

Research Articles

Renewable Energy and Tourism: Conflict and Compatibility Between Iceland's Major Economic Sectors

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Keywords: Iceland, Tourism, Energy, Sustainability, Geothermal, Hydropower, Industrial Tourism, Nature Based Tourism, Renewable energy

<https://doi.org/10.56020/001c.121428>

Journal for Global Business and Community

Vol. 15, Issue 1, 2024

Both the tourism and energy sectors in Iceland are key drivers of economic growth highlighting the importance of understanding how they grow together. This review will explore the conflict and compatibility that the tourism and energy sectors have with one another. Tourism in Iceland focuses on the importance of preserving the natural beauty of the landscapes people visit which inadvertently disrupts energy development in those same areas. The dispute between the two sectors ultimately revolves around the best use of land. The energy sector has fortunately found somewhat of a middle-ground by which tourists visit the power facilities themselves for industrial sightseeing. There are initiatives in place that foster compromise between the two sectors to help shed light on the importance of the issues at hand. Ultimately, more people must understand the interplay between tourism and energy in Iceland so that policymakers can move forward in making the best decisions for the country.

Introduction

In recent years, energy and tourism have grown to be two of the most predominant players in Iceland's economy (Sæþórsdóttir & Hall, 2019). Tourism within the country has risen rapidly over the past decade and is projected to continue rising (Gil-Alana & Hujibens, 2018). The energy sector within the arctic country has also seen advanced growth and the National Energy Authority of Iceland plans for it to continue doing so through means of hydro and geothermal power (National Energy Authority, 2023). With both the tourism and energy sectors on the rise, it is important to understand how these two industries interact with each other. Tourism and energy in Iceland can each have very different interests in following their agendas, therefore acknowledging any conflict or compatibility between the two sectors clarifies how they can coexist efficiently within Iceland's economy.

It is natural that as energy plants continue to be developed, large amounts of space are needed to support such vast infrastructure (Sæþórsdóttir & Hall, 2019). The land used to develop power plants effectively takes from that of popular tourist destinations. The beauty of Iceland's unique landscape is one of the major factors that motivate tourists to visit the country each year (Gil-Alana & Hujibens, 2018). The obstruction of energy development on the natural landscape can create a less appealing image for tourists visiting and could potentially prevent a tourist from wanting to visit (Stefánsson et al., 2017). Although it is easy to assume that most tourists visiting Iceland would resent a large power plant obstructing their view, there are gaps in the research that fail to consistently link energy develop-

ment with a negative impression on tourists (Sæþórsdóttir & Hall, 2019).

As mentioned earlier, the tourism and energy sectors of Iceland's economy have seen proliferation over the last several years and are expected to continue growing in the future. Intertwined within this growth are differing agendas of sustainability that each sector pushes to achieve (Sæþórsdóttir & Hall, 2019). Particularly environmental sustainability, which is concerned with maintaining the present conditions of Earth's physical environment to conserve more for the future (Sutton, 2004). As each sector grows and continues being environmentally sustainable, conflict often ensues resulting from the differing interests (Sæþórsdóttir & Hall, 2019). With help from the government of Iceland, there are strategies in place to mitigate any conflict and promote a sense of harmony between the tourism and energy sectors (The Master Plan, 2023). The focus of this research will be to answer the question of what sort of conflict or compatibility emerges from the growth of the two very different tourism and energy sectors of Iceland's economy.

This literature review will use the research method of thematic organization to break the main question down into multiple categories of context. Themes such as tourism, energy, and the interaction between the two will be used as focal points throughout the research to portray the research at hand. Each part will be examined through several different sub-themes that provide more context to the theme being explored. The purpose these organizational methods have in answering the research question is to provide an answer in a coherent, structured, and informative manner.

As mentioned earlier, the primary focus of this research will center around a reliable conclusion as to what sort of implications erupt from the interplay between the tourism and energy sectors of Iceland's economy resulting from growth. There is substantial research regarding tourism, energy, and sustainability in different parts of the world, but because the topic of this paper focuses on the implications of these subjects in Iceland, other countries will not be included. Although this research will explore the history of themes such as energy and tourism in Iceland, the focus will be shifted away from the effects of the COVID-19 pandemic. The consequences of the pandemic will of course be considered when applicable to the context of the research, but the overall scope of the paper will focus on where Iceland is at today and what that could mean for the future.

Research Findings

Tourism in Iceland

Over the past decade, tourism has become one of the most rapidly growing sectors of Iceland's economy even contributing to a large portion of the country's exports (OECD, 2017). The number of tourists visiting Iceland in the summer of 2022 was over double that of 2021 and even exceeded the numbers before the pandemic in 2019 (Icelandic Tourist Board, 2022). When compared to the rest of the world, Iceland ranked 128th in the total number of tourists at 488,000 visitors in 2020 (World Data, 2023). This of course is expected from a smaller country, but when put into relative terms Iceland had approximately 1.3 tourists per resident putting it at 37th in the world and 4th in Northern Europe. These statistics highlight Iceland's relatively high-ranking place in the world of international tourism.

History of Tourism in Iceland

To fully understand the tourism sector's current presence in Iceland, it is important to first know how far it has come from the early days of its emergence within the country. Midway through the 20th century legislation was passed to promote Icelandic tourism growth through the creation of the 'Icelandic Tourist Board' (Jóhannesson et al., 2010). The Icelandic Tourist Board, with a focus on marketing Iceland to people all around the world, was well-financed by the country and even built several hotels to support greater numbers of visitors.

The Icelandic Tourist Board was beneficial in 2010 when tourism in Iceland started a proliferating ascent into inbound tourism numbers that had never been seen before all thanks to several factors surrounding the time (Gil-Alana & Hujibens, 2018). A recent study pinpoints the trajectory of Icelandic tourism in the year 2010 and lists several motivating factors including the recession just prior. Iceland being one of the first countries impacted by the 2008 financial crisis coupled with the eruption of an Icelandic volcano made news headlines all around the world putting Iceland on the map. The media covered the culture and exotic wilderness of Iceland making it out to be an enticing travel destination for people all around the world wanting to explore.

Tourism numbers subsequently inclined after 2010 and continued doing so throughout the next decade (Gil-Alana & Hujibens, 2018). COVID-19 was only a temporary setback for Iceland as inbound tourism bounced back almost exponentially following 2020 (Remer & Liu, 2022). Isavia, the company in charge of all airport operations on the island, predicts that there will be a total of 2.4 million tourists in 2024 marking a new foreign tourist record and beating that of the pre-pandemic peak in 2018 (Isavia, 2024).

This portion of the research gave a brief history of the last 100 years of tourism in Iceland. With various types of legislation passed throughout the 1900s, Iceland was able to securely establish an organizational method of promoting tourism through the Icelandic Tourist Board (Jóhannesson et al., 2010). The foundation built prior to the 21st century paved the way for what would become record-breaking tourist numbers during the second decade in the 2000s (Gil-Alana & Hujibens, 2018). This background information is important to understand because it showcases the context behind the tourism growth predicted to occur in the future.

Tourism's Effect on Iceland's Economy

Previously this research discussed the history of tourism in Iceland and some of the reasons behind that growth. This portion of the paper will analyze how that growth in tourism transfers over economically. Knowing the economic implications of tourism in Iceland can help to understand what incentive there is for government officials to push for the industry's growth.

Exports in Iceland account for nearly half of the country's Gross Domestic Product (GDP) each year (OECD, 2017). Of these exports, tourism contributes to about 39% of the yearly export revenue (Mulvihill, 2022). This contribution has of course risen alongside the general rise in incoming travelers from just 12% in 1995 to the 39% where it was in 2019 (Sæþórsdóttir & Hall, 2019). With such a large contribution to revenue, tourism is undoubtedly the largest export sector next to aluminum smelting and fishing within Iceland's economy.

Not only does Icelandic tourism play a big role in contributing to the nation's GDP but it also creates a myriad of jobs effectively reducing the unemployment rate (Mulvihill, 2022). Since 2010, the tourism industry has seen an increase of 60% in new jobs which was much higher compared to other job fields in Iceland (Sæþórsdóttir & Hall, 2019). Roughly 15% of the total workforce in Iceland stems from the tourism industry (Mulvihill, 2022). Iceland generally has maintained one of the lowest poverty rates in the world at 4.9% but this number has only decreased since the rapid growth of tourism on the island.

Over the last decade, the growth of tourism in Iceland has successfully established the industry as a primary economic sector. Leading the way in exports and job growth, it is evident that tourism in Iceland is a very valuable means of economic growth and will be held in such regard by policymakers and government officials.

Renewable Energy in Iceland

Just as this research has discussed the prominence of the tourism sector in Iceland, it will now move on to discuss the presence that renewable energy has within the country. Roughly 85% of the total energy supply in Iceland is domestically sourced renewable energy with 65% provided from geothermal energy and 20% coming from hydropower (Government of Iceland, 2023). The other 15% of the total energy comes from oil products for transportation. Almost all the electricity produced is provided by renewable energy with 73% of electricity coming from hydropower and the other 27% from geothermal sources.

On the consumption side of energy development, the industrial sector consumes about half of all energy produced in Iceland (Nordic Energy Research, 2013). Much of this industrial energy consumption is done by aluminum smelting; one of Iceland's major exports (Helgason, 2014). The development of a manufacturing plant in Iceland can subsequently lead to the development of a new energy plant to fuel it, as is the case with Karahnjúkar, a hydropower plant built to provide electricity for a newly built aluminum smelter.

Relative to the rest of the world, Iceland is the largest renewable energy producer per capita (Government of Iceland, 2023). This per capita statistic is in part a result of the country's low population but is also rightfully attributed to its vast green energy production (Ritchie & Roser, 2022). In 2021 Iceland sourced approximately 87% of its primary energy from renewable sources which is 76% more than that of the United States at the time.

History of Energy in Iceland

Regarding renewable energy, Iceland clearly stands out amongst other countries around the world (Government of Iceland, 2023). If Iceland is held in such high regard how then did it manage to make it this far? Where does the start of Iceland's vast renewable energy development begin? This portion of the research will explore the history of energy in Iceland.

In much of the time leading up to the 20th century, Iceland was mostly depleted of primary fuel resources going as far as using animal manure as a fuel source (Melsted, 2022). It wasn't until the early 1900s that imported coal became a more dominant resource providing fuel to the general population. Coal was eventually replaced by oil which offered a "cleaner" and more efficient means of energy for Icelandic homes.

While coal and oil were dominating Icelandic energy throughout the early 20th century, geothermal energy was slowly building its presence behind the scenes (Logadottir, 2015). Renewable resources were just beginning to be tapped when an Icelandic farmer found a way to heat his farm through the hot water rising from the ground. This farmer's discovery snowballed as other towns began implementing similar renewable practices including new hydro developments. Eventually, the government of Iceland poured more funding into renewable energy development transitioning from fossil fuels to where it is today.

Energy's Effect on Iceland's Economy

This research has now explored the transition that Iceland's energy sector made from fossil fuels to renewable energy through geothermal and hydro developments. Much of the energy transition that has been discussed can be attributed to economic motivation (Logadottir, 2015). To better comprehend the future implications of Iceland's energy sector it is important to know what economic incentive is involved in catalyzing such growth.

Historically the transitions from coal to oil and then oil to renewable energy mostly stem from economic reasons in that each of the prior sources became unaffordable (Melsted, 2022). Knowing that prior decisions made toward energy were done with economics in mind helps predict what kind of decisions could potentially be made for future energy developments in Iceland.

As mentioned earlier, almost half of all energy consumed in Iceland is done by the industrial sector which primarily consists of aluminum smelting (Nordic Energy Research, 2013). Previous parts of this research established how efforts to facilitate growth in the aluminum smelting industry can effectively lead to semi-proportional growth in the energy sector. Development in one sector subsequently generates growth in the other as energy is needed to fuel industrial plants (Helgason, 2014).

Iceland's energy resources are attractive to foreign companies for several different reasons. Because geothermal and hydro energy is domestically sourced, they are easy to provide and comparatively cheaper for investment from other companies (Krater & Rose, 2009). Geothermal and hydro energy are also considered to be very clean sources of energy which are especially enticing for companies wanting to maintain a low carbon footprint (Krater & Rose, 2009).

Foreign direct investment is not the only economic benefit stemming from Iceland's renewable energy sources (Logadottir, 2015). These resources have also led to job growth. Sectors involving manufacturing and energy have provided a total of 22,800 jobs for Iceland in 2023. Additionally, the construction industry that is directly associated with building infrastructure in these sectors has provided another 15,300 jobs in the same year (Statista, 2023).

The Interaction Between Tourism and Energy

This research has now explored the background of both tourism and energy in Iceland respectively. Themes such as the history and economics of each sector were discussed—giving context to where the tourism and energy sectors have been—leading to what those past implications might mean for the future of Iceland. As mentioned earlier, Isavia (2024) predicts that there will be a new high in Icelandic tourism numbers in 2024. Alongside this growth in tourism is a predicted growth in energy through the Master Plan, a framework developed by the government to facilitate efficient economic growth for future years (*The Master Plan*, 2023).

The present research of literature has highlighted the establishment of tourism and energy in Iceland as leading economic sectors. It is important to understand the impli-

cations of the concurrent growth of these sectors. The remainder of this research will focus on how the tourism and energy sectors in Iceland conflict with yet also complement each other.

Conflict Between Tourism and Energy

In knowing how the two sectors conflict with each other it is important to first understand how they each implement their own definitions of the word 'sustainability'. This research will take a narrower approach to the word sustainability with a primary emphasis on environmental sustainability. Environmental sustainability is concerned with maintaining the present conditions of Earth's physical environment to conserve more for the future (Sutton, 2004).

The tourism sector promotes environmental sustainability through landscape conservation, which emphasizes the preservation of the raw beauty of the untouched, natural environment (Sæþórsdóttir & Hall, 2019). The Icelandic tourism sector relies on this type of sustainability, as most tourists visit the country to experience the vast exotic landscapes (Gil-Alana & Hujibens, 2018). While the tourism industry is concerned with sustaining above-ground resources, the energy sector is concerned with sustaining below-ground non-renewable resources (Sæþórsdóttir & Hall, 2019). This type of energy sustainability focuses on the preservation of fossil fuels and promotes the use of renewable resources through geothermal energy and hydropower.

It is through these two different paths of sustainability that conflict ensues (Sæþórsdóttir & Hall, 2019). As Iceland's energy sector grows, so does its need for land to support the infrastructure. As mentioned earlier, the industrial sector is closely linked with the energy sector. Development is often associated with one plant providing energy for the other (Helgason, 2014). When an energy plant is built, a manufacturing plant is subsequently developed to source that energy, and even more land is required to provide for this development.

The large, imposing infrastructure associated with energy plants takes up land obstructing the landscape's natural beauty that a tourist might visit to see (Sæþórsdóttir & Olafsson, 2010). Power plant obstruction is not just limited to visual appeal. Geothermal plants, for example, can create noise pollution that may deter tourists looking for a peaceful experience in a natural environment. The impact that these energy developments have on tourism extends even further outside of just the plant parameters where visual and noise obstruction takes place. Up to 50 km long pipelines can connect geothermal plants to other destinations which often cross tourism sites hindering the attractions' natural beauty.

Like geothermal development, hydropower plants also affect tourism in many ways (Sæþórsdóttir & Olafsson, 2010). Hydropower plants often consist of large dams that obstruct the flow of rivers and subsequently use the flowing water as a source of electricity (Office of Energy Efficiency and Renewable Energy, n.d.). These dams along with other man-made infrastructure associated with hydro development act as significant hindrances to the natural landscape that tourists come to visit (Sæþórsdóttir & Olafsson, 2010).

Because hydropower dams greatly reduce the flow of water, many other areas downstream are affected by the development. A popular waterfall, for example, could be reduced to a mere trickle effectively removing that spot from the list of options for tourists to sightsee. There are also consequences upstream from hydropower development as dammed-up water will rise and potentially flood over hiking trails in the area.

One other energy obstruction that hinders the natural environment in ways like geothermal and hydro developments is the presence of electrical transmission lines (Stefánsson et al., 2017). Transmission lines are tall metal structures that often extend wire across several miles of distance. These towers give an industrial look to otherwise untouched land and expand great distances becoming more visually intrusive than geothermal and hydropower plants.

Sæþórsdóttir and Hall (2019) investigated tourism operators' opinions of energy development and its impact on tourism. They found electrical transmission lines to be one of the more negatively viewed means of energy development. This study highlights the indirect impact energy expansion has on the tourism industry as some tourism operators were left unmotivated to continue working because of energy development on the environment.

This portion of the research has primarily focused on the conflict between tourism and energy from the viewpoint that energy obstructs tourism. There are, however, several plans in place whereby tourism hinders energy through land protection (Sæþórsdóttir & Olafsson, 2010). These policies effectively limit the number of places where the energy sector can develop. The presence of land protection policies combined with the obstruction of nature-based tourism by geothermal and hydropower are all ways in which the tourism and energy sectors conflict with each other.

Harmony Between Tourism and Energy

This research has now covered the conflict between tourism and energy in Iceland. Although the interaction between the two sectors is usually associated with disagreement, there are also ways in which they prove to be rather compatible in their growth (Sæþórsdóttir & Hall, 2019). The next part of this research will explore how tourism and energy exist in harmony with one another.

One direct way that the energy sector supports tourism is through the actual consumption of energy by tourists (Frantal & Urbankova, 2014). Tourism is often an industry associated with having a high carbon footprint and relies on amenities such as hotels and transportation which are both vast consumers of energy. Therefore, by using clean energy sourced from Iceland's resources, the tourism sector can operate sustainably and effectively profit from Iceland's energy sector.

In addition to supplying energy, power plants also provide a location for tourists to visit (Frantal & Urbankova, 2014). Although the general consensus is that energy infrastructure eliminates places for tourists to sightsee, it can provide a new destination for people to visit. Tourists frequently travel to experience attractions that they have

never seen before. This can of course be an exotic untouched landscape but could also be the unseen advanced infrastructure of a power plant. For example, tourists in Iceland can visit the Geothermal Energy Exhibition at the Hellisheiði power plant which provides educational insight into how geothermal power works in the country (Orka Náttúrunnar, 2023). Plant tours and exhibits like the one at Hellisheiði can be a popular means of what is called industrial tourism which acts as a sort of middle ground between energy and nature-based tourism in Iceland (Frantal & Urbankova, 2014).

There are other indirect ways in which the energy sector benefits tourism alongside the more direct methods discussed earlier (Sæþórsdóttir & Hall, 2019). When power plants are built, new roads are developed to access the facilities, and existing ones are often upgraded which, in turn, provides easy access to other parts of the country that tourists may want to visit. This improvement to the infrastructure can provide tourists access to places that might have otherwise been too difficult to access previously. This indirect benefit from energy development, therefore, opens new pathways for the tourism industry in Iceland.

When discussing the ways in which tourism and energy can effectively coexist, it is important to mention the Master Plan for Geothermal and Hydropower Development (Sæþórsdóttir, 2012). In response to a proliferating renewable energy sector, the Icelandic government created the Master Plan in 1998 to aid future decision-making processes. The Master Plan analyzed how the energy sector can sustainably grow with the interests of other industries, such as tourism, in mind. The plan analyzed 84 new power plant proposals to ascertain both the energy potential and possible impact on the environment. One group of experts in the planning process was delegated with assessing the proposed plants' effects on the tourism industry (Sæþórsdóttir, 2012). This group divided the country into different areas based on various tourism attributes and then assessed which regions had greater popularity amongst tourists along with the impact power plant development would have on these areas. Each region was assigned a score based on its perceived worth for the tourism industry and ultimately provided policymakers with an idea of the impact proposed power plants might have on the tourism industry in certain areas.

The Master Plan is a great example of how strategic planning can offset the conflict that arises from differing views of land utilization between the tourism and energy sectors in Iceland. It is from efforts made during the Master Plan that policymakers can make the most informed decisions on where to build power plants and the tourism and energy sectors can maintain sustainable growth regarding one another.

This portion of the research discussed the ways in which tourism and energy in Iceland can coexist in a manner that isn't comprised entirely of competition. The research shows that Iceland's energy sector is instrumental in providing the tourism industry with clean energy to support the amenities it relies on (Frantal & Urbankova, 2014). Not only does the energy sector provide clean energy but it also

provides destinations for people to tour as a part of industrial tourism. This portion of the research also covered the positive impact that newly built roads have on the tourism industry resulting from power plant development (Sæþórsdóttir & Hall, 2019). Lastly, the Master Plan was discussed offering solutions to the heightened debate over land utilization between tourism and energy (Sæþórsdóttir, 2012). Each of the interactions above along with the implementation of the Master Plan show the numerous ways in which tourism and energy can be rather compatible.

Conclusion

Any attempt to analyze the interaction between tourism and energy in Iceland can be complicated and requires consideration of multiple factors (Sæþórsdóttir, 2012). There is no clear answer as to what the best method of land utilization is considering the needs of each party involved. The purpose of this research was to highlight where conflict and compatibility exist between the tourism and energy sectors in Iceland. The paper began by detailing important background knowledge of both sectors along with the economic implications of each. This established background transitioned to the topic of the research which analyzed the interaction between the two sectors answering the question as to how they exist in conflict and compatibility with each other.

When analyzing the conflict between tourism and energy, one particular subject that held more prevalence in the impact of energy on nature-based tourism was the use of hydropower (Sæþórsdóttir & Hall, 2018). When compared to other energy obstructions in the natural environment, research on hydropower development showed a more widespread impact on nature that tourists visit to experience. The visual intrusion on the landscape from the dams themselves along with fluctuating water levels were some of the impacts included with hydropower. These developments often require electrical transmission lines to carry hydroelectricity across the country which further widened the area impacted. Overall, hydroelectric power developments held more weight when compared to geothermal developments in that the impact on nature-based tourism was spread out across a larger area.

Similarly, when looking at the compatibility between the two sectors, industrial tourism is one means of compromise that holds more weight over others discussed in this research (Frantal & Urbankova, 2014). Industrial tourism bridges the gap between the two industries and provides options for tourists allowing power plants to be more than just obstructions on a tourist's visit. This type of tourism is beneficial to both sectors in that energy profits off the people tourism provides and the tourism sector is given more options for its visitors to explore. The research holds industrial tourism with more value in compatibility as it provides benefits to both sectors in Iceland.

As this research has discussed, there is a niche group of tourists who enjoy visiting the plants themselves and therefore don't look at them as an intrusion on their experience (Frantal & Urbankova, 2014). In one study, tourists were divided into categories on a "Purist Scale" with one

side of the scale valuing untouched nature and remoteness in their excursions and the other side being unbothered by energy development almost favoring a more modernized experience not concerned with the number of tourists around them (Sæþórsdóttir & Hall, 2018). This diversity in visitors' preferences eliminates the ability to lump tourists into the same category of opinions when considering energy's effect on the environment. Because tourists visiting Iceland have different values on what they consider to be a hindrance to their experience, it can be hard to accurately determine the impact that energy developments have on the industry.

Although the differing views among tourists reduce the certainty of how much energy development impacts tourism, many surveys have been conducted that establish a consensus in the idea that tourists prefer untouched environments in Iceland (Sæþórsdóttir & Olafsson, 2010). Perhaps increasing the survey size for future observations could increase a level of confidence in whether there are more or fewer tourists bothered by energy development in

natural areas. If policymakers are more confident in what tourists' views are, they can make more informed decisions when considering the impact of energy development on tourism in certain areas.

This research has now discussed some of the more prominent ways that tourism and energy affect each other. Impeding hydro development highlights the differing interests between the two sectors and industrial tourism provides a way in which they can compatibly coexist (Frantal & Urbankova, 2014; Sæþórsdóttir & Hall, 2018). Although it is difficult to trace a direct link between energy development and a negative impact on tourism, many studies have shown general disapproval from certain tourists on such energy development (Sæþórsdóttir & Olafsson, 2010). Overall, understanding the interaction between tourism and energy is important because it allows policymakers to make educated decisions for future developments.

Submitted: February 29, 2024 EST, Accepted: July 17, 2024 EST

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