóttir & Hall, 2018; Smythe et al., 2020; Smythe et al., 2021). Some of the reviewed studies have discussed REI as tourist attractions and have shown that tourism activities in sites of REI can effectively contribute to shaping positive attitudes toward renewable energy and to raising awareness on the importance of REI for sustainability (Beer et al., 2018; Frantál & Urbánková, 2017; Pavlakovič et al., 2021). However, the interrelationships between REI and tourism seem to be more often negative. REI generally transforms surrounding landscapes, which often leads to changes in the image and character of tourist destinations and to reduced quality of tourist experience, decreased tourism demand and economic losses (Broekel & Alfken, 2015; Parsons et al., 2020; Sæþórsdóttir et al., 2018; Voltaire & Koutchade, 2020). Furthermore, high reliance of a region on tourism makes REI developments more challenging due to the need to preserve the resources important for tourism (Rizzo, 2017) and can also affect the economic impacts of REI in terms of gross value added (Schallenberg-Rodriguez & Inchausti-Sintes, 2021).

The review of the factors affecting the interrelationships of REI and tourism revealed that these interrelationships highly depend on the context. Thus, while this review provided an overview of the factors which should be taken into consideration while planning REI, how these factors will affect tourism depends on the context of each renewable energy project.

The factors affecting the interrelationships between REI and tourism identified by this literature review can be divided into three categories: 1) factors related to REI, 2) locational factors, and 3) factors related to tourism stakeholders. The first category includes factors such as type and design of REI and of accompanying infrastructure, meanings assigned to REI and its image, practical concerns related to REI and its reliability (Figure 5). The factors related to the location of REI include the level of development of the area, its degree of naturalness, meanings ascribed to the area and its image, the level of use of the area for tourism, local demand for renewable energy, diversity and aesthetic quality of surrounding landscapes, presence of tourist attractions and opportunities for tourism activities, as well as distance between REI and tourist attractions and activities. The third category includes factors related to tourism and its stakeholders, which, among others, include tourist motivations, expectations, and activities

they are undertaking, previous experience of REI and of the area where REI is discussed, country/region tourists are coming from, other demographic characteristics, type of information tourism stakeholders receive about REI, as well as their values and views on various topics, including concerns over climate change.

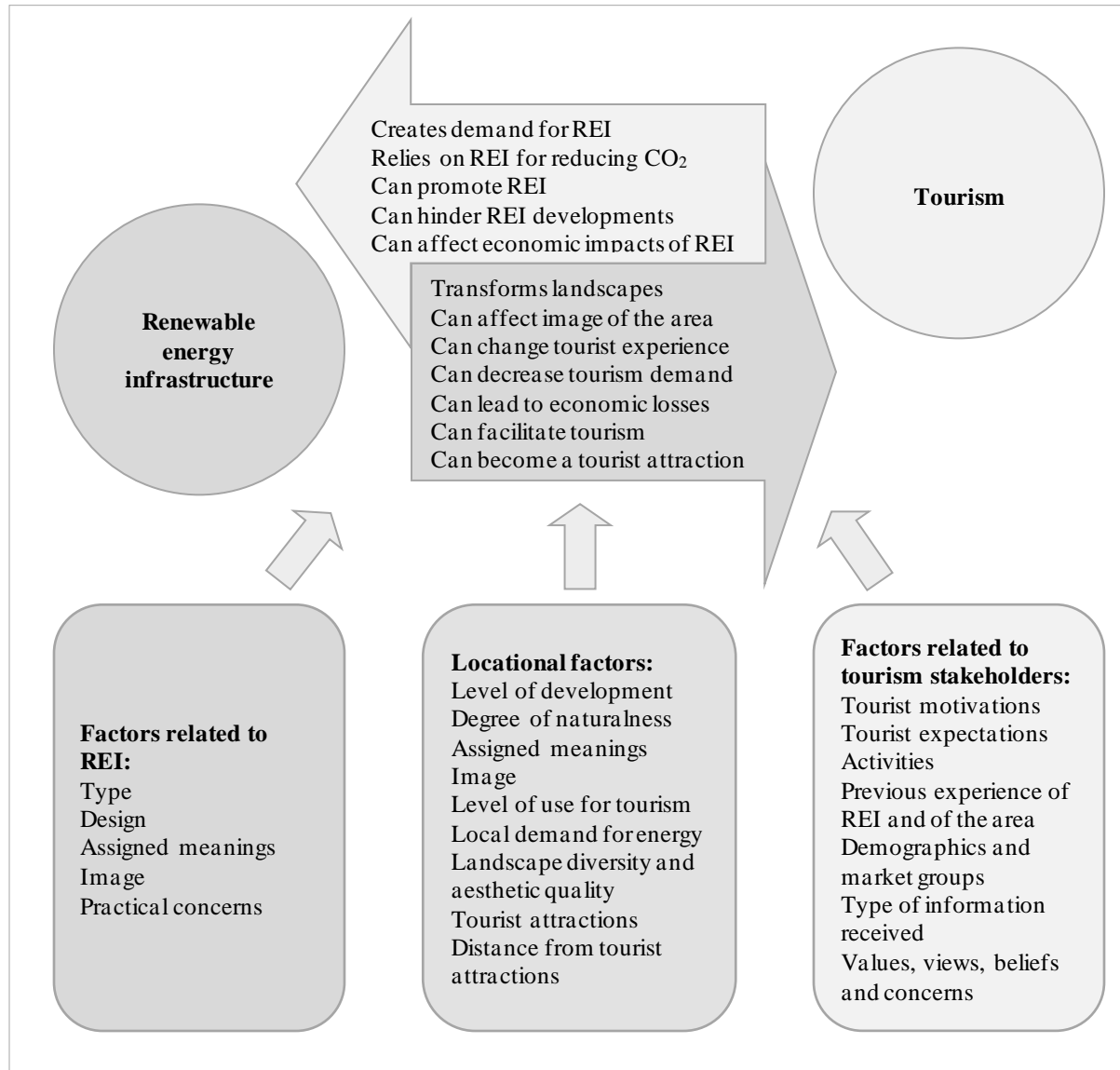


Figure 5. Interrelationships of REI and tourism and the factors affecting them.

The factors identified in this review partly relate to the factors identified by Devine-Wright (2008) explaining public views on renewable energy technologies, which fall into three categories: 1) personal (various socio-demographic factors), 2) social-psychological (degree of awareness, experience, environmental and political beliefs, perceived impacts, perceived fairness in development process), and 3) contextual (type and scale of REI, spatial context, and institutional structure). This emphasises the connection between public views on REI and its impacts on tourism. However, while numerous reviewed studies suggest improvements to REI planning based on their findings, this literature review reveals the lack of empirical studies

investigating the effects of institutional factors such as REI planning strategies and policies for reducing the impacts of REI on tourism.

This literature review has identified other research gaps and opportunities for further research. Conducting more longitudinal studies would help investigate how the attitudes of tourism stakeholders toward REI are changing with rapidly developing REI technology and increasingly pressing need to mitigate climate change. Longitudinal studies would also allow investigating tourism stakeholder attitudes before, during and after the construction of REI and provide better understanding of attitudinal changes of tourism stakeholders over time. More studies conducting a systematic comparison of the impacts of different types, design and locations of REI on tourism would facilitate REI planning. While numerous studies focusing on wind turbines emphasise the importance of distance on the attitudes of tourism stakeholders and on the severity of the impacts of REI on tourism, studies estimating the spatial extent of the impacts of other types of REI on tourism are lacking. This literature review has also revealed the need for a better geographical distribution of research as well as the need for comparative international studies, which would provide a more complete picture on the interrelationships between REI and tourism.

4.2 Implications for REI planning

The findings of this literature review show that the impacts of REI on tourism are context-specific and highly depend on tourism stakeholders' perceptions, attitudes and preferences, which are heterogeneous. This demonstrates the importance of considering the context of each REI project while planning REI development, which is supported by various researchers (Navratil et al., 2019; Smythe et al., 2020). The findings also re-emphasise the importance of including social perceptions into the planning process of REI development in order to minimise land use conflicts between REI developments and tourism (Minsch et al., 2012; Sovacool, 2014). This can be achieved by employing participatory processes in REI planning. Tourism stakeholder inclusion into REI planning is likely to positively affect their attitudes toward projects and improve the compatibility of REI and tourism (Smythe et al., 2020; Tverijonaite et al., 2022). Consideration of tourist preferences, motivations, expectations and behaviour can facilitate prediction of potential impacts of planned REI on tourism and selection of the best location and design for REI. It has also been shown (i.e. Silva & Delicado, 2017) that inclusion of local actors into REI planning processes is likely to positively affect their perceived impacts of REI on tourism.

In natural areas where REI is perceived as less compatible with the surrounding landscape and with tourist expectations, it is important to set a limit of use in order to ensure that their attractiveness is not lost, and that wild areas provide opportunities for transformative experiences and connection with nature (Ingólfssdóttir & Gunnarsdóttir, 2020; Sæþórsdóttir & Saarinen, 2016b). Nevertheless, cases of REI becoming tourist attractions in their own right

have shown that visits to the sites of REI not only benefit tourism by providing more opportunities for activities but are also an effective marketing tool for REI. This emphasises the importance of providing tourism operators with sufficient resources for presenting REI to tourists and promoting it as an important contributor to sustainable development (de Sousa & Kastenholz, 2015; Smythe et al., 2020). Moreover, it has been pointed out (Frantál & Kunc, 2011; Liu et al., 2016) that developing energy and tourism policies so that they support each other can contribute to cooperative relationships between REI and tourism.

Importantly, construction of REI affects tourism processes not only in the areas surrounding such infrastructure, but also in connecting regions. This emphasises the importance of planning REI developments in coordination between all affected municipalities and regions (Broekel & Alfken, 2015) by taking into consideration travel routes that tourists are using and the changes REI may bring to these areas (Sæþórsdóttir & Ólafsson, 2010a, 2010b).

Both the energy industry and the tourism industry aim to be sustainable, but if not managed appropriately both of the industries cause damage to the natural environment and negatively impact other land uses (Sæþórsdóttir & Hall, 2019). Finding a balance between the needs of local residents, economic benefits, environmental aims and tourist preferences is therefore of crucial importance for ensuring sustainable interrelationships between REI and tourism and sustainable use of land (Michel et al., 2015).

5 Conclusions

This literature review on the interrelationships between REI and tourism has revealed that they are complex and reciprocal. While in some cases REI and tourism can successfully coexist by creating symbiotic relationships, more often REI is likely to negatively impact tourism, especially in areas where REI is perceived as not suitable in settings that are of high value for the tourism industry. This literature review identified three categories of factors shaping the interrelationships between REI and tourism: 1) factors related to REI, 2) locational factors, and 3) factors related to tourism stakeholders. As revealed by this review, the character of the interrelationships between REI and tourism is highly context dependent. Thus, while the identified factors should be considered during the planning of REI to ensure its sustainable coexistence with tourism, their role highly depends on the context surrounding REI.

Appendix 1. Reviewed articles

List of themes identified by the review: (1) tourism stakeholder attitudes toward REI, perceived impacts, and behaviour; (2) economic impacts of REI on tourism; (3) REI as a tourist attraction; (4) factors affecting the interrelationships between REI and tourism; and (5) tourism-related REI planning.

Nr.	Author/s (year of publication)	Journal	Country/ies	Main focus	Methods	Themes
1	Pavlakovič et al. (2021)	Sustainability	Slovenia	Interest of general public in geothermal energy tourism	Online questionnaire survey	3, 4
2	Sæþórsdóttir et al. (2021)	Land	Iceland	Attitudes of tourism operators toward proposed wind farms, perceived key factors for selecting locations for onshore wind farms	Semi-structured interviews	1, 4
3	Schallenberg-Rodriguez & Inchausti-Sintes (2021)	Renewable and Sustainable Energy Reviews	Spain	Socio-economic impacts of a proposed floating wind farm in a region highly relying on tourism	Economic estimation	2
4	Smythe et al. (2021)	Marine Policy	USA	Recreational fishermen perceptions of an existing offshore wind farm on their experience	Semi-structured interviews and an online survey	1, 4
5	Callejas-Jiménez et al. (2021)	Ocean and Coastal Management	Mexico	Combining marine energy harnessing with marine tourism	Field surveys and secondary data	5
6	Smythe et al. (2020)	Energy Research and Social Science	USA	Perceptions of tourism operators and recreational professionals of the effects of an existing offshore wind farm on tourism and recreation sectors	Focus groups	1, 3, 4
7	Mordue et al. (2020)	Journal of Sustainable Tourism	UK	The reasoning behind the local opposition to existing and proposed onshore wind farms in rural tourism locations	Literature review, online questionnaire survey of tourism businesses, a focus group with tourism stakeholders opposing wind farms	1, 4, 5

8	Parsons et al. (2020)	Energy Policy	USA	The effects of a large hypothetical offshore wind farm on recreational beach use	Online contingent behaviour survey among beachgoers	1, 3, 4
9	Voltaire & Koutchade (2020)	Resource and Energy Economics	Spain	Factors affecting the acceptance of hypothetical offshore wind turbines among beach users and their beach trip behaviour	On-site combined travel cost - contingent behaviour survey	1, 2, 4
10	Szumilas-Kowalczyk et al. (2020)	Renewable Energy	USA	Planning and design strategies related to decommissioning and repowering of onshore wind farms	Literature review and field surveys	3, 5
11	Ingólfssdóttir & Gunnarsdóttir (2020)	Journal of Outdoor Recreation and Tourism	Iceland	Impacts of power plants on the economic value of natural areas for tourism vs eco-centric environmental ethics approach in the planning of renewable energy development	Critical discourse analysis, review of four survey reports on tourist experiences and attitudes	1, 5
12	Liu & Upchurch (2020)	Journal of Leisure Research	China	The use of eye-tracking technology for investigating hypothetical onshore and offshore wind farms as tourist attractions	Mixed experimental design using eye-tracking technology and self-report assessments among students	1, 3
13	Sæþórsdóttir & Ólafsdóttir (2020)	Energy for sustainable development	Iceland	Residents' and tourists' attitudes toward a proposed onshore wind farm	On-site questionnaire survey	1, 4
14	Trandafir et al. (2020)	Journal of Ocean and Coastal Economics	USA	Tourists' preferences for the views with and without an existing offshore wind farm during their recreational activities	A stated preference survey disseminated to respondents using a Qualtrics panel	1, 2, 4
15	Ólafsdóttir & Sæþórsdóttir (2019)	Land Use Policy	Iceland	Attitudes of residents and tourism service providers toward a proposed onshore wind farm	On-site questionnaire survey of residents, semi-structured interviews with residents and tourism service providers	1, 4
16	Tverijonaite et al. (2019)	Sustainability	Iceland	Tourist attitudes toward a proposed hydropower plant	On-site questionnaire survey, semi-structured interviews, open-ended diaries, participant observation.	1, 4

17	Brudermann et al. (2019)	Clean Technologies and Environmental Policy	Austria	Acceptance of existing and hypothetical onshore wind farms among tourists	On-site questionnaire survey	1, 4
18	Carr-Harris & Lang (2019)	Resource and Energy Economics	USA	The effect of existing offshore wind farm on the Airbnb vacation rental market	Analysis of the Airbnb data before and after construction of a wind farm; a difference-in-differences (DD) model using three nearby tourist destinations as controls.	2
19	Navratil et al. (2019)	Renewable Energy	Czech Republic	Preferences of solar panels on rooftops/on the ground, heat pumps, anaerobic digestion plants and wind turbines in hotels among visitors in cultural and natural sights	On-site questionnaire survey	1, 4
20	Sæþórsdóttir & Hall (2019)	Sustainability	Iceland	Tourism operator perceptions of geothermal, hydro- and wind power generation and of implications of such developments on tourism	Online questionnaire survey, semi-structured interviews	1, 4, 5
21	Burns & Haraldsdóttir (2019)	Journal of Outdoor Recreation and Tourism	Iceland	Perceptions of tourists and tourism businesses of potential impacts of proposed hydropower wind farms	On-site visitor questionnaire survey, interviews with tourism operators	1, 4
22	Liu et al. (2019)	Tourism Review International	China	The influence of behavioural beliefs, normative beliefs, attitudes, and subjective norms on residents' intent to visit an existing onshore wind farm	Questionnaire survey	1, 3, 4
23	Beer et al. (2018)	Current Issues in Tourism	USA, Canada, UK, Iceland, Denmark	Tourism potential of existing hydro-, geothermal and offshore and onshore wind power infrastructure	Literature review and analysis of visitor numbers	3, 4, 5
24	Smith et al. (2018)	Energy Research and Social Science	USA	Social effects of an existing offshore wind farm on the tourism and recreation experience	Thematic media content analysis, ethnographic participant	1, 4

					observation, tourism and recreation sector stakeholder focus groups	
25	Teisl et al. (2018)	Energy Policy	USA	Tourists' responses to a virtual reality and static picture rendering of proposed floating offshore wind turbines	On-site visitor survey	1, 4
26	Sæþórsdóttir et al. (2018)	International Journal of Sustainable Energy	Iceland	Tourists' attitudes toward a proposed onshore wind farm	On-site questionnaire survey	1, 4
27	Klain et al. (2018)	Ecological Economics	New Zealand	Predictive power of the psychometric risk paradigm while assessing perceived risks on ecosystem services by a hypothetical offshore wind farm among various stakeholders, including tourism	semi-structured interviews using animated seascape visualisation of the hypothetical wind farm	1, 4
28	Sæþórsdóttir & Hall (2018)	Sustainability	Iceland	Impacts of an existing hydropower plant on tourist experience and perceptions, main variables affecting these perceptions and comparison with the areas where hydropower plants have been proposed but are not yet built.	On-site questionnaire survey	1, 4
29	Frantál & Urbánková (2017)	Current Issues in Tourism	Czech Republic	Conceptualising the interrelationships between energy and tourism, energy infrastructure as a tourist attraction (coal safari, nuclear power plant's information centre, kite festival under wind turbines)	On-site visitor questionnaire survey	1, 3, 4
30	Frantál et al. (2017)	Moravian Geographical Reports	Iceland	Factors shaping attitudes of tourists toward a proposed onshore wind farm	A field trip with observations and note-taking; mental mapping; a questionnaire survey	1, 4
31	Fooks et al. (2017)	Agricultural and Resource Economics Review	USA	Tourists' willingness to pay for hotel rooms with and without the views of an existing onshore wind turbine	A within-subject field experiment offering tourists the opportunity to purchase a lottery for a weekend stay at one of several hotels	1, 2, 4

32	Rizzo (2017)	Sustainable Cities and Society	Malta	Managing the possible conflicts between landscape protection and renewable energy implementation (offshore wind and solar PV) in a country relying on tourism	Unstructured interviews with government stakeholders, analysis of official policy documents and web material	5
33	Voltaire et al. (2017)	Marine Policy	Spain	Potential welfare impact on beach recreation demand due to construction of hypothetical offshore wind turbines	On-site visitor questionnaire survey, which includes travel cost and contingent behaviour methods	1, 2, 4
34	Silva & Delicado (2017)	Moravian Geographical Reports	Portugal	Residents' and visitors' perceptions of existing onshore wind farms and their effect on destination choice	Semi-structured interviews	1, 4
35	Liu et al. (2016)	Journal of Sustainable Tourism	China	Governmental initiatives on wind farms and tourism development, domestic tourist perceptions of wind farms as a form of energy tourism	Analysis of tourist postings on google.com and baidu.com	1, 3, 4
36	Sæþórsdóttir & Saarinen (2016)	Polar Record	Iceland	Solving conflicts related to development of tourism and renewable energy harnessing in natural areas	Review of various reports and questionnaire surveys	4, 5
37	Sæþórsdóttir & Saarinen (2016)	Scandinavian Journal of Hospitality and Tourism	Iceland	Tourist perceptions of wilderness areas and acceptance of REI in these areas	Semi-structured interviews	1, 4
38	Westerberg et al. (2015)	Energy Research and Social Science	France	Factors affecting tourist attitudes toward the siting of hypothetical offshore wind turbines	On-site questionnaire survey, which includes choice experiment	1, 2, 4
39	Veidemane & Nikodemus (2015)	Journal of Environmental Planning and Management	Latvia	Attitudes of residents and tourists toward hypothetical offshore wind turbines	Questionnaire survey, residents surveyed at home, tourists at the beach, in parking lots and at their accommodations	1, 2, 4
40	de Sousa & Kastenholz (2015)	Journal of Sustainable Tourism	Portugal	Visitors' and residents' attitudes toward existing onshore wind farms and perceptions of their impacts on tourism in a historic village	Semi-structured on-site interviews	1, 4

41	Broekel & Alfken (2015)	Energy Policy	Germany	Relation between existing onshore wind turbines and tourist accommodation occupancy rates	Analysis of data on wind turbines and tourist arrivals, available beds, accommodation facilities, and number of inhabitants for German municipalities	2, 4
42	Michel et al. (2015)	Mountain Research and Development	Switzerland	Residents' and tourists' perceptions of photovoltaic installations on avalanche barriers	Questionnaire survey of tourists in accommodation and on paths, of residents in this and neighbouring municipalities	1, 4
43	Rudolph (2014)	Scottish Geographical Journal	UK, Germany	The reasoning used by opponents of offshore wind turbines regarding tourism	Review of documents and consultation responses, interviews with experts	1, 4
44	Voke et al. (2013)	Ocean and Coastal Management	UK	Coastal users' opinion of proposed tidal and wave devices, and non-use values of a marine habitat	On-site user questionnaire survey which includes the travel cost and the contingent valuation methods	1, 2, 4
45	Westerberg et al. (2013)	Tourism Management	France	Tourists' attitudes toward hypothetical offshore wind turbines at different distances, factors affecting them	On-site questionnaire survey, which included choice experiment	1, 2, 4
46	Sæþórsdóttir (2012)	Tourism Planning and Development	Iceland	Approaching land use conflicts between tourism and power plant development in natural areas	Delphi method using systems approach	4, 5
47	Rodriguez (2012)	Journal of Alpine Research	France, Spain	The relationships between hydropower landscapes and mountain tourism	Not specified	3, 5
48	Landry et al. (2012)	Resource and Energy Economics	USA	Assessing the impacts of hypothetical offshore wind turbines on local coastal tourism and recreation using stated preference nonmarket valuation methods	A combination of telephone and web survey, which included travel cost models and revealed and stated preference methods	1, 2, 4

49	Vega & Alpizar (2011)	Impact Assessment and Project Appraisal	Costa Rica	Assessing potential impacts of a hydropower plant under construction on a tourist centre due to water reduction	On-site visitor questionnaire survey, which included choice experiments	1, 2, 4
50	Frantál & Kunc (2011)	Annals of Tourism Research	Czech Republic	Impacts of an existing and a proposed wind farm on tourist experience and their tourist attraction potential	On-site visitor questionnaire survey, semi-structured interviews with tourism entrepreneurs	1, 3, 4
51	Riddington et al. (2010)	International Journal of Tourism Research	UK	Economic impacts of existing and proposed onshore wind farms on tourism	A GIS model to estimate how many tourists would be exposed to the wind farms, an intercept survey on likelihood to return, and an online survey on willingness to pay for the scenery	1, 2
52	Warren & McFadyen (2010)	Land Use Policy	UK	Residents' and tourists' perceptions of impacts of onshore windfarms on landscapes and seascapes	A questionnaire survey, semi-structured interviews	1, 4
53	Lilley et al. (2010)	Energies	USA	The effects of hypothetical offshore wind turbines on tourist behaviour and local tourism	On-site visitor questionnaire survey which included contingent behaviour method	1, 3, 4
54	Sæþórsdóttir & Ólafsson (2010)	Journal of Heritage Tourism	Iceland	A methodological framework developed to evaluate the value of nature tourism destinations where renewable energy projects have been proposed	Defining spatial boundaries, determining scale on the score card, defining attributes, their categories, sub-categories, and relative importance, calculating scores, ranking according to value	5
55	Sæþórsdóttir & Ólafsson (2010)	Journal of Heritage Tourism	Iceland	A methodology developed to evaluate the impacts of the proposed renewable energy projects on tourism and recreation and to rank the projects according to their impacts	Defining spatial boundaries of construction regions and impact regions, determining the effect of REI on attributes and re-evaluating the affected tourism regions,	5

					calculating the impact coefficient, ranking based on impacts	
56	Sæþórsdóttir (2010)	Scandinavian Journal of Hospitality and Tourism	Iceland	Wilderness tourism, wilderness experiences of tourists and potential conflicts between wilderness tourism and REI	On-site visitor questionnaire survey, semi-structured interviews, diaries	1, 4
57	Dalton et al. (2008)	Renewable Energy	Australia	Tourist attitudes toward hypothetical solar PV and wind energy conversion systems in tourist accommodation	On-site questionnaire survey	1, 4
58	Dalton et al. (2007)	Renewable Energy	Australia	Tourist accommodation operators' perceptions of renewable energy sources	Questionnaire survey sent by post or by email	1, 4
59	Hynes & Hanley (2006)	Land Use Policy	Ireland	The nonmarket benefits from the preservation of natural river conditions where the development of hydropower plants is considered	An on-site and online questionnaire survey among whitewater kayakers, which included travel cost method	1, 2
60	Teigland (1999)	Impact Assessment and Project Appraisal	Norway	Short- and long-term effects of hydropower and road developments on tourism and recreation	Questionnaire surveys, road surveys, interviews (longitudinal study)	1, 4
61	Hanley & Nevin (1999)	Energy Policy	UK	Estimating economic impacts of the development of onshore wind, hydro- and biomass power plants	Local economic impact study among visitors, contingent valuation study among residents	1, 2, 4

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Paper II



Article

Renewable Energy in Wilderness Landscapes: Visitors' Perspectives

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Abstract: Increasing the share of renewable energy in the energy mix is of crucial importance for climate change mitigation. However, as renewable energy development often changes the visual appearance of landscapes and might affect other industries relying on them, such as nature-based tourism, it therefore requires careful planning. This is especially true in Iceland, a country rich in renewable energy resources and a popular nature-based tourism destination. The present study investigated the potential impacts on tourism of the proposed Hverfisfljót hydropower plant by identifying the main attractions of the area as well as by analyzing visitors' perceptions, preferences and attitudes, and the place meanings they assign to the landscape of the area. The data for the study were collected using onsite questionnaire surveys, interviews with visitors to the area, open-ended diaries, and participant observation. The results reveal that the area of the proposed power plant is perceived as wilderness by its visitors, who seek environmental settings related to the components of a wilderness experience. Visitors were highly satisfied with the present settings and preferred to protect the area from development to ensure the provision of currently available recreational opportunities. The results further show that the proposed Hverfisfljót hydropower plant would reduce the attractiveness of the area to its visitors, degrade their wilderness experience, and therefore strongly reduce their interest in visiting the area. Moreover, the participants perceived the already developed lowlands of the country as more suitable for renewable energy development than the undeveloped highland areas, which is in line with the principles of smart practices for renewable energy development.

Keywords: renewable energy; energy infrastructure; nature-based tourism; visual impacts; wilderness; visitor

1. Introduction

The importance of renewable energy (RE) production is increasing worldwide in light of the continuing growth in demand for electricity and, simultaneously, the need to mitigate climate change. Ensuring access to reliable sustainable energy by increasing the share of renewable energy worldwide, among other actions, is listed as goal 7 of the 17 Sustainable Development Goals set in the United Nations 2030 Agenda for Sustainable Development [1]. Among renewable energy sources, hydropower currently constitutes the largest part: 15.8% of all electricity produced worldwide in 2018 came from hydropower, which is more than from all other renewable energy sources combined [2]. Although hydropower is currently expanding at a slower pace compared to solar photovoltaic and wind power [3], hydropower capacity is still increasing [4]. It most likely will remain an important component of

the renewable energy mix due to its ability to quickly change the amount of electricity supplied and complement intermittent renewable energy sources such as wind and solar energy [5–7]. According to the International Hydropower Association (IHA) [8], the global median greenhouse gas emission intensity of hydropower reservoirs is around 18.5 gCO₂ –eq/kWh, which is significantly lower than that of coal (820 gCO₂ –eq/kWh) or gas (490 gCO₂ –eq/kWh) [9]. The IHA [8] emphasizes that run-of-river hydropower projects have even lower emissions. Thus, hydropower production is a feasible and important solution for climate change mitigation. However, many studies [10,11] have pointed out various negative environmental impacts of hydropower plants, which should be taken into consideration when planning energy production.

While the environmental impacts of small-scale in-stream hydro-turbines are considered to be relatively small [12], numerous researchers [3,13,14] have pointed out that hydropower plants containing dams might result in numerous and diverse negative impacts on the surrounding environment. Moreover, beyond hydropower infrastructure that comprises dams, reservoirs, canals, and power stations, hydropower plant projects generally include the development of new roads for the construction and maintenance of a power plant as well as the building of new transmission lines, which also have been shown to have various environmental and social impacts, such as habitat fragmentation, loss of valued landscapes, and increased visitation due to improved access [15]. Therefore, hydropower infrastructure development affects other industries that rely on landscapes as a resource, such as nature-based tourism, which might lead to land use conflicts between the two industries. This is especially relevant in wilderness areas and pristine nature, since people choosing such areas for recreation often prefer a minimal amount of infrastructure and a low level of use [16,17].

Iceland is a popular nature-based tourism destination and a country rich in renewable resources. In 2018, a total of 69.66% of all electricity produced in Iceland derived from hydropower, 30.31% came from geothermal plants, and 0.02% of electricity was produced from wind [18]. With the aim of ensuring that sustainable energy development considers the interests of various stakeholders, in 1999 the Icelandic government designed a “Master Plan for Nature Protection and Energy Utilization”. It evaluated proposed energy development options and categorized them into energy utilization or protection categories [19]. Some proposed options lacking the data necessary for decision-making were put into an “on hold” category, requiring further research. The present study was one portion of the research conducted for the “Master Plan”, and it aimed to assess the potential impacts on tourism and recreation of the proposed Hverfisfljót hydropower plant, whose categorization required further research [20]. The proposed hydropower plant would be located in southern Iceland in a highland area characterized by limited accessibility and accordingly very low recreational use.

The objective of this paper was to evaluate the potential impacts of the proposed Hverfisfljót hydropower plant on the tourist experience. This was accomplished (I) by identifying the main attractions of the area to its visitors and (II) by investigating visitor perceptions, preferences, and attitudes toward renewable energy and other infrastructure development in the area of the proposed power plant. Furthermore, by using a phenomenological approach originating from Husserl [21], the study examined what meanings visitors assign to the landscapes of the study area and the compatibility of these meanings with renewable energy development.

2. Landscape: A Place Created in a Visitor's Mind

Pereira and Long [22] emphasized that when analyzing the relationships between people and spaces, both physical and symbolic aspects have to be taken into consideration. While physical spaces refer to landscapes, symbolic spaces describe the image of a landscape created in a person's mind [23]. Furthermore, as has been pointed out by numerous authors [24–26], it is the meaning ascribed by people to a certain space that transforms it into a place. By visiting, experiencing, and getting to know landscapes, people ascribe certain values to them, thereby transforming their understanding of a location into one of place, a meaning-based concept [27]. Emotional relationships with a place are created by experiences that make the place meaningful [28,29]. According to Cheng, Kruger,

and Daniels [30] (p. 89), “Place meanings encompass instrumental or utilitarian values as well as intangible values such as belonging, attachment, beauty, and spirituality. This definition explicitly acknowledges the subjectivity of people’s encounters with places.” Thus, due to the multifaceted and complex nature of meanings created during the person–space–place interaction, one space can contain multiple places, i.e., it can have different meanings for different people [27,31]. For example, the same undeveloped natural area will be perceived as different places by park managers, local communities, and tourists [32]. Moreover, place meanings might also differ on an individual level [33].

Favorable place meanings assigned to a certain place can contribute to a stronger bond between the person and the place [27]. According to Eisenhauer [34], particularly strong person–place bonds are created while people engage in recreational activities. These bonds can deeply affect people’s attitudes regarding issues related to these places and can even affect their behavior [35]. This might lead to a higher willingness to protect an area from environmental change in order to preserve its value [36,37]. Therefore, the concept of place meanings has been proposed by various researchers [30,34,38] as a tool to be included in the management of natural resources, since it allows for the consideration of stakeholders’ attitudes and preferences in decision-making and helps avoid treating landscapes as a commodity [38]. Moreover, such inclusion allows for acknowledgment of the complexity of landscapes and their connections with humans [30]. Landscape, according to Greider and Garkovich [32] (p. 1), can be defined as “the symbolic environment created by a human act of conferring meaning on nature and the environment”. The European Landscape Convention [39] (p. 2) also includes the aspect of human perception in the definition of landscape: “Landscape means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.” Thus, landscapes strongly relate to the definition of place [30].

When discussing the person–place relationship using the approach of social constructs, Stedman [27] emphasized the importance of the effects that landscape characteristics have on people’s place attachment and satisfaction and stressed that changes in the physical environment will most likely affect the person–place interaction and change the meanings a person ascribes to a place. Kühne [40] emphasized the role of aesthetic interpretation in the social construction of landscape, which was in line with previous research [41–45] concluding that visual impacts of renewable energy infrastructure play a crucial role in their public acceptability. For such infrastructure to be socially acceptable, it has to positively fit the landscape type and the identity of the place [46,47]. Thus, visual changes brought to a natural landscape by renewable energy development are likely to affect visitors’ experience, although the scale and character of the effects will depend on the meanings the visitors assign to a certain landscape.

Studies have shown that tourists perceive energy landscapes in different ways. While some visitors tend to avoid the areas where energy infrastructure is built, to others such infrastructure seems to become an attraction [48–50]. Frantál and Urbánková [51] described the interrelationships between tourism and energy from three perspectives. First, energy development can constrain nature-based tourism due to visual impacts and landscape degradation. Second, energy landscapes can become tourist attractions in their own right. Lastly, tourism relies on an energy supply for its operations and is a significant energy consumer and contributor to CO₂ emissions. Whether an encounter between a tourist and energy infrastructure in a nature destination will be positive or negative depends, among other factors, on the meanings people assign to the landscape and the perceived suitability of energy infrastructure. Gailing and Leibenath [52] showed that people supporting renewable energy development in a natural area perceive it as part of the cultural landscape. Accordingly, they view the use of the area to harness energy as a significant contribution to climate change mitigation. On the other hand, the opponents of energy infrastructure development perceive the same landscape as a home to a wide range of species providing various recreation opportunities that should be protected. Thus, on the basis of their beliefs and values, people create a social construct of a natural area that shapes their attitudes toward energy development.

The conflicts between tourism and renewable energy development are especially likely in wilderness areas due to certain meanings and expectations of visitors related to the concept of wilderness, such as solitude, peace, primitiveness, and a lack of human intervention [16,53,54]. Numerous studies focusing on nature-based tourism in the central highlands of Iceland have shown that a wilderness experience is one of the main attractions of the area [17,55–58]. Consequently, highland visitors state that energy infrastructure would make the area less attractive as a tourist destination and reduce the quality of their experience [16,57]. Interestingly, a study conducted at the edge of the central highlands with an existing hydropower plant revealed that visitors were more positive toward renewable energy infrastructure compared to visitors to other highland areas where hydropower plants had been proposed but not yet built [59]. This supports the notion of the landscape as a social construct and a place intertwined with meanings: in an area perceived as wilderness, support for energy infrastructure was much lower compared to an already developed area. Moreover, this confirms that visual landscape alterations lead to changes in meanings ascribed to the landscape and to changes in visitor attitudes [27]. Therefore, before developing renewable energy infrastructure in wilderness areas, it is important to evaluate the importance of these areas for nature-based tourism and to investigate what meanings visitors ascribe to the landscapes, what expectations they have before visiting the area, how these expectations are met, and how the visitor experience would change if renewable energy infrastructure were to be constructed.

3. Research Settings

3.1. Tourism in the Highlands of Skaftárhreppur Municipality

The proposed Hverfisfljót hydropower plant is planned for the highlands of Skaftárhreppur municipality in southern Iceland (Figure 1). The municipality is the second largest in the country [60], but its population is very small. However, the population increased from 452 inhabitants in 2014 to 583 in 2019 [61]. This rapid increase was most likely related to the growth of the tourism industry in the area [62].

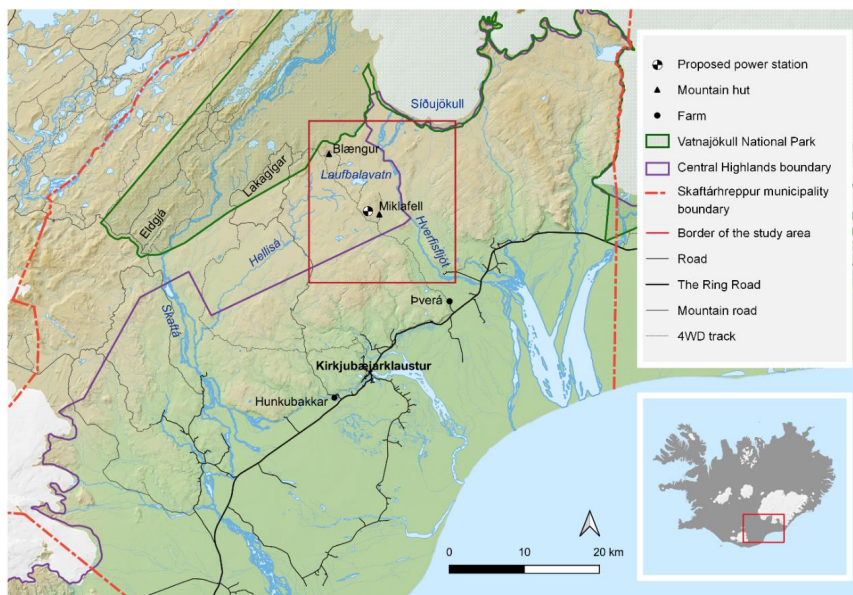


Figure 1. The location of the study area within Skaftárhreppur municipality (based on data from the National Land Survey of Iceland IS50V geodatabase).

Since Iceland's main road, also called the Ring Road, crosses Skaftárhreppur from west to east, the municipality receives a flow of tourists, most of whom travel along the Ring Road and stop at the main tourist attractions. However, only a relatively small proportion visit the highlands of the municipality. The most frequently visited locations in the municipality's highlands are the volcanic fissure of Eldgjá (around 10,600 visitors in 2017) and the volcanic craters of Laki, also known as Lakagíggar (around 8800 visitors in 2017) [63]. Both sites are located in Vatnajökull National Park, one of the largest national parks in Europe. The study area was located just outside the national park, a few kilometers east of the Laki craters (Figure 1), and it receives a much lower number of visitors than does the Laki area.

The study area included the site where the proposed power plant infrastructure (dams, reservoirs, water channels, a tunnel, and a power station) would be situated. It also included the Hverfisfljót and Hellisá rivers (which would be harnessed by the proposed power plant, since development would reduce their water volume) as well as the surrounding areas that would be directly affected by the proposed power plant infrastructure. Thus, the study area covered approximately 420 km² and reached west of the Blængur hut, continued up to the Síðujökull glacier in the north, stretched south to the Miklafell hut, and included the Hverfisfljót River in the east (Figure 1).

The study area, as well as the Laki craters, was located between the glacial rivers of Hverfisfljót in the east and Skaftá in the west, both of which are bridged only on the Ring Road. Thus, both areas have limited accessibility. To reach the Laki craters, the majority of visitors drive a mountain road that is only passable by 4WD vehicles and requires several river crossings. The western part of the study area is connected with the Laki craters by a small dirt track that passes by the Blængur and Miklafell mountain huts and reaches the Ring Road south of the Þverá farm (Figure 1). East of the river Hverfisfljót, there are no roads or dirt tracks.

The landscape of the study area was shaped by interactions between glaciers, volcanoes, and freshwater springs. Part of the study area is covered by an extensive lava field called Eldhraun, which resulted from the Laki eruption of 1783–1784, one of the biggest basaltic flood lava eruptions in Iceland's history [64]. At the edge of the Eldhraun lava field, east of Laufbalavatn Lake, an extensive system of lava tubes containing over 200 caves was created by the eruption. Since the area contains numerous freshwater sinks, water cascading into the lava tube caves can be observed in the study area [65].

3.2. Hverfisfljót Hydropower Plant

The proposed 42-MW Hverfisfljót hydropower plant is designed to harness energy from the Hverfisfljót and Hellisá rivers (Figure 2). The power station would be built underground and would be located on the southern side of the mountain Miklafell. A 3.2-km-long underground tunnel (see I in Figure 2) would be constructed for the transportation of water from the reservoirs to the power station. The proposed power plant would contain four dams: two of them would be located on the eastern and western sides of Langasker (see II in Figure 2), one would be in Laufbalavatn (see III in Figure 2), and one would be west of Miklafell (see IV in Figure 2). With the help of the four dams, three reservoirs would be created. The reservoir west of Miklafell (see V in Figure 2) would cover 8.6 km² at its highest water level and 5 km² at its lowest, the reservoir west of Laufbalavatn (see VI in Figure 2) would be 2.2 km² at its highest water level, and the reservoir north of Langasker (see VII in Figure 2) would be 11.4 km² at its highest water level and 5.5 km² at its lowest. Two water channels would connect the reservoirs, with the total length of the channels being 3.1 km. Part of the road currently crossing the area would be submerged. Thus, it would no longer be possible to access Blængur and Lakagíggar using the road. A new road is being planned from Þverá to the construction area of the proposed power plant; however, it is not yet known whether a bridge connecting the parts of the separated road would be constructed [66].

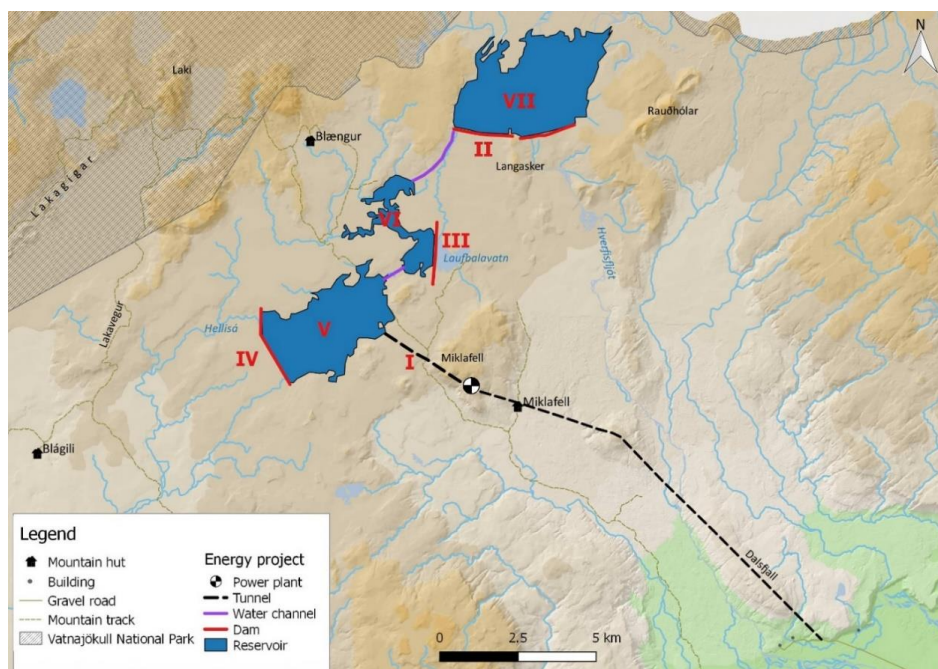


Figure 2. The proposed Hverfisfljót hydropower plant and its infrastructure [66]. Red roman numerals refer to the text describing the proposed power plant above.

4. Methods

4.1. Research Approach and Design

Research on tourism in remote and wilderness areas presents specific problems [67,68]. Although tourism is often of great economic significance in such areas, the actual number of tourists is low, and they are often highly dispersed, which makes research access to potential respondents difficult [69,70]. Therefore, mixed research methods were chosen for this study, which included a questionnaire survey, semi-structured interviews, open-ended diaries, and participant observation.

Questionnaire surveys were employed with the aim of producing representative and comparable results and identifying trends and patterns in visitor perceptions, preferences, and attitudes [71]. Questionnaire surveys were used to gather information regarding the following:

1. Visitor perceptions and satisfaction;
2. Preferences regarding infrastructure and level of use;
3. Attitudes toward the proposed hydropower plant and toward renewable energy development in general; and
4. Demographic data.

Questionnaires were available in three languages (English, Icelandic, and French), and it took 10 to 15 min on average for the participants to fill them in.

The questionnaire survey was complemented by semi-structured interviews to add explanatory power to the research as well as to obtain a deeper understanding of tourists' perceptions and the meanings they attach to certain places or objects [72]. Semi-structured interviews were selected for this study since asking a set of predetermined questions allowed for the collection of data that were comparable between different sites and cases, while asking additional probe questions based on the answers of the interviewee provided an opportunity to receive more in-depth information regarding the topic that could not have been predicted by the researcher [72,73].

The interviews included predetermined questions focusing on the following:

1. The reasons for the visit to the area and the main attractions of the area;
2. Environmental qualities that visitors are seeking during such a trip;
3. Perceptions of the area;
4. Preferred future management of the area; and
5. The potential effects of the proposed hydropower plant on the visitor experience.

Additionally, open-ended diaries kept by the participants were employed focusing on the self-reported experiences in the study area, which through introspection provided additional insight into the participants' points of view [74].

Finally, participant observation was also included since, as has been pointed out by numerous researchers [75,76], this positively contributes to the validity of research by providing a better understanding of the context and thereby facilitating data interpretation.

The present study was built on the phenomenological approach, which focuses on participants' experiences and aims to understand how individuals perceive particular phenomena, why they experience them in a certain way, and how they construct the surrounding world [77]. A mixed methods research design was chosen for this study since it is among the most suitable for such an approach [78]. While quantitative data provided information about the main trends in visitor perceptions and attitudes, qualitative interviews, open-ended diaries and participant observation allowed for the development of further insights into the ways visitors perceive and experience the area in question, the meanings they assign to the landscape of the area and to renewable energy infrastructure, their opinions regarding the suitability of renewable energy infrastructure in natural landscapes, and the factors affecting these opinions.

4.2. Data Collection

Initial observations on tourism in the study area showed that two tour operators offered organized tours in the study area in summer 2018. One offered backpacking tours and the other mountain bike tours.

Two backpacking tours were organized in the summer of 2018, the first of which took place from 1 to 5 July and the second of which took place from 2 to 6 August. The tours were five days long, and during the first two days, the participants hiked along the Hverfisfljót River. Over the next three days, the participants hiked further east. Those willing to continue the tour could hike for four more days, which the majority of the participants did. One of the authors of the present study joined the two backpacking tours. On the first day of the tours, she distributed notebooks and pencils to the participants and asked them to write down their positive/negative experiences and highlights after each day. On the second evening of the tours, after hiking through the study area with the proposed power plant, participants were asked to fill out a questionnaire, which was followed by an interview. In order to ensure that the participants understood which area was being discussed and that they had knowledge about the proposed hydropower plant, they were provided with a description of the power plant as well as a map of the study area, which presented the infrastructure of the proposed power plant (Figure 2). Since 7 participants joined the first backpacking tour and 8 participants joined the second tour, a total of 15 completed questionnaires were received, 15 interviews were conducted, and 15 diaries were collected at the end of the tours.

The biking tours were organized by a couple who owns a sheep farm located around 15 km south of the proposed Hverfisfljót hydropower plant. Their company offers day tours, multiday tours, as well as glamping (glamorous camping). One of the authors of the present study joined their mountain bike tour, and a total of four completed questionnaires were received from the participants of a tour that took place in the study area.

In order to include independent travelers to the study area in the sample and to assess the level of use of the area for recreation, visitors traveling the road connecting the Þverá farm with Laki via

Miklafell and Blængur (cf. Figure 1) were surveyed and interviewed between 27 and 29 July 2018. Four people (all Icelandic) in two cars drove the mountain track crossing the study area during these three days. All four visitors agreed to fill in the questionnaire, and two agreed to participate in an interview. Furthermore, empty questionnaires with a map, a description of the proposed Hverfisfljót hydropower plant, and a cover letter were left in the Miklafell hut with the aim of increasing the research sample. The questionnaires were available in the hut from 29 July until 5 October. During this period, nine guests (all Icelandic) filled in the questionnaires.

Thus, the total sample included 32 questionnaires, 17 interviews, and 15 open-ended diaries. On the basis of interviews with the managers of the mountain huts and the tour operators organizing tours in the area, it can be roughly estimated that 50–70 tourists visited the area in the summer of 2018. In winter, the area is more or less closed to jeeps due to snow, although some locals go there on snowmobiles. Thus, the sample included about half of all visitors to the area in 2018.

4.3. Data Analysis

A quantitative analysis of the data collected via questionnaires was conducted using descriptive statistics. Due to the small size of the sample, inferential statistics could not be used. Several questions in the questionnaire used a five-point Likert scale, with the points ranging from one to five (assigned to descriptors ranging from “strongly disagree” to “strongly agree”). During the data analysis, the proportions for each answer and the means were calculated.

The sample of the questionnaire survey consisted of 19 male (59%) and 13 (41%) female participants. The age of the participants ranged from 14 to 70 years old, with the mean age of the sample being 47.4 years. The highest proportion of the participants in the research were Icelandic (13 people); the second largest group were U.S. Americans (9 people); 3 participants came from France; and other participants were from the United Kingdom, Italy, New Zealand (2 from each country), and Australia (1).

Qualitative data were analyzed using an inductive approach [79]. The 17 semi-structured interviews were transcribed, and together with the 15 open-ended diaries, they were analyzed thematically, meaning that they were divided into segments to which codes were assigned, and a set of primary themes related to the research questions was developed. Next, the codes were grouped into related categories, and redundant codes were removed. Major and minor themes were identified, which were used as a structural frame for the data presentation. Such an analysis allows for the identification of the most important themes emerging from a dataset [71] and is suitable for investigation of the meanings assigned by individuals to various phenomena [80].

5. Results

5.1. Main Attractions of the Area to Tourists

In order to identify which characteristics of the study area were perceived as the most attractive by the visitors and therefore of the highest value for tourism, the participants were asked during the interviews what, according to them, was the main attraction of the area. Many interviewees identified the diverse landscape, which comprises spectacular features such as craters, lava fields, lava tube caves, rivers, and glaciers, as the main attraction of the area. Another important attraction mentioned by the interviewees was the wilderness, unspoiled nature, and beauty of the area. Especially attractive and impressive to the visitors seemed to be the vastness of the wilderness landscapes, which allowed for the experience of solitude. According to participant 1, who took part in one of the backpacking tours through the study area, the main attraction of the area could be described as “this depth as far as you can see around you, and you can see quite far, you cannot see anything else than nature, not any other groups, no one else”.

This vast undeveloped natural area allowed for unique experiences: “All that you can see around was untouched . . . It’s quite impressive to find a place, where you have a feeling that you are the first one to be there, and that’s quite fascinating.”

According to the interviewees, the fact that such a vast natural area unchanged by humans was located close to the European mainland added value to the area. Participants 2 and 3, a couple who joined the backpacking tour, described it as follows:

A huge area, horizon is very far, there is a variety of landscape all around, for kilometers and kilometers. And it's quite unique I would say, I don't recall such place in Europe. In continental Europe it's very difficult, there is a few left, but it's not that big, not walk for days and days without meeting anybody else and anything else. . . . And honestly, from our place it is about three and half hours' flight, so it's quite convenient.

The data collected via open-ended diaries focusing on the highlights of the visitor experience in the study area provided similar results. The diversity of the area and the uniqueness of its landscapes stood out to the visitors, as well as the powerful beauty of the Hverfisfljót River: "The amount of water here in Vatnajökull is beyond belief. Streams abound with busy flows that quickly become rivers. The highlight however was the waterfalls. I could stand and watch for hours."

The characteristics of the area, which allow for a wilderness experience, also came up frequently in the open-ended diaries. According to participant 4, the remoteness of the area was the feature that made the study area stand out from other Icelandic nature destinations, since it provides the opportunity to enjoy the beauty of nature in solitude or in a small group of likeminded people:

Remoteness. I am grateful that places exist where it is possible to go and lose yourself. After enjoying the beautiful scenery of Laugavegur it was a pleasant change to walk all today and not see another person other than from your group. The remoteness provides a serenity matched in few places in the world which also have so much raw beauty.

The possibility to escape the crowds and to experience solitude was mentioned also by numerous other participants as one of the highlights of their trip: "The sudden change from the crowded highway with all sorts of people enjoying all sorts of activities . . . To the beauty of solitude."

These results were supported by the answers to the open-ended questions asked in the questionnaire survey: "What fascinates you in the area?" (Table 1). The highest proportion of the respondents (32%) were fascinated by the wilderness and unspoiled nature of the area, with the same proportion being fascinated by the views. Other fascinating aspects included beautiful nature and the landscape, geology, and diversity of the area, as well as the Hverfisfljót River and its waterfalls. Since some of the respondents mentioned more than one aspect, the sum of the percentages was higher than 100%.

Table 1. Characteristics of the study area perceived as most fascinating by the visitors and reasons for visiting the area.

Most Fascinating Characteristics of the Area	%	Reasons for Visiting the Area	%
Unspoiled nature/wilderness	32.3	Hiking/trekking/backpacking	28.1
Views	32.3	Nature	25.0
Beautiful nature/landscape	29.0	Mountain biking	18.8
Geology	29.0	Caving	18.8
Diversity	22.6	The waterfalls of Hverfisfljót	12.5
Hverfisfljót and its waterfalls	22.6	Experiencing wilderness	9.4
Unique nature	16.1	Volcanic landscape	9.4
Peace	12.9	Challenge	9.4

The diverse landscape of the area provides a wide range of opportunities for recreational activities for visitors (Table 1). The answers of the questionnaire survey to the open-ended question "Did you come to do/see/visit anything in particular in the area?" showed that 28% of the study participants came for hiking, trekking, or backpacking, while around 19% came for mountain biking and the same

proportion for caving. Seeing the nature of the area (25%) and the waterfalls of Hverfisfljót (13%) were also mentioned among the reasons for visiting. A smaller proportion of the respondents (over 9% for each category) stated that they came to the area to experience wilderness, to see volcanic landscapes, or to challenge themselves.

5.2. Visitor Perceptions of the Study Area

In order to investigate how respondents perceive the study area, the questionnaire contained a multiple-item question for which a five-point Likert scale with opposing characteristics was used. The vast majority (over 93%) of respondents perceived the area around the river of Hverfisfljót as very quiet and natural (Figure 3), almost 87% found the area very impressive, and around 84% thought that the area was very beautiful. The opinions of the participants differed strongly when asked about the accessibility of the area: while over 53% found the area somewhat or very accessible, almost 37% perceived the area as very or somewhat inaccessible.

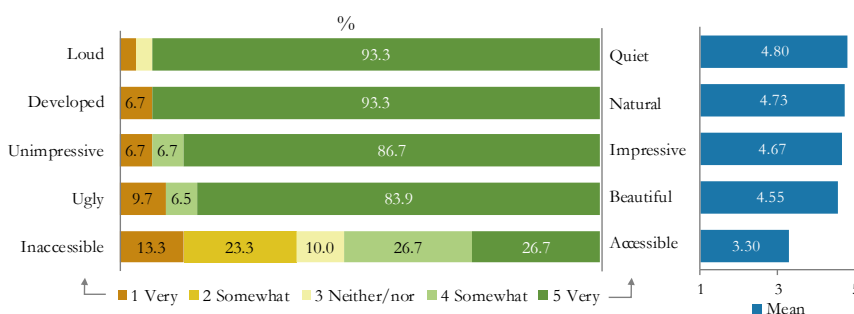


Figure 3. Visitor perceptions of the area.

Deeper insights regarding preconceived images of the study area were provided by an analysis of visitor expectations and environmental settings that participants were seeking on their trip. Several aspects were mentioned during the interviews. One of the environmental qualities that the participants were seeking in the area was natural beauty and landscapes that were not degraded by any construction or other human impacts. According to participant 4, on a trip like this, he seeks an environment that could be described as “natural, raw . . . ” The interviewee further added: “So yesterday, I would describe yesterday in my journal as raw beauty, it’s very natural, it’s very rugged, it’s very earthy, and that interests me.” Not seeing any human impacts seemed to be important to the interviewees. Participant 5 stated that she seeks “no human impacts, or maybe there is, but I cannot see it . . . ” This answer is in line with the opinion of participant 1: “I would say the top would be if there is no trace of human activity at all . . . ”

People also chose recreation in the study area to escape everyday life by immersing themselves in nature and disconnecting from work, daily life, and phone services. This seemed to be the case for participant 6, who chose the backpacking tour through the area “because I was looking for some sort of hike to get away from my daily routine and to meet new people in somewhere that’s natural with things to see.” Peace and quiet were also identified by numerous interviewees as important qualities for their experience while visiting the area.

Some of the visitors came to the area looking for a challenge. Participant 7 stated that he chose the backpacking tour through the area “because I am always looking for new challenges and last year I have done a challenge in the heat, so this year I wanted to do cold”. A similar answer was provided by participant 8: “I think the trip itself, it was getting out into untouched land, from what the itinerary told me it was just going to be something not everyone could do, you have to be a little bit athletically fit . . . ” Participants 9 and 10 noted that “it was the most challenging trek we could find that was extended, that was more than a day or two . . . ”

The opportunity to experience solitude was also identified as an important reason for visiting the area. Participant 1 explained: “I was looking for a trek where I would be out of the world basically ... the idea was to be alone, not to see other tourists or other people than just you and connecting with nature.” Escaping the crowds was significant for participant 8, who described his preferred recreation environment as “untouched by man, not a lot of crowds, I think that’s one thing for me, (...) when you start getting large tour groups, it’s such a turn off”.

Seeking a spiritual experience in natural wilderness landscapes also came up during the interviews. Participant 11 explained, “My interest was to be in 100% nature where you can immerse yourself in it completely, where there is no infrastructure, no access for tourists or any commodification.”

The results of the questionnaire survey revealed very high satisfaction among visitors. Over 90% of the respondents stated that they were very satisfied with the nature in the area (Figure 4), and more than 81% answered that they were very satisfied with their stay in the area. This confirmed that the study area currently provides the environmental qualities visitors are seeking and meets their expectations.

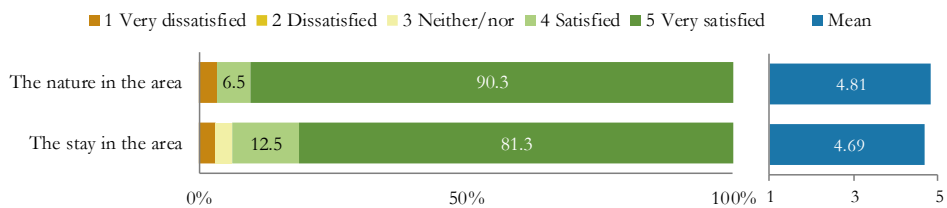


Figure 4. Visitor satisfaction with the stay and the natural environment.

5.3. Wilderness as Defined by Visitors

Since the majority of the participants perceived the study area as wilderness and identified wilderness as an aspect that they were seeking on their trip, during the interviews they were asked what characterizes a wilderness in their minds. One of the main aspects necessary for a wilderness experience, according to the interviewees, is the perceived absence of human intervention and human impacts: “no manmade structures”, “no trash left by others, no trace left behind”. The interviewees emphasized that this lack of signs of human activity creates the feeling for participants that they are “the first person to see all this”, which is a special experience to them since wilderness areas are becoming scarce and harder to find close to home: “Where we came from, it is hard to find wilderness areas that don’t have anything in there.”

Some interviewees, however, pointed out that certain types of human structures would be acceptable in a wilderness area, but it is important to manage infrastructure development in order to ensure that the wilderness experience in the area is not spoiled. As stated by participant 9, the wilderness can be described as “natural beauty, unspoiled, undeveloped. ... No buildings, no power lines. Mountain huts are ok. But don’t lead to overdevelopment of the area, that’s the risk. You put a mountain hut there, and suddenly everybody will go there.” Thus, a lack of infrastructure was seen also as a tool to control visitor flows in the area and to ensure low levels of use, which also was identified by the interviewees as essential for unique experiences that visitors are seeking in wilderness areas: “Being able to do a trek or a backpacking trip and get away from the crowds is an experience that just a few take but it’s wonderful.”

Remoteness is another important characteristic of wilderness that was pointed out by the interviewees. Some related it to a challenge: “hard to get to, hard to travel through, and requiring effort”. For others, remoteness provides an opportunity to enter a totally different world away from their daily life and even from those people closest to them: “You come from civilization as a whole, can’t even get a signal in your phones, communicate with your loved ones, it’s just a completely different thing, something for us to experience, something not many people are going to experience.”

Hence, remoteness and the low accessibility of wilderness areas allow visitors to escape a routine and to disconnect from daily demands and worries in a totally different environment. As pointed out by participant 12, a reliance on natural resources and the use of them during the trip also enriched the wilderness experience by contributing to the feeling that civilization was left far behind: “I am sitting, I am trying to find comfort on a rock, I am using hot springs to get clean, or I am drinking water from a spring . . . everything I am doing is outdoors.” Participant 13 summarized wilderness as “the absence of human intervention, infrastructure or impact”, which was supported by the answers of other interviewees. Wilderness was seen by the interviewees as an opposite to civilization, human activity, and the impacts related to it.

The answers of the interviewees regarding built structures that would be acceptable in a wilderness area were in line with the results of the questionnaire survey, where participants were asked what type of infrastructure may be present in the area for it to be considered wilderness. Over half of the respondents of the survey stated that no built structures should be present in a wilderness area (Figure 5). However, 78% of the respondents perceived trails made by hikers and animals as suitable in wilderness areas, and almost 63% thought that mountain huts would not spoil a wilderness experience. Fences and tracks made by vehicles were perceived as acceptable by less than half of the respondents. None of the respondents identified power plants as suitable infrastructure in wilderness areas, and other not acceptable types of infrastructure included hotels, reservoirs, roads, power lines, radio masts, and wind turbines.

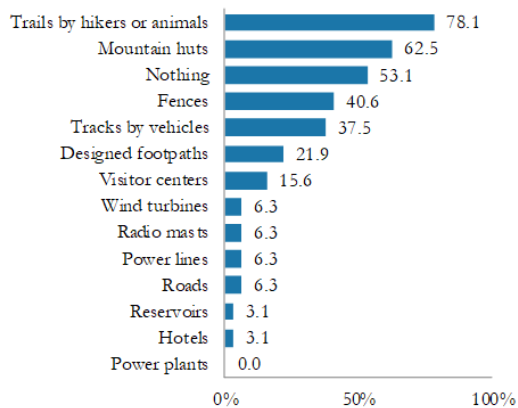


Figure 5. Attributes that may be present in a wilderness.

Respondents’ opinions regarding the effects of the built structures that they knew of, but could not see, on their wilderness experience were nonhomogeneous (Figure 6). While around 45% of the participants stated that their wilderness experience would be strongly affected by the infrastructure they knew of, but could not see, 32% said that their wilderness experience would be little or not at all affected by such infrastructure. Around 23% of the participants would be affected to some extent.

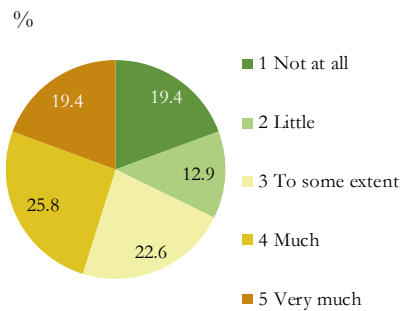


Figure 6. The extent of the effects of nearby structures visitors knew of, but could not see, on their wilderness experience.

5.4. Visitor Attitudes toward Built Structures in the Area

The answers to the question focusing on the suitability of various built structures in the study area revealed that most types of infrastructure were perceived by the visitors as not appropriate (Figure 7). While gravel roads, mountain huts, campsites, and toilets had higher acceptability among the participants of the questionnaire survey, the vast majority of the participants (94%) perceived hotels as inappropriate, and almost 88% of the respondents stated that shops and restaurants were inappropriate. Other human-made structures perceived as not suitable in the area included wind turbines, radio masts, power lines, hydropower plants, gas stations, geothermal power plants, reservoirs, service facilities selling cooked food, and asphalt roads.

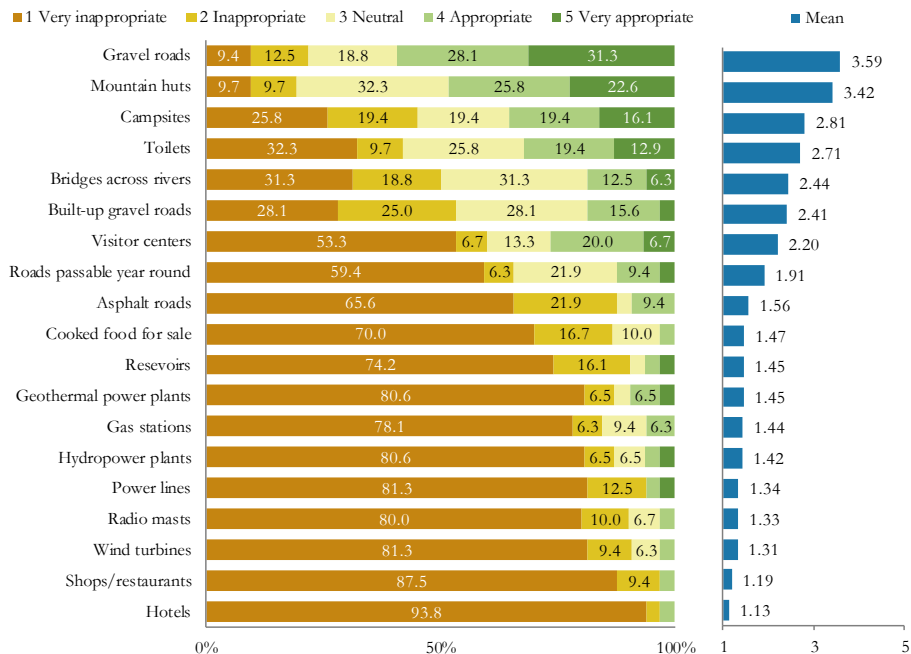


Figure 7. Visitor opinions on appropriate infrastructure and services in the area.

An analysis of the interviews revealed several reasons for the perceived low suitability of infrastructure in the study area. The reason mentioned the most was that visitors coming to the area seek natural settings. Participant 1 stated the following:

For the trek I am doing right now I wouldn't add anything, because it is really that you are bringing your own equipment, that was kind of things I was looking for . . . so I wouldn't do anything else. Could there be some infrastructure for some other kind of activities? Why not, but this part should be preserved so that we can continue to have such trek not seeing any impacts, that could be visible in another region. I think it's quite rare to find such place in a European country.

This was supported by many, for example, by participant 3, who emphasized the importance of keeping certain wilderness areas undeveloped in order to provide recreation opportunities for the most purist visitors: "There are plenty of other options on the planet already, there are far less options for people looking for no structures than for kept trails, I wouldn't feel guilty [if the area would remain undeveloped]." The same interviewee added, "I think the wild areas like this one are fewer and fewer on the planet. So, it is precious to preserve them." As pointed out by participant 11, the component of challenge would be lost if infrastructure such as bridges were built in the area: "I prefer to wade a river rather than to walk across a bridge." Participant 14 emphasized that even the areas with currently low levels of use should be protected from development due to their intrinsic value: "I would leave it as it is, definitely leave it, because I think we need sort of wilderness even if nobody experiences it, I think we need it anyway."

Some of the interviewees were positive toward infrastructure, but on a low scale. Various reasons for this support were mentioned by the interviewees. First, tourist infrastructure would help reduce the negative environmental impacts of visitors if the level of recreational use in the area increased: "A mountain hut and a toilet would reduce the impact of people, so that would be a thing." Second, tourist infrastructure would increase the level of comfort, which might be relevant especially during bad weather. As participant 4 stated on a rainy and chilly evening during the backpacking tour: "I think I would rather stay in a mountain hut tonight." A few pointed out that increased infrastructure would enable people who are not able or not willing to participate in multiday backpacking tours to visit the area: "A lot of those people would love to come here, but they can't because they don't want to camp or can't camp or they can't hike a trail or can't read a map, and that shouldn't be denied."

However, even the interviewees supporting the development of some primitive tourist infrastructure in the area were very aware that such infrastructure might have negative effects on a wilderness experience and therefore should be planned very carefully. Participant 2 emphasized the following:

They need to keep in mind the wilderness and make it a blend, so that they don't disrupt the beauty and the wilderness that's here, but certainly if you bring more people in, you do have to think about toilets, you need to think about huts and those type of things, but making sure that it's used correctly, and the people are mindful of how they utilize the system so that the beauty remains and is not destroyed. In the U.S. they allowed it to happen and then had to fix it. It would be nice to do it correctly from the beginning, then you don't have problems that arise from too many people coming into an area.

The interviewees also pointed out that Icelandic ecosystems are very fragile, and a lot of time is needed for them to recover from any human damage; therefore, it is of high importance to protect natural areas from overdevelopment and overcrowding and from exceeding their carrying capacity:

If you develop this up, then you are going to run a risk of damaging. This environment does not repair itself. Nothing grows here, so I would say you don't want any infrastructure in this environment here. If you put in trails someone will say: if you have a trail it will help to preserve the environment, people just wouldn't wander all over the place, but trails will have more people, right now you don't have a lot of people coming through here.

5.5. Visitor Attitudes toward Renewable Energy Infrastructure

One of the questions in the questionnaire was about the suitability of renewable energy infrastructure in the central highlands of Iceland compared to the lowlands. The respondents viewed all energy development as more positive in the Icelandic lowlands compared to the highlands (Figure 8). The attitudes of the participants were the most negative toward the further construction of power lines and reservoirs in the central highlands and slightly less negative toward the development of geothermal and hydropower plants as well as the construction of wind farms in the highlands. Although energy development was perceived as more positive in the Icelandic lowlands, the acceptability of such projects was still relatively low: 72% of respondents stated that their attitudes toward the further construction of power lines in the lowlands were very or somewhat negative, 66% had negative attitudes toward reservoirs in the lowlands, and 56% had negative attitudes toward further hydropower development in the lowlands of the country. The attitudes were less negative about the further development of geothermal power plants in the lowland areas and the least negative about wind farms in the lowlands.

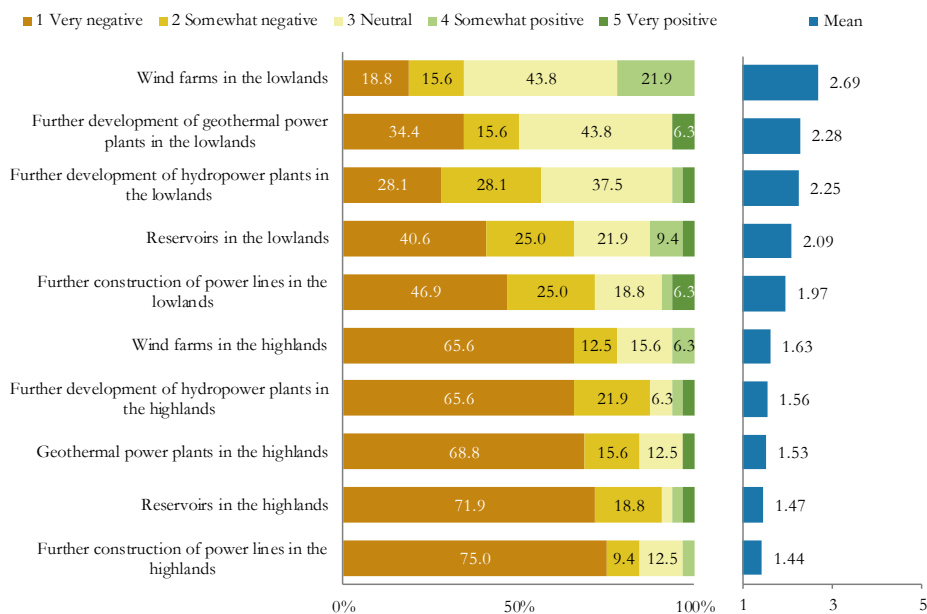


Figure 8. Visitors' attitudes toward further power infrastructure development.

The participants were asked how infrastructure related to the proposed Hverfisfljót hydropower plant would affect their interest in visiting the area. Over 90% of the respondents stated that all the infrastructure accompanying the proposed power plant would strongly or somewhat reduce their interest in visiting the area (Figure 9). The infrastructure with the highest negative effects included dams, power lines, and canals, followed by power stations and reduced water flow in rivers and reservoirs.

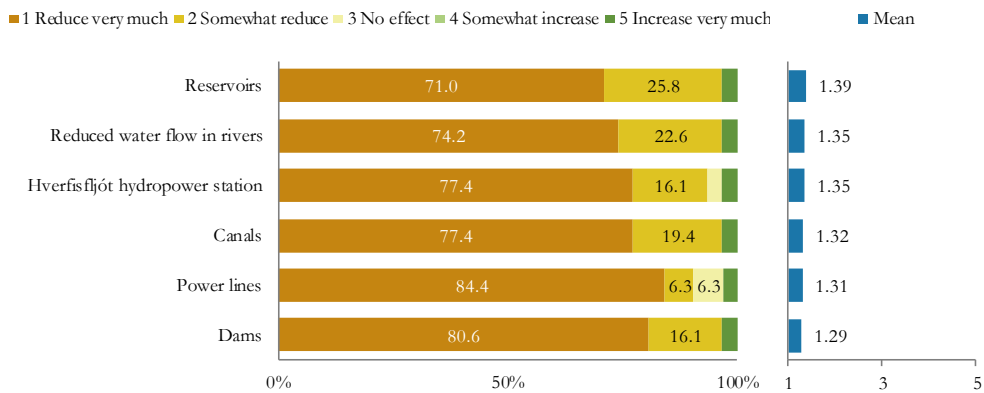


Figure 9. The impact of the Hverfisfljót power plant's infrastructure on visitors' interest in visiting the area.

An analysis of the interviews revealed that the proposed Hverfisfljót hydropower plant would ruin the interviewees' experience in the area by impacting the surrounding landscapes:

At the moment it is untouched, the only thing we see is our own footprints and they go with the rain after a couple of days. So, you would be walking through such an unspoiled place to find a big dam, powerlines coming from it, it would absolutely ruin it.

Moreover, as pointed out by participant 11, the negative environmental impacts of such a power plant might be higher than expected since building a power plant would start a chain of changes in the surrounding ecosystems:

I think that this project would be destructive to the nature. The problem with a project like this is that we don't think about the long-term consequences, about the infrastructure, and the effects on the natural evolution of the lake and how everything is connected, all the ecosystems are connected. If you affect one, it will have an impact on another. ... It is all interconnected in the long term, and it is important to resist the outsiders' financial powers that push for investments in projects like that.

According to the interviewees, such unspoiled wilderness areas, which are becoming scarcer worldwide, should be preserved and protected from energy development:

I'm not from here, I just think, if you have a little bit of nature, save it as best as you can, ... but I understand if people have to work and have a living, but nature is just so, they are not building any more of it. I would just hate for the nature you guys already have, the environment, to get smaller, to be ruined.

Therefore, renewable energy infrastructure should be built in already developed areas of lower environmental value:

For me from what I saw yesterday, there must be other places that are already built up that could have a power plant near the city or some of the smaller villages, but when it's a whole natural area with nothing in it, I don't think there is any need to build.

The interviewees, however, emphasized that their opinions on the topic were very subjective since they lacked knowledge about the needs of local communities and the potential benefits of such power plant projects:

If you ask us as tourists, we definitely say we don't want to have the plant, we don't want to have the dams, we don't want to have the reservoirs, but we don't have enough information to evaluate why they are considering this construction, what will be the major advantage of having this.

The answers to the question about whether the interviewees would visit the area if the proposed hydropower plant were built were very diverse. Some interviewees would still visit the area. Participant 14 stated the following:

I don't think it would change my mind, but it would be just spoiled by having man-made things, by the construction in the places where there is nothing at the moment. I don't think it would change my mind though.

To others a trip to the area would become a lower priority, and they might choose to visit what they regard as a more natural area instead: "One of the reasons why we have chosen this trek is that we knew that it would have been in a remote region, so maybe it would have not been on the top of the list." A few interviewees would do more research about the invasiveness of the proposed power plant and its effects on the experiences of previous visitors: "We would probably read the reviews what others said, we would be looking at how it affected their trip, and maybe we could still see what we have seen in this trip and still have the wilderness . . ." And some of the interviewees would not visit the area at all: "No, not if I could go somewhere else that's totally natural."

6. Discussion

6.1. The Study Area as Perceived by Visitors

The area around the proposed Hverfisfljót hydropower plant stands out due to its limited accessibility and therefore is characterized by pristine nature, very low visitation, and primitive settings. Consequently, it is currently visited by a small number of people who prefer recreation in unspoiled nature, peace and quiet, a low level of infrastructure, and no human impacts. The results of the study reveal that those visiting the area sought environmental qualities that were in line with the components of the wilderness experience identified by Sæþórsdóttir [16], namely, unspoiled beautiful nature, escapism, solitude and companionship, challenge, and a spiritual experience. High levels of visitor satisfaction with their stay and with the nature in the area show that visitor expectations were met, and the area provided opportunities to experience wilderness, which was identified by visitors as an important part of the attraction of the area. Moreover, the characteristics of the area identified by visitors as the most fascinating were closely related to wilderness characteristics [53,54]. Next to the diverse landscapes, visitors were fascinated by the vast natural areas unmodified by human activity and by the opportunity not to meet any other people for days.

According to the participants, to be perceived as wilderness, a natural area should contain no human impacts, retain a low level of use, and have limited infrastructure. For most visitors, trails made by hikers or animals and mountain huts were acceptable in wilderness areas, while other built structures were perceived as rather unsuitable. Interestingly, visitor opinions regarding effects on wilderness experience of the built structures that existed in the area but could not be seen were very diverse. Such results support studies emphasizing that the visual impacts of various infrastructure elements are one of the most important aspects that must be taken into consideration during infrastructure planning [41,42]. The results are in line with Kyle and Chick [29] (p. 214), who suggested that "the meanings people associate with the physical landscape are the product of interactional processes involving the individual, the setting and their social worlds". However, while in the settings analyzed by Kyle and Chick [29] the sociocultural context was of high importance, the present study shows that in natural areas, the perceived physical characteristics of the area play a crucial role in the process of assigning place meanings to landscape. Wilderness areas without built structures are regarded as very valuable settings that should be protected from environmental degradation. Meanwhile, more

developed areas are perceived as more suitable for further infrastructure development, including renewable energy infrastructure, which is supported by Sæþórsdóttir and Hall [59].

The results further show that people have a preconceived image of wilderness areas as places that allow for unique experiences that are totally different from daily life. They choose recreation in such areas to escape from daily problems and responsibilities, recharge, immerse themselves in nature, and test their physical and psychological limits. This preconceived image of wilderness areas, however, seems to be in harmony with the actual visitor experience. Visitor descriptions of their expectations blended with their actual impressions and experiences in the study area, showing that it does indeed provide the expected environmental qualities to its visitors. Through unique experiences in wilderness areas, visitors tend to realize the importance of keeping such areas intact. Preserving wilderness areas seems to be especially important in light of continuous infrastructure development and a decrease in wilderness areas worldwide, which places wilderness areas further away from populated areas, and therefore reaching them requires more effort.

6.2. Hydropower Infrastructure and Tourism in a Wilderness Landscape

Due to the multiple impacts of hydropower infrastructure on its surrounding environment and especially due to its visual impacts, the construction of such infrastructure might strongly affect the visitor experience. As pointed out by Bevk and Golobič [81], renewable energy development is likely to add new meanings to a landscape. Therefore, when planning the construction of a hydropower plant in areas with significant landscape value, it is important to evaluate how compatible these meanings would be with the current image and perceptions of the area and how the current meanings and values ascribed to the area will be affected by the construction of such infrastructure. The present study shows low compatibility between large-scale hydropower infrastructure and the wilderness landscape from the perspective of visitors. They would prefer to protect the area from any infrastructure development and see renewable energy development as more suitable in areas that are already developed. Such suggestions are in line with the criteria of best practices in renewable energy development proposed by various researchers [82,83], which, among other factors, emphasize that energy infrastructure should be built in already environmentally degraded areas or landscapes of no special value, where some infrastructure that could be used by the energy sector already exists and where energy infrastructure would not lead to land use conflicts. Importantly, landscape changes caused by hydropower development are long-term, and they are very hard or even impossible to reverse. Therefore, in cases where renewable energy infrastructure would reduce the current value of an area to its users as well as its future potential, other areas more suitable for such projects should be considered. Moreover, the sustainability of the design and the visual characteristics of the power plant should be taken into consideration [83]. While large-scale hydropower plants can have high negative effects on the environment and landscape, medium or small-scale plants might be easier to blend into the surrounding environment and might have higher stakeholder support [84].

Icelandic landscapes that are of high value for nature-based tourism but also contain abundant renewable energy resources point to the need for comprehensive national energy and conservation policies, which could be essential in solving conflicts related to renewable energy development [85]. When choosing the most suitable areas for renewable energy development, the landscape character—which, as pointed out by Bevk and Golobič [81], includes physical settings, the evolution of the area, and the perceptions and values ascribed to the landscape—should be taken into consideration together with the type of tourism that is best suited to the character of the area as well as broader development goals. Since nature-based tourism, which strongly relies on wilderness areas, is currently one of the most important industry sectors in Iceland, the development of such areas should be carefully planned, taking into consideration what tourism opportunities the country aims to provide long-term, what market segments would be the most beneficial for the country, and what environmental settings should be kept intact in order to ensure the high satisfaction of these market segments.

7. Conclusions

The study revealed that, currently, the area provides recreation opportunities for tourists who prefer pristine nature, natural settings, and minimal human impact. Visitors perceive the area around the Hverfisfljót River as a wilderness area and seek environmental settings closely related to the components of a wilderness experience. According to the visitors, the study area provides opportunities for unique experiences away from daily demands and worries. It gives tourists an opportunity to disconnect, immerse in nature, recharge, and challenge themselves in an environment that is completely different from their daily life. Therefore, visitors see the need to protect the study area as well as other wilderness areas from development. Next to the recreational opportunities that wilderness areas provide, the participants also emphasized that such areas should be protected due to their intrinsic value.

The majority of tourists stated that the proposed Hverfisfljót hydropower plant would strongly reduce their interest in visiting the area. With regard to specific power plant infrastructure elements, the visitors' attitudes were the most negative toward dams and power lines. Furthermore, the Icelandic lowlands, which are more developed, were perceived by the study participants as more suitable for renewable energy development. The present study shows that the proposed hydropower plant would destroy the wilderness experience, which currently is an essential part of the attraction of the area. With wilderness areas decreasing worldwide [86], it is of crucial importance to ensure that the use of resources in such areas does not degrade their wilderness quality. In cases where such degradation is likely, moving the project to a more suitable location of lower scenic value should be considered.

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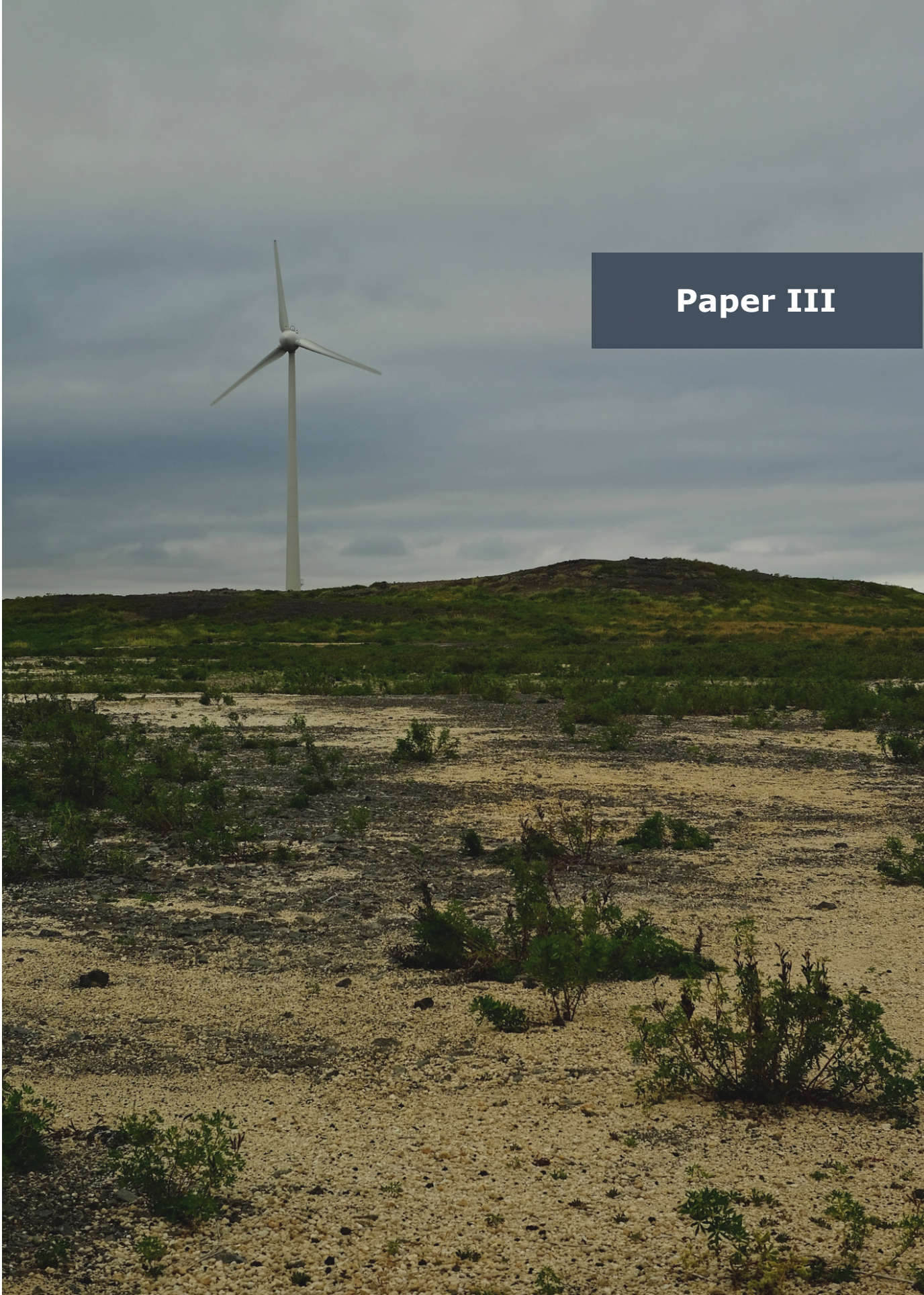
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Paper III

Article

Wealth of Wind and Visitors: Tourist Industry Attitudes towards Wind Energy Development in Iceland

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Abstract: The interest in harnessing wind energy keeps increasing globally. Iceland is considering building its first wind farms, but its landscape and nature are not only a resource for renewable energy production; they are also the main attraction for tourists. As wind turbines affect how the landscape is perceived and experienced, it is foreseeable that the construction of wind farms in Iceland will create land use conflicts between the energy sector and the tourism industry. This study sheds light on the impacts of wind farms on nature-based tourism as perceived by the tourism industry. Based on 47 semi-structured interviews with tourism service providers, it revealed that the impacts were perceived as mostly negative, since wind farms decrease the quality of the natural landscape. Furthermore, the study identified that the tourism industry considered the following as key factors for selecting suitable wind farm sites: the visibility of wind turbines, the number of tourists and tourist attractions in the area, the area's degree of naturalness and the local need for energy. The research highlights the importance of analysing the various stakeholders' opinions with the aim of mitigating land use conflicts and socioeconomic issues related to wind energy development.

Keywords: wind farm; wind energy; renewable energy infrastructure; impacts; tourism industry; nature-based tourism; Iceland



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1. Introduction

The interest in wind energy has increased worldwide due to its potential to mitigate climate change. At the same time, technological advances have made it possible to harness wind energy in areas where this was previously not possible and have resulted in more efficient wind turbines with greater capacity [1,2]. As a result, wind energy harnessing has increased considerably, and in 2019, it constituted around one-quarter of the global renewable power capacity [3].

While public attitudes towards wind energy are generally positive [4], specific plans for building onshore wind farms often meet opposition. Building wind farms can create land use conflicts, in particular when they are located in natural areas used for tourism and outdoor recreation [5]. For the social acceptance of wind farms, the greatest hindrance is their visual impacts, and studies have shown that opposition to wind farms most commonly stems from the fact that wind turbines degrade people's visual experience of the nature [6–8].

Iceland is among the countries which are considering taking the first steps to utilise their wealth of wind to produce electricity. Presently, Iceland is taking advantage of its abundance of hydro and geothermal energy sources so that nearly all electricity produced in Iceland is renewable [9]. However, the options for further utilisation of geothermal and hydro power seem to be getting scarcer [10–12]. In order to increase and diversify the power production as well as to take advantage of decreased production cost of wind power [3], the opportunities for harnessing wind energy are for the first time being considered in Iceland. However, Iceland is not only rich in renewable energy, but also in another kind of natural resource: the spectacular landscape admired by tourists. Prior to the Covid-19

pandemic, tourism had become the country's largest export sector [13], and the number of international visitor arrivals had increased by 22% on average between 2010 and 2018 [14]. Iceland's nature is its main tourist attraction, with 90% of the international visitors stating that it had been one of the main motivations for travelling to Iceland. When asked what in particular about Iceland's nature motivated them, the most common answer is that it is unspoilt and pure [15]. Iceland's tourism industry is therefore heavily dependent on decisions on future land use, which are likely to impact the natural quality of the country. Thus, conflicts between nature-based tourism and wind energy development are foreseeable, and the locations for wind farms have to be considered carefully. The aim of this paper is to analyse what impacts wind farms would have on nature-based tourism from the perspective of the tourism industry and what the tourism industry considers as the key factors that need to be taken into account, when considering an acceptable location for a wind farm. This is done by analysing 47 semi-structured interviews with tourism service providers about their opinion on five wind farm proposals which are currently under evaluation by the Icelandic authorities.

The study is based on a standpoint that beliefs about nature, and the impacts of wind energy development, are a socially produced "reality" [16]. This is in line with Mordue et al. [17] who concluded that "claimed impacts of wind farms on tourism are often social constructions of risk rather than objective facts". Thus, it may be that the tourism industry's perceptions can be conflicting and change over time. Nevertheless, that does not make the perceptions of potential impacts irrelevant. Quite the contrary, it is important to shed light on the beliefs of the tourism industry since tourism service providers are active agents in the creation of wind farms' impacts on tourism [18]. Based on their attitudes and perceptions of wind farms, tourism service providers will adjust their behaviour and decision-making, for example, with regard to further investments in the sector and destination development [19,20], thereby influencing how wind farms impact the tourism industry.

Research reflecting the attitudes of the tourism industry on wind energy development is extremely limited. It is important to address this gap in literature and shed light on the tourism industry's perspective. In the next decades, there will be an increasing demand for sustainable energy such as wind energy [21] and simultaneously demand for nature-based tourism is expected to grow, in particular after the Covid-19 pandemic [22]. Wind farms will inevitably affect the landscape in many natural areas in the world leading to conflicts with industries such as nature-based tourism which depends on the quality of the natural environment. Iceland is a good case for examining the perceived impacts of proposed wind farms on nature-based tourism, as the country is about to start wind energy development and heavily relies on nature-based tourism. This research is therefore an important contribution to the debates in landscape and land use studies related to society and renewable energy development [23].

The paper starts by presenting relevant literature on public and tourism stakeholders' attitudes towards wind energy development and wind farms. Following that, it describes the context of energy harnessing in Iceland and provides an overview of the study areas selected for this research. After an outline of the results from the interviews, the findings of the study are discussed with the aim of highlighting ways towards an improved coexistence of wind energy harnessing and nature-based tourism.

2. Background

2.1. Public Attitudes towards Wind Energy

Wind power production has increased considerably, in particular as it mitigates the effects of global warming and since its cost has decreased [3,24]. In 2019, the overall capacity of renewable power was 2588 GW, of which 651 GW came from wind power, meaning that wind power constituted around one quarter of all renewable energy capacity [3]. Most of the wind power capacity comes from onshore wind farms (621 GW out of 651 GW in 2019) [3], and these are often situated in areas where they have to coexist with other land

uses, for example, in agricultural, residential or recreational areas. As wind farms have a range of negative impacts, such as visual and noise pollution, land erosion, deforestation and bird fatalities [25,26], conflicts between the various land uses can arise.

Studies have shown that the public is generally quite positive towards wind energy [4], but when asked about their attitudes towards specific wind farm proposals, attitudes are often negative. Researchers have used the term NIMBY (not-in-my-back-yard) to explain the opposition to specific proposed wind farms. The term means that individuals may generally support developments such as wind energy infrastructure, as long as they are not in their own locality [27,28]. However, NIMBY has also been criticised for portraying the causes of opposition in a simplified way [29–32], as it may fail to identify other reasons for the lack of support.

There are various factors which have been shown to influence public attitudes towards wind farms, including concerns about noise pollution [4,33], possible health impacts [34] and the perceived need for wind energy [35]. The main factor shaping public attitudes are the visual impacts of wind farms which are generally perceived negative [1,6–8,36–38]. Due to wind farms' visibility, finding a site for wind turbines which is accepted by the public can be challenging since, as argued by Frantál and Kunc, "an ideal area does not exist, only more or less acceptable areas do" [39].

Studies have found that the type of landscape in which wind turbines are placed shapes public attitudes towards wind farms. Devine-Wright [40] points to the need for addressing the question to what extent energy infrastructure is compatible with the symbolic image of a place and the socially constructed ideas of how the area "ought to" look. In that regard, new constructions have to fit the existing place identity and its symbolic dimensions in order to be accepted [41,42]. In a study by Wolsink [43], recreational areas, nature reserves and other natural areas were perceived to be unsuitable sites for wind turbines, whereas it was perceived as more acceptable to place wind turbines in military and industrial areas. In natural areas, the opposition to wind turbines can stem from the need to protect wilderness and preserve the natural character of areas, thereby sustaining their value as areas for relaxation and recreation [29,44]. The distance between the onlooker and the wind turbines also plays a role with regard to the perception of visual impacts. A study by Molnarova et al. [45] found that wind turbines with a larger distance from the observer (4.5 km to 8 km) were considered to have a less negative impact on the landscape, whereas wind turbines close to the observer (1.5 km) were considered to degrade the landscape more severely. The number of wind turbines can also shape the perception of visual impacts and the same study by Molnarova et al. [45] found that respondents were more positive towards one instead of four wind turbines in the landscape. However, in a study by Riddington et al. [46] the participants preferred fewer wind farms with more turbines over many small wind farms.

2.2. Tourism and Wind Energy Infrastructure

While there is extensive literature on public attitudes towards wind energy infrastructure, studies on the attitudes of tourism stakeholders towards wind farms are scarce. Those which exist focus disproportionately on tourists' perceptions of wind energy infrastructure and neglect other stakeholders, such as the tourism industry. Much like public attitudes, tourist attitudes towards wind energy are generally positive, as it is perceived as sustainable, renewable and green [47,48]. However, tourists tend to be less positive when expressing their opinion on particular wind energy projects due to the visual impacts of wind turbines on the landscape, and they prefer the construction of wind turbines in agricultural areas rather than in areas of pristine natural quality and wilderness [39,49,50]. This is in line with findings from studies on public attitudes towards wind turbine installations, as outlined in Section 2.1 [29,43,44]. A study from Iceland [49] also showed that tourists thought that it should be prohibited to install wind turbines in national parks or other protected areas. Moreover, another study from Iceland concluded that tourists are

more sensitive than residents towards wind turbines in pristine nature, as the nature is the reason for their trip to Iceland [50].

The main threat that wind farms pose to tourism stems from their visual impacts [39,47,51,52], which can lead to a degradation of the tourist experience, in particular at destinations of nature-based tourism as it relies on the aesthetics of the environment and landscape [51,52]. As a result, tourists may not want to visit areas with wind farms, which in turn can result in economic losses for the tourism industry and local communities [53]. Due to the complexity of the tourism sector, analysing the impacts of wind farms on tourist visitation to an area can be difficult, as there are various other factors which influence tourism demand, e.g., the value of the local currency, supply of activities, services and attractions, trends and weather [39]. The studies investigating whether tourism demand would be affected by a wind farm construction report different results, with some showing results that tourists tend to avoid areas with wind farms (see, e.g., in [49]) while most conclude that wind turbines would not influence tourists' destination choice (see, e.g., in [48]). However, even a small decrease in tourism demand can quickly have large repercussions for local economies [46].

Shedding light on the perceived impacts of wind farms from the perspective of the tourism industry is a needed contribution to the existing knowledge, as the beliefs of tourism service providers shape how they behave and make decisions, for example, when it comes to further investments and destination development [19,20]. Only few studies have focused on the perceived impacts of wind farms on tourism from the perspective of tourism service providers. A study by Frantál and Kunc [39] set out to investigate the possible negative impacts of wind turbine construction on tourism in two areas in the Czech Republic. It was based on a questionnaire survey among tourists, but also on interviews with local entrepreneurs from the sphere of tourism. The results revealed that entrepreneurs assumed that the wind energy infrastructure would not have a significant negative impact on the tourism industry, as they believed that tourists would not be disturbed by it, in particular, as many of the foreign visitors in the Czech Republic come from countries where wind farms are a common sight. Instead, they believed that the success of the tourism industry depended on the quality of services and the currency exchange rate. A recent study by Mordue et al. [17] about impacts of onshore wind farms on rural tourism in the UK reported that around two thirds of the participants (tourism-related businesses) said that onshore wind farms had not impacted their business in a negative way, while one-third said that they had. The findings with regard to impacts on turnover of tourism companies were quite neutral, as 34% said that turnover had increased, 30% said it had decreased and another 36% said it stayed the same. When asked whether wind farms would influence decision-making with regard to future business investment, almost half said that it was unlikely, whereas one-third said it was likely.

Other studies, however, concluded that tourism service providers perceive the impacts of wind farms on tourism to be negative. Silva and Delicado [48] conducted a study on attitudes towards wind turbines near a heritage site in Portugal. The results showed that residents in the area, including some with links to the tourism sectors, worried that the wind turbines would have a negative impact on the tourist experience, since the wind farms' modern appearance clashed with the historic site. In a study from Iceland [52] about a proposed wind farm in the southern Highlands, tourism service providers emphasised that the area's attraction stems from its pristine nature. Despite its proximity to seven hydro power plants, the area is perceived as natural, but adding highly visible wind turbines would transform the landscape of the southern Highlands from natural to more anthropogenic. The authors argue that "consequently, the area will attract different types of tourists groups—groups that will have a dissimilar connection to the landscape, and thus different planning as well as management requirements" [52]. The tourism service providers preferred the wind turbines to be placed in a more suitable area, one where the image of unspoilt nature which the industry is selling would not be impacted. In addition, the tourism service providers stressed the importance of maintaining vast and open land-

scape as a part of Iceland's image and therefore they regarded the proximity of the wind turbines to the onlooker as more important than the number and size of the turbines.

Studies have also discussed wind farms as potential tourist attractions and Frantál and Kunc [39] reported that 65% of their respondents expressed an interest in visiting wind farms with information centers. Silva and Delicado [48] argue that modern wind farms can become interesting tourist attractions in industrial areas, but that they would not generate the same interest in areas with natural or cultural heritage. In contrast to old windmills, which can be an important tourist attraction as, for example, in the Netherlands, where they are part of the cultural landscape and an element of the country's image [54,55], modern wind farms are standardised and look similar in most countries [47]. Thus, they are most likely to be "one visit" attractions. International tourists seek unique experiences and destinations, meaning that the attractiveness of standardised wind farms is low [47].

3. Methods

3.1. The Study Areas and Background

Iceland's wealth of renewable energy resources has been the base of the country's hydroelectric and geothermal power production, which started in the latter half of the last century. Of the total electricity produced in 2019, approximately 70% stems from hydro power and 30% from geothermal power, with less than 0,1% coming from non-renewable energy sources [9]. Furthermore, about 84% of the national energy consumption is based on hydro and geothermal power produced in Iceland [56]. The majority (80%) of electricity produced in Iceland is used for about seven international energy intensive factories, such as aluminium smelters [9]. While the electricity transmission system is largely built to ensure a steady supply of electricity to those heavy industry companies, certain areas of Iceland, e.g., in the Westfjords and some parts in the north, are excluded from the main transmission system and lack a stable and adequate supply of electricity [57].

There have been divergent ideas on the use of Iceland's bountiful renewable energy resources. In order to create greater consensus on the use of energy resources in Iceland, a governmental project called the Master Plan for Nature Protection and Energy Utilization (*Aætlun um vernd og orkunýtingu landsvæða*) was launched in 1999. It evaluates and ranks all proposed power plants with respect to their economic, social and environmental impacts and classifies them into three categories: energy utilisation category, protection category and on hold. The overall aim is to "reconcile the often competing interests of nature conservation and energy utilisation on a national scale and at the earliest planning stages" [58]. The power plant proposals which are put in the energy utilisation category are not automatically given permission to be built as they also have to go through an environmental impact assessment. Those which fall into the protection category are excluded from energy utilisation in the future and those which are on hold need further research for a final evaluation.

The Master Plan project is split into phases which last for about four years: phase 1 was from 1999 to 2003, phase 2 from 2004 to 2010, phase 3 from 2013 to 2017 and phase 4 began in 2017 and finished in March 2021. Phases 1 and 2 only evaluated hydro and geothermal power plant proposals, and in phase 3 two wind farm proposals were evaluated in addition to hydro and geothermal power plants. In phase 4, a total of 34 wind farm proposals were handed in to the Master Plan, reflecting the increased interest among energy companies to harness wind energy. The steering committee of the Master Plan assessed that only five of the proposals had sufficient data to be evaluated by the Master Plan. Three of them are in the west of Iceland, one in the north and one at the edge of the southern Central Highlands (Figure 1).

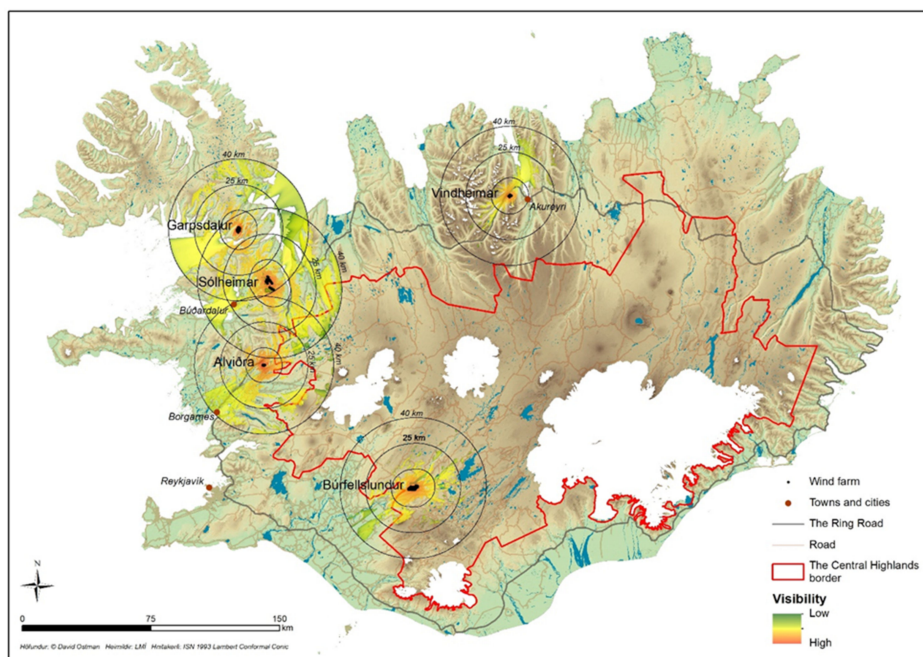


Figure 1. The five wind farms from the 4th phase of the Master Plan and their visibility.

The proposed wind farm Búrfellslundur is at the periphery of the southern Highlands and is the largest one with regard to the number of wind turbines (Table 1). It is located next to a road which functions as “the gateway” to the Central Highlands, an uninhabited natural area characterised by wilderness. This road leads to the most popular Highland destination called Landmannalaugar as well as many other Highland destinations. The proposed wind farm is furthermore close to the most developed power production area in the country, which includes six hydro power plants and their appendant infrastructure such as reservoirs and transmission lines. In addition, there are two experimental wind turbines which were set up there in 2012 to examine the practicality of wind energy utilisation in Iceland.

Table 1. The characteristics and locations of the five proposed wind farms.

	Búrfellslundur	Vindheimar	Alviðra	Sólheimar	Garpisdalur
Number of wind turbines	30	8–12	6	27	21
Estimated capacity	120 MW	40 MW	30 MW	151 MW	88 MW
Max. height of wind turbines	150 m	160 m	150 m	200 m	160 m
Location	At the gateway to the Central Highlands and popular wilderness areas	By the Ring Road, 15–20 km away from Akureyri (town)	By the Ring Road, 30–35 km away from Borgarnes (town)	Rural area, 20 km away from Búðardalur (village)	Rural area, 25 km away from Hólmavík (village)
Tourism and outdoor recreation	Hiking, jeep, bus, bike and horse tours	Hiking and skiing	Fishing, hiking and nature gazing	Very little use	Hiking
Nearby tourist attractions	Landmannalaugar, Hekla (volcano) Háifoss (waterfall)	Hraundrangar conical peaks	Grábrók (crater) Glanni (waterfall) Baula mountain	Very limited	Very limited

The wind farm in the north is called Vindheimar. It is located in a wide and fertile agricultural valley, just by the so-called Ring Road which is the main travel road in Iceland

as it circles the island and connects the capital Reykjavík with many towns and tourist destinations. One of those towns is Akureyri, the largest town in North Iceland. It is within a 15-min drive from the proposed wind farm. However, Vindheimar is not visible from Akureyri. The Hraundrangar conical peaks are the valley's most prominent tourist attraction. In addition, hiking and skiing activities are practised in nearby mountain areas.

Three of the proposed wind farms are located in the west of Iceland. One of them, called Alviðra, is, like Vindheimar, located in an agricultural valley next to the Ring Road. The area is a one-hour drive away from Reykjavík, there are a lot of second homes in the area and various recreational opportunities such as hiking and fishing. Based on the number of wind turbines, Alviðra is the smallest of the five proposed wind farms (Table 1).

The other two in the west, Sólheimar and Garpsdalur, are further to the north and more off the beaten track, especially Sólheimar which is located in a very sparsely populated rural area and by a road travelled by few. The wind farm Garpsdalur is even further to the north compared to Sólheimar. It is close to a road which goes to the Westfjords and is travelled rather frequently, though much less than the Ring Road. Few people live in the area of the proposed wind farm and there are some venues for outdoor recreation in the vicinity, mostly related to hiking.

3.2. Interviews

This study's aim was to investigate the perceptions and opinions of the tourism industry, and thus it adopted a qualitative approach with the aim of "interpreting phenomena in terms of the meanings people bring to them" [59]. Semi-structured interviews were chosen as the method in order to allow the participants to express what they see as relevant and important [60]. Overall, 47 interviews were conducted until theoretical saturation was reached [60] and the participants were sampled based on a purposive strategy in order to include different perspectives and thus ensure quality [60,61]. The aim was to interview tourism service providers which offer tours and/or other tourism services in the areas where the proposed wind farms would be built. As such, the study included both representatives from companies whose headquarters are close to the sites of the proposed wind farms as well as companies in other parts of the country, e.g., in the capital Reykjavík, but which use the wind farm sites for their business. When selecting participants, emphasis was put on interviewing managers of companies offering different tours, for example bus, jeep, helicopter, hiking, horse riding, skiing, glacier, whale watching and fishing tours, as well as accommodation service providers. The size of the companies varied as well, as some participants were self-employed while others worked in companies with 2–20 employees.

At the beginning of each interview, the aim of the study was presented to the participants, it was explained that the researchers would aim to preserve the participants' anonymity to the best of their ability and participants gave their consent. The participants were asked to express their personal opinion and perception of the impacts of the proposed wind farms on nature-based tourism, rather than company perspectives.

Then, the interviewer presented the various wind farm proposals to the participants, gave an overview of their installed capacities, and clarified where they would be located. In addition, the participants were presented a visibility map of each proposal, showing from which areas the wind turbines would be visible. The tourism service providers were then asked to specify which of the sites they used for their business, i.e., which areas they took their customers to. Naturally, some used only one of the sites while others took their customers to multiple sites. Overall, participants only expressed their opinion on wind farm proposals which were in areas they were familiar with. The length of the interviews varied in accordance with how many of the sites were familiar to each participant, but most lasted between 30 and 60 min. During the interview, participants were asked to describe how they use the proposed site(s), what the attraction of each area is for their customers and how the construction of a wind farm in the area(s) could impact their business and the Icelandic tourism industry in general. Those who were able to discuss more than one proposal were also asked to rank the wind farms according to how they evaluated their

impacts on tourism, from the proposal they preferred the most to the one they preferred the least.

The interviews were conducted between June and November 2020. During most of this time period, social distancing regulations were in place because of the Covid-19 pandemic. Therefore, many of the interviews were conducted via phone or through online meetings instead of in person. A limitation of particularly the phone interviews was that it did not allow for observations of facial expressions and body language, while online meetings provided at least the opportunity to see facial expressions [60]. The interviews were conducted either in Icelandic or English, depending on the preference of the participant. Most of the interviews were carried out by two researchers, but due to scheduling conflicts some were conducted by only one. All interviews were transcribed, and their analysis was conducted based on the grounded theory method using the software Atlas [62]. Open and axial coding were used, as well as diagrams for mapping out relationships [62,63]. The coding process was “cyclical rather than linear”, as described by Saldaña [63]. The definition and selection of codes was done by one of the researchers, but during the process of creating diagrams of the relations between the different codes, emerging ideas were discussed within the research team, as recommended by Saldaña [63].

4. Results

4.1. Perceived Impacts of the Proposed Wind Farms on Nature-Based Tourism

The attitudes of the participants towards the proposed wind farms were mostly negative due to their visual impacts on Iceland’s main attraction, i.e., its nature. The participants stated that all wind farm development would result in a decrease in the natural quality, which inevitably is negative for nature-based tourism. One of the participants said:

I think windmills are, in terms of tourism, speaking for myself, always negative because they look ugly and they just ruin the visibility.

The participants claimed that wind farms have severe visual impacts. One described that Icelandic nature was like “a beautiful painting” and that wind turbines would “rip apart the image of nature”. Another participant said:

Windmills, they’re kind of gross and vulgar. They’re so big and they are so humongous. They tower over the area.

Some also found that “windmills are always so visible because they are on the move. The blades are turning like crazy”. The visual impacts were regarded as particularly negative in landscape characterised by unspoilt nature. By building windmills in pristine nature, the landscape would be transformed into an industrial area and as such be less appealing to tourists. The participants argued that the visual impacts together with potential noise pollution would have a negative impact on tourists’ experience, as they would not experience the pristine nature they came to see in Iceland. The tourism service providers commonly said that tourists did not come to Iceland to see wind turbines. When asked about how wind turbines would affect the experience of tourists, one of the participants answered: “Negatively. They are big, ugly, man-made structures and not what they [tourists] came to see”. Another said:

The people are searching for this, this that you can stand somewhere and don’t see anything, except the grass and the rocks and the water. But if you see something like that [a wind farm] and you’re just . . . it’s just fake, as I call it, just fake. It is not anymore what we are trying to sell, if I can put it like that, you know, the wild untouched wilderness.

When asked about what impacts the installment of wind turbines in Icelandic landscape would have on their business, one of the participants said:

It would mean that Iceland was less interesting because people are coming here to see untouched nature. They are only, almost only, coming to see that. They are not coming here to sleep or eat. So what are they doing here? Why did you choose Iceland then? Because it’s different from what they are used to. It has so much variety of landscapes, so

many things to see in one day. So, installing a windmill anywhere will have a negative impact on my business.

Some mentioned that certain hydro and geothermal power plants in Iceland function as tourist attractions for visitors, as they provide an educational experience for tourists. However, because wind farms are common in many countries, the tourism service providers doubted that they would be an interesting attraction. In fact, they said they would try to avoid wind farms should they be built. Where possible, they would choose routes from which the wind turbines would not be visible in order to still provide their customers with a positive nature experience in Iceland. Some said that they would stop visiting areas with wind turbines altogether, as the area “would then die as a recreational area”. One of the participants said:

You come into a beautiful area which has been polluted with such structures. The structures destroy it. You stop coming there. That is the risk.

Moreover, some pointed out that seeing wind turbines in the landscape could have a negative impact on Iceland’s image:

Tourists have their cameras up in the air, all days, in all weathers, everywhere along the way. And they are posting worldwide. This is marketing which we cannot control. They say that Iceland is great, but it will not stay this way if they start posting pictures of wind farms.

Another said:

Tourists want to see the cute image of Iceland and not some blades of wind turbines spinning on top of some mountain. That is never great for the image.

If the image of Iceland would be negatively impacted, it would create a “chain reaction”, since it might decrease tourists’ motivation to travel to Iceland and thus ultimately result in economic losses for the tourism industry and the country as a whole.

Still, according to the participants, certain benefits of building wind farms can outweigh the negative impacts on the tourism industry, particularly in areas with a shortage of energy. In areas where the demand for energy exceeds the supply, participants showed a greater understanding for the development of wind farms. Participants claimed that local energy production could provide areas with opportunities to develop new businesses, including in tourism, as well as support already existing businesses. Moreover, strengthening local businesses and employment opportunities counteracts outmigration from the rural areas, which is necessary if the tourism industry wants to be able to thrive in sparsely populated areas. The participants pointed out that renewable energy, including wind energy, generally has a positive image, which the tourism industry could use to their advantage. By telling the “the right story” about wind energy, tourism service providers could mitigate the negative impacts on the tourist experience and thus try to limit the damage of the construction of wind farms. One of the participants described how he was “telling this story” when travelling with his tour group in an area with hydro power plants and how the same could be applied to wind farms:

I cannot take these energy constructions down. Instead, I need to be creative and tell this story in a positive way and make the constructions become friends rather than enemies of the tourists. So, then I am always looking for ways to tell this story, highlighting the positive and trying to strengthen this relationship: “Okay, here is a power plant and it has also done a lot of good. It did this and this and that”.

If the wind farm would be built in an area with energy shortages, it would make it easier to highlight the benefits of the installation. However, if the participants felt that there was generally no need to increase energy production, they perceived that the impact of wind farm constructions would be mostly negative.

There were also a few tourism service providers who believed that wind farms would have no effect on the tourist experience because wind energy production is common in

the home countries of many tourists. Moreover, due to wind energy's positive image as a "green" energy source, they did not believe that tourists would be negative towards potential wind farms. One of the participants, for example, said:

One thing you say about it [wind energy production] is that it is green energy and it is something that people are used to seeing from their home countries, very much in Europe. Although it is probably not beautiful to have it in your backyard, it is something that people have an understanding for and that we are creating green energy and it can be removed at any time and without any trace. So, I do not think there is any damage to the nature. Actually, I would say it will not really have an impact on peoples' travelling plans.

Last, a few participants also hoped that the development of wind farms could have a positive impact on the tourism industry in the form of improved access.

One good thing about all power plants—especially the ones in Þjórsá [hydro power plant], Kárahnjúkar [hydro power plant] and many of the other ones—they have improved roads. They have built roads, they have opened up areas for us that are not driving a 4 × 4 or a super jeep and monster tyres. We can get there, we can see these beautiful areas. [...] That's why I said in Gilsfjörður [location for Garpsdalur]: "Yeah, okay. If you build the power station there, maybe the roads will be better, and I will not have two flat tyres there."

4.2. Locations of Wind Farms

Following the conclusion that the impacts of wind farms on nature-based tourism would be mostly negative, this research aimed to determine which of the five proposed wind farms would lead to the least negative impact compared to the wind farms in other proposals, according to the tourism service providers. The results revealed that the participants evaluated and ranked the proposed wind farms and their impacts on tourism based on five factors.

The first factor was the degree of visibility and the number of wind turbines. The participants were generally of the opinion that the less the wind farms would be visible, the better. As such, flat landscape where "you can see it from 20–30 km when you are driving there, and then the other 30 when you are driving away" was not a good location for a wind farm, as this participant explained:

I see it then all day when I drive out here and then back again. So, I do not want to be driving to the windmill park for three hours and always have it in front of my car.

Four of the wind farms were regarded as having a high degree of visibility, which was due to either a flat landscape and/or a high number of wind turbines. Vindheimar, on the other hand, would have the second fewest wind turbines and would also be located in a valley where the turbines would be "locked in by mountains", which meant that the wind turbines would be less visible compared to the remaining four wind farms (see also Figure 1).

Second, the number of tourists that visit the area of a proposed wind farm or nearby areas, either by staying or travelling through the area, was considered to play a role in determining the wind farm's impacts on tourism. Those areas which are visited by many tourists were regarded as less suitable locations for wind farms, since the wind turbines could create a negative experience for a large number of tourists. Vindheimar and Alviðra would be located along the busy Ring Road, which runs around the island, and it is very popular among tourists to drive the circle. Consequently, "everybody will see it [the wind farm], that is for sure", one of the participants said. The wind farm Búrfellslundur has also been proposed along a popular tourist route crossing the Highlands. These three wind farms were, thus, said to have a negative impact on many tourists, as opposed to Garpsdalur and Sólheimar which would be outside of the main travel routes and far fewer tourists would travel by. When asked how tourists would perceive wind farms in Iceland, one of the participants said:

It all depends on where you put them. But, I mean, of course, if you put them in out-of-the-way places like in Gilsfjörður [location for Garpsdalur], where no one actually travels because everyone uses the new bridge, I don't think it will affect them that much.

As the third aspect, the participants made a distinction between the wind farm proposals based on whether the wind farms would be in areas with tourist attractions. Of the five proposals, most participants agreed that the area where the wind farms Sólheimar and Garpsdalur would be located was “a drive through part of the country where you don't really stop” and had no special tourist attractions. One of the participants said that the area around Sólheimar “is commonly known among us tour guides as the area where we let the group sleep”, as they considered the landscape to be quite monotone. With regard to Garpsdalur, another participant said:

In that area, there just is not a lot of interesting nature nor are there interesting attractions. There hasn't been any success in creating interesting attraction for tourists there and that will always remain difficult, since it is not along the Ring Road nor close to any popular places.

The wind farm Vindheimar in the north was said to be in the proximity of areas interesting for adventure tourism such as skiing, hiking and climbing in challenging terrain due to its “artic and alpine atmosphere”, but for the “general” tourist interested in sightseeing the area was said to have no special attraction. Therefore, while some participants claimed that the area was experiencing a tourism boom with a lot of innovation in nature-based tourism, others described the area as an uninteresting “transit area” for tourists on their way to or from Akureyri. Most participants agreed that Alviðra and Búrfellslundur were proposed in areas with many tourist attractions nearby, making them less suitable locations for wind farms in comparison to the other three. With regard to Alviðra, one of the participants said:

The area around Grábrók [volcanic crater] is very beautiful. The lava field and of course Grábrók itself are attractions at which many people stop. Groups stop and walk up Grábrók so it is a very sensitive area, I would say.

Another described the reactions of tourists who they had accompanied to Grábrók near Alviðra in the following way:

They always say like “Wow, this is a beautiful view”. [...] I am sure that every single person who goes to this valley and walks up to Grábrók and looks down [on the wind farm] would say: Ugh, it is a shame that that is there.

Most participants agreed that Búrfellslundur was “close to such valuable natural wonders”, such as the volcano Hekla and the waterfalls Háifoss and Gjáfoss, and many used the area for tours with their customers:

It's really weird to choose this point. Why don't you put it somewhere else? This is actually surrounded with amazing nature, all around. I mean this is one of the few places in Iceland that are just like crowded with amazing nature. And we are here a lot [with our customers].

Closely related to whether an area has tourist attractions, is the fourth aspect brought up by the participants, namely, whether or not a wind farm site and its surrounding areas are perceived as unspoilt by travellers. Unspoilt natural areas have the potential to be attractive to tourists and therefore building a wind farm in areas which currently have no human-made structures was perceived to have a more negative impact, compared to wind farms in agricultural or industrial areas. For instance, one of the participants explained that the pristine Highlands would be an unsuitable location for wind farms:

We should preserve the Highlands as a place of unspoilt nature or minimise the human touch to it. I think it's our duty to do that as we still have this part of land and we're able to do it.

When discussing the proposal of Búrfell, another said:

I would rather put them [wind farms] in the lowlands. I would prefer not to put them in areas which we have defined as unspoilt wilderness, one of the world's treasures. If we have enough space, do we then need to put it there [at the edge of the Highlands]?

Many found areas with human-made structures to be more suitable locations for wind farms, such as this participant who said:

I would just say, why not build it closer to Reykjavík? Because then it just integrates in the city infrastructure. And I think, if you want to build windmills, then just do it more in a city infrastructure and not like out in nature.

However, the perception of what constitutes an unspoilt area varied greatly between participants. For some an unspoilt area was equal to an uninhabited area where there were no houses and roads. For others, an unspoilt area could still contain farms and roads, but if it had energy infrastructure (e.g., boreholes, dams, powerlines, etc.) or other industrial infrastructure it could not be regarded as unspoilt anymore.

For example, some perceived Sólheimar, Garpsdalur, Vindheimar and Alviðra to be located in anthropogenic landscapes with houses and roads and as such they did not believe that these landscapes had a high value for tourism. However, others regarded the areas as beautiful agricultural landscapes due to their natural appearance and lack of industrial infrastructure. One participant, who opposed Vindheimar, said:

I think this is a terrible place [for a wind farm]. This is in the middle of agricultural landscape which in itself is, how can I say it, low-key and charming. The Icelandic agricultural landscape is most often low-key and beautiful and it would be terrible to get such big windmills in there. I think that would be very bad.

Furthermore, due to the high visibility of wind turbines their impacts on the landscape and consequently on tourism were perceived by some participants to exceed the areas of their construction. As such, some participants supported the installation of Búrfellslundur wind farm based on the fact that its proposed location is next to existing hydro power infrastructure and believed that the area had already been “destroyed”. Others opposed its construction since the wind turbines would also be visible from pristine natural areas in the proximity of the wind farm site:

This is in an area we are selling as being one of the most remote areas in Iceland where you go up in the nature and we have very little houses and signs of civilisation. So, that is definitely in a part where you are going to look to experience the desert and have nothing. And then of course a windmill park is something that does not really fit to that.

Some participants stressed that the impacts of wind turbines on the tourist experience would extend beyond their visual impacts and would be felt in natural areas reached by travelling past the wind farms. One participant discussing the impacts of Búrfellslundur said:

[The impacts] would reach the ones that are going up from Búrfell [a mountain by the main road into the Highlands] definitely—the ones that are going to Gjáin [canyon], to Háifoss [waterfall], the ones that are going across to Sprengisandur [the main road through the Highlands] and over to Fjallabak Nature Reserve which is the Landmannalaugar area [the most popular Highland destination], the ones that are going for a trip up Hekla [volcano], both Hekla and Veidivötn [fishing lakes] and all of that area. It would definitely affect the people going to these areas.

The last determining factor for the suitability of a wind farm site was if the nearby area is suffering from a lack of energy or not. Overall, many found that there was no need to increase the production of electricity and believed that the plans for new power plants were in the interest of power intensive industry instead of the local population. One of the participants said:

If we absolutely desperately need more electricity, not for another aluminium smelter but something else, simply the population of Iceland, ok, then we must sacrifice these areas. But to export or to build another aluminium smelter... No, we don't need that.

As already mentioned, participants stated that the construction of wind farms is justifiable in areas where there is not enough energy for the population and businesses. In the context of the study areas, many participants believed that the energy production is sufficient in all areas, but out of the five wind farms three (Vindheimar, Garpsdalur and Sólheimar) were found to be in areas with a higher need for more energy compared to the other two. This was due to the lack of steady electricity supply in the west and north of Iceland. One of the participants described the need for electricity in Akureyri, close to Vindheimar:

Many times a year we get power cuts in Akureyri. Many times a year. That is only due to the fact that there is not enough supply of electricity towards this area nor within it. When these power cuts happen, we have the hospital running on diesel engines. [...] That is totally unacceptable.

Based on these five factors, the tourism service providers perceived that Búrfellslundur and Alviðra would have the most negative impact on tourism, while Sólheimar and Garpsdalur would have the least negative impact (Figure 2). Most participants found that Búrfellslundur and Alviðra would be located in areas where the wind turbines would be very visible from important tourist attractions, thereby impacting the experience of many tourists. Sólheimar and Garpsdalur, on the other hand, were considered to be more acceptable, as they would be located in areas with fewer tourists and attractions. Vindheimar was perceived as having neither the most nor the least negative impact of the five proposals. Its main advantage was the low visibility of the wind turbines, while its main disadvantage was the proximity to the busy Ring Road.

Proposed wind farm	Sólheimar	Garpsdalur	Vindheimar	Alviðra	Búrfellslundur
Factors					
Visibility of wind turbines	High	High	Low	High	High
Number of tourists	Few	Few	Many	Many	Many
Tourist attraction(s)	Few	Few	Disputed	Many	Many
Unspoilt nature	Disputed	Disputed	Disputed	Disputed	Disputed
Need for energy in the area	Disputed	Disputed	Disputed	No	No
	←—————→				
Perception of impacts	Least negative			Most negative	

Figure 2. The tourism industry's ranking of the proposed wind farms according to their impacts on nature-based tourism.

5. Discussion

This study aimed to analyse what impacts wind farms would have on nature-based tourism as perceived by the tourism industry and what key factors need to be taken into account when considering an acceptable location for a wind farm with regard to the interests of the tourism industry. The findings revealed that the tourism service providers identified visual pollution as the most severe impact of wind farms on nature-based tourism, which is in line with previous studies, showing that both the public and tourists

regard visual impacts of wind turbines as the most negative ones [1,6–8,36,38,39,47,51]. Wind farms change the character and appearance of the landscape and since the quality and aesthetics of Iceland's nature are the key elements for the success of the tourism industry [15,20,52], wind energy development was generally considered as a threat to the tourism industry. In other words, pristine nature is the most important resource for Iceland's tourism industry and thus a degradation in the natural quality will inevitably impact tourism in a negative way. In line with Ólafsdóttir and Sæþórsdóttir [52], the tourism service providers in Iceland feared that wind energy development in relatively pristine nature would have a negative impact on the image of the country. This, in turn, could lead to a change in the composition of tourists travelling to Iceland, repelling those who seek to experience pristine nature and wilderness and attracting target groups who are not as sensitive to human-made structures [52]. Moreover, the participants feared that wind farms could also decrease Iceland's attractiveness and competitiveness as a tourist destination, thereby affecting both individual businesses as well as the tourism industry as a whole. Similarly to de Sousa and Kastenholz [47], the tourism service providers considered the potential of wind farms in Iceland to become tourist destinations as low.

These findings are in contrast with some previous studies (see, e.g., in [17,39]) which found that most tourism service providers do not perceive wind farms as a threat to tourism demand nor business turnover. In Frantál and Kunc's study [39] in the Czech Republic, the tourism entrepreneurs believed that the success of the tourism industry depended first and foremost on the quality of services and the currency exchange rate and that tourists' destination choice was not dictated by the installation of wind turbines. In the case of Iceland, as this study as well as others [15,20,52] show, the aesthetics of the nature and landscape play the most important role in shaping tourism demand [52]. This points to the need for shedding light on what the tourism industry perceives as its most valuable resource, when evaluating potential impacts of wind farms on the tourism industry. If the tourism industry relies on the natural quality and appearance of the landscape, the industry might perceive wind farms as a greater threat, compared to tourism destinations where the demand is shaped by other factors, such as the quality of service provided.

Furthermore, the study identified five factors which determine the severity of the negative impacts of wind farms on nature-based tourism according to the tourism industry. Consequently, these factors should be taken into careful consideration when selecting sites for wind farms in order to ensure the least negative impact of wind farms on the tourism industry: wind turbines should not be located in areas (1) where they would be highly visible, (2) where many tourists go or travel through, (3) where there are (many) tourist attractions, (4) which are characterised by pristine nature and (5) where there is no need for increased electricity production (Figure 3). The attitudes of the tourism industry towards wind farms thus align to some extent with public attitudes, since previous studies found that the public prefers to install wind turbines in industrial or military areas rather than in recreational areas, nature reserves and wilderness areas [29,43,44]. In addition, public and tourist industry attitudes towards wind farms are both impacted by the degree of visibility, i.e., how far the wind turbines are from the onlooker [45] and how many wind turbines are installed [45,46].

Iceland is in the enviable position of being bountiful in terms of its pristine landscape which attracts tourists to the country. At the same time, the country's climate is characterised by strong winds, making wind farm development feasible. In light of this, and as Iceland is at a crossroads regarding future land use for wind energy development and nature-based tourism, it is an interesting case for examining the interplay of the wind energy sector and the tourism industry. It provides an opportunity to address potential conflicts between the two industries and influence planning strategies right from the start. It is likely that wind turbines will become a new feature in the Icelandic landscape. In fact, in the time that the data for this study was collected and this article was written, the Master Plan for Nature Protection and Energy Utilization completed the evaluation of the five wind farm proposals discussed in this study. Three of them—Garpdalur, Vindheimar

and Alviðra—were put in the energy utilisation category and the remaining two were put on hold [64]. The huge increase in the interest in wind energy development in Iceland has also called for some changes in the legal environment regarding renewable energy development in Iceland. The Minister for the Environment and Natural Resources has suggested a change to article nr. 48/2011 concerning the protection and energy utilisation plan. The proposal suggests to divide Iceland's surface into three categories: (1) areas where wind farms would be prohibited, (2) areas where wind farms would need to be evaluated by the Master Plan for Nature Protection and Energy Utilization, and (3) areas where permissions for building wind farms would only be in the hands of the local municipality [65]. If the amendment will be accepted, the lack of restrictions for building wind farms in specific areas could lead to a significant impact on tourism in the country, with wind turbines becoming a common sight. The findings of this study point out that this would pose a threat to Iceland's image and thereby to the tourism industry. Iceland's competitive advantage in the global tourism industry is based on its pristine nature, and an abundance of wind turbines could lead to a loss of Iceland's attraction. Furthermore, giving municipalities full control over the permissions for building wind farms in certain areas can result in negligence of the impacts that wind farms can have beyond the boundaries of the municipality. For instance, a municipality may decide to give a permission for building a wind farm within its boundaries in order to take advantage of the wind farm's economic benefits. However, while the wind farm may be located in a municipality without tourist attractions and services, the wind farm can impact the experience of tourists travelling through the municipality on their way to nearby areas which are rich in tourist attractions and services. Thereby, the wind farm can cause economic losses for tourism businesses in adjacent municipalities.

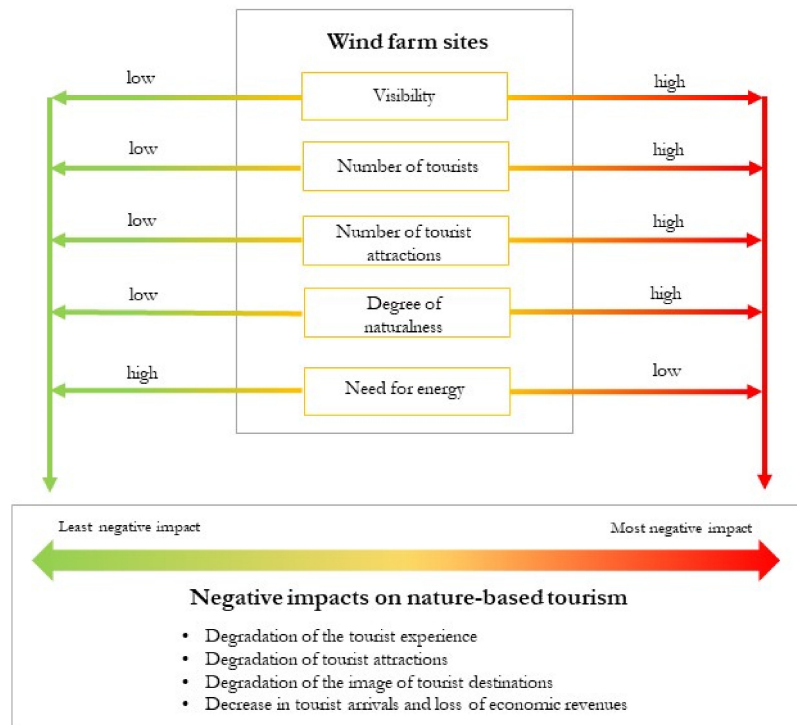


Figure 3. Factors affecting the severity of negative impacts of wind farms on nature-based tourism as perceived by the tourism industry.

The participants in this study also discussed the need for building more power plants in Iceland and many feared that the motivation behind new power plants was rather in the interest of large multi-national companies than the local population. They stressed that wind energy development should only be allowed if there is a local need for increasing electricity production. Overall, the findings of this study thus emphasise the importance of holistic planning of wind energy development, which takes into consideration the need for further electricity production, the wide-reaching impacts of wind farms and the needs of the diverse stakeholders, including the tourism industry.

Installing wind turbines in more suitable areas, i.e., areas where the turbines would have a low visibility, where the number of tourists and tourist attractions is low, where nature has already been partly spoiled and where the need for energy is high, does not mean that all conflicts with the tourism industry will be avoided. From the perspective of the tourism service providers, wind farms have a mostly negative impact on the industry, regardless of their location. Moreover, defining which areas are more suitable for wind farms according to the five factors is not unproblematic. For instance, while all participants agreed that protecting pristine nature was of vital importance for the success of the tourism industry, their perception of what constitutes unspoiled nature varied. For some, an unspoiled area could still contain farms and roads as long as there was no energy or industrial infrastructure, whereas others believed that a natural area was only unspoiled if it did not contain any human-made structures. Similarly, an area can contain attractions for customers of a particular tourism business, whereas other businesses might see no appeal for their customers in the area. Furthermore, even if wind farms are placed in an area which is perceived as industrial, high wind turbines are likely to visually impact surrounding areas, some of which may be perceived as natural or unspoiled [66]. This points to the importance of including tourism stakeholders in the planning process, when deciding on locations for wind farms. Wind farm sites can be perceived in different ways by their users, and in order to ensure greater compatibility between the tourism industry and the energy sector, these multiple meanings assigned to the sites and to the wind energy infrastructure need to be identified, analysed and considered.

6. Conclusions

This study has provided an understanding of the conflicts which can arise between two land use sectors, that is wind energy harnessing and nature-based tourism. Furthermore, it has identified ways in which both parties can mitigate potential conflicts and minimise the negative impacts of wind farms on nature-based tourism. By identifying five factors which make certain locations more suitable for wind energy development with regard to the interests of the tourism industry, this study facilitates the decision-making of energy companies and policy makers and provides them with tools to achieve stronger tourism stakeholder support for the individual wind energy projects. Energy companies can make an effort to situate wind turbines in areas, where they would have less of a negative impact on the tourism industry compared to other areas. Similarly, the tourism service providers can adjust their operations, either by “telling a positive story” about the importance of renewable energy or, in some cases, change the travel routes of their customers. Overall, this study thus supports Frantál and Kunc’s [39] conclusion that there are no ideal wind farm sites, only “more or less acceptable areas”. It provides an understanding for how to define a “more acceptable area” in the hopes of highlighting ways towards higher compatibility of wind energy harnessing with the tourism industry and preservation of the natural resources which the tourism industry relies on.

A limitation of this study is that the participants were asked to express their opinion on something which does not yet exist and may never exist. This study focused only on proposed wind farms as there are currently no wind farms in Iceland. Previous studies focusing on tourism stakeholder attitudes towards energy infrastructure [66–68] have shown that they tend to be more negative towards proposed renewable energy infrastructure compared to the existing one. Thus, it is possible that the opinions of tourism service

providers will change if/once the wind farms will be constructed. This provides great opportunities for conducting research in the same study areas after the construction of the wind farms to investigate the potential changes in tourism service provider attitudes and the factors causing these changes.

This study focused on nature-based tourism and its interrelationships with wind energy harnessing. In the future, it would be interesting to investigate the opinions of tourism service providers in the sphere of other types of tourism, such as cultural or heritage tourism, to illustrate which areas they would consider as “more acceptable” for wind farms and to what extent the attitudes of tourism service providers from different spheres of tourism differ or align. Similarly, the suitability of areas for wind energy harnessing from the perspective of tourists could be analysed and related to the perceptions of the tourism industry.

Due to the high visibility of wind farms and their vast impact on the landscape, future wind energy development is likely to pose challenges in areas of high-quality nature and with strong nature-based tourism [7,21]. Wind energy development in such areas will therefore raise important public policy questions with regard to the trade-offs between land use for nature-based tourism and for wind energy harnessing.

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Paper IV





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Original research article

How close is too close? Mapping the impact area of renewable energy infrastructure on tourism

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ABSTRACT

Estimating the spatial extent of the impacts of renewable energy infrastructure on tourism is crucial for the identification of potential locations of resource use conflict. Such a task, however, is complicated and requires inclusion of social perceptions on the spatial extent of the impacts. This study investigates perceptions of the tourism industry in Iceland regarding the impact area of existing and proposed energy projects on tourism and analyses the factors affecting its size and shape. It is based on semi-structured interviews with tourism service providers, during which participants mapped their perceived impact areas using participatory mapping software. The results revealed that the reasoning affecting the perceived spatial extent of the impacts falls into three categories: visibility of renewable energy infrastructure and related environmental impacts; tourist mobility; and changes in tourism due to energy projects. Moreover, the impacts of the proposed energy projects were perceived as more negative compared to existing ones. Energy projects were considered less suitable in wilderness areas, which were defined by the tourism service providers as an important resource for nature-based tourism, but more acceptable in developed areas. Thus, the spatial extent of the impacts and the compatibility of renewable energy infrastructure with tourism highly depend on changes in place meanings and tourism processes brought by energy infrastructure as well as affected elements of tourism networks. This emphasizes the importance of including tourism stakeholder perceptions and knowledge into the early stages of energy planning to ensure sustainable development of both the tourism and energy industries.

1. Introduction

With a pressing need to mitigate the climate crisis, interest in the harnessing of renewable energy is increasing worldwide. In 2020, more than 260 GW of global renewable energy capacity was added, setting a new annual record [1]. Iceland is among the leading countries in renewable electricity production per capita. Almost 100% of electricity produced in the country in 2020 came from renewable sources with 68.8% coming from hydropower and 31.2% from geothermal power [2]. Over 80% of all energy used in Iceland is renewable [3]. The country's reliance on renewable energy sources is likely to increase further, since in Iceland's *Climate Action Plan* [4] the low share of renewables in the transport sector is being addressed by, among other measures, facilitating the purchase and the use of electric cars and other clean energy vehicles. Iceland has utilized hydro and geothermal power for several

decades, and numerous wind farm proposals are under consideration [5].

However, renewable energy infrastructure (REI) is characterized by limited spatial flexibility, meaning that renewable energy resources have to be harnessed where they are available. In the case of Iceland such resources are, for the most part, available in relatively undeveloped natural areas which are of increasing value for tourism and recreation, potentially creating contestation over the resource use [6–8]. The tourism industry has been the largest contributor to the Icelandic economy in terms of export earnings [9] and to regional development since 2010 [8], with nature and scenery being the main attractions to tourists [10]. High quality natural areas are therefore a critical resource for the tourism industry. Thus, Iceland provides a valuable case for studying the impacts of REI on nature-based tourism.

An important factor in identifying the locations most suitable for REI

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with regard to tourism is the spatial extent of potential impacts of REI on tourism. Estimating the impact area of REI on tourism is, however, a challenging task. Previous studies [11–13] have revealed that tourism stakeholder attitudes toward REI are highly heterogeneous along with the factors affecting the severity and extent of the impacts of REI on tourism. While visual impacts of REI have been shown to be a major concern among tourism stakeholders [14–17], numerous studies [18–22] have suggested that the visual impacts of REI are by far not the only factor affecting stakeholder attitudes toward REI. The meanings assigned to places where such infrastructure is proposed or constructed also play an important role given that they have been shown to shape the attitudes of tourism stakeholders toward specific REI projects [11,19,23].

In order to estimate the impact area of REI on tourism it is therefore essential to understand how changes brought by REI development affect tourist destinations as places containing multiple meanings to the people using them [24]. This study focuses on the views of tourism service providers on existing and proposed REI in Iceland. The beliefs and perceptions of tourism service providers regarding the impacts of REI on tourism and their spatial extent are likely to affect their decision-making on future investments and actions related to tourism planning and development in the areas that tourism service providers perceive as affected [8,25]. Furthermore, tourism service providers play a major role in shaping tourist attitudes toward REI encountered during their travels [26]. Hence, knowledge of how tourism service providers perceive the impacts of REI on tourism and their spatial extent is an important contribution to understanding the complex relationships between REI and tourism.

The present study aims to: (I) map the impact area of REI on tourism as perceived by tourism service providers; and (II) investigate the factors affecting the size and shape of the perceived impact area. To achieve these aims interviews with tourism service providers in Iceland were conducted using participatory mapping software to estimate the perceived impact area.

2. Estimating the spatial extent of the impacts of REI on tourism

The spatial extent of the impacts of REI on tourism is a crucial factor for the selection of the most suitable sites for REI in regions relying on tourism and for reducing potential resource use conflicts, therefore several studies have investigated how the impacts of REI on tourism change with distance. Various studies [11,27,28] that examined how hypothetical offshore wind turbines would impact beachgoer attitudes and consequently visitation demand showed that with increasing distance between the wind turbines and the shore the proportion of visitors reporting negative impacts on their experience and intention to avoid the beach decreased. In a study by Parsons et al. [11] the base trip-loss was estimated to be 29% if 100 wind turbines reaching the height of 175 m would be constructed at a distance of 2.5 miles (4 km) from shore and would drop to 5% at 20 miles (32.2 km). A study by Veidemane and Nikodemus [28] revealed that if 20 wind turbines with a 100 m high tower and 40 m long blades would be constructed at a distance of 8 km from shore 48,3% of tourists would be deterred from visiting the beach, while at a 20 km distance the proportion would drop to 18%. The distance between the wind farm and the shore was also positively correlated with the willingness to stay longer in the area [28]. Similarly, the experienced visual disamenity costs among tourists decreased with increasing distance of offshore wind turbines from the shoreline [29].

Distance has also been found to play a role in shaping the attitudes of tourism service providers. Burns and Haraldsdóttir [30] indicated that tourism service providers located further away from a proposed hydropower plant or not directly relying on the area where it was proposed were less negative toward the proposed infrastructure. Ólafsdóttir and Sæþórsdóttir [14] showed that distance of a proposed wind farm from tourist activities and scenic areas used for tourism was an important factor shaping the attitudes of tourism service providers.

While studies investigating how distance affects tourism stakeholder attitudes toward REI have emphasized the importance of the degree of visual impacts caused by REI (e.g. [11,15,28]), the heterogeneity of these attitudes points to the need for research investigating other factors affecting the spatial extent of the impacts of REI on tourism. Such studies presently are relatively few. Sæþórsdóttir and Ólafsson [31,32] described a method which was developed by one of the expert groups of the *Icelandic Master Plan for Nature Protection and Energy Utilization*. The *Master Plan* was implemented by the Icelandic Government with the aim to ensure sustainable energy utilization which would be compatible with other land uses, such as tourism, as well as nature conservation goals, and is responsible for the evaluation and ranking of the energy projects proposed by the energy companies [6,33,34]. The method developed by the expert group besides evaluating REI proposals simultaneously serves as a tool for estimating potential impact areas of the proposed REI on tourism and recreation. The impact areas include regions where the attributes falling into at least one of the five following categories would be affected: experience, recreation opportunities, use, infrastructure and future value [31]. While this method has been used in the *Master Plan*, some of the energy companies have criticised the large size of the identified impact areas [35]. Therefore, research investigating how tourism stakeholders perceive the impact area of REI on tourism and which factors they define as decisive for the size and shape of the impact area is greatly needed to ensure sustainable REI planning.

Several studies [18,19,36] emphasized that the technical and locational characteristics of REI do not fully explain stakeholder attitudes toward REI and pointed to the importance of place-based management of natural resources. As Devine-Wright [36] observed, “locations of renewable energy projects are not merely sites with topographical, ecological or archaeological features; they are also places replete with memories, experiences, stories and myths that are as much a feature of any locality as the soil type, height above sea level or average wind speed.” This demonstrates the importance of also considering the sense of place [37–39] when assessing the impacts of REI on tourism [24]. According to Stedman [40], physical environment characteristics shape the symbolic place meanings which serve as a basis for people's place attachment and satisfaction with the place. While place meanings are socially constructed and might be kept even when changes to the physical environment occur [41,42], various studies [40,43] have pointed out that radical environmental changes are more likely to threaten the place meanings and lead to changes in the sense of place. Just how far these changes are likely to reach when REI is constructed in natural areas used for tourism may depend on how tourism stakeholders perceive the places where such infrastructure is constructed and their boundaries.

With respect to the concept of place, Massey [44] stated: “if space is rather a simultaneity of stories-so-far, then places are collections of those stories, articulations within the wider power-geometries of space”. She further argued that places can be defined as “bundles of trajectories”, “integrations of space and time” or “spatio-temporal events” [44], the character of which is defined by the intersections of the multiple relations to them. Places are not static, they are constantly changing and being co-produced by human mobilities and immobilities. While travelling, people also contribute to the construction and alteration of the spaces and places they move through. Thus, the concepts of mobility and place are not antagonistic, they are instead closely related and complement each other [24,45].

Places are shaped by networks of social relationships which reach much further than the places themselves, with the multiple identities of places being created via complex internal and external linkages [46]. Therefore, while analyzing places and impacts of physical changes brought to them, it is important to take into consideration their interrelationships with other places and the wider surrounding environment [47]. This is highly relevant for tourism destinations which Hannam et al. [48] define as *mobility nodes*, a meeting point of multiple social connections. As a result, tourist places are “economically,

politically and culturally produced through networked mobilities of capital, persons, objects, signs and information” [49]. All these mobilities contribute to shaping tourist places and create networks connecting tourist destinations, and therefore affect the spatial extent of the impacts of REI on tourism.

3. Research settings

3.1. Study context

Due to its location on the Mid-Atlantic Ridge in the northern periphery and consequent interplay of glaciers and volcanic activity, Iceland is recognized for its diverse landscapes and unique nature [50]. Around 25% of the country's area is currently under formal conservation protection (Fig. 1) [51]. The country's protected areas include three national parks, 42 nature reserves, 48 natural monuments as well as numerous other protected areas [52]. Icelandic protected areas include sites of international importance. Vatnajökull National Park and a volcanic island of Surtsey are UNESCO natural World Heritage Sites, while Thingvellir National park is a UNESCO cultural World Heritage Site [53]. Six sites in Iceland have been designated as Wetlands of International Importance, or Ramsar sites [54]. At the time of writing, eight natural areas are protected from energy developments according to the *Icelandic Master Plan for Nature Protection and Energy Utilization* [55].

Generally, energy developments are not permitted in protected areas in Iceland, however, renewable energy resources are often available in scenic natural areas used for tourism which do not hold any formal protection status. Some of these areas are located in the interior of the country known as the Central Highlands, which the present study focuses on. The region consists of a 400–700 m high plateau covering around 40% of the country and is characterized by lava fields, glaciers, vast sand deserts, mountains, geothermal areas, vegetated oases, and

wetlands. The Central Highlands are of high value for tourism and serve as a location for numerous tourism and outdoor recreation activities [7,56,57]. Water running from the glaciers and falling down the plateau and active geothermal areas provide numerous opportunities for harnessing energy [31,32,34]. Renewable energy resources within or at the edge of the Central Highlands provide for a significant proportion of current electricity production in Iceland [58]. Furthermore, various new energy projects have been proposed in the area and evaluated by the *Master Plan for Nature Protection and Energy Utilization* [5,59,60].

Most of the Icelandic population, which in January 2021 reached almost 370,000 [61], lives in the coastal lowlands of the country, with over 60% living in the greater capital area and the rest in small towns, villages, and farms [62]. The lowlands have numerous agricultural and other land uses, while the uninhabited Central Highlands are a venue for nature-based tourism, outdoor recreation, renewable energy harnessing, nature conservation, and sheep grazing.

For over two decades there has been discussed an idea of establishing a national park in the Central Highlands of Iceland [63], which resulted in creating Vatnajökull National Park in 2008 [64]. In December 2020 the Minister for the Environment and Natural Resources submitted a bill on establishing a Highlands National Park to the Icelandic Parliament. The park would cover an area of around 30,000 km² in the Central Highlands, corresponding to about 30% of the country [65]. After publishing the bill, however, opposition against establishing the park increased [66–69], which partly contributed to the bill's withdrawal from the Parliament as well as political disagreement. The establishment of the Highlands National Park would limit new energy developments in its territory [65]. Meanwhile, energy projects proposed in the Central Highlands are going through standard evaluation procedures, according to the *Master Plan* framework [70].

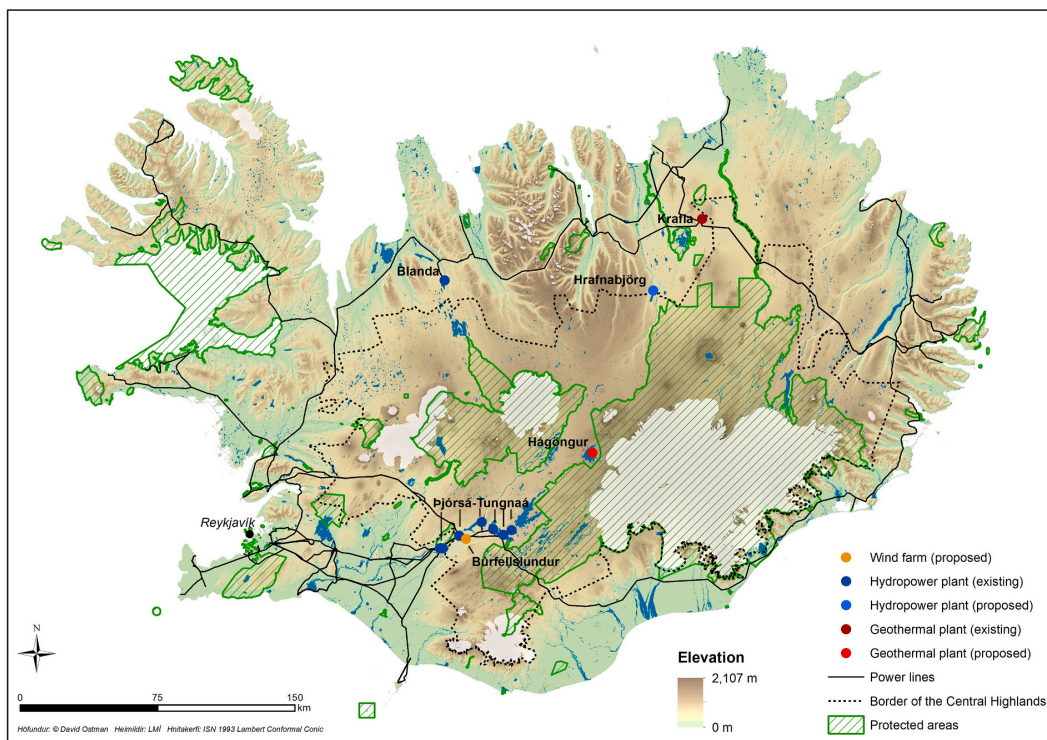


Fig. 1. Locations of the existing and proposed renewable energy projects included in this study.

3.2. Study areas

For this research six study areas located within or at the boundaries of the Icelandic Central Highlands were selected due to the importance of the area for nature-based tourism and opportunities for energy utilization. Study locations include areas with existing as well as proposed renewable energy projects in order to see if there are any differences in the tourism industry's perceptions of their impacts on tourism (Fig. 1; Table 1). Since previous research has shown that tourism stakeholders have different preferences regarding various types of REI [12,71,72], potential differences were investigated with respect to three types of REI, i.e. hydro-, geothermal and wind power, thereby also providing insights into the spatial extent of the impacts of various types of REI. The six selected renewable energy projects differ in their visibility and environmental impacts due to their type, size, and design (Table 1). The study areas are located at relatively high elevations, thus, their land cover is mostly desert-like with scarce vegetation [34]. While five study areas situated in the southern and in the northeastern parts of the Central Highlands are surrounded by diverse scenic landscape, the landscape around the study area containing the Blanda Hydropower Plant is rather uniform with no significant tourist attractions nearby.

4. Methods

4.1. Data collection

This study adopted a phenomenological research design which aims to investigate how participants perceive and interpret the phenomena and what meanings they assign to them [84–86]. The tourism service providers' perceptions of the impacts of REI on tourism and their spatial extent were analyzed by employing qualitative research methods since they best suit the phenomenological exploratory nature of this study [87]. As pointed out by numerous researchers [88–90], semi-structured interviews enable investigation of participants' perceptions, attitudes

and meanings assigned to certain places and phenomena. Asking predetermined questions during semi-structured interviews also allows collection of data comparable between several study areas, while probe questions based on the participants' answers provide opportunities to receive information which could not be predicted in advance and space for the participants to discuss the issues that they perceive as the most important [88,90]. Therefore, the data for this study was collected by conducting 49 semi-structured interviews in May–August 2020 with selected tourism service providers that use the natural areas located next to the existing or proposed energy projects discussed in this study for their business.

Purposive sampling [85] was used for the selection of the participants, and, in line with the aims of this study, the tourism service providers who are knowledgeable about tourism in at least one of the study areas were selected. In order to provide multiple perspectives of various types of tourism businesses, maximal variation sampling [91] was used for identification of the participants. Thus, companies that differ in the type of services that they provide, type of tourists they serve, size and length of operation were included in the sample. The interviewed companies included accommodation and food service providers as well as travel agencies and day tour providers offering a wide range of tours, including hiking, sightseeing, jeep and super jeep, self-driving, horse riding, skiing, mountain biking, fishing, kayaking, photography, yoga and meditation, and flight tours. The size of the businesses ranged from one for self-employed participants to over 60 employees. While some companies included in the sample were active for less than 10 years, the oldest companies had been operating for over 40 years. Companies having their headquarters next to the study areas as well as those operating from the capital Reykjavik were included in the sample. Such sampling ensures the inclusion of a wide range of views and perspectives and allows the identification of factors that affect the views of the tourism service providers regarding the impact area of REI on tourism.

Each interview was started by introducing the research team and the aims of the study to the participants. They were further informed that all data collected will be treated confidentially, that their participation is fully voluntary, and they can withdraw at any time. Once the participants gave their consent to participate in the study, they were asked whether the interview can be audio recorded, to which all of the participants agreed. In order to identify the perceived impacts of REI on tourism, their spatial extent and the factors affecting it, the following topics were covered during the interviews:

- The type of tourism business, customers and their preferences;
- The areas of Iceland and of the Icelandic Central Highlands used for the business;
- The main resources for tourism, main tourist attractions, and activities undertaken in the Central Highlands and in used study areas;
- The impacts of REI on the business of each participant and on tourism in Iceland in general, and factors affecting the character and the severity of these impacts;
- The estimated impact area of existing and proposed REI on tourism; and
- The reasoning behind each estimated impact area.

During the interviews the participatory mapping software *Maptionnaire* was used, allowing each participant to draw the estimated impact area of REI on tourism. For the estimation of the impact areas participants were asked to draw polygons to include the areas in which they considered tourism to be impacted by the energy infrastructure in question. The use of polygons during semi-structured interviews allows efficient mapping of the discussed place meanings, changes brought to them, and their spatial boundaries [92–94], and therefore is highly suitable for mapping the perceived impact areas of REI on tourism. However, the areas drawn by participants are often generalized, the boundaries of such areas tend to be 'fuzzy', and the level of precision varies according to each individual [92,95]. Moreover, since the

Table 1
Existing and proposed REI included in this study [73–82].

Existing REI ^a	Description	Installed capacity	Operation started
Blanda Hydropower Plant	Underground power station, reservoir (56 km ²), intake reservoir (5 km ²), 5 dams, several canals and tunnels	150 MW	1991
Krafla Geothermal Power Plant	2 steam turbines, 33 wells	60 MW	1977
Seven hydropower plants in the Þjórsá and Tungnaá Catchment Area	7 power stations, 3 main supply reservoirs (32–92 km ²), 7 smaller reservoirs (0.6–20 km ²), 24 dams, numerous canals and tunnels	1035 MW	1969
Proposed REI		Estimated capacity	
Hrafnabjörg Hydropower Plant	Underground power station, reservoir (27 km ²), 1–2 dams, several canals and tunnels	Three versions: 88.5 MW 50 MW 36.5 MW	–
Hágöngur Geothermal Power Plant	Directly disturbed area would reach around 0.3 km ² , infrastructure specifics not provided	150 MW	–
Búrfellslundur Wind Farm	30 wind turbines up to 150 m high	120 MW	–

^a Since presently only two experimental wind turbines are operated in Iceland, located at the edge of the Central Highlands of Iceland [83], this study focused only on existing hydro- and geothermal power infrastructure.

polygons were drawn by placing points which were connected by the software with straight lines, the areas tended to be less precise and to contain sharp angles when the participants placed relatively few points. In this study the impact areas were presented as drawn by the participants, and no changes were made to the drawings to account for the fuzzy boundaries of the mapped impact areas.

The maps prepared in *Maptionnaire* were presented to the participants on a portable computer screen. Participants could select between several base maps and could easily manipulate the map to choose their preferred scale. The maps included existing and proposed REI discussed in this study. Before mapping each participant was instructed about the use of *Maptionnaire* and was provided assistance during mapping if required. Few participants did not feel comfortable with using the software. They were offered a big, laminated map of Iceland with marked REI on it and were asked to draw their perceived impact areas with a marker. Later the drawings were copied into *Maptionnaire* and analyzed using the same procedure as impact areas mapped digitally.

While drawing their perceived impact areas participants were asked to provide their reasoning behind the estimated areas. Thus, they explained what impacts, landscapes, features, objects, routes, activities, and meanings they included in the mapped impact areas and what factors, according to them, shaped the boundaries of these impact areas. Participants were also asked about the character of the described impacts and of their estimated impact areas, which varied among the projects and was defined by the participants as positive, negative, mixed, or neutral. Participants were only asked to draw the perceived impact areas of the REI existing or proposed in the areas that they are familiar with, use, have used or are planning to use for their business and feel comfortable and knowledgeable enough to estimate impact areas of these energy projects on tourism. Additionally, to ensure that participants received sufficient information about the energy projects included in the study, detailed descriptions of the projects as well as various visual material, such as maps of the study areas, maps with visibility analysis of the energy infrastructure, and photographs were provided during the interviews. The interviews were conducted face-to-face, mostly by two interviewers, although several interviews were conducted by only one interviewer due to scheduling conflicts. Participants could choose either Icelandic or English as the interview language. The interviews lasted from 22 to 241 min depending on the number of study areas that each participant was familiar with and the number of estimated impact areas.

4.2. Data analysis

The interviews were transcribed verbatim and analyzed inductively based on the grounded theory method [96]. The data analysis started with open coding using Atlas.ti software. The data clusters for each study area were created and initial codes describing the value of each study area for the tourism industry, the impacts of each REI project on tourism, the factors affecting their character and their spatial extent, as well as the main arguments for the estimated impact areas were identified. During the second round all codes related to the same energy project were revised and clustered into categories based on the reasoning used in the estimation of the impact areas. The GIS data drawn from the interviews containing perceived impact areas was imported into ArcGIS software and the analysis of each polygon as regards their localization, size and shape and the reasoning revealed in the interviews was conducted. Later, axial coding was used, and the reasoning categories were compared between the study areas to identify the factors affecting the spatial extent of the impacts of REI on tourism.

Based on the interviews and on the GIS data, an Excel sheet was prepared which contained the information about each estimated impact area, its size and character, the arguments for its size, the impacts of each energy project discussed, the factors affecting the character of these impacts, and the perceived need for further energy development in Iceland as well as information about each participant's business. Thus,

the Excel sheet combined the information from the interviews with the information of the GIS data and served as a basis for writing up the results. Diagrams were also used to map the relationships between the various factors revealed in the interviews and the spatial extent of the impacts of REI on tourism [97]. Initial coding was done by one researcher, while the later steps of the analysis were conducted by the research team.

4.3. Overview of participants and their mapped impact areas

Some of the interviewees were not able or willing to map their perceived impact areas of REI on tourism. The reasons included not feeling knowledgeable enough or having never thought about the spatial extent of the impacts of REI on tourism before. Out of 49 participants 32 were willing to draw impact areas and to discuss the reasoning behind their drawings. Among the participants who estimated the impact areas, 15 tourism businesses were operating from Reykjavik, and 17 were located close to the areas with existing or proposed REI included in this study: five were in northwest Iceland, seven in northeast Iceland and other five in south Iceland (Table 2). All the tourism companies operating from Reykjavik were offering tours throughout the country, while companies located close to the areas with REI also included accommodation and food service providers, who estimated only the impact areas of REI located nearby. Thus, tourism businesses operating from Reykjavik constituted the highest proportion of participants who mapped impact areas of each energy project (Table 2).

The data collected revealed differences regarding the character of the perceived impacts of REI on tourism. While some participants perceived the impacts of the REI on tourism as negative, others described them as positive or mixed/neutral. Therefore, the impact areas estimated in this study were categorized and the reasoning behind them was analyzed accordingly. Three participants preferred to draw two impact areas of different character for the same energy project. One drew separate impact areas for neutral and positive impacts of the Blanda Hydropower Plant. Two participants estimated two impact areas each of the proposed Hrafnabjörg Hydropower Plant on tourism. One of them estimated separate positive and negative impact areas of the power plant, while the other estimated mixed and negative impact areas. In total, participants estimated 51 negative impact areas, 23 of the areas focused on positive impacts, and 31 were perceived as mixed/neutral impact areas.

5. Results

5.1. Perceived impact areas of REI on tourism

The participants were more negative toward the proposed energy projects compared to existing ones. Between 12 and 18 (80% and 86%) estimated impact areas of each proposed energy project on tourism were perceived as negative compared to 1–3 (6%–17%) impact areas of the existing REI (Table 3, Fig. 2). Besides discussing potential impacts of the proposed energy projects on tourism, most participants questioned the need for further energy development and the purpose of it.

The attitudes of participants toward the existing power plants were more positive than toward proposed energy projects. Participants stated that they have adapted their businesses to existing REI, since in most cases it was built before they started operating their businesses. In line with that, between 4 and 10 (28% and 56%) estimated impact areas of existing REI were perceived by the participants as positive, while the number of estimated positive impact areas of the proposed energy projects was relatively low, between 1 and 2 (5% and 13%) (Table 4, Fig. 3).

Some participants perceived the impacts of REI on tourism as mixed or neutral. For each existing energy project between 7 and 10 mixed/neutral impact areas were estimated, which constituted between 39% and 62% of all estimated impact areas, while 1–3 mixed/neutral impact areas estimated for each proposed renewable energy project constituted 7%–15% (Table 5, Fig. 4). Out of 31 mixed/neutral impact areas seven

Table 2
Number of participants who estimated the impact areas of each energy project.

Location and type of tourism business	Interviews conducted	Participants who estimated impact areas	Existing power plants			Proposed power plants		
			Blanda	Krafla	Þjórsá-Tungnaá	Hrafnabjörg	Hágöngur	Búrfellslundur
Reykjavik	19	15	9	9	13	10	10	13
(1) Travel agency/day tour provider	19	15	9	9	13	10	10	13
Northwest Iceland	8	5	5					
(1) Travel agency/day tour provider	2	0						
(2) Travel agency/day tour provider and accommodation	2	1	1					
(3) Accommodation/food service provider	4	4	4					
Northeast Iceland	13	7	3	4	1	7		3
(1) Travel agency/day tour provider	7	4	2	2	1	4		2
(2) Travel agency/day tour provider and accommodation	3	2	1	2		2		1
(3) Accommodation/food service provider	3	1				1		
South Iceland	9	5			4	1	5	5
(1) Travel agency/day tour provider	0	0						
(2) Travel agency/day tour provider and accommodation	6	3			2	1	3	3
(3) Accommodation/food service provider	3	2			2		2	2
Total	49	32	17	13	18	18	15	21

Table 3
Negative impact areas of all six energy projects on tourism.

Power plant		No. of impact areas	No. of all impact areas	% of all impact areas	Mean size (km ²)	Standard deviation	Median (km ²)
Existing	Blanda Hydropower Plant	1	18	6	640	–	–
	Krafla Geothermal Power Plant	1	13	8	548	–	–
	Þjórsá-Tungnaá Hydropower Plants	3	18	17	5423	3160	6336
Proposed	Hrafnabjörg Hydropower Plant	16	20	80	4361	9432	1447
	Hágöngur Geothermal Power Plant	12	15	80	3238	3312	2729
	Búrfellslundur Wind Farm	18	21	86	2559	1838	2247

impact areas (23%) were defined as neutral. All of them focused on the impacts of the existing energy projects.

5.2. Rationale behind the estimated impact areas

5.2.1. Negatively perceived impact areas of REI on tourism

The majority of the participants who perceived the impacts of REI as negative pointed to the environmental impacts of the energy projects in question. They emphasized that REI visually impacts the surrounding landscapes and transforms the image of the surrounding areas from natural into 'industrial'. Such changes, according to the participants, negatively impact visitor experience and reduce opportunities for the tourism industry in the areas around REI. Out of 51 estimated negative impact areas 26 (51%) were based on the visibility of the power plant infrastructure and associated environmental impacts and were relatively small (Table 6, Fig. 5). Their size, among other factors, depended on the design of the power plant, as well as on the topography of the surrounding landscape which affects from how far the REI can be seen. The type of REI also affected the size of the perceived impact areas based on visibility. Participants pointed to the high visibility of the proposed wind turbines, which would be visible in the Icelandic landscape from tens of kilometers. In some cases, participants took into consideration the visibility of the power lines, thus, such estimated impact areas were larger in size. While discussing the impact areas of the geothermal plants, some

participants considered the visibility of steam released by such power plants, which also led to estimating larger perceived impact areas of such power plants on tourism, compared to the impact areas the estimation of which was based on visibility of only power plant infrastructure.

Among the estimated negative impact areas extending beyond the visibility, 22 or 43% of all negative impact areas were mapped by taking into consideration tourist mobility (Table 6, Fig. 5). Participants who used this reasoning emphasized that tourists travel to the Central Highlands for wilderness experience and tend to perceive power plants as not suitable in natural areas, therefore REI is likely to negatively impact their experience. Such impacts, according to the participants, might last for an entire day or during the entire trip. Thus, REI encountered on the way to a nature destination is likely to affect how tourists experience and perceive this destination. The participants who estimated the impact areas based on tourist mobility in such areas often included the main Central Highlands roads passing the REI, such as Sprengisandur and Kjölur roads as well as roads to and around Landmannalaugar, the most popular tourist destination in the Central Highlands (Fig. 5). They included tourist destinations reached by travelling past the REI, the image and perception of which was/would be affected by the power plants. Several participants included into their estimated impact areas hiking routes that stretch to the various parts of the Central Highlands and emphasized that hikers are especially

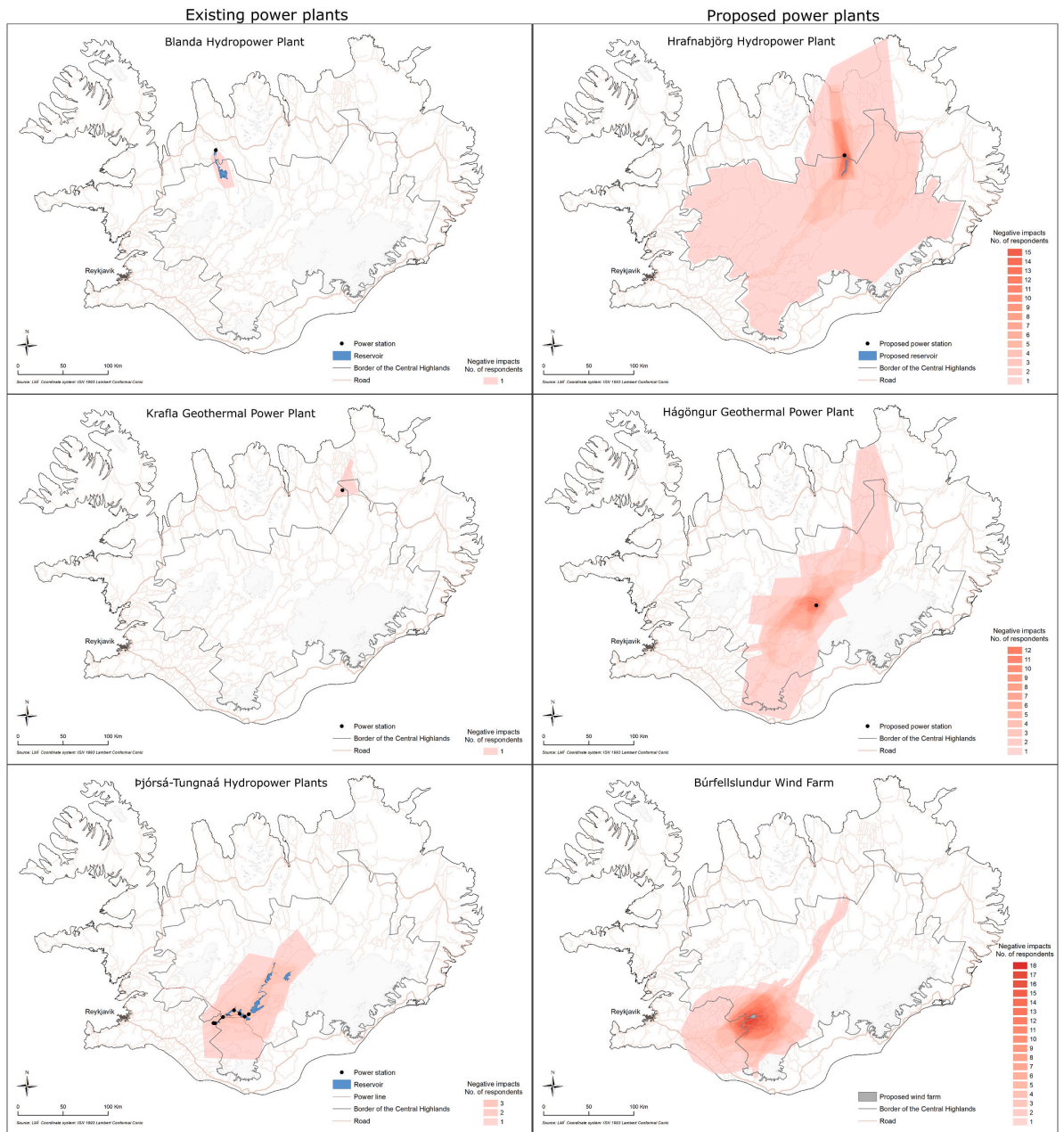


Fig. 2. Negative impact areas of all six energy projects on tourism.

Table 4
Positive impact areas of all six energy projects on tourism.

	Power plant	No. of impact areas	No. of all impact areas	% of all impact areas	Mean size (km ²)	Standard deviation	Median (km ²)
Existing	Blanda Hydropower Plant	10	18	56	2768	5264	685
	Krafla Geothermal Power Plant	4	13	31	1167	2137	141
	Þjórsá-Tungnaá Hydropower Plants	5	18	28	10,284	12,020	5356
Proposed	Hrafnabjörg Hydropower Plant	1	20	5	36	–	–
	Hágöngur Geothermal Power Plant	2	15	13	1160	1183	1160
	Búrfellslundur Wind Farm	1	21	5	131	–	–

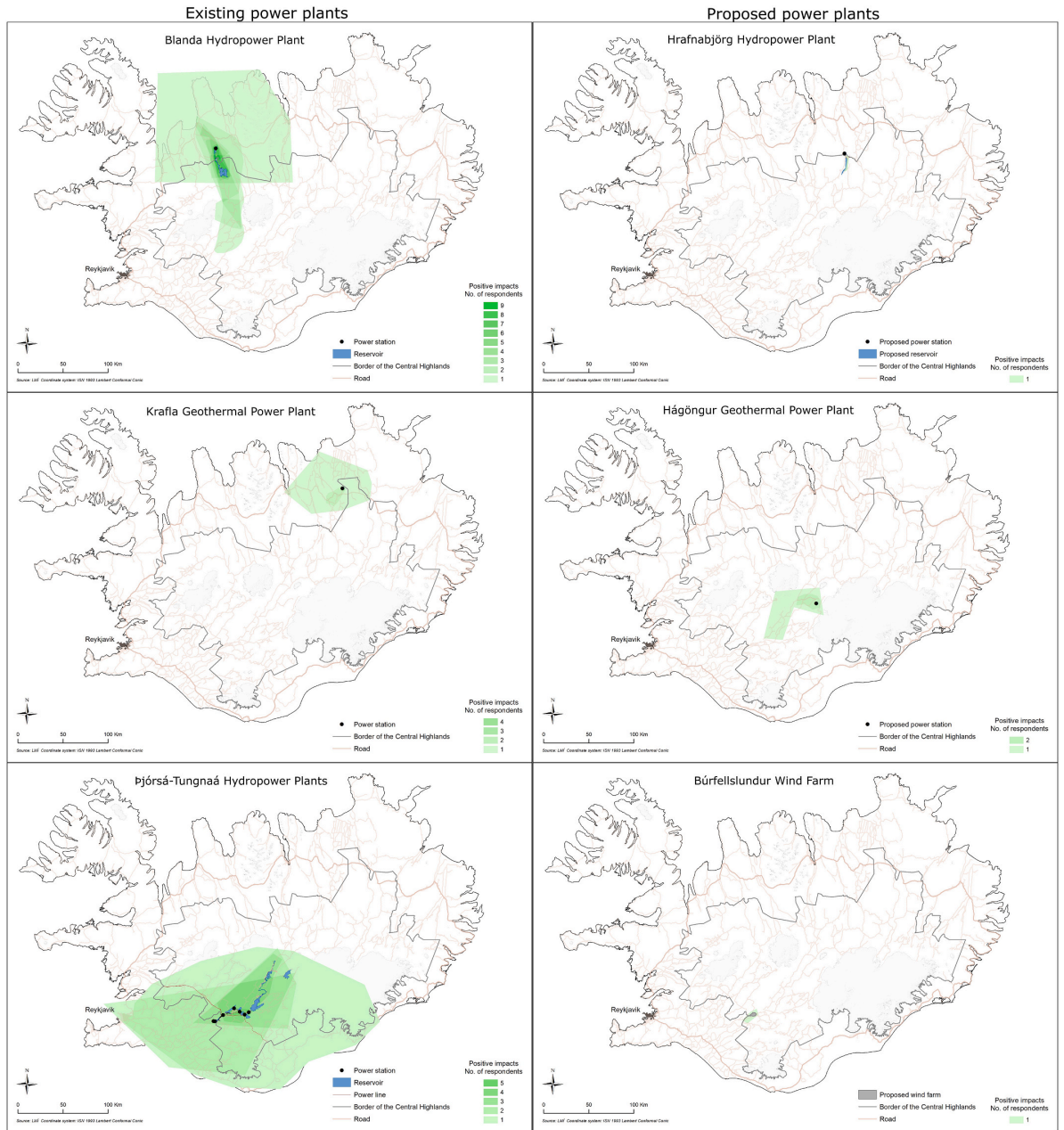


Fig. 3. Positive impact areas of all six energy projects on tourism.

Table 5
Mixed and neutral impact areas of all six energy projects on tourism.

	Power plant	No. of impact areas	No. of all impact areas	% of all impact areas	Mean size (km ²)	Standard deviation	Median (km ²)
Existing	Blanda Hydropower Plant	7	18	39	1012	967	531
	Krafla Geothermal Power Plant	8	13	62	765	764	482
	Þjórsá-Tungnaá Hydropower Plants	10	18	56	3139	2258	2158
Proposed	Hrafnabjörg Hydropower Plant	3	20	15	7244	327	7419
	Hágöngur Geothermal Power Plant	1	15	7	6983	–	–
	Búrfellslundur Wind Farm	2	21	10	310	9	310

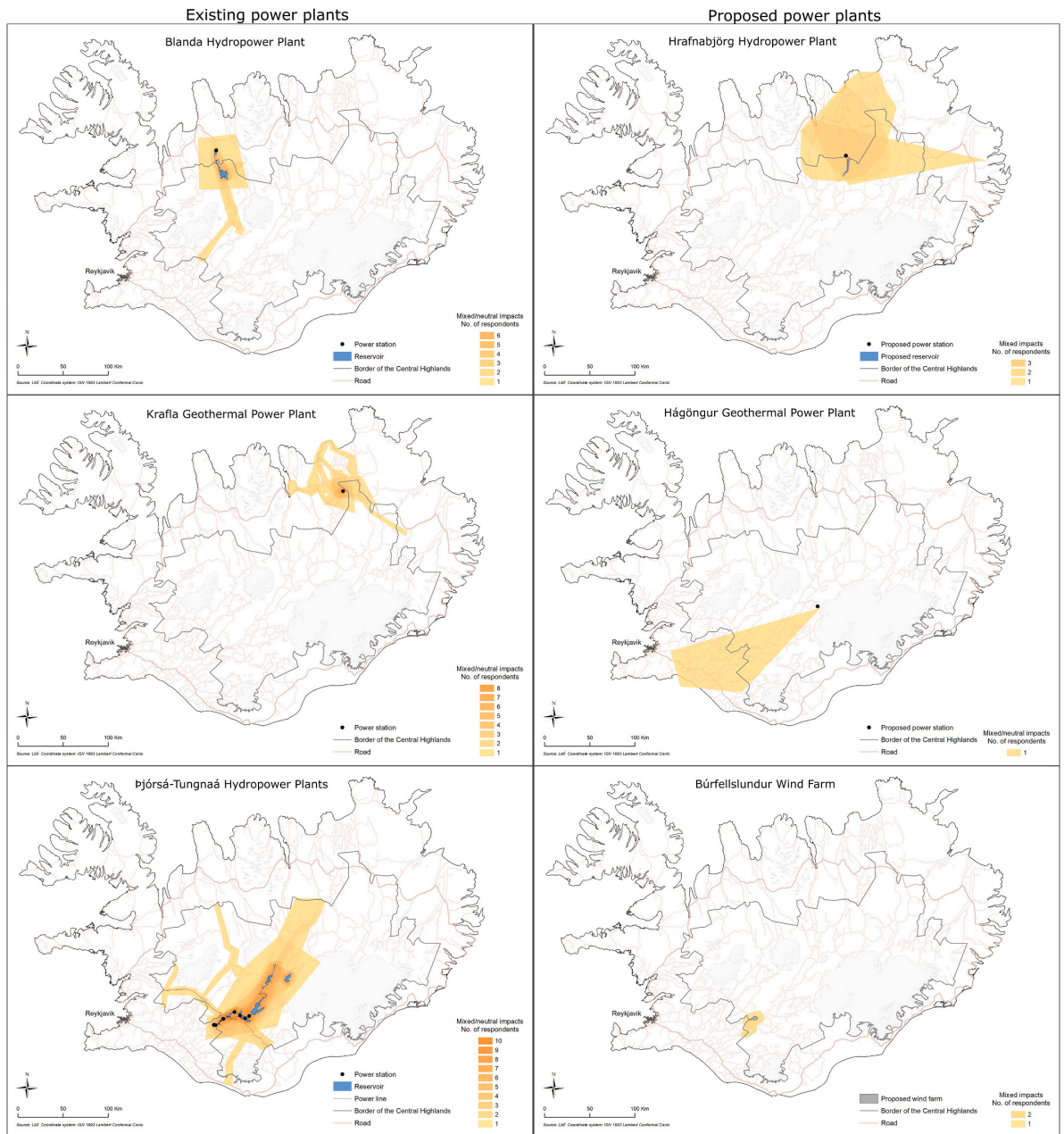


Fig. 4. Mixed and neutral impact areas of all six energy projects on tourism.

sensitive to encounters with REI, therefore REI heavily impacts the value, image and future potential of hiking routes that it interferes with. Thus, the size of the perceived impact areas of REI on tourism based on the tourist mobility depended on the routes tourists are using, the destinations they are visiting, their travel mode, and the experiences they are seeking.

Some participants believed that more REI in the Central Highlands is likely to negatively impact wilderness areas which the tourism industry relies on and, subsequently, damage the image of the whole Central Highlands and of the proposed Highlands National Park. The

participants stressed the importance of keeping the size of the wilderness areas large in order to provide high quality experience to tourists and stated that building new power plants would cut into a large wilderness area. In those cases, participants defined the whole Central Highlands or large parts of them as the impact area of REI on tourism, since the experience of tourists travelling in these areas would be degraded. Participants emphasized that wilderness experience is an important attraction for tourists and a resource for tourism businesses and therefore stated that wilderness areas should be protected from energy developments. They perceived areas which are already developed, contain

Table 6
The number of estimated impact areas based on visibility, tourist mobility and changes in tourism.

Power plant		No. of negative impact areas			No. of positive impact areas			No. of mixed/neutral impact areas			Total
		Visibility	Mobility	Changes	Visibility	Mobility	Changes	Visibility	Mobility	Changes	
Existing	Blanda Hydropower Plant	1	0	0	4	0	6	4	0	3	18
	Krafla Geothermal Power Plant	0	1	0	1	0	3	2	0	6	13
	Þjórsá-Tungnaá Hydropower Plants	0	3	0	0	0	5	6	1	3	18
Proposed	Hrafnabjörg Hydropower Plant	10	4	2	0	0	1	0	1	2	20
	Hágöngur Geothermal Power Plant	7	5	0	0	0	2	0	0	1	15
	Búrfellslundur Wind Farm	8	9	1	1	0	0	2	0	0	21
	Total:	26	22	3	6	0	17	14	2	15	105

no tourist attractions and therefore are of low value for the tourism industry as being more suitable for REI development.

Three impact areas constituting 6% of all negative impact areas were estimated by considering the changes REI brings to tourism (Table 6, Fig. 5). The participants who used this reasoning emphasized that REI alters tourist movement and their travel patterns and consequently affects other tourism processes in the estimated impact areas of REI on tourism. According to them, the construction of a power plant is likely to lead to avoidance of the surrounding areas due to decreased attractiveness of these areas and/or destruction of tourist attractions. For example, as pointed out by the participants, construction of the proposed Hrafnabjörg Hydropower Plant would destroy Aldeyjarfoss and Hrafnabjargafoss waterfalls, which are of increasing importance for the tourism industry. Such changes, according to the participants, might have negative impacts that stretch far out among the region. Tourists travelling in the region have less attractions to visit and therefore might spend less time there, which is likely to lead to reduced demand for tourism services and economic losses. The participants who estimated impact areas using these arguments often included the areas where tourism services are provided.

5.2.2. Positively perceived impact areas of REI on tourism

Most of the positive impact areas, or 17 out of 23 (74%) were estimated taking into consideration the changes in tourism that REI brought to the areas (Table 6, Fig. 5). Numerous participants pointed to the improved access due to the road construction related to REI development. New roads and bridges opened up new areas for tourism and added new tourist destinations for visitors to the Central Highlands. Better roads enabled visitors to reach the destinations in the Central Highlands faster and safer. This allowed tourists to go on day tours to the Central Highlands while using the accommodation services in the lowlands. Moreover, they provided better opportunities for winter tourism in the Central Highlands.

According to the participants who estimated positive impact areas, improved access resulted in tourism industry using much wider areas of the Central Highlands for their businesses and including these areas into larger itineraries. For example, improved access due to construction of the Þjórsá and Tungnaá Hydropower Plants enabled the tourism industry to add Central Highlands destinations such as Landmannalaugar or other nearby areas into south Iceland itineraries and to diversify their tours. Improved access was also an important factor in estimating the positive impact areas of the Blanda Hydropower Power Plant since, according to the participants, improvement of the Kjölur road, one of the main roads of the Central Highlands, positively impacted tourist destinations located along the road, such as Kerlingarfjöll and Hveravellir, by making them easier and safer to reach. The perceived positive impact area of the Krafla Geothermal Power Plant based on improved access was relatively small, it included the tourist sites located nearby which became more accessible, such as Leirhnjúkur and Víti (Fig. 5).

Some participants who perceived the impacts of REI on tourism as positive stated that although nature and, in particular, unspoiled nature is Iceland's main attraction, REI can become a tourist attraction to a certain type of tourist. According to the participants, tourists' attitudes

toward renewable energy harnessing are generally positive, and some tourists are interested in visiting the power plants and learning about energy harnessing processes. Thus, power plants can become tourist attractions themselves and serve as a good addition to the itineraries organized in the region. Participants noted that geothermal power plants have a higher tourist attraction potential compared to hydro-power plants and to wind farms due to their rarity and high educational value. The largest positive impact area of the Krafla Geothermal Power Plant was estimated using these arguments. In some cases, construction of a power plant might have unexpected positive impacts on tourism. After the construction of the Blanda Hydropower Plant and of its dams and reservoirs the water downstream became clear, which provided opportunities for recreational salmon fishing attracting foreign and Icelandic fishing enthusiasts to the area. Several participants considered it while estimating their perceived positive impact areas. In addition to improved fishing opportunities, the participant who estimated the largest positive impact area of the Blanda Hydropower Plant on tourism took into consideration the economic benefits of the power plant, via the creation of new jobs, which made the area a more competitive destination, and the future potential of the power plant as a tourist attraction if it would be better marketed. In their estimated impact area, they included a location in which tourists would have one more tourism attraction to visit during their trip.

Six positive impact areas (26%) were estimated based on visual impacts of the power plants. According to the participants, naturally looking reservoirs of the hydropower plants add diversity to uniform landscapes as, for example, around the Blanda Hydropower Plant, and provide guides opportunities to talk about renewable energy harnessing and sustainability in Iceland. The estimated impact areas based on these arguments were relatively small and ended with the visibility of REI.

5.2.3. Mixed and neutral impact areas of REI on tourism

Some of the participants who estimated mixed impact areas included both positive and negative impacts of REI on tourism, such as visual impacts on surrounding landscapes and on the environment as negative on one hand and the use of roads and bridges for their tours as positive on the other. Some participants also considered impacts that can be perceived both positively and negatively. For example, improved access allows faster and safer travel of tourists, but also leads to higher visitor numbers in natural areas, increased environmental pressure, crowding, and consequently degraded visitor experience and changes in the image and perception of tourist destinations that have become easier to access. Moreover, participants emphasized that while, in some areas, visitation increased due to improved access or investments into tourism infrastructure by the energy company, the areas located closest to the REI are often avoided due to their degraded attractiveness, especially by the businesses the customers of which are seeking wilderness experience. Thus, the perceived mixed impact areas varied largely in size. While the size of eight mixed impact areas was based on the visibility of REI, two impact areas were drawn by taking into consideration tourist mobility and 14 considered changes in tourist movement, their travel patterns and consequently in other tourism processes (Fig. 5).

Some participants who estimated mixed impact areas stated that REI

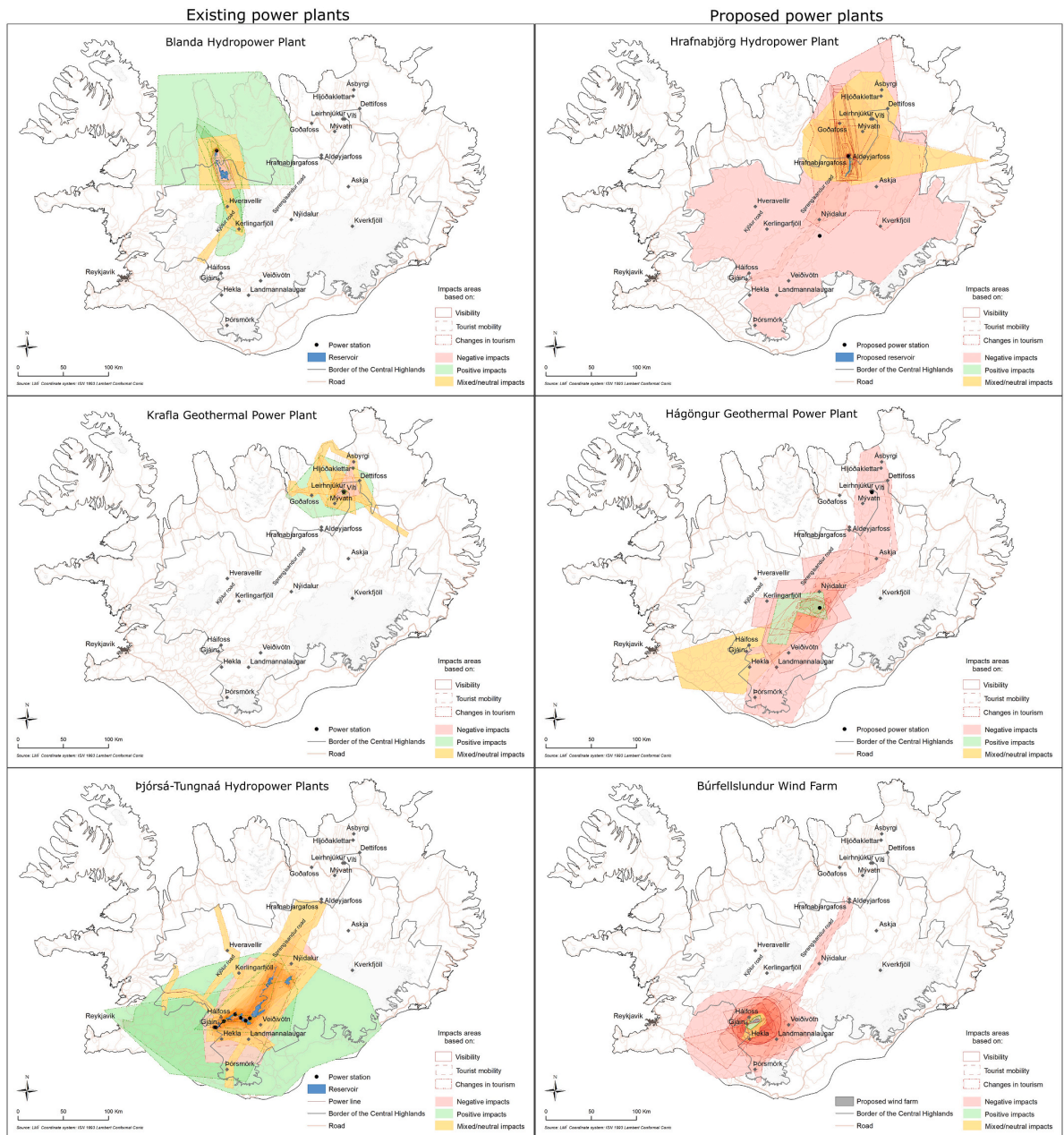


Fig. 5. Perceived impact areas of all six energy projects.

certainly changes the landscapes, however, how REI is perceived by tourists and how it consequently impacts tourism depends on various factors. They pointed to the importance of information that tourists receive about renewable energy harnessing in Iceland. According to the participants, if presented in a positive light by the guides as contributors to the sustainable development of the country and to climate change mitigation power plants are likely to be perceived positively. Tourists' perceptions of REI, as stated by the participants, are also likely to depend on their preferences and expectations, interest in renewable energy harnessing, and familiarity with REI.

Participants who perceived the impacts of the existing Blanda and Þjórsá and Tungnaá Hydropower Plants as neutral stated that the well-designed power stations fit well into the surrounding landscape and do not degrade visitor experience, while reservoirs have an appearance of natural lakes for those who are unfamiliar with the area. Impact areas estimated based on these arguments were generally relatively small and their size often depended on the estimated visibility of REI. According to the participant who estimated a neutral impact area of the Krafla Geothermal Power Plant, the power plant is often visited on the way to Víti or Leirhnjúkur, but could not be defined as a tourist destination,

thus, its impact on tourism is neutral.

5.3. Factors affecting the spatial extent of perceived impacts of REI on tourism

Much of the estimated negative, positive, mixed, and neutral impact areas are overlapping (Fig. 5). This shows that the impacts of REI on tourism and their spatial extent are highly subjective and depend on numerous factors. These factors can be related to the landscape of the area surrounding the energy project, to the REI itself, as well as to the tourism stakeholders (Fig. 6). Landscape characteristics together with the type, design, spatial distribution, and image of REI define the severity of the environmental, visual and aural impacts of REI. These impacts, as well as activities undertaken by the tourism stakeholders, their preferences, expectations, and place meanings assigned to the areas of REI, play an important role in shaping the impacts on the perception and image of the area and on the visitor experience. As the interviews revealed, the spatial extent of these impacts highly depends on the subjective perceptions of the tourism stakeholders. Participants who thought the impacts of REI on tourism end with visibility estimated the smallest impact areas. Participants who considered that the impact areas of REI on tourism stretched far beyond the visibility of REI and its environmental impacts, took into consideration tourist mobility. Thus, their mapped impact areas included routes and destinations where visitor experience, image and perception of the area as a whole would be affected if tourists would travel by the REI (Fig. 6). Participants who based their mapped impact areas on changes brought about by REI to tourist movement, travel patterns and other tourism processes included the areas which are/would be avoided due to decreased attractiveness or destroyed tourist attractions, where demand for tourism services would decrease due to lower tourist traffic and shorter stay and which, consequently, would experience economic losses. These impact areas also included areas where tourist flows increased due to improved access

and which became part of larger itineraries, as well as areas in which visitors have another tourist attraction – a power plant – to visit.

6. Discussion

The results of this study revealed that the transformation of the physical environment due to the construction of REI leads to changes in place meanings assigned to the area by the tourism service providers, which supports the findings of Stedman [40]. REI proposed in natural areas was perceived by the tourism service providers as mostly incompatible with nature-based tourism, a finding in line with the majority of previous studies conducted in Iceland [8,14,26]. Most businesses perceived the areas surrounding the proposed REI as wilderness and emphasized that wilderness experience is an important attraction to tourists visiting the Central Highlands and therefore a valuable resource for the tourism industry. REI, according to the tourism service providers, changes the character of natural areas into ‘industrial’, thereby degrading the quality of visitor experience and reducing opportunities for tourism activities. Place meanings assigned to natural areas by the tourism service providers are threatened by REI developments, therefore such proposals in natural areas do not receive their support [98,99]. Tourism service providers prefer to preserve wilderness areas instead of developing them for energy harnessing. They furthermore emphasized the importance of keeping the size of the wilderness areas large to ensure high quality visitor experience and more opportunities for product development.

The spatial extent of the impacts of REI on tourism as perceived by the tourism service providers has been shown to depend on their perception of place and its boundaries. While some tourism service providers mapped the impact areas of REI on tourism ending with the visibility of REI and of its environmental impacts, others took into consideration the interrelationships of the areas surrounding the REI with other places and perceived these areas as parts of larger tourism

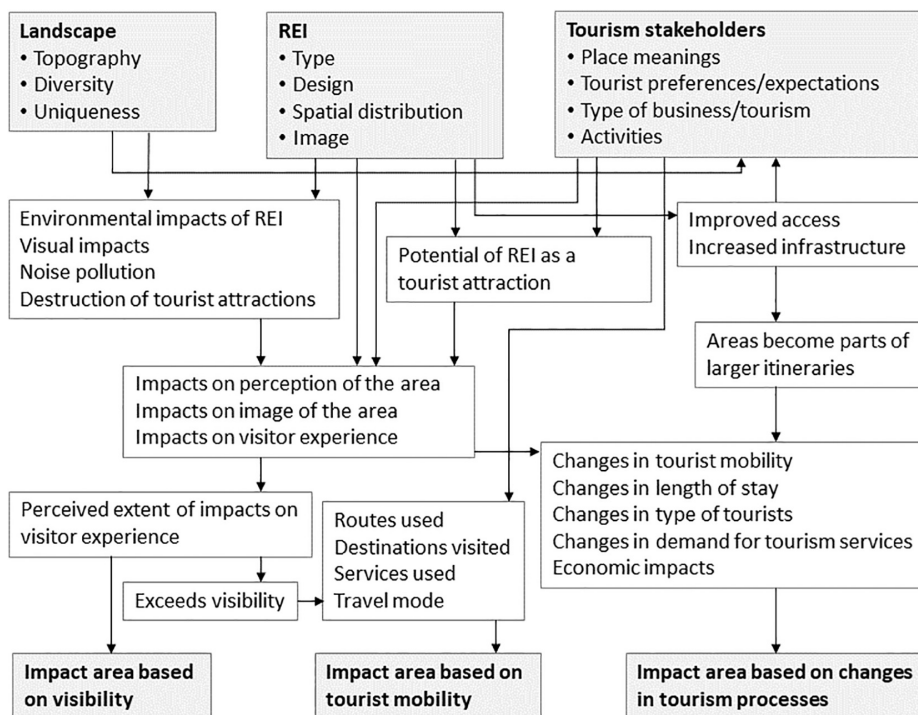


Fig. 6. Factors affecting the spatial extent of the impacts of REI on tourism as perceived by the tourism industry.

networks. They estimated the impact areas covering the whole itineraries during which visitor experience would be affected. In some cases, the estimated impact areas included extensive areas where construction of REI is likely to lead to a chain of changes in tourist travel patterns, tourism demand and other tourism processes. This emphasizes that changes made to the physical environment in the areas of REI are likely to affect other tourist destinations, in places which are connected to these areas via tourism relationships. Previous studies have shown that when tourism demand in certain areas or regions declines due to the construction of REI, it is likely to increase in the neighboring areas or regions [11,15]. Therefore, it is important to plan REI developments in coordination with multiple municipalities [100], which are also likely to experience changes in tourism demand. This study furthermore revealed that in smaller countries relying on nature-based tourism, such as Iceland, construction of a renewable energy project might affect a significant part of the country, pointing to the need for holistic approaches to planning renewable resources. Moreover, given that tourism processes and networks generally tend to stretch over the boundaries of administrative units, it is of crucial importance in planning REI developments to gather information on the spatial distribution of tourism processes connected to the area where the construction of REI is being considered.

Besides stressing the importance of preserving relatively undeveloped and wilderness areas as an important resource for the tourism industry, tourism service providers interviewed in this study also questioned the need for further renewable energy harnessing in the country and its purpose. In 2019 over 77% of electricity produced in Iceland was used by heavy industry [101]. In line with previous research [26], tourism service providers emphasized that new renewable energy projects should be constructed when they are needed for the local population. When such a need exists, various characteristics of the areas, including their value for current and potential future users and meanings assigned to these areas by stakeholders, should be examined in order to identify locations most suitable for REI development. Furthermore, characteristics of REI itself and changes it is likely to bring to the meanings and perceptions of the areas should be taken into consideration [102,103]. Tourism can be better facilitated by including tourism stakeholder perceptions of the places where REI is proposed as well as information on tourism in the areas and connectivity elsewhere. Numerous researchers (e.g. [104,105]) have pointed to the benefits of stakeholder inclusion at the early stages of planning of energy projects, when selecting the most suitable location for REI. One such benefit is higher support from stakeholders for developing REI [106–108]. As shown in this study, higher support of the tourism service providers for specific renewable energy projects would ensure that tourism businesses present energy projects to their customers in a positive light, which, according to the interviewed tourism service providers, plays an important role in shaping tourist attitudes toward renewable energy developments.

Numerous studies have emphasized the usefulness of participatory GIS for mapping the spatial distribution of the place meanings ascribed to the areas by the stakeholders and for identification of potential conflict areas [109–113], with research pointing to the need for a wider use of PGIS in natural resource planning to inform and facilitate decision-making [114]. This study showed that PGIS is an effective tool for mapping the perceived impact areas of REI on tourism. Such spatial information is essential for the selection of the most acceptable energy project proposals and for mapping the areas where conflicts between the energy and tourism industries are most likely to occur.

In this research the impacts of the proposed renewable energy projects on tourism were perceived by the tourism industry as being more negative compared to the impacts of existing REI. This is in line with the findings of previous studies showing that visitors' attitudes are more positive toward existing energy projects compared to planned but not yet built projects [16,42,115]. According to Brudermann et al. [16], such differences can be explained by *status quo bias* [116], a phenomenon describing people's preference for the current situation over change.

According to Samuelson and Zeckhauser [116], such preference can be partly explained by the *loss aversion bias*, which means that people tend to prefer to avoid losing something they already have over gaining something new.

More positive attitudes toward existing renewable energy projects compared to the proposed ones suggest that tourism service providers over time are likely to adapt to the changes brought by REI and to adjust their activities to the new conditions. Thus, in some cases, construction of REI in natural areas might not lead to direct economic losses for tourism. However, as emphasized by Ingólfssdóttir and Gunnarsdóttir [117], it is likely to result in lost opportunities for tourists "to experience the deep, transformative connection to nature that the raw, untouched wilderness has the capacity to elicit". REI developments in highly natural areas might lead to the displacement of visitors seeking wilderness experiences, who would be replaced by tourists that have different preferences and expectations and therefore are less sensitive to human alterations of natural landscapes [42,118]. With wilderness areas decreasing worldwide it is essential to ensure that REI developments are planned appropriately by taking into consideration their impacts on nature-based tourism and its most valuable resource.

7. Conclusions

This study focuses on the spatial extent of the impacts of REI on tourism as perceived by the tourism service providers and on the factors affecting it. While the study was conducted in Iceland, a country highly suitable for such research due to the high importance of tourism for the local economy as well as abundance of renewable energy resources, its relevance extends beyond the Icelandic context. The study provided new insights into the spatial perceptions of the tourism service providers regarding the interrelationships between REI and tourism by employing PGIS. The results revealed that while some tourism service providers were of the opinion that the impacts of REI on tourism reach as far as REI and related environmental impacts are visible, 56% of the estimated impact areas exceeded visibility and included areas comprising of routes and destinations used by tourists where visitor experience is affected due to the previous encounter with REI as well as areas where tourism processes change due to construction of REI and other accompanying infrastructure, such as roads or power lines. This emphasizes that when planning energy development and selecting the most suitable REI locations it is of crucial importance to examine the areas used for tourism where REI has been proposed, given that elements of larger tourism networks would be impacted by the REI development.

Massey [44] emphasized that while attempting to draw boundaries it is impossible to consider everything, and relevant aspects must be selected. This study allowed identification of the issues related to REI and nature-based tourism that are perceived by the tourism service providers as the most important and therefore affecting the spatial extent of the impacts of REI on tourism. The present study revealed a high variety of shapes and sizes of the perceived impact areas, pointing to the importance of tourism stakeholder inclusion in REI planning. Consideration of the resources, place meanings and values essential for the tourism industry, their spatial distribution, their perceived compatibility with REI as well as tourism service providers' knowledge of the tourism processes going on within and between places allow identification of the most likely areas of conflicts between REI and tourism and identification of the areas where tourism would be the least impacted.

While knowledge of the spatial extent of the impacts of REI on tourism is greatly needed for the planning of REI developments, this issue is currently largely under-researched. This study provided new insights into the spatial extent of the impacts of REI on tourism in areas which are used mostly for nature-based tourism. In line with previous studies [13,14,20,115,119], most participants of this study perceived REI as more suitable in already developed areas. Therefore, future research including renewable energy projects in landscapes comprising

other types of place values, such as industrial or urban landscapes, would provide a needed contribution to the discussion regarding the factors affecting the spatial extent of the impacts of REI on tourism. Moreover, further research aimed at distinguishing personal landscape perceptions of the tourism service providers from commercial ones would provide deeper insights into the interrelationships of REI and tourism. Research investigating how other tourism stakeholders, for example tourists, perceive the impact areas of REI on tourism is also needed. A limitation of this study is that while it included three types of REI, hydro-, geothermal and wind power, and revealed differences in their perceptions by the tourism service providers, the qualitative character of this study did not allow the investigation of significant differences in the perceptions of the impacts of the three types of REI and of their spatial extent. A quantitative study investigating how tourism stakeholders perceive the impact area of various types of REI on tourism would allow such comparison.

This exploratory study has laid a groundwork for further research investigating the spatial extent of the impacts of REI on tourism by employing PGIS to map the impact areas of REI on tourism as perceived by tourism service providers and by providing the insights into the reasoning used by them. The findings of this study are expected to inform policy-makers and to be of value while planning REI developments. This study points to the importance of gathering knowledge on the spatial distribution of the tourism processes going through the areas of proposed REI and of the inclusion of the tourism stakeholders into the early stages of planning.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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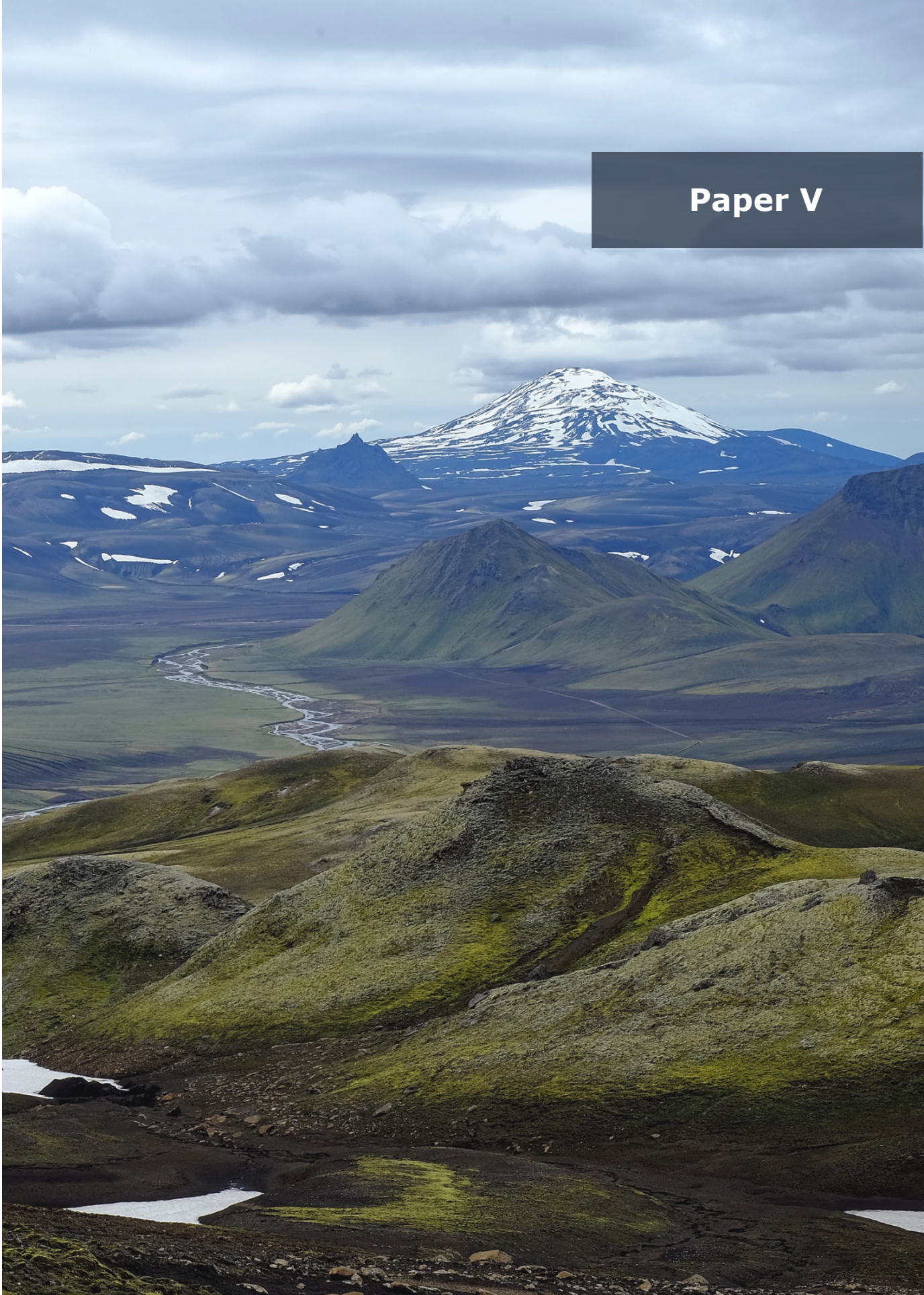
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Paper V



Wilderness: a resource or a sanctuary? Tourism service providers' views on development of the Icelandic Central Highlands

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Abstract

The growing popularity of nature-based tourism means that the tourism industry is increasingly utilizing wilderness areas to provide visitor experiences. However, such activities negatively impact wilderness quality. The Icelandic Central Highlands are among Europe's largest wildernesses and an important venue for tourism. This study focuses on the preferences of tourism service providers regarding future development and management of the Central Highlands. The relationship between participants' preferences and environmental attitudes is also investigated, providing insights into the sustainability of these preferences. The data for this study was collected by an online questionnaire which was distributed among day tour providers and travel agencies operating in Iceland. The results revealed that the attitudes of over 87% of the participants were pro-environmental. Accordingly, most tourism service providers preferred basic tourism infrastructure in the Central Highlands, and they did not support further energy or road developments. However, their attitudes toward the Central Highlands National Park proposal were divergent despite the positive relationship with environmental attitudes. Concerns about regulations and access restrictions to the area played an important role in shaping the attitudes toward the national park proposal, demonstrating the importance of considering tourism stakeholders' interests for ensuring their support for wilderness conservation.

Keywords: wilderness management; wilderness planning; stakeholder inclusion; wilderness conflicts; NEP scale

Introduction

The number of nature-based tourism visitors to wilderness areas, most of which stretch across high latitude areas (Watson et al., 2018), is continually increasing. Thus, the tourism industry increasingly relies on wilderness as a resource (Saarinen, 2016; Sæþórsdóttir & Hall, 2021). However, wilderness areas contain natural resources that are of high interest to multiple stakeholder groups with different preferences regarding their use. In the northern peripheries, natural areas have not only been used for tourism and outdoor recreation, but also for renewable energy harnessing, oil, gas and mineral extraction, agriculture, fish and timber harvesting, and traditional lifestyles (O'Garra, 2017; Sæþórsdóttir & Saarinen, 2016a; Sonter et al., 2020). As a result, growing anthropogenic pressure on wilderness areas and their sensitivity to human activities has led to increasing conservation efforts in the Nordic countries, and broader discussion on the sustainable use of wilderness areas (Avango & Roberts, 2017; Bastmeijer, 2009; Watson et al., 2003; Youdelis et al., 2020). Saarinen (2016) categorized the various approaches to wilderness areas into three main perspectives: wilderness as a conservation unit, which separates wilderness and society; wilderness as provider of natural resources and materials; and wilderness as a tourism product. These differing perspectives describe the ways people define, frame, and use wilderness areas in the Nordic regions and elsewhere. Significantly, they can lead to various conflicts between users, but also to symbiotic relationships, which contribute to wilderness conservation.

Tourism is generally viewed as more compatible with wilderness conservation than extractive land uses (Hall et al., 2008; Sæþórsdóttir & Saarinen, 2016a), and is also an important contributor to regional development, thereby providing an economic justification for wilderness conservation (Hall & Saarinen, 2010; Mura & Ključnikov, 2018; Sæþórsdóttir & Hall, 2019). However, excessive tourism numbers and the related infrastructure developments threaten the natural environment and other qualities associated with the wilderness experience, such as remoteness from signs of human settlement and solitude (Saarinen, 2019, 2021; Sæþórsdóttir, 2010b). Therefore, identifying potential conflicts between tourism, wilderness conservation and other land uses and opportunities for symbiotic relationships is essential (Saarinen, 2016). Increased knowledge of the tourism industry's preferences for future use of wilderness, their environmental attitudes and the sustainability of their preferences is needed to achieve that.

The Icelandic Central Highlands contain wilderness areas, which are among the largest in Europe (Thórhallsdóttir, 2007). The Icelandic Nature Conservation Act Nr. 60/2013 (Althingi, 2013) defines unbuilt wilderness as an uninhabited area of at least 25 km² in size, where it is possible to enjoy solitude and nature without disturbance of human-made structures or motorized vehicle traffic and which is at least 5 km away from human-made structures and

other technical traces such as power lines, power plants, reservoirs, and built-up roads. Wilderness mapping, conducted based on this definition (Ostman & Árnason, 2020), shows that 16.7% of the area's surface has been affected by human-made structures, suggesting that most of the Central Highlands can be defined as wilderness. While legally defined by the above characteristics for management and conservation purposes, wilderness is also a social construct produced through various discourses and social practices (Williams, 2002). The Icelandic Central Highlands, which are a focal point of competing wilderness uses, can thus be described as a hybrid place, which is simultaneously natural, social, political and cultural (Sæþórsdóttir et al., 2011).

Since the 1960s, various Highland rivers have been harnessed for hydroelectricity production, and the area is also rich in wind and geothermal energy resources. Consequently, numerous energy projects in the Central Highlands are currently under consideration (Pétursdóttir, 2021). However, nature is the main attraction for most international visitors coming to Iceland (Icelandic Tourist Board, 2020), and the Central Highlands are attractive for tourism and recreational activities. The Icelandic Central Highlands also contain numerous protected areas (The Environment Agency of Iceland, n.d.-a), and a proposal to establish a national park covering most of the Central Highlands has been at the center of public discussion in recent years (Bishop et al., 2022). Therefore, the area offers a valuable opportunity to investigate the tourism industry's preferences for wilderness use and conflicts between tourism and other land uses.

This study focuses on the views and preferences of tourism service providers, namely travel agencies and day tour providers operating in Iceland, regarding the future use, management, and development of the Central Highlands. Tourism in Iceland grew enormously between 2010 and 2019, with revenues from foreign travelers totaling almost half of all exports of goods and services in 2018 (Statistics Iceland, 2022). International visitor numbers are rapidly recovering after the COVID-19 pandemic (Icelandic Tourist Board, 2022), reemphasizing the importance of the tourism industry as a stakeholder in the discussion about the use of the Central Highlands. Tourism service providers, such as travel agencies and day tour providers, only represent a fraction of the Icelandic tourism industry. Nevertheless, they can be defined as key tourism stakeholders in the discussion about management of the Central Highlands, since their businesses depend on tourist experiences, which are directly impacted by management decisions in the area.

The overall aim of this study is to improve the understanding of tourism service providers' perceptions of wilderness and of its value for tourism, and to investigate how their environmental attitudes contribute to shaping their preferences regarding wilderness use. The following research questions were put forward: (I) How important are the Icelandic Central

Highlands and the wilderness areas they contain for the Icelandic tourism industry? (II) What future management and development of the Central Highlands is preferred by tourism service providers? (III) How do the preferences of tourism service providers regarding future development of the Central Highlands relate to their environmental attitudes? (IV) What are the existing and potential conflicts between nature protection, renewable energy harnessing and tourism development in the Central Highlands? and (V) How can these conflicts be transformed into more collaborative relationships?

Tourism in wilderness

The attractiveness of wilderness areas to tourists continues to grow (Frost & Hall, 2012; Saarinen, 2021). The image of wilderness presented and sold by the tourism industry is one of pristine nature with limited human interference (Müller-Roux, 2021; Pludwinski & Grimwood, 2021; Saarinen, 2019). In line with that, Sæþórsdóttir (2010b) identified five components that visitors to natural areas relate to wilderness experience, which include being surrounded by unspoiled beautiful nature; escaping the daily constraints; spiritual experiences; solitude and companionship; and challenge. Hence, wilderness for the tourism industry embodies a source of extraordinary experiences and opportunities to challenge oneself, which contributes to the sensation of experiences that are totally different from everyday life (Urry & Larsen, 2011). However, wilderness, along with nature in general, is socially constructed, and meanings of wilderness are continuously created and recreated through complex social, cultural, and political processes (Castree, 2001; Cronon, 1996; Williams, 2002). These meanings further shape people's preferences and consequently their actions concerning wilderness use and preservation (Williams, 2002). Viewing wilderness as socially constructed, however, neither denies the importance of the physical environment of wilderness areas nor definitions of wilderness based on the physical qualities of natural areas (Stedman, 2003). Rather, it stresses that a single wilderness area has multiple and often competing meanings assigned to it by various stakeholders (Saarinen, 2005). Consequently, stakeholders can perceive different settings as acceptable in that area, which might lead to divergent use and development preferences (Sæþórsdóttir & Hall, 2018; Sæþórsdóttir & Saarinen, 2016b; Sæþórsdóttir et al., 2021; Wall-Reinius, 2012; Zoderer et al., 2020). Vannini and Vannini (2019) therefore stressed that wild places should be protected by taking into consideration the multiple meanings and forms that they contain. However, they emphasized that “this multiplicity cannot become the justification for ‘anything goes’ exploitative approaches that treat wild places as monetary resources for either industrial extraction, tourism development, or species separation and confinement” (Vannini & Vannini, 2019, p. 270).

While the notion of wilderness has changed over the centuries (Frost & Hall, 2012; Hall et al., 2008; Nash, 1967; Sæþórsdóttir et al., 2011), current approaches often combine wilderness conservation with tourism promotion and practices, which is not unproblematic (e.g. Gogarty et al., 2018; Saarinen, 2019; Vidon, 2016; Zanolin & Paül, 2022). Viewing wilderness areas as sites for tourist activities may “marginalize other uses and meanings of wilderness” (Saarinen, 2019, p. 477). Indeed, Job et al. (2017) argued that current tourism marketing is in line with the Dominant Social Paradigm (DSP) (Pirages & Ehrlich, 1974), which is based on self-interest and economic growth as a main economic driver and reliance on technological solutions for environmental issues (Kilbourne et al., 2002; Shafer, 2006). Reliance on this paradigm is likely to lead to conflicts between continuous economic growth and sustainable use of limited natural resources (Byers & Gilmer, 2018). Despite a growing awareness of the negative environmental and social impacts of tourism activities and recently increasing effort to incorporate these impacts in the cost of tourism, they are still often externalized, and therefore long-term sustainability cannot be ensured (Streimikiene et al., 2021; Urry & Larsen, 2011). This is especially relevant in wilderness areas, where tourism is one of the major threats which can degrade not only the natural environment, but also the wilderness resource tourism relies on (Duffy, 2015; Saarinen, 2019). The use of natural areas for tourism increases the demand for more infrastructure and better accessibility, which degrade the wilderness experience of certain tourist market groups (e.g., Ólafsdóttir, Sæþórsdóttir, & Runnström, 2016; Sæþórsdóttir, 2013), leading to changes in the type of tourism in the area (Haraldsson & Ólafsdóttir, 2018; Ólafsdóttir & Haraldsson, 2019; Ólafsdóttir et al., 2018; Sæþórsdóttir & Hall, 2021; Tverijonaite et al., 2018). Thus, tourism development in natural and wilderness areas should be carefully planned (Gogarty et al., 2018; Saarinen, 2012; Sæþórsdóttir & Hall, 2021).

As the tourism industry is a key stakeholder in the future management of natural areas, it is important not only to collect knowledge regarding the views and preferences of tourism service providers, but also to critically investigate the economic, social and environmental sustainability of the perspectives gathered. As emphasized by Keul (2014), protecting natural areas purely for economic reasons might not be as effective for less charismatic areas, and this might lead to the value of places being defined only in relation to the qualities and attributes that sell.

The New Ecological Paradigm (NEP) scale (Dunlap et al., 2000) is among the most utilized scales for assessing environmental attitudes and worldviews (Ntanos et al., 2019). This study employs the NEP scale (Dunlap et al., 2000) to measure the pro-environmental orientation of tourism service providers, facilitating the investigation into how understandings of economic growth and the environment affect perspectives regarding the future management and development of the Central Highlands of Iceland and their sustainability.

Study area

The Icelandic Central Highlands are an uninhabited region in the interior of Iceland, consisting mostly of a 400-700 m high plateau and characterized by high geological diversity and scenic landscapes (Árnason, 2020). The area covers around 40% of the country and stretches over 21 municipalities, with around 86% of the land in the area being publicly owned (Bishop et al., 2022; Ministry for the Environment and Natural Resources, 2017; Óbyggðanefnd, n.d.).

The use of the Central Highlands for tourism and recreation only emerged in the twentieth century, enabled by the introduction of cars and the construction of new roads and bridges in the 1960s for the first hydropower plants, which made the area more accessible to visitors (Huijbens & Benediktsson, 2015; Sæþórsdóttir, 2004). Currently nine hydropower plants use water from reservoirs constructed in the Central Highlands for power production: seven power stations in the Þjórsá and Tungnaá Catchment Area in the Southern Highlands, Blanda Hydropower Plant in the northwest, and Fljótisdalur Hydropower Plant in the east of the Central Highlands (Figure 1) (Landsvirkjun, n.d.-b). In 2020, these power plants produced over 60% of the country's electricity supply (NEA, 2021). All geothermal power plants operating in Iceland are located outside of the Central Highlands, with Krafla Geothermal Power Plant being located at the border of the area (Figure 1). The country currently does not have any wind farms, with the exception of two 2 MW experimental wind turbines operated at the edge of the Central Highlands (Landsvirkjun, n.d.-a). However, two wind farm proposals have been approved by the Icelandic Parliament (Althingi, 2022), both in the Central Highlands. Furthermore, since the Central Highlands contain abundant hydro and wind resources and high potential geothermal areas (Arnórsson, 2012; Ragnarsson et al., 2020), various projects have been proposed by energy companies in the area. These are being evaluated by expert groups for the Master Plan for Nature Protection and Energy Utilization (Gíslason, 2016; Ministry for the Environment and Natural Resources, n.d.; Pétursdóttir, 2021).

The existing infrastructure related to hydropower projects in the Central Highlands created extensive visual and environmental impacts on the surrounding areas. The roads that have been built in the Central Highlands for the hydropower infrastructure are generally built up paved or gravel roads, while other roads are gravel roads and tracks without bridges requiring four-wheel drive vehicles and passable only during the summer months. Consequently, hydropower plant developments have made some scenic sites more accessible, which resulted in these becoming popular tourist attractions (Sæþórsdóttir, 2013; Sæþórsdóttir & Hall, 2021). Many other areas in the Central Highlands are not so easily accessible, and the traffic there does not seem to have increased significantly (Ólafsson & Þórhallsdóttir, 2019; The Icelandic Road and Coastal Administration, 2022; Þórhallsdóttir & Ólafsson, 2018).

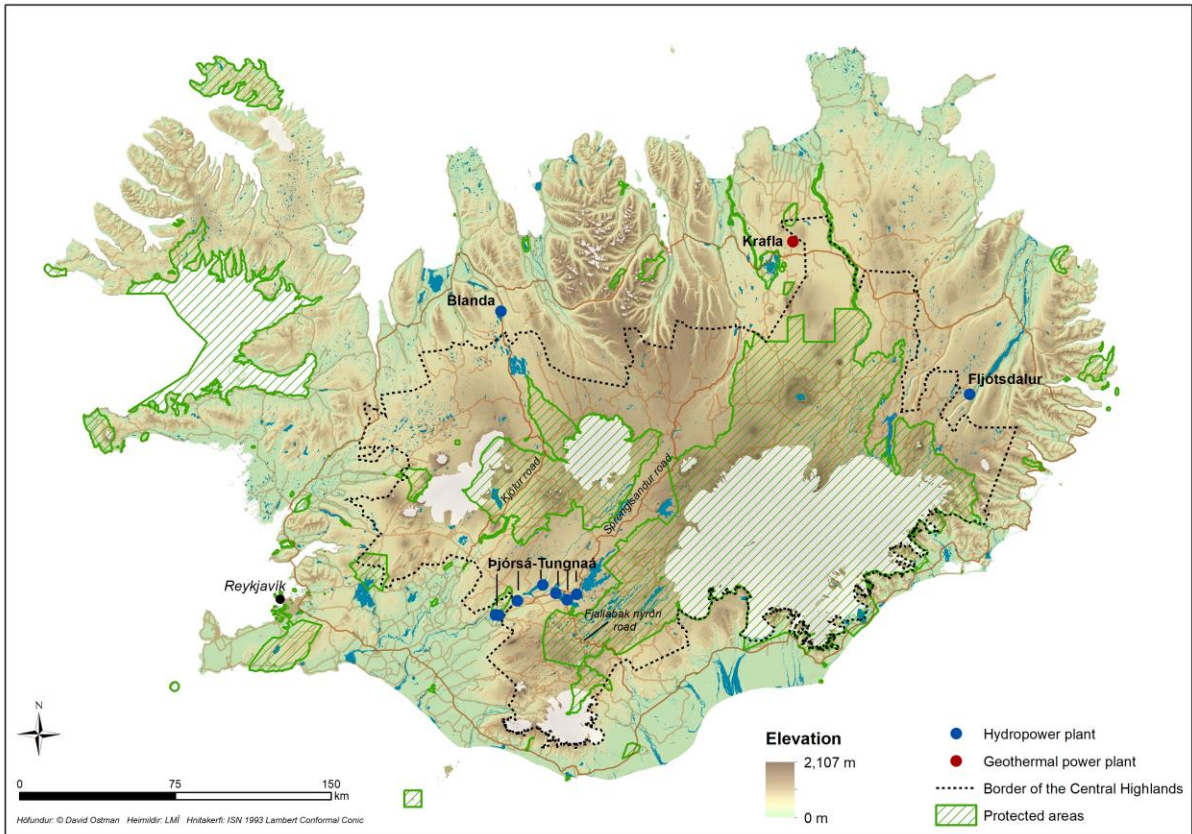


Figure 1. Study area map presenting the boundaries of the Icelandic Central Highlands, existing power plants discussed in this study and protected areas.

Various wilderness mapping studies conducted in the area (Ólafsdóttir & Runnström, 2011; Ostman & Árnason, 2020) show that despite the presence of some energy and tourism infrastructure the Central Highlands contain large wilderness areas. This is in line with public perceptions of wilderness in the area (Ólafsdóttir & Sæþórsdóttir, 2020; Ólafsdóttir, Sæþórsdóttir, Guðmundsson, et al., 2016). More than one-third of the Central Highlands are protected areas (Bishop et al., 2022), which include Vatnajökull National Park, several nature reserves, natural monuments, and protected landscapes (The Environment Agency of Iceland, n.d.-a). Several Highland areas are also protected from energy developments based on the Icelandic Master Plan for Nature Protection and Energy Utilization (The Environment Agency of Iceland, n.d.-b).

Moreover, the idea of establishing a Central Highlands National Park, which would cover most of the Central Highlands and around 30% of the country (Government of Iceland, n.d.), has been discussed in recent years. In the end of 2020, the Minister for the Environment and Natural Resources submitted a bill on establishing a Central Highlands National Park to the Icelandic Parliament (Althingi, 2020). Upon its introduction, the bill sparked substantial debate (Bishop et al., 2022) and it was later withdrawn from Parliament, which was partially due to increased

public and stakeholder opposition (Capacent Gallup, 2011; Gallup, 2021; Samráðsgátt, 2019-2020; Social Science Research Institute of the University of Iceland, 2016).

The wilderness character of the Central Highlands and their diverse nature are important attractions for visitors to the area (Sæþórsdóttir, 2010b, 2014), which constitute around one-third of all international tourists coming to Iceland during summer months (Icelandic Tourist Board, 2017). Increasing tourism in the area provides feasible economic alternatives to energy development (Sæþórsdóttir & Saarinen, 2016a, 2016b). However, tourism activities in the Central Highlands have their own implications. If not well managed, they can result in environmental degradation, crowding, demand for more tourism infrastructure and reduced wilderness quality (Ólafsdóttir et al., 2021; Sæþórsdóttir, 2010a, 2013, 2014; Sæþórsdóttir & Hall, 2021). This emphasizes the importance of careful tourism planning in the area and the need for research providing insights into the preferences of the tourism industry regarding management and development of the Central Highlands and their compatibility with sustainable management of the area.

Methods

Data collection

Quantitative research methods were employed for this study. An email with a link to an online questionnaire survey was sent to 984 companies that are licensed by the Icelandic Tourist Board to operate as travel agencies or day tour providers. The study was limited to travel agencies and day tour providers, since these types of tourism businesses are most likely to be directly affected by development decisions in the Central Highlands. The survey was open for one month from 18th November to 17th December 2020.

Online questionnaire surveys have been shown to have many advantages, such as low cost of data collection and the ability to quickly access participants in a wide range of geographical locations, whilst also offering the opportunity to immediately start data analysis once the data is collected (Dillman et al., 2014; Hung & Law, 2011). Furthermore, due to the absence of an interviewer and higher perceived anonymity, participants are likely to be more open and less likely to provide socially desirable answers (Deutskens et al., 2006; Duffy et al., 2005). However, online surveys tend to have relatively low response rates, often not exceeding 30% (Hung & Law, 2011; Shih & Fan, 2008). To address this issue, two reminder emails were sent to the recipients concerning the survey. An automatic reply was received from 27 email addresses stating that the email was not delivered to the recipient. Five recipients contacted the research team and informed them that they had stopped operating their businesses. Thus, 32 companies were excluded from the contacted sample. Therefore, responses were received from 382 of the contacted tourism companies, constituting a 40.13% response rate.

At the beginning of the questionnaire, survey participants were informed about the aim of the survey and its length. The leader of the study was also introduced, and her email address was given. Furthermore, participants were notified that their participation was purely voluntary, and they could skip any question that they did not wish to answer and withdraw from the research at any time. They were informed that all the responses were anonymous and would be kept confidential, that only the research team would have access to the raw data, and only group results would be discussed, written up and published. Depending on the answers given by the participants, the length of the questionnaire survey varied between 28 and 34 questions, which can be grouped into the following categories:

- (1) General questions about the company and its activities;
- (2) Use of the Central Highlands for their business;
- (3) Attractiveness of the Central Highlands to tourists and importance of the area and its wilderness for the tourism industry;
- (4) Attitudes toward further development of tourism infrastructure, roads and access in the Central Highlands;
- (5) Perceived impacts of existing energy infrastructure in the Central Highlands on tourism and attitudes toward further energy developments;
- (6) Attitudes toward the proposed Central Highlands National Park;
- (7) Environmental attitudes.

Data analysis

Descriptive statistics were used to analyze the characteristics of the surveyed companies. Simple linear regression tests and independent t-tests were also conducted to analyze the effects of their characteristics on environmental attitudes. The environmental attitudes of participants served as a foundation for further analysis, and assessment was completed using the New Ecological Paradigm (NEP) scale. The scale consists of 15 items (Table 1), which fall into “five hypothesized facets of an ecological worldview”: limits to growth, anti-anthropocentrism, balance of nature, rejection of exemptionalism, and the likelihood of an eco-crisis (Dunlap et al., 2000, p. 432). A five-point Likert scale was used, and participants were asked how strongly they agreed or disagreed with each item. The answer of ‘strongly disagree’ equaled one point, while ‘strongly agree’ equaled five points. Eight items used in the scale represented pro-environmental attitudes, while seven items were in line with the Dominant Social Paradigm (DSP). The points related to these items were reversed when the NEP score was calculated, then the points for all the items were summed up. A higher NEP Score indicated the attitudes of the participants were more pro-environmental.

The assessment of the environmental attitudes revealed that the participants were leaning toward an ecocentric orientation, with 87.6% of them exhibiting more pro-environmental attitudes. The NEP score range varied between 31 and 75, $M=55.24$, $SD=8.48$, median=56 (Figure 2).

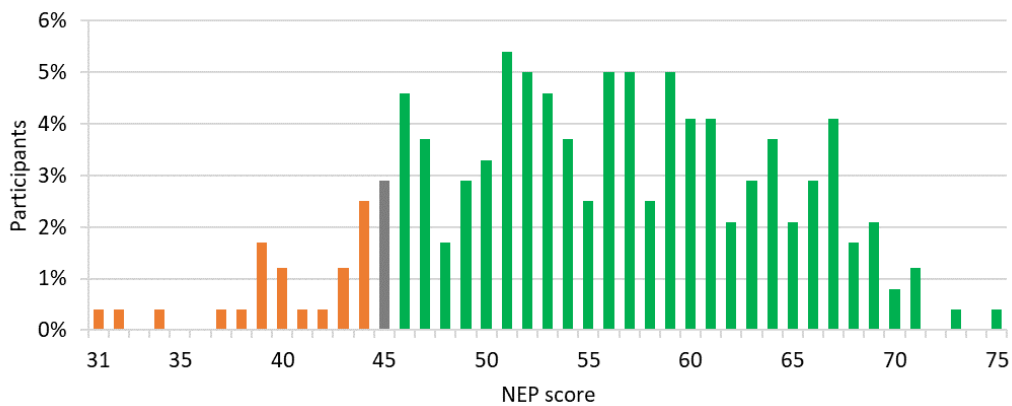


Figure 2. Distribution of the participants' NEP scores. Column 45 marks the median of the scale separating anthropocentric (15-44 points) and pro-environmental attitudes (46-75 points).

The highest agreement mean was for the items revealing pro-environmental attitudes: ‘Despite our special abilities humans are still subject to the laws of nature’ ($M=4.17$, $SD=0.83$); ‘Humans are severely abusing the environment’ ($M=3.99$, $SD=0.96$); and ‘The balance of nature is very delicate and easily upset’ ($M=3.86$, $SD=1.00$) (Table 2). The lowest agreement mean scores was for the items representing the attitudes supporting the DSP: ‘Humans were meant to rule over the rest of nature’ ($M=1.89$, $SD=1.00$); ‘Humans have the right to modify the natural environment to suit their needs’ ($M=2.07$, $SD=1.01$); and ‘The balance of nature is strong enough to cope with the impacts of modern industrial nations’ ($M=2.10$, $SD=0.95$).

Table 1. Descriptive statistics for the 15 NEP scale items.

Item ^a	Strongly disagree (%)	Disagree (%)	Unsure (%)	Agree (%)	Strongly agree (%)	M	SD
We are approaching the limit of the number of people the earth can support	3.3	13.4	30.8	35.9	16.7	3.49	1.03
Humans have the right to modify the natural environment to suit their needs	34.7	35.4	19	9.9	1.1	2.07	1.01
When humans interfere with nature, it often produces disastrous consequences	1.8	9.9	20.1	43.6	24.5	3.79	0.98
Human ingenuity will insure that we do NOT make the earth unlivable	9.9	17.2	46.5	22.7	3.7	2.93	0.97
Humans are severely abusing the environment	2.2	7.4	11.4	47.1	32	3.99	0.96
The earth has plenty of natural resources if we just learn how to develop them	7.2	12	18.8	47.8	14.1	3.50	1.10
Plants and animals have as much right as humans to exist	4.7	13.1	9.5	42.5	30.2	3.80	1.15
The balance of nature is strong enough to cope with the impacts of modern industrial nations	29.7	39.8	21.5	8.2	0.7	2.10	0.95
Despite our special abilities humans are still subject to the laws of nature	2.2	3.2	4.7	55	34.9	4.17	0.83
The so-called "ecological crisis" facing humankind has been greatly exaggerated	32.4	32	21.6	11.2	2.9	2.20	1.10
The earth is like a spaceship with very limited room and resources	3	11.4	21	43.2	21.4	3.69	1.03
Humans were meant to rule over the rest of nature	44.9	31.4	15.3	6.9	1.5	1.89	1.00
The balance of nature is very delicate and easily upset	2.5	10.1	12.6	48.2	26.6	3.86	1.00
Humans will eventually learn enough about how nature works to be able to control it	19.5	22.7	41.5	14.8	1.4	2.56	1.01
If things continue on their present course, we will soon experience a major ecological catastrophe	3.7	10.6	21.2	42.5	22	3.69	1.04

^aStrong agreement with odd numbered items shows pro-environmental attitudes while strong agreement with even numbered items shows attitudes which are in line with the DSP.

Previous studies (Dunlap et al., 2000; Ntanos et al., 2019; Rosa et al., 2021) have raised issues concerning the low internal consistency of NEP, which can negatively affect the NEP scale correlation with other constructs (Barradas & Ghilardi-Lopes, 2020). A reliability test of the NEP scale was conducted to address this issue, which revealed that Cronbach's alpha value

was equal to .84, showing the scale had a good level of internal consistency. However, the item-total correlation for ‘The earth has plenty of natural resources if we just learn how to develop them’ reached only .096, and Cronbach’s alpha if item deleted equaled to .854, pointing to improved internal consistency of the NEP scale without that item. Issues with this particular item have been encountered in other studies (Harraway et al., 2012; López & Cuervo-Arango, 2008; Van Petegem & Blicek, 2006), suggesting that the item tends to be misinterpreted by the participants (Rideout et al., 2005; Van Petegem & Blicek, 2006). While the item is intended to represent attitudes aligned with the DSP, participants with higher pro-environmental attitudes tend to agree with it, especially in regions where natural resources are perceived to be abundant (Barradas & Ghilardi-Lopes, 2020; Rosa et al., 2021). To improve internal consistency, this statement was excluded from the NEP scale and further data analysis was conducted using a 14 item NEP score.

Furthermore, as suggested by various researchers (e.g., Dunlap et al., 2000; Ntanos et al., 2019), the dimensionality of the NEP scale in this study was evaluated by conducting principal component analysis using varimax rotation with the remaining 14 items, which revealed results similar to Dunlap et al. (2000). The first unrotated component explained 35.7% of the total variance among the items which all loaded heavily on the first factor (between .39 and .74), while the second and third unrotated components explained 11.2% and 10% of the total variance between the items respectively. Therefore, while investigating the relationships between development preferences regarding the Central Highlands and the environmental attitudes of participants, the NEP scale was treated as a unidimensional scale.

The preferences of the participants regarding the future development of the Icelandic Central Highlands were presented using descriptive statistics. The differences between the preferences of users and non-users of the Central Highlands were assessed using independent t-tests. Relationships between the development preferences and environmental attitudes of participants were investigated by conducting simple linear regression tests. Cochran's Q test was also used to compare the proportions of multiple responses related to road development preferences, with the McNemar tests being utilized as post hoc tests to identify statistically significant differences between specific road development preferences. The Chi-square tests for multiple responses were used to assess differences in road development preferences between users and non-users of the Central Highlands.

Results

Participant characteristics

Among the 382 surveyed tourism companies, 64.9% stated that they operated as day tour providers, 45.5% as travel agencies, and 9.3% were other types of businesses, which most often included accommodation provision and tourist transportation. About half of the companies operated from the capital area, 17.9% had their headquarters in North Iceland, and 16.0% in South Iceland. Most participants (73.9%) organized their tours in the southern part of the country, the second-most mentioned region was the Central Highlands (58.8%), 55.1% operated in the West, and 52.7% in North Iceland. Companies varied greatly in the length of their operations, with 25.6% of the companies being younger than five years, and 13.7% having operated for 25 years or longer (Table 2).

The companies using the Central Highlands for their business offered a wide range of tours in the area. A higher proportion of companies offered various day tours, while fewer companies offered multi-day tours in the Central Highlands (Figure 3). Of the 41% of the tourism companies not currently operating in the Central Highlands, almost half stated that they were very (24.8%) or rather likely (22.4%) to use that area in the future.

Table 2. Characteristics of the surveyed tourism companies

Headquarters	N	%
Capital area	135	51.3
North Iceland	47	17.9
South Iceland	42	16.0
West Iceland	13	4.9
Westfjords	10	3.8
Reykjanes	9	3.4
East Iceland	7	2.7
Areas used for business	N	%
South Iceland	278	73.9
Central Highlands	221	58.8
West Iceland	207	55.1
North Iceland	198	52.7
Capital area	197	52.4
Reykjanes	186	49.5
East Iceland	154	41.0
Westfjords	125	33.2
Length of operation	N	%
Less than 5 years	69	25.6
5 to 9 years	71	26.3
10 to 14 years	51	18.9
15 to 24 years	42	15.6
25 years or longer	37	13.7

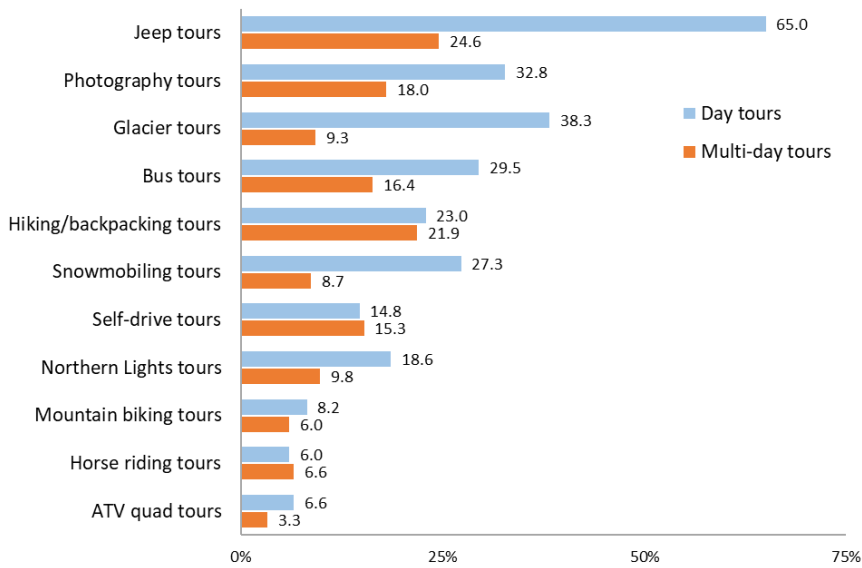


Figure 3. Tours offered by the surveyed companies in the Icelandic Central Highlands.

The characteristics of the surveyed tourism companies were shown not to affect environmental attitudes. A simple linear regression test revealed that a company's length of operation was not a significant predictor of its NEP score ($\beta=-.052$, $p=.432$). Furthermore, independent t-tests showed no significant differences in the 14 item NEP scores between companies operating from the capital area ($M=52.39$, $SD=7.60$) and companies who had their headquarters in more rural areas ($M=53.38$, $SD=8.75$), $t(226)=-.910$, $p=.364$, nor between users ($M=52.77$, $SD=8.23$) and non-users of the Central Highlands ($M=52.90$, $SD=8.61$), $t(235)=-.114$, $p=.910$.

Importance of the Central Highlands for the tourism industry

The majority of participants (84.5%) perceived the Icelandic Central Highlands as important or very important for the tourism industry. Independent t-tests revealed that the importance of the Central Highlands and of the wilderness areas they contain was perceived as significantly higher by users of the area in comparison to non-users (Table 3). However, no significant differences between users and non-users of the Central Highlands were observed when discussing the increase in the future value of the area for the tourism industry, 73.0% of users and 70.4% of non-users stated that the value of the Central Highlands will increase rather or very much in the next ten years (Table 3).

Table 3. Perceived importance of the Central Highlands and of wilderness areas they contain for the tourism industry in Iceland among users and non-users of the Central Highlands.

Statement		Not at all (%)	Somewhat (%)	Very much (%)	M	SD	t-test
The Central Highlands are important for the tourism industry in Iceland	Users	0.0	1.0	6.3	8.9	83.9	4.76 0.61 t=-4.80
	Non-users	1.5	5.1	20.6	11.0	61.8	4.28 1.02 p<.001
The value of the Central Highlands will increase in the next ten years	Users	0.5	1.6	20.5	17.3	60.0	4.35 0.90 t=-1.77
	Non-users	1.5	6.1	22.0	17.4	53.0	4.14 1.06 p=.078
Wilderness areas in the Central Highlands are important for the tourism industry in Iceland	Users	0.0	2.6	8.5	9.5	79.4	4.66 0.75 t=-2.38
	Non-users	2.2	2.9	15.4	10.3	69.1	4.42 0.97 p=.018

When asked how important it is for their company to have a say in the discussion on the future land use and management of the Central Highlands, 15.8% of participants using the Central Highlands stated that it is somewhat important, 30.5% said it is important, and 50.0% stated that it is very important. These proportions were somewhat lower among non-users (Figure 4).

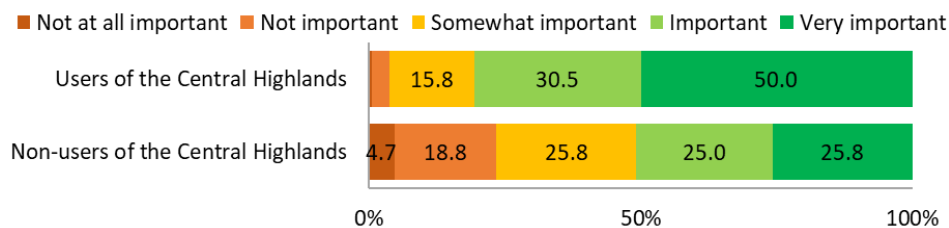


Figure 4. Perceived importance of participating in the discussion on the future land use and management of the Icelandic Central Highlands for the companies using and not using the Central Highlands.

Development preferences of the Central Highlands

The participants were asked about their preferred level of various tourism infrastructure in the Central Highlands. The highest perceived need related to marked hiking trails, expressed by 78.6% of participants, and toilets (83.4%), followed by mountain huts (63.2%) and visitor centers (45.2%) (Figure 5). Perceived need was lowest in respect of hotels (22.8%) and food services (35.9%). No statistically significant differences were observed between the preferences of users and non-users of the area.

When an open question was posed as to where more tourism infrastructure should be built, most participants mentioned the names of the most popular tourist destinations, areas along the most used roads in the Central Highlands, or they stated that more tourism infrastructure should be built in popular and already developed places.

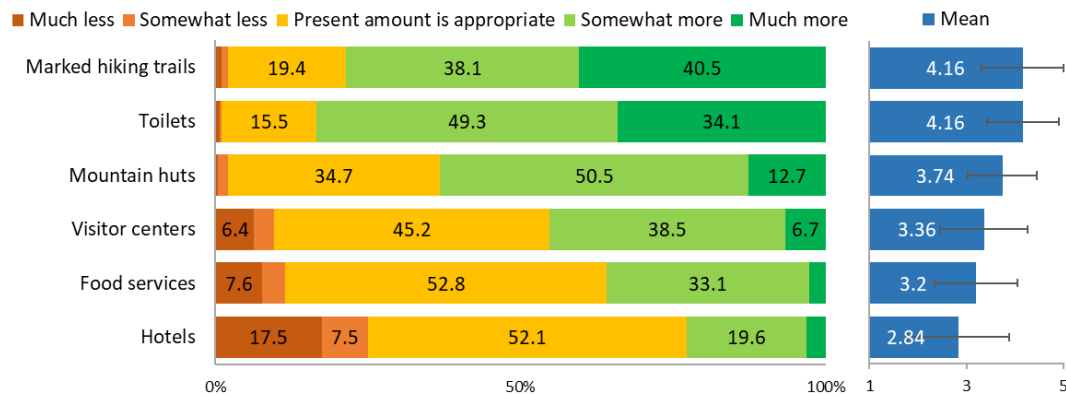


Figure 5. Preferred tourism infrastructure in the Icelandic Central Highlands.

No effect of environmental attitudes was observed on the perceived need for marked hiking trails, toilets, mountain huts and visitor centers. However, there was a significant negative relationship between NEP score and perceived need for food services ($\beta=-.15$, $p=.032$) and for hotels ($\beta=-.22$, $p=.002$).

When asked about road developments in the Central Highlands, around half of the participants wanted the existing roads to be somewhat better maintained, while the second highest proportion of participants preferred them to be kept in their current state (Figure 6). Cochran's Q test revealed significant differences between the five development preferences concerning the main roads of the Central Highlands, i.e., Kjölur road ($Q(4)=106.019$, $p<.001$), Sprengisandur road ($Q(4)=145.667$, $p<.001$) and Fjallabak nyrðri road ($Q(4)=240.667$, $p<.001$), as well as other Central Highlands roads ($Q(4)=297.922$, $p<.001$) (see Figure 1 for road locations). McNemar tests with Bonferroni correction showed that the proportion of participants who preferred the roads of the Central Highlands to be more developed by building up, paving the roads, or bridging the rivers they crossed, was significantly lower compared to the participants who preferred the roads to be kept in their current state or better maintained, except for the Kjölur road, which produced a Bonferroni adjusted $p=.06$ for the difference between the categories of 'kept in current state' and 'built up'.

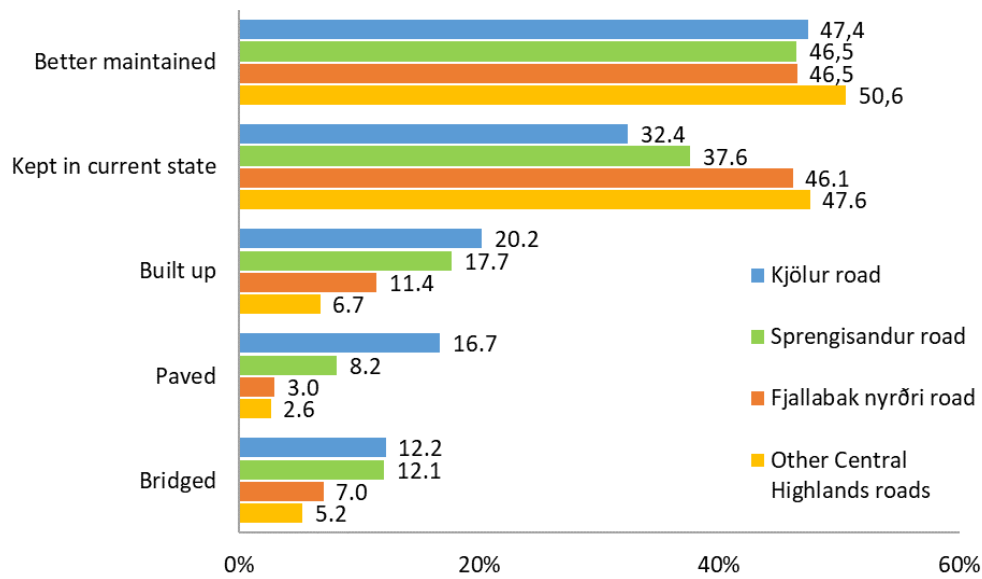


Figure 6. Preferences for road developments in the Icelandic Central Highlands.

Chi-square tests for multiple responses revealed significant differences between users and non-users of the Central Highlands regarding road development preferences (Table 5). A smaller proportion of participants using the Central Highlands for their businesses preferred the roads of the Central Highlands to be built up, paved, or the rivers to be bridged compared to non-users. No significant effect of environmental attitudes was observed regarding road development preferences.

Table 4. User and non-user preferences for road developments in the Icelandic Central Highlands.

Road		Better maintained (%)	Kept in current state (%)	Built up (%)	Paved (%)	Bridged (%)	χ^2 (df)	p
Kjölur road	Users	50.3	36.9	14	12.3	6.7	33.614 (5)	p<.001
	Non-users	41.7	26.2	30.1	23.3	20.4		
Sprengisandur road	Users	50.8	40.1	11.9	6.2	8.5	23.447 (5)	p<.001
	Non-users	38.6	33.7	27.7	10.9	17.8		
Fjallabak nyrðri road	Users	45	52.6	7.6	1.8	4.7	19.597 (5)	p<.001
	Non-users	48.4	35.8	17.9	5.3	10.5		
Other Central Highlands roads	Users	48.5	53.9	2.4	1.2	3	23.986 (5)	p<.001
	Non-users	54.7	37.9	13.7	4.2	6.3		

When asked about the importance of limiting the number of tourists in the Central Highlands, 14.9% of participants stated that it is not at all important, 26.6% regarded it as not important, 29.4% stated that it is somewhat important, 15.2% considered it is important, and 13.8% stated

it is very important. No significant differences were observed between the perceptions of users and non-users of the Central Highlands, $t(282)=1.426$, $p=.155$. A simple linear regression test revealed that environmental attitudes positively affected the perceived importance of limiting tourist numbers in the Central Highlands ($\beta=.363$, $p<.001$). Participants were further asked in an open question what they considered to be the best ways to limit tourist numbers. The most popular answers, among others, included the use of quotas, booking systems or permits, which were suggested by 24.1% of participants, along with keeping the roads difficult to drive (20.7%), applying entrance or service fees (18.2%), and allowing or encouraging only guided visits to the area (17.2%) (Figure 7).

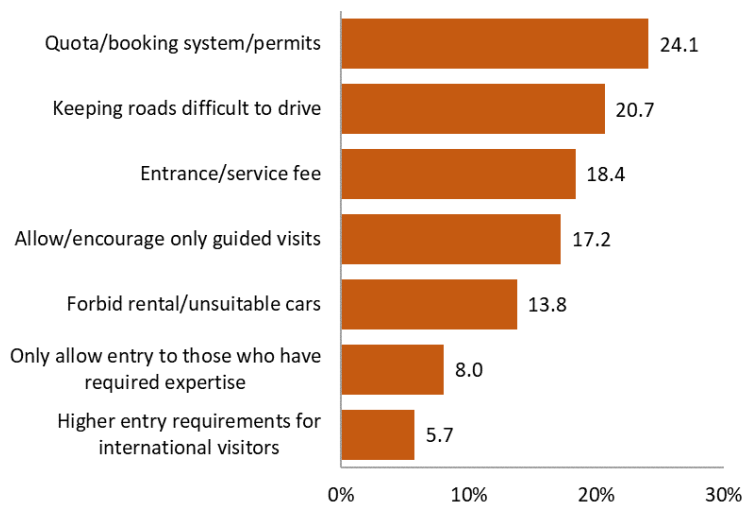


Figure 7. Participants' suggestions to limit the number of tourists in the Icelandic Central Highlands.

Attitudes toward energy infrastructure

When asked about the effects of the nine hydro- and the one geothermal power plants operating within or just outside of the Icelandic Central Highlands on the tourism industry, 51.4% of participants stated that the existing power plants had both positive and negative effects on the tourism industry, 18.6% perceived the effects as positive, 13.8% as negative, and 16.2% stated that the power plants had no effects on the tourism industry.

Participants were asked an open question concerning how they would describe the most significant positive and negative effects of the existing power plants on tourism. While discussing the positive effects of power plants, most participants, or 43.1%, mentioned improved access to scenic natural areas (Figure 8). Furthermore, 23.8% of participants emphasized that renewable energy harnessing is interesting to tourists, therefore some power plants become tourist attractions and provide opportunities for education about renewable energy (mentioned by 6.5% of participants). Other positive effects included the harnessing of

clean/green energy (mentioned by 15.3% of participants), which is needed for various uses, including tourism (4.5%), contributing to a positive image of Iceland (9.4%), and the creation of new tourist attractions (4.0%). Among the most mentioned negative effects of power plants on the tourism industry was visual pollution (mentioned by 40.3% of participants), especially visual pollution caused by power lines (18.8%). Other identified negative effects were the degradation of nature and the surrounding area (28.0%), which does not fit with tourist expectations (7.0%), leading to destroyed perceptions concerning untouched nature (14.0%) and consequently to degraded wilderness/nature experiences (4.8%), as well as loss of land due to flooding (11.8%) and loss of tourist attractions (5.9%).

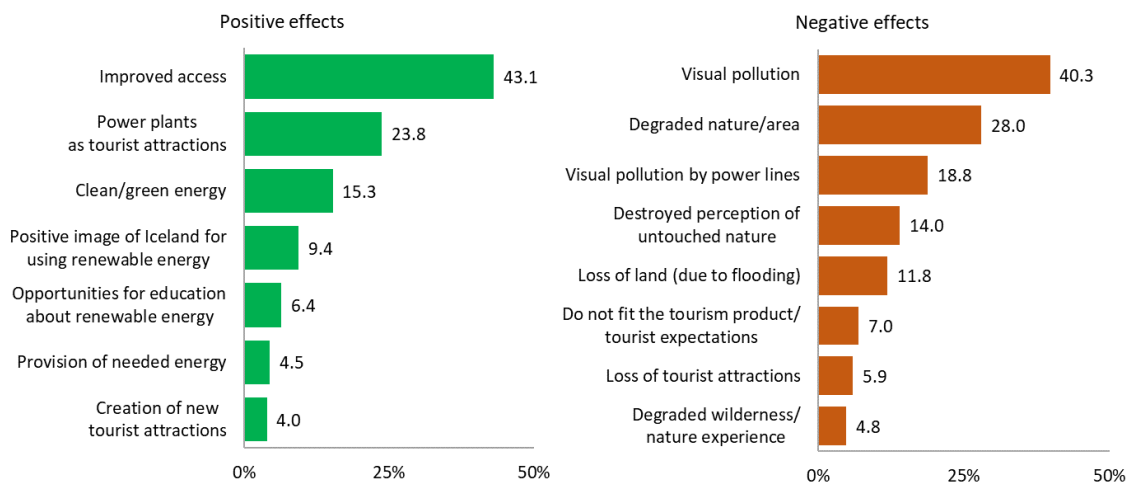


Figure 8. Perceived positive and negative effects of power plants operating within or just outside of the Icelandic Central Highlands on the tourism industry.

While participant attitudes were rather negative toward the future development of all types of energy infrastructure in the Icelandic Highlands and the lowlands, developments in the Highlands were perceived as significantly more negative compared to developments in the lowlands, with $p < .001$ for all types of energy infrastructure (Figure 9). No significant differences were observed between the attitudes of users and non-users toward future developments of energy infrastructure in the Highlands and in the lowlands, with the exception of wind farms and power lines in the Highlands. Non-users of the Central Highlands were less negative toward wind farms in the Central Highlands ($M=2.21$, $SD=1.25$) than users ($M=1.90$, $SD=1.10$), $t(238.64)=2.22$, $p=.028$. Similarly, non-users were less negative toward power lines in the Highlands ($M=2.00$, $SD=1.05$) than users of the Central Highlands ($M=1.70$, $SD=0.92$), $t(307)=2.67$, $p=.008$.

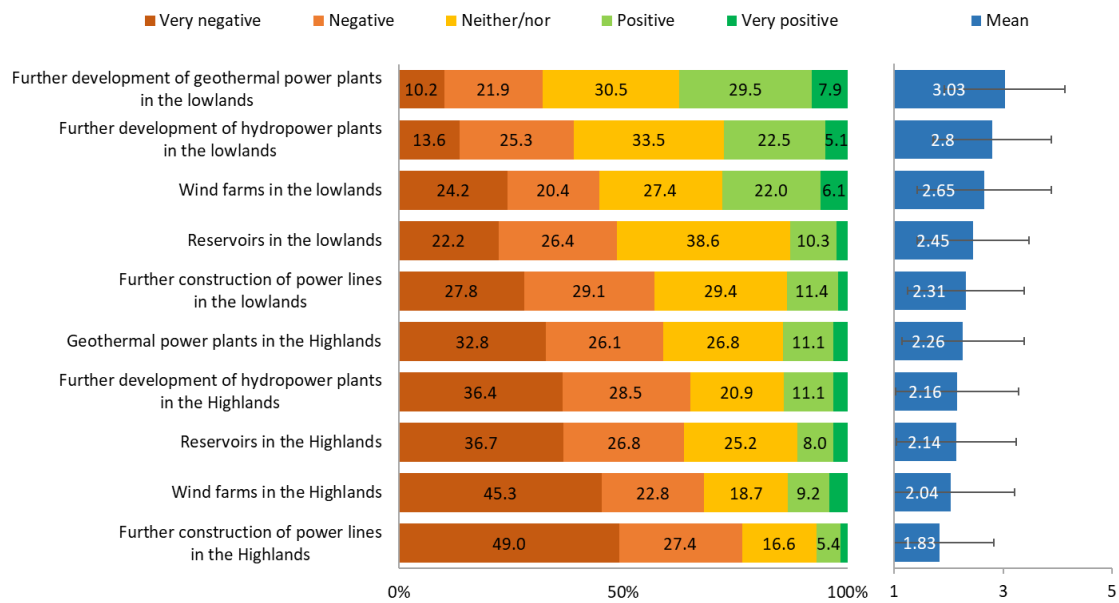


Figure 9. Attitudes toward future developments of energy infrastructure in the Icelandic Central Highlands and in the lowlands.

Simple linear regression tests revealed that stronger pro-environmental attitudes of participants lead to more negative attitudes toward all types of energy infrastructure except for wind farms in the lowlands (Table 5).

Table 5. Effect of environmental attitudes on attitudes toward future energy infrastructure development in the Icelandic Central Highlands and in the lowlands.

Item	β	p
Further development of geothermal power plants in the lowlands	-.294	p<.001
Further development of hydropower plants in the lowlands	-.330	p<.001
Wind farms in the lowlands	.017	p=.804
Reservoirs in the lowlands	-.274	p<.001
Further construction of power lines in the lowlands	-.153	p=.017
Geothermal power plants in the Highlands	-.336	p<.001
Further development of hydropower plants in the Highlands	-.449	p<.001
Reservoirs in the Highlands	-.444	p<.001
Wind farms in the Highlands	-.228	p<.001
Further construction of power lines in the Highlands	-.309	p<.001

Attitudes toward national park proposal

When the participants were asked for their opinion concerning the parliamentary proposal for a Central Highlands National Park, 44% expressed a negative opinion, while 39.6% were in favor of the proposal (Figure 10). The opinion of 6.8% was neither positive nor negative, and 9.6% described their opinion as both positive and negative. Significant differences were observed in the opinions of users and non-users of the Central Highlands, with users being significantly more negative toward the parliamentary proposal, $t(243)=2.473$, $p=.014$.

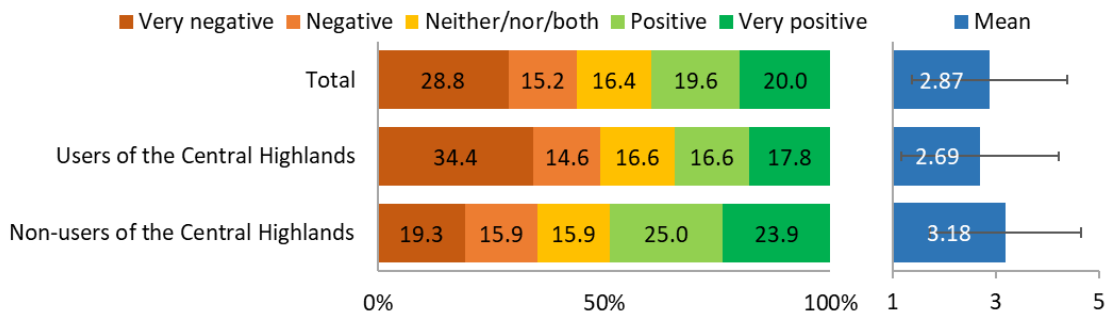


Figure 10. Attitudes toward the parliamentary proposal for a Central Highlands National Park among users and non-users of the Icelandic Central Highlands.

A simple linear regression test revealed a positive effect of environmental attitudes on the participants' opinion on the parliamentary proposal for a Central Highlands National Park ($\beta=.383$, $p<.001$).

When asked how the Central Highlands National Park should be managed, 79.2% of participants stated that it should be managed by a body of various stakeholder representatives, such as the state, local municipalities, tourism, environmental NGOs, farmers, and recreational organizations. In answer to an open question about the most important issues for the tourism industry which should be taken into consideration when establishing a Central Highlands National Park, 22% of participants mentioned ensuring access to the area. The other most mentioned issues included nature protection (20.4%), provision of infrastructure and services for visitors (15.7%), the inclusion of stakeholder opinions in decision-making related to the management of the national park (15.2%) and ensuring opportunities for a range of tourism activities (11.0%) (Figure 11).

Participants were also asked an open question concerning how establishing a Central Highlands National Park would affect the tourism industry in Iceland. The largest proportion (27.5% of participants) believed that the effects would be generally positive, while 14.5% described them as generally negative (Figure 12). More specific effects included, among others, increased attractiveness of the Central Highlands to tourists (mentioned by 15.0%), more rules,

regulations, and control in the area (10.5%), limited access to the area (7.5%), more nature protection (5.5%) and more services, infrastructure, and information for tourists (4.5%). Interestingly, while some participants described the effects of establishing the Central Highlands National Park on the tourism industry as positive, others perceived the same effects as negative or neutral (Figure 12).

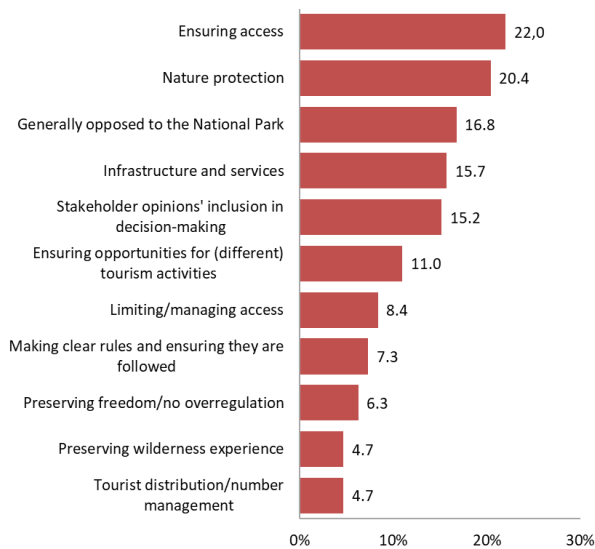


Figure 11. Most important issues for the tourism industry which should be taken into consideration in establishing the Central Highlands National Park.

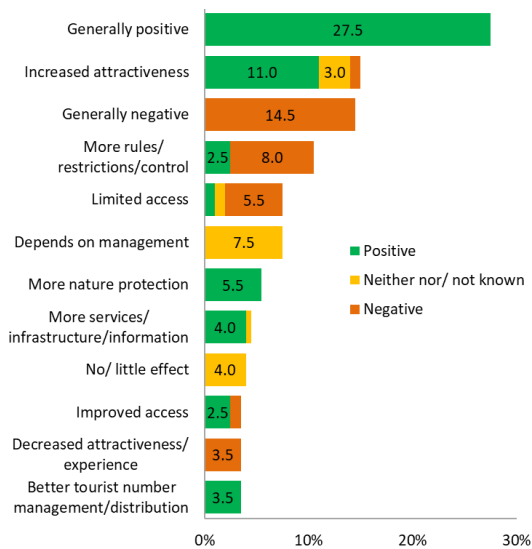


Figure 12. Potential effects of establishing the Central Highlands National Park on the tourism industry in Iceland.

Discussion and conclusions

Wilderness value for the tourism industry

In Nordic regions, the tourism industry increasingly relies on wilderness areas to meet the growing interest in nature-based tourism and outdoor activities (Fredman & Margaryan, 2021). Concurrently, in Iceland and other Nordic countries, tourism is becoming an increasingly important contributor to regional development by providing jobs and income to local communities (Ianioglo & Rissanen, 2020; Sæþórsdóttir & Hall, 2019), making the tourism industry one of the critical stakeholders in the discussion on wilderness use. However, rising visitor numbers to relatively undeveloped natural and wilderness areas and consequently increasing demand for more and different recreational options, pose a threat not only to the environment of these areas, but also to the wilderness experience (Duffy, 2015; Saarinen, 2019; Sæþórsdóttir, 2010b). Furthermore, increasing use of natural areas for tourism challenges traditional meanings of wilderness and brings new meanings to natural places, thereby

complicating the decision-making related to the management of these areas (Hall et al., 2008; Saarinen, 2005). To identify and mitigate conflicts with other wilderness uses and wilderness conservation, it is essential to incorporate the meanings and values wilderness areas contain for the tourism industry within the planning strategies of wilderness areas. This emphasizes the importance of research investigating the value of wilderness for the tourism industry, and compatibility between the preferences of tourism service providers and sustainable wilderness use.

This study has provided much needed insights into the views of travel agencies and day tour providers operating in Iceland, where the country's wilderness has long been one of the main attractions for tourists. The employment of the NEP scale in this study not only facilitated understanding regarding how compatible the development preferences of the tourism service providers are with sustainability, but it also provided valuable insights into the reasoning behind some development preferences.

The results emphasize that the Icelandic Central Highlands, used by almost 60% of the surveyed tourism service providers, are an important venue for the tourism industry. Current users of the area perceive this importance to be significantly higher than non-users. However, over 70% of both users and non-users believe that the area will become increasingly important for the tourism industry over the next ten years. Furthermore, almost half of the companies who do not currently use the Central Highlands state that they are likely to operate their business in the area in the future. This stresses that the development decisions taken for the Central Highlands are likely to influence tourism activities beyond the borders of the area, emphasizing the need for systemic and holistic approaches to wilderness management. As noted by Saarinen (2021), wilderness areas should be viewed as parts of wider regional and global networks, and their relationships with other areas and communities should be taken into consideration.

Development preferences of the Central Highlands and their relationship with environmental attitudes

The tourism industry is highly diverse, as well as the preferences, expectations and motivations of tourists visiting natural areas. They are related to the meanings assigned to these areas, which are created not only during but also before tourists' visit through various channels, for example, (social) media, marketing, advertising or word of mouth (Lichrou & Panayiotopoulos, 2021; Urry & Larsen, 2011). Previous studies focusing on the preferences of visitors to the Central Highlands have shown that support for further infrastructure developments in the area is generally low among tourists (Sæþórsdóttir & Hall, 2018; Tverijonaite et al., 2019). Accordingly, most tourism service providers participating in this study prefer basic tourism infrastructure, while only a few prefer more comfortable infrastructure such as hotels and food

services. The negative relationship between the environmental attitudes of tourism service providers and the perceived need for hotels and food services suggests that such infrastructure is perceived as negatively impacting the surrounding environment and unsuitable for wilderness areas.

Despite identifying some positive effects of existing power plants in the Central Highlands, such as improved access to natural areas, provision of green energy, and energy infrastructure as a tourist attraction, most tourism service providers perceive further energy infrastructure developments in the Central Highlands as negative. This is supported by previous studies on tourist attitudes concerning the Icelandic Central Highlands (Sæþórsdóttir, 2010b; Sæþórsdóttir & Hall, 2018; Tverijonaite et al., 2019), as well as the views of tourism service providers (Sæþórsdóttir & Hall, 2019). Furthermore, the results show that energy related developments in the wilderness settings of the Highlands are perceived significantly more negatively compared to energy developments in the lowlands of Iceland, which are more developed and perceived to be more suitable for such infrastructure, in line with the findings of Sæþórsdóttir and Hall (2019).

Notably, a negative relationship between environmental attitudes and attitudes toward future energy developments in the Icelandic Central Highlands contradicts the findings of studies conducted in other countries, showing that higher pro-environmental attitudes lead to greater acceptance of renewable energy infrastructure (Ntanos et al., 2017; Ntanos et al., 2019). The findings of this study suggest that the negative impacts of energy infrastructure on the environment of the Icelandic Central Highlands and on the wilderness value of the area are perceived as more important than the positive contribution of such infrastructure to climate change mitigation. This emphasizes the importance of the context surrounding renewable energy infrastructure in shaping the attitudes and perceptions of stakeholders. Furthermore, it demonstrates that it is crucial to take these contextual factors into consideration when planning energy infrastructure developments (González et al., 2016; Segreto et al., 2020; Tverijonaite et al., 2022). In Iceland, almost 78% of all electricity produced in 2019 was used by multinational heavy industry companies, and 82% of this electricity fueled aluminum smelters (NEA, 2020). Such a situation raises doubts among tourism service providers regarding the need for further energy developments in the country (Sæþórsdóttir et al., 2021; Tverijonaite et al., 2022), which is likely to be one of the factors that led to the observed negative relationship between environmental attitudes and attitudes toward renewable energy developments. The findings of this study support previous research (Øian, 2013; Saarinen, 1998, 2019), stressing the importance of contextual discourses and of considering place-specific settings and socio-cultural relations when deciding on management approaches to wilderness areas.

Remoteness is among the key indicators of wilderness quality (Hall, 2007; Lesslie & Taylor, 1985) and also an important dimension of wilderness experience (Johnson et al., 2005; Sæþórsdóttir, 2010b). In line with that, most tourism service providers surveyed in this study prefer the roads of the Central Highlands to be kept in their current state or to be better maintained, while the perceived need for building up and paving the roads or bridging rivers is significantly lower. These preferences differ significantly between users and non-users of the Central Highlands, with companies currently not using the area being more in favor of road developments. Such findings suggest that current road conditions in the Central Highlands deter some companies from using the area. Road improvements are therefore likely to lead to increased use of the area and related changes in the type of tourism, appealing more to service-oriented visitors, as observed in more accessible natural areas (Sæþórsdóttir, 2010a; Tverijonaite et al., 2018). Thus, keeping the roads difficult to drive is one of the ways to limit tourist numbers in the Central Highlands. Limiting tourist numbers was perceived as somewhat important by around a third of the tourism service providers, while another third perceived this as important or very important, highlighting the wilderness value of the area for their businesses. Furthermore, the positive relationship between the environmental attitudes of the participants and the perceived importance they accorded to limiting tourist numbers shows that the reasoning for this is not only based on the potential impacts of crowding on tourist experience, as it likely also relates to potential environmental impacts.

Ensuring access or sustainable wilderness management?

While the environmental attitudes of tourism service providers were positively related to their attitudes toward the parliamentary proposal for a Central Highlands National Park, the participants' attitudes toward the national park proposal were strongly divergent, with users of the Central Highlands being significantly more negative toward the proposal. When discussing the issues which should be considered when establishing a national park, the most often mentioned issue was ensuring access for the tourism industry, while nature protection was the second most important. Limited access and increased regulations were mentioned as the potential effects of establishing a Central Highlands National Park. Most perceived these as negative but some identified the same effects as positive. Such findings suggest that ensuring access to the area and opportunities for tourism activities is of high importance to the tourism industry, and tourism service providers are concerned about the uncertainty aspect related to establishing the national park. Similar concerns were observed among the Icelandic general public regarding the possibilities for outdoor recreation by Bishop et al. (2022), who suggest that such concerns are likely to be linked to previous experiences with access restrictions and management issues in existing national parks (Huijbens & Benediktsson, 2015; Petursson & Kristofersson, 2021).

The analysis of the NEP score revealed that the attitudes of over 87% of the surveyed tourism service providers were pro-environmental. Thus, their Central Highlands development preferences might be expected not to contradict sustainable management of the area. In general, the tourism industry's preferences seem to be in line with wilderness preservation: Tourism service providers prefer to keep the tourism infrastructure in the Central Highlands simple and to protect the Highlands from road and energy infrastructure developments. However, while emphasizing the importance of limiting tourist numbers to the area, the tourism industry is not willing to compromise their own access. Thus, concerns about profit reductions appear to be prioritized over the sustainable management of wilderness, despite it being an important resource for the tourism industry. This raises questions as to how tourism service providers perceive the impacts of tourism and of their own activities on the natural environment and its wilderness value, and how they view the dilemma of using wilderness areas for tourism and ensuring their sustainable management.

Ensuring sustainable wilderness management and development in combination with tourism and recreational activities is a difficult task (Baker & Fick, 2022). As emphasized by Williams (2002, p. 125), "There is no single objective condition of the landscape, such as wildness, with inexorable implications for management". The meanings, uses and management preferences of wilderness areas are diverse and keep evolving and changing, thereby challenging decision-making (Hall, 2002; Saarinen, 2019). This study focuses on the preferences of travel agencies and day tour providers. Thus, it only covers a fraction of the Icelandic tourism industry and does not represent the preferences of the industry as a whole. Other types of tourism businesses might assign different meanings and values to the Central Highlands and its wilderness. Thus, they might have different preferences for management and development of the area.

To preserve the wilderness values and meanings ascribed by tourism stakeholders, it is essential to include their interests in decision-making related to management of wilderness. Willingness to participate in the discussion on the future land use and management of the Central Highlands was expressed by most tourism service providers in this study. In line with that, almost 80% of tourism service providers stated that the proposed National Park should be managed by a body of various stakeholder representatives, such as the state, local municipalities, tourism, environmental NGOs, farmers, and recreational organizations. Collaborative approaches which incorporate multiple stakeholder interests, concerns and preferences within decision-making are likely to be effective in anticipating and mitigating conflicts between various stakeholder groups.

Increasing tourism in wilderness areas is likely to lead to changes not only in the natural environment of these areas, but also in the socially constructed values, meanings and uses of wilderness (Hall et al., 2008). Therefore, ensuring sustainable coexistence of wilderness

conservation and tourism might require managing potential threats related to tourism activities by employing approaches which include limiting tourism growth in wilderness (Saarinen, 2021). While deciding on such approaches, however, stakeholder consultation is essential to ensure their support for decision-making and for wilderness conservation.

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Appendix A

Interview guide used in the study presented in Paper II

1. Introducing the research, its purpose and scope, and the research team to the participant.
2. Receiving participant's consent to be interviewed and permission to record the interview, informing the participant that all the data in this study will be treated confidentially, that the participation is voluntary, and the participant can choose to withdraw at any time.
3. Visitor background, motivation, and perceptions:
 - Could you tell a little bit about yourself?
 - Why did you decide to participate in this trip?
 - Was there anything special which attracted you to this area? Did you come to see anything in particular in the area?
 - What fascinates you in the area? What is, in your opinion, the main attraction of this area?
 - What environmental qualities are you seeking on a trip like this?
4. Appropriate infrastructure and recreation in the area:
 - Do you miss tourist facilities in this area?
 - What would be appropriate infrastructure and recreation in this environment?
 - What do you think about tourism infrastructure development in the area, for example, maintained hiking trails, bridges over rivers, hotel, restaurant, gas station, roads, etc.?
5. Satisfaction:
 - How satisfied are you with your trip? What was pleasant/disappointing?
6. Proposed Hverfisfljót Hydropower Plant:
 - What do you think about the proposed idea to build the Hverfisfljót Hydropower Plant in this area?
 - What do you think about the different constructions related to such a plant, like dams, canals, reservoirs, electricity lines, in this landscape?
 - Would you choose this tour if you knew there is a hydropower plant in the area?
 - Do you think the benefits of the hydropower plant would outweigh its negative effects on the area?
 - Do you consider renewable energy to be a solution for reducing CO₂ emissions?
 - Since Iceland possesses abundant renewable resources, do you think Iceland should export renewable energy to countries currently relying on energy from fossil fuels in order to reduce global CO₂ emissions?
7. Closing question: Would you like to add anything that we have not discussed?
Thank you very much for your participation!

Survey on tourism at Hverfisfljót

This survey is a part of a research on the effects of the Hverfisfljót hydro power plant on tourism in the area (see map and description). The research is led by the University of Iceland, and is a part of governmental project called The Master Plan for Conservation of Nature and Utilization of Energy. It takes approx. 10-15 min. to fill out the questionnaire.

Thank you very much for your participation!

1. How descriptive do you find the following words for this area?

	very	somewhat	neither/nor	somewhat	very
1 Natural	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5 Developed
2 Quiet	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5 Loud
3 Accessible	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5 Inaccessible
4 Beautiful	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5 Ugly
5 Impressive	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5 Unimpressive

2. How important are the following factors for you while travelling in this area?

	not at all important	not important	neutral	important	very important
1 Marked walking routes	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
2 Designed footpaths	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
3 Walkways (footbridges)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
4 To enjoy peace	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
5 To enjoy unspoiled nature	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
6 Picnic places (benches and tables)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
7 To have few other tourists around	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
8 That there is no trace of off-road driving	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
9 To walk without seeing structures (other than huts)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
10 To see no trace of others having been there	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
11 Special markings on places of interest	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
12 Campsites with facilities (toilets, trash cans etc.)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
13 To camp wherever you want within the area	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
14 To camp where you don't hear or see other travellers	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
15 Not to be disturbed by air traffic	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

3. How satisfied or dissatisfied are you with the following?

	very dissatisfied	dissatisfied	neither/nor	satisfied	very satisfied
1 Your stay in the area	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
2 The nature in the area	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

4. Would you consider it desirable or undesirable to improve roads in this area?

	very desirable	desirable	neutral	undesirable	very undesirable
	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

5. Did you visit this area to experience wilderness/unspoiled nature?

<input type="checkbox"/> 1 Yes	<input type="checkbox"/> 2 No	<input type="checkbox"/> 0 No opinion
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6. Do nearby structures you know of, but you don't see, affect your wilderness experience?

	not at all	little	to some extent	much	very much	no opinion
	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0

7. In your opinion which of the following may be present in an area for it to be considered wilderness? *Mark more than one if appropriate*

- 1 Nothing
- 2 Mountain huts
- 3 Hotels
- 4 Roads
- 5 Tracks by vehicles
- 6 Fences
- 7 Visitor centres
- 8 Power lines
- 9 Radio masts
- 10 Power plants
- 11 Reservoirs
- 12 Wind turbines
- 13 Designed footpaths
- 14 Trails made by walkers and/or animals

8. What is your opinion on the following statements?

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
1 I go to places like this to escape the demands of daily life and to put my worries aside	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
2 I go to places like this to be able to rest and recover ("recharge my batteries")	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

9. How strongly do you agree or disagree with the following statements?

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
1 More and better infrastructure and services are needed in the area	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
2 Nature conservation limits the quality of recreation in areas like this	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
3 Hotels should not be built in this area	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
4 The value of an ecosystem only depends on what it does for humans	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
5 Only humans have value for their own sake	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
6 If humans do not manage nature, it becomes a threat	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
7 More infrastructure in the area would negatively affect my experience	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
8 Picking wildflowers and small rocks causes no harm in the long run	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
9 I consider the wild character and tough terrain to be the major challenge of the tour	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
10 Native plants and untouched nature are beautiful	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
11 Seeing wild birds and animals in nature gives me a magical feeling	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
12 I would pay more taxes to protect nature	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

10. Please rate your opinion on the following structures/facilities in the area:

	very inappropriate	inappropriate	neutral	appropriate	very appropriate	no opinion
1 Gravel roads	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
2 Built-up gravel roads	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
3 Asphalt roads	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
4 Roads passable year-round	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
5 Bridges across rivers	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
6 Hydro power plants	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
7 Geothermal power plants	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
8 Reservoirs	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
9 Power lines	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
10 Wind turbines	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
11 Hotels	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
12 Mountain huts	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
13 Campsites	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
14 Shops/restaurants	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
15 Gas stations	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
16 Toilets	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
17 Cooked food for sale	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
18 Visitor centre	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
19 Radio masts	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0

11. Would the following power infrastructure affect your interest to visit the area?

	reduce very much	somewhat reduce	no effect	somewhat increase	increase very	no opinion
1 Hverfisfljót hydro power station	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
2 Reservoirs	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
3 Reduced water flow in rivers	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
4 Power line	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
5 Dams	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0
6 Canals	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 0

12. Please state how positive or negative your attitude is to the following:

	very negative	somewhat negative	neutral	somewhat positive	very positive
1 Further development of hydro power plants in the Highlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
2 Further development of hydro power plants in the lowlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
3 Geothermal power plants in the Highlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
4 Further development of geothermal power plants in the lowlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
5 Wind farms in the Highlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
6 Wind farms in the lowlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
7 Reservoirs in the Highlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
8 Reservoirs in the lowlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
9 Further construction of power lines in the Highlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
10 Further construction of power lines in the lowlands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Demographic questions:

Nationality _____

Age years

Gender Female Male

Appendix C

Interview guide used in the study presented in Paper III

1. Introducing the research, its purpose and scope, and the research team to the participant.
2. Receiving participant's consent to be interviewed and permission to record the interview, informing the participant that all the data in this study will be treated confidentially, that the participation is voluntary, and the participant can choose to withdraw at any time.
3. Company and its customers:
 - Could you please introduce yourself and your company?
 - What is your role in the company?
 - What type of business does your company run? What kind of tours does it organize?
 - For how many years has the company been operating?
 - How many employees work in your company?
 - How would you describe the aims of your business?
 - How would you describe your customers? What are they seeking?
 - Which areas of Iceland do tourists visit with your company?
4. Areas where the wind farms have been proposed:

Show the map with five proposed wind farms to the participants. Ask the following questions about each area of the proposed wind farm (start with the most used area):

 - What activities do you undertake in the area of the wind farm?
 - How many tourists come with you into this area each year?
 - What is the main attraction of the area? What is special about this area?
 - What do tourists do in this area?
 - What do they see and where are the longest stops?
5. Proposed wind farms:
 - How would this wind farm affect your business/the tourist experience?
 - a) Would it have any positive effects?
 - b) Would it have any negative effects?
 - How would power plant infrastructure/the roads affect your business/the tourist experience?
 - How do you think tourism would develop in the area if the wind farm were to be built?
 - How do you think tourism would develop in the area if the wind farm were not to be built?
 - Which of the proposed wind farms:
 - a) Would have the most negative impact on your business? On tourism in general? Why?
 - b) Would have the most positive impacts? Why?
 - Could you rank the proposals based on the highest/lowest impact on your business?
 - Could you rank the proposals based on the highest/lowest impact on tourism in the country?
6. Closing question: Would you like to add anything that we have not discussed? Thank you very much for your participation!

Appendix D

Interview guide used in the study presented in Paper IV

1. Introducing the research, its purpose and scope, and the research team to the participant.
2. Receiving participant's consent to be interviewed and permission to record the interview, informing the participant that all the data in this study will be treated confidentially, that the participation is voluntary, and the participant can choose to withdraw at any time.
3. Company and its customers:
 - Could you please introduce yourself and your company?
 - What is your role in the company?
 - What type of business does your company run? (What kind of tours does it organize?)
 - For how many years has the company been operating?
 - How many employees work in your company?
 - How would you describe the aims of your business?
 - How would you describe your customers? What are they seeking?
 - Which areas of Iceland do you use for your tours? (Or for accommodations: which areas of Iceland do your customers use for their tours?). Where does the highest proportion of your customers go?

4. Impacts of existing REI projects on tourism and their spatial extent:

Show the map with three existing REI projects included in this research to the participant.

- Did/does the construction of any of these power plants affect your business? If yes, which ones?

Discuss each REI project separately.

- Which were the most significant impacts of the power plant on your business?
- How do you think the power plant affected tourism in general?
- How has the construction of the power plant affected the value of the area for tourism?
- Were there any tourist attractions affected by the construction of the power plant? Which and how?
- How did the image/perception of the area change due to the construction of the power plant?
- Which infrastructure of the power plant had the highest impact (power station, dams, reservoirs, power lines, pipes, boreholes, reduced water level in the rivers, roads)? Why?
- So, now, if we start to think about the size of the impact area of the power plant, what factors should be considered when estimating the impact area of this power plant on tourism?
- What would be the size of the impact area of this power plant on tourism?

Ask the participant to draw an impact area on a map. While drawing ask the participant to explain which features they included in the mapped impact area and why.

- How would you define the character of the estimated impact area?

5. Impacts of proposed REI projects on tourism and their spatial extent:

Show the map with three proposed REI projects to the participant.

- Do you use any of these areas where the power plants have been proposed for your business?

Discuss each proposed REI project separately.

- What kind of tours do you organize in this area?
- How many tourists come with you into this area each year?
- What do tourists do in this area?
- What do they see and where are the longest stops?
- What is the main attraction of the area? What is special about this area?
- Are you familiar with this power plant proposal?

Describe the proposed REI project to the participant and present visual material.

- How would this power plant affect your business and tourism in Iceland as such?
- How would the proposed power plant affect the main attractions of the area?
- How would the proposed power plant affect the value of the area for tourism?
- Which infrastructure of the power plant would have the highest impact (power station, dams, reservoirs, reduced water level in the rivers, power lines, pipes, boreholes, boreholes/windmills, turbines, landscape, roads (new/improved)? How would it impact tourism?
- How do you think tourism would develop in the area if the power plant would be built?
- How do you think tourism would develop in the area if the power plant would not be built?
- What would be the size of the impact area of this power plant on tourism?

Ask the participant to draw an impact area on a map. While drawing ask the participant to explain which features they included in the mapped impact area and why.

- How would you define the character of the estimated impact area?

6. Overview questions:

- Which of the discussed energy projects have the highest impacts on your business and on tourism in Iceland in general? Why?
- How, in your opinion, different types of REI impact tourism? Which types, if any, are more likely to become tourist attractions? Why?
- Do you think there is a need for more energy harnessing in Iceland? Please elaborate.
- Do you think that energy development and tourism development in Iceland can go hand in hand?
- Are there any other options for economic development that would be better for the country?

7. Closing question: Would you like to add anything that we have not discussed?

Thank you very much for your participation!

Appendix E

Online survey questionnaire used in the study presented in Paper V

Dear recipient,

The aim of this survey is to collect information about the preferences of tour operators and travel agencies regarding the future use and management of the Central Highlands of Iceland.

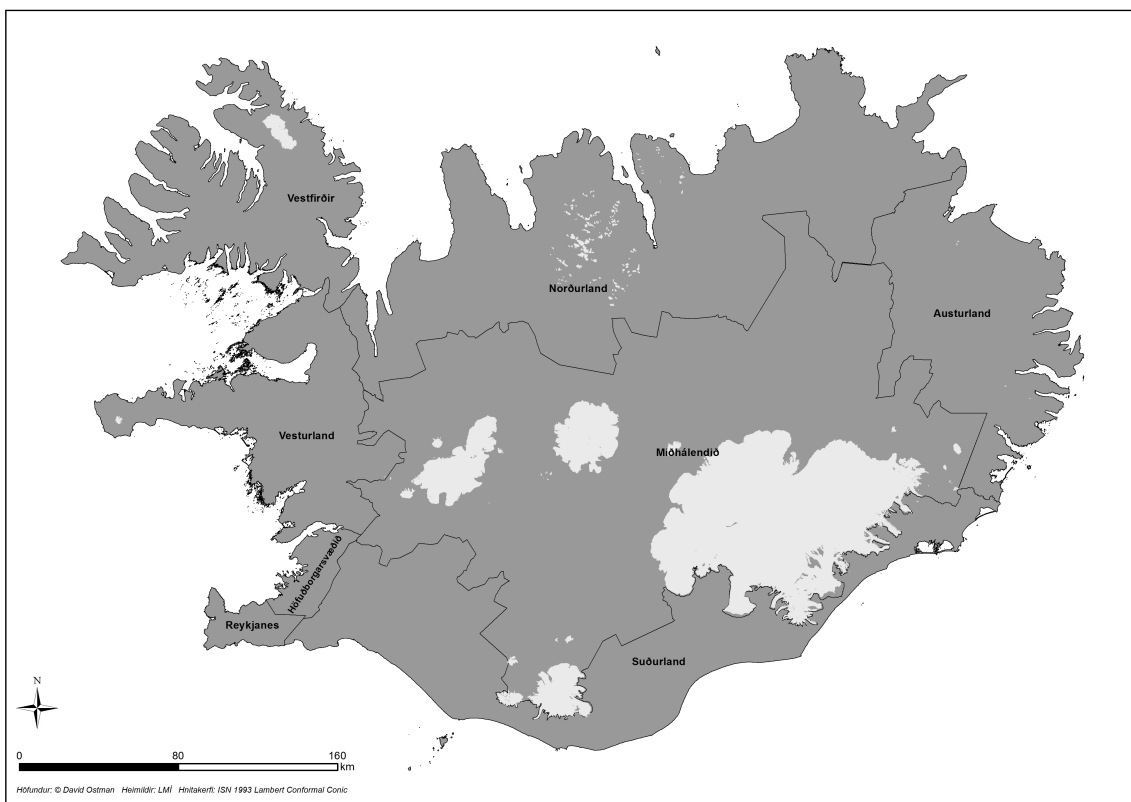
The survey consists of 28 to 34 questions and responding to this survey should take around 10-15 minutes. While your participation plays a crucial role for the reliability and validity of this research, it is purely voluntary - you may skip any question you do not wish to answer and withdraw from the research at any time. Furthermore, the responses are anonymous and will be kept confidential. Only the research team will have access to the raw data, and only group results will be discussed, written up and published.

The study is led by Anna Dóra Sæþórsdóttir, professor in Tourism Studies at the University of Iceland. If you have any questions related to this study, please do not hesitate to contact her via email: annadora@hi.is.

Thank you very much for your participation!

1. Which parts of Iceland (see map below) did your customers visit with your company in 2019? Please mark all that apply.

- | | | |
|--|--|---------------------------------------|
| <input type="checkbox"/> Central Highlands | <input type="checkbox"/> North Iceland | <input type="checkbox"/> Reykjanes |
| <input type="checkbox"/> West Iceland | <input type="checkbox"/> East Iceland | <input type="checkbox"/> Capital area |
| <input type="checkbox"/> Westfjords | <input type="checkbox"/> South Iceland | |



2. Which of the following tours did your company offer in any part of Iceland in 2019?

Please mark all that apply.

	Day tours	Multi-day tours
Bus tours	<input type="checkbox"/>	<input type="checkbox"/>
Jeep tours	<input type="checkbox"/>	<input type="checkbox"/>
Hiking/backpacking tours	<input type="checkbox"/>	<input type="checkbox"/>
Glacier tours	<input type="checkbox"/>	<input type="checkbox"/>
Snowmobiling tours	<input type="checkbox"/>	<input type="checkbox"/>
Photography tours	<input type="checkbox"/>	<input type="checkbox"/>
Northern Lights tours	<input type="checkbox"/>	<input type="checkbox"/>
Self-drive tours	<input type="checkbox"/>	<input type="checkbox"/>
Horse riding tours	<input type="checkbox"/>	<input type="checkbox"/>
Mountain biking tours	<input type="checkbox"/>	<input type="checkbox"/>
ATV quad tours	<input type="checkbox"/>	<input type="checkbox"/>

Other tours (please specify)

3. How likely are you to use the Central Highlands for your business in the future?

- Very unlikely Rather unlikely Neither/nor Rather likely Very likely
- Not sure
- It depends (please specify)

4. As a destination, how attractive do you think the Central Highlands are for your customers?

- Not at all attractive Not attractive Somewhat attractive Attractive
- Very attractive Not sure

If attractive, what would be the main attraction of the Central Highlands?

5. Please answer the following questions:

	Not at all		Somewhat		Very much	No opinion
How important are the Central Highlands for the tourism industry in Iceland?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will the value of the Central Highlands for the tourism industry in Iceland increase in the next ten years?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How important are wilderness areas in the Central Highlands for the tourism industry in Iceland?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. How important is it for your company to have a say in the discussion on the future land use and management of the Central Highlands?

- Not at all important Not important Somewhat important Important
 Very important No opinion

If important, through what medium would you prefer to express your views?

7. Which of the following tours did your company offer within and outside the Central Highlands in 2019? Please mark all that apply.

	Day tours in the Central Highlands	Day tours outside the Central Highlands	Multi-day tours in the Central Highlands	Multi-day tours outside the Central Highlands
Bus tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jeep tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hiking/backpacking tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Glacier tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Snowmobiling tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Photography tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Northern Lights tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-drive tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Horse riding tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mountain biking tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ATV quad tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other tours (please specify)

8. Please answer the following questions:

	Not at all		Somewhat		Very much	No opinion
How important are the Central Highlands for your business?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How important are the Central Highlands for the tourism industry in Iceland?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will the value of the Central Highlands for your business increase in the next ten years?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will the value of the Central Highlands for the tourism industry in Iceland increase in the next ten years?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How important are wilderness areas in the Central Highlands for your business?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How important are wilderness areas in the Central Highlands for the tourism industry in Iceland?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. What is the main attraction of the Central Highlands for your customers?

10. How important is it for your company to have a say in the discussion on the future land use and management of the Central Highlands?

- Not at all important
 Not important
 Somewhat important
 Important
 Very important
 No opinion

If important, through what medium would you prefer to express your views?

11. Today 10 hydro- and geothermal power plants are situated within or just outside the Central Highlands border: seven hydropower stations in the Þjórsá and Tungnaá Catchment Area (Búrfell and Búrfell II, Búdarháls, Hrauneyjafoss, Sigalda, Sultartangi and Vatnsfell), Blanda Hydropower Plant, Kárahnjúkar Hydropower Plant and Krafla Geothermal Plant. Have these power plants had any effects on the tourism industry?

- No effects
 Positive effects
 Negative effects
 Both, positive and negative effects
 No opinion

12. How would you describe the most significant effects of these power plants on the tourism industry?

Positive effects

Negative effects

13. Please state your attitude towards the following:

	Very negative	Somewhat negative	Neutral	Somewhat positive	Very positive
Further development of hydropower plants in the Highlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Further development of hydropower plants in the lowlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geothermal power plants in the Highlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Further development of geothermal power plants in the lowlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind farms in the Highlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind farms in the lowlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reservoirs in the Highlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reservoirs in the lowlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Further construction of power lines in the Highlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Further construction of power lines in the lowlands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. Do you think there should be more or less of the following in the Central Highlands?

	Much more	Somewhat more	Present amount is appropriate	Somewhat less	Much less	No opinion
Food services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visitor centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Toilet facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mountain huts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hotels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marked hiking trails	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. Which areas of the Central Highlands, if any, are in need of (further) tourism infrastructure? Please also specify what type of infrastructure is needed.

16. Which areas of the Central Highlands, if any, should be protected from any development? Why?

17. The roads in the Central Highlands should be:
Please mark all that apply.

	Kept in current state	Better maintained	Built up	Paved	Bridged	No opinion
Kjalvegur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sprengisandur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fjallabak nyrðra	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other roads in the Central Highlands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. Which areas of the Central Highlands, if any, need better roads? Please specify the improvements needed.

19. How important is it to limit the number of tourists in the Central Highlands?

- Not at all important
 Not important
 Somewhat important
 Important
 Very important
 No opinion

If important, where is it needed and what would be the best ways to limit the number of visitors?

20. How strongly do you agree or disagree with the following statements regarding Icelandic national parks:

	Strongly disagree	Disagree	Neither/nor	Agree	Strongly agree	No opinion
National parks attract tourists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
National parks have positive effects on local communities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public investment in national parks is positive for nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public investment in national parks is positive for the tourism industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. What is your opinion concerning the parliamentary proposal for a Central Highlands National Park?

- Very negative
 Negative
 Neither positive nor negative
 Positive
 Very positive
 Both positive and negative
 No opinion
 I am not familiar with the parliamentary proposal

Please elaborate on your answer. Why is this your opinion?

22. What do you think are the most important issues for the tourism industry which should be taken into consideration in establishing the Central Highlands National Park?

23. How do you think establishing the Central Highlands National Park would affect the tourism industry in Iceland?

24. The Central Highlands National Park should aim at protecting:

	Strongly disagree	Disagree	Neither/nor	Agree	Strongly agree	No opinion
Landscape	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecosystems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wilderness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cultural heritage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

242 Other (please specify)

25. The Central Highlands National Park should be managed:

- Exclusively by the state
- Exclusively by local municipalities
- By a body of various stakeholder representatives (e.g. the state, local municipalities, tourism, environmental NGOs, farmers, recreational organizations)
- No opinion
- Other (please specify)

26. How strongly do you agree or disagree with the following statements about the relationship between humans and the environment?

	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
The earth has plenty of natural resources if we just learn how to develop them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plants and animals have as much right as humans to exist	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is strong enough to cope with the impacts of modern industrial nations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Despite our special abilities humans are still subject to the laws of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The so-called "ecological crisis" facing humankind has been greatly exaggerated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The earth is like a spaceship with very limited room and resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans were meant to rule over the rest of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is very delicate and easily upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans will eventually learn enough about how nature works to be able to control it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If things continue on their present course, we will soon experience a major ecological catastrophe

We are approaching the limit of the number of people the earth can support

Humans have the right to modify the natural environment to suit their needs

When humans interfere with nature, it often produces disastrous consequences

Human ingenuity will insure that we do NOT make the earth unlivable

Humans are severely abusing the environment

27. Which characteristics of Iceland might become more important for the tourism industry as it recovers from the effects of the COVID-19 pandemic? Please mark all that apply.

- Low population density - easy to avoid crowded areas
- Vast natural areas
- Areas under nature protection
- Good healthcare system
- Iceland being an island
- The image of Iceland as a green and healthy country
- Other (please specify)

28. What type of business does your company run? Please mark all that apply.

- Day tour provider
- Travel agency
- Other (please specify)

29. How many years has your company been operating?

30. Where are your company's headquarters? (postal code)

31. How many full-time employees (approximately) did your company have in January 2020?

32. How many full-time employees (approximately) did your company have in August 2019?

33. Any other comments are very welcome!

34. Thank you very much for participating in this survey!

If you have 10 extra minutes, we would like to hear your opinion on the management of specific areas in the Central Highlands . To answer these questions please continue to the longer version of the questionnaire. To finish your participation now please select "Finish the survey".

- Finish the survey Continue to the longer version of the questionnaire

Since different areas of the Central Highlands might require different development and management, the Central Highlands have been divided into the sub-regions (see map). Please mark the statements for each sub-region with which you agree.

36. Southern part of the Central Highlands:

	I am not familiar with this area	Is used for my business	Has high future value for tourism	Needs (more) toilet facilities	Needs (more) food services	Needs (more) mountain huts	Needs (more) hotels	Needs (more) marked hiking trails	Does not need any of the aforementioned infrastructure
The whole area (all sub-regions below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eldgjá	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gljúfurleit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hágöngur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hekla	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hrunamannafréttur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hruni	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jökulheimar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kerlingarfjöll	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laki	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landmannalaugar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Langisjór	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mælifellssandur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Þjórsárdalur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Þjórsárver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Þórisvatn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Þórsmörk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tindfjöll	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Torfajökull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Veiðivötn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

37. Eastern part of the Central Highlands:

	I am not familiar with this area	Is used for my business	Has high future value for tourism	Needs (more) toilet facilities	Needs (more) food services	Needs (more) mountain huts	Needs hotels	Needs (more) marked hiking trails	Does not need any of the aforementioned infrastructure
The whole area (all sub-regions below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Arnardalur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Askja	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fljótsdalsheiði	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fljótsdalur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fremri námar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gjástykki	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hraun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jökulsárgljúfur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kárahnjúkar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kverkfjöll	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lónsöræfi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Möðrudalsöræfi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ódádahraun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vesturöræfi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

38. Northern part of the Central Highlands:

	I am not familiar with this area	Is used for my business	Has high future value for tourism	Needs (more) toilet facilities	Needs (more) food services	Needs (more) mountain huts	Needs hotels	Needs (more) marked hiking trails	Does not need any of the aforementioned infrastructure
The whole area (all sub-regions below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eyjafjarðardalir	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eyvindarstaðaheiði	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiðagil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skagafjarðardalir	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sprengisandur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vonarskarð	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

39. Glaciers and their peripheries in the Central Highlands:

	I am not familiar with this glacier	Is used for my business	Has high future value for tourism	Needs (more) toilet facilities	Needs (more) food services	Needs (more) mountain huts	Needs hotels	Does not need any of the aforementioned infrastructure
Hofsjökull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Langjökull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mýrdalsjökull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vatnajökull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>