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Power of the Future

Security of Supply in Danish and Finnish National Energy and Climate Strategies

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Each country in the world is currently under pressure to find other means than fossil fuels to satisfy its energy needs, as the legally binding Paris Agreement urges to limit global warming to 2 degrees Celsius. Denmark and Finland were part of the Kyoto Protocol, and as part of the EU, agreed earlier on targets on their emissions, energy efficiency, and renewable energy. Although these countries were at the forefront to combat climate change, they are still far away to complete the transition of their energy systems.

This thesis analyses Danish and Finnish national energy and climate strategies. The study asks how will Denmark and Finland ensure their security of energy supply as energy and climate targets necessitate to replace all fossil fuels until 2050. It applies a social structurationist approach to develop a theoretical framework to answer the question of why have these countries chosen exactly the means they are currently employing.

Through comparative case study approach this study shows that there are both major similarities and differences in Danish and Finnish energy strategies. Both countries expand the production of bio-based energy sources, and strive to reduce energy consumption through energy efficiency measures. However, Denmark considers wind power a financially viable energy source and crucial for its future energy mix, whereas Finland views it as a complimentary alternative. Finland relies on nuclear energy for the foreseeable future, in contrast to Denmark which gives the technology no part in its energy planning. This divergence highlights how the EU in general is divided in regard to nuclear power.

This thesis finds Denmark more ambitious than Finland in light of energy and climate targets. Finland deems further technological development, especially the commercialisation of carbon capture and storage, necessary to reach the long-term targets.

Contents

1. Introduction

1.1. The research question and initial hypothesis

The research question for this study concerns how Denmark and Finland are pursuing the security of energy supply in their national energy and climate strategies for the short-, medium-, and long-term in the period from 2020 to 2050? How do they approach this issue similarly or differently in relation to each other? Both countries have set ambitious energy and climate targets within the EU and on their own behalf, which strongly advocate finding other means to satisfy their energy needs than burning fossil fuels. At the same time, EU member states must ensure that the energy available is affordable so that their industries and companies' competitiveness, and their households' purchasing power, doesn't suffer. It is by no means a simple task to fit progressive climate targets and such a vital factor for a modern society as a secure energy supply together.[1] Yet succeeding in it is crucial for societies and the environment. The actions of the 21st century states are of central role, and therefore I find this research question justified.

Based on the binding energy and climate targets which alone direct EU countries' energy policy decision-making,[2] my initial hypothesis purposes Denmark and Finland are, at least in part, pursuing security of supply through similar means. These could include stronger utilisation of biomass for energy and heat production; increased efforts to grow non-food crops and reuse agricultural waste and woodchips for biofuel and biogas production; further initiatives to cut energy consumption by setting increasingly stricter energy efficiency standards for vehicles and devices; advocacy for measures to increase the CO_2 allowance price within the ETS; and by automating and digitalising the electrical grid (smart grid technologies) which allows two-way communication between the utility and customer (i.e. small-scale energy producers can sell their excess electricity to the operator), and enables the grid to respond to quickly changing electricity demand.

However, I anticipate there will be notable differences between Denmark and Finland in relation to their attempts to guarantee security of energy supply. Presumably wind power is given a much more significant role in Danish strategies than in Finnish ones. In 2014, the installed wind capacity in

[1] Even without considering energy and climate targets, security of supply hasn't evolved for the better in the Nordic countries in last decades. One example is that between 1992 and 2002 electricity consumption increased by 17% in the Nordic countries whereas production capacity grew only by 2% (Ruostetsaari 2010, 92).

[2] Some earlier works close to the subject of this study which have guided me include, for instance, Birchfield and Duffield 2011, Goldthau 2013, Morata and Solorio 2012, and Proedrou 2012.

Denmark equalled 5,030 MW, while in Finland the parallel number was 1,005 MW.[3] [4] Moreover, the countries – most likely – differ in regard to nuclear energy. It accounts for around 18% of Finland's total energy consumption whereas in Denmark it has no part in energy planning, a situation which will likely remain the same.[5] [6] Presumably nuclear energy continues to be part of Finnish energy mix, maybe even more so in the future than today.

My argument is that both the similarities and differences between Danish and Finnish energy and climate strategies, regarding security of supply, can at least partially be explained by the respective EU member states' assessments of surrounding policy environments (of which more in the theory section below). Basically, I argue, it comes down to questions of resource sufficiency, the price of different energy sources, the role of other actors of energy policy, the environmental effects of different forms of energy production and consumption, and how much leeway the technology available allows for energy policy. Additionally, it must be noted that even when the surrounding policy environments are exactly the same for the states in question, as in this case with technology, the countries' interpretations of it might well be different.

Furthermore, I expect that security of supply is a more central theme in the short- and medium-term for Finland than it is for Denmark. This is due to the fact that Denmark was a net-exporter of energy until 2012 and its degree of self-sufficiency for energy was 90% in 2014,[7] a rare case in the EU, whereas in Finland the degree of self-sufficiency was 35% on average in 2010–2013 (53% if nuclear power is counted as domestic energy, which is hardly the case in Finland because all the uranium is bought, converted, and enriched abroad).[8] But in the long-term both countries have agreed to (almost) entirely phase out the use of fossil fuels for energy production and transport, which calls for significant measures to ensure that security of energy supply can be covered by renewable energy sources.

1.2. Central concept: security of supply

Having now laid out the research question and the initial hypothesis, a clarification about the central concept for this study, namely security of supply, is needed. While security of energy supply may

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[3] Danish Energy Agency 2015.
[4] Finnish Windpower Association 2016.
[5] Statistics Finland 2015.
[6] World Nuclear Association 2016.
[7] Danish Energy Agency 2015.
[8] World Nuclear Association 2015.

seem self-evident initially (e.g. the International Energy Agency (IEA) defines it as the uninterrupted availability of energy sources at an affordable price), it may mean different things for different actors.[9] To start, one must note that security of supply and security of demand are the two sides of the same coin. Where energy consumers, let them be countries, companies or households, seek to ensure that sufficient amount of electricity, fuel and heat are always available, the energy producers pursue certainty that their products will be purchased.[10] One common way to protect domestic or renewable energy producers is to subsidise them so that the state in question can reduce dependency on imports of fossil fuels. Another example of how supply and demand security are closely connected can be found, for instance, in the gas sector. Russia is the most important gas supplier of the EU, and as the EU is dependent on Russian gas, the most prominent Russian supplier, Gazprom, tries to lock up the demand through the construction of direct Russia–EU pipelines. This would reduce the impact of disputes with third-parties, such as Ukraine, and therefore Russian gas could be delivered to Europe with fewer interruptions, increasing both the security of supply and demand.[11]

In the context of this study, the concerns over the security of demand are not fully relevant. As previously noted, Finnish self-sufficiency of energy was 35% in 2010–2013 and in 2011 about half of its total primary energy supply consisted of fossil fuels.[12] [13] Although Denmark was a net-exporter of energy until 2012, 85% of its energy production in 2010 was covered by oil and gas. The production of both of these fuels peaked already in the last decade, and the state is dedicated to phasing out their use in energy production completely by 2050.[14] Hence, the market opportunities for (domestic) renewable energy producers are plentiful in both countries for the foreseeable future. At state level, Finland and Denmark are nowhere near having the amount of renewable energy production capacity that would put them, now or in the near future, in some kind of category of 'Renewable Energy Exporting Countries' whose members would have to be concerned about the sufficiency of demand for their products. Therefore, it seems justified to concentrate on the consumer side of energy security, i.e. security of supply.

Understanding the whole concept of security of supply may vary from country to country depending on their respective energy policy environments. Some EU countries are heavily dependent on Russian

[9] IEA 2014b, 13.
[10] See for instance OPEC 2006.
[11] Proedrou 2012, 77–84.
[12] Finnish Government 2014, 23.
[13] IEA 2013a, 15.
[14] IEA 2011a, 15–21.

gas alone, and this is reflected in the EU level documents. In some occasions, the term is used regarding the gas sector only.[15] In this context, security of supply is understood as increasing the share of energy imported to Europe from other countries at the expense of the state who currently has the dominant position in the market, namely Russia, and more efficient use of energy produced within the EU.[16] This is close to the IEA terminology for short-term energy security, which is defined as "the ability of the energy system to react promptly to sudden changes within the supply-demand balance".[17]

Undoubtedly, this dimension of energy security is crucial and will likely impact Finnish and Danish energy and climate strategies, but it does not indicate how the states are going to reformulate their energy mixes in the decades to come. Short-term energy security only directs the states to have sufficient reserves of energy and possibilities to substitute one energy source or supplier to another. For the purpose of this research, a long-term understanding of security of energy supply is necessary. To use the IEA terminology, such definition mainly deals with 'timely investments to supply energy in line with economic developments and sustainable environmental needs'.[18] At first glance on the Finnish and Danish energy and climate strategies, this understanding seems to be shared with the countries.[19] [20] Security of supply is but one cornerstone of the energy trinity the EU countries are committed to. It comes at a price, but the countries try to reduce the cost as much as possible but sustainably. It must be kept in mind that both Finland and Denmark are dedicated to reducing their use of fossil fuels in energy production almost to nil. How exactly are Finland and Denmark going to do it without compromising their security of energy supply, and why this avenue and not in some other way, is the central question of this study.

To summarise, I define security of supply in this study as uninterrupted and sufficient availability of energy sources at an affordable price in line with climate and other environmental commitments.

1.3. Why does energy matter?

Energy lies at the very heart of every society. For long economic development and demand for energy were coupled, meaning that the more society evolved, the more substantial the role of energy became,

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[15] European Commission 2015a.
[16] European Commission 2015b.
[17] IEA 2014b, 13.
[18] Ibid.
[19] E.g. Danish Government 2011b, 20; 30. Danish Government 2013, 35.
[20] E.g. Finnish Government 2014, 10; 15–16; 33.

and specifically secure access to sufficient energy resources.[21] Even the Domesday Book, the oldest register of people and regions compiled by the order of William the Conqueror in the eleventh century England, recognised the vitality of energy for agricultural production by carefully recording the number of the main draught animal, oxen, in every village.[22] While energy and all the issues related to it have received increasing attention among policymakers, financial institutions, the public, and in the media – though still surprisingly little in academia – at least since the first oil crisis in the 1970s, the full importance of energy is yet to be wholly appreciated. Susan Strange, an international political economy scholar who practically set the research agenda for energy within her field, has purported that classical economists such as Adam Smith and David Ricardo should have included energy, and with it technology too, as factors of production. She argues it was already evident in their time that the increasing production of wealth depended on energy and technology, in addition to land, labour, and capital.[23] Only quite recently have technological developments made it possible to extend economic production while consuming the same amount of, or even less, energy than before. To illustrate this one can look at two measurements, gross domestic product (GDP) and energy intensity, which means total energy consumption per unit of GDP. From 2000 to 2014, the average annual global economic growth was 2.7%,[24] whereas average annual global energy intensity reduction was -1.4%[25], indicating falling costs of converting energy into GDP.[26] [27] However, some economists remain doubtful whether it is possible to significantly reduce the number of energy units used for economic activities. They claim that the world has merely shifted to other, higher quality, forms of energy.[28] Nevertheless, the necessity to fulfil energy needs securely and with less carbon dioxide (CO_2) is ever more important and calls for measures such as increasing energy efficiency and switching from fossil fuels to ‘greener’ sources of energy.

How exactly did secure supply of energy become as indispensable as it is for us now? Arguably, there are three phases which have each alleviated the value of energy in the world. Industrialisation and the increased mobility of people mark the first phase which made the modern society much more dependent on energy than its predecessor, the agrarian society. Production of coal and the Industrial Revolution are strongly linked, although the former was already growing before the latter began in

[21] Washington Post 2014.
[22] Strange 1988, 186–187.
[23] Ibid., 186.
[24] In constant 2005 US dollars.
[25] In constant 2005 US$.
[26] World Bank 2016a.
[27] Enerdata 2016.
[28] Sorrell and Ockwell 2010.

the 1760s. Coal was the very fuel of industrialisation, but traditional energy sources such as wood remained more important for long. In the United States, it was only in 1885 when coal became the primary source of energy.[29] It remained so everywhere in the industrialised countries even after the Second World War. At that time coal was cheap, much more efficient than wood, and plentiful. As it happens, the latter remains true and at the current rate of use, the known coal stocks are predicted to last for more than another century.[30] Finally, during the 1950s oil replaced coal as the world's primary energy supply. World War II heralded a new age of mass production of aircraft, ships, and other motor vehicles which required substantial increase in oil production. After the war, the oil industry grew more productive and could provide (nearly) all the petrol, diesel, and kerosene the societies, which were becoming much more mobile than before, needed for cars and airplanes.[31] [32] Today, mankind uses about 85 million barrels of oil per day. An average human has to work 10 hours a day for more than two weeks to produce the energy equivalent of one litre of crude oil. This highlights our reliance on energy and cautions against romanticising the pre- Industrial Revolution age, when life was constant struggle against scarcity for everyone no matter where (s)he lived.[33]

In the 1960s most policymakers, industry leaders, and scientists were not really concerned over the sufficiency of cheap oil, let alone other fossil fuels, on which the society became all the more reliant. In the words of Susan Strange, 'people thought the supply of oil was inexhaustible and would continue to flow uninterruptedly for ever.'[34] All this changed in 1973 when the first oil crisis hit the industrialised world. It was instigated by the Organization of the Petroleum Exporting Countries (OPEC) which proclaimed an oil embargo resulting in quadrupled prices in just half a year. This marked the second phase which underlined energy's importance. All the actors of energy policy and the public began to believe that inexpensive oil might not always be available. Moreover, piling evidence suggesting finite oil supplies urged states, industries, companies, and others actors to look for alternative sources of energy. If oil reserves ran out, the consequences for electricity and heat production, the basic industries, transport, agriculture, and households would be catastrophic. The 20th century society would quickly come almost to a halt. The oil crisis of 1973 had many long-lasting effects. In Europe, supranational institutions led by the Commission prepared to reintroduce energy onto the Community's political agenda where it had not been since the start of the European

[29] Energy Tribune 2010.
[30] Smith 2011a.
[31] Energy Tribune 2010.
[32] Birchfield and Duffield 2011, 1–9.
[33] Smith 2011b, 71–72; 79.
[34] Strange 1988, 205.

integration in the 1950s.[35] [36] Accordingly, interest in natural gas rose significantly worldwide,[37] but this did not prevent new oil crises, such as in 1979, nor did it preclude disruptions in the supply of natural gas too. This was clearly demonstrated in Europe during Russia–Ukraine gas dispute in winter of 2006 when, after Russia stopped delivering gas for its Ukrainian customers because of disagreement on price, Ukraine diverted some of the gas volumes destined to Europe for its own use, causing shortfalls of deliveries of Russian gas to central European countries.[38]

While the world energy consumption has continued to grow, insecurities in the supply of oil and gas have led to a resurgence in coal production.[39] This was the policy adopted in Denmark in the 1970s.[40] However, from the 1980s onwards, apprehensions over the environmental effects of energy policies gained ground. Denmark was among the frontrunners pursuing alternative resources, particularly with its investments into wind power.[41] I would characterise this period, which we are still living in, as the third phase of energy dependency. Unfortunately, from an environmental point of view more than 80 percent of global primary energy supply comes from hydrocarbons – oil, coal and natural gas.[42] Although the total primary energy supply of OECD (Organisation for Economic Cooperation and Development) countries has been decreasing in recent years, the whole world's energy supply keeps growing, mainly because of the rapid expansion of Chinese and other emerging market economies.[43] Very recently there have been indications of slowing down of the latter, but it still remains to be seen how it will affect global energy supply.[44] [45] According to the Intergovernmental Panel on Climate Change (IPCC), global land and ocean surface temperatures have risen 0.85 degrees Celsius over the period of 1880–2012, and it is extremely likely that humans are causing most of the warming through burning fossil fuels which intensify the concentration of greenhouse gases in the atmosphere.[46] [47] Climate changes are already causing impacts on natural and human systems. The former include, for example, heat waves, floods, melting glaciers and permafrost. Moreover, the changes that are occurring may themselves accelerate global warming. If, for instance, the Siberian permafrost melts,

[35] Andersen 2000.
[36] Solorio and Morata 2012, 11–13.
[37] Our Finite World 2012.
[38] Pirani 2012, 176–177.
[39] Our Finite World 2012.
[40] Danish Wind Industry Association 2002, 1–2.
[41] Ibid., 1–3.
[42] IEA 2014a.
[43] IEA 2015, 6–8.
[44] IMF 2015.
[45] BBC 2015.
[46] IPCC 2013.
[47] NASA 2015, ref. Bloomberg 2015.

it will escalate the release of methane, a powerful greenhouse gas, so drastically, some researchers argue that it will increase the atmospheric methane burden 12 times.[48] As for the latter, decreasing crop yields, rising sea levels and more frequent extreme weather make human settlement in coastal zones and drylands more dangerous or almost impossible, and this is clearly visible on all continents and sea areas.[49] If the average temperature rises more than two degrees, the consequences will be far-reaching. The question of energy supply is thus more imperative than ever. At the same time when the world needs increasing amount of energy, it should more rapidly switch the climate change inducing energy sources to low-carbon power.

Therefore, it has been rightly argued that the whole economic and social well-being of the peoples, the industry and the economy relies on safe, secure, sustainable and affordable energy.[50] In the case of the European Union (hereafter the EU) which is greatly dependent on imported oil and gas, this is especially true.[51] Until December last year the world lacked a legally binding and worldwide international climate change agreement. The Kyoto Protocol did not qualify as such, for the developing countries were not issued any binding targets, and the United States, then the biggest polluter, never ratified the treaty. Furthermore, countries such as Russia, Japan and New Zealand did not agree on any mandatory targets for the Protocol's second commitment period (stretching from 2013 to 2020; the first commitment period was in 2008–2012), and Canada withdrew from it altogether.[52] The few non-EU countries taking part in the second period included, for instance, Iceland, Norway, Switzerland, and Ukraine. The world leaders reached a climate agreement in Paris in December 2015 (of which more below), but many countries had already consented to reducing their greenhouse gas emissions through various mechanisms either on their own or, as in the case of the EU, in regional blocs. This is the subject of this master's dissertation. I will examine how two EU countries, namely Denmark and Finland, are aiming to transform their energy systems. That is, how will they secure their energy supply in the short-, medium-, and long-term while simultaneously pledging to decarbonise their energy supply and energy consumption almost entirely by the end of the respective period.[53] [54] I will also make an argument about the reasons why Denmark and Finland are pursuing their energy supply in the way they have outlined in their strategies. By the short-term I refer to time period stretching from the publication of a relevant energy and climate strategy to 2020.

[48] Shakhova et al. 2008.
[49] See more in IPCC 2014.
[50] European Commission 2010, 2.
[51] See for instance Eurostat 2015.
[52] See for example UNFCCC 2014.
[53] Danish Government 2013, 14.
[54] Finnish Government 2014, 10.

The time frame for the medium-term is in 2020–2030, and the reason for this is because the EU has agreed on further, post-2020 energy targets for 2030. Hence, the long-term indicates the 2030–2050 period, for the energy roadmaps of the EU and its member states reach the middle of the century. However, I will not conduct the analysis in three stages, going forward from one time frame to another. Instead, I will analyse the material through the lenses of one piece of analytical framework at a time, of which more below. All the same, time is an essential factor in this kind of study which focuses both on the present day, the near-future, and the rather distant one. Therefore, I find it necessary to classify time frames in some categories.

1.4. International climate agreement – at last

The worldwide and legally binding climate agreement was reached among the world leaders in global climate change conference in Paris during the time of writing of this thesis. My original intention was not to concentrate on global climate agreements, but the signed treaty deserves to be dealt with some detail, for it likely will alter the policy environments within which energy policy actors, especially states, operate. My material consists of Danish and Finnish energy and climate strategies, which could hardly predict specifically when an international climate deal would be reached. Nonetheless, presumably the states in question counted on that the world would come to sign a treaty sooner or later, making it easier for them, too, to transform their energy systems. Conventional thinking argued clean energy cannot yet compete with cheap coal, and thus countries that keep burning coal gained a competitive edge over those who did not.[55] However, if all states truly became dedicated to phasing out coal and other fossil fuels that would offset the disparity. How much Denmark and Finland relied on a global climate agreement will be reflected later in the analysis. No doubt their next energy and climate strategies will look partly different but in this dissertation I will have to use papers which they have produced in the last five years.

The governments agreed to prevent global average temperatures from increasing close to 2 degrees Celsius above the pre-industrial level. Further, the governments are aiming to limit the increase to 1.5 °C, for this would significantly reduce the risks and impacts of climate change.[56] After years of failure to reach any agreement at all, the ambitiousness of the Paris deal regarding emission reductions came as a surprise for many.[57] [58] Apparently scientific evidence about the harsh effects of climate change,

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[55] TIME 2013.
[56] See for example European Commission 2016a.
[57] National Geographic 2015.
[58] ABC 2015.

that would occur even if warming was halted to 2 degrees, became simply undeniable, e.g. low-lying Pacific nations such as the Marshall Islands would still sink.[59] The treaty also acknowledged the need for global emissions to peak as soon as possible – understanding that this would take longer for developing countries – and then take rapid reductions thereafter.[60] The targets will be revised every five years and the countries' progress monitored. However, there is still urgent need for improvement, for the national climate plans the states submitted during the Paris conference, let alone the policies already conducted, are not nearly enough to limit warming even to 2 degrees. According to Climate Action Tracker (CAT), a scientific analysis produced by four research organisations, implementing all the pledges in the national climate plans would result in around 2.7 °C of warming in 2100. With the policies governments have in place already, the world would be heading towards warming of 3.6 °C by the end of the century.[61]

1.5. Energy policy of the EU

Arguably, EU countries are at the forefront to combat climate change, though one must assess such claims with caution.[62] However, one has to merely take a glance in the energy and climate targets agreed on international and EU level to note that to a large extent this argument is valid. While the international community was just reaching the stage of agreeing on the need for global emissions to peak soon, the EU had already implemented measures to reduce its emissions by tens of percents, not to mention the other legally binding targets. Prior to 2020 energy and climate targets, the EU reduced its greenhouse gas emissions by 8% from 1990 levels during the first Kyoto Protocol commitment period from 2008–2012. That is why I find it fruitful to concentrate on the European energy policy in this thesis. Examining the EU countries' plans to undertake energy transition, which ultimately will be necessary for all were the world to avoid the unmanageable consequences of climate change, seems a justified approach to shed light on how the energy and climate targets can possibly be met.

In the last five years or so, the EU has adopted ambitious targets for energy and climate policy outlined in a number of documents, including the 2020 Energy Strategy and Energy Roadmap 2050. By 2020, it aims to reduce its greenhouse gas emissions by 20% from 1990 levels, improve its energy efficiency by 20% (i.e. reduce energy consumption by 20% by 2020 compared to the projected energy consumption in 2020, based on projections made in 2007), and increase the share of renewable energy

[59] National Geographic 2015.
[60] European Commission 2016a.
[61] CAT 2015.
[62] Youngs 2013, 421–425.

to at least 20% of consumption (including 10% share of renewables in transport).[63] The 2020 Energy Strategy also introduced national targets which would better reflect the initial situations at individual state level. Not only has the EU agreed on remarkable energy and climate targets, it is also as a whole well on track to meeting them. In 2015, 24 countries were expected to achieve their greenhouse gas targets; 20 to achieve their renewables targets; and likewise 20 to reach the energy efficiency targets. Additionally, 13 member states were on schedule to deliver their national targets in all three areas, whereas a year before only nine were on track.[64] Finland's emission reduction and energy efficiency targets are the same as EU-level targets, but it pursues to increase the share of renewable energy sources in its final consumption to 38%.[65] Denmark has set an ambitious target of 40% reduction in greenhouse gas emissions by 2020.[66] The country's energy efficiency target is also in line with that of the EU and it has pledged to increase the share of renewables in final energy consumption to 35%.[67]

Furthermore, the European Council reached an agreement over the energy and climate targets for 2030 in October 2014. As the conclusions of the agreement read, emissions were to be cut by 40% from the 1990 levels, the share of renewables in the energy mix must be at least 27%, and energy efficiency was to be increased by 27%. The former two were binding targets on EU-level, the latter was merely indicative.[68] Moreover, neither the energy efficiency target nor the renewable energy target is nationally binding.[69] In the long term, the EU committed to cutting emissions by 80–95% of the 1990 levels by 2050 while maintaining or improving the security of energy supply and competitiveness, as envisaged in the Energy Roadmap 2050.[70]

To fully understand how the EU's energy policy is closely linked with those of its member states keep in mind that emissions arising from various sectors are treated differently. Emissions from electricity and heat generation, heavy manufacturing industry, and aviation are part of the EU Emission Trading System (the ETS), which cover around 45% of the EU's greenhouse gas emissions.[71] In 2013, the respective number was 41% for Denmark and 52% for Finland.[72] [73] Every power plant, factory, and other installation is granted a certain limit of CO_2 which it can emit within

[63] European Commission 2010, 3.
[64] European Environment Agency 2015a, 16–55.
[65] Finnish Government 2013, 7.
[66] Danish Government 2013, 14.
[67] Danish Energy Agreement 2012, 4.
[68] European Council 2014, 1–6.
[69] Ibid., 6.
[70] European Commission 2011.
[71] See for instance European Commission 2016b.
[72] European Environment Agency 2015b, 2.
[73] European Environment Agency 2015c, 2.

a given time period. This cap is reduced over time – and it cannot be crossed – so that a desired emissions fall is forcibly reached (an EU-wide target for the ETS sector is 21% emission reduction by 2020 compared to 2005 level).[74] If, say, a power plant invests in energy efficiency and thus does not need all the CO_2 allowances it has been given, it can sell the excess allowances to other actors within the ETS. Correspondingly, a factory which has exceeded its quota must buy the extra allowances it needs. The idea is to encourage energy policy actors to switch, in one way or another, to forms of production and consumption which produce fewer emissions. The price of CO_2 allowances is determined by market rules, i.e. by supply and demand. Arguably, the ETS spot price has to be high enough to give a real incentive for power plants and others to invest in renewable energy sources or energy efficiency, but for a long time, the ETS carbon spot price remained low; for the whole year of 2013, around €5 per tonne of CO_2.[75] When the price of carbon dioxide does not actually compel energy companies and other actors to take efforts which would contribute in reaching the energy and climate targets, additional measures and tools were required both from the EU and the member states.

In contrast, emissions from transport (excluding aviation), agriculture, buildings, and waste are treated as non-ETS sectors, and they are part of the so called Effort Sharing Decision (ESD) which sets binding annual greenhouse gas emission targets for each member state. Since the recent, overall EU target is a sum of the national targets, action from every member state is required. Although there are EU measures which can assist the member states in reaching these targets, for the most part they require action on the national level.[76]

Obviously, the aforementioned targets will require considerable changes and enormous investments in every sector on international, regional, national and local level. But striving towards a low-carbon economy presents a huge opportunity for companies and countries exporting renewable energy technology and cleantech solutions. For instance, the size of the global cleantech market was €1.6 trillion in 2012, and the market was estimated to grow about 7–8% annually.[77] Since reaching a global climate agreement, the demand for green technology will most likely increase even further. Still, there is no point to argue that green energy transition comes at no cost. But it makes equally little sense to argue that it is not necessary – the cost of not decarbonising our energy systems eventually is even

[74] European Commission 2016b.
[75] The Economist 2014.
[76] European Commission 2016c.
[77] Ministry of Employment and the Economy of Finland 2014, 2.

greater,[78] not only in economic[79] but – or especially – in human and environmental terms.[80] However, in order to reach the climate targets in an economically feasible way, the EU member states must reformulate their energy mixes and energy infrastructures in a way that neglects none of the elements in the 'energy trinity': (1) (increased) security of supply; (2) economic competitiveness through affordable prices; (3) environmental sustainability.[81]

As previously outlined, this thesis aims to shed light on how two EU member states, namely Denmark and Finland, attempt to secure their economies' continuous access to energy between the present to 2050. It bears mentioning that none of the elements of the energy trinity can be analysed in total isolation from the others. Indeed, they do overlap and sometimes align together, but they can also contradict one another. For instance, phasing out some energy sources on environmental grounds may increase dependency on imports; some renewable energy technologies may not be able to compete with fossil fuels, at least not without subsidies etc. Due to the scope of this kind of research and in the interest of comparing different countries, the focus will be narrowed down to one element, security of supply.

The reason is that I'm mostly interested in studying how the member states can contribute to achieving the commonly agreed energy and climate targets. Indeed, one hardly needs to emphasise how crucial their role is.[82] While the European energy policy is defined by the coordinated action of the EU and of its member states, it is the security of supply on which the member states still have full sovereignty.[83] As the Treaty on the Functioning of the European Union reads, each member state has the 'right to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply'.[84] This is also carefully reflected in the 2030 Climate and Energy Policy Framework, where it reads that '[the energy and climate] targets will be achieved while fully respecting the Member States' freedom to determine their energy mix.'[85] Hence, I find the composition of the member states' future energy mix, designed to guarantee their secure access to energy and defined in their national energy and climate strategies, as the most

[78] Krugman 2010.
[79] See for example Westphal, Hughes, and Brömmerhörster (Eds.) 2013, 61.
[80] IPCC 2014.
[81] For typology see Morata and Solorio 2012.
[82] Ecofys 2014, 53.
[83] Morata & Solorio 2012, 3.
[84] Eur-Lex 2012, TFEU, Article 194 (2).
[85] European Council 2014, 6.

meaningful way to scrutinise how the *member states* are aiming to reach the ambitious energy and climate targets.

Notably though, despite the member states having full de jure sovereignty in defining security of supply, de facto EU legislation could set several limits on them. For instance, shale gas and shale oil explorations and extraction are covered by EU environmental legislation, therefore their use can possibly be restricted.[86] Another example is that heavily subsidising some production forms might contradict EU competition laws. It follows that in some respects, common EU policies regarding security of supply can be deemed beneficial or even necessary by the member states. Such stances are possibly reflected in the material chosen for this study.

It is evident that there is not only one way to reach the energy and climate targets while at the same time taking care of the energy needs of the industry, companies, households, and the whole society. To be able to say anything about the possibly quite varied ways to achieve the energy targets without neglecting any of the elements of the energy trinity, at least two different states should be the subject of this study. Of course the means Denmark and Finland are using might well be similar, but that remains to be seen in the analysis. In any case, it should prove useful for further research, and indeed for policymakers, to have some knowledge of the range of choices states can make to achieve the demanding, ambitious, and yet essential energy and climate targets.

1.6. Why Denmark and Finland?

So securing energy supply through reasonable planning of future energy mix, which is also in line with the energy and climate goals, is the most meaningful instrument states have in their own repertoire to complete the energy transition that inexorably lies ahead. However, the reader might legitimately ask at this point, why have I chosen to examine the cases of Denmark and Finland in this dissertation – why not some other countries? Before moving on to discuss the specified research question and the central concept for this thesis, security of supply, I shall add a few remarks on why have I picked exactly these two Nordic countries as the objects of analysis for my work.

First of all, this is a thesis done in a Finnish university so it is only natural that Finland receives a special interest. While the EU energy policy is a fruitful subject from the perspective of green energy transition, Finnish energy policy is, in my interpretation, even more so; in some respects, the country

[86] European Parliament 2012.

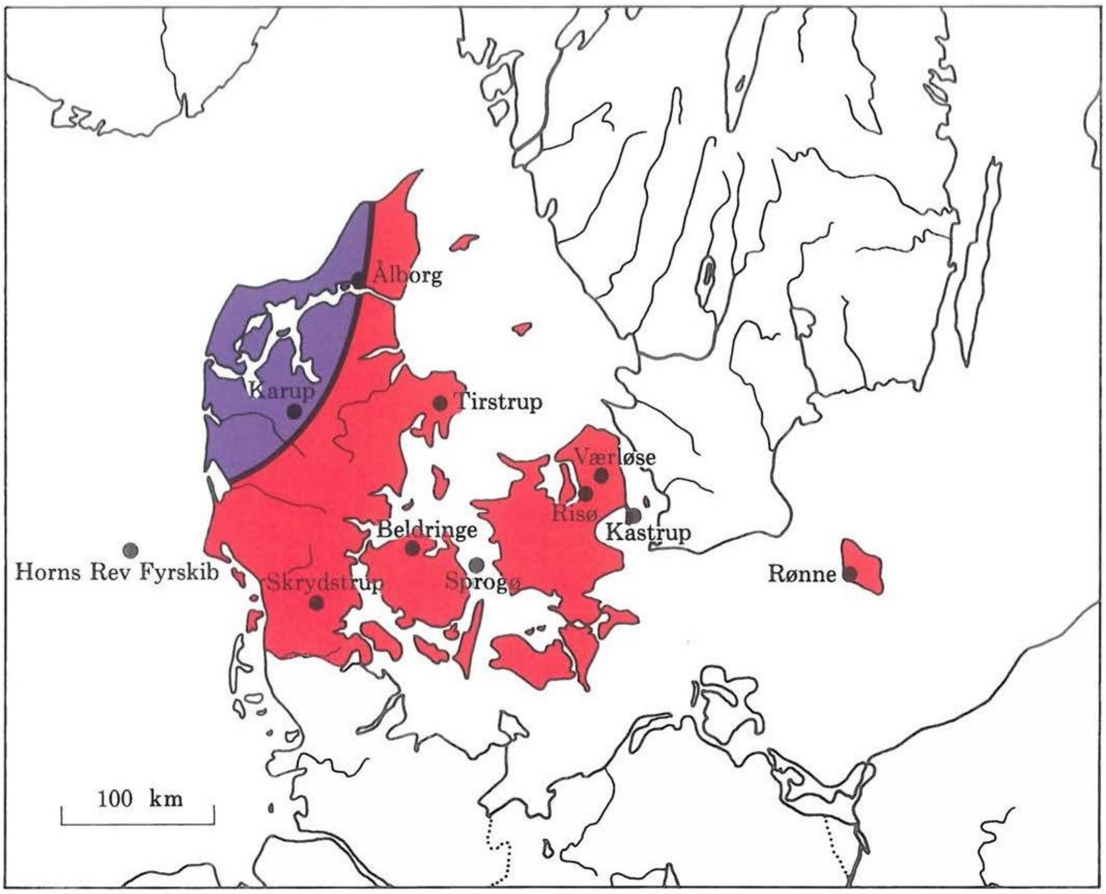
pursues more ambitious energy and climate policy than the EU as a whole, aiming to increase the share of renewable energy to 38% by 2020. Still, the share of renewables in electricity production is even bigger in neighbouring countries like Sweden or non-EU country Norway. Why is this so and would these countries make a meaningful pair for comparison with Finland? Not really in my view, since this is largely due to the much bigger hydropower sector in the respective countries (although Sweden has a large capacity of wind power production too). Annually, Sweden generates around 66 terawatt-hours (TWh) of electricity and Norway as much as 127 TWh by hydropower, while Finland produces 12 TWh.[87] [88] [89] Undoubtedly, the conditions for hydroelectricity production are ideal in Norway and Sweden, and further, better than in Finland because of the greater annual rainfall and the vast amounts of melt water streaming from the Scandinavian Mountains. Hydropower is a well-established sector, and there is little room to increase its capacity in Northern Europe or most parts of the world. There are only certain amounts of big rivers, and they are already utilised for hydroelectricity production in most cases. Moreover, there are hardly any new suitable places for dams.[90] Besides, hydropower, despite being nearly carbon neutral, can be very harmful for the society and the environment. Dams may force people, wildlife and agriculture to emigrate elsewhere. They can also cause political tensions if situated on a border river,[91] and hydroelectric plants without fish passages can be fatal for entire migrating fish stocks.[92]

Much more peculiar than the role of the hydropower sector is that of the wind power, and it is here where Denmark comes into picture. Finland has increased its wind power capacity rapidly – last year it grew by 60% reaching narrowly the limit of 1 gigawatt (GW) – and hence its production, which totalled to 2.3 TWh in 2015.[93] It is still very small compared to Denmark. The southernmost Nordic country has five times more wind power capacity than Finland, and its production amounted to 14.1 TWh in 2015.[94] Hence the question is, why is there so big a difference between these two countries? The limits for the increment of wind power capacity are nowhere near exhausted, neither in the Nordic countries nor in the world, but the opposite is true with hydropower. The biggest disputes concern land use, but wind farms can also be built in the sea, either near or offshore. If land use problems have been resolved in densely populated Denmark, which is much smaller in size than sparsely

[87] IEA 2013a, 111–136.
[88] IEA 2013b, 105–130.
[89] IEA 2011b, 95–113.
[90] Smith 2011b, 94.
[91] Ibid.
[92] Amaral, Fay, and Hecker 2012.
[93] Finnish Windpower Association 2016.
[94] Danish Energy Agency 2016.

populated Finland, they can hardly explain the differences in the respective countries' wind power capacity.

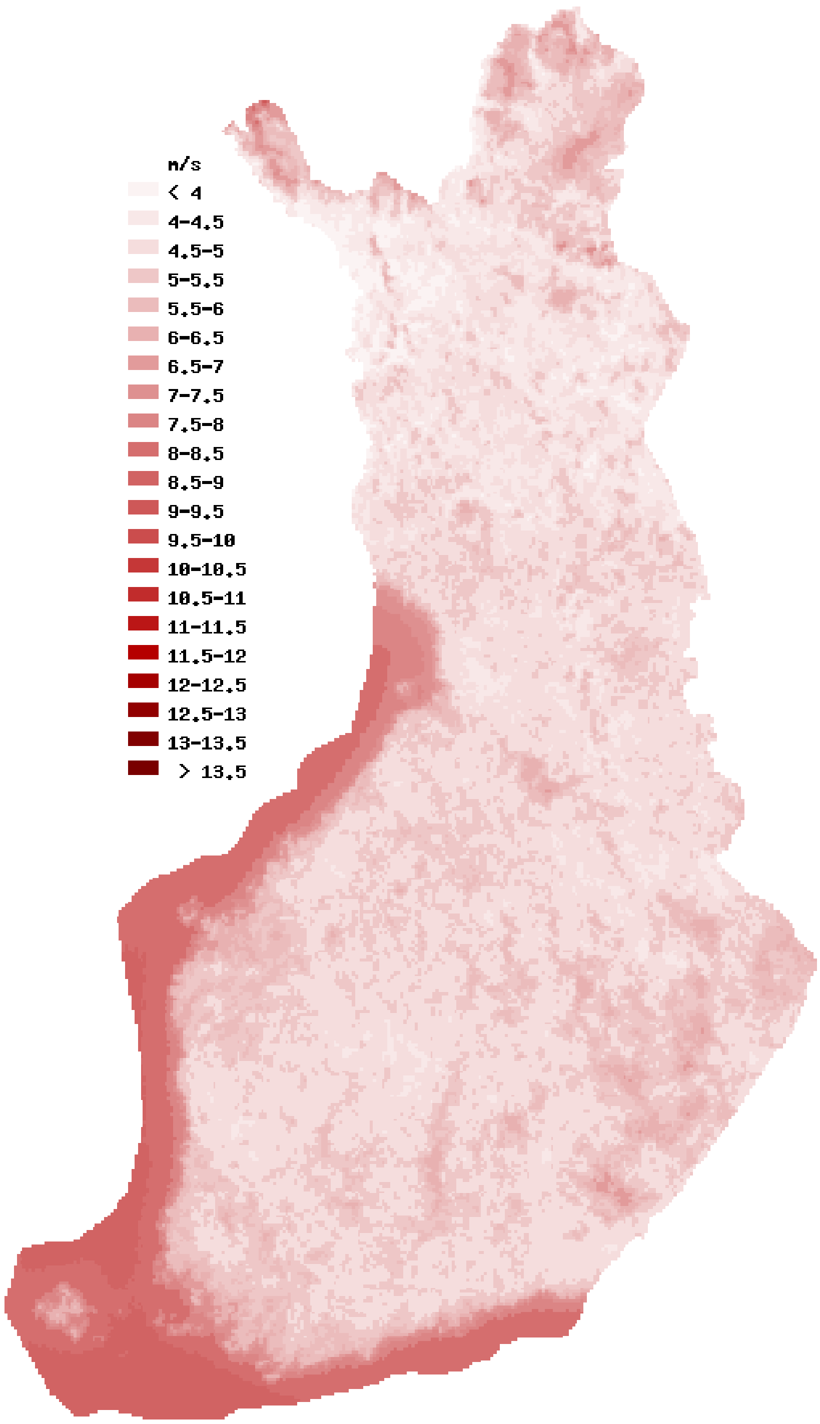
Finnish public discussion commonly predicate that it is not windy enough in the country to produce wind power cost-efficiently.[95] Is it simply much windier in Denmark than in Finland, thus optimizing wind power production within the borders of the former than the latter? The wind simulations based on statistics do not support this claim, as the two maps below illustrate.



Wind resources at 50 metres above ground level for five different topographic conditions*										
	Sheltered terrain		Open plain		At a sea coast		Open sea		Hills and ridges	
	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}
	> 6.0	> 250	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 11.5	> 1800
	5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
	4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
	3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0-8.5	400-700
	< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 7.0	< 400
o	Regions where local concentration effects may occur						* see Fig. 2.3 for full explanation			

Source: Troen and Lundtang Petersen 1989. Copyright © 1989 by Risø National Laboratory, Roskilde, Denmark.

[95] For instance Mtv.fi 2012.



The average annual wind resources in Finland at 50 meters above ground level. This map is on 2.5x2.5 square kilometre spatial resolution and thus more accurate than the former. Unfortunately I was unable to locate a corresponding data for Denmark, but the current version should provide a general view. Source: Finnish Wind Atlas.

There are differences in windiness considering the inland areas of Denmark and Finland, but around the lakes, which are very plentiful in Finland, the average wind speed comes close 6–7 m/s. On the

Lapland fjelds, the average annual wind blows even faster. Not taking the northwest of Jutland into account, there are not many discrepencies – at least not enough to explain the differences in size of wind power capacity regarding these two countries – in wind resources in coastal zones and open sea. Similar environmental conditions should make wind power technology, more or less, equally economically feasible in both countries. Since its introduction in the 1980s, the cost of generating electricity from wind power has fallen significantly and further reductions are likely when taller turbines with longer blades increase the capacity and efficiency of the machines. Already in some states in the US, wind power can compete with coal.[96] The U.S. Energy Information Administration predicts that in 2020 the levelised cost of electricity (which is often used as a measure of the overall competitiveness of different technologies, taking into account capital costs, fuel costs, fixed and variable operations and maintenance cost, assumed life-cycle for each power-plant etc.) for onshore wind power will be 74 US$ per megawatt-hours (MWh) on average.[97] This will make onshore wind equally competitive in economic terms with the most cost-efficient natural gas-fired power plant types and second only to geothermal energy, leaving all the other energy production forms behind.[98]

In short, the inherently material basis for energy policy, i.e. the resources, cannot self-evidently explain the huge differences in wind power capacity between Denmark and Finland – the same way the resource structure, arguably, explains the difference in hydropower capacity between Finland and Norway. It seems that policymakers and other energy policy actors in the respective states have simply estimated the prominence and suitability of, and need for, wind power in very diverging terms. This might be for all sorts of reasons, say, the influence of different lobbyists, the interpretation of available information, or the (dis-)advantages of other energy production technologies. But unless Finland is planning to increase its wind power capacity ultra-rapidly to approximately match it with that of Denmark – which I do not believe – the different views of the surrounding policy environment, on which the states as a whole base their assessments of possible policy choices, must still be prevalent. How exactly do their views differ, is what I will try to uncover in this thesis. Since I don't have the possibility to trace which lobbyists were heard in the preparation of energy strategies, what information the government officials give the biggest value etc., I will form a theoretical model with which I could say something about the governments' interpretations of the energy policy environment. This is the subject of the next section.

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[96] NY Times 2014.
[97] U.S. EIA 2015.
[98] Ibid.

The fact that Denmark and Finland have invested in wind power in such a distinct manner in relation to each other, was the central motive for me to choose this subject. It has also guided me in formulation of the theoretical and methodological framework for the study. However, it must be noted that I do not wish to concentrate on this particular aspect only. My aim is to reach an understanding of the respective countries overall energy policy. But the inspiration for this study came from the great differences in wind power sector.

Motivational grounds aside, I would still argue that Denmark and Finland qualify as an adequate pair for the method employed in this thesis, namely comparative case study, of which more in the section 3. As the logic in comparative case study goes, the cases selected must predict similar results or produce contrasting results but for predictable reasons.[99] On one hand, these countries are very similar in some respects. They are both developed, Nordic welfare countries who most arguably can be said to be in a good position to do their bit to combat climate change. In addition to the EU energy and climate targets, some of their national goals are almost identical (such as nearly 100% share of renewables in energy production and transport sector by 2050).[100] [101] Conversely, there are also notable differences between the countries which make them an interesting pair to compare. Firstly, some of the manufacturing sectors vary quite a lot in size; mining and manufacture of food products occupy a bigger share in Danish than Finnish industry, whereas energy-intensive lumber and paper industries are significantly more important in Finland than Denmark. Secondly, Finland is sparsely populated, Denmark rather densely. Thirdly, Denmark is a net exporter of energy and receives revenues by selling oil and natural gas; in turn, oil and gas imports increase Finland's current account deficit. This paper will attempt to uncover which factors could possibly explain the differences and similarities in Danish and Finnish plans for the low-carbon energy transition. Such analysis could, of course, be conducted correspondingly to other EU member states as well. What I hope to achieve, is to shed at least some light on what could be taken better into account regarding country-specific characteristics when planning further energy and climate targets on a supranational level. It is also possible that the strengths in either country's strategies could be taken into use elsewhere, too.

1.7. Structure of the thesis

I hope I have provided in this section a coherent account of the historical development and contemporary circumstances of energy policy, convinced the reader of the significance of the subject

[99] Zucker 2009, 6.
[100] Danish Government 2011a.
[101] Finnish Government 2014.

of this study, and justified acceptably why the EU countries, Denmark and Finland, make an interesting comparison. I also wish that the central concept is crystal clear and the reader has a proper picture in mind of what exactly am I going to do. The next section covers the theoretical background for this thesis, and reviews the pros and cons of established approaches in energy policy research specifically with regards to this study. I will then unpack how I formulated my own framework, based on the idea of structuration, as understood by Anthony Giddens and Alexander Wendt, as the theoretical point of departure, and introduce the works of Susan Strange[102] and Aalto et al.[103] from which I draw much in this study. Finally as a summary of all the theoretical discussion I shall present my own model.

The third section will give an account on the methodological approach used in this work. It will briefly assess the role of methodology in general – what does it actually mean, what it is and what it is not, and how to actually use it. After that I will discuss in more detail the method, namely comparative case study, I have chosen for the study. The analysis will be carried out in the section four. The first subsection will introduce the material, and the second and third subsections, will analyse Danish and Finnish strategies, respectively, responding to the research questions of *how* is the state going to secure its security of energy supply in 2020–2050, and *why* is it planning to do it in this exact manner. As I argue, their choices can at least partially be explained on the basis of their assessments of the surrounding structures. Therefore, I will go through the states' interpretations of each dimension of my model outlined in the section 2.5. The last section will cover the conclusions and evaluate their validity.

[102] Strange 1988; 1994.
[103] Aalto et al. 2008; 2012; 2014.

2. Contemporary theoretical models and framework for the study

2.1. Established approaches

To begin with assessing the theoretical framework for the study at hand, it must be noted that theoretically oriented International Relations approaches are currently severely underused in energy policy research.[104] This is equally true regarding International Political Economy,[105] as well as security studies. One illustrative example being, the fact that the principal journal in international relations and security studies, *International Security*, had published only eight articles devoted to energy in its then 30-year history.[106] It has been said that energy is a classic case of 'no man's land', an area that lies between social sciences, largely unexplored or unoccupied by any major field of study.[107] In the existing research, there are some prevailing, well-established approaches, such as energy diplomacy, geopolitics and energy security, and energy economics and trade.[108] One emerging approach, namely energy and the environment, has probably already institutionalised itself, at least in the context of European energy policy.[109] [110] Each of these approaches will be examined in more detail, after which their relevance to this study will be summarised before moving on to the development of the framework for the thesis.

Before beginning it must be said that the following description of the above-mentioned approaches inevitably generalises a lot. It is not possible here to make a deep review on several aspects of energy policy research. Rather, I will have to remain on 'ideal type' level.[111] I would expect that there are variations in the literature and not all scholars want to follow rigorously defined traditions. However, the energy policy community arguably does focus on very selective aspects of global energy policy.[112] Therefore, I find the following, rather generalising discussion, justified.

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[104] Aalto et al. 2012, 33.
[105] Ibid.
[106] Dannreuther 2013, 80.
[107] Strange 1988, 191.
[108] see Aalto et al. 2008.
[109] Buchan 2009.
[110] Morata and Solorio 2012.
[111] See for typology: Max Weber. Protestant ethic and the spirit of capitalism.
[112] Goldthau 2013.

2.1.1. Energy diplomacy

Energy diplomacy aims to describe the dependencies and interdependencies of energy producers and consumers, of developing and developed countries, and of regional blocs and institutions.[113] [114] In the context of EU–Russia energy relations, this approach highlights the prospects and hardships of economic integration in the Eurasian continent whilst striving to enhance political cooperation between the two biggest players in the region, namely the EU and Russia.[115] The scholars of Chinese energy policy recognise China's huge appetite for, and growing dependency of, foreign energy resources which direct it to form close ties especially with oil and gas exporters in Asia and Africa.[116] Therefore, the country stresses the importance of seeking common ground with different actors with their variant interests in order to forge a favourable balance with all the parties involved in global energy policy. China finds developed countries, especially the United States, disproportionally represented in the international energy regime. It strives to alter the balance in its favour and get recognition worldwide.[117]

Summits, negotiations, state visits, agreements, programmes for cooperation in financial and economic affairs and diplomatic conflict resolution provide the basic material for energy diplomacy researchers.[118] [119] The picture they convey of energy policy is strongly agent-centric.[120] Through the lenses of energy diplomacy, the actors of each respective policy field have, by far, the most influence on what kind of energy policy is practiced. They are not constrained much by the policy environments where they operate but rather, are able to define and pursue their own interests. Energy diplomacy scholars regard states, regional blocs, institutions, and political and business leaders as the core actors who have the most say in forming and negotiating energy policy.[121]

Undoubtedly, energy diplomacy has a lot to say about why the new global climate agreement could be reached in Paris on December 2015. It is worth noting that at least Finland kept some of its own long-term energy and climate targets, only indicative if a global climate agreement could not be forged. However, this provides a very narrow answer to the questions of how Finland and Denmark

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[113] Aalto et al. 2008.
[114] Qinhua 2007.
[115] Aalto et al. 2008, see also Barysch 2005.
[116] Kreft 2006.
[117] Qinhua 2007.
[118] Kreft 2006.
[119] Aalto et al. 2008.
[120] Ibid.
[121] Ibid.

are going to secure their energy supply in the future and why so. Negotiations, bargains, alliances and competition with others cannot explain the full content of national energy and climate strategies of the two countries. Furthermore, the energy diplomacy approach is only usually applied when the dependent variable, state, regional bloc, institution, corporation etc., is relatively big like China, Russia, or the EU. There is possibly a fair explanation to this: small states like Finland and Denmark, with their limited significance and capacity, are rarely in a position where they can negotiate, let alone define, the rules of energy policy on their own. Besides, as EU member states, both of these countries align much, and increasingly,[122] with the EU's energy policy, leaving themselves little space to bargain on a national level. Finally, I find that the agent-centricity of energy diplomacy clearly limits its explanatory power. The interests of the agents and what they really negotiate for are, in my interpretation, taken too much for granted. The idea that the surrounding policy environment, *the structure*, can and frequently does have an effect on what the actors of energy policy perceive as necessary, satisfactory, or possible in the first place, does not receive much attention among energy diplomacy approach.

2.1.2 Geopolitics and energy security

Energy and (international) security overlap in multiple ways. This intersection is in the centre of studies leaning towards geopolitics and energy security approaches.[123] [124] One framework for thinking about the relation between energy and security is to explore how the former shapes the political, military, economic, and diplomatic strategies that countries develop.[125] First, energy might be seen as an ends itself, of a 'grand strategy' which urges the leaders of a country to find ways to provide secure access to energy resources at a reasonable price to their people, economy, and industry.[126] Plainly, every state that wants to survive must secure sufficient resources, and scholars argue that when a country's energy needs are growing rapidly or are otherwise scarce, energy comes to dominate especially foreign policy. China's engagement in Africa is one contemporary example; by constructing railways, roads and harbours, and granting loans and investments to host governments, China has received direct access to oil fields, obtained by its national oil companies.[127] Second, energy might provide tools through which countries can further their interests in another policy areas. These might include recognition and power in international arenas, access to international decision-making bodies and influence over, say, neighbouring countries. Russo–Ukrainian gas conflict in 2006

[122] European Council 2015.
[123] O'Sullivan 2013.
[124] Bahgat 2006.
[125] O'Sullivan 2013, 32–36.
[126] Ibid.
[127] Ibid., 35–36.

is an often mentioned example of this. Third, energy can provide means, i.e. the resources and revenues, for states to pursue their foreign or domestic policies, which can have implications for international security. For instance, Iran has spent an estimate 100–200 million USD every year to support Lebanese Hezbollah. Without revenues from fossil fuels, it could have hardly done so.[128]

In the context of the EU, geopolitics and energy security approaches situate Russia and its energy policy into the context of geopolitics and interregional competition.[129] [130] Scholars highlight the importance of maintaining a close energy dialogue with Russia, despite disagreements and problems in other policy areas. Furthermore, they stress how crucial it is for the EU to diversify its energy mix in order to reduce dependency on Russian gas, which accounted for 42% of the EU's gas imports in 2009.[131] [132] This calls for deeper energy cooperation with the Caspian states and actions to strengthen the EU's energy partnership with the Middle East states.[133] Other issues that are frequently examined within the geopolitics and energy security approach include Russian pipeline politics and gas disputes between Russia and Belarus in 2004 and 2007, and between Russia and Ukraine in 2006.[134] Prevalent interpretations in this framework conclude that Russia's energy policy and pipeline projects aim to ensure Russia's national interest and increasing power in traditional, realist terms.[135]

Although both approaches discussed so far in section 2.1. agree on who the central actors in energy policy are, – the only difference being that energy diplomacy approach sees a role for business leaders too whereas geopolitics and energy security approaches emphasise the meaning of state-bound companies as such – their understanding of the formation, alteration, and significance of the actors' preferences differ. Unlike the energy diplomacy approach, the explanatory model of geopolitics and energy security approaches can best be understood as very structural-objectivist. Material factors, the surrounding structures, i.e. who has what resources and how much, seem very much to determine one actor's policy.[136] I don't find this a fruitful departure point for this study. No doubt the surrounding structures and the policy environments in which energy policy is conducted, direct, allow, and limit some actions the actors can make, but I don't see the actors as completely deadlocked in the structures. Their own preferences and goals count as well, and they are not dictated merely by the 'national

[128] Ibid., 36–42.
[129] Aalto et al. 2008.
[130] Bahgat 2006.
[131] Proedrou 2012, 53–58, 77–137.
[132] Bahgat 2006, 966–970.
[133] Ibid., 970–975.
[134] Aalto et al. 2008.
[135] Ibid.
[136] Ibid.

interest', which I find rather vague concept in the first place. It is also worth noting that the preferences of actors may, and do, change, a concept which is not fully appreciated in geopolitics and energy security approaches. They offer valuable insights on, for example, (inter-)dependency, vulnerabilities, and power accumulation which will be taken into account in this study. However, for me geopolitics and energy security approaches, just like energy diplomacy approach, seem insufficient frameworks on their own to provide a decent explanatory model for Finnish and Danish national energy and climate strategies.

2.1.3. Energy economics and trade

The main focus of energy economics and trade approach tends to be on making the markets work, fixing any shortcomings, and fostering technological innovation.[137] Scholars in this framework concentrate mostly on quantifiable issues such as energy resources, market mechanics and other energy economic related phenomena.[138] Common subjects for studies in the approach include; market imbalances such as energy cartels,[139] energy as public goods,[140] and state-owned energy companies and their effect on energy production, investment, and pricing.[141]

Sometimes energy economics and trade approach is coupled with geopolitics. These studies, rightly, point out that security of supply is closely related to micro- and macroeconomic developments, but they take place in a specific geopolitical settings and both influence each other.[142] One possible way to look at this is to create two storylines which can predict the future development of a state's energy policy. Correljé and van der Linde call these *Markets and Institutions* and *Regions and Empires*. The former storyline will be more accurate if states align their energy policy with market mechanics. In that case further globalisation of energy markets and institutionalisation of multilateral international system prevail. The latter storyline predicts multilateral international system to be dismantled into competing regional blocks, which may stir rivalry over the control of resources.[143] As the dynamics of international politics and economics are intensively intertwined, scholars stress that any singular approach to security of energy supply, or other aspects of energy policy, may not be enough.[144] Energy economics and trade should be combined with whole other approaches as well. By bringing together economic and environmental factors, it could be argued that putting a higher price on coal,

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[137] Goldthau 2013.
[138] Aalto et al. 2008.
[139] See Hallouche, Hadi 2006.
[140] See Andrews-Speed, Philip 2011.
[141] See Stevens, Paul 2008.
[142] Correljé and van der Linde 2006.
[143] Ibid.
[144] Ibid.

e.g. through carbon tax, is a truly effective way to reduce the use of polluting fossil fuels.[145] It could also provide new impetus for the EU's common energy policy and hence promote further integration.[146]

Much of energy economics and trade approach is based on game theoretic assumptions which inevitably makes it rather agent-centric.[147] As a highly agent-centric approach, I don't consider energy economics and trade suitable for this study for the same reasons as energy diplomacy. It is also equally true with this approach that I don't find it fully comprehensive alone for the purpose of my study. Still, its notions of market mechanics and the actor landscape[148] – along with states, regional blocs and institutions this approach include companies and financial institutions –, are important to keep in mind and integrate in the final framework of this dissertation.

2.1.4. Energy and the environment

Much of the research of the fourth approach, energy and the environment, concentrates on the energy policy of the European Union and how the various forms of EU energy policy affect the environment. This follows logically from the state of affairs in the field: the EU and its member states being at the forefront of integrating climate and other environmental aspects into the energy strategies.[149] Not only are environmental concerns reflected in the various documents the EU has produced, but the Union has also a plethora of instruments to actually reach its 'energy trinity goals'.[150] Moreover, the environmental perspective is, more or less, taken into account in three of five dimensions in the EU's new framework strategy for the Energy Union, namely decarbonisation of the economy; energy efficiency; and research, innovation and competitiveness.[151]

Some researchers argue that though energy was initially at the core of European integration in the 1950s, it never developed far enough to lay the foundations for a truly common energy policy, which led it to be considered as a great failure of integration.[152] However, from the 1970s onwards the energy policy integration has advanced, and according to some, it got its impetus from environmental concerns regarding the energy chain.[153] This happened shortly after the oil crisis and hence, the

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[145] The Economist 2015.
[146] Solorio and Zapater 2012.
[147] Aalto et al. 2008.
[148] Ibid.
[149] See e.g. Youngs 2013.
[150] Solorio and Zapater 2012.
[151] European Council 2015.
[152] Solorio and Morata 2012.
[153] Ibid., 10–13.

environment was used as an excuse to legitimise Community intervention. Many argued that energy governance was 'Europeanised' before the EU had any formal competence in 'green' energy policy.[154] As already mentioned, the EU has nowadays several, and possibly an increasing number of, instruments in its energy policy. As a result, it is used as 'green-model' for other countries and regional blocs in the world.[155] [156]

Other scholars remain more doubtful towards the EU's role model position in 'green' energy policy.[157] Despite its noble goals and manifested efforts to significantly ease the burden on the environment caused by the production, transportation, and consumption of energy, the EU has still come to set a primary importance to a rather conventional understanding of energy security. This is demonstrated by oil and gas diplomacy which has recently all but gained strength. The focus on non-conventional fossil fuel sources is another example.[158] Perhaps this explains why much of the literature referring to EU external energy governance covers the trends of the internal energy market rules,[159] the market and geopolitical dimensions of EU energy policy,[160] and the questions related to the security of supply.[161]

As regards the actor landscape of this approach, it considers states, regional blocs, and institutions the central actors in energy policy, like all the other approaches above. In line with energy economics and trade, energy and the environment highlight the role of companies and financial institutions as their investments are deemed necessary for energy transformation. In this respect, the scholars of energy and the environment also count in scientists as the most important actors in energy policy, for the environmental implications of energy production and prominence of 'green technologies', which are of significance from this approach's point of view, are precisely scientific questions. I would argue that emphasising the scientific, the 'material' factors make energy and the environment more nuanced in relation to agency and structure. However, energy governance – strategies, agreements, policy instruments – and financial/economic viability of 'green technologies' through various mechanisms, such as joint markets and subsidies, receive more attention, which conveys a slightly agent-centric picture of energy and the environment approach. Though better for this study's needs

[154] Ibid., 11.
[155] Ibid., 11–12.
[156] Wurzel and Connelly 2011.
[157] See for instance Youngs 2013, 422–425.
[158] Ibid., 429–431.
[159] Escribano 2010.
[160] Correljé and van der Linde 2006.
[161] Umbach 2010.

than strict agent- or structure-centricity, further adjustments are in place to find a balance between the actors' preferences and the range of possible choices of the surrounding policy environments, i.e. the structure. Energy and the environment offers yet another valuable perspective to keep in mind in this dissertation. Environmental and climate concerns undoubtedly are taken into account in the national energy strategies, even more so in Denmark and Finland than in the EU countries on average.[162] Yet, for the purpose of this study, environmental viewpoint should not be the primary, let alone only, perspective. The same is true with each approach dealt with above.

2.1.5. Summary

Four established approaches in energy policy research have been outlined. The classification I have used derives much from an earlier work of Aalto et al.[163] To summarise, what distinguishes the abovementioned approaches is how they respond to the question of *who* is doing *what* in energy policy and *why*. They all accept states, regional blocs, and institutions as being actors in energy policy, but to a varying extent, they also see a role for business leaders (energy diplomacy), state-bound companies (geopolitics and energy security), companies and financial institutions (energy economics and trade), or scientists (energy and the environment). They underline the importance of somewhat different affairs, let it be summits and negotiations (energy diplomacy), binding security aspects tightly to energy policy (geopolitics and energy security), investment and finance (energy economics and trade), or 'green transformation' of energy systems (energy and the environment). The approaches also highlight the priority of partly different policy goals, e.g. political stability (energy diplomacy), relative economic gains (geopolitics and energy security), absolute economic gains (energy economics and trade), and reducing energy and emission intensity (energy and the environment).[164]

From a theoretical perspective, these approaches can either be characterised as agent-centric or structure-centric. Most of them fit in the former category, although I find energy and the environment only slightly agent-centric, in contrast to energy diplomacy and energy economics and trade. This is due to the importance of environmental implications of different energy forms, phenomena which are mostly material in nature. Then again, geopolitics and energy security is best classified as strongly structure-centric because it seems common to argue within this approach that the determining element of any energy policy is *who* has *what* resources and *how* much. This is an old and continual debate

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[162] Knudsen 2012.
[163] Aalto et al. 2008.
[164] Ibid. It is worthy to note that energy and the environment approach is covered only very briefly in Aalto et al. 2008. Therefore, the interpretations of it I have presented here are my own.

everywhere in social sciences about whether *agents* or prevalent social *structure(s)* have primacy in the creation and reproduction of social systems. I have already supported an approach that finds both the agents and structures meaningful for analysis in this study and therefore, I try to bridge them together. Perhaps the most well-known attempt to base both of these factors as part of the analysis is Anthony Giddens's structuration theory.[165] What Giddens did, mostly on a domestic level, Alexander Wendt pursued on the international.[166] I will next turn to formulate the first theoretical starting point of this dissertation, the idea of structuration as outlined in the works of Giddens and Wendt.

2.2. Social structuration and energy policy formation

If the history of international relations can be understood through Great Debates, the same can be said about sociology. At least since the time of Émile Durkheim,[167] many sociologists have reasoned that the societies we live in impose social constraints on our actions by setting limits to what we can do as individuals. Everyone has to fulfil her obligations which are written in law, everyone grows up in a social system that has certain beliefs, norms, and practices which would exist with or without him, and no one can buy (or barter) goods with money which is not accepted in the society. In this sense, society is external to us and it is as firm as the material world around us. This structure-centric view has received a lot of criticism especially from sociologists inspired by social interactionism. They argue that people are not the products of society but rather, its producers. Society consists of a myriad of individual actions. If people were not constantly creating and re-creating society through actions, it would obviously cease to exist. People assign meanings to different things and act accordingly. The same things may carry different meanings for different people, and they can change over time.

As is evident from the subsections above, this debate is not limited to sociology but it preoccupies scholars in all social sciences.[168] Due to the 'nature' of this field of academics, it is unlikely the debate over action versus structure will be wholly resolved. Yet, the differences between these two models are not too big to overcome. Although neither is fully sufficient, in some respects, both are valid. Probably the most well-known scholar attempting to bridge these two views is Anthony Giddens. Already several decades ago, he introduced the concept of structuration. Giddens argues that social institutions do exist before any given individual and, in that sense, are external to us.[169] Institutions also do constrain the actions of each individual. Language is a commonly used example of this. Clear

165 Giddens 1984.
166 Wendt 1999.
167 Durkheim 1982 [1895].
168 Giddens 2009, 88–91.
169 Ibid.

communication requires adherence to grammatical rules and use of words which have well-established meaning in the group. However, it is clearly misleading to suppose that society and its social structures are external to us in the same way the physical world is. While it is the case with every individual alone, it does not certainly apply to all individuals taken together. Obviously, if all human beings died this moment, nothing would remain of society, including the language. Furthermore, although society can constrain the actions of each individual, it does not determine them. Humans do not just passively react to events but they make choices.[170] While language is socially structured, once an individual gains fluency, the possible variations seem almost infinite and she can also break the rules without being misunderstood. In short, societies – or any groups – have 'structure' as long as people behave in a regular and relatively predictable manner. But 'action' is only possible because each individual possesses vast amount of socially structured knowledge. What follows is that structure and action are necessarily related to one another.[171]

What does this kind of view mean for international relations or energy policy? Firstly, it allows the actors – let them be states, institutions, organisations etc. – to have their own goals, preferences, and interests which they can pursue. Their ambitions and actions are not *determined* by their geographical position, their size in land area or population, or the natural resources allocated within their borders. It also follows that certain (material) things do not always have the same meaning. Canada, for example, borders the United States, which has an estimated 7,100 nuclear warheads.[172] Russia has only slightly more nuclear weapons, many of them situated much farther from Canada than the US ones but undeniably they are seen as more threatening to the state. They are the same substance but clearly not the same 'thing' for Canada. Weaponry arsenals, or any other material factors, do not dictate state's policy. Secondly, structural positions at a given time do still matter. Actors cannot define, let alone, strive for their goals in vacuum. The surrounding policy environments, everything from geography to other actors and their relationships, constrain but also enable, any given actor. If a state wanted to practice a wise energy policy, it would have to form a comprehensive picture of the current state of affairs, develop a good understanding of factors limiting and extending the scope of its policy options, evaluate possible choices on how to move forward, and on its part try to recreate the surrounding structures so that they allow more leeway for the state to practice successful energy policy. Neglecting the structural position the state is in will most likely result in bad outcomes. For instance, an Eastern European country, say, Poland, could make a decision to stop importing gas from

[170] Ibid.
[171] Ibid.
[172] Arms Control Association 2015.

Russia starting tomorrow, but this would lead it to catastrophe because substitutive sources that would answer to Polish needs are simply not available at this moment (not to mention the rising tension with Russia which would likely take place if Poland unilaterally cancelled their gas contract).

This idea of structuration has been developed on an international level by Alexander Wendt. For Wendt, the most important actors are states, and he concentrates on the interaction between them and international social structures. Of course, a state is not an 'individual' strictly in the same sense as a single human being because it consists of several bodies and even competing forces. However, as a juridical sovereign in certain marked areas, a state is a member of 'international society'. As such, they have their interests which they pursue in the structures of international society, and while doing so they encounter other members, states, of the society. To avoid utter anarchy, states must act, and be able to trust that other states will do the same, in relatively predictable and regular custom. This constrains and enables their actions but does not determine them. By engaging in international society, states can reproduce existing structures or create new ones.[173] Thus, the idea behind structuration can easily be stretched from community or national level to international level. As is evident, in practice states, like many other actors as well such as companies, operate on multiple levels at the same time. My interpretation is that this merely underlines the explanatory power of structuration. Actors are surrounded by structures which can be complex, overlapping, and their boundaries might be blurred but each of them are upheld only through repetitive actions.

Before moving on to discuss a couple of works of which I draw on regarding the theoretical framework of this study, I shall add a few notions on the concept of structuration. First, Giddens talks mainly about *social* structures surrounding individuals in a society. To some extent, Wendt takes the argument a bit further, in my view, by including some material factors as part of the structures as well. He argues that social structures are still more important than material ones because the meaning and effects of the latter depend on the beliefs and expectations of the system, i.e. social structures.[174] While this is true – e.g. crude oil or natural gas wouldn't be of any significance if people had not any use for it – it should not lead to neglecting material factors such as resources and the environment. Simply, fossil fuels are desired now because the world is what it is, and that is why the role of these fuels is so important in global energy policy. Furthermore, our use of fossil fuels is causing the climate change and harming the environment because that is what follows from such an intensive use of these fuels. That is why material factors too, socially constructed or not, form the structures within which

[173] Wendt 1999.
[174] Ibid., 20; 92–138.

energy policy actors have to operate. Hence, it is essential to integrate them in the framework of this study and understand that surrounding structures have both social and material qualities.

Second, there is a question of what do the actors know about the structures surrounding them. Scholars informed by social interactionism recognise that two people might assign different meanings to the same thing. This might be for whatever reason, but one possibility is because they have different information and experiences of the object. Therefore, it must be stressed that structures do not always appear the same or even similar to particular actors. Even if the actors have equal information available, they might still, and I suppose quite frequently do, interpret it in various ways. Further discussion on the topic of rational choice theory and its critiques about whether or not people, or states, always make rational decisions goes beyond the scope of the research question, but suffice it to say, in the context of this study, energy policy actors do not always make rational choices for they do not possess all the relevant information. For instance, many decisions, such as constructing a pipeline, will have consequences for several decades and it is not possible to know for certain that big expensive projects will be worthwhile still in 20 years or so. Another reason is that some choices which advance some of their interests may contradict some other goals, and it is not always easy, or possible at all, to calculate and compare gains and losses that could follow from a given decision.

2.3. Susan Strange: four structures of power

Susan Strange pointed out in 1988 that despite its significance, energy policy is vastly unexplored by any major academic discipline.[175] She then outlined a research agenda from an international political economy perspective, but still, there has been surprisingly little interest towards energy questions in IPE community.[176] In my view, Strange's model is close to, or at least in line with, structuration theory. Her goal is to synthesise politics and economics by scrutinising the structural effects of states on markets and, vice versa, of market forces on states.[177] This should emphasise how difficult, and slightly irrational, it is to draw a clear distinction between economic and political power because they are necessarily linked. It is impossible, say, for a state to have political power if it has no purchasing power, command over production, or ability to mobilise capital and credit. Similarly, a company cannot have any economic power if no political authority offers it legal and physical security and is ready to sanction when those are violated.[178]

[175] Strange 1988, 191.
[176] Aalto et al. 2012, 33.
[177] Strange 1988, 13–14.
[178] Ibid., 25.

Instead, Strange suggests that there are two kinds of power in a political economy, namely structural power and relational power. According to her, scholars of international relations, especially realists, have conventionally described relational power as 'the power of *A* to get to *B* to do something they would not otherwise do.' Then again, she defines structural power as "the power to shape and determine the structures of the global political economy within which other states, their political institutions, their economic enterprises and […] scientists have to operate." In other words, structural power shapes the frameworks within which actors, states, people, and financial enterprises, relate to each other.[179] As such, structural power counts far more than relational power because the relative power of an actor in a relationship increases only if it can determine the surrounding structure of the relationship all by itself. According to my interpretation, Strange argues that in very few occasions any actor is in this kind of position. If anyone rarely manages to unilaterally determine the surrounding *structures* of any relationship, it can hardly be the case that any actor could determine the *actions* which other actors might take in that relationship. This is fully in line with the idea of structuration as understood by Giddens and Wendt.

It has already been said and repeated that structures do matter, but what are they in fact? Susan Strange argues that the world economy, in general, comprises of four power structures: security, production, finance, and knowledge. The security structure consists of the possibility of violence or conflict, whether internal or external, that threatens personal security. He who is in a position to offer protection can usually exercise power in other aspects than security affairs as well, such as administration of justice. If the perceived risk of violence grows, the actors will be ready to pay a bigger price for their protection. At the same time, though, the risk that the defence force will use its power to threaten itself those who it claims to protect will also become more likely.[180] Those who feel themselves insecure might question the authority of the established order and pursue to install a new one.

Equally fundamental question as who offers protection, concerns how production is organised in a community/state. At the time when Strange was writing her research, the Soviet Union and the Communist bloc in Europe, with their state ownership as the mean of production, were still in place. Thus, the differences in modes of production were perhaps more visible than today, but their significance is as great as ever even though much of the production mode based on state ownership

[179] Ibid., 24–25.
[180] Ibid., 29–34; 45–61.

has ceased to exist. The production structure defines 'who gets to decide what shall be produced, by whom, by what means, with what combination of land, labour, capital, and technology, and how each shall be rewarded.'[181] Whoever has structural power over production can use it to defend their social and political power as well. And when an ever-increasing amount of goods and services are produced in response to the needs of the global economy, not the local community, the structural power over production – 'the base for social and political changes' – becomes extended far beyond the national frontiers.[182]

Strange admits that of all structures, the finance one – the control of credit – is more present in advanced industrialised economies than in less developed countries or small tribal communities. When much of the production is for the producer's own use and only things being bought or bartered are the ones that people cannot produce themselves, there is little need for credit. In last half century or so, the importance of finance structure has risen enormously and it is as vital as the security and production structure in today's international economic relations.[183] The control of credit implies the power to allow or deny other actors – people, companies, or states – to buy today and pay back tomorrow and hence influence markets for production. It also comprises the monetary system(s) which designate(s) the relative values of different currencies.[184] It is crucial to keep in mind that credit does not equal money. What is invested in an advanced economy is credit rather than money. To invest money, one must accumulate capital, i.e. profits. If that had been the case, the world would not have seen any of the economic growth since the Second World War, Strange argues.[185] In the high-technology age, investments can only be financed through credit, because credit can be created. Whoever gains the confidence of others that they are capable of creating credit will control an economy.[186]

A very special kind of structural power is that of knowledge, ideas, and beliefs. To have power in this structure, one must be able to acquire a kind of knowledge that is respected and sought by other actors. At the same time, to have any 'competitive edge' one must be able to deny others access to the desired knowledge and/or control the channels through which knowledge is communicated to those who have access to it. Power in the knowledge structure is more elusive and less easy to keep control over but

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181 Ibid., 29.
182 Ibid., 29–34; 62–87.
183 Ibid., 30–34; 88–114.
184 Ibid., 88.
185 Ibid., 30.
186 Ibid.

it is certainly helpful, if not essential, to reinforce other kinds of structural power. Strange notes that today – I would argue that for a long time in history – knowledge in technology is most sought after.[187] Technological superiority opens up several possibilities to exercise other forms of structural, and even relational, power. History is checkered with examples of how states and entities were able to dominate others because of their military might achieved by more advanced weaponry technology.[188] There is also an interesting discussion going on about the significance of paradigm shift in economics. Some argue that in the last 80 years or so, changes in the production and finance structures, to use Strange's vocabulary, have actually been preceded by paradigm shifts in academic economics – i.e. in the knowledge structure – which in turn were informed by the perceived limits of first Classical, then Keynesian, and now Neoclassical economics to explain and offer cure to a bad economic situation.[189] [190]

In Strange's view, these structures are universal and can be found in every society, as she illustrates in her story of castaway people who strand on a desert island.[191] While this might be found controversial, I think it is reasonable to think that every community will have to make a decision about how they balance security, distribution of wealth, economic freedom, and justice, whether or not they conceptualise it this way or not. According to Strange, the security, production, finance, and knowledge structures are interacting with and affecting each other, but none necessarily dominate. Whoever (actor) has dominance in one or more structures (i.e., who offers protection against the threat of violence, who decides what shall be produced by what combination of land, labour, capital etc., who has control over money and credit, and who controls the channels through which desired knowledge is sought by) is able to change the range of choices open to others.[192] To be more precise, what is essential is how do the actors *perceive* and *interpret* the structures surrounding them and how they aim to alter them on the basis of the picture they have formed. It should not be presumed that the structures appear to the actors 'the way they are.' Often times, each actor's understanding of the surrounding policy environments is somewhat incomplete (perhaps because some other actor in a stronger position in the knowledge structure is denying them access to relevant information). That being said, this notion should not be exaggerated, for the surrounding structures, the world, does give

[187] Ibid., 30–34; 115–134.
[188] Alnæs 2003.
[189] The Week 2014.
[190] Al Jazeera America 2015.
[191] Ibid., 1–6.
[192] Strange 1988, 29–31; 43–138.

feedback if the actor's presumptions are clearly wrong – if their decisions or policies simply do not work.[193]

Susan Strange applies her framework to examine the development in the energy structure (secondary to the four 'primary' structures), specifically in the oil industry in the last hundred years. Instead of first scrutinising changes in the market conditions or policies of states and companies, and then trying to understand what changes occurred in the structure, the model suggests going the other way around. Starting with changes in the four structures, one can then ask about the spin-off effects on the policies of states, outcomes in international organisations, and the political economy of related markets.[194] One could object that all the author is doing is 'going in at a different point on the circle.' Strange notes that this is a legitimate observation, but insists that the four structures are less liable to sudden changes than policies or market conditions, and therefore it is better to start with the former.

Strange found two major changes in the security structure. One was the redefinition of energy security following the OPEC (Organization of the Petroleum Exporting Countries) oil price rise in 1973. It was now obvious that energy insecurity might be fatal for any state, including, or especially, to a superpower like the United States. The other change was, resulting from a change in knowledge structure, that the technology developed for atomic weaponry technology could be used to produce electricity. In the production structure, the biggest change occurred in the 1970s as well. Due to the fast economic growth in industrialised countries in the 1960s, OPEC was able to exploit the rapidly increasing market for oil. Eventually oil demand outran oil supply at 1972 prices, causing uncertainties in the market which have never fully ceased since. The financial structure has affected the oil industry in last hundred years, especially through the volatility of oil prices and national currencies, with the US dollar being of greatest significance. Not only has this accumulated uncertainties in the financial structure itself but also of energy supply and future prices. Another significant impact has been the credit. While credit makes many expensive investments possible, it has been strikingly more easily available to the big oil companies than to some of their customers. In regard to the knowledge structure, it is worth noting that originally and for quite long big oil companies and not anyone else, not even the states, had a monopoly of knowledge that was necessary to locate, drill, and sell oil. As a result, governments did not really know how to tax the oil companies because they did not have enough knowledge about how much or how little they could ask for. The change in attitudes and beliefs after the first oil shock – that the supply of oil wasn't inexhaustible

[193] Haukkala 2010, 37.
[194] Strange., 200.

after all –, another notable change in the knowledge structure, translated into big changes everywhere in the energy structure.

In this thesis, where the focus is not in the past but the future, this kind of framework could be used in analysing the material to uncover how the existing four structures of power seem to enable and restrict what choices the EU member states have in securing their supply of energy in the future, and moreover, how the member states aim to alter the structures with the means they have to get other actors of energy policy to make choices deemed desirable regarding the member states' goals. Indeed, much of my final framework stems from Strange's work but before formulating it I will discuss another valuable model which has guided me in my study.

2.4. Aalto et al.: frames and dimensions

Aalto et al.[195] develop a model resembling, in my reading, that of Susan Strange. The authors have outlined their model in three articles of which I will concentrate on the most recent form, from 2014, in this subsection if not mentioned otherwise. In their model, Aalto et al. attempt to link the actors, their interests and wider schemata, the structural dimensions, and events with their consequences in Russian energy policy. They call this framework as 'social structurationist model of energy policy formation.'[196] Their idea of structuration comes mainly from Giddens and Wendt, an idea which I have decided to follow in this study. Although Aalto et al. are dealing with Russian energy policy, the authors note that their approach could be applied in other contexts as well.

Aalto et al. purport that actors of energy policy are driven by their interests which are constantly influenced by social and material environments. Moreover, interests and their development are embedded in other social practices which may stretch far into history. To give an example one can point out the different logics which Russia seems to have in the gas sector considering 'Old' and 'New' Europe. Western Europe, which never was under Russian control or within its sphere of influence, is considered as a lucrative economic zone from Moscow, one with which gas trade is indispensable for the country's economy.[197] Then again, Eastern Europe, much of which integrated with the West on the first chance they had, is not as crucial market for Russia. Some writers argue that this allows Russia to practice 'neo-imperialism' towards its former sphere of influence in the form of punishing the new EU member states for their hostility and creating hurdles to their

[195] Aalto et al. 2008, 1–22; 2012, 20–44; 2014, 1–29
[196] Aalto et al. 2014, 3.
[197] Proedrou 2012, 80.

prosperity.[198] Therefore, to better grasp the subtle and elusive nature of interests, the authors treat them as embedded within the wider schemata with which the actors operate. Schemata are cognitive devices which direct the actors in forming interests and assigning meaning to the surrounding structures, i.e. social and material environments.[199]

The writers divide schemata into two types: frames and sense-making. The former, according to the typology of Erving Goffman[200] implies rather distinct conditions for intentions and interaction. A frame can help an actor to decide how to coherently and comprehensively articulate his interests.[201] There are, of course, several frames which can either compete or complement each other. In the context of energy policy, these include a business frame, influence-seeking frame, energy security frame, and sustainability frame. The authors recognise that in Russian energy policy the first is common among state-owned companies, the second is widely associated with the state's military ambitions, the third frame concerns mainly Russia's European customers and the fourth one is more represented among Russia's European partners such as Norwegian Statoil.[202] The latter type of schemata refers to a situation where an actor lacks explicitly defined interests and is working to develop a coherent explanation of the state of affairs.[203] As regards the purposes of this study, frame could be more useful tool than sense-making, for in my view situations where interests are difficult to define might occur especially after sudden changes in policy environments or major events. Such occasions are obviously extremely hard to predict in long-term national energy and climate strategies.

The *actors* develop the schemata and the interests, derived thereof, by observing and assessing their policy environments which form the *structure*. Action takes place on the basis of these assessments. Furthermore, the outcome of these assessments depends on how much they know about the real content and character of the policy environments, i.e. how (ill-)informed they are.[204] The authors call the respective structures *dimensions* which have both social and material qualities. These are conceptualised as the resource-economic, financial, institutional, and ecological dimensions.[205] The first, forms the inherently material base of energy policy which should underwrite every aspect of it, the researchers argue.[206] Indeed, any actor who doesn't make proper account of the resource-

198 Larsson 2006, cf. Proedrou 2012.
199 Aalto et al. 2014, 7; cf. Wendt 1999, 133–134.
200 Goffman 1974.
201 Aalto et al. 2014, 7.
202 Aalto et al. 2012, 26–29.
203 Aalto et al. 2014, 7.
204 Dusseault 2010, 162–163, ref. Aalto et al. 2014, 7–8.
205 Aalto et al. 2014, 7–10.
206 Ibid., 8.

economic dimension is inexorably going to make poor energy policy choices. The dimension consists of finite resources, the means and know-how of production, and physical geography which have an effect on the forms of transportation and distribution of energy.[207] Concordant with the model of Susan Strange, which claims that whoever possesses a dominant position in one structure can significantly alter the range of choices for other actors, Aalto et al. argue that companies, energy industries, and consultancies have special expertise in resource-economic dimension. Therefore, the epistemic communities, consisting of experts working for firms, agencies, and organisations, are in a critical position to communicate the technological limitations and opportunities forward.[208]

The second, the financial dimension includes all the transactions, investments, and capital needed to explore, produce, refine, and distribute energy. It also consists of pricing mechanisms for energy commodities, the exchange rate fluctuations, and size of both domestic and international energy markets. Typical actors who are in a central position in the financial dimension are banks, insurance corporations, big energy companies and international financial institutions. Because of the capital intensity of energy industry, some states with their export credit agencies also appear as important actors within this dimension.[209]

The authors classified international agreements and institutions, informal norms and rules, decision-making capacity, and international culture as part of the institutional dimension. In other words, the continuum is long and the content of this policy environment diverse and multifaceted. Hence, the outcome of energy policy may vary significantly depending on the surrounding institutional setting. States, regional blocs, their bureaucracies, and international/non-governmental organisations are the primary actors in the institutional dimension.[210]

The effects the various energy policy activities have on the environment have in recent times given rise to the ecological dimension. It portrays the material nature of energy and the consequences of its usage in very different light than the resource-economic dimension. In addition to the environmental effects and the climatic consequences of energy production, transport, and use, the pressure to develop green renewable energy and the criticism of the conventional rationales of energy policy form the ecological dimension. Here the writers find various environmental organisations and government

[207] Ibid.
[208] Prontera 2009, 19–22, ref. Aalto et al. 2014, 8.
[209] Aalto et al. 2014, 9.
[210] Ibid, 9–10.

agencies, activists, and experts to be the central actors. Despite the criticism towards the traditional energy policy structures, the actors within the ecological dimension pursue cooperation with the actors more represented in other dimensions in order to improve the stance of green energy.[211]

Aalto et al. also add another level in their model, namely events. As their model goes, the actors express intentions, set goals, and develop interests on the basis of their schemata, which also guide them while acquiring knowledge from the surrounding structures, i.e. dimensions. They suggest that concentrating on the 'biggest turning points' or 'key events' is the best way to grasp the interaction, or 'evolvement of processes', between the actors, their schemata, and the policy environments, that is structuration to use Giddens's term.[212] According to the authors, neither Giddens nor Wendt considers events as part of their models, but I would argue that they are present in Strange's framework. Starting by locating big pivotal changes in the four power structures, she is doing exactly the same as Aalto et al. when they assess key turning points. The authors understand events as 'sequences of occurrences that may result in the reformulation of energy policies.'[213] Events may urge the actors to re-analyse the policy environments, which in turn might lead them to highlight different information within and across dimensions. Hence, the dimensions can reinforce or conflict one another.[214] The Paris Agreement signed in December 2015 can be seen as a major event prompting the energy policy actors to give substantially more importance to the ecological dimension and thus reformulate the schemata accordingly. As a consequence, electric power companies may increase the share of renewables in their energy mix to remain competitive in the future. This example should highlight that events themselves do not make anything happen. Change requires action, as stressed among the critics of structuralism. Then again, active agency requires that actors assign meanings to things, that they possess tremendous amounts of socially structured knowledge, or, as Aalto et al. put it, that the actors have developed schemata in which their interests are embedded and which guide their actions. The authors conclude that 'schemata are maintained or re-made in response to events.'[215] Still, in line with their structurationist model, the writers stress that the effects of events will actualise only within the four structural dimensions.[216]

[211] Ibid.
[212] Ibid., 10–11.
[213] Aalto et al. 2012, 35–37.
[214] Aalto et al. 2014, 10–11.
[215] Ibid.
[216] Ibid.

Aalto et al. apply their framework to study Russia's energy relations in Europe and the Far East. They develop analytical narratives in the context of Nord Stream gas pipeline project, which directly connects Russia and Germany, and the Sakhalin-1 and 2 oil and gas projects. The authors found profit interests related to a wider business frame to be of primary importance for Russian energy policy actors. The energy superpower frame, which many realism-oriented writers[217] see to be the dominant one in Russian energy policy, appears only amongst some of the actors, and even for them it is not as appealing as the business frame.[218] Similar profit interests drive the actions of Russia's energy partners and customers too. However, security of supply and transit interests stemming from the energy security frame were also found common among them, but these were structured in a different manner in Europe and the Far East, which the authors explain by pointing out the differences in resource-economic and institutional dimensions. Energy security was constructed in a very distinctive way amongst Russian energy policy actors; security of supply appeared not to be of significance, but rather security of demand/markets, which is an interest mostly embedded in the business frame.[219]

2.5. Forming the analytical model for the study

Having now discussed the works I mainly draw on in this study, it is time to formulate my own framework. As it is evident by now, the idea of structuration, as outlined by Anthony Giddens and Alexander Wendt, is the theoretical starting point in this dissertation. I'm of the opinion that society or, maybe more appropriately, community is surrounding individuals and entities at all levels, whether local, domestic, regional, or international. Many of those structures are social, but I wouldn't say that is the case with all of them. Wendt, while admitting that there are material structures too, points out that the meaning and effects of the material structures depend on the beliefs and expectations defined in the social ones.[220] Even that definition might go too far in my view. Think for example that a quarry has a wastewater problem and as a result local groundwater gets contaminated, and the local people, cattle, agriculture, wildlife, and vegetation cannot use the water anymore without getting poisoned. Is the rapidly rising need to solve the problem and prevent it happening again socially constructed? The need to have clean freshwater is essentially biological and thus 'material'. However, this is not the time or place to engage in metatheoretical debate about the ontological composition of the world. Suffice it to say that the structures around energy policy actors are both social and material in kind.

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[217] See Larsson 2006; Orban 2008.
[218] Aalto et al. 2014, 12–25.
[219] Ibid.
[220] Wendt 1999, 20; 92–138.

Hence, both the (intended) actions of the EU member states concerned in this study, Denmark and Finland, and the policy environments within which they operate shall be of significance in the analysis. Other actors of Danish and Finnish energy policy, such as the EU, local governments, companies etc., surely have an important, both enabling and restrictive, role in national energy policy formation but assessing those parties' own goals and means to reach them is outside of the scope of this research project. Such a structuration-oriented study obviously could be conducted where the focus would be on several, say, the most important, actors and their interests and intentions in one country's energy policy. As it happens, Aalto et al. do just this kind of analysis.[221] However, in this dissertation I suggest a different kind of approach wherein only one actor's – or two since the analysis covers two different energy policies – preferences and policy choices are under the lens. I do argue that such an approach is compatible with the structuration theory, for, from the point of view of the states, the other actors can be seen as part of the structure who have an effect on the states' range of policy choices and whom the states try to influence, control, and steer. From this perspective, other entities than the sates in question can, and should be, taken into account in this thesis, too, but as 'part of the structure', not as individual actors. Treating other relevant actors as part of the structures does not mean that they would have to act in a predetermined manner in accordance with the best knowledge they can acquire about the surrounding structures, nor does the state in question have to assume so. If anything, it merely underlines the fact that no individual, whether a state, a company, or a human-being, lives in a vacuum and can make of the reality whatever they desire once they have enough information of the world. Other actors necessarily limit and direct any individual's expectations and range of choices, but the individual can also influence the others. As already mentioned, without the others possessing vast amount of social knowledge and repeatedly acting on the basis of it, the whole idea of social structures would vanish.

I find both the works of Strange[222] and Aalto et al. stimulating, and they contain valuable elements and guidance for constructing a decent framework for many studies. Some modifications are still in place, which should be expected – copying a ready framework is rather dubious anyway. Though there is much in common in the works of the abovementioned scholars, I find the latter more sophisticated and adjusted for energy policy research in particular. After all, Strange's model depicts general structures of the whole global political economy, although she herself applies it to the energy sector as well – a rare case in her time and for decades to come. But in my view Strange primarily

[221] Aalto et al. 2008, 1–22; 2012, 20–44; 2014, 1–29.
[222] Strange 1988, 43–136; 186–206.

attempts to theorise how the global political economy functions, i.e. what kind of forces are crucial in restricting and enabling what the actors can make of it. Moreover, the concept of power is in the core of Strange's work. The focus of this comparative case study is the actors' goals and their interpretations of the surrounding policy environment, and as such power and all the widely varying theorisation related to it is not very central for this paper. A study concentrating purely on, say, how much the actors' can possibly alter the surrounding structure in their favour could benefit more of the power aspects of Strange's model.

Then again, in my interpretation Aalto et al. use their analytical model to scrutinise the formation of energy policy, i.e. how the involved parties act, and what kind of interests drive them forward. This is closer to the research task of this study. However, my intention is not that much to grasp the interests (that seems to be the aim in Aalto et al.'s approach) which motivate Denmark and Finland in their energy policies, but to examine how the states in question are trying to combine security of supply with energy targets and other principles in energy policy (i.e. competitiveness and sustainability), and as the latter part of the research question goes, why are they pursuing security of supply in the manner they have outlined in their national energy and climate strategies?

I strongly think that the skills, techniques, and know-how, embedded in the knowledge structure in Strange's model, must be seen as part of the energy policy structures, for they have a big part in forming the range of choices the energy policy actors can make. Indeed, Strange herself argues that the kind of knowledge most sought after nowadays is technology.[223] That is why I'm of the opinion that technology, including the tools and appliances that are necessary in all the stages of energy production, transmission, and consumption, should be seen as one separate policy environment. Aalto et al. include the technology needed for the extraction, refinement, and transportation of energy in their resource-economic dimension,[224] but I don't think this gives sufficient account to it. Moreover, technology-related issues aren't necessarily linked with resources or economics, but possibly with the environment too, and the spread of devices and technological know-how have substantial effects for affairs which in Aalto et al.'s model are seen as part of the financial and the institutional dimension.

[223] Strange 1988, 31.
[224] Aalto et al. 2014, 8.

Aalto et al. suggested adding ‘events’ as another level in the analytical model.[225] They argued that the interaction between the actors, their schemata, and the policy environments can be grasped through analysing the key turning points in energy policy. In fact, Strange uses similar kind of method by examining the biggest changes that have occurred in the four primary power structures, and then scrutinises their implications for the secondary power structures, such as energy.[226] Undoubtedly, tracking events, understood as external shocks which may alter both the surrounding structures of energy policy and the actors’ preferences in the respective field, is a useful tool in forming the big picture of historical development, whether recent or distant. But it is not really a suitable tool for the purposes of this study, since this research focuses on the future, not the past, and, clearly, no upcoming events can be anticipated. However, the member states concerned, Denmark and Finland, most likely try to hasten the kind of future development they prefer, and possibly even build their strategies on assumptions they expect to realise (these could include, for instance, major progress in electricity storage technologies or significant increase in EU-wide emission allowance price, which is currently at €4.8 a tonne of carbon dioxide),[227] albeit their influence can vary greatly between different policy phenomena. Therefore, although not very fruitful tool for this paper, the importance of ‘events’ in shaking policy environments must be kept in mind, for a lot of dynamics of energy policy field can be understood through them.

As for the policy environments within which Denmark and Finland operate in their energy policy, I shall use similar kind of conceptualisation than those developed by Strange and Aalto et al. The policy environments surely could be classified in various ways but two principles are worthy to follow in forming any analytical model. First, there should be reasonable amount of categories so that each dimension gets covered – with no relevant structures left out or unnecessarily combined together. Second, categories shouldn’t be too numerous, for it would merely undermine the analysis by making it messy, and put the researcher’s ability to encapsulate the most important factors behind a phenomenon, no matter how complicated, into question. I would argue that the policy environments can be classified in five categories without compromising the fluency with the analysis. In my theoretical framework the policy environments of energy policy consist of the resource, the financial, the institutional, the environmental, and the technology structure. For analytical purposes the different structures are to be kept apart, even though in reality they, obviously, relate to each other in several different ways – possibly by depending on each other (e.g. to utilise any resources one must have

[225] Aalto et al. 2012, 35–37; 2014, 10–11.
[226] Strange 1988, 200–201.
[227] European Energy Exchange 2016.

sufficient capital and adequate technology at hand) or by contradicting one another (decarbonising the economy comes at a cost, though the cost of not decarbonising is even bigger in the long-term).[228] My argument is that Denmark and Finland, naturally, aspire to fulfil their goals and preferences in energy policy, including those regarding security of supply. They act within the limits of the (observed) structures, and whether they make a certain choice or not depends on whether they find it possible within those structures. Therefore, the states' 'worldviews', their assessments of the surrounding energy policy environments can be understood by examining their goals and actual policies in the energy sector.

- By *the resource structure* I mean the distribution of resources which the states can access, domestically or through imports, and use to satisfy their energy needs (i.e. for transport fuels, electricity, heating etc.). These resources include not only hydrocarbons, uranium, or biomass such as woodchips or (agricultural) waste, but also renewables, e.g. wind and solar resources. The resources available and the infrastructure of the economy, industry, housing, and transport sector set the material foundation and range for any energy policy, i.e. what kind of energy can be used and/or is needed, to what end, and in what extent.
- I define *the financial structure* to include the price of different energy sources, the employment of related sectors of the economy, and all the financial transactions, e.g. investments, subsidies, and the EU emission trading scheme, needed to extract, refine, transmit, and consume energy. The financial structure can set some limits for energy policy, or at least make some options to look undesirable, but it can also grant incentives for the kind of decision-making that forwards the actor's policy goals.
- *The institutional structure* consists of formal entities, such as local and regional governments, other states, supranational unions (the EU), intergovernmental organisations, companies, non-governmental organisations, and epistemic communities. I also count in informal institutions, including customs and norms. The institutional structure can oblige, advise, discourage, or restrict the actor's energy policy. Depending on the actor's position, the (observed) structure may be beneficial or disadvantageous for the actor. Consider, for example, the global legally binding climate agreement that was reached. States whose economy is highly dependent on fossil fuels will struggle whereas countries that have started decarbonisation of their economies will gain a competitive edge.

[228] Krugman 2010.

- *The environmental structure* comprises of all the segments of the environment: soil and other layers of lithosphere, hydrosphere, atmosphere, and biosphere. It is affected in various ways by energy production and consumption. Those effects can be felt either on local, regional, or global level. Experienced or estimated alteration of the environmental structure can direct the policy-making in energy affairs sometimes directly, e.g. through groundwater contamination, but more often, I'd argue, indirectly through numerous mechanisms which relate to changes in other structures as well (e.g. a technological breakthrough which makes extracting solar power more cost-efficient than before allowing to shut down environmentally harmful coal mines when they aren't needed anymore).
- Technology, and the importance of it, could perhaps be best appreciated as one of the factors of production, among labour, capital, land, and energy.[229] I define *the technology structure* to enclose all the tools, techniques, skills, methods, processes, and appliances available for energy production and consumption. I also count in technologies that are in development stage, e.g. carbon capture and storage, because they, too, can have an impact on actor's assessments of (future) energy policy environments. The technology structure is affiliated with all the other structures very deeply and development in it can have profound, even revolutionary effects on not only the other energy policy environments but also the whole society, as the introduction of steam engine or nuclear power illustrates, just to give a couple of examples.

Next I will lay out the methodology, comparative case study, which I am going to use in the analysis. After that, I will present my findings in the analysis which I have divided into three subsections. In the first, I will present in detail the material I have used in this study. The second subsection answers to the research questions of *how* and *why* as regards Denmark, and the third with regard to Finland.

[229] See Strange 1994, 190.

3. Methodology: A comparative case study approach

3.1. The role of method in the research setting

The methodological choices in any study should not concern merely the data acquisition and technical execution of the study. They are, or at least they should be, closely linked with the (meta-)theoretical premises upon which the researcher builds the study.[230] Chosen methods should advise the reader how the author intends to draw conclusions from the data and reflect his ontological and epistemological presumptions. Moreover, the methodological choices in any work should also be fit with the (meta-)theories, and their typology and particular aspect of the world, contained in the literature which the work is grounded.[231] Method should be tool with which to bind the empirical and theoretical perceptions and guide the scholar to draw meaningful conclusions from the myriad of data.[232] If there is a gap between the ontological and epistemological presumptions between the theory and method, then obviously the researcher must change their methodological approach or ground their work in different vocabulary and worldviews, in a word, theories.

Different meanings are constantly being attached to the method itself among International Relations scholars. This is due to largely diverging research settings everywhere in social sciences, originating from philosophical debates about the world's composition and humans' abilities to gain knowledge of it. Much has been written about the 'contemporary' polarisation between 'positivists' and 'post-modernists'.[233] [234] Numerous categories could be added between these two extremes, but suffice it to say that few positivists are advocates of such a strict form of scientific realism which insists that humans are capable of grasping the observable world 'as it is' without limitations or distortions from our senses or concepts.[235] Likewise, there are few post-modernists who would not reject extreme relativism.[236] Still, the wide variety of methods in International Relations – only a glance into the contents of a methodology textbook will illustrate just how many approaches with their various forms there are[237] – reflects the underlying ontological and epistemological differences among IR scholars. These differences legitimately lead researchers to formulate their study agendas in a specific manner.

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[230] George & Bennett 2005, 127.
[231] Klotz 2009a, 5.
[232] Haukkala 2010, 50.
[233] Klotz 2009a, 1–7.
[234] Wendt 1999, 47–91.
[235] Ibid.
[236] Klotz 2009a, 1–7.
[237] For instance Lamont 2015.

Some pursue to *explain* a certain phenomenon while the others are keener to add *understanding* of it. Furthermore, some have argued that there are two kinds of the former: causal and constitutive explanations.[238] Probably the most common way to characterise research agendas is to deal them into quantitative and qualitative approaches. All these divisions, undoubtedly they could be categorised in many other ways too, reflect that within different methodological approaches, the meaning and function of the method varies. Some approaches, which might be quantitatively oriented or are advocates of critical realism, such as historical analysis, see method as a tool which, if properly used with right kind of data, provides decent explanations for how certain things have occurred in the world.[239] Qualitative approaches like feminist ethnography and rhetorical analysis utilise method more as a mean with which to make sensible accounts of affairs.[240] [241] Here the question of generalisation is given two-folded answers.[242]

It is very difficult to provide an exhaustive summary, especially in a limited space like this, about how should a method be chosen, how is it 'formed', and how is it 'used'. But it is not a particularly complicated process either. First, methods can do different things and therefore the research question must be answerable with the chosen method. Second, the method should reflect the (meta-)theoretical premises, i.e. the general conceptualisation of the world, which form the basis for the study. Discourse analysis of policy papers does not make sense if language is not even included as a form of observable behaviour. The third point concerns operationalisation; what to look at, what material should one gather, and in what extent? Depending on the array, level, and scope of the study, not all methods are equally fit. Finally, each scholar must work reflecting the validity and quality of the study, and the implications which might follow from their own position and the looping effects their publications might have (that is, while studying 'the reality' of the social world, in a way social scientists also end up *(re-)creating* the reality).[243]

A master's dissertation is not the place to engage in a metatheoretical debate much more deeply, not to mention it is not expected in this kind of paper. However, before discussing the selected methodological approach for this study, my own ontological and epistemological assumptions in this work need to be made clear for the reader. This should provide him now a more comprehensive

[238] Wendt 1999, 77–89.
[239] Trachtenberg 2006.
[240] Buch and Staller 2007, 187–222.
[241] Perelman 1982.
[242] Denzin 1983, 133–134, cf. Gerring 2007, 79–80; ref. Haukkala 2010, 53.
[243] The discussion in this paragraph draws much on the work of Leander 2009.

picture of the research agenda and later on its part justify the chosen method and its compatibility with the theoretical and empirical perceptions. To start with ontology, my view is in accordance with all forms of scientific realism, and common sense. The physical world around us is independent of the mind and concepts of people. The world consists of material, but social structures can be, and frequently are, just as real, constraining, and enabling for each individual as the material structures. There are, especially within Foreign Policy Analysis, neurobiological, behaviour genetics, and such approaches which aim to explain some of the phenomena within the sphere of international relations with the help of natural sciences, namely physics in the very end. I do not follow such reductive materialism, which still remains mostly a philosophical question. However, I am not convinced, to say the least, that, say, analysing the causes behind a foreign policy choice is most meaningful in the level of particle physics. Therefore, ideas matter, in fact often more than the material setting, for often, though not always, the relevance of the latter depends on what kind of meanings a person or people have assigned to it. But the world is not ideas *all* the way down, as the common expression goes.

As for epistemology, I’m an advocate of critical realism. By this I mean, that our minds and language can refer to the physical world through careful, accurate, and repeatedly tested theories even when it is not directly observable. This is not to say that mind and language can hook on to the world from the perspective of some almighty. By default, our perceptions of the world are ‘merely’ aspects of it, and they are necessarily limited and distorted by our finite senses and selective concepts. However, the right conclusion of this is not that each interpretation is just as valid and invalid as the others. The pragmatists’ account which goes that truth must be useful-to-believe makes sense. I do not fully endorse the argument, but it highlights the fact that the world constantly gives us feedback about our actions. If people can build up applications to improve the quality of their lives, and it turns out that they can successfully use them in the long-term, then the people must have understood something about the laws of nature and physics. There is a good reason why trial and error is a fundamental problem solving method, if we only can learn from our mistakes, that is, the feedback the world gives us.

3.2. Comparative case study

Case study research is used in many academic disciplines and other situations. In addition to political science, it is fairly common in psychology, sociology, management studies, public administration research, and city and regional planning.[244] Analysis of cases has been applied to so many studies, both quantitative and qualitative, that some scholars like Audie Klotz have questioned the common treatment of case study as a single ‘method’ at all.[245] According to her, it should be seen as part of research design since all kinds of methodological tools can be employed in analysing a single or several cases.[246] [247] Audie argues, that to decide the applicable case study research set for any work, scholars need to start from thinking about what are the key concepts which make the case what it is and what are the qualities that should be compared? If the object of the study is a state, which it often is, then the case is a state, but a case of *what*?[248] After clarifying the key questions and concepts, scholars must map the universe of possible cases, and choose how many cases are dealt with in the analysis. Finally, they must decide which logic of comparison is used to analyse the selected cases.[249] What results is that there is either a single case, a pair of them, or more than two cases (but Klotz argue that there shouldn’t be too many). Each setting has its own features and even though several tools could be used in the analysis, the logic of these three case studies is different in relation to each other.

However, stating that different case studies should be analysed with different means is doing nothing but saying the obvious, and leaves the question of *how* should the analysis be conducted completely unanswered. Even Klotz does not discuss much about this in the texts I have referred to above. Further, I do not find it very productive to deny case study the status of a method on the basis that its implementation practices vary so significantly. Can’t this be said about many other methodological traditions as well, like, say, discourse analysis? It has been suggested by scholars within feminist methodology and rhetorical analysis as well.[250] [251] Wouldn’t it be more fruitful to think that there are different kinds of case study strategies which use varying sources of evidence and modes of analysis but they all have a common definition?

Robert Yin does just this. I shall use his definition of case study in this work. In the words of Yin:

> A case study is an empirical inquiry that
> - investigates a contemporary phenomenon within its real-life context, especially when

[244] Yin 1994, 1–3.
[245] Klotz 2009b, 43–44.
[246] Klotz 2009a, 4.
[247] Klotz 2009b, 43–44.
[248] Ibid., 44–46.
[249] Ibid., 46–51.
[250] For instance Hesse-Bieber and Leavy 2007.
[251] Palonen and Summa 1996.

- the boundaries between phenomenon and context are not clearly evident.[252]

Based on Yin's definition, this study's research agenda fulfil the criteria for case study. Transformation of two states' energy-mix through strategic planning is a contemporary, empirical phenomenon which content and qualities cannot be self-evidently driven from the context, i.e. the surrounding structures. Furthermore, there is a fit between the research questions of this work and case study strategy, for how and why questions are characteristic for a case study. They are typical for experiment and historical analysis, but in social sciences the former is mostly applicable in psychology and microsociology, and the latter obviously concentrates on already occurred events.[253]

Yin argues that case studies, just like many other research approaches, can be either exploratory, descriptive, or explanatory. Still, questions of how and why typically lead to more explanatory strategy because such questions address operational links which need to be traced over time – frequencies or incidences are not as significant.[254] An example of an explanatory case study is Graham Allison's attempt to explain the Cuban missile crisis in October 1962.[255] In Allison's work there is a single case, the confrontation between the United States and the Soviet Union over the Soviet decision to place offensive missiles in Cuba. Allison suggests three theories to explain the course of events and answers three key *why* questions. By comparing each theory with the evidence, he then presents the best explanation not only for the Cuban crisis but for the *type* of crisis which the former is an example of.

My research strategy is close to the one Allison has applied in his study but instead of formulating several competing theories, I have 'only' one theory which consists of five separate, yet linked, dimensions – as I have laid out above. Summing up how two states are pursuing their security of supply is not difficult in the light of their energy and climate strategies, but explaining why they are doing it just that way and not some other requires similar approach than what Allison used in his work. I believe that the states in question are committed to reaching their energy and climate goals but they want to do it as cost effectively as possible and without compromising, too much, the secure supply of energy.[256] That is why the path they choose in their strategies, must reflect their

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[252] Yin 1994, 13.
[253] Ibid., 3–11.
[254] Ibid.
[255] Allison 1999.
[256] There can be counter arguments questioning if the states are actually committed to reach their goal, or am I just assuming so? If they aren't in reality interested in achieve these goals, does the whole research setting make sense? This is a fair notion, but I would reply that one way to measure how seriously the states' take their energy and climate obligations is to scrutinise their view on the environmental structure, i.e. how much value they put on the consequences

interpretations of the surrounding structures which allow them to take such a route to meet their goals. It would not make much sense to pursue goals which they deem impossible to reach with the selected means or due to the unfavourable policy environment. This way, the states' 'worldviews', their interpretation of the surrounding structures, which I have theorised in the previous section, can be explained. In my view, this can be done by looking at: (1) the policy goals and choices the governments are pledging to make or are currently conducting; (2) the reasoning behind those decisions; and (3) the given room for alteration of goals if possible, needed, or necessary. The intention is not to explore which one of the five dimensions seems to count the most, but to explain how each of the structures appears as a part of the energy policy environment from the perspective of states.

Since there are two separate cases – in the 'universe' of states, or, probably more appropriately, EU states[257] – it makes my methodological approach a multiple-case study. But I shall call it a comparative case study, for in the field of political science that has been the generic term for long.[258] [259] A commonly raised concern about case studies, whether single or comparative, is that they provide little basis for scientific generalisation – the same goes, of course, with single experiments. To become facts they have to be successfully repeated multiple times under different conditions.[260] Some scholars argue that although case studies might offer 'only' a detailed snapshot of a given phenomenon, they reveal something of the wider social structures at the same time.[261] That depends where the snapshot was taken, but it is not the idea to view a case as 'a sample' in the same way as an experiment. After all, case studies might be generalisable, not directly to any experimentees such as an individual or a group, but to theoretical propositions. A social scientist pursuing case study strategy attempts to expand and generalise theories.[262] Yin calls it analytic generalisation, in contrast to statistical generalisation, which is usually the goal in experimental approaches. Just as Graham

that have followed, and, in harsher forms, will continue to do so according to scientists, if our energy systems are not transformed? So even if the states do not bother themselves a bit about the energy and climate goals, which I certainly do not believe, that, too, would be explainable within the outlined research setting.

[257] In Audie Klotz's terms, in this study an EU member state is a case of an entity which has major, but not sole, authority to design and conduct energy policy (energy production and consumption, energy export/import, energy transmission, efficiency regulations, incentives, taxation, legislation etc.) within particular geographical area. Comparing an EU state with a non-EU state might prove problematic, for some of the authority which the latter possesses lies in the hands of supranational EU institutions in the case of the former. But comparing two EU countries shouldn't require a comprehensive account because without any special exemptions the authority the states have is exactly the same.

[258] George 1979.

[259] Lijphart 1975.

[260] Yin 1994, 10.

[261] Gerring 2007.

[262] Yin 1994, 10.

Allison strived for creating an explanatory model for power politics in crisis situation, this paper tries to formulate a model which can be used in other contexts of (national) energy policy planning too.

4. Analysis

4.1. The material

This work's primary material consists of Danish and Finnish short-, medium- and long-term energy and climate strategies. In Denmark, the long-term strategy goes under the name of Energy Strategy 2050: from coal and gas to green energy. Its Finnish counterpart is named Energy and Climate Roadmap 2050. The former was published in 2011 and the latter in 2014. Both are official government strategies and thus the countries in question are committed to reaching the goals outlined in their respective documents, at least until they are officially overruled or replaced by new strategies. It is worth to note, of course, that the national energy and climate strategies are prepared by ministries which have different areas of responsibility. In Denmark, energy policy affairs are under the Ministry of Energy, Utilities and Climate, in contrast to Finland where the responsible ministry is that of Employment and the Economy. Undoubtedly this may have an effect on which experts and lobbyists are heard, and how much, in the preparation, and what kinds of aspects receive the most attention in the papers. Indeed, the mere fact that the responsible ministries with their underlying agencies may have diverging interests could partially explain why these two states have interpreted the energy policy environment differently on official level. However, evaluating which authority, industry, organisation, or political party has left the biggest mark in national energy and climate strategies would be a subject for a completely another study. Therefore, I will have to take the national energy and climate strategies 'as given' in a sense that whoever gets to define them, they are officially accepted government documents and as such represent the will of the respective governments until the strategies are overruled or replaced.

Both the Danish Energy Strategy 2050 and the Finnish Energy and Climate Roadmap 2050 are, accordingly to their names, future-oriented papers embedded with different scenarios. Danish Climate Policy Plan (from 2013) and Finnish National Energy and Climate Strategy (from 2013) are much more specific government documents covering the binding targets and initiatives for the short- and medium-term, and current and further measures needed to achieve those energy and climate goals. In addition, there are other government documents, such as energy policy reports and legislative publications, which both establish a framework for short-term energy policy and outline the paths the countries will take in medium- and long-term. The Danish documents include an Energy Agreement which came into effect in March 2012, a publication called Our Future Energy from 2011, which paved the way for the agreement, and Energy policy report 2013. The Finnish government, which was formed in May last year, has listed "bioeconomy and clean solutions" as part of its strategic government programme, and therefore this paper and other relevant publications concerning so called key projects in energy policy are included in the material. The lengths of these documents vary between 5 and 75 pages, and, in total, the primary material consists of about 300 pages.

4.2. Denmark – fossil fuel independency by 2050

4.2.1. How? From expansion of wind power to energy efficiency

The short answer to the question of how is Denmark securing its energy supply in the short-, medium- and long-term is through a significant increase in renewable energy production and various energy efficiency improvements. Its energy and climate strategies are not, however, and quite understandably, merely expressions of what have already been decided, but reflect a long-term need for new initiatives and room for flexibility. Therefore, the long answer is nuanced and in some respects uncertain.

The erstwhile governments'[263] strategies and other documents analysed in this study were published between 2011 and 2013. Already within two years the governments made notable changes which will accelerate the transition of Danish energy system. To give an example, with the initiatives of the Energy Agreement of 2012, the greenhouse gas emissions would be reduced by 34% in 2020 in relation to 1990, but the Climate Policy Plan published in the next year introduced a set of additional measures which would allow cutting the emissions by 40% in 2020 compared to the 1990 level. Some of the short-term goals for the transition period between today and 2020 vary, but the long-term goal of completely fossil fuel independent Denmark is clearly stated in all documents.

The aim to cover half of electricity consumption by wind power in 2020 was first outlined in Our Future Energy, which paved the way for the Energy Agreement of 2012. In the same document, the government also pledged to phase out the use of coal in Danish power plants by 2030. In the same year, oil burners used for heating and electricity production are also to be phased out. The electricity and heat supply are to be covered fully by renewables in 2035, and other remaining sectors such as transport and industry, i.e. all primary energy supply, in 2050. Achieving these goals would still leave some emissions emerging from agriculture and, for instance, from old landfills, but since the absolute majority of Danish greenhouse gas emissions originate from the energy sector and transport, Denmark

[263] Hereafter in all sections of the analysis, by 'the government' I refer to the government in power at the time.

would be able to reach the EU long-term target of 80–95% emission reduction in 2050 in relation to 1990.

The Danish government attempts to create a framework which enables the significant increase of renewable energy in energy consumption. These measures include, for example, preferential treatment in combined heat and power (CHP) production (which is a very large sector in Denmark), subsidies, and an option to use the energy generated in a biogas plant for the plant's own processes or to sell it to the highest bidder. Additionally, large-scale CHP plants using biomass were previously limited by non-profit regulation, but the Energy Strategy in 2011 strove to change this provision and allow producers and consumers of CHP to agree on a price. Effectively this means that the supplier and buyer can share the tax benefits of switching to renewable energy.

As already mentioned, one of the main means Denmark will use to reach its targets is through expansion of their capacity to produce renewable energy. In 2009, the share of renewables in electricity production was 29%, and wind power alone accounted for 19%. The government has accepted and adopted several measures which increased the share of wind power more than twofold in five years.[264] In 2012, the government initiated the expansion of offshore wind power capacity by 1,000 MW by 2020 – this amount is almost exactly the same as the whole Finnish wind power capacity in 2015. Furthermore, new nearshore wind turbines with the combined capacity of 500 MW will be built, and new land-use planning tools will encourage a net increase of 500 MW in onshore wind power capacity by 2020. The government estimates that these measures will ensure that more than 50% of electricity production will be covered by wind power in 2020 and roughly two-thirds in 2030. The Danish government sees that it can easily increase the capacity of wind turbines in the sea due to plentiful space and favourable conditions. However, the government's view is that in a densely populated country like Denmark, land-use and public acceptance do not leave as much leeway to substantially increase wind farms on land. Therefore, onshore wind power production can mainly be increased by upgrading the existing turbines to more efficient ones at the point when they reach the end of their life spans. As the state aims to electrify its whole energy system by 2050, it has provided funding – e.g. worth of DKK 105 million (€14 million) as part of the Energy Agreement 2012 – to research, development, and demonstration of technological solutions related to electricity and heat production, since problems like the volatility of wind power production cannot be solved by plainly increasing the capacity. The government recognises that technological advances in energy storage of

[264] Danish Ministry of Energy, Utilities and Climate 2015, ref. Worldwatch Institute Europe.

wind power, are needed to optimise the consistence between wind power production, its transmission, and electricity consumption.

As for renewable energy, in general, the Danish goal outlined in 2011 aimed to cover 33% of final energy consumption with renewables in 2020. This was three percentage points higher than the target agreed earlier on EU level. However, the 2012 Energy Agreement increased this target to 35%. The share of electricity sector is relatively small in primary energy consumption in Denmark, about one-sixth,[265] and outside of the respective sector, solid biomass accounts for the majority of renewable energy consumption in Denmark.[266] The government believes that large amounts of coal and natural gas can be replaced cost-effectively by biomass already in the short-term through the conversion of large- and small-scale power plants. In addition to biomass, the Danish government wants to increase the use of biogas and biofuels. Much of the expansion of biogas production comes from livestock manure, of which up to 50% are to be exploited for energy purposes by 2020. Biogas can be used to replace all fossil fuels, oil, coal, and natural gas, but it is especially useful in phasing out the latter because it can be utilised in an already existing grid. Denmark also expects to reach the 10% target for biofuels in transport by 2020. In the long-term however, the government worries that the rising demand of biomass resources might put their sufficiency under question and thus raise prices and put pressure on security of supply. On the other hand, the government anticipates that the technologies used in production of biomass will develop, which will also lower the price of energy produced from biomass. Then again, biofuels do not factor much in Danish medium- and long-term planning of energy system. This is because the policymakers estimated that fossil fuel independency in transport will probably have to be based on more electric power, since electric motors are far more energy efficient than combustion engines, and for electrification of the energy system is the state's main aim. Second generation biofuels made from residues and waste, in contrast to first generation biofuels derived from edible sources, may play an important role only for freight and aviation. Contrary to biofuels, biogas has an important role in securing supply of energy in the long-term too, for it reduces emissions from agriculture – and benefits aquatic environment and air quality –, which is an important mean in sharing the burden of climate commitments with all sectors of society.

Danish policymakers view carbon capture and storage (CCS) as a relevant technology in the long-term. The idea in the technology is that a power plant equipped with CCS can, presumably, capture approximately 90% of the carbon dioxide produced while burning coal, and the CO_2 is then stored in

[265] IEA 2015, 50.
[266] See for instance Danish Government 2011a, 50.

liquid or solid form to a site wherefrom it cannot escape to the atmosphere. For now, the Danish government sees that the technology is not commercially viable, but it does not overrule the possibility that CCS could be part of Danish energy system at a later date. If it becomes mature, then the use of coal will be justified according to the strategies, but CCS could also be combined with biomass to reduce CO_2 emission to negative, resulting in a situation where carbon dioxide would be withdrawn from the atmosphere. Solar and wave energy could also provide valuable supplements to wind and biomass in the long-term, specifically because they are productive at different times than the former, which would decrease pressure to develop energy storage solutions. However, the Danish energy and climate strategies take a different stance towards these technologies. They affirm several times that the state is ready to continue supporting research, development, and demonstration of the solar and wave energy technologies, but rarely mention the state's contribution to supporting CCS technology. Only if a breakthrough within it is reached internationally will the state reconsider the suitability of CCS for Danish energy system.

Ramping up renewable energy production is one way the Danish government pursues to secure its energy supply, which is currently very high, for at the time of writing the strategies, Denmark was a net exporter of energy. But the strategies convey a clear message that it is disproportionally expensive to expand energy production into renewables without reducing energy consumption, i.e. demand for energy, at the same time. Therefore, increasing energy efficiency is the other core of Danish energy strategies. Electrification of the energy system is a big part of this because it is in itself an efficiency improvement both at the consumption and at the production side (oil and gas furnaces and boilers, combustion engines, and coal plants are more inefficient than applications and devices which use electricity). In the short-term, district and individual heating and industrial processes are steered towards electrification, for they can be run with heat pumps. As the share of electricity in all primary energy grows, the government attempts to make electricity consumption more flexible with an intelligent system, also known as smart grid technologies, enabling customers to react with the changing conditions of production; for example, reducing their consumption of electricity when the demand, and thus price, is high. The government sees the electrification of transport more as a medium- and long-term goal, for currently new technological advances are required to make large-scale, electrified transport technologically feasible and competitive in economic terms. The Danish government pushes the EU for more intensive research and development in this field. In its own right, the government has guaranteed tax exemptions for electric cars and is building a recharge station network for electrified cars.

> The 20th century was largely driven by access to cheap and plentiful coal, oil and gas. In the 21st century we will have to find other means of satisfying our energy needs.[267]

As part of the efficiency measures, the Energy Agreement also ruled that no new oil- or gas-fired boilers can be installed to new buildings from 2013 onwards. Replacing oil-fired burners with new ones in existing buildings is not possible starting from 2016, with an exception for areas which are not covered by district heating or natural gas grid. Moreover, the energy companies had been targeted by energy saving obligations in 2010–2012. These included, for instance, installations of energy efficient equipment and building refurbishments, and they can be realised by, for example, offering subsidies. The obligations were increased in 2013–2014, and again in 2015–2020. This translates to 2.6% increase in energy savings in final energy consumption (excluding transport) in relation to the 2010 level in 2013–2014. In 2015–2020, the savings will have to rise to a yearly 2.9%. In contrast, the EU's directive on energy efficiency requires an annual reduction of 1.5% of 2010 final energy consumption (excluding transport) up to 2020.

The Danish government is also working on stricter requirements for appliances and products in terms of energy efficiency. Because it cannot be done nationally, the government pursues this agenda on EU level. It also prepares a strategy to make sure that all new building components meet efficiency requirements and that efficiency improvements (additional insulation, windows that reduce air leakage, more efficient form of heating etc.) are carried out while renovating existing buildings. The public sector, although having relatively limited energy consumption, will meet these standards at a fast pace.

Finally, although Denmark has been a net exporter of energy for years, it does not arguably strive for absolute energy independence in the long-term. Instead of building an extensive capacity of renewable energy which could meet the country's energy demand in all occasions, it pursues to further its security of supply by building new electricity transmission lines to Germany in the short-term and possibly to Sweden in the medium-term. Most of the electricity in the Nordic and the Baltic countries is sold in a joint market, Nord Pool. Denmark wants the whole of Europe to increase the transmission capacity between countries so that an efficient, truly international electricity market is possible. Depending on weather and market conditions, Denmark could, for example, export wind power to Europe and import hydropower from Norway and Sweden.

[267] Danish Government 2011a, 5.

4.2.2. Why? To promote domestic cleantech expertise and to take the lead

The Danish government appears to interpret the surrounding structures of energy policy so that they make it possible to strive for an ambitious energy policy – one which allows a rather rapid transition to green energy system without excessive costs on the Danish companies and people. Moreover, the government seems to view that any other energy policy other than green transition will result in a worse outcome. The policymakers also see that transformation of the energy system is a huge possibility to further the expertise of an already well-developed and growing cleantech sector which accounts increasingly more in total exports of Danish goods – in 2009 its share was 12%. The government works on EU and international level to get other countries to adopt similar energy and climate measures, but it believes that it can take the lead by showing an example for others. Of course, this might be a message they knowingly wish to convey for others, leaving them more leeway to demand further actions elsewhere too. Nevertheless, the Danish government's interpretation is that being amongst the frontrunners will result in their benefit.

Resource structure

Increase the share of renewable energy in production and consumption through expansion of wind power is the most appropriate choice for the Danish government because, first of all, their view is that they have plentiful wind resources within their borders. With the right technology and shrinking costs, the windy conditions can be harnessed for energy purposes on a substantially larger scale that is currently being done. The Danish sea areas offer massive possibilities to expand wind power capacity. On land, the situation is different, for it is difficult to build new large wind farms in a densely populated country which is rather small in size. The resource base for solar and wave power is interpreted as suitable as well, but technological and economic reasons set limits for their use. Denmark has a large agricultural sector which seemingly offers good potential for biogas production but since the farmlands are already in intense use, the government remains sceptical whether biomass and second-generation biofuels can be produced domestically in such amounts that can cover the needs of different energy sectors, especially transport. Therefore, the government opts for the electrification of the energy system, including transport, because the potential to produce electricity is deemed greater than the potential of bioeconomy.

> In the long term, much of the transition to fossil fuel independence in the transport sector will probably have to be based on more electric power.[268]

[268] Danish Government 2011a, 38.

Electrification is an efficiency improvement too, and although the resource structure isn't the only one which seems to direct Danish policy choices in favour of energy efficiency, the environment and the economy also affect this, the finite or volatile resources need to be utilised efficiently. The oil and gas resources in Denmark are shrinking but there are remarkable volumes left which will grant the government revenues for years to come. However, if Denmark holds on to its energy and climate targets in the future, the utilisation of these resources will come to an end by 2050 at latest.

Economic structure

An important part of allowing the expansion of wind power is the Danish government's interpretation that the cost of especially onshore wind power is very near to become fully competitive with other forms of energy production, most of all with Norwegian and Swedish hydropower. Offshore wind power will still require subsidies and other sorts of preferential treatment, but the government views that through research, development, demonstration, and innovation the costs will decrease. The same will eventually happen with solar power, although later. Biomass, like wind power, is regarded as on the verge of being mature for markets with low costs. Then again, the Danish government's vision was at the time of publication of the documents that fossil fuels will become increasingly scarce, concentrated on the hands of few unstable regimes, and thus all the more expensive. As the world has evidenced, the massive expansion of the unconventional oil and gas production specifically in the United States has led to radical price decreases – a barrel of Brent crude oil cost US$ 114 on 20th June 2014 but less than a fourth of that, only US$ 27, on 21st January 2016 (since then the price has been increasing).[269] Nuclear energy is not part of Danish energy planning, partly because the government remains doubtful about the price of it. It recognises that theoretically it provides relatively cheap electricity, but it alleviates that in practice many power plants have significantly exceeded budgets and required subsidies of various kinds. The government stresses that the green energy transition will unavoidably come at a cost, but it strives to conduct it as little expenses as possible. The assumed cost of conversion to renewable energy – 0.5% of GDP in 2050 – is assessed as feasible, with the Danish economic situation strong enough to take the lead in paving way for green transition. The intention is not purely altruistic, for early efforts to fulfil energy and climate commitments will help make environmentally sound forms of energy production and consumption cheaper for everyone, including Denmark. Furthermore, investments in green technology research and various demonstration and deployment projects will benefit domestic cleantech companies, resulting in

[269] Thomson Reuters 2016, ref. Neste Oil 2016.

positive employment effects and thus increasing welfare, even in the short-term. Finally, most investments in energy efficiency are deemed cheaper than investments in production capacity.

Institutional structure

Because of the successful climate negotiations in Paris in last December, the international community has a legally binding, worldwide climate agreement. Obviously, this was not the case during the time of writing of the Danish energy and climate strategies, but the government seemed to have a lot of faith in reaching one. One main element in this process was evaluated to be the example the rich industrialised countries can show, and therefore Denmark decided to take the lead as part of, and indeed within, the EU in combat against climate change. The government also interprets that the benefits of international energy markets and specifically the ever closer cooperation in energy affairs in the EU are greater than those achieved in a system where energy policy is strictly under national authority. That assessment leads it to advocate for more integrated energy networks in terms of capacity and rules. In addition, the government attempts to push the EU for ever stricter energy efficiency standards for devices and applications, because it would further assist it in reducing demand for energy, thus easing the pressure to build energy production capacity. In the government's view the kind of measures are unavoidably insufficient on national level. The government also advocates for notable increase of the CO_2 allowance price (through reducing the number of available allowances) within the sectors covered in the EU's Emissions Trading System (ETS) – which accounted to slightly over 40% of Danish emissions in 2008 –, because it would make renewable sources of energy more attractive in economic terms. Inside the country, the Danish government pursues to better recruit local governments to help in green energy transition. This requires frameworks for cooperation and incentives to support them. As a demonstration project, the island of Samsø will be made free of fossil fuels already in 2030.

Environmental structure

The Danish government has a clear view that the environment simply cannot bear much more impacts caused by the use of energy, of which 80% comes from burning fossil fuels. Cheap access to coal, oil, and gas was descriptive for the 20th century, but the government is convinced that already during the first half of this century, other means must be developed to cover most of the use of energy for people's purposes. Otherwise, the global average temperature – not to mention other direct consequences – will rise too much, and the effects will be too harsh to handle. This view necessitates the government to pursue policies which will cut the Danish emissions to the 80–95% target level, and moreover, to cover its energy needs solely from renewable sources by 2050. As already mentioned in the resource structure paragraph, electrifying the Danish energy system and energy efficiency, in general, is also desirable from the point of view of the environmental structure, for the massive production of biomass and other fuels within the bioeconomy might as well be a burden on the environment. Therefore, the government insists continuous monitoring of the sustainability of bio-based energy sources. At the same time, it wants to count in other kinds of environmental effects than only emission reductions. These include fumes, odour, and noise nuisances, effects on water quality, and effects on soil. The environmental challenges regarding the safety of nuclear power plants and disposal of radioactive waste further affect the Danish government's choice to keep nuclear power out of Danish energy system.

Technology structure

According to the understanding of the Danish government, wind power and biomass technologies are on the verge of being mature for mass markets with low costs. Technologies which already are there include, for example, fossil fuels and hydropower. However, offshore wind power is still more expensive than the wind power produced on land. As stated earlier, subsidies for wind power, and various sorts of biomass, can be phased out, starting already in the short-term. In the government's view, solar power technologies still operate in niche markets meaning that the costs in relation to capacity are yet high. Thus the government believes that the knowledge of solar power technologies are, more or less sufficient, but there is a need for further preparation and planning of the next phase before they can be integrated into the energy system in large scare. Biogas, as regards it taking over natural gas, needs similar measures, as well as the so called smart grid technologies. Then again CCS and hydrogen technologies are wholly at the development stage, which is why more knowledge, analysis, testing, and demonstration is required before even the preparation for niche markets can begin. Electrification of the transport system is also estimated to be a long-term project which will take time. Thus, emissions from transport most likely will increase at least until 2035. To hasten favourable technological advances, the Danish government is investing especially in demonstration projects in wind, solar, wave, and biogas technologies. It doesn't rule out the possibility of CCS technologies being part of the Danish energy system in the future, but it is not relying on it and the strategies do not cover notes of Denmark investing in this particular technology. Although the electrification of the transport system is crucial for Denmark so that it can achieve the long-term emission target, it primarily depends on international technology development within this field. With regard to nuclear power, the government sees little growth potential for nuclear power technology in Denmark, for it would have to be purchased from abroad.

4.3. Finland – further technological advances needed

4.3.1. How? Sufficient domestic capacity from forest-based biomass and nuclear power

One guiding principle in Finnish energy and climate strategies is that the EU's (and the international community's) greenhouse gas reduction targets must be in line with the objective of limiting global warming to two degrees Celsius. Therefore, Finnish government supported the EU target of reducing emissions as much as by 30% in 2020 compared to the 1990 level, if other industrialised countries would have undertaken similar emission reductions. The government of the time saw that without increasing efforts already in the short-term, the additional measures taken in the medium- and long-term would have to be even more ambitious. Still the strategies state clearly that Finland is committed to the long-term target of 80–95% emission reductions by 2050.

> Should the central biomass fuels not remain zero-emission or CCS not be commercialised, the 80–95% reduction of emissions cannot be reached in practice.[270]

However, the tone is rather different than in the Danish publications. The Finnish government notes that because of 80% of emissions in Finland emerge from energy production and consumption (including transport), reaching the target would require an energy system altered to an almost emission-free state. At the same time, its view is that achieving the long-term target is not only 'very challenging' but actually dependent on development in international fields, such as technology and various institutions. Especially without the commercialisation of CCS technology and if forest-based biomass fuels should not be counted as zero-emission in the future, the government argues that reaching the emission target for 2050 is practically impossible, at least in a cost-efficient way.

In the Energy and Climate Roadmap 2050, the government (or more precisely, a parliamentary committee consisting of members from all parties represented in the parliament) conducted six different scenarios reflecting the Finnish energy system in the short-, medium-, and long-term. These included a baseline scenario, which is built on the premises of the 2013 Energy and Climate Strategy and trend-like development thereafter; a Base -80% scenario, which adheres to the latter but reduces emissions forcibly to the 80%-target level; a Growth scenario, in which the economy of Finland and the world grows quickly; a Stagnation scenario, in which the economic development is opposite to the Growth; a Save scenario, where the EU implements ambitious energy efficiency goals quickly; and a Change scenario, where the energy system is transformed in a hastened timetable. All of these

[270] Finnish Government 2014, 10.

scenarios invest in the increase of renewable energy and the improvement of energy efficiency, but in a different way. On the basis of pre-2013 decided measures, the Finnish final energy consumption would be 325 TWh in 2020. The 2013 strategy set a target of 310 TWh at a maximum in 2020. However, the Finnish government sees that the relative importance of the electricity supply grows in primary (and final) energy consumption due to the ongoing electrification of the energy system. Therefore, all but one scenario predict a rise in Finnish electricity supply in the short- and medium-term, and even the remaining one in the long-term. In 2010, the electricity supply was a little below 90 TWh, and in 2050 it is estimated to be somewhere between 90 and 110 TWh. Finland is part of the Nord Pool spot market, just as Denmark, and is promoting the expansion of common European electricity market and building more international transmission capacity, but at the same time, it strives to increase its self-sufficiency in electricity consumption. However, the government notes that since the usage of most power plants within the Nord Pool is based on commercial agreements, it is unlikely that Finland will acquire sufficient amount of production capacity with low production costs to be able to phase out all imported electricity. The biggest reason for this is the vast – and increasing – capacity of hydropower and wind power with low production costs in other Nordic countries. Still, to be able to respond to the peak demand of electricity in cold winter months, the government sees it is justifiable to set the target for production capacity so that it equates the annual demand of electricity in the country, even when some of the capacity would remain idle under market conditions.

The Finnish government pursues to increase its energy production through expansion of renewables, especially forest-based biomass, the creation of a proper framework for small-scale energy production, and expansion of nuclear power. Other renewable energy sources might have a small or relatively significant role in the Finnish energy mix depending on the future development. Finland has currently four nuclear power reactors in operation. Construction of the fifth, Olkiluoto-3, has been underway since 2005 but because of numerous of delays, the reactor is currently expected to be in operation in late 2018.[271] The sixth reactor, Hanhikivi-1, should be in commercial operation in 2024. Then, for a few years, Finnish nuclear power capacity would be about 5,500 MW, twice the amount of today. In 2013 nuclear provided 23.6 TWh of electricity production,[272] and the government in power in 2014 expected the number to be about 35 TWh in 2020 and slightly above 50 TWh in 2030. This will reduce the heavy dependency on imported electricity Finland is experiencing now especially during the winter, and, coupled with the expansion of wind power, phase out the use of coal in power plants by 2025 (but the newly elected government worded this goal differently in their programme,

[271] World Nuclear Association 2015.
[272] Ibid.

stating that coal will be gradually phased out in energy production by 2030). However, two of the already existing reactors will be shut down in 2027 and 2030, and the other two in 2039 and 2042, and thus new power plants have to be opened if the share of nuclear power is to be kept on the peak level of mid-2020s. No scenario expects nuclear power production to grow much further than 50 TWh per year by 2050.

The central and most cost-efficient way to increase the share of renewable energy in all production and consumption modes is to significantly increase the use of forest-based biomass, i.e. mostly woodchips and pulpwood. Already in 2010, the Finnish national renewable energy action plan demanded that in 2020 the use of woodchips in power and heat production must total to 25 TWh. The 2013 strategy further added that woodchips will substitute peat in power plants which are equipped with multi-fuel boilers. Furthermore, the Roadmap 2050 estimates that the use of forest-based biomass in electricity and heat production will double from 15 TWh in 2012 to 29–32 TWh in 2050. In addition, wood-based biomass will be used to manufacture liquid biofuels. In 2012, they were not applied at all in biofuels but under the Finnish Distribution Obligation Act, the fuel distributors must increasingly add biofuels in their supply, and these obligations are tightened steadily so that in 2020 20% of transport fuels are covered by biofuels. As a result, forest-based biomass will account 7–19 TWh in 2030 and 21–33 TWh in 2050 in the manufacture of liquid biofuels. The potential of agricultural biomass in Finland, e.g. livestock manure and second-generation biofuels, suitable for energy uses is estimated to be around 11–21 TWh. The government uses various mechanisms such as subsidies, removals of non-economic obstacles, legal obligations, and advocacy for certain international rules to promote the use of various forms of biomass – and to remove any hindrances to do so. The newly elected government pursues to increase the share of renewable energy in consumption to 50% already during the 2020s.

Prior to the 2013 strategy, Finland had set an objective of wind power production amounting to 6 TWh by 2020. The strategy aims to increase the production to 9 TWh by 2025. The obstacles to onshore wind power construction are mostly related to land-use planning, which is why the government promotes the establishment of large wind farms instead of small groups of wind turbines. However, the government finds the conditions for wind power production weak in many inland areas and thus its long-term objective is to promote offshore wind farms. In 2050, depending on the scenario in question, wind power production in Finland may be as small as 7 TWh in 2050, or 29 TWh at maximum.

The production of hydroelectric power cannot significantly be increased in Finland, for much of the hydropower potential is already utilised in energy uses. The government's goal is to increase the production to 14 TWh by 2020 (an increase of around 4% from today's level) and to 15–16 TWh by 2050. Solar power and solar heat production is tiny in Finland, although the government's view is that southern Finland does not differ very much from northern Germany as regards conditions for solar energy production. Finland encourages small-scale solar power production, for example through tax exemption, but large production units are still mainly on demonstration phase. The variation of possible solar power production in 2050 is wide, between 0.2 and 18 TWh depending on multiple factors and policy choices. Until 2030, the government predicts, production is likely to remain minimal. The production potential of other technologies, such as solar heat and heat pumps, is even more uncertain, but unlike the Danish strategies – which saw that emissions arising from industrial processes could be reduced with heat pumps (and thus they are worth pursuing) – the Finnish ones do not recognise such potential. In light of the latter, industrial CO_2 emissions released when manufacturing, say, steel and concrete may be reduced only through CCS technology.

Currently, as well as in the short- and medium-term, the Finnish government sees that peat has an important role as a supplementary fuel to biomass in Finnish energy mix. It is also a domestic source of energy and thus in a key position regarding security of supply. On the minus side, peat's environmental effects are not limited to the carbon dioxide emissions released in burning of the fuel, but altering mires to retrieve peat for energy uses reduces the carbon stocks in mires which release even more greenhouse gases into the atmosphere. Moreover, organic matter and nutrients leaching into water bodies in the process harm the aquatic environment and thus the flora and fauna of peatlands. Therefore, the government pledges to gradually reduce the use of peat for energy, but it wants to make sure that it won't be replaced by coal (which is usually imported from Poland or Russia), and that phasing out peat won't lead to an unreasonable increase in district heating prices. In 2010–2013 the annual use of peat for energy amounted to 23 TWh on average. The government aims to reduce this by a third by 2025. In the medium-term, the need for peat in heat production will be around 11–13 TWh. However, the target of 80% emission reduction necessitates that peat cannot have a part of Finnish energy system in the long-term unless the commercialisation of CCS technology allows its use.

In contrast to coal, which is to be phased out in energy production mostly by 2025 (and entirely by 2030), natural gas is seen as an important transition fuel. Natural gas can be used in energy production and industry, and as a fuel for cars and ships. Carbon dioxide emissions following from burning the gas are approximately 40% lower than those of coal. Finland and Estonia have agreed on a joint LNG-terminal (liquefied natural gas) that will reduce both countries' dependence on Russian gas. The government further favours the use of natural gas as it retains the existing pipes which can be used for biogas and bio-based synthetic natural gas (bio-SNG). Moreover, manufacturing biofuels requires hydrogen that can be produced from natural gas. However, the long-term emission target necessitates that natural gas has to be phased out by 2050 from the Finnish energy system if CCS doesn't become commercialised.

The CO_2 emissions from transport in Finland accounted to 12 million tonnes in 2012. The EU has set a target of 60% reduction for transport sector by 2050, which requires Finland to bring the emissions down to 5 million tonnes of CO_2-equivalent. In the short- and medium-term the emissions are reduced by increasing the share of biofuels, but the government doubts that the entire transport sector – including international transport – can be covered by renewables because their need is so large. Therefore, to advance security of supply, among other things, the energy needs of transport must be reduced. The government aims to do this by advocating stricter efficiency standards in the EU and promoting and directing people to other modes of transport than passenger cars. According to its estimates, well above 50% of urban travels could be conducted by public transport, walking, or bicycling. This, however, requires dense urban regions and zoning policies which, unlike before, do not heavily rely on passenger cars.

Overall, there seems to be a little uncertainty about how Finland can at the same time make sure that sufficient amount of energy at reasonable prices is available at all times in the future, especially in the long-term, and that the energy and climate targets will be reached. As is evident by the above paragraphs, the commercialisation of CCS is deemed very desirable, or even necessary, as is the case regarding emission reductions of industrial processes. Furthermore, the Finnish government seems to be concerned over the possibility that forest-based biomass, or other sorts of biomass as well, won't be regarded as emission-free fuels in the future. Were this to happen and CCS didn't become mature for market, the 80–95% emission reduction target would be practically impossible to achieve. This implies that if the Finnish government had to make a choice between securing energy supply and reaching energy and climate targets, it would by all means opt for the former.

4.3.2. Why? Dependency on nuclear power, biomass, and CCS technology

Despite some similarities with their Danish colleagues' assessments, the Finnish government sees the surrounding structures as more limiting and conditional from the perspective of ambitious green energy policy. In fact, the underlying thought in Finnish strategies appears to be that it is not practically possible for Finland to reach the long-term energy and climate targets within the current policy environment. Further, and remarkable, technological development is needed, especially in the commercialisation of CCS technology which is vital for the state. Furthermore, if scientific evidence shows in the future that biomass is not entirely emission-free, and international calculation rules for the sustainability of the fuel change as a result, the Finnish government views its means to successfully complete green energy transition by 2050 as severely limited. Reaching the targets in this worst-case scenario would translate into remarkably higher costs for energy and deteriorated security of supply, a price too great for the government to pay.

Resource structure

As the second most heavily-forested country in the EU,[273] Finland has a vast potential for wood-based biomass production, amounting to 220,000 square kilometres. According to the strategies, afforestation continues and the country's forests could be used, sustainably, up to twice as much for energy and other purposes compared to the current level. This directs the government to view wood-based biomass and other bioproducts as the single most important sources of renewable energy, and further, the most prominent means to achieve energy and climate targets. It also highlights why Finland does not share much the Danish concern over the sufficiency of biomass resources. Only the energy needs of the transport sector exceed the capacity bioproducts in the long-term. Biomass resources originating from agriculture are notable too, and both forestry and agriculture generate a lot of waste suitable for energy production, further increasing the Finnish biomass base. There are no uranium mines in Finland and very few explorations for the mineral thus leaving the country fully dependent on imports for nuclear power, but the government does not seem concerned about it. In Finland there is significant potential for wind power production on the sea and coastal areas allowing wind power expansion, but in inland the potential is limited. Solar radiation for power and heat production is also regarded sufficient, especially for small-scale production, whereas large installations are best-suited for buildings which need heating during the summer. Resources for hydropower are decent but the government views that they might grow only slightly due to rising annual rainfalls caused by global warming. Therefore, energy transition must be completed without much further help from hydropower production. Finland imports all the fossil fuel resources consumed in the country leaving it no reasons, at least from the perspectives of the resource and the environment structures, why not to phase out their use as quickly as possible. Then again, the total

[273] World Bank 2016b.

area of mires in Finland is massive leaving the country with vast stocks of commercially extractable peat.

> [t]he utilisation of peat for energy will be reduced systematically due to emissions and other environmental damage caused, in such a manner that peat is not replaced by coal.[274]

It follows that the government wants first to stop using coal for energy purposes, which can be replaced by peat, before taking peat out of energy uses. The government fears that striving to phase out peat and fossil fuels in tandem could lead to a situation where the former is merely displaced with the latter, thus further reducing Finnish self-sufficiency.

Economic structure

Although wind power production has great potential from the perspective of the resource structure, it views that within the economic policy environment wind power is remarkably less promising. The feed-in tariff system for onshore wind might be continued also in the medium-term, and the expansion of offshore wind would require even more considerable state subsidies. In other words, the government does not view wind power as profitable in the near future. There are no mentions about the competitiveness of nuclear power in the strategies which implies that the government is confident about it. Such seems to be the case with most wood-based bioproducts, and peat too, though the former receives preferential treatment. Some bioproducts, like bio-SNG, need also subsidies, for currently it is more expensive than natural gas. Just as its Danish counterpart, the Finnish government views green energy transition as very beneficial for the cleantech industry, and hence for the whole economy in terms of employment and balance of trade, already in the short-term but increasingly so in the medium- and long-term. However, reaching the energy and climate targets cost-effectively is not possible for Finland without the commercialisation of CCS technology, which arguably explains in part why the Danish strategies appear more ambitious than the Finnish ones. The low price of CO_2 emission allowance within the ETS sector threatens the discontinuation of fossil fuels and thus expansion of renewables. On the other hand, the government argues that too high prices of fossil fuels in the EU only will not just undermine the competitiveness of domestic companies, but might lead to carbon leakage which refers to moving (polluting) industries abroad – which does no good for the environment but hampers the domestic economy.

Institutional structure

[274] Finnish Government 2013, 35.

Avoiding carbon leakage is crucial in ensuring that climate change is halted to bearable levels, according to the Finnish government. Therefore, it insisted on a global climate agreement which eventually was realised. The government also required that the global efforts must be in line with what is needed to reach the target of limiting the global warming to two degrees Celsius. As for the country's own part, the central role of biomass resources in Finnish energy planning explains why the government seems to be worried about the possibility of changes in international emission calculations in regards to woodchips and other wood-based biomass. Whether or not wood-based resources are emission-free is a scientific debate, but the government tries to avoid any hindrances to their use that may follow from such discussion. In the EU, the Finnish government advocates setting only one or two binding targets instead of three which were set for 2020. According to it, this would leave more room for optimisation of most suitable measures on national level. In the government's view, the emission reduction target would probably yield the highest cost-efficiency whereas the renewable energy target would reassure investors and developers of green technology. Binding energy efficiency target is not viewed as helpful but the government supports ever higher standards for equipment and EU-wide eco-planning and energy labelling as it allows the country to pursue efficiency in areas where it is not possible on solely national basis. As the sufficiency of renewable resources for the needs of transport is questionable – and since the electrification of the sector is not dealt with as much details as in the Danish strategies – the government strives to decrease the energy needs in transport. This is done by affecting local governments' zoning policy regulations and other sorts of community development planning so that the need for passenger cars, by far the biggest energy consumer sector within transport, would decrease. Easing legal and administrative obstacles especially for the expansion of renewable energy, say, wind farms, is also in the toolkit.

Environmental structure

The Finnish government recognises the scientific evidence which clearly indicates that human-induced climate change must be limited to the average temperature rise of two degrees Celsius to avoid drastic consequences for the natural environment and societies. The fact that northern regions warm even more than the globe as a whole further seems to support the government's involvement in ambitious EU energy and climate targets, even setting higher targets nationally (e.g. the share of renewables in transport by 2020), and to insist that the burden must be shared with every country. However, seemingly this does not determine Finnish energy policy even in the long-term in a sense that the government would pursue to reach the energy and climate targets at a very high cost or severely compromising security of supply. This suggests that if (wood-based) biomass was considered scientifically as a fuel which produces smaller emissions than fossil fuel, but which is not entirely carbon-neutral, Finland would hesitate, to say the least, before giving up on its use and finding other means to satisfy its energy needs. In short, the vast forests in the country (the resource base) and the expertise and competitive edge in the wood sector (the economic structure) apparently outweigh environmental considerations. In the long-term, this does not appear true in regards to peat, which has the same benefits but undoubtedly is a more harmful pollutant and has other damaging effects on the environment. Then again, the environmental threats of nuclear power are deemed manageable, and since it is emission-free, apart from mining the uranium, the Finnish government finds backing from the environmental structure to justify the use of nuclear power in all time periods covered in this paper. The commercialisation of CCS technology is not viewed necessary only because it could significantly reduce emission, but because, if coupled with biomass, it could actually withdraw emissions from the atmosphere leading to a decrease in greenhouse gas concentration, which would otherwise take a lot of time.

Technology structure

Apart from some forms of biomass, renewable energy technologies are not mature for mass markets in the short-term so that they could compete in price, according to the Finnish government. This applies to both onshore and offshore wind power, and at least partially explains why the Finnish wind power capacity is not being expanded by 2025 anywhere near the Danish current level. Economic and institutional reasons, namely high cost for taxpayers and international market rules, apparently limit the possibilities of heavier subsidising. The Finnish government view’s that solar power technology will not be able to compete in the mass markets until the long-term, if even then since solar power production was remarkable only in two scenarios. However, regarding small-scale production, i.e. the consumer’s own use, solar power will become competitive in the medium-term. Both technologies are subsidised and given other forms of preferential treatment in the short-term, but future subsidies are not guaranteed. There is a great potential for biogas and biofuels production from livestock manure and non-food crops but both technologies are deemed to require support and the government is still preparing a fully coherent legal and administrative framework to better assist them. Although CCS technology is viewed as of vital importance for Finland, there are no mentions about CCS-related demonstration projects in Finland and the technology is overall in an early development stage. Moreover, the 2050 Roadmap notes that even on an international level, progress has not been as fast as estimated before. In short, Finland is almost wholly reliant on technological advances made elsewhere. Based on this material, there is a visible paradox between the importance the CCS technology is given in Finnish future energy system and the efforts the government is preparing to assist the commercialisation of the technology.

5. Conclusions

In this paper I have analysed the national energy and climate strategies of Denmark and Finland to find answers to questions of how these countries are planning to transform their energy systems in the coming years and decades, and why have they chosen exactly the means they are currently employing. I have contextualised this study within the spheres of energy and climate change, both understood in a wide societal sense. I have applied social structurationist approach to develop a theoretical framework which, I argue, covers the most relevant aspects of energy policy.[275] Methodologically this thesis can be defined as a comparative case study which – I further argue – in spite of some arising critical notes can provide generalisation to the theoretical framework, and, moreover, to some of the empirical findings. In this final section I shall first add a few concluding remarks on the discussion of the previous section. Some of the reasons behind the Danish and Finnish aim to decarbonise their energy system might not have been covered in the countries' strategies, and hence, in the analysis above. Based on the literature and theoretical framework I have utilised in this work, it is now time to raise a few other possible factors which may direct the countries' energy planning although they were not dealt with in their strategies. Then I will evaluate the theoretical and methodological model utilised in this study estimating its suitability for other works, after which I shall discuss the accuracy of the hypothesis. Finally, I will point out some key factors which might be crucial in defining the content of future energy and climate strategies of Denmark and Finland, or any other country.

Overview of the findings

From the perspective of energy and climate targets, the Danish aims to decarbonise their energy system can be judged as more ambitious than the Finnish ones. One inevitable fact that was mentioned in both countries' papers was that reaching the energy and climate targets comes at a cost. Due to several years of stagnation and sluggish economic growth prospects in Finland,[276] the policymakers might just see that the economic structure leaves less leeway for ambitious efforts in comparison to Denmark where at least some parts of the energy transition can be funded through sales of oil and

[275] Arguably the (rather traditional) notion of using energy as a mean of power politics was almost obsolete in the analysis, which is hardly surprising since Denmark and Finland are small countries and therefore such means are well out of their reach – moreover, it cannot be assumed that they would practise such a policy even if they had the opportunity. But I do find the theoretical framework just as suitable for cases of energy 'superpowers' who inextricably bind their energy policy with power politics. One way to view this is that the state in question interprets the surrounding structures, specifically the resource, institutional, and economic structures as something which enable the practice of using energy as a mean to increase the country's direct influence outside its borders.

[276] European Commission 2016d.

natural gas. However, it would be misleading and too simplistic to put a lot of weight on the general view of the economy. Although it might not be the kind of thing policymakers want to stress in such documents as the long-term energy strategies, one would expect to see at least some mentions of the stagnating economy, if it really was deemed to notably constrict the country's efforts. Therefore, I do think that the findings made in the analysis do at least partially cover the Danish and Finnish interpretations of the energy policy environment. In that light, Danish governments have viewed the surrounding structures as more favourable and promising than the Finnish governments have, and thus, aspiring measures make more sense for the Danes than the Finns. It also seems that the environmental structure with all its implications appears for the Danish governments more as something which must not be neglected in favour of, say, the resource and the economic structures, and which, perhaps, must even be given the priority in the long-term. It seems that for Finland even the long-term environmental considerations may have to be compromised in a sense that the greenhouse gas emission target may not be reached – although at the same time the countries' policymakers strongly stress that internationally climate change commitments must be met with the scientific evidence of their sufficiency. What could not be traced in this analysis was the effect of interest groups and lobbyists on the politicians and government officials who have planned and produced the energy strategies. Quite possibly, say, environmental NGOs have had significantly less influence on the respective authorities than, for instance, power companies. Conversely, the wind industry and the cleantech sector in general might already have grown to such scale in Denmark that they have been able to develop a significant lobbying capacity of their own. There is certainly no need to underestimate such factors. For instance, in 1993 the Finnish Parliament voted against building a fifth nuclear power plant in the country, but nine years later it narrowly voted for the power plant. At the time most of the most influential interest groups such as the Central Organisation of Finnish Trade Unions, the Confederation of Finnish Industry and Employers, and the Central Union of Agricultural Producers and Forest Owners were all eagerly supporting building more nuclear power.[277] They also had an effect on parties which were linked with these groups.[278]

Wind power

Denmark and Finland were chosen as the subjects of the study because of the striking difference in their wind power capacity. As the analysis shows, this big difference both in capacity and production will most likely remain in all time periods. What was rather surprising for me was that in terms of resource sufficiency there was not really divergence in interpretations between Denmark and Finland,

[277] Berg 2009, 114.
[278] Hylkilä 2003, 136–138.

in line with the two maps in section 1.6 which suggested that there shouldn't be. Potential for wind power was estimated limited only in large parts of Finnish inland areas due to lack of resources (for Denmark the potential for further growth was also limited but for land use reasons), but on the coast and on the sea it was deemed vast just as in Denmark. Instead, it was the economic competitiveness and, to some extent, the maturity of the technology of wind power which divided the countries, and rather clearly. Whereas the Danish government in power in 2011 suggested renouncing subsidies for onshore wind turbines connected to the grid from 2014 due to their 'very favourable financial perspectives', the Finnish government's feed-in tariff for wind power, including onshore, continues well into the medium-term. It was also the view of the Finnish government reigning in late 2014, that reaching the targets set for offshore wind power production by 2050 would require 'heavy subsidising' that could contradict with EU competition laws, thus creating doubts about the prospects of reaching the targets.

Nuclear power

The different stance Denmark and Finland take on nuclear power highlights the division that can be seen much wider in Europe. Twelve EU states have signed an agreement to promote the role of nuclear energy in the energy mix of the EU. In addition to Finland, for instance France and the UK are part of this group.[279] Then again, Germany has taken similar approach than Denmark, for it has pledged to phase out the use of nuclear power by 2023.[280] Hence it seems that as long as the nation states have full sovereignty to determine their own energy mix nuclear energy will be part of the EU's energy planning. Even if security of supply would partially be subjected to supra-national decision-making, it would be a long way to install some restrictions to the production of nuclear energy, not least because among the countries producing nuclear energy are some of the most influential EU member states. In this respect a centralised and common EU energy policy including, among other things, all energy production forms seems now an unlikely prospect even for decades to come, for nuclear energy alone is dividing the member states into two different camps. However, one must keep in mind that although right now there is no specific energy mix which could meet both the energy needs of societies and the 21st century environmental standards, technological development can change the current situation very quickly. If some technological breakthrough would make a given production form preeminent compared to others – the same way the car once became to be the dominant transport mode – then countries' energy mixes, and thus prospects for a common EU energy policy, may be redrawn rapidly.

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[279] World Nuclear Association 2016.
[280] Ibid.

Bioproducts and transport

Regarding the use of biomass in energy production the countries' viewpoints align with each other. Since Finland has significantly larger forest areas the question is understandably more crucial to the Finns than the Danes. However, when it comes down to biofuels and biogas in transport, the countries have somewhat diverging views. Here it is Finland which is increasing the share of bioproducts in more ambitious pace, its resource base and expertise in this sector providing it with a competitive edge. Although both countries recognise there is still much uncertain about the long-term composition of the transport sector, the Danish government argues that future transport system will probably have to be based on electrification – due to lack of resources and efficiency gains –, and therefore, it has not got many plans to increase the share of biofuels after the medium-term. Finland recognises that to cover the energy needs of transport fully by bioproducts doesn't appear possible, but they will nonetheless have a big role in the system even though parallel solutions have to be developed in addition, whether electric or hydrogen vehicles. This question too might divide EU countries and other states, moreover, there might be other preferred options for future transport system which didn't emerge in this study. The question is ever more crucial, for in energy affairs decided measures and policy choices have very long-lasting effects and building a new infrastructure can be extremely costly – once the process is underway it might prove very difficult to change the path. That is why it is utterly important to consider carefully all the positive and negative implications of different systems. Furthermore, an EU-wide or indeed a truly international transport infrastructure – just like an international electrical grid – might have significant benefits in relation to 28 or so national systems. This should be held in mind in all policy planning.

Theoretical framework

As for the theoretical and methodological framework I have utilised in this paper, I would argue that it turned out to be decent, and combined with the chosen material, I was able to adequately answer the research questions. I remain strongly in favour of social structurationist approach, for it allowed me to capture both the limiting and enabling aspects of the policy environment within which states operate, but also include states' own goals and attempts to influence the surrounding structures in the analysis. One of the findings, the diverging view Denmark and Finland have on the economic feasibility of wind power, further illustrate that the policy environment as such does not determine the countries actions, but they have to be interpreted, and these perceptions are hardly independent of the governments' aspirations and targets, not to mention those of lobbyists. I am confident that with the approach I used in this study I was able to grasp some central aspects of Danish and Finnish – or any other country's which is committed to energy and climate targets – energy policy. Only one visible paradox arose in the analysis, namely the estimated significance of the carbon capture and storage technology for the Finnish energy system and the lack of mentions how to actively promote the development, deployment, and, later, commercialisation of the technology. However, if there is a problem here, I would say it is somewhere else than in the theoretical framework itself. It can be that the material chosen for the study was inadequate in this respect – there might well be other documents covering Finnish efforts to support the CCS technology. But just as well, the apparent paradox in the analysis could originate from reality, that is, the Finnish energy policy itself may be paradoxical in this respect. Taking into account the cost and technological difficulties associated with many demonstration projects of CCS, it wouldn't be too much of a surprise. In 2010 a Finnish state-bound company Fortum cancelled its CCS project in a coal power plant in Meri-Pori, Finland, due to "company strategy and the outcome of various studies".[281]

No doubt a similar approach could be used for studying many other countries' energy policy too. Instead of comparing two or more countries I should think this kind of approach could also be utilised to analyse one country's strategies in different times and hence track in a process-tracing manner how its energy planning has developed over the years. This would obviously make the study a single-case study, which should be perfectly applicable. Of course, other methodological choices should be possible too. The actor does not necessarily have to be a state, but also an energy association, a company, or an NGO, to name a few, could well be the subject of the study. In that case, however, the theoretical framework, the dimensions of energy policy, might have to be reworked. This could mean narrowing the structures to include only the relevant factors which are of the interest of the actor, say, a given resource or a few certain technologies. As long as the two principles of case study research defined by Robert Yin are met – that a case study investigates a contemporary phenomenon which cannot be explained self-evidently by the context which surrounds it –,[282] the research qualifies as a case study.

Hypothesis

Initially, I hypothesised that Denmark and Finland are pursuing security of supply partly through similar means, including, for instance, stronger utilisation of biomass and agricultural waste, advocacy for stricter energy efficiency standards in the EU and increase of the CO_2 allowance price within the ETS, and promotion of smart grid technologies. All these assumptions turned out to be

[281] Zero Emission Resource Organisation 2016.
[282] Yin 1994, 13.

accurate, but what I did not expect was that Finland seems to support the development and use of various biomass resources in the medium- and long-term more strongly than Denmark, who appears to favour the use of electricity (and heat) producing technologies and devices especially in transport, and is worried about the sufficiency of biomass resources in the country due to already intense farming. The notion that Denmark and Finland pursue security of supply through different means proved also true. Denmark is expanding wind power capacity, and hence production, far more than Finland, even though the latter aims to significant increases in wind power production in the short-term. Still, Finland will be far away from the Danish levels. The assumption about nuclear energy was also valid, and indeed, its significance for the Finnish energy mix is growing although the peak levels are apparently met already in the medium-term.

Due to Finland's rather low rate of self-sufficiency in energy consumption, one part of my hypothesis was that security of supply would be a more stressing matter for Finland than Denmark. The analysis shows that this kind of statement is not accurate. All the different aspects (availability of energy, competitive prices, and environmental considerations) of security of supply were very much dealt with in both Finnish and Danish documents, and based on this material it cannot be evaluated which one seems to be more worried or cautious about it. Neither the theoretical framework suggests that security of supply would be a more pressing matter for some than others. Only two differing stances between the countries were found in this study as regards 'the importance' of security of supply. The first was about the need to have a big enough domestic electricity production capacity to be able to cover the domestic demand of electricity. At the time the Danish strategies were published, Denmark was a net-exporter of energy, but it did not seem too worried about the prospect that it would not remain so in the long-term. In fact, it was clearly stated that the country is willing to integrate its electricity sector with those of other EU countries, and beyond that. Danish governments did not seem to think that it was necessary to be fully self-sufficient in such an international market as long as the market as a whole had the required capacity. Finland was also a supporter of this development but at the same time it wanted to make sure that its own electricity production capacity would be able to cover domestic consumption even if there wasn't need, or under market rules, even a possibility, to keep it in full use. The other diverging position was about the prospects of security of supply in an energy system undergoing ambitious green transition. Finland saw a couple of big threats – the CCS technology remaining on research and development level, and changing emission calculations for biomass resources – which could undermine both the long-term energy and climate targets, and security of supply. Denmark also recognised that further technological advances are required but it seemed much more confident about the possibility to fit uncompromised security of supply and the climate targets together.

Further research

It would be interesting to analyse Denmark and Finland's next energy and climate strategy with a similar approach to see, how are the countries' policymakers seeing the energy policy environment then – are there any differences compared to these documents written in the first half of this decade, and if so, what kind of. In Finland the preparation of the next energy and climate strategy is on the way and it should be published later this year. Its content can and should be the subject of some other study. As pointed out at the very start of this paper, the significance of constant and affordable energy is, if anything, ever greater. For Denmark and Finland, some of the most defining factors of their future energy and climate strategies include first of all technological development. The fate of the CCS technology is especially crucial. How long will it form one of the cornerstones of Finnish energy policy if it faces a setback after another and the commercialisation of the technology is delayed even more?

The pricing mechanism of energy production might also become a huge problem to solve. It didn't seem to raise many concerns in the documents covered in this paper but according to a recent study, mainly the expansion of wind power specifically in Sweden and Denmark has already cut the annual electricity bill of Nordic countries' customers by 20%, i.e. around 3.5 billion euros, and the prospects are that the prices may come down another 8 billion euros by 2020.[283] This is substantially shrinking the profits of coal power plants, CHP plants, nuclear power plants, and even hydropower which likely will end up in shutting down a great number of them. In an environmental sense wind power is thus doing just what it was supposed to, but due to the volatility of it and – at least now – the lack of sufficient storage technologies, this is a threat to security of supply. Therefore, there is a 'new' problem at hand of how to guarantee the economic feasibility of power plants which are at least now needed to level up the volatile wind power production. The shrinking electricity prices, if the abovementioned scenario is realised, will likely put the expansion of nuclear energy in Finland under doubt.

The next a few years or so could also offer some answers of future transport system – whether it is going to be based on biofuels, electricity, or something else such as hydrogen, probably granting both

[283] Liski and Vehviläinen 2015.

Denmark and Finland more tools, which at the time of publishing the documents dealt with in this thesis appeared somewhat limited. On the positive side, now that the world has a global, and legally binding, climate agreement, we could expect to see increased efforts from the states to combat climate change. At the end of the day, although there remain several key questions regarding green energy transition, this shouldn’t lead to desperation, and I think the analysis in this study echoes that statement. But solving these problems will determine not only the structure of our future energy systems, but also much of the dynamics of international community and, ultimately, the life prospects of current and upcoming generations of people.

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