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SUSTAINABLE ENERGY AS THE POTENTIAL CORNERSTONE OF INTERNATIONAL ENERGY SECURITY: A COMPARATIVE STUDY BETWEEN ICELAND AND THE UNITED KINGDOM

Bachelor's thesis

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I hereby declare that I have compiled the paper independently and all works, important standpoints and data by other authors have been properly referenced and the same paper has not been previously presented for grading. The document length is 15 481 words from the introduction to the end of the conclusion.

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ABSTRACT

Energy security as a concept has started to play an increasingly dominant role in the global energy discussions in the past decade and is currently strongly linked to sustainability. This research is focusing on the historical relevance and definitions of energy security in two countries, Iceland and the United Kingdom, studying their energy histories and then further linking the concept to the increase in sustainable energy sources' implementation. The study is conducted via data and discourse analysis and supported by applying constructivist theory in order to discover whether switching to more sustainable energy sources can lead to an increase in sovereign states' energy security, why countries would need to switch to using sustainable energy sources with a view of potentially increasing their energy security instead of meeting international quotas and additionally how it can then affect overall international energy security.

Keywords: Energy security, Sustainability, Iceland, United Kingdom

LIST OF ABBREVIATIONS

EU	European Union
GDP	Gross domestic product
GEI	Global Energy Institute
GHG	Greenhouse gases
IEA	International Energy Agency
IRENA	The International Renewable Energy Agency
OECD	The Organisation for Economic Co-operation and Development
OPEC	Organisation of the Petroleum Exporting Countries
UK	The United Kingdom
UN	United Nations
WEC	World Energy Council

INTRODUCTION

The reasons for choosing this research topic are because energy security as a concept is intriguing in the way it has become relevant over a relatively short time and how its definition has changed and is still evolving. The origins of energy security tie the concept with sovereign states' security but the current globalised world has moved on from this idea and focuses more on the supply and demand of energy, resource availability, affordability, global cooperation and sustainability. Energy security has become an increasingly important subject during the last decades in the global arena mainly concentrating on cooperation and strengthening supply chains via energy diplomacy and international agreements. There is still an ongoing discussion on how to measure and define energy security as different countries have their own issues to focus on, which can also change over time or even regionally. This research is thus investigating how the definitions of energy security play a role in states' energy policies. Some states may focus on getting a steady not easily affected supply of energy with a good price for their citizens whilst other states focus on the distribution of their produced energy and enhancing their GDP. However, energy security is relevant to all countries regardless of their focus.

Presently one of the key reasons for states to move towards more sustainable energy sources is to cut greenhouse gas (GHG) emissions and potentially slow down and manage global warming that threatens to affect every ecosystem and therefore each state and its individuals. Steering towards sustainable energy has been fuelled by the realisation that traditional energy sources like oil, coal, gas and even wood are limited, thus global and regional quotas have been established to control the usage of those resources and manage waste and GHG emissions. However, this research focuses on using more sustainable energy to achieve greater energy security instead of switching to sustainable sources merely to cut emissions to meet quotas.

In order to simplify the research and eliminate vast socio-economic factors between the developed and undeveloped regions, this research is focusing on energy security from two first world states from the same region that are both currently considered to have sufficient funds to support themselves in technological advancements and in diversifying energy sources. For the purpose of this research two countries, Iceland and the United Kingdom (UK), were selected to be analysed and compared in order to support the research objective. The reasons behind why those two countries were particularly preferred lay mainly in the vast differences in the energy sector's

history between them and their definitions of energy security. Distinctions amid human settlement periods, naturally available resources, population size, history of diplomatic relations, cultural differences and recent energy sources preferred by the government and its people, also played a role in choosing these two states. The immense difference was chosen knowingly in order to highlight the contrasting political goals and the overall approach towards the subject of energy security and usage of sustainable energy. However, as they are both island nations, their geolocation has historically forced them both to outsource energy options from overseas and has thus played a key role in the formation of their energy policies.

Relying on the examples from these two countries the main aim of this research is to discover whether using more sustainable energy sources contributes to these states' energy security and thus consequently positively affects international energy security. The research objective is to study both selected countries' energy history and their sustainable energy policies' formation by analysing the possible change in their energy securities and how it might affect measuring international energy security. Two research questions have been formulated to give a focus for the study.

1. How can using more sustainable energy sources in a state's energy mix lead to an increase in its energy security?
2. Why would countries need to use more sustainable energy sources with their focus on energy security rather than only focusing on meeting international quotas?

This research is conveyed by the application of theoretical concepts such as social constructivist theory and energy diplomacy in order to support its findings in this comparative study with a view to answering what are the potential benefits of sustainable energy being used as a stabilising force in the world. Energy resources and the history of both Iceland and the UK are thoroughly researched and presented in order to form a conclusion on whether the usage of more sustainable energy sources has led to more international energy security and is, therefore, a cornerstone to be built upon. The shortcomings of this research could lay in the usage of constructivism theory that can alter the findings of this study by not providing a clear answer to the research questions as it considers everything as evolving and never the absolute truth. However, the ideas of constructivism support the concepts of energy security and sustainable energy sources as they are also still developing. The theoretical approaches relevant to the topic are briefly described and then applied during the analysis answering thesis questions to form a coherent conclusion.

This research was conducted via the medium of data analysis and supported by discourse analysis that investigated the concepts of energy security in Iceland, the UK and the international arena and studied the use of sustainable versus renewable energy sources in said countries. The discourse analysis method in international relations has become more relevant as international cooperation in the ever-globalised world increases. Assistant professor and researcher Luísa Godinho stated that "a discourse analysis of international practice combining textual analysis and contextual analysis allows making political and sociological inferences that can be of great use for the topic" (2016, 3). This is beneficial to this research as the topic for this study involves various materials from government documents, articles and secondary resources on the subject. First, the methodology of this study was selected along with theoretical concepts that would support the argument. Secondly, energy history and ideas behind energy security were investigated in the example states and thirdly a conclusion was reached through data and discourse analysis based on the supporting materials.

The first part of this research after the introduction discusses how social constructivist theory can be applied to this research followed by brief notes on the energy diplomacy concept that is used in this study. Then there is a chapter on energy security followed by a chapter on sustainable energy. After this, there is a section on Iceland containing its energy history, sustainable energy sources and energy security. This is followed by a section on the UK consisting of energy history, sustainable energy sources and energy security. In the final chapter, there is a conclusion marking the research findings and answering the previously presented two thesis questions. Lastly, there is a list of references followed by relevant appendices.

1. THEORETICAL APPROACHES

1.1. Constructivist theory

This research is using the viewpoint of constructivist theory in international relations as it seems to be the most appropriate for the topic. The constructivism approach fits this research better than, for example, neorealism because energy security as a concept is based on ideas and societal norms rather than hard material evidence. Because of the nature of this study, incorporating various theoretical concepts, it was important to choose a theory that would explain a change of action based on the revolutions of ideas in the global community or the individual states. Whilst neoliberalism would have also been an applicable option for this study it was disregarded due to its materialist foundations and hierarchy of affecting factors regarding states' internal politics. Constructivism allows the ideas concerning energy security in local politics and the global arena to affect the decisions and actions of states without focusing only on the material elements. The discourse analysis method was chosen for this research and encouraged by constructivism to explore the changes through ideas. Constructivists say that "if the thoughts and ideas that enter into the existence of international relations change, then the system itself will change as well, because the system consists in thoughts and ideas" (Møller *et al.* 2006, 166). Constructivism can be applied to this study because of the continued formation of ideas regarding energy security and discourses on the usage of sustainable energy in the two chosen countries. Constructivism will support the research by providing the space for changes in societal norms that have resulted in alterations in energy policies and thus approaches to energy security.

Constructivism as a more theoretical approach backs the idea that the proper effect on politics, global policy-making and sovereign states' future regarding energy security can only be predicted and is yet to be determined as there simply has not been enough time to collect and evaluate presently available data and that said data is evolving. Furthermore, seeing trends in data analysis related to energy security and sustainability also have their limits due to the ever-changing and unpredictable advancements in technologies, natural conditions and world issues in focus. Everything seems to be interrelated in the globalised world and even small states seem to be able to affect popular opinions in the international arena, like Iceland's geothermal research, which has sparked interest in other countries and made it a relevant topic in the global discussions. The decision-making process of each state regarding energy security cannot be fully predicted as the focal points can change depending on available resources, the speed of advancement in

technologies, policy formations, local people's preferences, weather conditions, worldwide events etc. The concept of energy security that had a different definition related to oil in the 1970s then lost its importance for a while and is now back in the global arena mostly linked with sustainable energy sources which have come from the international climate crisis related research and thus the change of ideas related to energy usage. The only possible way to try to explain this phenomenon is through a constructivist approach.

Constructivist theory suggests that the world is rather a "project under construction" (Adler 2013, 113) other than what is currently evident, which aids this study by approaching energy security in a similar way. Via the data analysis supported by discourse analysis, the changes in ideas and social norms regarding sustainable energy and energy security in Iceland and the UK become evident, which is backed by the constructivist theory supporting changes through the formation of new ideas meaning state-level actions are not only based on material factors like lack of oil or internationally established quotas. In theory, global usage of more sustainable energy sources could be one of the key elements of advanced international cooperation and thus greater energy security. Social constructivist theory can support this argument by encouraging looking at the situation from different progressive standpoints. One state's decision to move towards more sustainable energy usage, in this case, Iceland, can affect other states in a chain reaction because it alters the supply and demand of more traditional energy sources in the area and therefore has a noticeable impact. Constructivists also support the notion that energy security can have varied definitions by different countries depending on what are the most important factors for them at present, or that it cannot be defined at all because of the still-evolving nature of the idea.

1.2. Energy diplomacy

Energy diplomacy is defined as "the use of foreign policy to secure access to energy supplies abroad and to promote (mostly bilateral…) cooperation in the energy sector" (Goldthau 2010, 28). This theoretical concept is relevant to this study due to both chosen states historically and presently using it as part of their foreign policy. It is important to study both chosen countries to learn how their energy diplomacy has changed over time regarding energy security and sustainable energy. Energy diplomacy is a concept that involves the government's policies concerning ensuring the country's energy security and business opportunities connected to the energy sector. (Yu, Dai 2012, 91-120)

Given the presently predicted future of world politics becoming more about cooperation and securing peaceful supportive relations between nations, diplomacy around energy from a non-power-related point of view is becoming increasingly prominent. Energy security is such a vast concept thus "a variety of energy politics and energy security concepts are formed under the multidimensional theory of international relations today, which can be broadly divided into different genres of theories on energy politics and security using analytic tools such as geopolitics, interdependence theory, neo-security theory and energy diplomacy" (*Ibid.*, 93). Thus, making energy diplomacy an integral part of this research almost by default. In the modern world, energy diplomacy has become an important structural part of international and non-governmental organisations backed by the constructivist theory used in this study stating that even the smaller actors can play a significant role in the overall discussion.

Assumed speed of evolvement in the world's energy sector's challenges and opportunities, the "management of international relations via diplomacy will become an increasingly important instrument of foreign policy as countries strive for strategic positioning in the future energy landscape" (Griffiths 2019). The way the world's energy market moves from supply and demand of non-renewable energy towards zero-carbon emissions and thus greater electrification of the energy sector results in the construction of a global energy grid. The amplified interconnectedness between sovereign states requires advanced diplomatic efforts in the sector and thus is relevant to this research of investigating increasing energy security in the international arena. Even though it is continuously important for the states to engage in the global energy discussion via the medium of large international platforms it has proven to be more effective to practice bilateral diplomatic relations for achieving quicker improvements thus reaching their goals in their energy sectors making energy diplomacy increasingly relevant.

2. ENERGY SECURITY

"Energy security is defined as reliable supply at affordable prices in the case of consuming nations and a reliable demand at sustainable prices in the case of producing nations" (Goldthau 2010, 26). Regarding this study, historically Iceland was a consuming and the UK both a producing and consuming nation and this categorisation has not changed, however, the ideas behind energy security in both nations have changed, especially during the last half a century. From a constructivist point of view, energy security became increasingly relevant since the international community made it an important part of the discussion based on the changes in societal norms. Concentrating on the discourse on energy security it became clear that as the supply and demand of energy in the world and related diplomatic relations changed over the years, the meaning behind energy security also changed its form. This starts from meaning mostly accessibility to oil in the 1970s and ends as a focus on strengthening supply and demand chains globally whilst ensuring sustainability in the 2020s.

The international community started to pay closer attention to global energy usage and the need for energy cooperation after the First World War when it became clear that many countries' interests were to invade other parts of the world to gain access to natural resources and thus grow their military and economic capabilities. (Energy Charter Secretariat 2015) The First World Power Conference was held in 1924 in London. This conference was the cornerstone of forming The World Energy Council (WEC), which was finally, after several evolvements and being called different names, established in 1989. Before that, energy security was not a topic that was taken seriously, but with advancements in technology and growing energy demands, it became important for central governments. The WEC (2022) has been a charitable trust since 2001 and has "Member Committees in nearly 100 countries, including the largest energy-producing and energy consuming nations. Corporations, organisations and individuals can join the WEC's network through the National Committee in their country of interest…representing the broadest possible range of energy and energy-related interests in their countries" (*Ibid.*). The WEC had to change its course over the years due to international events, economic factors and changing global concerns however, its focus was and still is on three main aspects: environmental impact mitigation, social equity and energy security. (Wright *et al.* 2013) Iceland is currently a member of the WEC, which shows the importance of participation in international forums for the country.

Considering the growing population of the world, fast industrial growth and technological advancements during the last century created the need to better manage finding and researching new reliable and stable energy sources better, creating energy and buying/supplying energy with a focus not only specific to the country of origin but also on the globalised world. The International Energy Agency (IEA) has stated that they see "energy security as the uninterrupted availability of energy sources at an affordable price" (2019). Given their broad statement, it can be presumed that for the IEA the differentiation between consuming and producing nations or types of energy sources used is not relevant, which leads to the conclusion that energy security for a sovereign state means exactly what that said state believes it to be, which is supported by the constructivist theory. On the other hand, The Energy Charter Secretariat has stated that "there is no clear cut energy security policy distinction between producing/exporting and consuming/importing countries, simply because almost all countries both produce and consume energy to a varied extent" (2015, 9) thus, it is actually difficult to define energy security in one way only because it may have a different meaning depending on the country or time of defining. This again highlights that the nature of energy security is based on the current focal points of ideas around energy and the difficulty in defining it can only be explained by applying constructivist theory.

The IEA (2022) was created in 1974 by the Organisation for Economic Co-operation and Development (OECD) initiative originally focusing on uninterrupted oil supply but has since evolved to cater for the changed global discussions. "Before the first oil crisis, the issue of energy security was not prominent" (Zhao 2019, 99-120). Issues with oil supply affected not only heavily oil-reliant countries but sent the whole global community into economic recession. In the early 1980s, it was believed that "The problem is not that the world will run out of oil in this century…The problem is that cheap, low-cost oil is heavily concentrated in areas with a high degree of political instability, both domestic and international. In short, the energy security problem of the 1980s is a geopolitical one that centres on the Persian Gulf" (Nye 1982, 133). It was clearly widely believed that even though oil is a finite resource, its abundance in the world covers the future energy demands in the world, thus the discourse on energy security at the end of the last century was mostly about oil supply. However, as countries like Iceland and the UK, heavily affected by the oil crises, started to look towards other alternatives the ideas behind energy security changed. The diversification of the energy sector was of vital importance both in Iceland and the UK, and it became clear that dependency on fossil fuel imports must significantly decrease in terms of energy security, which meant bringing sustainable energy sources to the focus.

Since the United Nations (UN) (2022) activation of the Kyoto Protocol in 1997, which focused on reducing GHG emissions, the WEC has directed its focus even more on renewable energy sources. (Wright *et al.* 2013) It can then be deduced that energy security has also become more closely connected to sustainability, which is the focus of this research. Lowering GHG emissions and combating climate change has since been the main motivation behind countries switching to more sustainable energy sources. However, the impact on energy security merely by switching to more sustainable energy sources is yet to be determined. Thus, the increasing relevance of climate change in energy use since the 1980s led to the establishment of international quotas regarding GHG emissions. Interestingly, in the late 1980s and early 1990s, the term sustainable energy was widely used but only started to include renewable energy in the late 1990s as also seen from the wording of the Kyoto Protocol. This meant that even though the diversification of states' energy mixes via sustainable sources was the foundation, in this study, especially in the UK, renewable energy sources started playing an important role in countries' long-term energy policies possibly due to the predicted increase in energy demand.

The meaning of energy security has advanced from having a smooth oil supply chain to more independent and sustainable energy sources with an aim that states are not as interdependent or solely dependent on one supply chain. However, with globalisation and the climate crisis moving away from oil and other natural resources the cooperation between states has had to greatly improve creating new issues with energy security. The IEA currently has 31 member countries, 8 association countries and 4 accession countries and they claim to be the leading "international forum for energy co-operation on a variety of issues such as security of supply, long-term policy, information transparency, energy efficiency, sustainability, research and development, technology collaboration, and international energy relations" (2022). The UK has been a member state since its establishment. The formation of organisations based on energy cooperation since the 1980s shows a clear need for a global platform for discussions in managing energy supply and demand and, it can be argued, managing energy security in the world.

Measuring energy security has been a topic of discussion for many decades and various concepts and indexes have been developed. Research published in 2021 focused on the methodologies of measuring energy security and concluded that the term 'energy security' needs a more comprehensive definition in order to become measurable. The authors defined energy security as "the state's ability to ensure efficient use of its fuel and energy, to optimize diversification of sources and resources to ensure the livelihood of the population and volatility of prices for fuel

and energy resources or to create conditions for rapid adaptation of the national economy to new prices for these resources" (Stavytskyy *et al.* 2021). According to the authors, the definition and variables chosen for the calculation can give different results and thus cater to different needs. They concluded that USA's Global Energy Institute's (GEI) Energy Security Risk Index offered the most comprehensive results. However, they noted that currently there are no energy security indicators that consider all the affecting variables, thus measuring energy security at the international level is still quite difficult because of the relevant indicators used in each country for the calculations. (*Ibid.*) However, there is no available data for Iceland from GEI's resources given that Iceland is not one of the top energy consuming nations, so this cannot be used in this study for comparison. One other commonly used index for indirectly measuring energy security is the WEC's "Energy Trilemma Index tool [which] ranks countries on their ability to provide sustainable energy through 3 dimensions: Energy security, Energy equity…[and] Environmental sustainability" (2022). This study will refer to data from the WEC as it offers information on both Iceland and the UK. Difficulties in developing a global 'one-fit-for-all' type of energy security index can be explained by the constructivist by stating that the change in variables results in modifying the method and thus offers a different incomparable outcome which in its nature makes comparing the level of energy security between sovereign states impossible. Therefore, energy security levels could possibly be best measured against the states' own historical data and a conclusion made on whether it has improved or weakened. And only after that the overall analysis of different parts of the world e.g., Europe, could be conducted based on the state-specific energy security changes.

2.1. International relations and energy security

Historically, energy security was mostly associated with state security meaning more oil and coal could provide better technological advancements and a stronger military force. However, as the concept of energy security has evolved over time moving towards more focused demand/supply transactions between states with the main concern of providing enough for the country's population and industrial usage, the politics of energy security have started to play a key element in international relations. (Energy Charter Secretariat 2015) From a constructivist point of view, the true power of energy security is what the international arena gives it. With the emergence of various international energy organisations and other smaller region-specific governmental and non-governmental organisations, the world has given energy security a greater power in internal

affairs and foreign affairs with a rise in energy diplomacy. Nevertheless, worldwide energy platforms for discussion are valuable to maintain technological developments in the sector and aid with necessary changes in both international and local legislation.

Energy diplomacy has become more prominent in international relations with increased discussions around energy cooperation between states. Bilateral relations are still important but as there are more factors and contributors in the implementation of sustainable energy such as knowledge sharing, material supply, geolocation, and varied needs, multilateral global relations have taken prominence. (Griffiths 2019) Icelandic international relations regarding energy were originally focused on establishing a reliable energy supply for the country however, their goals have changed and are now focusing on sharing the knowledge of their insights in geothermal energy and educating the world in their area of expertise whilst attracting foreign investment. The UK's focus on energy in international relations has been different since the UK has a very diverse energy market compared to Iceland. The UK has historically also focused on stable supply chains through friendly relations however, at present the government's goal next to ensuring necessary energy supply is to also promote their own energy companies to the international market and thus sell their produce.

Energy security in the future may mean something completely different to what it currently is thus the significance of international relations within the sector is predicted to increase. With states concentrating more on their energy security via diversifying and securing their energy supply or focusing on the development and research of sustainable energy sources, the focus remains on energy diplomacy and international cooperation with sharing knowledge, technology, and discussing the distribution of global finances in energy sector's enhancements. (Zhao 2019, 99-120) This means that in the future energy diplomacy will be used more for promoting countries' energy interests and attracting international investment. Furthermore, the management of the globalised energy grid via international organisations will most likely fall in the field of energy diplomacy as part of the countries' foreign policies.

3. SUSTAINABLE ENERGY

Sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (UN 2022). This was defined by the UN in 1987 and has not changed since. During the research, it became clear that sustainable energy and renewable energy are two terms often used interchangeably however, even with a significant overlap there is a difference in the meanings. Investigating this discourse highlighted which country or area was more prone to a sustainable or renewable energy future. In the case of this study, Iceland is currently focusing more on renewable energy whilst the UK does not distinguish between the terms clearly. Renewable energy is defined as energy that is produced from currently existing natural resources like hydropower, wind, solar, biomass and geothermal heat that "naturally sustain or replenish themselves over time" (John Hopkins University 2021). Sustainable energy is defined as energy originating from resources that currently meet energy needs without compromising future generations. The distinction between those two terms is often confused and generates debates about whether some previously thought sustainable energy sources can be continued to be categorised as such. Most common renewable energy sources like hydropower, solar, nuclear, biomass and geothermal heat are currently also considered sustainable, however, biomass usage produces high levels of GHG that affect climate change and nuclear waste disposal has its difficulties thus these energy sources are still possibly jeopardising future generations and could not be categorised as sustainable. Switching to sustainable energy sources can be a trying task due to economic disparities, legislation issues, geographical locations and naturally available resources. (*Ibid.*)

With the rise of sustainable energy sources' implementation came the necessity to establish global platforms for discussions. The International Renewable Energy Agency (IRENA) (2022) has its roots in the 1981 UN Conference but was officially founded in 2009. It is an intergovernmental organisation that supports states in their transition into a more renewable energy future with financial knowledge of renewable energy sources, practical tools and offering a platform for a global renewable energy forum. (IRENA 2022) Sovereign states being dependent on sustainable energy can mean greater energy security if it is thought through and energy supply has been made more local with a view of using the areas' geographical advantages. According to IRENA (2022), Europe has a great richness of renewable energy sources and has become one of the key contributors to developing technology for sustainable energy sources.

The main importance from an energy security standpoint is that there are 167 member states and 17 accession states in IRENA (2022) signifying the importance and focus of renewable energy in the global community. Compared to the IEA's 31 members, it highlights the significance and direction the world is heading: energy security through sustainable sources. Both Iceland and the UK are contributing members of IRENA. This research would argue that it is not only due to concerns about climate change and growing demands for energy but also point toward the further need for independent energy sources that provide increased energy security for states. Locally sourced and state-controlled renewable energy could create better conditions for managing fluctuations in energy demand and supply, improved international relations and a greater focus on other issues in the areas. The main importance is of course the sharing of sustainable energy technologies, knowledge, and experiences and supporting each state on its way towards a sustainable energy future. This was and is the basis of IRENA which tries to offer that support and thus lead the way towards a more energy secure future.

The Energy Charter Secretariat (2015) points out that one of the various policy tools for achieving energy security is diversifying energy sources. Originally, after the oil crises in the 1970s, it mostly meant countries moving away from oil and dependency on oil suppliers and therefore using alternative sources e.g., coal or natural gas. However, it became obvious that considering climate change and pollution concerns the focus should not just be on diversification of energy sources but on using renewable energy. (*Ibid.*) Moving away from traditional energy sources and focusing on long-term sustainability has, of course, created its own set of problems as the countries or regions do not all have the same availability of resources both natural and technological and thus advancements in international cooperation in the sector are required. Iceland and the UK make an interesting study in their motivations behind using more sustainable energy sources which are discussed later in the appropriate chapters.

4. ICELAND

4.1. Iceland's energy history

Iceland is a small Nordic country in the North Atlantic Ocean physically separated from other states due to its geographical location. It is a relatively newly established and sparsely populated island with only a near hundred years of energy history. The estimated population in 2021 was 371000 people, however, Iceland is one of the highest consumers of energy per capita in the world due to industrial needs. (Matthíasson 2022) It is also well-known for its geothermal energy resources due to its unique location and thus the increased usage of sustainable energy from an energy security point of view is relevant. For the purpose of this research, focusing on how using more sustainable energy can provide greater energy security, a history of the Icelandic energy sector is required.

Iceland's economy only started to properly independently flourish after the Second World War. The successful implementation of renewable energy technologies and diversifying energy sources has come a long way since the 1960s when Iceland was considered one of the poorest states in the western world and sustainable energy was not yet in the government's focus. A report written by the National Energy Authority and the Icelandic Government on Iceland's energy sector was published in 2006. According to the report "the most widely used fuels in Iceland until the mid-20th century were peat and dried sheep-dung" (Orkustofnun 2006, 10). The reasons behind the rapid development of Iceland's energy sector in the last 60 years are tied to both the internal mindset change and external global factors as also highlighted by the constructivists. Iceland has a scarcity of wood and has no known oil, natural gas or coal and the natural peat reserves have not been utilised again since the 1960s. Fossil fuels have always been heavily imported and oil still plays a small part of their energy mix to power cars and aid the backup hydropower plants that were built in the 1940s. Thus, energy availability and therefore energy security have played an important role in the country's energy policy development and economy enhancement decisions.

The main energy for industrial and technological usage in Iceland is electricity produced by hydropower, whilst geothermal energy is mostly used for heating, and oil is still used on a smaller scale for industrial and transportation needs. (*Ibid.*) "The first hydropower turbine began operation in 1904" (*Ibid.*) but was only used on a minor scale locally. The first hydropower plants to be effectively used by growing industries were built in the 1960s which started an energy revolution.

Its fast-growing population and industries initiated the building of hydroelectric power plants and further research into harnessing the country's geothermal energy resources. (Matthíasson 2022) In terms of energy security, Iceland had to manage energy resources more effectively than ever due to an enormous increase in the energy demand by the industrial sector, whilst still focusing on strengthening power-grid systems to support its people and ensure raising the living standards, which then aided the rapid development of sustainable energy sources.

The proportion between these energy sources being used over time has changed with the emergence of sustainable energy sources. From the data available (*see Appendix 1*) it is clearly seen that in 2005 geothermal energy made up most of Iceland's energy usage for space heating and according to the government plans it is expected to grow. (Orkustofnun 2006, 13) Technological advancements have made it possible to harness geothermal energy more efficiently to generate electricity and according to the National Energy Authority (2022), it made up 29% of Iceland's total electricity production in 2013. According to a report by IRENA (2022), Iceland's electricity produced by renewable energy sources reached a 100% capacity in 2020. The total primary energy supply in 2018 was 92% from sustainable sources with geothermal energy making up 85% and hydropower 15% (*see Appendix 2*). Looking at the speedy increase in sustainable energy usage it can be deduced that Iceland's current focus is directed at becoming as self-sufficient as possible to control its energy production and consumption, without having to engage in energy diplomacy to ensure energy supply and thus energy security for the state.

Originally geothermal energy was mostly used by local entrepreneurs to power greenhouses and historically hot springs were sometimes used for bathing and washing purposes. However, due to the growing energy demands the country needed to rethink its energy supply methods and currently, geothermal energy is mostly harnessed for space heating and still used in greenhouses, swimming pools and even parking lots. (Orkustofnun 2006) Already back in 2008, Einar Karl Haraldsson, then the chief political adviser to the Icelandic foreign ministry said that "When the oil crisis receded in the 1980s all the interest other countries had shown in renewables disappeared and they fell back on their oil-reliant ways…but we continued to make progress in renewable energy development and now Icelanders are going to reap the benefits" (Aldred 2008). From this statement, it can be concluded that Icelanders are extremely proud of their progress with smart and concise decision-making in the past, making sustainable energy expertise part of their national identity. Further research into sustainable energy sources was sparked by an external force, the oil crisis, but then resulted in a shift in the Icelandic mindset wanting to become self-reliant and thrive

with local energy production therefore, the constructivist theory can be applied. Constructivism explains the shift in the energy sector in the 1980s by stating that with all the factors starting to play a role together and interchangeably modelling each other including global crises, international agreements, other countries' decisions, local mindsets, naturally available resources, Iceland reached a point in which focusing on change seemed the only way forward. The technological advancements in the geothermal energy sector have made Iceland the leading expert in the area. Sharing their knowledge with the rest of the world via various international programmes such as the UN geothermal energy programme or training future experts in geothermal energy in Iceland School of Energy in Reykjavík University has led to an influx of geothermal energy usage in the world and thus making the switch to renewable energy sources in some countries easier. (Logadóttir 2015)

Presently, according to the Government of Iceland, "85% of the total primary energy supply in Iceland is derived from a domestically produced renewable energy source" (Ministry of the Environment, Energy and Climate 2022). That makes Iceland currently the biggest sustainable energy producer per capita in the world. The nation is now stated to be one of the countries with the highest living standards and the switch to sustainable energy has played a key role in it. (Sigurðsson 2006) From the point of energy diplomacy, Iceland has not solely focused on establishing bilateral relations to ensure energy security and thus it has lost its significance in ensuring oil supply however, energy diplomacy is still needed to promote the country's renewable energy sector's effort and thus Iceland has ambassadors across the world to keep the discussions about geothermal energy advancement relevant. For Iceland, expertise in the area has become a sellable commodity and therefore using diplomatic efforts to encourage other states to take an interest in Iceland by investing or paying for knowledge has become an essential part of Iceland's international presence.

4.2. Iceland's sustainable energy sources

The two main sustainable energy sources utilised in Iceland are geothermal energy and hydropower, which are both also categorised as renewable. The country is geographically fortunate with an abundance of volcanoes, hot springs and heated rock areas to have access to such great geothermal power and advancements in geothermal technology research are supported and funded by the local government, various private companies and international programmes. Harnessing

geothermal energy is still a relatively new concept as it has only been properly researched and applied during the past 50 years, however, the recent decade has been abundant with greater advancements in the field and thus geothermal energy offers a huge potential for the future being an affordable and reliable source of sustainable energy not only in Iceland but in other parts of the world also. (Orkustofnun 2006) In 2013 Iceland's then president Ólafur Ragnar Grímsson gave a speech at the OECD Ambassadors meeting promoting further clean energy usage and stating that "based on our experience, that the development of a clean energy economy is a good insurance policy against long-term difficulties which inevitably will continue to follow the financial crises of the future; against making the downturns of economic cycles too painful" (2013). In his speech, he noted that Iceland's recovery from the 2008 worldwide economic recession was supported by the previously made decisions for incorporating more sustainable energy sources. Thus, it can be concluded that Iceland's increase in energy security has supported its economy and is of vital importance for the Icelandic nation. From this statement, it can also be seen that Icelanders are continually proud of their sustainable energy implementation success story and see it as the foundation of increasing their energy security.

Hydropower plays a significant role in the country's energy history and is supported by Iceland's abundant precipitation, powerful glaciers and rivers and has been used for much longer than geothermal energy. Hydropower technologies were more available and widely known in the mid-20th century when Iceland's industry started to rapidly develop thus the country focused on making hydropower the main electricity producer for the country. Iceland's biggest hydroelectric powerplants were originally erected to support the international aluminium industry relocating to Iceland in the 1960s nevertheless the current hydroelectric grid is supporting both industrial and local household electricity consumption. (Orkustofnun 2006) However, building hydro plants and new energy-related infrastructure has generated an internal divide in Iceland as Icelanders feel a deep connection to unspoilt nature and raise questions about whether economic gains for the country and thus increasing energy security, weigh up against disturbing natural environments. For example, the Kárahnjúkar Hydropower Project that started in the mid-2000s sparked an environmental movement in Iceland and attracted international environmentalists to influence the local's views. According to an article published in 2010, political geographer Karl Benediktsson has said that the battle between preserving Iceland's unique landscapes and the choice for using them for economic gain has become part of the Icelandic conundrum. Raising the standards of living and strengthening energy security seem to be essential for the people but there has been a reluctance toward sacrificing natural beauty. (Newson 2010, 161-164) This statement raises

questions about whether energy security importance has embedded itself in citizens' minds or is it merely a concern at the governmental level. By applying constructivist thinking that a change in ideas can therefore lead to a different outcome, in this case the interest is whether energy security in Iceland can be enhanced if the locals are against further infrastructural developments around their homes. Furthermore, does the stance for preserving nature instead of focusing on capitalist gains come from the locals, or is it an international influence or global concern for losing more wilderness areas. In Iceland's case, it can be said that whilst energy security and being self-reliant is number one there are concerns about preserving their natural environment and thus the government must take that into account when proposing projects.

Other types of sustainable energy have not been focused on in Iceland but investigated in the past. For example, solar or wind power would not be as cost-effective and serve the country's excessive energy needs compared to geothermal and hydropower which have already been developed and heavily invested in thus currently their potential is not properly known. A study conducted in 2017 stated that from an energy security point of view, Iceland should focus on diversifying its sustainable energy sources and being one of the windiest countries in the world it should research the options for harnessing wind power for enhancing energy security. (Askja Energy 2017) Iceland's GHG emissions are still high due to its heavy industries, however, they are working towards cutting carbon emissions by moving away from fossil fuels completely and experimenting with turning harmful carbon monoxide and hydrogen sulphide into a stable mineral via carbon capture and fixation technique. (Veal 2020)

4.3. Iceland's energy security

The Icelandic government supported by local people and international investors has been working tirelessly to become self-sufficient in energy production and independent from fluctuations of price and supply in the world energy market. Investment of time and funds into research regarding local sustainable energy sources and the implementation of those methods have put Iceland decades ahead of other nations by becoming energy independent and thus potentially reaching the maximum energy security. Its last hurdle is to completely cut the usage of fossil fuels that are still imported and mostly used in the transportation and fishing sectors. The former president of Iceland Mr Grímsson said in 2016 that "The capital, Reykjavik, about the time I was born was every day under a black cloud from the smoke from the coal fires…This transformation into the leading

example in the world in a clean energy economy came from a country which, perhaps, had the greatest odds against it" (Worland 2017). From his words, it can be taken that Iceland only managed to change its course in the energy sector towards more sustainable energy sources through the fundamental change of ideas which were then implemented at both local and governmental levels. In 2018 Ragnheiður Elín Árnadóttir, former minister of Iceland, said that "Concerted efforts and long-term political vision, along with an important support mechanism, transformed Iceland into a clean energy economy within just two decades" (Pantzar 2019). The key element for Iceland was the natural drive towards self-sufficiency and thus research originally initiated by entrepreneurs was adopted and further developed by the government. Constructivism is the only possible theory to explain the changes in Iceland because it all started from nationalistic ideas to become self-reliant, taken further by the oil crises and then supported by the availability of natural resources.

In 2018 oil made up 7% of the country's used energy supply (*see Appendix 2*), nonetheless the Icelandic government has set its aims high and is moving towards becoming the world's first fossil-fuel-free country. (IRENA 2022) Birta Kristín Helgadóttir, who is the Head of Green by Iceland, a cooperation platform for green solutions in Iceland, said that "Iceland has set the goal to become fossil fuel free by 2050, meaning that we must also shift to 100% renewable energy in the transportation sector" (Cooper 2021). The Icelandic government's new Climate Action Plan published in 2020 states that "Iceland aims to achieve carbon neutrality before 2040 and to cut GHG emissions by 40% by 2030 under the Paris Agreement" (Ministry of the Environment, Energy and Climate 2022). This suggests that Iceland makes further developments in sustainable energy implementation due to international quotas and government legislations however, being one of the highest renewable energy producers per capita in the world and striving to be the leader in the area, a sense of Icelandic pride can be detected.

These forward-thinking decisions are aiding Iceland to achieve energy security at the highest level by not being entirely dependent on the world market and having the possibility to dictate its own energy prices. With the impressive switch to using renewable energy, Iceland is one of a kind, but it did not move forward with sustainable ideas due to climate concerns. The local entrepreneurs followed by the Icelandic government saw the long-term goals in terms of energy security. As a small nation situated on an island far away from other states it was almost entirely reliant on imported fossil fuels, local industries would not have flourished if there was not enough energy available, so it was a question of economic establishment and independence. According to Halla

Hrund Logadóttir, who is the Director of the Iceland School of Energy at Reykjavík University, "Iceland could not sustain oil price fluctuations occurring due to a number of crises affecting world energy markets" (2015) and thus started to focus on the energy resources available in the region. It cannot be known for certain that if Iceland would have had its own fossil fuel deposits found in the mid-20th century it would have focused on the technological advancements in geothermal energy thus "Iceland's conversion is therefore a meaningful success story rather than a 'one model for all' approach" (*Ibid.*). These statements show the reasons for relying on sustainable energy in Iceland are most closely connected to energy security rather than climate crisis concerns.

A study conducted on Iceland's energy security published in 2017, stated that "There is a lack of clear legislation on acceptable norms in terms of energy security… legislation needs to be clearer on which agency/department is responsible for how to achieve such criteria for energy security" (Askja Energy 2017). Therefore, even though the concept of energy security has been a fundamental factor in implementing sustainable energy sources it has not been written into legislation and seems almost coincidental that with the rise of sustainable energy the energy security has improved. A renewed energy policy for Iceland from 2020 to 2050 has defined energy security as "ensuring a sufficient and reliable supply of energy, electricity, hot water and fossil fuels for households, basic services and the industries, and also protecting the infrastructure of the energy industry from disturbances caused by natural disasters, sabotage or other causes" (Government of Iceland 2020, 12). The wording of this implies that Iceland tends to focus on domestic energy security and strengthening its national grid system rather than focusing on securing imports. It is also interesting that it mentions fossil fuels given the general discourse on enhancing energy security focuses on sustainable energy use. It can thus be deduced that even though the ideas are there to become a 100% sustainable energy using country it will be difficult to achieve this in the next 30 years based on government policy. The energy policy also states that the future goal of Iceland by 2050 is that "energy security has been achieved through a supply of varied renewable energy options and sound infrastructure" (*Ibid.*) and that "the use of fuel from renewable domestic sources will enhance energy security" (*Ibid.*). These two statements suggest that it is continually important for Iceland to be self-reliant with a focus on renewables and that fossil fuel usage does not play an important role in Icelandic energy security in the future. Therefore, the policy is still quite vague and does not offer clear paths on how to achieve better energy security and whether it means focusing only on renewables or also using energy diplomacy to ensure fossil fuels supply and increasing the energy storage capabilities in the country.

According to a research paper published in 2021 the energy security index between 2000 and 2020 improved "in the Nordic and Baltic countries due to the active use of alternative fuel sources and the replacement of fossil fuels" (Stavytskyy *et al.* 2021). This information is relevant as Iceland being part of the Nordic cluster has therefore increased its energy security levels due to its increased usage of sustainable energy and making the 'right' decisions to decrease oil dependency. According to the WEC, Iceland ranked 15th in the world on the Trilemma index however its energy security factor was only 56.1 out of 100. This is explained by Iceland's lack of long-term energy storage capabilities. (WEC 2022) However, Iceland is aware of this issue and the Energy Policy published in 2020 states that "Steps need to be taken to ensure that energy storages and reserve power use renewable fuel" (Government of Iceland 2020, 14). Even though Iceland's energy security has increased based on the data available there is still much to improve, and it is difficult to see if merely switching to sustainable energy sources continues to aid the increase in energy security as Iceland is already almost entirely running on renewables. Therefore, from the data analysis and presented discourses, it can be concluded that improving energy security in Iceland is not only related to increasing sustainable energy use but is further linked to the diversification of energy sources and the domestic production and storage capabilities of sustainable energy.

5. THE UNITED KINGDOM

5.1. The United Kingdom's energy history

In comparison to Iceland, the UK has thousands of years of settlement history and is an extremely densely populated island and thus has a completely different set of challenges in the energy sector. As of April 2022, the UK population was over 68.5 million people. (Worldometer 2022) The UK is also known for its historical dependence on locally deep-mined coal, imported oil, and gas, and therefore makes an excellent study from an energy security point of view whether switching to sustainable sources has proven effective in terms of strengthening the country's energy security and what have been the driving factors behind the switch.

Coal as a natural resource was known to locals, and mining was practised from the Middle Ages in an open pit method but not fully exploited before the industrial revolution when the energy demand grew drastically. More relevant to this research, the UK's recent energy history started in the mid-18th century with the invention of the coal-powered steam engine which led to deepening coal mines. In the 1850s 70% of Europe's coal production originated from the UK. Britain naturally has vast coal reserves, which were used excessively to power the country until quite recently. In 1946, coal was used to produce 90% of the country's electricity (Planete Energies 2015), in 1960, coal made up 90% of the country's power supply (National Grid 2022), and even in 1970 fossil fuels still made up 94% of Britain's energy consumption (Planete Energies 2015). The reasons behind Britain moving away from coal mining were mostly related to climate change concerns and the extremely unhealthy working conditions. There was not an end of resources, war, or any other purely materialist factor that sparked that shift, but it was a change in the mindset of the British people from the 1970s that contributed to the closing of the mines thus, various factors added to the change in the country's energy sector which can be explained by applying the constructivist theory.

During the times of the British Empire in the 20th century, the UK was skilfully exploiting oil reserves in the Middle East on British colonial land. Access to oil reserves and managing oil distribution was of vital importance during both the First and Second World War and played a key role in war tactics. At the time, energy security was still linked to a state's overall sovereignty and military capabilities. Most of the UK's energy production, including oil drilling in the Middle East, was privatised, which subsequently created a problem of maintaining affordable and stable prices

for end consumers in case there was an issue in the production line or trading routes. (*Ibid.*) Oil supply concerns became dominant and therefore the UK started exploring and using the country's own natural gas and oil reserves buried in the North Sea and started the creation of multiple oil rigs. (*Ibid.*) Energy security at the time was still linked almost solely to oil supply and drilling oil domestically contributed to ensuring supply to meet the demands of the country.

According to the UK's National Grid (2022), the gas industry dates to as far as 1813 and pipes were used to distribute gas to its consumers powering multiple households and lighting streets. This was also the first time that the people of Britain experienced reliable light, heat and energy sources. During the turn of the century, the UK's natural gas production peaked, and the country was considered almost self-sufficient in energy production capacity. (Planete Energies 2015) In the 2000s it was believed by the British people that preferring natural gas would decrease the dependency on foreign energy imports and provide more energy security. For British consumers, it has historically been important to dictate energy supply and keep improving the standards of living without concerns over energy availability or fluctuations in price. However, with technological advancements and population growth, energy demands led the country to keep importing natural gas even though the UK at the time was a major exporter of natural gas. Nevertheless, natural gas is still preferred by a large proportion of the UK's population and considered more reliable and safer in comparison to, for example, renewable nuclear power. The general public has been accustomed to short-term fixes that the UK's government seems to prefer, and believes, that the implementation of sustainable energy sources is expensive and time-consuming thus the people prefer something that has always been there without realising that this is not a limited resource and the time for switching to sustainable energy must start sooner than later. (Pearson, Watson 2012) However, there has been a major shift in the global sustainable energy market in the past 20 years, which has made the British consumers more accepting of sustainable energy-related projects who are now demanding clearer long-term action plans and encouraging the government to make difficult unpopular decisions.

The UK energy market is entirely privatised since the Thatcher government's privatisation efforts in the 1980s in order to introduce more international competitors and let the market control the energy prices which would in theory naturally lead to lower prices for consumers. However, this idea has backfired, and energy prices keep soaring. The UK government is trying to take control of the prices by introducing price caps and financial support schemes, nevertheless, more households are predicted to be harmfully affected by the price surges potentially increasing their

risk of fuel poverty and consequently decreasing their standards of living. The main problem seems to be that 77% of the energy market is controlled by only 6 companies who operate a very consumer unfriendly strategy, charging higher prices "because they deliberately make their price structures complex so that households find it difficult to evaluate whether their gas tariffs offer value relative to others" (Baines, Hager 2021). This demonstrates the UK government's inability to lay down and implement clear long-term plans for the country's energy sector thus future energy security may be compromised.

With excessive coal and oil usage, the UK was one of the worst GHG emitters in the world and a leading polluter in Europe in the 1980s. Due to international and local pressure, the UK started to reduce its emission rates by diversifying resources and replacing fossil fuels with other more sustainable resources. However, the switch did not come from an energy security point but rather from the pressure of meeting international quotas. (Planete Energies 2015) Sustainable and renewable energy sources have been considered modern ideas that came about with international recognition of the climate crisis at the end of the 20th century which is surprising as hydropower had been used in the UK for centuries and solar and wind power possibilities were known. However, cheap and locally available coal and historical reliance on oil and gas have held back the UK's sustainable energy sector's development. The first wind farm in the UK opened in 1991 in Cornwall, a location known for its windiness, and during the past 30 years, the UK has done a lot to diversify and replace its fossil fuels' energy sources, cut GHG emissions and thus become more energy secure. 2019 was an important year for sustainable energy usage as for the first time in the UK's history "more energy was generated from zero-carbon sources than fossil fuels" (National Grid 2022). Nevertheless, the implementation of sustainable energy sources has been driven by meeting the UK's zero emission plans not so much by energy security concerns.

Historically, the UK whilst being part of the European Union (EU) has always been against the common EU energy policies mostly because of concerns about the EU then dictating the UK's North Sea oil rigs' operations. However, 2005 marked an important U-turn in the UK's discourse as their then Prime Minister Tony Blair decided to support the need for a common policy in the EU stating that "for far too long we have been in the situation where in a random way, energy needs, and energy priorities are simply determined by each country according to its needs. It is time that we developed in Europe a common energy policy" (Politico 2005). This came at the time of a predicted increase in the future demand for energy and the further necessity to import oil and gas to the UK, which through EU common policy would have made international trade agreements

clearer and potentially more stable. It seems that Tony Blair's government tried to focus on energy diplomacy in order to enhance energy security in the UK in the foreseeable future. However, due to Brexit and the Wars in Ukraine, the trade agreements had to go back to the bilateral level and potentially compromised the UK's energy security. From a constructivist point it can be deduced that whilst Tony Blair tried to redirect national interests toward an international energy management grid, he failed in that his ideas were not backed by the general discourses in the country, which in contrast supported the UK's self-reliance and the historical way of managing energy policies internally. One idea can spark a discussion in the short term, but there was an opportunity there, and the UK went back to its old ways of practising energy diplomacy through bilateral relations without external policy dictations. This continues to be the case, the UK, whilst being part of various international organisations and often participating in global energy discussions, continues to focus on using energy diplomacy yet, it is currently also finding new ways to increase domestic sustainable energy production.

5.2. The United Kingdom's sustainable energy sources

In 2020, 20.5% of the total energy used in the UK came from sustainable energy sources compared to the 6% in 1970 (*see Appendix 3*). (Planete Energies 2015) Britain currently uses a mix of sustainable energy sources like wind, hydropower, geothermal, solar, nuclear and biomass. "Renewable electricity accounted for a record 43.1% of electricity generated in the UK during 2020" (Department for Business, Energy & Industrial Strategy 2021, 33) supporting the UK government's aims for cutting GHG emissions and focusing on the further development of sustainable energy sources. A reaction from the then future Prime Minister Theresa May in 2008 regarding the UK being the first country in the world to formally commit to reducing GHG emissions stated that "to stay reliant on fossil fuels would mean tying ourselves to increasingly unstable supplies which could endanger our energy security" (Hickman 2016), which means that looking for available sustainable resources was already a pressing matter in the country. Furthermore, it can be deduced that the UK was already aware in 2008 that switching to more sustainable energy sources can help to strengthen its energy security. However, the main reasons behind cutting fossil fuels have since been international quotas and internal milestones put in place by the government. Cutting carbon emissions plays a significant role in cutting back the use of fossil fuels as there was an announcement in 2021 that "The UK Government has committed to reaching net zero by 2050, as part of a commitment to the global 2015 Paris Agreement" (Office

for National Statistics 2021). The UK's current Prime Minister Mr Boris Johnson announced an ambitious government plan in 2021 that they move towards all the "UK's power to be green by 2035" (Reuters 2021). His announcement has then been backed by the newest energy security report containing a 10-point plan on using more green energy and promoting a green lifestyle. (Department for Business, Energy & Industrial Strategy 2022)

In the UK the wind is predicted to have the greatest positive impact among sustainable energy sources, along with hydropower, thanks to Britain's geographical location and ability to harness the energy from powerful Atlantic Ocean currents and a windy coastline. Even though there has been a significant increase in using wind farms in the UK the main issue has been the financing of construction with a lack of funding and general local support for sustainable energy sources. (Planete Energies 2015) In 2020 wind, marine and hydropower made up 29% of the state's utilised sustainable energy sources (*see Appendix 4*). (Department for Business, Energy & Industrial Strategy 2021, 32) Most hydropower plants are 60-70 years old and need to be seriously upgraded or repurposed. However, hydropower in the UK has great potential due to its mountainous terrain and various water reservoirs, however, the best sites for new generation plants "are in areas of protected natural beauty and the cost of construction is often considered prohibitive" (The Renewable Energy Hub 2022). Regardless of costs and environmental factors, the UK government has announced in 2022 that they aim to significantly increase the usage of wind power for electricity generation and ambitiously said that "We will be the Saudi Arabia of wind power, with the ambition that by 2030 over half our renewable generation capacity will be wind" (Department for Business, Energy & Industrial Strategy 2022). However, it is not clear how the UK will implement the plans but based on this information it can be concluded that wind energy is of vital importance for the UK energy security thus using sustainable energy sources does play a significant role in enhancing the energy security of the UK.

Biomass usage in the UK is also on the rise as it can be burnt to generate heat and thermal power or used to make biogas for further electricity production. (Energy UK 2022) Bioenergy applications made up the greatest part of the UK's renewable energy mix in 2020 at 61% (*see Appendix 4*). (Department for Business, Energy & Industrial Strategy 2021, 32) The technological advancements regarding the full capabilities and further research in how to make it more sustainable in terms of GHG emissions are still on the way, and biomass usage is expected to play a much greater role in the UK's energy mix in the future. What makes it so accessible and cost-effective is the fact that it "can be sourced from any living substance as well as from material such

as biodegradable waste, food waste and animal manure" (Energy UK 2022). However, even though biomass makes up a large proportion of the renewables used in the UK it does not currently lead the major discussions around increasing sustainable energy sources in the future.

Nuclear power usage in the UK has historically been tied to both energy security and sustainability. It was originally frowned upon, then briefly supported in the mid-2000s and is presently viewed as not the best possible solution for a securer energy future by the UK citizens. (Pearson, Watson 2012) Almost all UK's nuclear power plants are expected to be decommissioned before the end of the decade with currently only one new plant under construction and an ongoing debate around the nuclear energy future. (Haves 2021) Environmental scientist James Conca said in 2016 that "nuclear power is presently a sustainable energy source but could become completely renewable" (2016). This is an interesting statement further proving the UK's internal struggle whether to focus on sustainable or renewable energy. Nuclear power stations in the UK have been used since the mid-1950s, however, the percentage of nuclear power in the country's energy mix has not changed much within the last 50 years, making up 3.5% in 1970 and 4% in 2020 (*see Appendix 3*). (Planete Energies 2015) Technological advancements in harnessing nuclear power have drastically changed over the last decades making most of Britain's power plants unsuitable for further usage and requiring more funds to modernise their operations. The lack of funding for nuclear power has not supported the upgrading efforts and so the future of the power plants is unsure. (*Ibid.*) However, a new energy security policy published in 2022 highlighted the importance of the UK's nuclear power and stated that the UK government will ensure that in the future the UK "is one of the best places in the world to invest in nuclear" and mentioned that they "will also collaborate with other countries to accelerate work on advanced nuclear technologies" (Department for Business, Energy & Industrial Strategy 2022) meaning that the UK is planning to use energy diplomacy to attract foreign investment and gain new technical knowledge. However, even with this proposal in the policy, it is still unclear how or why the UK has chosen to continue focusing on nuclear power. It seems that whilst diversifying energy sources and becoming a self-reliant and domestically energy producing country it is lacking clear focus and action plans, which in consequence could result in weakening the UK's energy security in the future. The British Prime Minister Boris Johnson has even said that the dependence on imported energy has been an issue and "Sometimes this was through deliberate planning; more often it was the by-product of policy fudges, decision-dodging and short-term thinking" (*Ibid.*).

The idea of using solar power and the science behind how to technologically manage it was discovered in the UK as early as 1839. (National Grid 2022) Solar power makes up a minor portion of the UK's current energy production. It is an underapplied sustainable energy source mostly because it is not considered as cost-effective compared to other sustainable energy sources. Even though only a small part of the UK's sustainable energy mix is made up of solar power, according to National Grid, Britain is still one of the top electricity producers of solar power in the world. (2022) In 2020 solar and geothermal power made up 5% of the country's total renewable energy sources (*see Appendix 4*). (Department for Business, Energy & Industrial Strategy 2021, 32) Solar power has become increasingly popular among private consumers wanting to manage their energy costs better, especially after the recent COVID-19 pandemic. During the pandemic, energy costs went up due to not as much energy being produced and distributed however, more people started working from home thus their private electricity consumption increased. Installation, material costs and maintenance of solar panels are quite expensive and the benefits for the consumer vary depending on their needs, geographical location, annual income and even the angle of their roof. (Hickey 2022)

Geothermal energy in the UK is still in the early stages as starting-up costs are extremely high, however, a newly opened geothermal plant in Britain discovered potential access to high concentrations of lithium in the extracted geothermal fluid, which could very well change the future of the UK's sustainable energy market. Lithium is being used as one of the vital components in the production of electric cars, an important factor in the world's emissions-cutting plans. The founder of the company, Geothermal Energy Ltd, said that "It's really become a game-changer for the industry to be able to say we don't just produce power, don't just produce heat – we will produce lithium as well, particularly zero carbon lithium" (Taylor 2021). This statement stresses the fact that becoming a 'zero emissions' country is of vital importance both for the UK's government and the general public. By applying constructivist thinking it can be argued that the UK's sustainable energy market's future is currently unpredictable as with new discoveries and further technological advancements the possible solutions for ensuring the state's energy security may change with all the possible options not currently known.

5.3. The United Kingdom's energy security

With growing energy demands and population growth, the national energy grid system, the first of its kind in the world, started operating in 1935 to cover the whole of the UK and distribute energy more evenly and reach further rural areas. The properly managed grid system made energy more accessible and affordable for consumers. (National Grid 2022) Energy security then meant access to energy supply domestically and improving the general living standards. The first thoughts of ensuring the country's energy security in the modern sense were seen during the World Wars but especially during the aftermath and subsequent oil crises that started in 1973 due to the Arab Israeli Yom Kippur War, which led the UK to look for alternative energy sources and then turn to its natural gas and oil reserves in the North Sea. (Planete Energies 2015) Due to the war Organisation of the Petroleum Exporting Countries (OPEC) decided to establish an international oil embargo and Britain, along with the rest of the world, was completely cut off from the oil supply for several months. It was the first time the international community realised the scope of dependency on oil from the Gulf Region and started taking action to free themselves of solely OPEC dictated market. The extreme crisis that many of the UK's citizens still remember hit the country hard by forcing the government to establish a 3-day working week in order to cut energy consumption, and as a result the UK's inflation and food prices rocketed, and unemployment soared. This period of oil crises in the 1970s has left its mark by making both the UK government and its people extremely cautious about the fluctuations in the world energy sector and wanting to establish future energy independence. (Macalister 2011) This has mostly been achieved by successful energy diplomacy implementation, which has been historically supported by the UK government.

The UK's North Sea natural gas and oil reserves are facing depletion and with the country's production significantly reduced, the state currently imports gas mainly from Norway and Qatar. Coal is still used but imported mostly from Russia, Columbia, and the United States rather than locally mined. A fair share of British petroleum comes from reservoirs near the UK's Shetland islands area. (Planete Energies 2015) The recent Russian invasion of Ukraine and subsequent sanctions on Russian origin oil, oil products and natural gas has led to an increase in energy prices and British people are worried about a repeat of the energy crisis of the 1970s. However, the current energy situation is quite different from what it was then. British Prime Minister Boris Johnson has announced that his government is doing everything to completely stop relying on oil

imported from Russia by the end of 2022 and they are also looking for alternatives to stop importing Russian gas. (Reuters 2022) However, it cannot be believed until it has happened as the UK's previous Prime Minister Theresa May also said in 2018 that "When we are looking to our gas supplies, we are indeed looking to other countries" (Young 2018) meaning four years ago the UK was already allegedly moving away from Russian origin gas with applying energy diplomacy but with little success. Constructivists could argue that the general ideas behind relying on gas have not fundamentally changed thus cutting more gas dependency and establishing new import deals from other countries through energy diplomacy can then take more time. From the perspective of the UK, the politicians' statements seem to have little value when considering what is going to happen in the future, meaning internal politics often disturb long-term plans and immediate support from citizens has been more important to policymakers than truly ensuring national energy security.

The UK's energy prices are currently still rising and with the government's new price cap strategy, the average customer is expected to pay nearly £700 more per year than in 2021. Low-income consumers are the most affected by higher energy prices that subsequently increase the overall average living costs. (Jones 2022) It seems like energy security for the country is becoming more relevant and immediate action by both the government and the British people needs to be taken. Moving away from fossil fuels is an important step in reaching the zero-carbon emission goals but is also vital for the change in the market dependency on energy imports. Britain has seen some periods of potential energy independence whilst the local economy flourished and the reliance on energy imports seemed to be decreasing however, it has not yet happened and continuous action for ensuring the UK's energy security needs to be taken (*see Appendix 5*). (Department for Business, Energy & Industrial Strategy 2021, 11) The UK government's current stance is that "a shift away from oil and gas and towards electricity will mean a shift away from global markets and towards domestic production and regional trade" (Haves 2021). In 2022, British Prime Minister Boris Johnson also said that "we need a flow of energy that is affordable, clean and above all secure. We need a power supply that's made in Britain, for Britain" (Department for Business, Energy & Industrial Strategy 2022), which further supports the emerging discourse on the rising importance of domestic sustainable energy production. Like in Iceland, energy security has started to mean not only diversifying energy sources by using more sustainable energy but the local production and distribution of energy other than relying on imports. This has been a very recent realisation in the UK compared to Iceland.

In 2021 during the UK parliament's gas market debate the UK's Secretary of State for Business, Energy and Industrial Strategy Mr Kwasi Kwarteng said that the UK's "security of gas supply is robust, but it is the case that the UK is still too reliant on fossil fuels. Our exposure to volatile global gas prices underscores the importance of our plan to build a strong, home-grown renewable energy sector to strengthen our energy security into the future" (2021). The government is therefore sending clear signs to consumers that the future is in switching to renewable energy sources and focusing on domestic sustainability, however, there is a lack of clear meaningful action taken and the meaning and importance of energy security are not addressed. Sustainable energy could potentially offer the UK more energy security in the future if managed well and using the most cost-effective methods but currently, the focus is still on the maintenance of good energy relations with international partners via energy diplomacy and securing imports of gas, oil, and coal, to meet demands. Whilst diversification of energy sources with sustainable options is happening the current technological dependence on fossil fuels and national mindset are slowing down the process.

Future greener and cleaner energy plans for the UK include better insulation of houses that reduces the energy use, switching to zero-emission vehicles in the transportation sector, investing in offshore windfarms, advancing nuclear power systems, promoting cycling, walking and usage of green public transport services, protecting the UK's natural environment and supporting green innovation research but do not focus on doing so to enhance energy security. (HM Government 2020) Energy security has not been paid enough attention to as international climate change efforts have taken precedence, however, the UK's Prime Minister Mr Boris Johnson said in 2021 regarding sustainable energy sources that expanding the sustainable energy sector will make the UK more self-reliant and clean power generation will also keep the costs down for the consumers. (Reuters 2021) Therefore, it can be deduced that the UK government is aware that successful implementation of sustainable energy sources can make the UK's energy sector more self-sufficient which will then result in greater energy security in Britain.

A report published in 2012 analysing the UK's energy policy from 1980 to 2010 highlighted that after the oil crises in the 1970s, energy security was a topic of discussion in terms of securing supply chains, but then it was not taken seriously again before as late as the mid-2000s when the global climate crisis started to play an integral part in the UK's energy policy and later on was tied together with the concepts of energy security and sustainability. (Pearson, Watson 2012) Thus, changes in global discussions started to affect local ideas and over time altered the UK's views on

energy security. In 2010 the UK's Government defined energy security as "making sure consumers can access the energy they need at prices that are not excessively volatile" (Department of Energy & Climate Change 2015) leaving the definition extremely vague. The UK's energy security policy between 2010 and 2015 did not mention switching to sustainable resources as a significant necessity or mention sustainable energy use as an integral part of the future, however, it stressed that with the global increase in energy demand in the next decades "The UK must stay ahead of these trends to secure reliable imports of oil and gas [and] energy diplomacy plays a vital role in achieving this" (*Ibid.*). From this policy paper, it is evident that the UK has focused on energy diplomacy as the main tool for ensuring energy security until very recently and tying the concept of sustainability with energy security has only happened over the last seven years.

The long-awaited British Energy Security Strategy published in 2022 interestingly fails to define what energy security means for the UK now. It does state that the "North Sea will still be a foundation of our energy security, but we will have reduced our gas consumption by over 40% by 2030" (Department for Business, Energy & Industrial Strategy 2022) which means that fossil fuels are still an integral part of the UK's energy mix in the future but by developing more sustainable alternatives and thus reducing the need to use fossil fuels, the UK's future in energy security is moving towards relying on sustainable energy sources. Commenting on the report the current British Business and Energy Secretary Mr Kwarteng said that "The simple truth is that the more cheap, clean power we generate within our borders, the less exposed we will be to eye-watering fossil fuel prices set by global markets we can't control" (Frangoul 2022) further strengthening the increasing discourse in focusing on domestic sustainable energy production in the UK in terms of energy security.

According to the WEC Trilemma Index, the UK ranked 4th in 2021, which is a great position and much higher than Iceland. However, in the last 20 years, the UK's energy security has not greatly improved and is still only 68.8 out of 100. The WEC analysis states that "The Energy Security index significantly declined until 2014, as the UK became a net importer of energy. However, since the dip, scores for Security have been growing steadily, suggesting that the UK has been able to increase the national production of renewable energy and manage reliability of imported supplies" (2022). Based on that it can be conducted that the diversification of the UK's energy mix with sustainable sources has led to an increase in energy security.

Currently, the UK's energy sector goals focus on securing its energy supplies, preserving the industry's competitiveness, cutting GHG emissions considering international agreements for combatting the climate crisis and ensuring the citizens of Britain have affordable access to energy for their everyday needs and comfort. (Planete Energies 2015) For a country as vast and complex with a long history of using various energy sources, it is not an easy task to manage to achieve maximum energy security in the UK. Energy prices have been on the rise for decades and disparities in the quality of living between the classes have played a vital role in the government's short-term decisions. The UK is still a major producer and exporter of energy however, as a country it still needs to import a vast amount of oil, gas and coal to meet energy demands which can result in weakening energy security if not managed with a long-term vision. Another crucial difference compared to Iceland is that the UK's energy market is privatised meaning that the government has little control over the future energy security and needs to focus on long-term clearer legislation in managing energy sources in order to maintain and then possibly enhance the UK's energy security levels.

CONCLUSION

The main discourses followed in this study were the definitions behind energy security in Iceland, the UK and the international discussion. Focusing on the two countries studied, it was evident that energy security has become more relevant since the international oil crises of the 1970s and consequent economic recession. However, the definition of energy security varies between the two states. Iceland focuses on independence and self-reliance in the energy sector rather than using energy diplomacy to secure supply chains which seems to be still preferred in the UK. Even though both Iceland and the UK are islands, Iceland is much more isolated from the world by distance and has less historically established diplomatic relations compared to the UK, and that is potentially one of the reasons its energy security ideas revolve around securing the country's energy needs locally and independently. Securing affordable energy prices for consumers is important to both states nevertheless more difficult for the UK to manage due to its reliance on energy imports, extended usage of non-renewable energy sources and entirely privatised energy sector. The UK government cannot do much to influence energy prices but is trying to soften the economic impact of increasing prices by introducing price caps, financial support systems and finally trying to focus on research into sustainable energy sources. In Iceland, energy prices are also relatively high due to the extensive financing needed to establish geothermal plants but are predicted to not be as affected by international energy market fluctuations and remain affordable for the locals in the long run. International financing is achieved by promoting Iceland's advancements in geothermal technologies internationally through energy diplomacy.

Driving forces and timeframes in sustainable energy development have also been entirely different in the studied countries. Developments in switching to sustainable energy sources in Iceland were driven by the need to become self-reliant and thus, being a distant island state, it had to focus on locally available resources. Hydropower and geothermal energy sources, that coincidentally happen to be both sustainable and renewable, have been researched and funded by straightforward plans from the government and supported by locals to achieve greater energy security. Iceland aims for zero-carbon emissions, unaffected energy supply without unpredicted fluctuations in supply and price and maintaining affordability for their consumers. The states' main contributions to energy diplomacy are to share their research and techniques internationally and support the switch to more sustainable resources. Based on Iceland's example it can be said that using more sustainable resources has led to greater energy security.

In contrast, the UK's sustainable energy sector's development has not been driven by the need for greater energy security but rather by meeting international quotas and especially the reduction of GHG. The UK's complex energy history with the country's long-established politics has made the switch to sustainable energy sources quite difficult. Cutting carbon emissions and focusing more on renewable energy sources like biomass and nuclear power are contradictory ideas as the sustainability of these resources can be argued. The UK's imperial history with access to Gulf Area oil, historical reliance on the deep-mined coal on the island and the exploitation of oil and gas reserves in the North Sea has made the UK rather slow in switching to sustainable sources because the historical focus has been on securing the supply through energy diplomacy. A major part of the UK's energy diplomacy still focuses on establishing friendly relations and securing oil, gas and coal supply to match the demands of the country. Sustainable and renewable local resources like wind, hydro and marine power, geothermal and solar power are underfunded in both research and establishment. The difficulties behind using more sustainable energy sources lay in many aspects and are supported by the discourse analysis in the area that discovered that the UK as a country does not seem to be able to focus on long-term sustainable goals because of its complex politics, historical backlog, lack of support from the local people and mainly in the fact that energy sector is privatised. Reasons for choosing sustainable resources vary greatly depending on the energy companies' current position, some focus on cutting carbon emissions, some focus on securing energy supply, and some focus on cutting costs and thus making more profit – the sector is extremely complex and difficult to analyse. Based on these findings from the UK it cannot be said that using more sustainable resources leads to greater energy security especially as the UK ranks much higher in the WEC Trilemma Index even though Iceland is almost entirely run by sustainable energy sources.

The discourse in international energy security proved that there is not a simple one form fits all solution, but it is still an evolving field with some issues disappearing whilst others surface and therefore it cannot be predicted how vital a role energy security plays in the future. Supported by constructivist ideas that everything is constantly in process and never established, greater international energy security may lay in using more sustainable energy sources however, using more electricity and thus consequently making countries more interdependent in cooperation, the energy security desired by states may not be reached. This also depends much on the definition of energy security in different countries.

In conclusion, to answer the research question of how can using more sustainable energy sources in a state's energy mix lead to an increase in their energy security, the answer is that by diversifying energy sources via increasing sustainable energy sources it can ensure a less volatile energy supply and greater control on the energy market. However, it is discovered in this research that this comes conditionally meaning the sustainable energy must be produced domestically and there must be efficient energy storage capabilities in order to increase energy security. Merely switching to sustainable energy sources does not guarantee an increase in energy security. And to answer the second research question of why countries would need to use more sustainable energy sources with their focus on energy security rather than only focusing on meeting international quotas, the answer is that domestic sustainable energy production naturally leads to a decrease in GHG emissions and thus international quotas can be met regardless, however, the overall goal to ensure energy security has been recently directly linked to using more sustainable energy sources. How to measure states' energy security is rather a difficult concept as it can focus on different things depending on states' focal point or even their current situation. It can best be measured by looking at the availability of energy and the cost of gaining it, depending on how accessible and affordable energy is to that region. With support from this research and definitions found on energy security, it could be achieved if the availability is not greatly challenged by unexpected demand fluctuations or supply interruptions, it is affordable and matches the region's economic capability and follows international long-term agreements regarding energy and climate change.

Discourse analysis focusing on the usage of sustainable and renewable energy sources emphasised that depending on the country's energy policy sustainability is not always achieved if the focus is merely on renewables. The UK's study highlighted this especially because it is currently planning on focusing on further developments in the nuclear sector whilst also trying to reach its zero-emission goals which show that those two things do not currently support each other and governmental census with a clear objective is vital to the reformation of the energy sector. Privately owned energy companies need to be directed and supported with a clear vision by the local government with support through legislation in order to maximise energy security. It is of the utmost importance that governmental action is based on a long-term plan with a clear strategy not a series of quick-fix systems that contradict each other. In terms of ensuring a sustainable energy future, it is necessary to be precise and act to achieve the set goals, much like Iceland which was very clear in its objectives and started investing towards the best course of action.

The main outcome of this research is to point out that international energy security does not come from only implementing more sustainable energy sources, but it may result from exploring local or at least regional renewable energy resources with help from international energy platforms, global legislation, and world-wide energy cooperation. International energy security can be achieved if all parties define it similarly and share the same goals which currently seems impossible due to both state-owned and private energy firms, importance of profitability, differences in geolocation and available natural resources, uneven distribution of finances towards sustainable development, technological reliance on fossil fuels and various other local, regional and global factors. Given the speedy advancements in technologies and further research into sustainable energy sources, the future may be quite different from what is predicted now. The world may gain overall energy security much sooner thanks to new discoveries or it may worsen because of bureaucracy slowing the matters down so that the states cannot keep up with renewing their old energy production and distribution systems.

With data analysis supported by discourse analysis and with the application of constructivist theory it can be concluded that energy security is a concept that is still evolving and is predicted to continue to change and gain and lose its importance over time due to the variables and everchanging global norms which then raises questions whether energy security can be fully measurable and thus achievable. If a definition of the concept can change and cannot be entirely comparatively measured, then how would independent states know they have achieved it, which is probably why energy security has been linked to sustainability goals because that is an easier thing to measure. If a country has managed to switch to fully sustainable energy dependency that is domestically produced with satisfactory storage capabilities, then it can be concluded that it has reached the highest possible energy security. In theory, Iceland is currently very close to it, but does this solve the element of how to reduce energy prices or how the fluctuations of energy demand are managed or what happens in case of natural disasters: it is still unpredictable. The globalised world with an increasing interconnectedness of electricity grids can pose new challenges in energy security thus, currently sustainable energy can be considered a cornerstone of modern views on international energy security but with conditions and cannot fully predict the future energy security as the concept may change.

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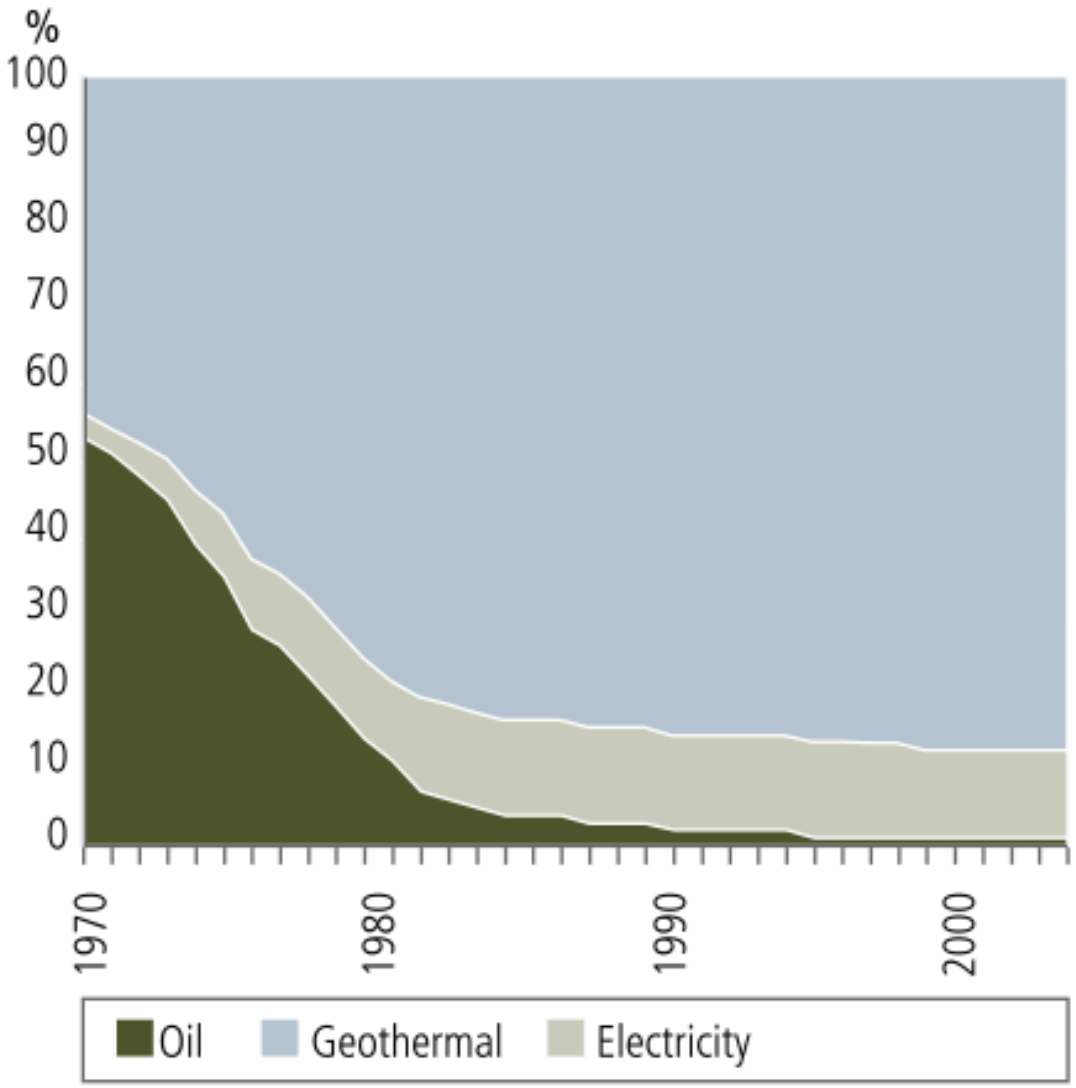
APPENDICES

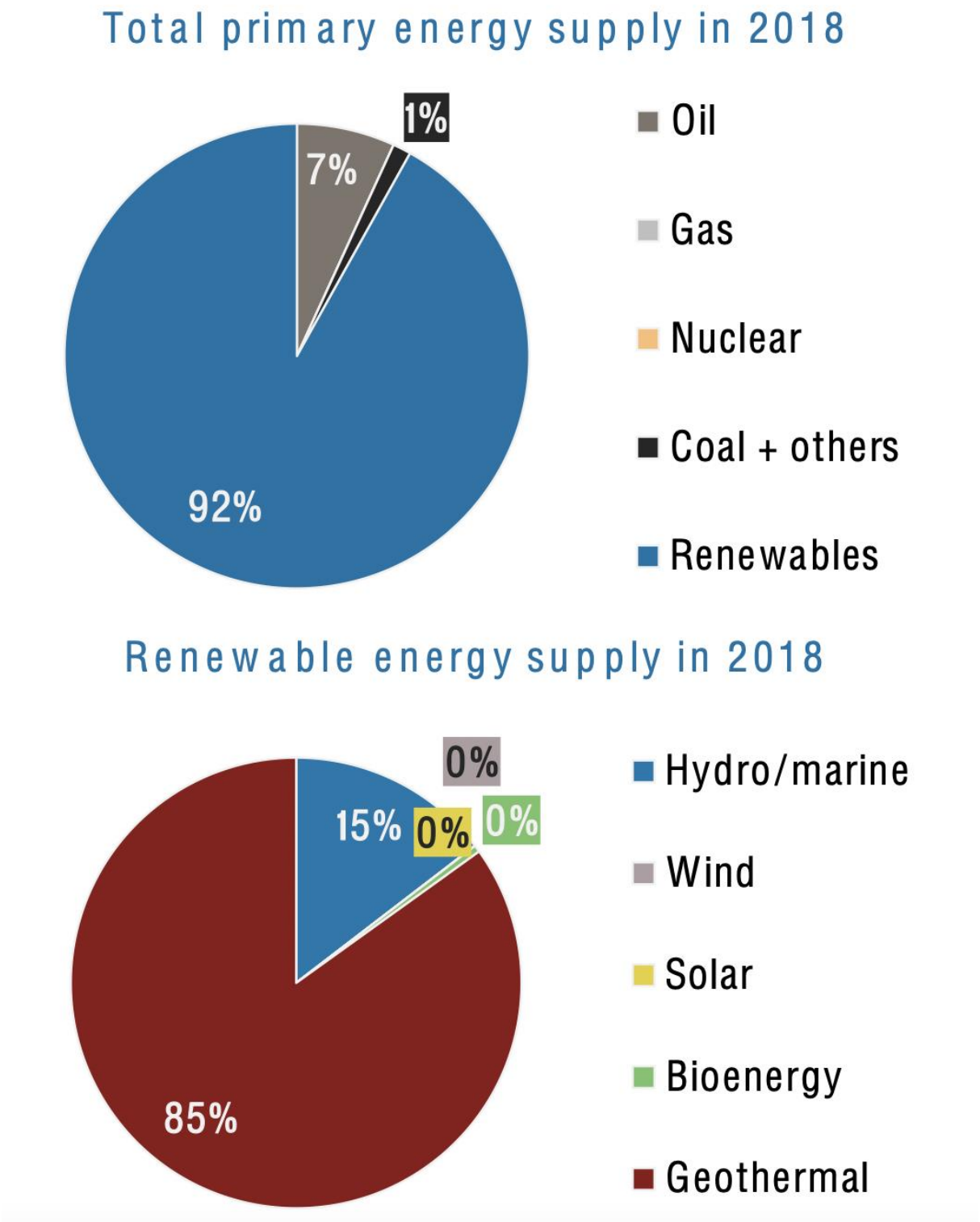
Appendix 1. Iceland's space heating by source 1970-2005

(Orkustofnun 2006, 13)



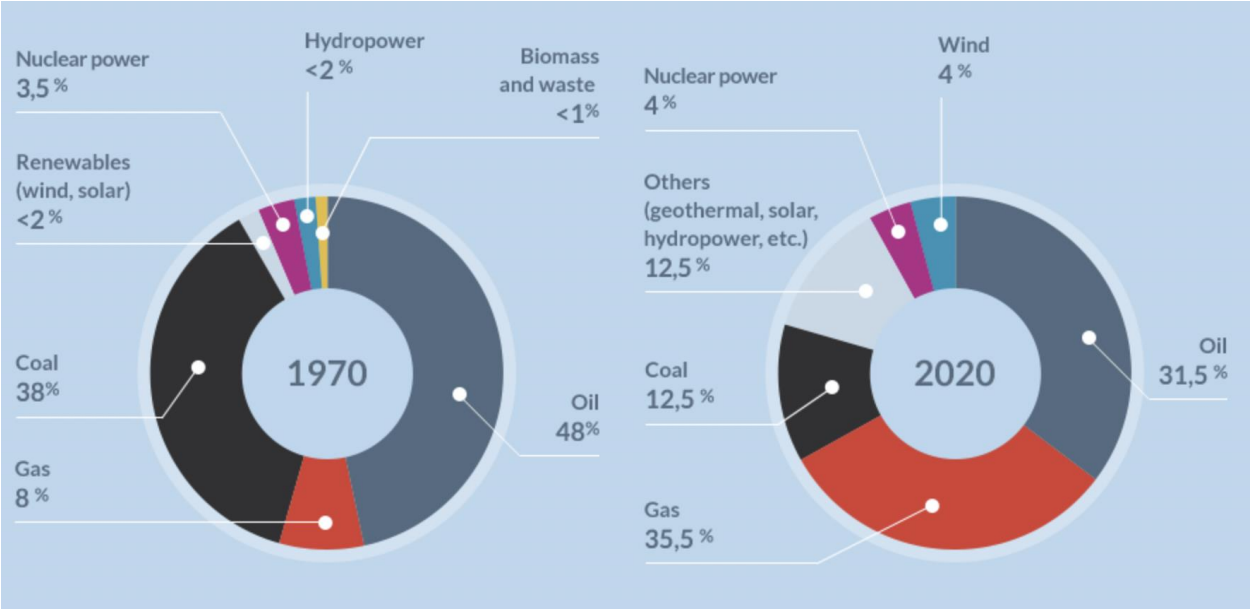
Appendix 2. Iceland's energy supply in 2018

(IRENA 2022)



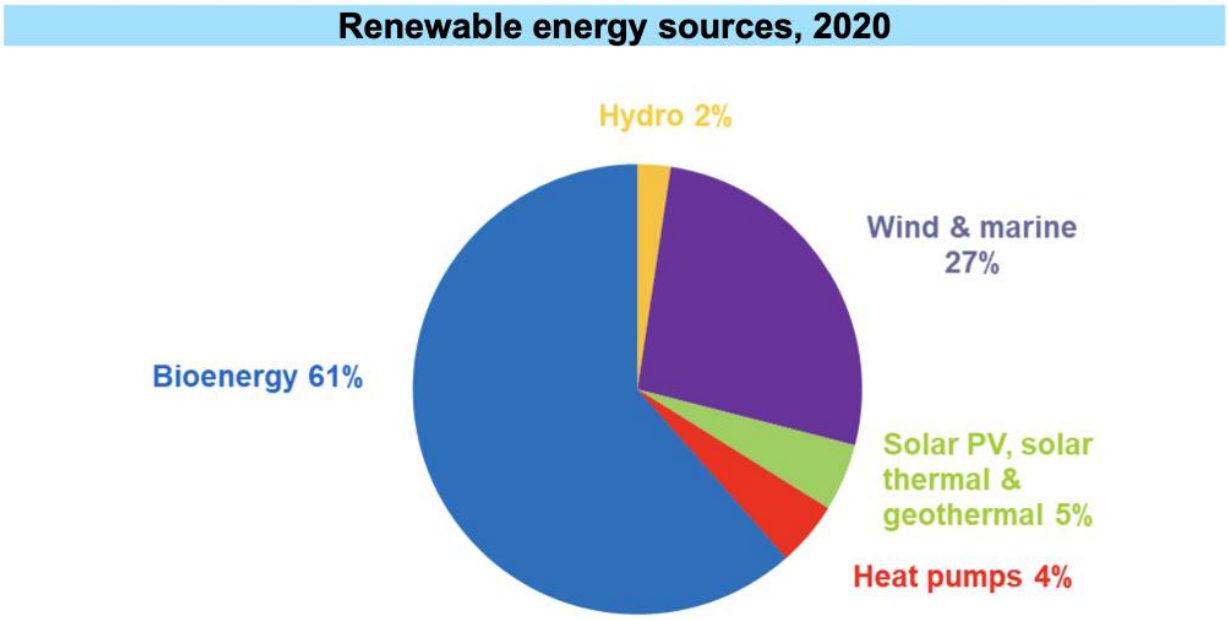
Appendix 3. The UK's energy mix in 1970 and 2020

(Planete Energies 2015)



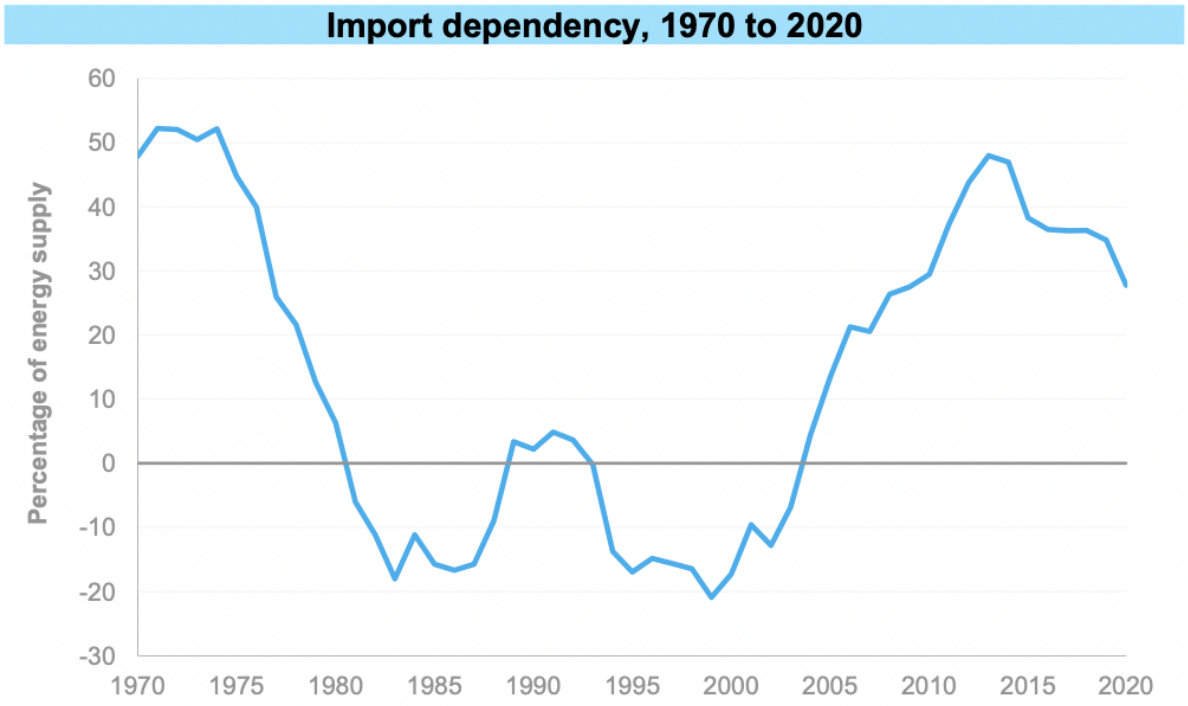
Appendix 4. The UK's renewable energy sources in 2020

(Department for Business, Energy & Industrial Strategy 2021, 32)



Appendix 5. The UK's energy import dependency between 1970 to 2020

(Department for Business, Energy & Industrial Strategy 2021, 11)



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