



Original research article

# When tourists meet transmission lines: The effects of electric transmission lines on tourism in Iceland<sup>☆</sup>

Porkell Stefánsson<sup>a</sup>, Anna Dóra Sæþórsdóttir<sup>a,\*</sup>, C. Michael Hall<sup>b</sup><sup>a</sup> School of Engineering and Natural Sciences, Faculty of Life and Environmental Sciences, University of Iceland, Askja, Sturlugata 7, 101 Reykjavík, Iceland<sup>b</sup> Department of Management, Marketing and Entrepreneurship, University of Canterbury, Private Bag 4800, 8140 Christchurch, New Zealand

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## ABSTRACT

The transition towards a low-carbon economy has led to a growing demand for renewable energy. However, while publics are often supportive of renewable energy they are often more critical of the infrastructure required to generate and distribute energy. Although transmission lines are necessary to carry renewable energy, they are often highly visible and frequently meet strong public opposition. This is especially true in areas with a high degree of perceived aesthetic naturalness, which are often valued landscapes for nature-based tourism. While nature-based tourism in Iceland has increased greatly, so also has energy production. There are plans for reinforcing the distribution system by building transmission lines in either existing areas or new locations, such as the relatively pristine Central Highlands. Due to tourism's economic importance, and the growing necessity for a stronger transmission system, it is imperative to identify tourists' opinions on transmission lines in natural areas. Attitudes were analysed by employing a questionnaire at seven locations where power plants are proposed. Results demonstrate that tourists are generally negative towards transmission lines, especially in the Highlands and consider them one of the least desirable infrastructures. Nevertheless, there is considerable variance between different markets, with opposition highest among domestic tourists.

## 1. Introduction

Most nations are facing increased demand for electricity with a corresponding need to develop and reinforce the distribution system [1,2]. Access to energy, and electricity in particular, is integral to wellbeing and quality-of-life. However, concerns over emissions, climate change and sustainability has led to renewable energy, such as thermal, wind, bio-mass, solar, tidal and hydro-electricity, becoming the fastest-growing source for electricity generation [3]. However, while renewable energy is usually framed as being sustainable the infrastructure necessary for producing large scale power and transporting it to the location where it is required is often perceived negatively, especially in areas with high natural quality.

Despite its economic importance for areas of perceived high aesthetic values, there is relatively little research on the implications of energy infrastructure for tourism, outdoor recreation and the visitor experience [4]. Where research regarding the impact of energy infrastructure on tourism and recreation has been conducted, it has been focussed on wind turbines, power plants and hydro-electric dams [4–8]. However, despite their integral role in electricity networks, there is a

dearth of research on the implications of transmission lines for tourism. Transmission lines often traverse natural and rural areas in transporting electricity from where it is generated to sub-stations for onward distribution, and although some appreciate them as a part of the cultural landscape [9] they are usually considered by permanent local residents to affect the landscape in a negative manner [9,10]. No research has sought to directly examine the perceptions of visitors. Yet, the impact of transmission lines on a landscape may be especially important for tourism, since they can have a direct effect on the landscape attributes that the industry relies upon in promoting destinations and visitation [11].

Most research into people's attitudes towards transmission lines has been on power lines in inhabited areas and conducted among permanent local residents [9,10,12–15]. Research concerning the attitudes of tourists in areas with high degrees of naturalness appears extremely limited [16] with an exception of a literature review from Norway [16] and being very briefly mentioned in a study from Iceland [17]. Nevertheless there has long been recognition that transmission lines lowers perceptions of wilderness quality [18], including a number of reports sponsored by developers, conducted in Iceland and Norway, as

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\* Corresponding author.

E-mail addresses: [ths@hi.is](mailto:ths@hi.is) (P. Stefánsson), [annadora@hi.is](mailto:annadora@hi.is) (A.D. Sæþórsdóttir), [michael.hall@canterbury.ac.nz](mailto:michael.hall@canterbury.ac.nz) (C.M. Hall).

part of the environmental impact evaluations of proposed transmission line projects [19–26].

This paper examines the effect of transmission lines on the tourist experience at nature-based tourism destinations in Iceland. Tourism and power intensive industry represent two of the country's three main economic sectors. Tourism has been growing very fast [27,28], with the natural landscape recognised by Iceland's national tourism agency as the most important resource for the tourism industry [29]. Simultaneously, power intensive industry, i.e. smelting, has also grown [27]. This has led to an intensive public policy debate over the need to strengthen the electricity transmission system [30] and any impact this may have on tourism [31].

As there is extremely limited research regarding the attitudes of tourists towards transmission lines in natural areas [2,13], this Icelandic study provides potentially valuable insights into the spatial competition between energy production and nature-based tourism [6,18], which will likely become of increasing importance in coming decades. As Bishop [32] observes, we are entering an era where landscape will be used in a different way for energy production and distribution due to increased concerns over climate change and reducing greenhouse gas emissions. The development of the renewable energy sector will likely unavoidably affect natural areas in many parts of the world as new infrastructure becomes more visible in the landscape [32], and raises fundamental public policy questions with respect to trade-offs and the effects of core elements of a national energy system, albeit renewable, on the environment and the economic wellbeing of other sectors. Although opposition to the deployment of transmission grids by permanent residents is very well recognised [2], tourists perceptions of transmission lines will also be significant for policy development and decision making in those countries and regions with economically significant tourism industries. The study therefore touches on some of the key questions and debates in energy and the social sciences [33]. In doing so, it significantly broadens research on the social context of energy issues by evaluating tourist reaction to environmental change arising from energy use.

The findings presented in this paper are therefore highly relevant to those locations that rely on nature as a tourist or recreational attraction. In the Icelandic context, tourist acceptance of energy infrastructure is an important component of policy making and the discourse about energy transition. Based upon a survey of tourists at seven nature tourist destinations in Iceland the main aim of this paper is to analyse the attitudes of tourists towards transmission lines in the natural environment and see if there is difference between the various markets. In order to maintain Iceland's competitiveness as a nature tourist destination it is important to understand the attitudes and perceptions of various markets given the potential impact of the tourist experience on future travel decision-making.

Before discussing the survey and its results in more detail, the paper will discuss the relevant literature on attitudes towards electricity infrastructure and distribution systems as well as the positioning of 'Green Iceland'.

## 2. Attitude towards transmission lines

People often connect the visual quality/beauty of a landscape with how natural they assume it to be [34]. Infrastructure, such as roads, factories, power plants and transmission lines, that are considered out of place in the landscape are often felt to detract from an area's attractiveness [35]. Consequently, resistance towards energy related infrastructure is often greater in areas where the quality of the landscape is perceived to be substantial [7], than in areas where it already exists [10]. The emotional attachment people have towards certain places and landscapes can also induce protests against landscape change, such as that arising from transmission lines [36]. Vorkinn and Riese [37] also observed that emotional attachments to places can contribute more towards opposition to environmental change than factors such as

gender, class and status. This is also significant for tourism given that outdoor recreation and visitation experiences can be factors in forming attachments to place [38,39].

The perceived impacts of transmission lines on the landscape can be a significant influence in overall attitude towards them [2,9]. Transmission lines have distinctive visual properties as they are large linear cable structures with towers at regular intervals that often stretch for long distances [40]. Due to their visibility they have substantial impacts on landscape perception and associated attachment and feelings towards the area [41].

Resistance to transmission lines on aesthetic grounds is one of the main factors that prohibits or delays further construction of electricity distribution systems [2,9,42], and which can also increase development costs [15,43]. Among other factors are decreases in real estate value [44]; clashes with other land use [4]; and concern over detrimental effects on people's health [1,9,12,15]. Even when the public are in favour of renewable energy sources, they are usually against the erection of transmission structures in their local communities [43,45,46]. Priestley and Evans [12] also showed that the likelihood of over-estimating the visual impact of power lines increased in accordance with proximity of the respondents' home to the line. This has been called the "not in my backyard" (NIMBY) attitude, which entails people's opposition to a development or land use in their own vicinity which they would not oppose if located elsewhere [47]. Nevertheless, some authors [e.g. 48,49] emphasise that the use of NIMBY to describe local attitudes and opposition to development is often a deceptive, imprecise and derogatory way of describing genuine local concerns. For example, Wolsink [46] reported on windmill projects near wetlands in the Netherlands, where opposition did not increase depending on residents' proximity to the designated area. He concluded that it is not axiomatic that self-interest is dominant in people's attitude, but that a concern for the public interest is also a factor. Similarly, Devine-Wright [36] suggests that consideration also needs to be given as to how developments fit with the symbolic and socially constructed ideas about the area in which they occur. Soini et al. [9] concluded that local opposition towards transmission lines decreased after they had been erected, suggesting an attitudinal adjustment can occur even though a project is usually met with initial resistance.

Because of the visual impact of transmission lines upon a landscape, and consequently on people's experience of an area, ways to reduce visual effects are often discussed [see e.g. 10]. One alternative is to design transmission towers that contrast less with their environment, adjust the structures to the landscape as much as possible, and erect the transmission lines in such a way that they circumvent more attractive areas. Underground power lines are much more likely to be endorsed by the public because they have less negative effect upon a landscape and hence people's visual experience [50]. In Norway the social benefits of avoiding negative landscape impact were found to be greater than the cost of burying the power lines [51]. However, this research was conducted in an urban landscape. Similarly, Ragnarsdóttir [52] employed a conditional assessment of value to analyse Icelanders' willingness to pay for the undergrounding of power lines, as a replacement for pylons, in order to reduce the negative visual impact of power lines. The results of her survey demonstrated that the visual effect of the transmission lines were somewhat important for the general public, especially for those that reside closest to the lines. It has also been shown that the willingness to pay in order not to see power lines in areas with a high degree of naturalness is greater than in inhabited areas [11,53].

Nevertheless, if transmission lines carry high voltage then the expenditure of undergrounding power lines is far greater than the cost of erecting transmission lines on pylons [50]. Importantly however, even though the visual impact of underground power lines is generally considered to be less than that of overhead lines, they do still negatively impact a landscape [51], with the time period of perceived negative impact depending on the regeneration capacity of vegetation where the underground line has been buried.

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