Electricity Security in Iceland

Security awareness in the Icelandic electricity sector, and its implications for society

Pollý Hilmarsdóttir

Lokaverkefni til MA-gráðu í alþjóðasamskiptum

Félagsvísindasvið

Júní 2015

HÁSKÓLI ÍSLANDS

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Leiðbeinandi: Alyson JK Bailes & Böðvar Tómasson

Stjórnmálafræðideild
Félagsvísindasvið Háskóla Íslands
Júní 2015

230187-2239

Reykjavík, Ísland 2015

Útdráttur

Skilningur á hugtakinu öryggi hefur breyst mikið síðan Kalda stríðinu lauk og hefur snúist frá því að einblína á öryggi ríkis og landssvæðis þess. Á meðal nýrra hugtaka um öryggi er samfélagslegt öryggi sem beinir sjónum sínum að mismunandi hliðum samfélagsins sem eru á margan hátt undirstaða lífs íbúa þess. Þar undir falla mikilvægir innviðir samfélagins, svo sem rafmagnsinnviðir. Þessi ritgerð nýtir sér mikilvægi innviða og hugtakið um samfélagslegt öryggi til að skoða öryggismeðvitund þeirra sem vinna innan rafmagnsinnviða á Íslandi og stærra samhengi rafmagns innan samfélagsins.

Við gerð þessarar ritgerðar var mikið stuðst við útgefið efni og viðtöl til að bera kennsl á þá öryggisþætti sem flutningsfyrirtækið og dreifiveitur kljást við. Það kom í ljós að fyrirferðamestu öryggisþættirnir eru þættir sem taka á innri þáttum fyrirtækjanna. Einbeiting inn á við er að miklu leyti komin til vegna lagalegra krafna um öryggi. Stærsta ógn rafmagnskerfisins á Íslandi reyndist þó vera öldrun flutningskerfisins og mótlæti við tillögur um styrkingu kerfisins.

Niðurstöður þessarar ritgerðar eru þær að þó styrking og endurnýjun kerfisins sé mikilvæg er áríðandi að leysa stærri vanda. Öryggisþarfir Íslands liggja alfarið í þeirri miklu þörf fyrir stefnu í orkumálum sem tekur mið af þeim fjölmörgu öryggisþáttum samfélagsins sem eru samtengdir.

Abstract

Since the Cold War ended, understanding of the concept of security has expanded and moved away from the traditional territorial, state-centric view. One of the newer concepts within security is ‘societal security’ which focuses on the aspects of society vital for its inhabitants’ survival. This includes critical infrastructures such as the electricity infrastructure. This thesis utilizes the idea of critical infrastructure and societal security to examine the security awareness of actors within the electricity infrastructure in Iceland and the larger societal impact of electricity security.

In order to identify security issues faced by the transmission company and distributors in Iceland, this study draws heavily upon published material and targeted interviews. These reveal a focus on internal security issues, largely dictated by legal prescriptions concerning the operators’ roles and the conditions for their continued operation. The largest security threat to Icelandic society is identified as the ageing of the transmission system and the obstacles in the way of proposed construction to further strengthen the system.

This thesis concludes that while strengthening and securing the physical infrastructures is vital, a broader and more proactive approach needs to be taken at the political level. Iceland’s true security needs lie in the acute need for a comprehensive energy strategy that incorporates all the various aspects of societal security affected by electricity supply.

Preface

Security is one of those things I have always been interested in, without finding an avenue in which to direct it. At the beginning of my master's studies I was introduced to security understanding in the academic world, and I found the place I had looked for. In the 21st century the very concept of security is changing and incorporating more aspects of life that have hitherto been largely ignored as security issues. The term 'soft' security may seem to belittle the idea, but its importance is not lost on those who find themselves at home there.

Writing about electricity security and societal implications of its failure was something I had carried in my head for a while. Daily life is based in large part on things that run on electricity and without it we, as individuals and a society, would be like fish out of water. Although imagining society without electricity would be like something out of science fiction, this danger is very real. These issues and the Icelandic electricity structure were first brought to my attention by the people who later agreed to be my instructors during this thesis, to whom I owe many thanks.

Further pondering the Icelandic situation, I became interested in how the transmission company and distributors thought about security. What kind of issues did they see as security issues? How did they deal with security, or even think about it? These questions led me on the path that ultimately produced this thesis and are an extension of how I have approached security thinking for a long time.

During the work on this thesis I have received great support from my family and friends. I would especially like to thank Agnes Henningsdóttir, for listening to my endless ramblings and worries and for assisting and supporting me throughout my studies. I would also like to thank my instructors, Böðvar Tómasson for first introducing me to this topic and for his guidance throughout the work and Alyson JK Bailes for expanding my understanding of security and for excellent guidance and comments on my work throughout the process.

This thesis is the final assignment in the MA studies of International Relations at the University of Iceland. It accounts for 30 ECTS credits and the instructors were Alyson JK Bailes, Adjunct Professor at the University of Iceland, and Böðvar Tómasson, Division Manager, Fire and Risk at EFLA.

Contents

1. Introduction

Iceland presents an interesting case when it comes to security planning. Although fully taking part in the globalized, interconnected world, it is only now for the first time proposing work on a comprehensive national security strategy. In spite of having played a part in the Cold War by hosting a US military base and joining NATO, Iceland's security development – practical and psychological - has not followed the path most other states have.

In the first two hundred years after settling in Iceland, its inhabitants did not need to organize centralized defence structures, as the island was far away and without anything desirable to defend. In addition, being an island, there was no need to organise defences from neighbours.[1] On the contrary, external interventions during the rule of Norway and Denmark were needed to shield Iceland from persistent internal disputes.[2] Security and defence awareness therefore does not have a long history in the Icelandic culture, as reflected in the decision at the time of gaining independence in 1918 to declare the state 'forever neutral'. In fact, one could argue that Icelandic security strategy has always been imposed by others; first by Danish rule, then by the United Kingdom after its invasion in 1940, and at last by the United States through its military base, bilateral agreements, and multilateral defence cooperation in NATO.

The dominant Icelandic political elite has focused on its security in the most traditional sense, i.e. defence of its territory and sovereignty, and has secured it through bilateral agreements with the US and participation in security organisations such as NATO. However, Iceland's internal (or soft) security arrangements have not experienced such organized structuring, perhaps owing to the general view that such hazards are not 'security issues' but something the population just needs to deal with. This includes events related to the natural conditions on the island, such as reactions to natural disasters and search and rescue on both land and sea.

After the end of the Cold War, general perceptions and understandings of security issues have moved away from the traditional ideas of territorial defence of the state and military responses to threats. The security concept has been expanded to include a multitude of issues that affect other entities than the state, such as individuals, groups of people, or

[1] Sigurður Líndal. "Ísland og umheimurinn" in *Saga Íslands I,* ed.Sigurður Líndal (Reykjavík: Hið íslenska bókmenntafélag, 1974), 199-226, 218.
[2] Baldur Þórhallsson and Tómas Joensen, "Iceland's External Affairs from 1550-1815: Danish societal and political cover concurrent with a highly costly economic policy," *Stjórnmál og stjórnsýsla,* Vol 10, issue 2 (2014): 203.

societies. Military responses to such threats are not always the appropriate route to take, thereby including more actors in the security environment and making room for different approaches to solve insecurity.

In 2006, Iceland experienced quite a shock to its security structure when the US withdrew all its military personnel and assets from the Keflavik base and elsewhere. Although the US intent had been known for some time, it still came as a shock to many and revealed a large void which had not been planned for. It highlighted how deeply Iceland had depended so far on external actors to secure its security interests and exposed the dilemma created by an outdated understanding of security, as the focus was on keeping weapons to defend the state.

In efforts to have Iceland take an active part in its security, the US itself had encouraged the government to perform a threat assessment on which continued cooperation could be based. Unfortunately, the government did not perform such an assessment at the time, nor did it respond to the efforts of domestic actors who wished to extend their role in domestic security precautions. After the base was abandoned, another result of inactivity came to light: there had not been a conscious effort to take advantage of the military's presence and build local knowledge of security and defence. Perhaps a few experts working directly with such matters could handle specific tasks, such as those who took over the radar supervision and air defence: but as a society, Iceland appeared utterly incompetent.

Over a year after the US departure, an independent commission was given the task of performing a risk assessment, on which a national security strategy could be built. This assessment was published in 2009,[3] and in 2014 a cross-party proposal from Parliament on the creation of a national security strategy was published.[4] In April 2015 the Foreign Minister introduced a proposal for a parliamentary resolution incorporating the strategy.[5] This recent development is, apparently, the first occasion when the Icelandic government has been proactively working on its security. It also appears to have caught up with international security thinking, as the proposed new strategy focuses overwhelmingly on soft security, the island having secured its hard security needs already.

When discussing internal security in Iceland the discussion often wanders towards natural disaster responses, search and rescue, crime, or economic security. Although all such

[3] Ministry of Foreign Affairs, *Áhættumatsskýrsla fyrir Ísland: Hnattrænir, samfélagslegir og hernaðarlegir þættir* (Reykjavík: Ministry of Foreign Affairs, 2009).
[4] Ministry of Foreign Affairs, Proposal from the committee on forming a national security strategy for Iceland, http://www.utanrikisraduneyti.is/media/oryggismal/Thjodaroryggisstefna-skjal.pdf, (accessed February 2, 2015).
[5] Ministry of Foreign Affairs, "Utanríkisráðherra mælir fyrir þingsályktun um þjóðaröryggisstefnu," *utanrikisraduneyti.is,* April 21, 2015.,http://www.utanrikisraduneyti.is/frettir/nr/8405, (accessed April 21, 2015).

issues are important to address, there appears to be a gap in the political debate. Seldom does one hear the security discussion applied to the state's infrastructure: its roads, IT systems, energy systems, or transportation system. Discussion is surely not absent but it appears to be of a different kind, lacking comprehension of how serious such issues are as the vital foundations that society needs to function properly. As Iceland expands its understanding of security, this thesis will explore the security of the electricity infrastructure in terms of the security awareness of actors within the sector; the security issues they face; and the larger context of electricity security in Iceland.

This thesis attempts to answer two main questions about the Icelandic electricity infrastructure.

What does the security awareness landscape of firms that transmit and distribute electricity look like?

What are the main threats to their operations and future electricity security in Iceland?

Being an island, Iceland's electricity infrastructure is special in the sense that it is not connected to, or dependent upon, electricity from other states. Its security can therefore be better managed than for many other states, which need to incorporate actions and situations in other states into their strategies. However, as the security environment is very newly being addressed on a policy level, threats may not be as clear or accurately assessed as if there were a longer history of such calculations. Briefly put, internal security has been treated as centring on law and order so that more and more dimensions have been brought under the police and other agencies of the Interior Ministry, while issues not suitable for handling in that way – like economic and financial security - remain in limbo. Such a history could also hinder effective security planning and response, as restructuring may focus on protecting existing actors and systems, even if they may not be needed, or be reluctant to add new actors in.

In exploring these processes, the present thesis relies heavily on previously published material such as official reports and legal documents. As the work on the first national security strategy is still underway, there will be few authoritative sources directly addressing the topics of this thesis. However, identifying written material that addresses the issue in some way can provide a useful glimpse into the process of building the framework in which electricity infrastructure security has so far been constructed. In order to compensate for the lack of written data, interviews have been conducted with individuals directly embedded into the framework. These will provide the best insight into the environment, the division of tasks and responsibilities, and the process of building and reshaping the security framework.

In order to limit the scope of this thesis, the focus has been placed on the security awareness of the electricity transmission company and the distributors, as well as those institutions that play a role in the security structure within the electricity sector. Although production firms could have been a valuable addition to this thesis, they were excluded in the light of time and length considerations. One could argue that energy production is a security issue all to itself and would deserve its own review, although it naturally impacts on electricity delivery security. Additionally, as interviews with distributors outside the capital area were not an option, this thesis relies on written material concerning their security awareness.

Although the option of a submarine cable between Iceland and Britain has recently been part of the electricity production debate– and its supporters often make security-related arguments, notably about the chance to import electricity in a crisis - that subject will not be discussed in the present thesis. Britain is currently working on its energy strategy post-2020 and is pressing the Icelandic government to enter into discussions about the possibility of such a cable.[6] Because the project is still in the conceptual stages, however, and has not become a reality in Iceland's energy production environment, this thesis will not take it specifically into account. Such a project would have an immense impact on energy production and infrastructure, impacts that are not known well enough to include in a scan of security awareness (and potential solutions) within the electricity sector in Iceland today.

The thesis begins by defining the concepts and theories it relies on in its analysis. The next, theoretical chapter introduces the theory of constructivism: how it deals with interactions between actors and the structures within which they interact. This will help provide an insight into the security environment in Iceland, assist in understanding how it has developed, and perhaps provide clues to how it may change. The chapter then introduces the dominant concept of securitization, which describes the act of moving issues into the privileged situation of being an urgent, priority issue in politics. It discusses whether such a view of security is necessarily the most appropriate or helpful way of thinking about the matter, and goes on to explain the way in which security will be approached through this thesis.

As a third conceptual focus, the concept of critical infrastructure protection is explained. Its origin is rather new, as it arose out of the new broader understanding of

[6] Svavar Hávarðsson, "Bretar kalla enn eftir viðræðum um sæstreng við stjórnvöld hér," *visir.is,* April 21, 2015, accessed April 22, 2015 http://www.visir.is/bretar-kalla-enn-eftir-vidraedum-um-saestreng-vid-stjornvold-her/article/2015704219953

security. Reference is made to the debate over whether security threats need to be known completely in order to be addressed, or not, in relation to policy-making and response plans. The chapter then moves onto human security, which focuses on (a wide range of) security threats to the individual. It introduces the debate over what standards to use when including issues in the category of security. Because of the many and serious domino effects that failure in electricity infrastructure can have on society, the human security framework is used in an effort to preserve security thinking from being over-focused on one aspect, whereas in real life security is never experienced in a void. Finally, another term used in Nordic countries (and increasingly in Iceland) to embrace the agenda in which infrastructure security is included –'societal security' is introduced and its merits explained.

Having thus introduced the theoretical foundations of the thesis, the third chapter explores the physical layout and structure of Iceland's electricity infrastructure. It introduces the legal framework that outlines the responsibilities of those operating within the electricity sector regarding safety and security. The Electricity Act sets up the division of roles and responsibilities, and further regulations develop the actors' responsibilities when it comes to delivery security, monitoring of operations, and the physical construction of the electrical structures needed to operate. This chapter will also introduce the main actors discussed in this thesis and briefly describe their role in the electricity sector structure.

The fourth chapter maps security awareness by listing threats to security as the actors define them. These are often similar across the sector, as the nature of operations is often similar, yet some aspects are emphasized by certain actors while being regarded as secondary issues by others. This chapter will introduce security issues within the firms' operations as identified by the transmission company, the distributors, and external actors. It will mention the existing forums for security cooperation before moving onto security issues external to the firms' operations.

The fifth chapter will place security issues facing the electricity sector in a larger perspective. It begins by summing up the picture of security awareness among actors within the electricity sector and relating it to the securitization theory introduced in chapter 2. It will then move to open up the security discussion by introducing four different elements of security that are intertwined and affect energy production, transmission, and delivery. Finally it identifies the most pressing security threat facing the electricity infrastructure, as presented by a general consensus within the sector. Proposed solutions to these problems and the opposition that they arouse will be discussed, as they are currently hotly debated among the Icelandic public. The analysis in this chapter will attempt to shed light on aspects left out of

the general discussion, and to open up an avenue of reflection that might help resolve the stalemate that the discussion seems to have reached. The chapter will end with comments on external risks. The thesis is then completed with brief conclusions and a bibliography.

2. Theoretical framework

This chapter introduces the theoretical foundations of this thesis. All of these theories and concepts have many aspects and applications. There are several different approaches to understanding them and many of them are subject to internal debate over the correct way to apply them. This chapter devotes most attention to the main debates or the most generally used approaches, while also prioritizing the elements that directly apply to this thesis and its objectives.

2.1 Constructivism

Constructivism is a theory in international relations that looks to the structure of the international system. It focuses on structures that are created through interactions and that reflect shared subjective meaning of the agents within the structure.[7] It also focuses on the identities of agents formed within the structures through interaction and the interests these identities suggest.[8] The state remains the main unit of analysis in an international context,[9] but there is nothing standing in the way of reducing that unit to societies, groups of people, or even the individual.

2.1.1 Identities

Constructivism approaches identities as non-constant, something that is tied to the context in which the actors live, be it historical, political, social, cultural, or all of the above.[10] Identities are the collective meanings of an actor that are built through self-understanding as well as others' understanding of the actor as a social object. One actor can therefore have multiple identities at any given time, which vary in salience.[11]

Identities serve a purpose in relations with others. They reveal to yourself and others who you are: they reveal who others are, and in so doing, reveal the interests and preferences that can help predict behaviour and choices, thus further stabilizing relationships and reducing uncertainty.[12,13] Identities are important in relations with others in order to have some level of

[7] Alexander E. Wendt. "Collective identity formation and the international state,"*American political science review* 88, no. 02 (1994): 385.
[8] Wendt, "Collective identity formation and the international state," 385
[9] Wendt, "Collective identity formation and the international state,"385.
[10] Ted Hopf. "The promise of constructivism in international state," *International security* 23, no. 1 (1998):176
[11] Wendt, "Collective identity formation and the international state," 385.
[12] Hopf, "The promise of constructivism in international state,"178
[13] Hopf, "The promise of constructivism in international state,"175

order and predictability in behaviour. This results in stability within the structure and eases interaction and negotiation through suitable behaviour.[14]

Identity includes the individuals, shared beliefs, and institutions that create a sense of belonging. The identity of a group provides (a) security and a place of belonging while differentiating the members from others; (b) predictability, through stable social identities in relation to others; (c) recognition by others; and (d) the possibility of development through the larger collective.[15]

2.1.2 Actors and structures

Constructivism sees actors creating structures at the same time that structures affect the actors.[16] A social structure can be made up of actors, practices, norms, territories, or technologies, i.e. anything that has a position within a social organization. If the elements are related within a structure they must be understood in the context of their position within the structure: they cannot be understood or defined independently of the structure because of the way it shapes them.[17]

Social structures are based on shared understandings, as well as expectations of behaviour and knowledge. These can give information about the nature of relationships between actors in the social structures, whether it be cooperative or a state of conflict.[18] Social structures, therefore, only exist because of the actors and their defining elements.[19] Social structures depend on their components and on their perception of the structure, unlike natural structures that exist independently of any other elements' perception of them.[20]

Yet social structures do not simply reside in the minds of the actors within them. They are constituted through the practices and processes of the actors. Therefore, ideas matter and can change the structures, since interests and powers only have an effect by means of shared knowledge.[21] However, social structures, even if created by the relevant actors, are not simple to change. Sometimes, these structures constrain the possible action of the actors within them, making attempts at change very difficult, if not impossible.[22]

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[14] Hopf, "The promise of constructivism in international state,"174
[15] Wendt, "Collective identity formation and the international state,"385.
[16] Alexander E. Wendt "The agent-structure problem in international relations theory." *International organization* 41, no. 03 (1987): 350.
[17] Wendt, "The agent-structure problem in international relations theory,"357.
[18] Alexander Wendt. "Constructing international politics." *International security* (1995):73.
[19] Wendt, "The agent-structure problem in international relations theory," 358.
[20] Wendt, "The agent-structure problem in international relations theory," 359.
[21] Wendt, "Constructing international politics," 74.
[22] Wendt, "Constructing international politics," 80

Agents and structures are ontologically distinct, while simultaneously being related and dependent upon each other. They affect each other and cannot be understood out of context with each other.[23] Social structures shape the actors and elements within them, such as the understanding of interests and methods of interaction.[24] These structures are in turn the accumulated result of previous behaviours; they cement the methods of communication and stances associated with each actor within them, and thereby the actors' conception of their interests.

2.1.3 Constructivism and the Icelandic security environment

Constructivism is a very appropriate tool to use when looking towards the elements that make up the security environment in Iceland, including specifically those directly concerned with electricity infrastructure security. The roles they play, their identities and perceptions of themselves as well as others within the structure, their interaction and general perception of the security structure will not only fit perfectly within the research of constructivist theories, but give great insight into the inner workings of security within Iceland.

Constructivism attempts to explore the relationship between agents and elements of a structure and the structure itself, where each has impacted upon the development of the other. It is the most appropriate theory and framework to follow in exploring the development and current position of security actors and policy in a specific sector within Iceland. It will assist in understanding how the division of roles has developed and what elbow room there is for change. It will facilitate the understanding of relationships between the legal framework, the government, the private companies, and other actors in the security environment, and shed light on the possibilities for future development and change within this structure.

As constructivism also emphasizes shared meanings and knowledge, it provides an opportunity to explore the understanding of security and perception of threats: asking whether these are shared between all elements within the structure, or whether there are discrepancies that need to be addressed to stabilize the structure.

2.2 Security and securitization

Security is a term that traditionally has described existential threats. When something becomes a security issue it is labelled as such because it presents an existential threat to the referent object, which can be the state, the government, or society. A security label allows the use of extraordinary means to handle the threat and legitimizes the use of force. It allows the

[23] Wendt, "The agent-structure problem in international relations theory," 360.
[24] Wendt, "The agent-structure problem in international relations theory," 359.

state to take special powers, utilize the resources at its disposal, and mobilize them to deal with the threat.[25] A security label moves the issue from the normal realm of politics to a higher status, either as above politics or a special kind of politics.[26] What is considered an existential threat is different across sectors, societies, and states.[27] Security in itself is subjective, as the human actors involved are those who decide whether an issue is a security issue and whether the referent object of securitization is important enough to be considered crucial to the survival of the state.[28]

Public issues can be situated on a scale ranging from non-politicized to securitized. When an issue is non-politicized the issue is not a part of public debate and it is not something the state deals with. An issue can become politicized when it becomes a part of public policy and the government deals with it through resource allocation and decision-making. When an issue reaches the other end of the spectrum and becomes securitized it is presented as an existential threat that justifies extreme measures or actions beyond the normal political procedure.[29] Securitization can be ad hoc or become institutionalized if threats are persistent or recurrent, such as natural events in Iceland. Response plans for such events, as well as the degree of urgency attached to them, are therefore often institutionalized in society.[30]

The Copenhagen School which developed the securitization concept looks at security as something constructed through speech and politics. Any issue, at any time, therefore, has the potential to become securitized, as the criteria for labelling it do not follow an objective scale but a subjective one. This also implies that different societies securitize different issues, and even the same society will securitize different issues at different times.[31]

Securitization is considered successful when it not only presents an existential threat but gets it recognized as such; and mobilizes emergency action; and affects other issues by abandoning the normal rules.[32] Issues do not become securitized because someone identifies them as existential threats, but because the audience decides to believe it and measures are taken in accordance with this.[33] When securitization builds up a public view of multiple

[25] Barry Buzan, Ole Wæver, and Jaap De Wilde, *Security: A New Framework for Analysis* (Lynne Rienner Publishers, 1998), 21.
[26]Buzan, Wæver, and De Wilde, *Security: A New Framework for Analysis*, 23.
[27] Ibid, 27
[28] Ibid, 31
[29] Ibid, 23-4
[30] Ibid, 27
[31] Keith Krause. "Critical Theory and Security Studies The Research Programme of Critical Security Studies'." *Cooperation and Conflict* 33, no. 3 (1998): 313.
[32] Buzan, Wæver, and De Wilde, *Security: A New Framework for Analysis*, 26
[33] Buzan, Wæver, and De Wilde, *Security: A New Framework for Analysis*, 31

threats and dangers requiring tough action, this inevitably leads to security politics that focus on negative views and reactionary policies towards security. [34]

When security threats are understood to be constructed through speech-acts, the process of securitizing issues is dependent upon discursive legitimisation. Through speech-acts and the approval thereof, arguments, dialogues, and shaping of understanding of security issues take place. The act of securitizing issues depends on the audience's acceptance and understanding that the issue at hand poses an existential threat to the state or society.[35]

This constructivist understanding of security highlights the possibility that things not constituting an existential threat, or not suitable for handling with security methods, can nevertheless be securitized and acted upon in ways that are neither effective nor normatively acceptable. An example would be a case where ethnic minorities are defined as a problem for security in themselves and militaristic measures are taken to address the constructed threat. Conversely, issues and vulnerabilities that have an objective possibility for existentially threatening society or the state may be overlooked or ignored, based on the subjective understanding and views of the ones with the power to provide a securitizing speech-act.

While these lessons of the securitization discourse are important, the Copenhagen School's approach ignores the possibility of an issue being a real security threat whether it is talked about as such or not. Any serious vulnerability in a society's way of life is a security threat, whether or not someone openly admits to wanting to exploit it or securitize it. Security issues should not always be at the mercy of being noticed and recognized by people with power to sway the public debate and to convince people to join the bandwagon. Some threats are constant, inherently built into our society, and some structures are always vulnerable, no matter how we may feel about them. A clear example is the infrastructure that provides the foundation of our society, whose existence is static, and whose practical importance does not depend upon other actors' arrival into the debate.

Where the securitization theorists are correct is in pointing out that security does not follow a structure where objective standards can always be used. It revolves around future events and hypothetical futures.[36] Security issues such as the environment or infrastructure protection are a concern for the existing level of civilization. The referent object is society and the levels of civilization it has achieved, the daily life its inhabitants are used to. The threat to

[34] Matt McDonald, "Securitization and the Construct of Security" *European journal of international relations* 14, no. 4 (2008): 564.
[35] Michael C. Williams. "Words, images, enemies: securitization and international politics." *International studies quarterly* 47, no. 4 (2003): 523.
[36] Buzan, Wæver, and De Wilde, *Security: A New Framework for Analysis*, 32.

society is that it loses this standing with all the powers and conveniences, as well as the safety that it provides.[37] Such issues are not necessarily viewed through objective measures of security, but depend for preventive measures on the relevant actors' subjective understanding of possible futures. However, the actual security threats inherent in these issues are not subjective or dependent upon actors' interpretation of their value to society. They reflect inherent vulnerabilities that will pose an existential threat to society and states, regardless of the speech-acts or securitization of the issue. The Copenhagen School, therefore, in efforts to broaden the security spectrum by allowing anything to possibly become a security issue, overlooks the simple fact that threats to states, societies, and people's lives can exist independently of the political debate. This being so, failure to securitize society's real vulnerabilities can be just as damaging for citizens as over-securitizing other issues that deserve a less politicized treatment.

2.2.1 The use of security in this thesis

Although some object to the use of the word security to cover a wide range of problems and national interests, and would rather use it in the traditional meaning referring to violence - or for newer theorists, based on speech acts or the constructed understanding that certain things are critical to the state's survival[38] - I will use the word in this thesis without hesitation. Security inherently refers to aspects that threaten survival. Whether this is the survival of the state or its people, even a portion of its people, should not be an issue in itself. Surely, states need to survive in order to provide for their inhabitants, but often the state itself proves to be the main threat towards the people living within its borders.

Security, as such, is therefore not a single denominator for some prescribed set of circumstances, but a word we can use to describe multiple issues. Naming something a security issue does not translate into the state having to militarize or fly into panic to make things safe. It can serve the simple purpose of placing the issue on the radar and changing the way individuals, organizations, and governments approach it – which may include rational, constructive, and cooperative measures. Timely recognition of a security problem allows preventive measures and can actually avoid being forced into a situation where an issue must be treated as a threat to the state or its inhabitants. Classifying an issue such as infrastructure protection as a security matter raises it on to the agenda and makes it easier to take precautions that will either facilitate solutions to the problems involved, or even prevent some of them altogether. Security, therefore, does not need to be a dramatic and immediate matter

[37] Buzan, Wæver, and De Wilde, *Security: A New Framework for Analysis*, 75.
[38] For example; Buzan, Wæver, and De Wilde, *Security: A New Framework for Analysis*.

that threatens the existence of the state or its foundations, but can refer to an underlying process and ongoing approach in maintaining the fundamental structures of the state.

The referent object for present-day security is the modern society and our ability to continue our way of life. Should the objective therefore not be to think of security in a larger perspective? Instead of positing a single process leading to securitization and a single set of negative consequences that follow, can security not also be about preventing critical aspects of the foundations of society from becoming wrongly securitized as the Copenhagen School writers fear? Security should not simply be about reactive policies or analyses of perceptions. Security should be about awareness and a responsibility for protection that guides actions and policymaking. Threats to security can exist whether the political discourse observes them or not, and treating security threats or vulnerabilities as non-existent until they have become securitized seems to be naïve and inherently reactive.

This thesis will explore the perception of Icelandic electricity infrastructure in the context of security, looking both at the legal frameworks and the opinions of people working within the security structure. It will define security not through speech-acts, but as an approach required to prevent critical situations and failures. Prevention, response plans, and the constructed understanding of infrastructure security in Iceland will all be included in the effort to understand how security is thought about, and to ask whether expanding the understanding of the concept could ensure better security in the future.

2.3 Critical infrastructure protection

Critical infrastructure as a security issue emerged in the mid-1990s. The term 'critical infrastructure' was coined by the Clinton administration in 1996, signifying a transition from the earlier use of 'infrastructure' as an element of military strategy to its new meaning for broader national security.[39] Infrastructure refers to an underlying physical system or organization within, for example, a country. This can include transportation structures, banking institutions, energy supply systems, health services, or information and telecommunication systems.[40] When an infrastructure is considered 'critical', it is because of the objective role it plays in the functioning of society. If a critical infrastructure becomes unable to perform its role, it can become an existential threat to society itself.[41]

[39] Claudia Aradau. "Security that matters: Critical infrastructure and objects of protection." *Security Dialogue* 41, no.5 (2010): 500.
[40] Jan Metzger. "The concept of critical infrastructure protection (CIP)." in *Business and Security: Public-Private Sector Relationships in a New Security Environment,* ed. Alyson JK Bailes and Isabel Frommelt (Oxford: Oxford University Press), 200.
[41] Metzger, "The concept of critical infrastructure protection (CIP)," 202.

A problem with the concept of critical infrastructure protection lies in the fact that it has moved from the technical level into the political realm. In the latter setting, the word 'critical' carries a meaning referring to crisis, which is a social event (created by those who observe it) and affects people, organizations, the society, or even the state itself.[42] When discussing elements of infrastructure in the political realm, we rarely refer to their physical properties. It is their services and the values society places on them that are to be protected.[43] Securitizing critical infrastructure involves the understanding that infrastructure serves as the foundation of society, and for society to survive, protection of critical infrastructure is vital.[44] The problem lies in the subjective and constructed nature of the terms 'crises' and 'security' that now become entangled with the concept, and which are not as clear as in objective technical terms.

Security policy concerns itself with the actors and the events that lead to crises; the context, the result and how they have been dealt with. Instead of measuring risks precisely, the objective is to identify all possible risks to the infrastructure in order, at least, to be aware of the risks and, at best, to be prepared to deal with them.[45] To reduce vulnerability, one does not need to accurately predict the events of crises. Any assessment is based on probabilities and is informed by what is considered reasonable or not, based on history, experience, scientific insight and so on. Probable threats do not need to be known precisely in order to manage the vulnerabilities of a system.[46]

Not being able to measure threats to the system in an exact quantitative way does not mean that these endeavours are not important. Risk awareness, as well as awareness of the infrastructure's importance to everyday life, can inspire preventive measures to reduce risk and increase awareness of threats.[47] The objective of security policy, therefore, is not to measure threats or crises mathematically, but to find the circumstances under which they emerge, consider how they may develop, and how they can be ended.[48]

When reducing system vulnerability, the consequential associated risk to other factors is reduced as well. Often, it is the effects and outcome risks from damaging events that are focused on through insurance and response plans, but such measures do not affect the underlying vulnerability. Reducing vulnerability is more difficult and expensive, and requires

[42] Metzger, "The concept of critical infrastructure protection (CIP)," 203-4.
[43] Metzger, "The concept of critical infrastructure protection (CIP)," 201.
[44] Aradau, "Security that matters,", 501
[45] Metzger, "The concept of critical infrastructure protection (CIP)," 205.
[46] Daniel Sarewitz, Roger Pielke, and Mojdeh Keykhah. "Vulnerability and risk: some thoughts from a political and policy perspective," *Risk analysis* 23, no. 4 (2003): 807.
[47] Metzger, "The concept of critical infrastructure protection (CIP)," 204.
[48] Metzger, "The concept of critical infrastructure protection (CIP)," 204.

political will.[49] The focus therefore is often placed on risk management and after-the-fact management instead of reducing vulnerability. In reality, for greater effectiveness and also better resource economy, the process should focus on reducing vulnerability through better policies.[50]

Infrastructure problems can originate from many sources: the weather, vandalism, system complexity, deregulation, or even economic growth.[51] Those who wish to keep security policy confined to crises or existential threats to infrastructures must confront the question of when an issue crosses the threshold from being a maintenance issue (a question of enabling business continuity for its users) to being a national security issue.[52] It is this narrow way of defining security, which fails to describe the underlying approach, that was objected to in chapter 2.2 above. Security should encompass a mind-set where ongoing maintenance and business continuity, as well as ad hoc existential threats, are all a part of the security challenge. Since it concerns critical infrastructures, in this case the electricity infrastructure, which is permanently in use, security never stops being relevant. Regardless of the owner of the physical structures, the users of the services, or the circumstances in which the system is being managed, security should not be reserved only for a crisis situation that threatens the existence of the state.

2.3.1 Critical infrastructure protection in Iceland

In modern society, electric power systems are the fundamental infrastructure.[53] When discussing critical infrastructure protection, we are once again deceived by language: full protection is never possible. Nor is that the objective. The objective is to protect the services provided by the infrastructure, which make words such as resilience or reliability more appropriate to use.[54] This thesis will explore the electricity infrastructure as a critical part of the foundation of Icelandic society, focusing on the preventive and responsive measures to threats to the system. As critical infrastructure protection has moved into the realm of politics, this thesis will not explore the technical aspects of its security, but the framework and approaches that the relevant human actors work within to prevent and respond to failures. It will, in essence, explore the measures in place to ensure resilience and reliability of the continued flow of electricity in Iceland, and different actors' roles in so doing.

[49] Sarewitz, Pielke, and Keykha, "Vulnerability and risk," 808.
[50] Sarewitz, Pielke, and Keykha, "Vulnerability and risk," 808.
[51] Massoud Amin, "Security challenges for the electricity infrastructure," *Computer* 35, no. 4 (2003): 8.
[52] Metzger, "The concept of critical infrastructure protection (CIP)," 200.
[53] Amin, "Security challenges for the electricity infrastructure," 8.
[54] Metzger, "The concept of critical infrastructure protection (CIP)," 207.

2.4 Human Security

The end of the Cold War provided a breathing space to look at security differently. The bipolar world and its security dilemma no longer dictated security thinking and academics and policymakers could expand their view from the state-centric, power-based model of international relations. The human security concept is an extension of this tradition and fits into the broadening of the security discourse.[55,56]

Human security is a relatively new concept within security studies. In 1994, the UNDP proposed in its Human Development Report that security should be redirected towards people's security, instead of states' security. It proposed that threats which affect many, such as hunger or disease, should be prioritized over traditional security concerns and that the preservation of people's daily lives should become a security issue.[57]

Traditional security in international security thinking focuses on the state, its military power, and its capabilities for defending its territory or deterring other states from attacking. The referent object of security has thus traditionally been the state and its territory. However, such threats are not what threaten the lives of most people: hunger, crime, disease, environmental contamination, and domestic violence are a few of the issues that threaten most people's lives on a daily basis.[58]

Human security does not pit the citizens against the state, as the state is, ideally, the provider of security and controls the resources, capabilities, and policies that can mitigate or reduce threats to human security. It simply points out that emphasizing state security can be at the expense of its citizens' security.[59] Although a state may be secure according to traditional understandings of security, its citizens can be very insecure.[60] Other theories within international relations that focus on the state as the main unit are incapable of confronting and dealing with the fact that states may pose a danger to their own inhabitants.[61] The concept of human security tries to draw attention to this mismatch.

Human security can be viewed as a framework to re-examine our understanding of the relationship between citizens and the state. It redirects our focus inward, towards the people

[55] Edward Newman. "Human security and constructivism." *International studies perspectives* 2, no. 3 (2001): 241.
[56] Alexandra Amouyel. "What is human security." *Human Security Journal* 1, no. 06 (2006):, 11
[57] Roland Paris. "Human security: Paradigm shift or hot air?." *International security* 26, no. 2 (2001): 89.
[58] Newman, "Human security and constructivism," 240.
[59] Newman, "Human security and constructivism," 240.
[60] Newman, "Human security and constructivism," 240.
[61] Andrew Mack. "A signifier of shared values." *Security Dialogue* 35, no. 3 (2004): 366.

from whom the state draws its legitimacy.[62] Turning attention to the problems affecting most people within society gives groups, often politically marginalized, a political voice.[63] The purpose is not to place every threat in the highest category of policy priority, but to shift security thinking towards different actors.[64] Placing the focus of security on smaller units than the state reveals the state's potential to be a source of threat, whether it is directly harming its citizens or failing to protect them from harm.[65]

Human security is defined as combining "freedom from want" with "freedom from fear." It has normative, ethical dimensions as it argues there is an ethical responsibility, in a context of emerging transnational norms of human rights, to shift the focus of security towards individuals. It also points to the empirical link between such an approach and stability within and between states, since an insecure population impacts peace and stability.[66]

Human security can be understood in two different ways, through the narrow definition and the broad definition. The broad definition seeks to shift the referent term of security to people and includes a wider range of issues that affect people, such as disease and poverty. The narrow definition does not agree on such an expansion of security issues and insists on not losing the special significance of threats: i.e., one should not take away from the importance the label security threat brings by handing it out to all possibly harmful scenarios.[67] Their most pressing issue with broadening the scope is that including everything as a security priority means nothing becomes a security priority.[68]

The narrow view concentrates on freedom from fear: freedom from militaristic and physical threats, based on threats of violence.[69] Violence, however, is only one threat among several that endanger individual security. Protection from violence is not the priority of those who are starving to death or being infected by preventable fatal diseases.[70] While the proponents of the narrow view criticize broadening the security concept because it makes it hard to set priorities in policy choices,[71] they ignore a large part of threats to human security by clinging to the traditional line of thinking about security threats as violence against the

[62] Taylor Owen. "Human security - conflict, critique and consensus: Colloquium remarks and a proposal for a threshold-based definition." *Security Dialogue* 35, no. 3 (2004): 377.
[63] Owen, "Human security – conflict, critique and consensus," 377.
[64] Owen, "Human security – conflict, critique and consensus," 380.
[65] Lloyd Axworthy. "Human security and global governance: putting people first." *Global governance* 7 (2001): 19.
[66] Newman, "Human security and constructivism," 240
[67] Owen, "Human security – conflict, critique and consensus," 375.
[68] Paris, "Human security," 93.
[69] Amouyel, "What is human security," 13
[70] Neil S. MacFarlane, "A useful concept that risks losing its political salience." *Security Dialogue* 35, no. 3 (2004): 369.
[71] MacFarlane, "A useful concept that risks losing its political salience," 369.

referent object. Defining security through the lens of traditional understanding, with a focus on violence, distorts the policy process by tending to view the military as the tool to solve security issues. In reality, there are several groups competing for the resources allocated to the military who are capable of resolving the underlying issues through other means than those the military employs.[72]

The broad view of human security encompasses more than threats from violence and includes human rights, education, good governance and health care.[73] It acknowledges that interdisciplinary work may be the best solution for tackling this multifaceted problem,[74,75] and is ready to sacrifice definitional accuracy in efforts to solve real-world challenges. Often, policies can address several different aspects of human insecurity through one type of action: e.g. through education a state can strengthen its democracy, reduce poverty, and more easily facilitate individual development.[76]

The difference between the broad and narrow views essentially lies in the scope of policy responses. The narrow view wants to keep the threats specific in order to develop policies to counter them, while the broad view wants to make the threats known without necessarily developing specific policy responses.[77] Definitional clarity is not strictly necessary if policy is able to address the issues and, in fact, interdisciplinary work could increase the chances of finding policy solutions for real-world problems.[78] Proponents of the narrow view accuse the broad view of introducing too many new issues as security threats, thus making it difficult for policymakers to respond adequately through resource distribution.[79]

In efforts to broaden the security spectrum, the inclusion of many new threats can by itself be seen as threats to security. When all potential harms become a security issue it becomes impossible to prioritize political action or distinguish the most relevant threats.[80] The usual approach to security raises issues to a priority status, but labelling everything a security issue makes everything a priority, and effectively nothing.[81] Its critics argue that it doesn't provide a framework of analysis that is useful for policymakers; it is simply a label to use in

[72] Ramesh Thakur. "A political worldview," *Security Dialogue* 35, no. 3 (2004): 347.
[73] Amouyel, "What is human security," 13.
[74] Owen, "Human security – conflict, critique and consensus," 377.
[75] Amouyel, "What is human security," 15.
[76] Amouyel, "What is human security," 15.
[77] Owen, "Human security – conflict, critique and consensus," 376.
[78] Owen, "Human security – conflict, critique and consensus," 377.
[79] Paris, "Human security," 92.
[80] Owen, "Human security – conflict, critique and consensus," 378.
[81] Owen, "Human security – conflict, critique and consensus," 379.

research that looks into non-military threats to domestic society.[82] Broadening the security concept makes priority in regards to policy choices difficult.[83]

Threats to human security do not depend on a category or a universal definition but are subjective insofar as they are threats that actually affect people, and both the reality and the perception of them will vary between societies.[84] While human security brings many threats to the table, it is impossible to prioritize them all. For that reason, each society should develop its own threshold for judging the point at which the threat elevates from being a security issue to a security threat. This category should be open in principle to all threats to human security, as death from floods or disease is no different from death from wars. If such events are preventable, policy responses should be in place to do so. Because different threats require different policy responses, the threats present should be prioritized according to which affects the greatest number of citizens. Elevating issues to security threats indicates severity and immediacy, and policy responses should be dictated by the conditions on the ground.[85]

In the years since the end of the Cold War, we have witnessed normative changes in the world: the increasing alignment of norms, internationalization of norms, and ethical standards increasingly finding their way into national laws and standards. Governance and socio-economic organization becomes the same and decisions in security increasingly look toward the needs and rights of human security. People's awareness of their rights, as well as expectations thereof, is having an impact on policymaking.[86]

2.4.1 Human security and electricity infrastructure in Iceland

Although articles on human security do not explicitly mention critical infrastructure protection as part of human security, it seems quite obvious that they should. Although disease and poverty are great problems in the world, one cannot overlook the foundations of the type of society in which one lives, including its level of technical development.

In Iceland, people are greatly reliant on technology and critical infrastructure in their daily lives. Electricity appears to be one of the central critical infrastructures and the services it provides are crucial for an uninterrupted daily life. Communications, banking, health services, storage of food, regulation of water and other services all rely on computers, which run on electricity. The importance of continued and uninterrupted flow of electricity therefore impacts people's lives in ways they may not even think of. Interruption of electricity

[82] Paris, "Human security," 96.
[83] MacFarlane, "A useful concept that risks losing its political salience," 369.
[84] Owen, "Human security – conflict, critique and consensus," 382.
[85] Owen, "Human security – conflict, critique and consensus," 382
[86] Newman, "Human security and constructivism," 241-2.

infrastructure services may therefore place people's health in danger, as well as economic security, food security, and - without communication abilities - perhaps even transportation to and from the island.

Of course, this is a worst-case scenario; but taking a lesson from the broad-view human security proponents, it is better to know of dangers to human security and have an idea of what to do to prevent them than focusing on few issues in detail and leaving out others. The present thesis is partially motivated by the domino effects that a failure in electricity supply can bring, and seeks to explore what steps are being taken to prevent human security issues related to electricity services from becoming security threats.

2.5 Societal security

Societal security can be viewed as the survival of a social group's culture, language, and identity as well as its material foundations.[87] In states' effort to secure their sovereignty and territorial integrity, societal security is a logical next step as it seeks to preserve an inherent part of a state's identity.[88] It has also been defined, more appropriately for the subject of this thesis, as society's "ability to sustain vital societal functions and secure its population's life, health, needs and basic values under extraordinary stresses."[89] It is therefore closely related to the idea of human security, although the latter has most commonly been applied to poorer states in the South while the societal concept was developed by European thinkers.[90]

Societal security is a concept the Nordics have used to reorganize their own security after the Cold War, as their focus has turned towards their internal and non-military security. Societal security is, in their interpretation, applied to threats and risks that concern the individual rather than the state, such as terrorism, crime and other transnational, non-military threats. Civilian departments or agencies – rather than the military - respond to challenges in societal security, further distinguishing it from the traditional security response and, perhaps, introducing greater flexibility in response options.[91] Being a civilian-centred aspect of security, many issues in societal security concern property and activity that is not owned or operated by the government. Securing these aspects of society therefore invites and, to a

[87] Barry Buzan *People, States & Fear: An agenda for international security studies in the post-cold war era* (ECPR Press, 2008), 38.
[88] Tobias Theiler, "Societal security and social psychology," *Review of International Studies* 29, no. 2 (2003): 250.
[89] Norden NordForsk, Nordic Societal Security Programme, *nordforsk.org* http://www.nordforsk.org/en/publications/publications_container/nordic-societal-security-programme (accessed January 27, 2015). 4.
[90] Alyson JK Bailes & Þröstur Freyr Gylfason, "'Societal security' and Iceland," *Stjórnmál og stjórnsýsla* 1 vol 4 (2008): 25.
[91] Bailes & Gylfason, "'Societal security' and Iceland,": 25.

degree, expects private business and local authorities to take part in security planning, responding, and re-normalizing their respective operations in case of a crisis.[92]

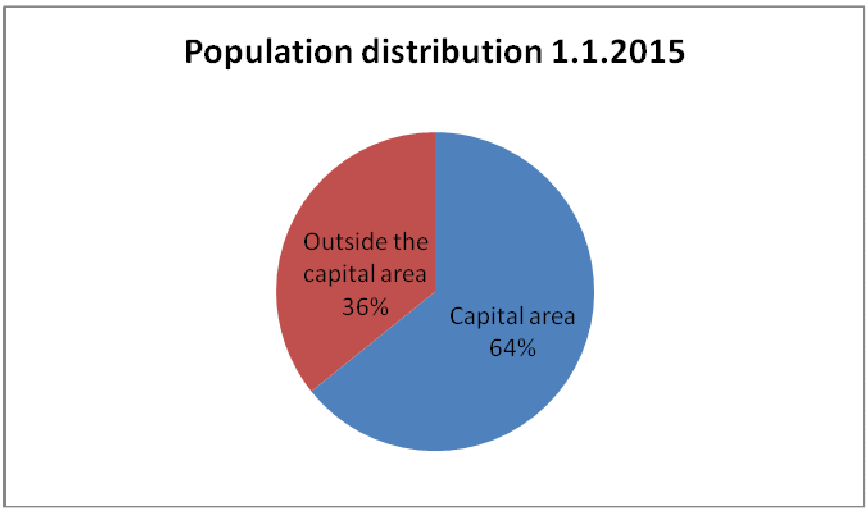
For most states, many of the issues that fall under the societal security framework are part of an interconnected transnational system, such as electricity infrastructure for mainland Europe or transnational crime. Focus on such issues encourages international cooperation in collective security, as the globalized, interdependent world rarely experiences security issues that threaten only one state.[93]

Critical infrastructure security touches on several different aspects of security: culture, norms, identity, economic security, health security, state security, and so on. The survival of a culture, a society, or a state depends in large part on the continued functioning of its critical infrastructure. However, this thesis will have to limit itself to a narrower range of interdependencies, as there is not room to explore in detail the connections between stable electricity services and culture and other elements of human security. The focus will be on the structures surrounding electricity infrastructure security and the efforts made to prevent, coordinate, and respond to failure in its services, as well as an exploration of how far security assessments have gone beyond routine disruptions. One should, nonetheless, always be aware that, should there be a critical failure of the system, the domino effects on multiple dimensions of human and societal security could have drastic effects.

[92] Bailes & Gylfason, "'Societal security' and Iceland," 25.
[93] Bailes & Gylfason, "'Societal security' and Iceland," 25.

3. The Icelandic electricity system

Iceland is an island in the Northern Atlantic Ocean, 103.000km^2 and sparsely populated. Settlement in Iceland is along the coast around the country, leaving about 80% of the island uninhabited, mostly the mountainous environment in its centre.[94] On 1 January 2015 Iceland had 329.100 inhabitants, 64,2% living in the capital area of Reykjavík and adjacent towns.[95] Only four urban areas outside of the capital area had over five thousand inhabitants; Akureyri (18.191), Árborg (8.052), Reykjanes (14.924), and Akranes (6.767).[96]



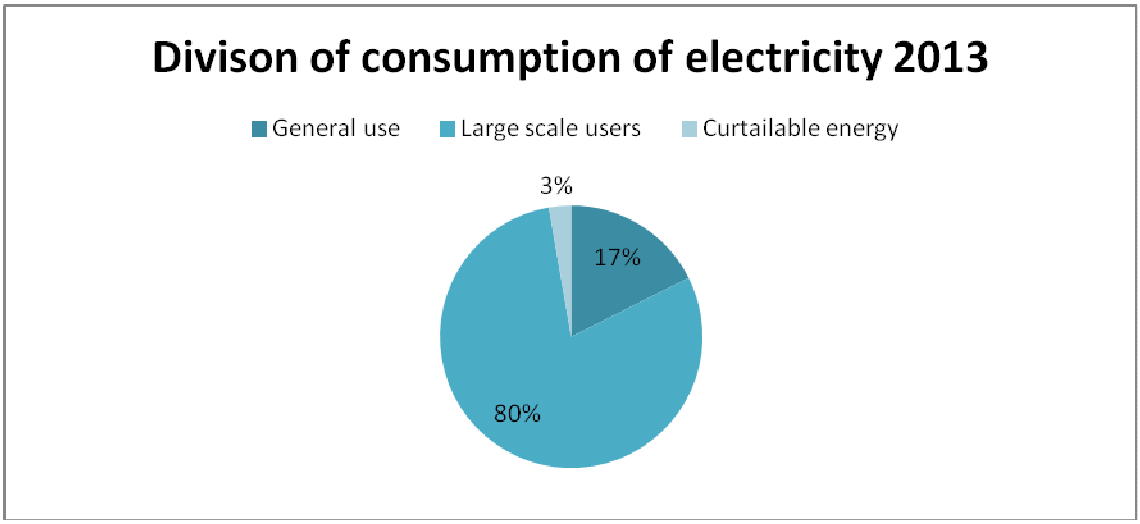
Population distribution in Iceland 1 January 2015[97]

General electrification in Iceland began in the 1930s. Probably because of the pattern of settlement, until the 1960s the emphasis was placed on getting electricity to rural areas and building regional distribution stations. In 1984, after a decade's work, the transmission system finally reached across the entire country through connection lines between regions.[98] Iceland therefore has only one central transmission system and several smaller regional distribution systems. The transmission system is owned and operated by a government-owned company, Landsnet hf, which oversees the transportation of electricity from power stations to regional distributors and power-intensive industries.[99]

[94] "Geography," Iceland.is,accessed March 18, 2015, http://www.iceland.is/the-big-picture/nature-environment/geography/.
[95] Statistics Iceland, "Mannfjöldi eftir kyni, aldri og sveitarfélögum 1998-2015," Statistics Iceland, accessed March 18, 2015, http://hagstofan.is/Hagtolur/Mannfjoldi/Yfirlit
[96] "Mannfjöldi eftir kyni, aldri og sveitarfélögum 1998-2015."
[97] "Mannfjöldi eftir kyni, aldri og sveitarfélögum 1998-2015,"
[98] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni* (Reykjavík, Ministry of Industries and Innovation, 2011), 6.
[99] "Raforkukerfið," Landsnet, accessed February 10, 2015, http://landsnet.is/raforkukerfid/.

The transmission system's total length is 3.169 km and runs on voltage from 30 kV to 220 kV.[100] The highest operating voltage is 220 kV, while a large part of the system operates at 132 kV, and a small part on 66 kV and 33 kV. The newest lines in South-Western Iceland have capacity to operate at 420 kV, but operate today at 220 kV[101] as energy consumption does not so far require a higher voltage. The transmission system consists mostly of overhead lines, although a portion of the system is underground.[102] Line support structures are made of timber or steel, designed to withstand pressure from wind, icing, and voltage strength.[103]

Icelandic electricity consumption is growing. In 2005 the total electricity transmitted through Landsnet hf's transmission system was 8.305 GWh, but in 2013 it was 17.490 GWh.[104] In 2013 total volume in the transmission system was 17,49 TWh, of which 3,12 TWh went to distributors and 13.98 TWh went to large scale users.[105] Icelandic energy consumption is therefore dominated by large scale users, as roughly 80% of electricity is used by power-intensive industries (notably, aluminium smelting).[106]

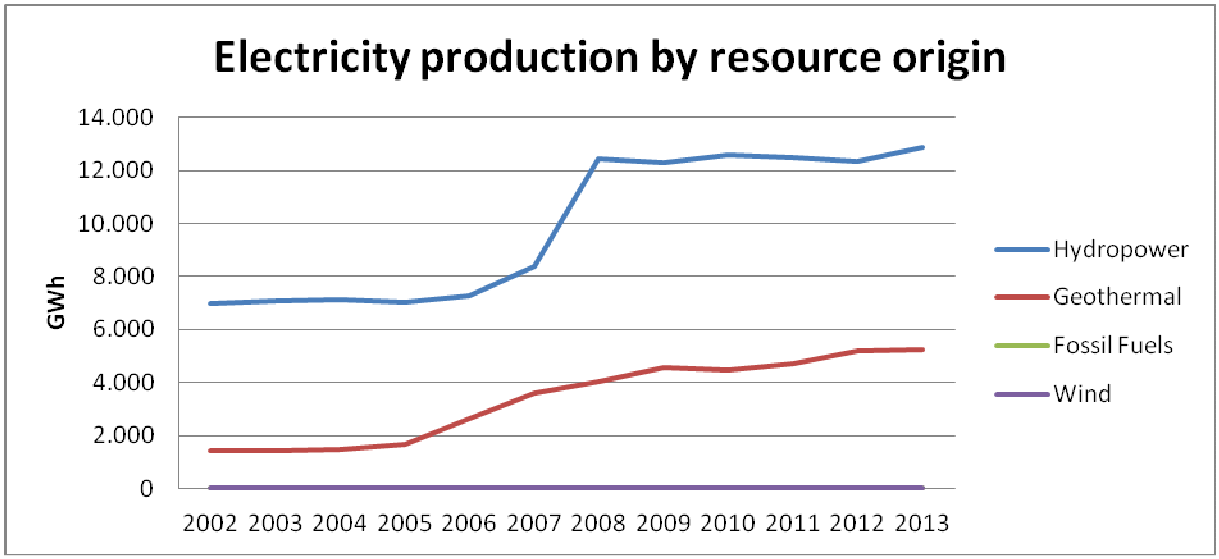


Division of consumption of electricity 2013[107]

[100] "Flutningskerfi Landsnets," Landsnet, accessed February 10, 2015, http://landsnet.is/raforkukerfid/flutningskerfilandsnets/
[101] "Raforkukerfið."
[102] "Flutningskerfi Landsnets."
[103] "Háspennulínur," Landsnet, accessed February 10, 2015, http://landsnet.is/raforkukerfid/flutningskerfilandsnets/haspennulinur/
[104] "Flutt orka um kerfi Landsnets," Landsnet, accessed February 10, 2015 http://landsnet.is/raforkukerfid/raforkumarkadurinn/fluttorka/
[105] Landsnet, *Kerfisáætlun 2014-2023.*(Reykjavík, Landsnet, 2014), 29.
[106] National Energy Authority, *Orkumál – Raforka,* 8, no 1 (2012) http://www.os.is/gogn/Orkumal-arsrit/Orkumal-Raforka-2012-8-1.pdf: 4.
[107] "Raforkunotkun, stóriðja, almenningur og skerðanleg notkun," National Energy Authority, accessed March 20, 2015 http://os.is/yfirflokkur/raforkutolfraedi/raforkunotkun-storidja-almenningur-og-skerdanlega-notkun.

3.0.1 Power plants and production

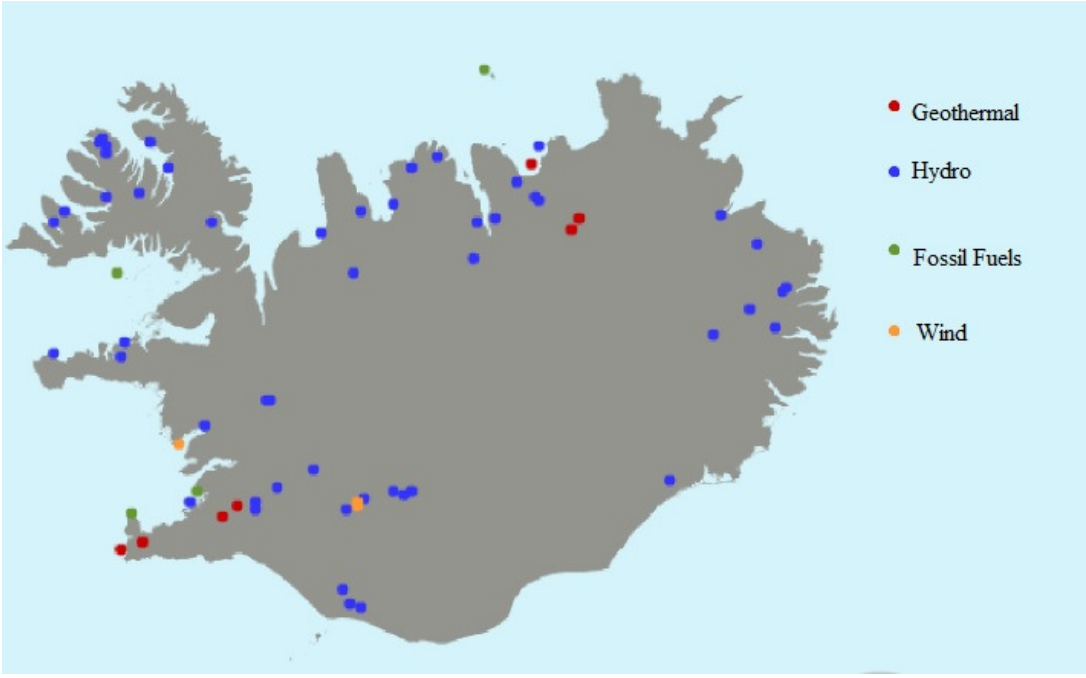
As a country rich in natural resources, Iceland's energy production is based on renewable sources. 73,81% of electricity is produced with hydroelectric power and 26,18% with geothermal power.[108] Fossil fuels account for just 0,01% of electricity production and are used in emergency generators to cover operational disruptions.[109] Recently, wind power has been added to the list.[110]



Electricity production by resource origin[111]

All power-plants that operate at 7 MW or more are required by law to connect to Landsnet hf's grid. Electricity is then fed to distributors at 57 locations and to power-intensive industries at five places around the country.[112] The power-plants are distributed throughout Iceland, yet only a few - mainly located in South West and Eastern Iceland - produce significant amount of electricity.

[108] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni,* 36.
[109] National Energy Authority, *Orkumál – Raforka*, 3.
[110] Mbl.is "Rekstur vindmylla umfram væntingar," *mbl.is*, accessed March 30, 2015. http://www.mbl.is/vidskipti/frettir/2015/03/17/rekstur_vindmylla_umfram_vaentingar/.
[111] "Raforkuvinnsla eftir uppruna árið 2013," National Energy Authority, accessed March 20, 2015. http://os.is/yfirflokkur/raforkutolfraedi/raforkuvinnsla-eftir-uppruna
[112] "Raforkukerfið."



Power-plants in Iceland[113]

3.1 Legal Framework

3.1.1 The Electricity Act

The electricity sector owes its present structure and governance largely to the Electricity Act, nr. 65/2003, where the duties of the National Energy Authority were detailed and a government-owned company (Landsnet hf) was created to operate the transmission system. The Electricity Act addresses the production, transportation, distribution, and trading of electricity within Icelandic jurisdiction.[114] It has been amended a few times since 2003, on points relating to ownership and operation of the transmission system. An amendment in 2004 established Landsnet hf[115] as the only company allowed to operate the transmission system,[116] and in 2008 it was decreed that the state or municipalities should always have a majority holding in distribution companies, thus prohibiting any direct or indirect transfer of ownership of Iceland's natural resources out of the hands of public entities.[117] In 2011, the direct ownership by the state and/or municipalities of the company that oversees and operates the transmission system was further cemented.[118] While the transmission and distribution of

[113] "Iceland Energy Portal," National Energy Authority, accessed March 20, 2015. http://www.orkuvefsja.is/vefsja/orkuvefsja.html.
[114] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 8.
[115] Ibid, 8.
[116] Ibid, 12.
[117] Ibid, 8-9.
[118] Ibid, 10.

electricity remains under a special licence from the National Energy Authority, competition in the actual production and sale of electricity became free in 2003.[119]

3.1.2 Delivery security

Delivery security is synonymous with the reliability of electricity delivery and applies to both the transmission company and the distributors.[120] It is defined by the quality of voltage and frequency and the security of delivery through the transmission and distribution systems, along with communicating information to the end-users.[121] It is assessed by comparing the number of disruptions that occur without notice, and the scale of electricity outages that result, year against year within the firm and as between firms.[122] The transmission company and the distributors are required to set their own goals for delivery security, which the National Energy Authority either approves, or changes if it deems them unrealistic.[123]

Delivery security is one of the cornerstones of security in the transmission system and is always cited when mentioning security in the electricity sector. It is the focal point of electricity security for the NEA[124] and the issue around which other security measures revolve. Although it is one of the most emphasized aspects of electricity security in legislative terms, it is not equal in practice everywhere in Iceland. It is highest in the South West corner, where most of the power plants are found and most of the economic activity takes place. Residents outside the capital area experience disruption and outage far more often than the residents within the capital area,[125] the Westfjords experiencing the lowest delivery security and reliability score in the system. The main reason is that the region has only one transmission line, which runs through a rough landscape that often experiences bad weather and hinders quick repairs. To palliate these outages, a back-up generator is being built that should lessen the impact and secure some degree of continued electricity supply.[126]

The transportation system between regions is weaker than the distribution systems within them, resulting in poor transmission to the end-user. Although efforts are made to equalize delivery security, it is evident that it cannot be fully standardized at this time due to how the system is structured. Regions that experience frequent disruptions or poorer delivery

[119] "Raforkumarkaðurinn á Íslandi," Landsnet, accessed February 10, 2015, http://landsnet.is/raforkukerfid/raforkumarkadurinn/.
[120] Reglugerð 1048 um gæði raforku og afhendingaröryggi, 1048/2004, *Reglugerðasafn,* http://www.reglugerd.is/interpro/dkm/WebGuard.nsf/key2/1048-2004 (Accessed March 24, 2015): 4.gr.
[121] Reglugerð 1048 um gæði raforku og afhendingaröryggi, 4.gr.
[122] National Energy Authority, *Orkumál – Raforka*, 6.
[123] Reglugerð 1048 um gæði raforku og afhendingaröryggi, 10.gr.
[124] National Energy Authority, interview conducted by author in Reykjavík, April 9, 2015.
[125] Landsnet, *Kerfisáætlun 2014-2023*, 31.
[126] Landsnet, *Kerfisáætlun 2014-2023,* 35.

security rely on back-up generators, usually supplying their health care services, law enforcement, and fire departments, but leaving the general public with deficient energy. It is important to ensure electricity supply and delivery security, even if it comes from back-up generators,[127] as the impact of electricity outages is increasingly critical for society and the economy. However, as a priority in operations from both the legal framework and as the ultimate function of the transmission and distribution systems, back-up generators should not be an acceptable strategy to deal with diminished delivery security.

3.1.3 Monitoring

Monitoring is an integral part of security within the electricity sector. The National Energy Authority is the primary actor responsible for monitoring the firms' compliance with laws and regulations regarding operations within the electricity sector. It works with the Competition Authority to monitor pricing and operations that are open to competition.[128] Internal monitoring is also a large part of the sector's security environment and is required by law. Producers, the transmission company, and distributors are responsible for establishing an internal monitoring mechanism focused on the quality and delivery security of electricity. These mechanisms are supposed to be based on recognized standards and evaluated by accredited inspectors.[129] These internal mechanisms are tested by documenting deviations from standards set in conjunction with the NEA, and by the latter's processing of this information.[130] The NEA is required to base its monitoring on the internal monitoring of others to the extent possible.[131]

Monitoring standards do not only apply to delivery security and quality of electricity. Standards regarding structures, personal safety, IT security and other security aspects are used to keep safety and security issues organized and in check. These are, again, monitored by internal mechanisms as well as the appropriate external monitoring agents.

3.1.4 Construction regulations

Strict guidelines exist on the construction of electrical structures. These are based on safety principles that aim to protect life and property from possible damage resulting from the operations of these structures. Electricity is dangerous, and it is the responsibility of the firms to prevent their property becoming dangerous to people or animals. In general, structures and

[127] Department of Civil Protection and Emergency Management, *Áhættuskoðun Almannavarna*, (Reykjavík: Department of Civil Protection and Emergency Management, 2011), 15-16.
[128] Reglugerð um framkvæmd raforkulaga, 1040/2005, *Reglugerðasafn. (*Accessed March 24, 2015.) http://www.reglugerd.is/interpro/dkm/WebGuard.nsf/key2/1040-2005, 34. gr
[129] Reglugerð um framkvæmd raforkulaga, 1040/2005, 38. gr
[130] Reglugerð um framkvæmd raforkulaga, 1040/2005, 38. gr
[131] Reglugerð um framkvæmd raforkulaga, 1040/2005, 35. gr

electrical equipment have to be constructed and designed so that they do not jeopardize the safety of people and animals, the environment, or property while being built, maintained, and used.[132]

Technical aspects of electricity structures are required to be so designed as, on the one hand, to prevent electricity from posing a danger to people, animals, or property, and on the other hand, to withstand external pressures notably from the weather.[133] The main concern is to minimize the threat electricity poses to its environment and through physical contact. The structures also have to be constructed in such a way as to withstand the pressure from operational use, such as the voltage running through, and to be placed at a safe distance, e.g. in the case of overhead lines that could harm people or animals, interfere with other electrical lines and structures, place traffic in danger, or damage the environment.[134]

Monitoring of the safety of such structures falls under the purview of the Iceland Construction Authority. Monitoring is divided between security controls on the operators and monitoring by the ICA.[135] The ICA oversees the professional implementation of electricity security measures and decides on steps to increase the security of structures within the system.[136] An accredited inspection agency can, on behalf of the Construction Authority, carry out inspection, monitoring and investigations of structures and security systems of power plants, electrical equipment, structures and other equipment.[137]

The Iceland Construction Authority oversees electricity security matters, creates the framework for inspections of electricity structures, and oversees electricity companies' security systems as well as the work of electricians and the marketing of electricity. Its main role in electricity security is to supervise the defences of electrical structures against damage and risk, and against disruption from their operations, while also being active in the process of creating and interpreting rules and regulations on electricity security.[138] In order to ensure the safe operation of electricity infrastructure, it requires all firms to have an electrical security

[132] Reglugerð um raforkuvirki, 678/2009, *Reglugerðasafn. (*Accessed March 24, 2015.) http://reglugerd.is/interpro/dkm/WebGuard.nsf/key2/678-2009, 2.gr
[133] Reglugerð um raforkuvirki nr 678/2009, 7.gr
[134] Ibid, 10.gr
[135] Ibid, 5.gr
[136] Lög um öryggi raforkuvirkja, neysluveitna og raffanga 1996 nr. 146 http://www.althingi.is/lagas/nuna/1996146.html, (accessed February 23, 2015), 6.gr
[137] Reglugerð um raforkuvirki nr 678/2009, 3.gr
[138] "Rafmagnsöryggi," Iceland Construction Authority, accessed February 23, 2015. http://www.mannvirkjastofnun.is/rafmagnsoryggi

system in place, detailing plans, the division of responsibilities, internal monitoring and general monitoring of structures.[139]

3.2 The Actors

There are six main actors on the Icelandic energy market: (a) the energy production companies that produce electricity and feed it into the grid, (b) Landsnet hf, which receives electricity from the energy production companies and transports it to distributors, (c) the local distributors, who distribute electricity regionally to the end users, (d) power-intensive industries, which buy electricity in bulk and get it directly from the grid, (e) the energy sales companies that sell electricity to other users, and (f) the National Energy Authority, whose role is to monitor the companies involved in production and sale of electricity.[140] The main actors concerned with the infrastructure itself and the subjects of this thesis - Landsnet hf, the National Energy Authority, and the distributors - will be briefly introduced in this section.

3.2.1 Landsnet

In 2004, as noted, a change in the electricity laws established a government-owned company to operate the transmission system.[141] Law nr 75/2004 established Landsnet hf as the only company that is allowed to operate the transmission system, including power lines and other structures connected to power lines that transport electricity from producers to large-scale users and distributors.[142].

The owners of Landsnet hf are Landsvirkjun (64,73%), Iceland State Electricity (22,51%), Reykjavik Energy (6,78%) and Orkubú Vestfjarða (5,98%). These companies contributed their transmission structures in return for shares in the new firm, and after Landsnet hf bought the rest of the transmission structures, it became the sole owner of the transmission system in Iceland.[143] Landsnet hf's transmission system is the centre of the Icelandic grid; it transports electricity from producers to regional distributors, who transport energy to the end users.[144] Power-intensive users are fed electricity directly from the transmission system.[145]

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[139] "Öryggisstjórnun rafveitna," Iceland Construction Authority, accessed February 23, 2015. http://www.mannvirkjastofnun.is/rafmagnsoryggi/oryggisstjornun-rafveitna

[140] "Aðilar á markaðinum," Landsnet, accessed February 10, 2015, http://landsnet.is/raforkukerfid/raforkumarkadurinn/adilaradmarkadnum/

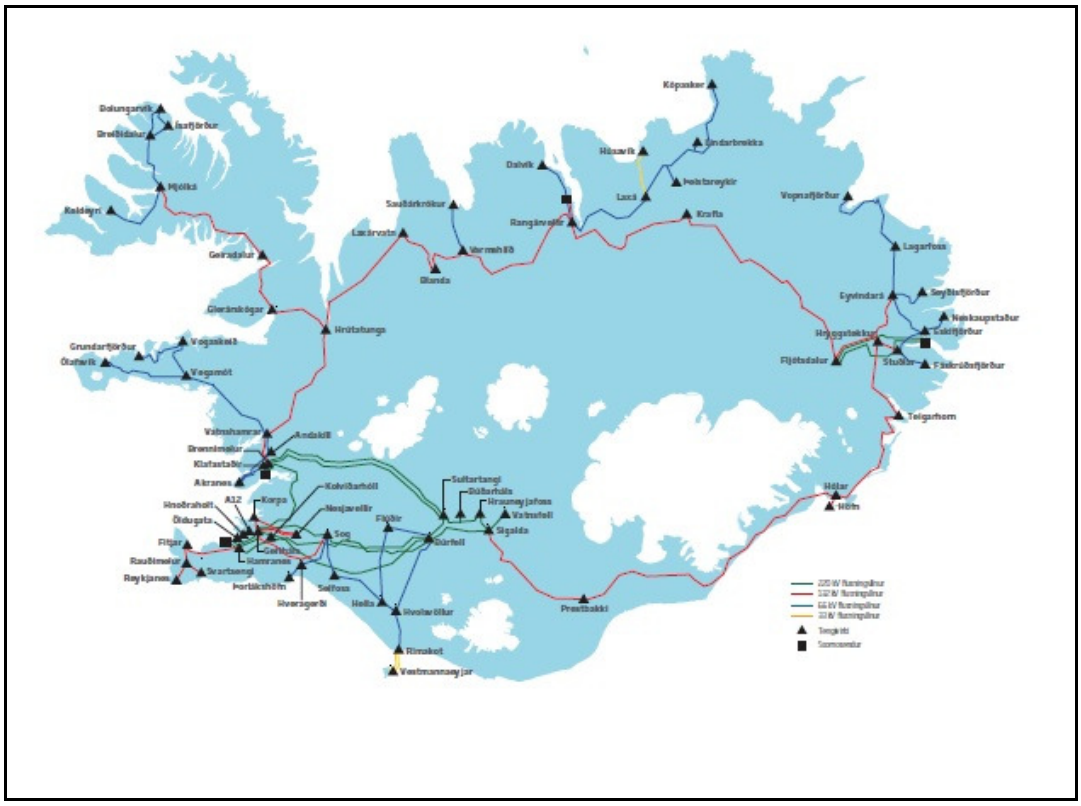
[141] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 8.

[142] Lög um stofnun Landsnets hf. 2004 nr. 75 http://www.althingi.is/lagas/nuna/2004075.html (Accessed February 23, 2015), 4.gr

[143] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 13.

[144] "Frá virkjun til notenda,"Landsnet, accessed February 10, 2015 http://landsnet.is/raforkukerfid/raforkumarkadurinn/fravirkjuntilnotenda/

[145] "Frá virkjun til notenda."



Map of Landsnet's transmission system at the end of 2013[146]

Apart from operating the transmission system, Landsnet hf is in charge of forecasting future electricity needs and developing the grid accordingly for the long term. Such a forecast is published every year, covering the next five years. Included in the publication are criteria for operational security and estimates of the boundaries of the system.[147]

Being the cornerstone of the state's electricity infrastructure, Landsnet hf places great emphasis on the efficiency and resilience of its systems. It operates a computer system to sense any deviation from normal flows and identify any breakdown within the grid. It can disconnect units from the system if it senses unusual activities that may badly affect the grid, and is required to analyze disruption within 0,1 seconds and react.[148] A 24/7 watch is held over the grid to ensure its operational security.[149]

In general, Landsnet hf operates a so-called N-1 system, where shutting down units that experience disruption does not affect other units' ability to deliver electricity. Parts of the system, however - mostly the 66 kV and 33 kV systems and small systems - are not fully operated as N-1 systems. Therefore, some disruptions can cause complete outage for the end

[146] Landsnet, *Kerfisáætlun 2014-2023,*115.
[147] "Raforkukerfið."
[148] "Kerfisvarnir," Landsnet, accessed February 10, 2015 http://landsnet.is/raforkukerfid/flutningskerfilandsnets/kerfisvarnir/
[149] "Kerfisstjórnun," Landsnet, accessed February 10, 2015 http://landsnet.is/raforkukerfid/kerfisstjornun/

users connected to these systems, if there is not enough backup power or local production to compensate.[150]

3.2.2 Distribution system operators

Six distributors operate in Iceland. They transport electricity from Landsnet's system to the end users through their own networks within specific areas. Companies that distribute and sell energy are completely owned by the state or municipalities.[151] The distributors are HS Veitur, Norðurorka, Orkubú Vestfjarða, Reykjavík Energy, Rafveita Reyðarfjarðar, and Iceland State Electricity.

Distributors	Areas they distribute to
HS Veitur	The Reykjanes peninsula, in the towns of Hafnarfjörður, Álftanes, and part of Garðabær, Árborg and the Westman Islands.[152]
Norðurorka	The northern city of Akureyri.[153]
Orkubú Vestfjarða	The Westfjords.[154]
Reykjavik Energy	Reykjavík, Seltjarnarnes, Kópavogur, the northern part of Garðabær, Mosfellsbær, Kjalarnes and Akranes.[155]
Rafveita Reyðarfjarðar	The urban area in Reyðarfjörður in Eastern Iceland[156]
Iceland State Electricity	All over Iceland, except for the Westfjords, South Western corner, Westman Islands, Akureyri and Reyðarfjörður.[157]

Iceland State Electricity was established on 1 August 2006, taking over operation of a previous state electricity company. Its system is 8000 km long, with 43% in the form of underground cables. Before the 2003 Electricity Act and the subsequent establishment of

[150] Landsnet, *Kerfisáætlun 2014-2023,* 31.
[151] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 7.
[152] "Dreifiveitur," National Energy Authority, accessed February 26, 2015 http://www.orkustofnun.is/raforka/raforkueftirlit/dreifiveitur/
[153] "Dreifiveitur."
[154] Ibid
[155] Ibid
[156] Ibid
[157] Ibid

Landsnet hf, ISE oversaw the wholesale marketing of electricity. Upon handing over this role, as well as selling most of its system to Landsnet hf, ISE became a stakeholder in the new company and owns 22% of the shares.[158]

3.2.3 National Energy Authority

The National Energy Authority is a government agency under the Ministry of Industries and Innovation[159] that advises the Government of Iceland on energy-related issues and topics. It oversees the licensing of operations within the energy sector, as well as monitoring the development and utilization of energy resources.[160] It gathers information on energy resources, their utilization, and society's evolving energy needs, and conveys this information to the government and the general public.[161] It also creates long-term forecasts and plans regarding energy consumption and utilization of energy resources.[162]

The National Energy Authority is a bureaucratic institution that is tasked with monitoring actors within the energy sector, making sure they adhere by rules and regulations.[163] It has responsibility for overseeing the implementation of laws concerning electricity and monitoring the book-keeping of companies that operate simultaneously in electricity and other fields, so as to ensure the energy accounts are kept separate. Its supervisory work is also designed to ensure security of supply for the end user, and fair prices.[164] To these ends, the NEA sets limits to the energy companies' profits, monitors pricing and quality of delivery, and handles complaints against electricity companies.[165] The NEA seeks to ensure that companies operate in accordance with the laws and regulations and fulfil the criteria required to operate in the sector, partnering with the Icelandic Competition Authority.[166] As part of its oversight duties, the NEA also issues licences to operate within the electricity sector.[167]

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[158] "Um RARIK," Iceland State Electricity, accessed February 26, 2015 http://rarik.is/umRARIK
[159] "Orkustofnun," National Energy Authority, accessed March 2, 2015 http://www.nea.is/the-national-energy-authority
[160] "Orkustofnun."
[161] Reglugerð um Orkustofnun, 400/2009, *Reglugerðasafn.* accessed March 2, 2015. http://www.reglugerd.is/interpro/dkm/WebGuard.nsf/key2/400-2009 2.gr
[162] Reglugerð um Orkustofnun, 400/2009,
[163] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 6.
[164] Sigurður H. Magnússon et al., *Skýrsla Orkustofnunar 2014 um starfsemi raforkueftirlits,*(Reykjavík, National Energy Authority, 2014), 8.
[165] "Raforkueftirlit," National Energy Authority, accessed February 10, 2015 http://orkustofnun.is/raforka/raforkueftirlit/
[166] Raforkulög 2003 nr. 65 http://www.althingi.is/lagas/nuna/2003065.html, (accessed February 5, 2015). 24.gr.
[167] Magnússon et al., *Skýrsla Orkustofnunar 2014,* 10.

4. Security awareness

As outlined above, the legal framework provides a strict framework for operating within the electricity sector. Firms are only allowed to operate under licensing; structural codes and regulations dictate the construction of their properties and infrastructure; standards for operation, quality, and delivery are rigorously monitored, both internally and externally, by multiple actors; and any expansion or change in operations is dependent on further licensing. Their operations are, therefore, guarded by strict boundaries that seek to ensure security for all parties involved and a fair treatment of the end-user. Abiding by these should ensure the minimum security that is required by law, but is in reality anything but minimum.

Yet there are several aspects to security that are worth probing further in order to gain a comprehensive understanding of the security awareness of the actors involved in electricity infrastructure. Although the threats confronting all firms in the sector are very similar, they are sometimes valued differently depending on the type of firm in question. This chapter will briefly introduce the different safety and security issues these firms face, internally and externally, and the domestic cooperative forums where such matters are discussed. The chapter will end by introducing two external security issues that arise from long-term energy production strategies, and the debate on environmental protection versus further development of the transmission system.

It is important to note that while discussing security awareness – in this instance - safety issues are included. This is mainly because in Icelandic the same word is used for both security and safety, making it difficult to distinguish between the two; but also because safety issues in the context of infrastructure and essential services are inherently related to security.

The security issues presented below are largely identified through interviews and reports from the firms themselves. Because of the sensitive nature of security measures, the purpose of this chapter is not to evaluate or detail security mechanisms within the firms. Instead, the purpose is to shine light on the multiple security issues that are dealt with in daily operations, both legally required for continued licensing of operations and independently identified issues that are of concern for the firms.

4.1 Security issues within the firms

Because the law clearly outlines firms' roles and how critical aspects of their operations are to be performed, a large part of their security awareness and related work revolves around fulfilling the requirements of laws and regulations. These are, as mentioned above, building codes, definitions of delivery security and quality of electricity, and the connected internal

monitoring mechanisms.[168,169] Other aspects that fall under the security spectrum are, however, worth exploring as they give a more rounded picture of the safety and security issues on the radar of firms and institutions within the electricity sector.

These companies' first priority is the safety of their employees. Electricity is dangerous, and the emphasis placed on proper procedures in all work, rigorous training, proper use of equipment, and proper use of protective gear reflects the main safety concerns when it comes to personal security within the firms.[170,171] Employees are educated on safety and security issues to increase their security awareness and to make them capable of providing a safe work environment for themselves and others. [172,173]

Although special attention has to be paid to individuals who work in close proximity to electricity, other health concerns are not disregarded. Landsnet hf prioritizes safety and security in its company culture, educating their staff on different issues that apply to their jobs, including first aid and mental health. Safety and security issues are tied to daily behaviour and the work environment, as stress, communication problems, and negative attitudes can have ripple effects on security.[174] Safety and security are, therefore, integrated aspects of every employee's daily work and permeate everything from work procedures to behaviour within the work environment. As safety and security is always on people's minds and integrated as a part of the company culture, it is easy to communicate about such matters: employees are encouraged to be alert, to think of security as fluid and constant, and to learn to identify and predict possible security issues before they arise.

Having employees trained to be vigilant and security aware in their daily work increases the company's security overall, as the people on the ground will act as the eyes and ears of the security management team and be able to identify and report security risks. Increasing everyone's security awareness makes it easier to identify possible security risks as more people are looking out for them, even subconsciously. When the company culture, including communication and behaviours in the workplace, teaches security awareness, any changes in the environment will trigger those in it to sense a difference and seek the source.

Although the operation of transmission and distribution of electricity is subject to licensing, these entities are run as companies. This introduces them to security risks that are

[168] Orkubú Vestfjarða, *Ársskýrsla 2013* (Orkubú Vestfjarða, 2014),35.
[169] Reykjavík Energy, interview conducted by author in Reykjavík, March 27, 2015.
[170] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[171] Landsnet chief of Security, interview conducted by author in Reykjavík, March 26, 2015.
[172] HS Veitur, *Ársskýrsla 2013,* (HS Veitur, 2014), 28.
[173] Orkubú Vestfjarða, *Ársskýrsla 2013*, 35.
[174] Landsnet chief of Security, interview conducted by author in Reykjavík, March 26, 2015.

common to other firms in a market environment, rather than specific to operation in the electricity sector. These risks affect their financial stance and value through, for example, changes in price of foreign currency, interest changes, legal changes that affect the market, and domestic price changes.[175,176] These affect the firm's ability to purchase material for maintenance and renewal of their structures and affects any loans in foreign currency. Financial risk is further present through loans - for the firms both as lenders and borrowers - and liquid asset management, all ultimately impacting on the firms' reputation and reliability.[177,178]

Financial risk is also present in the domestic context, through the factor of demand. Should any settlement in Iceland be abandoned, ending the demand for electricity, the distribution firms would lose revenue and the structures that previously serviced the area would be redundant.[179]

IT security was forced onto every firm's radar when Vodafone Iceland was hacked in 2013.[180] Since then, security of computer systems and protection from outside interference has been taken very seriously, leading Iceland State Energy to make it a priority in its security strategy in 2014.[181] The development of the firms' operations is leading them increasingly to utilize information technologies, which create a growing necessity for data protection.[182]

Operational security includes ensuring that the system fulfils any relevant regulation or standards, including the existence of an emergency management team, response plans that include electricity rationing guidelines, and setting measurable goals for quality and delivery security.[183] To ensure continuity of operation, the firms must ensure the operational safety of their installations in order to be able to continue their legally prescribed function of ensuring safe transmission of electricity.[184] Their function is to transmit and distribute electricity and make transmission available from the power plant to distributors and further to the end users. This includes making sure the physical structures of the grid are operational, making

[175] HS Veitur, *Ársskýrsla 2013*, 47.
[176] Iceland State Electricity, *Ársskýrsla 2013,* (Reykjavík: Iceland State Electricity, 2014), 47.
[177] HS Veitur, *Ársskýrsla 2013*, 46- 47.
[178] Iceland State Electricity, *Ársskýrsla 2013,* 46.
[179] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[180] Una Sighvatsdóttir, "Hakkari birtir persónuupplýsingar," *mbl.is,* November 11, 2013, accessed April 11, 2015 http://www.mbl.is/frettir/innlent/2013/11/30/hakkari_birtir_personuupplysingar/
[181] Iceland State Electricity, *Ársskýrsla 2013,* 20.
[182] Landsnet, *Ársskýrsla 2014* (Reykjavík: Landsnet, 2015), 54.
[183] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[184] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.

maintenance and renewal an important aspect of the operational security.[185] Included in this category is the continued supply of electricity from producers,[186] although it is out of the firms' hands to affect supply.

Operational security has several aspects. Ensuring standards and legally prescribed duties are followed require knowledge of the law and understanding of how to construct safe structures. These competences rest in their human resources, where hiring policies and identification of needs are critical. Further, competent staff is key when it comes to energy forecasting, in order to plan long-term for energy demand. This includes the external governmental process of identifying and developing available energy production options to keep up with demand.

Timely repairs and maintenance allow the system to continue serving its purpose and possibly extend its life span. System control allows oversight over the entire system, identifying and responding to damage that could disrupt the operation. These ensure the continued possibility of delivery security through secure operations.

The transmission grid's technical (electrical) approach is a so-called N-1 system, where the idea is to be able to disconnect one unit for maintenance or in case of other disruptions while being able to maintain energy transmission throughout the country. However, the system becomes less dependable while the unit is disconnected and even a small mischance can present a real problem for the system. Because of increasing demand for electricity there is considerable strain on the system, resulting in it becoming increasingly difficult to disconnect units. This results in disruptions becoming more frequent, making it harder to maintain the system properly and ultimately reducing the system's delivery security.[187]

Long-term planning is an integral part of the security landscape, as each part of the system has a designated life-span. Predictable issues can be prevented by timely maintenance, pre-empting further problems in the system. Long-term visions include response plans for security issues that can arise and the planning and structuring of the system for long-term operations.[188,189]

[185] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[186] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[187] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[188] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[189] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.

As demand for electricity increases, Iceland also faces the problem of an ageing system. At this time, most of the system is approaching its tolerance limits and needs to be replaced, not merely maintained.[190] This is a problem known in other states where the electricity grid was built relatively quickly, resulting in the need to renew the entire system simultaneously. Such a comprehensive overhaul poses steep short-term financial demands that can present as a shock to the economy.[191] However, the transmission company has a designated pool of money for infrastructure maintenance and renewal within the income limits set by the NEA. It may not finance its operations through increased pricing without a license from the NEA, and any money financed directly by the government ultimately comes from the taxpayers' pockets. Financing of these system renewals can therefore be very controversial: they may be desperately needed, but financing will ultimately come from the end-users who are often opposed to increased expenditures.

These factors explain why Landsnet hf, the distributors, and the NEA all identify the predictable ageing of the system and its need for renewal as the primary security risk to the Icelandic electricity system.[192,193,194] They also emphasize the need for societal understanding of the necessity to renew and strengthen the system;[195] and societal understanding is important. The electricity infrastructure is critical to the daily operations of society and would have grave repercussions for all aspects of society should it fail. Those involved in the electricity sector are constantly aware of how important their continued operations are to society, as their failure to deliver has immense impact on law enforcement, the government, emergency services, health care, telecommunications, and multiple other aspects that affect everyone. Because of how society has developed, electricity is one of the foundations it needs to function properly. The responsibility of the transmission company to ensure the security of its systems and ability to transmit electricity is immense and is always present in the management's security awareness.[196]

The distributors are equally aware of this responsibility, made visible in their guidelines for electricity rationing. In addition to providing electricity to emergency services,

[190] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[191] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[192] National Energy Authority, interview conducted by author in Reykjavík, April 9, 2015.
[193] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[194] Landsnet chief of Security, interview conducted by author in Reykjavík, March 26, 2015.
[195] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[196] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.

house heating for those who use electricity, and telecommunications, the guidelines also identify areas of commercial activity where valuable products need electricity for safe handling, such as fish, and farms that need to milk their cows.[197] These priorities are included in order to guard against economic losses through spoiled goods, and demonstrate knowledge and understanding of societal needs and functions that might easily be overlooked in the prioritization of electricity rationing.

4.2 External security issues

Hitherto, nature has been considered the gravest threat to Icelandic electricity infrastructure.[198] The Icelandic weather is a large source of disruption in the electric system through harsh winds, icing, and lightning, and through experience with volatile weather its effects have been incorporated into the design of the system. The landscape itself is also a factor for security as in some areas it obliges structures to be extended across heaths and mountains, which introduces undesirable weather hazards.[199] Earthquakes and volcanic eruptions are factors that need to be carefully assessed and planned for, especially when expected in places close to electricity structures, such as dams or power stations.[200] In the case of extreme weather events, some security precautions can be taken as these are often predictable to a certain degree. Staff and equipment can be strategically placed, ready to repair expected damage and to minimize any disruption.[201]

Although structures are built with the intent of causing no harm to others, the firms are aware that the roles may be reversed and do their best to prevent vandalism. This issue is quite different for the distributors and the transmission company, as there is a great difference in the effects of vandalism for the two. ISE's system, for example, covers large areas which are divided into units. These units do not cover large areas and any disruption from vandalism would be limited. Vandalism is therefore not a priority security issue, although ISE does take some measures both to secure its structures from vandals and to prevent people from accidentally harming themselves.[202] In most cases, accidents are more likely to affect the distributors, such as a car accidentally hitting a power box, or an underground cable being

[197] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[198] Ministry of the Interior, *Stefna stjórnvalda í almannavarna- og öryggismálum ríkisins (drög)* (Reykjavík: Ministry of the Interior, 2013), 17.
[199] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 59.
[200] Ministry of the Interior, *Stefna stjórnvalda í almannavarna- og öryggismálum ríkisins (drög),* 17
[201] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[202] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.

damaged during construction because the distributors were not consulted on the location of their cables.[203,204]

Vandalism is however also climbing higher on the awareness list for the transmission firm, and could possibly place the entire system in danger, depending on its scope.[205,206] Although it is difficult to properly monitor every structure at all times other than through the system itself, the security of installations is actively pursued through access control and other security systems. These, again, serve the purposes both of keeping away vandals and of keeping people from accidentally endangering themselves.[207]

The Risk Assessment did consider vandalism a great threat to the production of electricity. Although it may prove difficult to enter power stations, there is equipment outside that would be easier to access. Sabotage of or breaches in dams could also be damaging to the area below the dam, and while these constructions are designed to resist floods and natural hazards, large-scale sabotage or action by an enemy military have not been considered in the design.[208]

Larger sub-stations in the transmission systems, where a large volume of energy flows through, are also vulnerable to sabotage,[209] with power lines considered to be fairly easy to disrupt. Their placement on mountains and in difficult terrain makes them more difficult to repair quickly, and their support structures are not impervious to damage by people. In addition, the time between maintenance checks of these lines is long and surveillance is very difficult in most of the areas,[210] so that perpetrators need not worry unduly about being caught.[211]

Lastly, with the increasing opposition of groups in society to energy production projects and Landsnet hf's operations, the likelihood of protests or, perhaps, a more decisive action increases.[212] This places both the structures and other property of the firm in danger - as well as the perpetrators themselves - and could result in disruptions for the end users. This risk is connected with the aforementioned societal (mis)understanding of the necessity for

[203] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[204] Reykjavík Energy, interview conducted by author in Reykjavík, March 27, 2015.
[205] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[206] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[207] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.
[208] Ministry of Foreign Affairs, *Áhættumatsskýrsla fyrir Ísland*, 115
[209] Ibid, 115.
[210] Ibid, 115.
[211] Ibid, 116.
[212] Guðlaugur Sigurgeirsson, head of network operations department at Landsnet, interview conducted by author in Reykjavík, March 17, 2015.

renewal, strengthening, and maintenance of the electricity grid and the possible ways of going about these, and with the conversation about industry's destruction of the environment. These issues will be addressed in chapter 5.

4.2.1 Cooperation on security issues

Because of the importance of electricity to society, the actors working within the electricity sector cooperate on security issues. NSR and Samorka are two domestic forums where the companies and other relevant actors share information about operational security issues and response plans. This is interesting for the fact that while firms in a competition environment are usually not allowed to consult with each other, the electricity sector is legally required to consult on security issues regarding production, transmission, and distribution of electricity.[213]

NSR is the emergency cooperative forum for the electricity sector. Members of this forum are the electricity production firms, the NEA, Samorka, large industrial firms, and the Chief of Police.[214] NSR emphasizes coordination of response plans (including some preventive measures), responses to danger, flow of information between its members concerning operational security issues, and the coordinated use of concepts.[215] In order to achieve these goals, the forum has created a data bank of human resources and equipment that can be made available in emergencies.[216] This forum is very active in security matters and hosts yearly exercises. As a small and close group, it is able to speak for the electricity sector when addressing emergency situations together with other response actors, such as the CPEM.[217]

NSR has made efforts to include the Icelandic Road and Coastal Administration, so as to ensure even shorter and secure communication routes. The IRCA's work is closely knit with that of NSR members as the latter often need information about roads and access ways to their structures that may need repairs. The transmission system often follows the road system and is sometimes built into road structures, such as bridges, which makes the protection of these structures a joint interest of the IRCA and Landsnet hf.[218]

Another forum that tackles common security issues is Samorka, an association for energy and distribution firms in Iceland and firms and institutions that are connected to the

[213] Raforkulög 2003 nr. 65.
[214] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 53.
[215] Ibid, 53.
[216] Ibid, 53-4
[217] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[218] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.

energy sector in some way.[219] The association is a forum for stakeholders to further their common interests, provide representation of the collective, gather and distribute information between its members and the government, and promote secure and efficient operation in the sector where its members operate.[220] Cooperation within Samorka takes place in committees dealing with different aspects of common issues, which have published informational material on safety and security measures for its members.[221]

The Icelandic electricity sector is also represented in international cooperative forums, most notably the Nordic cooperative forum, NordBER (Nordisk el-berednings forum). The Nordic countries cooperate on many issues, from cultural and educational issues to security matters. It is therefore no surprise that the operational security of their electricity systems falls under an area of cooperation. In 1999, a formal cooperation network on emergency responses was established and has only been strengthened since, especially with heavy shocks to the Swedish and Danish systems as a result of hurricanes.[222]

Within NordBER, the members share information to increase their capabilities in terms of planning, preparedness, and execution of emergency responses, while simultaneously making preparations for receiving assistance from each other when needed.[223] This forum has evolved, and a former working group under NordBER, NordAM (Nordisk Assets Management) has risen to become a distinct unit within Nordic cooperation; it addresses common issues regarding operational security.[224]

4.2.2 Other issues

An issue perhaps unrelated to the actors within the electricity sector themselves is that of backup power. Although the distributors operate backup generators in areas where delivery security is low, firms, institutions, and emergency services around the country are responsible for operating their own backup generators. However, these are often only available in small quantities[225] or not at all, for the simple reason that the need for them has not arisen or is not perceived. However, it is important that those who rely on electricity - especially emergency

[219] "Samorka," Samorka, accessed February 26, 2015, http://samorka.is/Apps/WebObjects/SW.woa/wa/dp?id=2124
[220] "Samorka."
[221] "Ýmsar handbækur," Samorka, accessed February 26, 2015, http://samorka.is/Apps/WebObjects/SW.woa/wa/dp?id=2140
[222] Ministry of Industries and Innovation, *Skýrsla Katrínar Júlíusdóttur iðnaðarráðherra um raforkumálefni*, 54.
[223] Ibid, 54.
[224] Ibid, 54.
[225] Department of Civil Protection and Emergency Management, *Áhættuskoðun Almannavarna*, 15-16.

services, those operating with vulnerable goods, farms, and others who want to secure their operations – should take a close look at this option.[226]

4.3 Societal issues

The two societal issues presented here have in common an aspect very tightly woven into the Icelandic psyche: environmental impact. The Master Plan (a long-term energy production plan) and proposals for strengthening the transmission system both involve some disruption of the environment, leading to considerable opposition from the general public. These issues will be briefly introduced here and further discussed in chapter 5. As the debate about placing cables in the ground is also very visible in current discourse, the chapter will conclude with a brief comparison of overhead lines and underground cables.

4.3.1 The Master Plan

At the turn of the century the government began to form a comprehensive plan to strategically develop energy production in Iceland. This plan was aptly christened "The Master Plan" in English. The objective of the laws that form the basis for the Master Plan is to ensure that land use where there is a possibility of development for energy production will be based on a long-term vision, sustainability, a holistic estimate of interests, efficiency and profitability, taking account of environmental, cultural, and historical aspects and other aspects and values that affect the national interest, while keeping in mind the interests of those who will use the goods produced.[227]

Creating the Master Plan is a long-term process that began in 1999. For the first four years, 20 large-scale hydro-power and 20 geothermal options were located and evaluated. Between 2007 and 2009 the list of hydro- and geothermal options grew and the steering committee began to categorize the options based on research findings and stakeholder impact. Included was an option to conserve potential development areas completely.[228]

Every four years the government presents a proposal to place areas with a potential for energy development into three categories: protective, waiting, and utilization. These categories reflect the conclusions drawn from policy and indicate whether a given area should be protected from being developed; be examined further; or be developed. When an area is placed into the utilization category, the government is allowed to issue permits for energy research and production. The waiting category is reserved for areas that need further

[226] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[227] Lög um verndar- og orkunýtingaráætlun 2011, nr. 48 http://www.althingi.is/altext/stjt/2011.048.html, (accessed April 2, 2015), 1.gr.
[228] "Past phases," Ramma.is, accessed March 25, 2015, http://www.ramma.is/english/past-phases/duis-dapibus-sodales.

examination in order to make decisions about their future. To that end, the government can issue permits for energy research. Any research that does not require a permit can be carried out for areas in these categories.[229] Areas in the protective category are not deemed to be good choices for energy production and are therefore protected by law. For these areas it is not permitted to conduct any energy research unless The Environmental Agency of Iceland allows surface research.[230]

In considering options for energy-harnessing activities, the proposed options are assessed through a multifaceted approach. Their categorization is based on economic profitability, efficiency, and benefits to the economy as a whole. Implications for regional development and employment are also taken into account, as well as the expected impact on the environment, wildlife, cultural heritage, landscape and other possibilities for land use, such as fishing, hunting and other traditional outdoor activities.[231]

To ensure confidence and trust, the Master Plan bases its evaluations on the best scientific research and information available and opens the process by informing the public and NGOs on the research findings. Further, an open forum for public participation in discussion and information exchange increases the chance of national consensus and acceptance, as the public is able to participate and be aware of every step of the process.[232]

A project steering committee oversees the collection of information and professional assessments, prepares proposals to the minister in charge, and serves as a cooperative forum for the Master Plan. The steering committee also assigns the task of reviewing plans for production to teams of specialists.[233] If an actor outside this process wishes to have an area considered for review, he/she can send a petition to the NEA which then decides whether to bring it before the steering committee for consideration. The NEA can also introduce an area into the process on its own initiative if it considers it a good option for energy production.[234,235] This points to a critical role of the NEA in energy security. As the only body able to place areas on the table for consideration for energy production, it has tremendous responsibility to produce options that will strengthen the system (its reliability and delivery security) and ensure that future production will keep up with the estimated future demand.

[229] Lög um verndar- og orkunýtingaráætlun 2011, nr. 48.
[230] Lög um verndar- og orkunýtingaráætlun 2011, nr. 48.
[231] "Past phases," Ramma.is.
[232] "Past phases," Ramma.is.
[233] Lög um verndar- og orkunýtingaráætlun nr 48/2011, 9.gr
[234] Lög um verndar- og orkunýtingaráætlun nr 48/2011, 9.gr
[235] Reglugerð um virkjunarkosti í verndar- og orkunýtingaráætlun nr 530/2014

In the third phase of the Master Plan, which began in March 2013, a new steering committee was formed. Its task is to further evaluate the options that have not been categorized and to evaluate several new options, including for the first time wind power options.[236]

4.3.2 Proposals for strengthening the grid

Given the limitations of the current grid when it comes to transporting electricity, Landsnet hf has proposed ways to strengthen it in its long term forecasting plans. According to the Master Plan, most of the proposed production options are located in the South West and North East. As a result, these areas have become a focal point for the long-term planning of the grid. Even though in principle the location of power plants should not affect its quality and useability,[237] their positioning does increase the stability of the system.[238]

Aside from the three options presented for long-term development of the system, based on different scenarios involving energy production options, the Landsnet hf's proposals include a few observations that are integral to strengthening the system. There is a need for strengthening the connection between the capital area and the South-west corner of the country, as well as between the capital area and Western Iceland.[239] The main transmission system needs to be strengthened on both sides of the power plant Blanda; connections between production sites need to be strengthened in general; the South-west corner connection needs to be strengthened; and the N-1 system's transmission limitations between the capital area and West Iceland need to be remedied.[240] There are a few connections that need to be strengthened regardless of the overall scenario adopted: namely between the South and North-east, the capital area and the South-western corner, the North-east and Eastern Iceland, the North and North-eastern Iceland, and the capital area and Western Iceland.[241]

The three options presented by Landsnet hf indicate what they consider optimal in terms of strengthening the system in view of the Master Plan, and in terms of long-term impact. One option presented to strengthen the system is to reinforce the current transmission line without going over the plateau in the centre of the island. This would make the circled system stronger and increase N-1 delivery security throughout the line system. However,

[236] "The third phase," Ramma.is, accessed March 25, 2015, http://www.ramma.is/english/the-third-phase/
[237] Landsnet, *Kerfisáætlun 2014-2023,* 43.
[238] Landsnet chief of Security, interview conducted by author in Reykjavík, March 26, 2015.
[239] Landsnet, *Kerfisáætlun 2014-2023,* 52.
[240] Ibid, 52.
[241] Ibid, 52.

these connections would still run the long way round and would not increase system stability until the project is almost complete.[242]

The other two options presented by Landsnet hf both include a new transmission line over the plateau through an area called Sprengisandur. It would increase reliability considerably and strengthen the connection between production sites in the South and Eastern Iceland.[243] It is important to connect Southern and Eastern Iceland, two large production regions, as this would also ease transmission between the north and south. A line across the island would halve the transmission route, and thereby eliminate problems associated with transmitting electricity over long distances such as losses through transportation and voltage problems.[244] Losses through transportation occur because of physical attributes, resulting in energy losses and more energy having to be fed in than is received at the destination.[245]

The line across the plateau is proposed as the most effective way of strengthening the transmission system.[246] The stated purpose would be to improve Iceland's electricity grid, ensure stability, and increase delivery security and quality of electricity, along with increasing the transmission capabilities of the system.[247] Connecting the South West to the northern part of the country is the most effective way to strengthen the grid, and more feasible in terms of impact and cost than other options.[248]

The proposed line would be a new 220 kV line that would run from a connection point at Langalda in the south to a connection point at Eyjadalsá in the north. Its total length would be about 195 km and would make the electricity system more robust, increase its transmission capabilities, as well as delivery security and quality of electricity. As it is already integrated into the municipalities' district planning as well as the regional planning of Iceland's central highlands[249] this proposition from Landsnet hf is not a new one. It is an accepted part of the municipalities' district planning, indicating acceptance from those whose districts it would run through. Its placement on the regional planning of Iceland's highlands also indicates a governmental understanding of the need to place the line through the area.

The current line serving the same areas was built between 1972 and 1984 and runs for 927 km. Its voltage capability is 132 kV and it extends from Hvalfjörður in the west to

[242] Landsnet, *Kerfisáætlun 2014-2023,* 55.
[243] Ibid, 56.
[244] Ibid, 59.
[245] Ibid, 48.
[246] "Sprengisandslína," Landsnet, accessed April 1, 2015. http://www.landsnet.is/verkefni/verkefni/sprengisandslina/.
[247] Landsnet, *Sprengisandslína 220 kV – Drög að tillögu að matsáætlun,* (Reykjavík: Landsnet, 2014), 1.
[248] Landsnet, *Sprengisandslína 220 kV – Drög að tillögu að matsáætlun,* 1.
[249] Ibid, 1.

Sigölduvirkjun in the south. Instability and transmission constraints have plagued this particular line and led to diminished delivery security. At this point, it has begun to hold back economic development.[250] As energy demand climbs, stronger transmission lines are needed to connect the largest energy production areas. To meet the increased demand, a voltage of 220 kV or higher is needed to transmit electricity, calling for a stronger grid that can handle such a load.[251]

The impacts of new construction such as this can be divided into three categories: a) direct impact on the environment, b) visual impact on the landscape, and c) impacts on society. A direct impact on the environment results from the disruption of plant life, archaeological sites and bird-life up to 20 metres around the line, all of which aspects are subject to evaluation before construction begins. Visual impact will always be subjective and therefore difficult to evaluate. Impact on society is twofold. First, there are restrictions on activities and development (including other construction) around the transmission lines. On the other hand, strengthening the grid will strengthen electricity security and create opportunities, notably for economic development, in areas needing more electricity than was previously available.[252]

The Icelandic Road and Coastal Administration is interested in rebuilding a road that runs through the same area as the proposed line through Sprengisandur. This has led to cooperation between IRCA and Landsnet hf on environmental assessments and in research into the impact of this construction on, among others, the environment, animal life, archaeological sites, and tourism.[253]

4.3.3 Underground cables versus overhead lines

These proposed construction projects have drawn protest on the grounds of their environmental impact, mostly because of the overhead lines that would visually interfere with the otherwise unspoilt nature Icelanders take pride in and market to tourists. While there are debates about letting these projects go ahead at all, when new lines are planned there is commonly a sector of opinion that calls for underground cables instead. Although underground cables would surely be preferable for the visual enjoyment of the island, that option is not always technologically or financially possible. An investigation into the options for transmitting electricity through the Sprengisandur area has revealed that only 50 km of

[250] "Sprengisandslína."
[251] Landsnet, *Sprengisandslína 220 kV – Drög að tillögu að matsáætlun,* 24.
[252] Ibid 28.
[253] Ibid, 23.

cable could be placed underground, the rest of the way needing to be covered by overhead lines.[254]

Reasons for the limited scope to lay underground cables start with the cables' physical attributes. If the cable distance underground is too long, it begins to affect the voltage controls in the transmission system, requiring equalization with a spool connected to the underground cable every 5-20 km, depending on the voltage and structure of the transmission system. At these points, the cable is taken up from the ground and connected to a spool, requiring the regular placement of structures on the ground along the cable's path. The scale of these structures can range from 150-1000m^2 depending on the size of the spool and the voltage of the cable.[255] The equalizing structures would impair the landscape just as overhead lines would.

Advantages and disadvantages of overhead lines and underground cables[256,257]

	Overhead lines	**Underground cables**
Advantages	• Relatively cheap with regards to start-up costs and operational costs • Lifetime of 50-70 years • Easy to repair • Knowledge and experience in working with overhead lines • Reliability high • Environmental disruption during construction low • Safety equipment simple from years of development • Relatively easy and cheap to increase transportation capacity after construction	• Less visibility • Better choice for urban areas • Not vulnerable to external aspects (weather, icing , wind, birds, etc) • Less likelihood of vandalism • Failures are rare • Technological developments in design

[254] Landsnet, *Sprengisandslína 220 kV – Drög að tillögu að matsáætlun,* 9.
[255] Steinsholt sf et al, *Sprengisandur – Vegir, háspennulínur og virkjanir, Forathugun á Holtamannaafrétti,* (Reykjavík: Landsnet, Landsvirkjun, and the Icelandic Road and Coastal Administration, 2013), 42.
[256] "Kostir og gallar," Landsnet, accessed April 6, 2015 http://landsnet.is/linur-og-strengir/kostiroggallar/
[257] Steinsholt sf et al, *Sprengisandur – Vegir, háspennulínur og virkjanir, Forathugun á Holtamannaafrétti* , 42-3.

Advantages and Disadvantages continued

	Overhead lines	Underground cables
Disadvantages	• Very visible • Inconvenience to land owners, the general public • Noise • Affected by weather • Affected by birds • Designated proximity area where construction or tall trees are not allowed	• Needs large equalizing stations • Affects voltage controls in the system • Repair times longer because of difficult access • Failures not visible, need to be identified using technical methods • Much more expensive to maintain in rural areas • Repair in urban areas can close down roads/halt traffic • High failure frequency at the end of life span • Operational difficulties relating to frequency and voltage • More vulnerable to floods, earthquakes, and landslides • Longer construction times and shorter life spans • Environmental disruption during construction • No increased transportation capacity unless adding or renewing cables • Work in the ground, including agriculture, in proximity to the cables is possibly dangerous

5. Discussion

5.1 Understanding security

Safety and security in Icelandic electricity transmission and distribution rest to a great extent on legal prescriptions defining the duties of the firms. The measures in question are prescribed in the interests of external actors' safety; secure receipt of electricity by end-users; and the safety of firms' employees. They largely involve preventive measures to tackle predictable and known issues, and are rigorously monitored by internal and external actors. Not all the precautions are necessarily based on issues that have been experienced in Iceland, but have been developed through long-term operations in other states and from their experiences. These security measures and standards are implemented to avoid contingencies that are understood as constantly threatening the safety and security of individuals, the firms' operations, and, therefore, society in its entirety.

Reverting back to the Copenhagen School's understanding of security, where securitization of an issue through speech acts is necessary for that issue to become a security issue, it is evident that many of the security issues the electricity sector is confronted with have been institutionalized in laws. At some point, actors through speech acts argued for these security measures to be specially treated and institutionalized, while the audience agreed. To this extent, one can argue that the Copenhagen School's analysis is exactly correct when it comes to tackling security in the Icelandic electricity sector.

However, these measures, although institutionalized, do not involve raising the question of electricity management above normal politics or making it a focus for any special kind of political attention. Rather, they are internationally recognized as the required safety and security measures to ensure the safe operation of firms working within the electricity sector; they do not hold a special place in public discourse as involving existential threats to society (although perhaps they sometimes should). Fulfilling these security measures is the responsibility of the firms that oversee the operations and is not a politicized issue for debate, but a daily process of securing the firms' employees, their operations, and the promises they make to end-users. Once these measures are laid down and monitoring mechanisms institutionalized, security ultimately rests in the hands of those firms operating in the sector: daily operations are not of such urgency as to warrant securitization in the sense of handing the responsibility of operational security to politicians.

As shown in chapter 4, security awareness for the firms appears to go beyond the prescribed set of measures because of their own identification of other aspects that threaten their operations. Their security issues thus arise on multiple fronts, all needing to be juggled simultaneously. There is no time to wait for one security aspect to be securitized within the firms or the sector, as all of them need to be addressed constantly. Possible new security issues may be sought out, and even the worst-case scenario rehearsed and planned for, but all of the issues identified are on the radar at all times. However, there is a threshold at which one issue becomes more pressing than others, elevating it from a security 'issue' to a security 'threat'. Although this would initially happen within the firms, it is very appropriate to think of these instances as thresholds for society, since security threats to a firm within the electricity sector can have devastating effects on society. This threshold would inevitably activate other relevant actors, such as the CPEM who would coordinate appropriate responses or readiness levels for those involved. Electricity security can thus be viewed as a part of the broad vision of human security, with its own threshold mechanism for prioritizing attention.

With a list of security issues, it is never enough to passively keep them in mind. Active assessment of different issues can not only better prepare for any action needed, but help predict the factor(s) that are most likely to cross the threshold and begin to pose a threat to the entire system. Although there are different firms and actors operating within the system, the system as a whole is what society is most concerned to keep operational. Therefore, security threats presented within any firms in the sector, from production to delivery to the end user, potentially poses a threat to the system. Security threats in the realm of infrastructure generally have the potential for very serious negative consequences for society, leading the security issues of those operating within these structures to become also a concern for society as a whole.

It is therefore important to be aware both of security issues coming from within the operation of these firms, and of those coming from actors outside the operations. As presented above, the firms appear to be very aware of the intrinsic security issues their operations face and claim to have their internal security measures in good shape. Their approach does not appear to be equally well-founded for the external issues - such as sabotage (including cyber-attacks), terrorism, or any other action of an outsider that may interrupt the system's ability to operate or the system's connections to other infrastructure systems - which inherently carry a degree of uncertainty leading to more difficult security planning. Although some measures are already taken to discourage actions by external actors, it is difficult to prevent those who want

to damage the system from doing so.[258] This creates a vulnerability in the sector's security structure, but also an opportunity. The opportunity lies in the generally acknowledged need for renewal of the system, changing out old equipment for new, and strengthening it i.e. through a more complex network. During such construction the security of the system from actions of external actors could be incorporated into the design, or at the least, the firms should have an opportunity to re-think their security measures. Although complete security is never possible, and difficult to increase without fundamentally changing the system, such reflections are necessary.

The security structure within the electricity infrastructure appears to be quite rigid, with little room to change. As the security understanding of the actors within the structure is largely based on the legal framework concerning their operations, the actors do not appear to desire to change it. They appear content with the extent of cooperation within the structure, as with their individual responsibilities. The most obvious way to possibly change the structure would be to incorporate it into a national energy strategy, where the operations of the actors within the structure would be affected – perhaps steered to a degree – and the energy security strategy would further increase the actors' cooperation among themselves and with other actors in the larger energy sector.

5.2 The bigger picture

Societal security, as introduced in chapter 2.5, emphasizes the survival of a culture or identity, essentially the building blocks of the society in question. The exploration of societal security issues is a multifaceted process and includes different approaches. There are many aspects to consider, and the analyst may be driven either to completely map the picture or to try to completely capture one societal aspect. This may lead the observer to be caught up in the smallest details, ending up on unfamiliar territory such as inspecting a firm's security structure or focusing on one narrow aspect of a sector's insecurities. Although these are important and valid enquiries, societal security essentially requires reflections on the broader implications for society.

Making society the referent object of security forces one to look at the big picture, incorporating different aspects and issues that inevitably are connected. Electricity security is like any other issue, in that it does not exist in a void but affects and is affected by other aspects of societal security. The Icelandic debate essentially covers only a small portion of this package, and the sector likewise seems to take only a portion into account. This results

[258] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.

from the way that interests of those stakeholders who receive the most attention overlook important aspects that affect decision-making and the resilience of Icelandic society. Additional security aspects are worth considering in connection with electricity security in Iceland, most notably energy security – which provides the wider context for the issue of electricity as such; economic security, human security, and environmental security.

5.2.1 Energy security

Energy security can be looked at in two ways: as it pertains to individuals in terms of secure supply and delivery security of electricity, and as it pertains to society in terms of securing continued energy production, fulfilling demand, and sustainable use of natural resources. Individual energy security rests on people's access to the energy needed in their daily life. Society, as part of societal security, requires energy production (or however supply is guaranteed in the society in question) to be secure, stable and able to keep up with demand. Security of supply includes the strategic placement of energy production both for purposes of - in Iceland's case - a more stable system, and to guard against the case of natural disasters or terrorism wiping out the production facilities. The recent volcanic eruption in Bárðabunga posed such a threat through floods that could have effectively wiped out a large portion of the Icelandic energy production facilities, as they are clustered in small areas.[259]

A strong system, high delivery security, and strategic planning of the entire electricity system from production to the end user can only benefit society, making one of the most critical infrastructures more secure and reducing insecurity for individuals. As many other aspects of society rely on the electricity infrastructure, such as telecommunications, health services, food storage, and control systems for other infrastructures, any strategy for energy security needs to not only be self-serving but to incorporate the effects its insecurities have on other systems. With so many systems relying on electricity, electricity security becomes a priority for those systems as well, leading to multiple stakeholders having an interest in a well-rounded, thorough-going security strategy for the entire electricity system.

Energy security therefore requires a strategic approach to its own development, both in terms of placement - especially in Iceland with its natural hazards that can threaten the physical structures - and in a strong transmission system that can deliver energy to end-users. These concerns affect the Master Plan, which evaluates production options and chooses which to utilize. Such decisions, although supported by scientific data, are influenced by also stakeholders, and in the end choices between two options may be decided through pure

[259] Civil Protection and Emergency Management, interview conducted by author in Reykjavík, March 24, 2015.

politics. A long-term energy production strategy should incorporate a strong energy security strategy that would guide these choices. Such a strategy would need to look to the production capacity of possible production sites, while also evaluating impact on the stability of the system and possibility of continued energy supply in case of major disruption.

Energy security, in terms of electricity, is also important from the individual's point of view. Daily life, economic activity, and many aspects of human security such as health care and food storage, rely heavily on electricity. A secure supply both eases human security concerns and increases possibilities for urban development outside the South-west corner, which could lead to increased population, economic activity, and higher living standards.

5.2.2 Economic security

Economic security can also be related both to individuals and to society. In both cases it refers to the ability to retain a stable financial income, which then allows the individual or society to maintain the current standard of living both in the present and near future. This includes most individuals' need for a secure financial income through jobs, requiring firms to operate in a stable market environment where they have access to the resources they need to operate, including energy.

As mentioned in chapter 4.3.2, the current condition of the transmission system is limiting economic development in Iceland. Insecurity when it comes to delivery security, either through low delivery security in general or results of an ageing system, affects the possibility of economic development outside the South-west corner, where the transmission system is strongest. Granted, the system's weak points are generally far removed from large production areas, but that should not prevent delivery security or at least attempts to increase it.

The proposal for state-wide planning focuses on urban development outside the South-west corner,[260] and efforts to strengthen other parts of the country already include plans to transfer government institutions out of the capital area.[261,262] This effort is rendered moot if the conditions are not available for operations of firms or institutions, especially when it comes to uncertain electricity supply. Most things run on electricity these days, and

[260] The Icelandic National Planning Agency, *Landsskipulagsstefna 2015-2026- Tillaga til umhverfis- og auðlindaráðherra*, (Reykjavík: The Icelandic National Planning Agency, 2015), 1.
[261] Mbl.is "Flytja höfuðstöðvarnar til Akureyrar," *mbl.is,* June, 27, 2014, accessed April 28, 2015. http://www.mbl.is/frettir/innlent/2014/06/27/flytja_hofudstodvarnar_til_akureyrar/
[262] Mbl.is "'Flytjum störf, ekki fólk'," *mbl.is,* July 2, 2014, accessed April 28, 2015, http://www.mbl.is/frettir/innlent/2014/07/02/flytjum_storf_ekki_folk/

technology has made electricity a basic need to function in a modern society. Therefore, economic activity and development requires electricity supply and secure delivery.

Economic activity could well continue to be focused in the South-west corner of Iceland. The geographic positioning of economic activity is not necessarily an important aspect for overall national security and prosperity unless the product of a specific economic activity requires it. In that context, tourism could be an important economic activity in the rural areas, introducing new opportunities for economic development and strengthening economic security both for local individuals and society as a whole. Treating rural areas as museums and hindering development in an effort to preserve some atmosphere or aesthetic not only traps the local inhabitants in a situation they did not ask for, but hinders their own development both individually and as a community. Therefore, increased economic security requires guarantees from the energy sector that local operations will not be frequently interrupted.

An economically secure society has the potential to be a very well functioning society, paying off its debts, affording services to its citizens, and maintaining its living standards or even increasing them. Economic security provides stability within the society and a level of predictability which is important in any economic activity and market environment. Economic development itself does not necessarily pose a challenge for other security aspects, such as environmental security, although it does require energy production. In fact, economic resources are needed to subsidize most current forms of environmental clean-up and protection, as well as measures to adapt to climate change.

In relation to electricity security, economic security goals require a strong transmission system and energy supply to meet growing future demand. Increasing the economic activity potential for any field of development requires the promise of secure energy supply. Along with plans to strengthen rural areas, economic security would require those areas to receive due attention with regard to future delivery security.

5.2.3 Human security

Human security in this context, as introduced in chapter 2.4, needs to be interpreted broadly as the electricity structures do not pose a direct violent threat to the citizens. Good governance in energy planning is vital since maintaining society's living standards rests in large part on energy production and supply. Human security issues dependent to some degree on electricity security include health care, food storage, telecommunications, economic development, and other infrastructure.

Like most things in our society, the health care system relies heavily on electricity. Back-up generators are in place to respond to any disruption in electricity supply, but will only last for a limited time.[263] Aspects of health security ranging from operations, scans, computer handling of information e.g. for medication, and even telephone communications rely on electricity. Without it, people's health is placed in danger and the health care system's capacity to care for its patients is diminished.

Because Iceland is an island in a climate not suited to producing most foods, food is largely imported from other states.[264] Food storage, i.e. refrigeration for both individuals and corporations, is important and heavily reliant on electricity. This issue is important enough for the ISE to allocate some of their priority energy provision in an emergency to firms that are moving frozen fish to a secure storage, in order not to lose both food and product value.[265]

Security issues relating to food and electricity are linked with the physical need for sustenance and the need for safe food for consumption, as any spoilt food may result in health issues. Refrigeration issues have impacted areas with low delivery security, even creating the need for food to be stored outside in the snow while repairs were being made to restore power. Not only do such situations impact upon possible health concerns, but also economic security, as people or companies may need to replace food lost because of electricity outage.

The telecommunications sector is another vital infrastructure in society. Without the means to communicate, economic activity, governmental activity, emergency services and health services are all compromised, as well as the ability to repair and maintain the possible causes of the loss of communication. Disruptions in the electricity system that spill over to the telecommunication system affect the chances of repairing the disruption, since the cause is often identified through computers or communicated through phones.[266]

The isolation of rural areas and inability to communicate with emergency services also pose an additional set of security threats to human security. If the government cannot communicate with the citizens they may make decisions without knowing what potential risks are at play, such as travelling or even remaining in a dangerous area. And lack of access to emergency services can compound health security issues.

For an island territory like Iceland, communications capabilities are also vital for transportation, both in the air and by sea. Without ability to communicate, transportation into

[263] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[264] Orri Jóhansson, "Food Security in Iceland: Present Vulnerabilities, Possible Solutions" (Master's thesis, University of Iceland, 2011), 28.
[265] Iceland State Electricity, interview conducted by author in Reykjavík, March 19, 2015.
[266] Civil Protection and Emergency Management, interview conducted by author in Reykjavík, March 24, 2015.

and out of the country is compromised, undermining not only the economic value gained through tourism, but also food security, as much of the food consumed is imported. Inability to communicate with actors outside the island - other states or institutions - also makes assistance difficult.

Economic development impacts human security through the implications for stable financial income and the maintenance of living standards in society. Low or absent economic security, implying low or absent economic development in some areas, may lead to derived impacts on other aspects of an individual's life: the ability to remain healthy through proper nutrition and health care, poverty, homelessness, and social exclusion.

As has been noted several times already, the effects of disruption in electricity supply upon the end-users include a multitude of security threats to other infrastructures and societal functions. This is increasingly so because modern society has become more dependent on electricity through its reliance on technological gadgets. From cell phones and laptops, to system controls and telecommunications, technology plays a large part in our daily lives, directly and indirectly. Control systems for other infrastructures, such as water and waste management, and economic activity all rely on computer systems, which in turn rely on electricity.

Of course, it would need a massive disruption for the general public to feel the full force of consequences from the failure of such systems. That fact does not negate the need to recognize and assess these security issues. The scope of society's reliance on electricity, especially in Iceland where the electricity grid is isolated and cannot be supplemented with energy from other states, places the whole of society at risk. The range of potential damage to human security coincides well with the broad view of human security, incorporating economic, health, and social issues among the domino effects of a breach in electricity security.

Human security concerns therefore require the electricity system both to be secure in its supply of electricity to the end-user, and to be secure from external damage that could adversely affect every aspect of an individual's life and society's ability to function. Human security concerns could be used as arguments for substantial investments in the electricity system, since the long-term development of a strong system would ensure a general state of societal security where the survival of Iceland's inhabitants along with their culture and identity could be assured.

5.2.4 Environmental security

Environmental security concerns nature's role as the factor that sustains life on this planet. This function and role becomes the referent object of security, leading to recognition of the need for protective measures against hazards ranging from aggressive attacks, military actions or other sabotage, through the prevention of conflicts resulting from environmental situations, such as lack of water or crop failure, to the protection of the environment because of the moral value society has placed on it. It is this moral value that is fiercely protected in the Icelandic debate through conservation efforts.

Environmental security focuses on forestalling any negative impact on the environment that prevents it from serving its primary function to sustain life and its secondary function through the values societies have placed on it. Failure of the environment to fulfil its primary purpose, such as the examples above, can affect human health and security and even lead to displacement. It can be argued that energy production methods, namely man-made reservoirs and dams, lead to negative impacts that prevent the environment from fulfilling its primary function, while man-made energy-related structures diminish the value imposed by society on untouched nature.

Protests against production options and environmental disruption from building reservoirs are rooted in the vision of those constructions as aggressive attacks on the environment, especially if the sites involved have stronger ties through the moral value of their beauty, or societal ties with outdoor activities or marketing to tourists. Such building involves a major disruption to the local ecosystem, as vast areas are changed and often placed under water. This aggressively changes the natural environment, destroys ecosystems, and diminishes the function of sustaining local life. Likewise, transmission lines are an aggressive intrusion into the landscape, diminishing the societal value of unspoilt nature. Given the prominence that such concerns have achieved in the recent Icelandic public debate, they will be analysed in more detail in part 3 of this chapter.

Climate change is a man-made security threat to the environment. Although temporarily climate change may increase electricity production in Iceland, due to glacial melting, in the long run changing weather patterns and acidification of the ocean are among issues that threaten not only environmental security in Iceland but also human and energy security. Iceland is, admittedly, in the forefront of using renewable energy, as it is rich in natural resources that enable such choices and thereby contribute less to climate change. In the end, however, these are natural resources that need to be managed properly in order to sustain a stable harvest of energy, and new production options need to be chosen carefully

with regard to the environment. Irresponsible use of renewable resources also places environmental security in danger as the natural processes involved are disrupted, changing the local ecology.

Iceland's national Master Plan is a mechanism that should incorporate environmental security, or at least the moral value aspect of it, into long term energy production planning. It should, however, also take account of the element of aggressive interference into the environment, leading to a strategy that incorporates environmental needs as well as environmental values. The proposal for state-wide planning also includes suggestions for mainstreaming environmental considerations in matters of urban development, placing a focus on the aggressive interference with nature alongside its value. Environmental security aspects are thus represented in debates regarding energy production and development in the highlands, transmission lines placed in vulnerable areas to ensure delivery security but may affect the environment and landscape, and in general urban development.

Yet environmental *needs* and environmental *values* are two different things. The needs represent the requirements for the environment to fulfil its primary function, while the values reflect the subjective or constructed value society attaches to the environment for its own benefit. Therefore, environmental needs, based on environmental security issues, should also be represented in any discussion or planning of the use of the environment. Such needs are best evaluated by specialists, scientists and those who have specialized in environmental security.

Environmental values are often introduced into the debate by special interest groups, making it difficult to incorporate such views in a political process as Icelandic debate tends to become an either/or issue. As Iceland expands its security understanding and strengthens its societal security, perhaps through the current effort to produce a national security strategy, environmental security concerns should have an easier access to political action. Ways of ensuring that this promotes, rather than blocks, optimal solutions are discussed in 5.3 below.

Environmental security concerns thus call upon the political process to be selective in its energy production strategy, and to weigh not only the environment's usefulness in regards to energy production, but also its functions as both sustaining life and serving a purpose for society's moral vision.

5.2.5 A holistic view

The four related aspects of societal security introduced above are associated with different needs in regards to electricity security, and represent a more holistic view of the issue than is

often found in the general public. These viewpoints are all useful and important, although some are more open to compromise than others. In essence, they all introduce sets of interests seen from different societal standpoints which are equally important, and which all affect and are affected by electricity security.

Energy security and environmental security both require a clear strategy for long term development that can satisfy both points of view. The Master Plan is an attempt at such a strategy, yet lacks a degree of societal consensus and vision. The process of creating it appears either to have been too open, so that lack of leadership and vision has made its every move contested, or to have received too little political priority because of the perceived lack of urgency. The longer it takes to create a strong vision and a clear strategy, the harder it may become to reach societal consensus on such a strategy. In the meantime stakeholders argue and fight for their interests and views, while using the available legal framework to pursue their aims. Specific actions and construction plans launched before the formulation of such a strategy can also become contested or change the structure of the strategy, as it must to some extent take its point of departure from the system in place.

Energy security and economic security agree on the need to strengthen the system and ensure a stable supply to the end-users. This is a prerequisite for economic development in a system that currently does not provide the conditions for further economic development in some parts of the country, despite governmental plans to strengthen rural areas. This is again an area where a strategy would serve both aspects of security well, providing a long-term development strategy where all internal and external security issues are incorporated into the system's design and strategic placement of economic development could follow.

Energy security and human security are tightly connected, as large parts of people's lives in Iceland rely on electricity. These issues both argue for increased strength in the system and capability of transmitting electricity. These claims may appear to be in contradiction with environmental security. That does not, however, necessarily have to be the case. If the debate can move from short-sighted interests to societal needs and future possibilities for changing the system, it could reveal ways to satisfy everyone's desires. Increased energy and human security through electricity security may temporarily impact the visual value of nature without permanently disrupting it. Future development of the system, incorporated into the long term strategy, could promise changes at a later date when the desire to place every transmission line in the highlands in the ground can be technically fulfilled. Satisfying other security requirements through a temporary low impact on the environment, through mostly visual impacts on the landscape, should be an acceptable price to pay if future

possibilities hold out the hope of eliminating the visual impact on the environment. A strong strategy for energy production can also prevent the most sensitive places from being utilized for energy production, fulfilling environmental security interests.

5.3 Environmental concerns

For a long time opposition from the general public to energy production projects has been based on environmental concerns (rooted in the moral value of the environment as presented above). These usually pertain to the permanent change and damage to the environment that a reservoir requires, and with hydropower being the largest source of energy production in Iceland, there are a number of such reservoirs around the country. In recent years this opposition has become louder with the introduction of foreign aluminium smelters into the Icelandic economy, the reason being that new power plants need to be constructed and dams or geothermal bores to be created to accommodate the energy demand of such large-scale users.[267]

A turning point in the opposition to such energy production developments came in the early 2000s with the decision to construct a dam in Kárahnjúkar to supply an aluminium smelter in Reyðarfjörður (a town in the Eastern part of Iceland). The spark that ignited what would lead to international protest (with protesters travelling to Iceland from Europe, North America, and Australia[268]) was the lack of regard for proper procedure, as the minister in charge unilaterally reversed the decision of the National Planning Agency to refuse permission for the dam.[269]

Such blatant disregard for scientific findings and the results of a recognized procedure sparked outrage, as the proposed site of the dam was home to much natural life and scenic features, and would require diverting rivers to fill the lagoon. Such large-scale environmental damage, as well as the apparent abuse of political authority to override the process designed to protect sites such as this, led to protesters fiercely fighting to interrupt the construction at the outset and throughout the construction process.[270] Additionally, the dam's sustainability

[267] Visir.is, "Virkja þarf í Krýsuvík og Eldvörpum fyrir Helguvík," *visir.is,* January 5, 2009, accessed April 11, 2015 http://www.visir.is/virkja-tharf-i-krysuvik-og-eldvorpum-fyrir-helguvik/article/2009605965933
[268] Andrew Stelzer, "A Dark Night in Iceland," *In These Times,* January 8, 2007, accessed April 11, 2015, http://inthesetimes.com/article/2975.
[269] Stelzer, "A Dark Night in Iceland."
[270] Visir.is, "Mótmæli við Kárahnjúka," *visir.is,* July 31, 2006, accessed April 11, 2015, http://www.visir.is/motmaeli-vid-karahnjuka/article/200660731007

was called into question as well as the reasoning behind constructing it, as it would not supply any other actors than the aluminium smelter.[271]

Hydropower reservoirs are not, however, the only focus of criticism. As the concerned groups have pointed out, the effects on residents close to geothermal production sites go beyond changes to the environment, with new structures, transmission lines and roads intruding on the landscape. Earthquakes have been connected to such operations in the area around Hveragerði and the power plants' sulphur emissions are believed to negatively impact people's health. Nonetheless, the Master Plan has approved further geothermal development in the area, which already hosts four production sites.[272,273]

Much as the key geothermal areas are now hosting many options in a small area, the river of Þjórsá is seen as a prime opportunity for further development. Already hosting several power plants, further development along the river's course is desired by the energy production firms and opposed by environmental organizations and even some locals, on the grounds that it will disturb the land remaining above water and will impact upon wildlife, including salmon in the river.[274,275]

As explained in chapter 3, large-scale users are by far the largest consumers of electricity in Iceland, using 80% of all electricity produced. The general debate surrounding their operations has revolved not so much around their own pollution, but around the issue of governmental intervention and the environmental damage caused in order to accommodate foreign multinational corporations' operations in the form of creating new reservoirs and power plants.[276] The opposing groups do not object to electricity development per se, but the methods used so far for energy production.

In addition to the suspicion of special accommodations for foreign companies at the expense of the Icelandic nature, there are persistent voices that claim unfairness in electricity pricing. These voices do not feel it is fair to the general consumer that aluminium smelters do not pay the same price for electricity and accuse the actors responsible for selling the energy

[271] Susan De Muth, "Power driven," *The Guardian,* November 29, 2003, accessed April 11, 2015 http://www.theguardian.com/environment/2003/nov/29/weekendmagazine.conservationandendangeredspecies
[272] Ruv.is, "16 virkjunum mótmælt," *ruv.is,* May 31, 2012, accessed April 11, 2015. http://www.ruv.is/frett/16-virkjunum-motmaelt
[273] Náttúruverndarsamtök Suðurlands, "Mótmæli og athugasemdir NSS við breytingum á aðalskipulagi Ölfuss," *Nátturan.is,* October 5, 2009, accessed April 11, 2015 http://natturan.is/samfelagid/efni/8232/
[274] Árni Finnsson, "Virkjanir í Þjórsá – er ekki komið nóg!" *Iceland Nature Conservation Association,* April 27, 2007, accessed April 11, 2015 http://natturuvernd.is/Sida/ID/620/Virkjanir-i-jorsa--Er-ekki-komi-nog
[275] Brjánn Jónasson, "Miklu magni framburðar verður mokað upp á Þjórsárbakka," *Morgunblaðið,* July 12, 2008, 20.
[276] Richard Hollingham, "Iceland faces 'green' energy dilemma," *BBC News,* March 21, 2007, accessed April 11, 2015 http://news.bbc.co.uk/2/hi/programmes/crossing_continents/6453703.stm

of robbing potential revenue from the national economy.[277] These criticisms are met with the admission that the large-scale users do pay a little less for their electricity, justified by the fact that they provide a more stable use than the general public, resulting in higher utilization of the energy provided than among the general public.[278]

Environmental groups have made many good arguments about the negative impact that energy production has on the environment and on individuals living close to geothermal production sites. They serve as important checks to balance the development of energy production, forcing some attention to be paid to the consequences overlooked by other stakeholders. That, however, does not give them the right to refuse cooperation or dictate the development of energy production, even if there is need in the process for these observations and criticisms. Energy production companies or politicians do not have a monopoly of decision-making, either, when it comes to the utilization of production sites. These different actors and interests need to coexist in a process that produces the best outcome, where energy production can keep up with demand while also being held to standards when it comes to the environmental and human health impact.

5.3.1 Underground cables

Those interest-groups who acknowledge the possibility of transmission lines in the highlands as proposed by Landsnet hf (and introduced in chapter 4) are mostly concerned about the environmental impact of these. In fact, this consideration is institutionalized in the licensing process to such a degree that much of the preparation for submitting such a construction plan entails evaluating and demonstrating how it will have the minimum environmental impact. A licence for such a construction depends on a number of actors and institutions commenting and approving on the preparation process, a process that should eventually ensure that the best compromise solution is licensed. Yet the question of visible impact on the landscape ranks very high in environmental concerns, leading to the widespread call for underground cables. Even proposals for state-wide planning reflect this preference and only concede the use of overhead lines where absolutely necessary.[279]

As with many things, those not closely involved with the operations of the electricity grid do not necessarily understand the most effective ways of strengthening and adding to the

[277] Jón Steinsson, "Ráðherra vill sóa orkuauðlindum þjóðarinnar," *Eyjan.is,* November 14, 2013, accessed April 20, 2015 http://blog.pressan.is/jonsteinsson/2013/11/14/radherra-vill-soa-orkuaudlindum-thjodarinnar/
[278] Mbl.is, "Raforkuverð ekki lægst á Íslandi," *mbl.is,* April 16, 2010, accessed April 20, 2015 http://www.mbl.is/vidskipti/frettir/2010/04/16/raforkuverd_ekki_laegst_a_islandi/
[279] The Icelandic National Planning Agency, *Landsskipulagsstefna 2015-2026- Tillaga til umhverfis- og auðlindaráðherra.*

grid. This is perfectly understandable. Most people's experience with electricity is limited to plugging devices into a socket; much as most people's experience with fruit consists of picking it up at the store without knowing what it took to get it there. It is therefore important to keep communication open and active, to educate the general public on Landsnet hf's purpose and duties as prescribed by law, and to explain why overhead lines are the best option when there is a strong call for underground cables. These explanations are readily available in the relevant reports, but perhaps not along the track of the average citizen's quest for information.

The underground cables versus overhead lines debate is an understandable one. Icelanders pride themselves on the unspoilt and beautiful nature of their country and overhead lines disrupt the landscape. The call for underground cables offers an easy way, in the general public's mind, to satisfy the need for electricity while preserving the environment. But the fact is that it is simply not always possible, even if many would agree that the ability to place all transmission lines underground would be the optimal solution in Iceland's case. However, those who ask for underground cables are perhaps not aware of some of the real difficulties in the way of their success, perhaps due to lack of information.

First, there are considerable financial concerns, as laying underground cables is very expensive. It is also a greater undertaking; digging, laying the cables, and covering them up, as well as creating temporary roads along the cable route. Second, there are technical and physical aspects that prevent underground cables from being the optimal choice. If the cable covers a long distance, equalizing structures need to be built, further adding to the cost while impacting the environment and landscape as well. Without equalizing stations, the cables can introduce instability to the system, impacting system management and operational security. In addition, repairs are difficult as the sites of damage need to be identified through the computer system, instead of offering visible confirmation, and are hard to get to, leading to longer repair times and more impact on the end-user.

Although not the optimal choice today, underground cables do have the potential through research and development to become a better option in the future. Technological developments already impact the way electrical infrastructures are built today and the underground cables should be no exception to the trend for improvements. But therein lays the problem. Iceland is confronted with a need to strengthen its system today, before these advances make underground cables the best choice for the entire grid. The debate should therefore turn towards both present needs and future possibilities.

5.4 The most pressing security issue?

The largest risk to electricity security as such - as identified by actors within the electricity sector - appears to be an internal security issue: the ageing of the system. As we have seen, general electrification in Iceland began in the early 20th century and its transmission system was completed in the 1980s. Many of its parts are rapidly approaching the end of their useful days as the bulk of the system was constructed in a short amount of time. With energy demand in Iceland having grown in the past 10 years and most likely to continue growing, it is more than probable that future improvements of the system will include replacing these old transmission lines with lines capable of transmitting higher voltage than those used today in order to secure the transmission needed to fulfil future demand. With technological advances comes increased demand for electricity, which in turn calls for better transmission capabilities, a factor already placing pressure on the present system.

Any system approaching the end of its use inevitably begins to experience failures and lowered reliability. The transmission grid, although built with the intent to be capable of disconnecting units for maintenance, experiences pressure because of increased demand on the system. The inability to safely disconnect units for maintenance makes it more difficult to extend the use of the system, shrinking the time-frame for renewal. If the system should fail to be renewed, one could easily picture the downfall of society, as it heavily relies on electricity for all its functions.

This does not appear to be what Iceland should expect, although there is some pessimism over the hopes of timely action to prevent disruption directly related to an outdated system. Renewal of the entire system may be expensive, and even result in temporary increase in prices, but the grid's importance has hopefully placed the relevant actors in positions to begin figuring out the best ways to solve this problem. Even so, given the concern that the ageing of the transmission system causes for actors within the sector, one cannot but wonder whether the need is fully grasped in politics and society for prompt action to protect end-users - and all society - from experiencing the potential ill-effects.

A related issue to the renewal of the system concerns the proposed ways to strengthen the transmission grid. Through strengthening the grid, increased opportunity to disconnect units may relieve some pressure on the system and provide a longer time-frame for renewal, while maintaining or even strengthening security both in terms of delivery security and stability. Proposals for strengthening the transmission system, mentioned in chapter 4, have however been met with great opposition. These proposals are not entirely new, and neither is opposition to the idea of transmission lines over the highlands, although the latter has recently

increased.[280] It has reached a point where actors connected to the tourism industry are entirely against it,[281] and will not even consider discussing it as a possibility.[282]

There appear to be two main interests involved in the debate on these construction plans: the side arguing for conservation of the environment and no construction in the highlands, and the side arguing for what they deem necessary actions to strengthen the transmission grid and delivery security. Because of the massive opposition from some conservation groups and their outright refusal to engage in discussion about how to approach these projects,[283] the discussion tends to revolve entirely around a single aspect and a single interest-group's point of view. Although many of those who strongly oppose transmission lines through the Icelandic highlands – notably mostly actors who are connected to the tourism industry - have a valid point in trying to preserve one of the largest marketing aspects of the island, there is a need for a holistic look at both the current domestic situation and future possibilities regarding the electricity system. Ignoring the security case, and the wishes of those who live outside the South-western corner, on the grounds of preserving the environment is irresponsible, in particular when strengthening the rural areas could actually increase opportunities for tourism.

5.5 Long-term outlook

The amount of discussion on electricity security among the media and general public in Iceland is currently little to none outside areas that experience insecurity, i.e. the Westfjords and in the northern part of Iceland. Instead of discussing rural areas' need for higher delivery security, or the need to renew and strengthen the system, the debate tends to turn towards the kinds of environmental issues explored above. Indeed these are important aspects of the issue, and many of the arguments for environmental considerations have their merit. However, such crucial aspects of electricity security as delivery security and meeting future demand are never addressed: they are dismissed as matters of corporate interest, when in fact they are the main point and the reason this debate exists.

Lost in the debate about strengthening of the transmission grid are the opportunities of the future. Although for now overhead lines are the optimal choice, the future may hold technological advances that change this fact. The object of discussion should then become

[280] Mbl.is"43% andvígir háspennulínu yfir Sprengisand," *mbl.is,* March 31, 2015, accessed April 11, 2015. http://www.mbl.is/frettir/innlent/2015/03/31/43_prosent_andvigir_haspennulinu_yfir_sprengisand/
[281] Mbl.is "Leggjast gegn Sprengisandslínu," *mbl.is,* January 15, 2014, accessed April 11, 2015, http://www.mbl.is/frettir/innlent/2014/01/15/leggjast_gegn_sprengisandslinu/
[282] Visir.is "Eru ekki til tals um raflínu yfir hálendið," *visir.is,* April 10, 2015, accessed April 11, 2015, http://www.visir.is/eru-ekki-til-tals-um-raflinu-yfir-halendid/article/2015704109937
[283] Visir.is "Eru ekki til tals um raflínu yfir hálendið."

whether it is not better to suffer the sight of occasional transmission lines for now, and put them underground later when it can be done safely and with little impact on the environment, than to either deny rural areas security or undertake very expensive and environmentally disruptive construction. Such a focus on long-term goals could engage the public in learning about the electricity system and ease the conversation about funding such ambitious plans, increasing general security awareness and understanding. This would also present opportunities to engage in a society-wide discussion with all the relevant stakeholders about the future of Icelandic society, even incorporating other security aspects.

Delivery security and secure electricity supply to Icelanders living outside of the South-western corner is in some places poorer than desired. Settlement outside the large towns or far away from production sites is simultaneously risky - because of limited capacity to develop further - and officially encouraged. Strengthening settlements outside the capital area is a goal expressed by the government inter alia in their proposals for state-wide planning.[284] Icelanders are therefore faced with the question of whether they desire a stronger settlement around the country, or settlement outside the largest towns, to exist at all. Strengthening the electricity grid and constructing the line through Sprengisandur is argued by its supporters to offer the best chance of achieving a stronger settlement in rural areas, as it will increase their security and introduce opportunities for increased economic activity, one of the fundamental needs for strengthening any region.

A further stage of securitization - the act of creating an existential threat to society and politically prioritizing it in terms of action - is therefore perhaps needed to a degree in the electricity sector. It may have been attempted with the Master Plan, but without success so far. The bottom line is that Iceland needs a comprehensive energy production strategy which can incorporate the different interests and needs of society, strategically utilize production options, and ensure that future energy demand is met, while sparing the environment as much disruption as possible and ensuring long-term stability. The current process of creating a national security strategy offers an excellent opportunity for such a sub-strategy to be created.

As the overall security discussion among the general public continues, energy security aspects should be incorporated, either by the electricity sector or the communities wishing to strengthen their own security. It should only be a matter of time before people affected by diminished delivery security confront those who stand in the way of their rights to equal security and possible development. Such a turn in the debate would hopefully increase the

[284] The Icelandic National Planning Agency, *Landsskipulagsstefna 2015-2026- Tillaga til umhverfis- og auðlindaráðherra*, 5.

general public's knowledge and understanding of energy needs, leading to better understanding of the proposed constructions and willingness to work on solutions.

There is hardly an option available today that all actors will agree upon. The pragmatic needs of society in the 21st century and the inherently Icelandic love of the environment are hard to reconcile at this time and concessions will be needed on all sides. It does not, however, help the debate or finding a solution to dig one's heels in and refuse to cooperate. Although energy production has been contested and perceived in the past as a matter of firms serving their own interests, it is ultimately a task performed for the people in Iceland. Rigorous legal prescriptions about roles and the limits of these roles, along with the fact of the Icelandic system not being connected to other systems, leave the energy sector serving the demands of its only market: Icelandic society. The electricity sector has responded to an immense increase of demand in the past decade, leading to protests over the location of installations as no clear vision has guided the growth of energy production.[285]

Lack of a strategy has fuelled divisions among stakeholders, most often rooted in choices of production sites. Some stakeholders have gone so far as to refuse to cooperate, as cooperation inherently includes compromising and compromising is difficult with irreversible changes to the environment. The debate must begin to incorporate other important aspects, both security aspects and future opportunities, and allow more stakeholders to share their views, in order for societal consensus to be possible.

5.6 What about external risks?

Although the greatest security threat to electricity security is seen as coming from internal security issues, it is important to discuss the potential effects of external security issues. Security among the actors within the electricity sector is rooted in large part in the legal framework. The legal framework provides a structure within which the actors can manoeuvre slightly to increase their own security but there are no requirements for a holistic risk management. External standards and regulations are used to strengthen the security structures within the sector and create a shared understanding of security threats. Individual actors can prioritize individual security issues up to a point within the operations imposed on them through the structure, and may also place issues on the security agenda that are not prescribed in the law, such as market and financial questions. The security structure includes a legally prescribed cooperative forum (NSR) as well as a voluntary cooperative forum (Samorka) where actors within the structure jointly work on common security aspects.

[285] Jónasson. "Miklu magni framburðar verður mokað upp á Þjórsárbakka."

Within the security structures, actors share an understanding of threats that appears to stem in large part from the legal set-up of the structure. This focuses security inwards, leaving cooperation on external security both within the firm and across sectors as secondary security priorities that are attended to on an *ad hoc* basis. External risks e.g. from human action, which may have been identified but hitherto not expressed as priorities, may pose a larger danger than thought. Sabotage is certainly on the radar but, as introduced in chapter 4, does not seem to attract the same amount of precaution or consideration as internal security issues or other external security issues, like the weather.

Nature holds a special place on the external security agenda as Iceland has ample experience with nature's destructive capabilities. Storms, avalanches, volcanic eruptions, and earthquakes are well known issues and are therefore incorporated to some degree in all firms' security structures. Although it is very difficult to completely prevent damage from natural hazards, response measures are well known and well planned in advance. The warning time for extreme weather provides a chance to prepare for repairing foreseeable damage and to position assets in the vicinity. Nature thus seems to be the only external factor to receive true security priority in Icelandic thinking, simply because of the frequency with which it becomes a threat to the infrastructure.

The 2009 Risk Assessment mentioned sabotage as a major risk factor that had not been addressed thoroughly enough.[286] Admittedly, some aspects have been looked into, but they have been only superficially addressed by installing security equipment for monitoring and preventing access where possible - measures that were actually taken in response to other security concerns. The most vulnerable elements of the system do not incorporate measures for preventing access because such measures would not only be expensive and complicated to execute, but would not necessarily stop those with the intent of causing harm to the system.

The general security environment in Iceland has a tendency to be reactive and confront the issues that it knows best. Response plans are synonymous with security and although some preventive measures are taken in the case of weather and sabotage, there does not appear to be any element incorporated in the design of the system's physical structures or in governmental oversight that plans for human action such as terrorism. The initial reaction in the general debate in Iceland when it comes to security threats such as terrorism is to assume that such things do not happen here. Granted, there has so far been very limited experience with such issues, which affects the incorporation of such issues into the security structure.

[286]Ministry of Foreign Affairs, *Áhættumatsskýrsla fyrir Ísland*, 115.

However, looking towards the country's neighbours and the states it likes to compare itself with, it can be seen that security threats such as terrorist attacks are not only actively worked on but have also been experienced. The other Nordic states actively monitor terrorist threats, and Norway has experienced a devastating attack from within, along with the rest of Western Europe. It is therefore only appropriate for Iceland to at least consider such acts and prepare as best it can: the best defence being a strong offence through the design and development of its systems. It is, at least, better to be prepared for atrocities that could happen but never do, than to utterly ignore and discard the possibility.

External risks such as sabotage or terrorism may, in fact, pose the greatest danger to the operational security of the system. It is therefore surprising to find that such acts are not identified as a priority within the security structure. Because of their predictable consequences, public protests in Iceland so far have not demanded a strategy capable of dealing with large-scale sabotage in general, but can be dealt with through temporarily increased security measures or police assistance. When dealing with terrorist attacks, by contrast, because of the element of surprise, plans to respond need to involve not only the firm under attack, but also major stakeholders and other sectors, as the electricity infrastructure is the basis for much of other infrastructures' operations.

As the CPEM becomes the coordination centre for any situation where multiple actors face an emergency, these partners can be provided with plans for massive electricity outages. The CPEM's job is essentially to scan the whole of society, look for security issues and threats, and assist in addressing these. Through this mandate it may often become the first actor to point to external threats previously overlooked, such as the possible consequences of flooding because of the volcanic eruption in Bárðabunga.[287] On its shelves may lie response plans for handling major disruptions to electricity outages, and even response plans to deal with terrorism. But these are *response* plans and in general, the CPEM's role begins after the event. If the best defence is a good offence, precautions must be taken from the start in the design of the system itself.

This may be a tall order and a lot to ask of a system that has little experience with sabotage or terrorism, and only a small financial pool to draw upon. The optimal solution would be to utilize the opportunities for adapting the system alongside its renewal, incorporating measures that would address these external security issues into the design of renewed equipment and structures. At the very least, actors within the electricity

[287] Civil Protection and Emergency Management, interview conducted by author in Reykjavík, March 24, 2015.

infrastructure should work on how to prevent or discourage external human action directed against their systems. Again, the creation of the national security strategy provides a fantastic opportunity to incorporate such measures into a larger energy security strategy. However, until such strategies are implemented, the actors themselves appear to be solely responsible for their structures and their defences. As a vital foundation of national infrastructure, governmental bodies should also be involved in protecting these attributes of the electricity sector, whether financially or through other supportive measures. In any case, external threats should not go unplanned for and should be on the list of active security issues.

6. Conclusions

Societal security is a new focus within the Icelandic security environment, as security has historically focused on the traditional security understanding that prevailed among the majority of previous governments as well as in the population. While securing Iceland's military security, domestic security developments within Icelandic society have long been focused on natural hazards, as these are widespread and frequent and dealing with such events has been a matter of survival. In the new era of security, however, when security is understood in ways other than territorial defence on the state level, the scope of security awareness and understanding is rapidly expanding in Iceland as elsewhere. Societal security and its many areas of focus open the way to a re-evaluation of society's position and possibilities, both within each area of security, and as a whole.

This thesis set out to explore security awareness within the electricity sector. As a critical aspect of societal security and a part of its critical infrastructures, actors within this sector carry an immense responsibility in preventing insecurities for their end-users, both individuals and other societal actors including business, media, and social organizations. Our research set out to explore the security issues that actors within the sector are confronted with and to explore their priorities. It asked in what ways these actors approach security and how they treat it in their daily operations. The thesis further set out to identify the largest risk factor(s) facing the electricity security of Icelandic society, and to discuss proposed ways of securing future electricity security against the background of other aspects of societal security, as no security issue is ever experienced in a void.

What this thesis found was that the distinction between safety and security is important when discussing the Icelandic security environment, as the same word is used in Icelandic for both of these concepts. Questions asked about security during the research often led to answers about safety, which of course is a part of the actors' security structures. A large part of the actors' safety measures are prescribed by laws and are a condition of retaining an operational licence. This leads to an emphasis on internal security aspects, as the related standards are monitored both internally and by external actors and fulfilling them is the basis for companies' continued operations. These measures thus tend to focus the sector's safety and security thinking inward, making operational security the centre of safety and security measures.

Of course it is vital to firms to ensure their operational security. Their continued existence depends on it. For the most part, security issues within the electricity sector are

potential threats to the continued operation of the sector, while safety issues are more concerned with individual contact with the structures and equipment. Even in the area defined as operational security, most issues identified by the operators are internal ones: financial, maintenance and renewal issues, and human mistakes. The only external threat identified as a persistent focus in security awareness appears to be the weather. There is, admittedly, some awareness of other external security issues, but identified weak points are not specifically addressed because it is costly, impossible, or thought not likely to hinder those who truly wish to do harm to the system.

Such thinking is worrying when external threats actually experienced by our neighbours are ignored as a possibility here, or at least not mentioned as concerns in reports or in the interviews conducted in the making of this thesis. The tendency to prepare for what you know is strong in Iceland, and while the external threats of the weather are well understood, sabotage and terrorism do not seem to be of specific concern to the firms, apart from case-specific issues regarding expansion or renewal of the transmission system.

When discussing security it is good practice to use widely accepted and acknowledged theories and concepts to connect the discussion to the larger literature. This thesis has employed the concept of securitization as a basis for understanding varied approaches to security. Although the Copenhagen School describes a set of steps towards calling an issue a security threat, this author did not agree with the implication that such securitization may be entirely artificial and unnecessary or even harmful. As the multiple security issues that confront firms in this sector daily need constant attention in order not to get out of hand and pose a threat to the operation, a fluid and open approach to security should allow for labelling issues as a security matter when identified and incorporating reflection on them into the sector's security agenda. Even on a societal scale, when an issue becomes a security threat and crosses the threshold of securitizing, an open-minded approach to security will allow actors to react to the security challenge even before, or regardless of, its classification as a threat. Therefore, active securitization and the raising of an issue above the normal constraints of politics should not be needed in order to let security awareness evolve in keeping with objective needs, unless a devastating event requires responses beyond the sector's own capabilities.

In general, approaching security as a threat only after an issue has become a problem, without engaging in preventive measures or preparation for dealing with the possible threat it may pose, leaves actors unable to deal with security issues adequately. Security issues exist regardless of our subjective perceptions, and for politicians to wait to focus on and respond to

threats until after an issue has been accepted by an audience as an existential threat to society would be irresponsible.

Societal security is an issue that should be approached with the understanding that security issues are always present: they are interrelated across sectors and across policy areas, and require multiple actors to partake in working on them and responding to threats. Societal security, although a relatively new concept, gives an opportunity to place security evaluations in a larger context. It provides additional frameworks for analysis and by its very nature obliges multiple aspects and actors to be integrated into the security understanding. Through the societal security lens, it is possible to make a more holistic evaluation of security threats, notably by recognizing the societal context in which the security threat is presented.

In any event, security issues within the electricity sector seem to be first and foremost the responsibility of the firms involved, only becoming connected to the political process through coordinated emergency response after an issue has crossed over to become a threat. Security in this sector is therefore an all-encompassing, fluid process that is constantly being evaluated and worked on within companies and without special political control.

This thesis has relied heavily on published material; reports, legal documents, articles, and informational booklets, while supplementing the analysis of security awareness with interviews as information on this aspect was not readily available in print. It therefore relied heavily on the willingness of firms to give information on their own security awareness. It may be assumed that the actual level of security awareness and the security environment within the firms and institutions concerned is more complex and deeper than reflected here, as a full disclosure of any firm's security information could increase insecurity by drawing ill-intentioned actors' attention to new weak points. The security environment of the sector as a whole is also much wider and more diverse than depicted in this thesis, as not all actors' viewpoints were included in the research (for example production companies, large-scale users, and politicians). The thesis does, however provide an insight into the nature of 'soft' security within the given sphere, where multiple aspects of a different nature – other than external military aggression - are identified as security issues and possible threats to the survival of the firm/sector; and into the interdependency of different security aspects within the firm and within society.

The security issues identified in this thesis range from construction codes and legally binding roles the firms must fulfil to the internal dealings linked with meeting these requirements and securing the firm's own employees. The most surprising aspects incorporated into security definitions were without a doubt those related to the market

environment and financial stance, although with hindsight such issues do threaten the firms' operations as much as damage or failure in the physical structures. Additionally, the cases discovered where security issues were elevated into potential threats further demonstrate the fluid security understanding of the firms, as they continually adjust their security strategies based on the information at hand. Security issues arising in other sectors, such as the Vodafone hack, demonstrate potential dangers that can either be dismissed as other sectors' problems or, as in the case of ISE, incorporated into the electricity sector's own security structure, further strengthening its own security.

This thesis has touched on the repercussions of large-scale disruption or damage to the electricity system. For now, it is unlikely that the Icelandic public will experience the full extent of these, as the efforts to secure operational capacity and the long-term outlook applied to planning and renewal of the system will surely prevent such a disaster. It is, however, not a useless exercise to ponder worst-case scenarios, if only - as in chapter 5 of this thesis - to illustrate society's reliance on electricity and the extent of its impact should anything go wrong. For firms, study of a worst-case scenario is necessary to identify weak points in their security structure, and to provide a basis for fixing, preventing, or planning for its repercussions. External actors embedded in the emergency response structure, such as the CPEM, do this for a living, often finding previously unknown weak points. The prudential approach, and the pessimism expressed in worst-case scenario exercises, therefore serves an important role in security.

This thesis has identified the largest single threat to the electricity system as the ageing of the transmission system and the need to strengthen it. This conclusion is largely based on the consensus among those interviewed who identified this as a major security threat, and the information provided in the various reports and projections. It appears to be a valid concern, as the health of the transmission system determines the grid's capacity to serve its function of delivering electricity to end-users. As shown, the diminished capacity of the transmission system to fulfil this role can have grave consequences, rooted in the simple fact that our entire society is based on technology powered by electricity.

Debates regarding proposals for strengthening the system are often hijacked by interest groups, who steer the conversation off track and focus on environmental issues while painting the firms as thinking only about their profits. Meanwhile, there is little else but silence on the firms' side. This thesis has therefore sought to offer a new road to follow in pursuing these discussions, and has presented three elements that could help society move forward in a less adversarial way.

First, it has been proposed to move the focal point of the debate to future possibilities, while recognizing that it is presently impossible to meet the call for underground cables. This would require the different stakeholders to reach an agreement on future goals that would allow the electricity grid to serve its purpose while meeting the wishes of those who oppose its interference with the landscape. This would require actors to acknowledge the present limited possibilities for physical structures to meet visual desiderata, while recognizing the importance of constructing the transmission line through Sprengisandur and the effects it would have on rural areas' security.

In an environment that is not prone to long-term planning, compromising present interests for the sake of future goals would be difficult, especially in the light of certain groups' outright refusal to cooperate in any way. The societal division reflected in the present debate, which impacts any development negatively, may ultimately (hopefully) give way to new stakeholders representing interests not currently expressed or valued. The way forward does not lie in division among stakeholders or in picking sides to fight for an absolute win of one set of interests over another, which all too often seems to be the way Icelanders deal with important issues. Only in cooperation can society move forward, incorporating all of its stakeholders' interests into future plans.

Second, this thesis has introduced additional societal security considerations. As electricity security impacts upon different aspects of society and vice versa, it is important to incorporate all these aspects for a better understanding of society's security needs. Security issues in one dimension rely on security issues in other dimensions, and may well coexist even if they disagree on priorities. These interlocking aspects have so far been completely left out of any debate in Icelandic society. This may be because of insufficient general understanding of security issues, as security awareness among the general public is still very much rooted in the traditional understandings that they have grown up learning from the political elite.

Incorporating these aspects into the debate would enrich it by incorporating more than just the most loudly stated arguments. It would give people insight into the needs and potential of those living outside of the capital area and should help to put all arguments into perspective relative to the needs of society. This does not mean that the loudest – and only – voice heard in the debate today is entirely to be discarded. But the disregard of some environmental advocates for other stakeholders' views and other issues' merits increases the oppositional character of the debate, further hindering any progress in any related policy area. Incorporating other security issues and educating the general public on these issues would

give the public the ability to make informed decisions and take part in informed discussions about the complex issues facing society today.

Third, this thesis has emphasized society's inability to continue without a larger vision and overall strategy. Such a strategy would incorporate energy production strategy as well as transmission, delivery, and the stability of the grid, resulting in increased energy security for Iceland. It would need to incorporate the security implications for other fields of societal security, as presented in chapter 5, including securing the ability of nature to sustain life, the responsible use of natural resources, and incorporating the moral values that society places on nature. Only through a comprehensive long-term strategy could Iceland reach a societal consensus and focus on cooperation instead of opposition.

Without such a strategy, energy production must remain a bone of contention when it comes to environmental protection, and without political leadership when it comes to new production areas this opposition is not likely to disappear. Although one could argue that the Master Plan is an attempt at such a strategy, it has taken over a decade to form, is heavily contested both in Parliament and the general debate, and appears to be lacking in security strategy. Lack of political will, or even lack of the knowledge needed to construct such a complex strategy, is both holding back the development of settlement outside of the capital area and fuelling the societal division over these issues.

The present moves towards adopting a national security strategy present an excellent opportunity to acquire the knowledge needed to construct such a strategy. However, the longer this work drags on, the less options there are to create a comprehensive security strategy for energy production and development, and one may expect increased dissatisfaction with the process. The more decisions on construction and production have to be taken before creation of a strategy such as that proposed in this thesis, the less flexibility this strategy will have regarding the distribution and strategic placement of production, as it would need to adjust to the system in place and develop its plans from there.

There is therefore a dire need for swift and decisive political action regarding a comprehensive energy strategy in order not only to create societal consensus, but to assure Iceland's energy security. This need requires both experts and politicians alike to face the problems at hand without prejudice and leave personal convictions at the door. The need for societal interests to take priority should motivate action, lest its future security hang in the balance, doomed by sloppy action and childish behaviour in taking sides.

When discussing security it is important to not lose the focus on what, in the end, is the object being secured. Although much emphasis has been placed on the physical structures

of the electricity sector, and on the ability both of firms and the government to keep supply, production, and transmission steady, and meet demand, in the end it is society and the individuals living within it that are the true objects of security. Securing the electricity infrastructure is a means towards protecting the Icelandic population from the multiple security threats they would face if they had to survive without the invention they have based their entire lives upon. It is this realization, that the true object of security is the population, that makes a holistic view essential - or at least, demands reflection on the inter-related aspects of security - when discussing societal security.

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