Bachelor thesis

SCM600 Logistics and Supply Chain Management

Internalizing the externalities - the effects of taxation as a measure to improve sustainability in the Norwegian energy sector

Oddvar Raugstad

Number of pages including this page: 37

Molde, 02.06.2020

Molde University College
Specialized University in Logistics

Mandatory statement

Each student is responsible for complying with rules and regulations that relate to examinations and to academic work in general. The purpose of the mandatory statement is to make students aware of their responsibility and the consequences of cheating. Failure to complete the statement does not excuse students from their responsibility.

*Please complete the mandatory statement by placing a mark **in each box** for statements 1-6 below.*		
1.	**I/we hereby declare that my/our paper/assignment is my/our own work, and that I/we have not used other sources or received other help than mentioned in the paper/assignment.**	☒
2.	**I/we hereby declare that this paper** 1. Has not been used in any other exam at another department/university/university college 2. Is not referring to the work of others without acknowledgement 3. Is not referring to my/our previous work without acknowledgement 4. Has acknowledged all sources of literature in the text and in the list of references 5. Is not a copy, duplicate or transcript of other work	Mark each box: 1. ☒ 2. ☒ 3. ☒ 4. ☒ 5. ☒
3.	**I am/we are aware that any breach of the above will be considered as cheating, and may result in annulment of the examination and exclusion from all universities and university colleges in Norway for up to one year, according to the Act relating to Norwegian Universities and University Colleges, section 4-7 and 4-8 and Examination regulations** section 14 and 15.	☒
4.	**I am/we are aware that all papers/assignments may be checked for plagiarism by a software assisted plagiarism check**	☒
5.	**I am/we are aware that Molde University College will handle all cases of suspected cheating according to prevailing guidelines.**	☒
6.	**I/we are aware of the University College's rules and regulation for using sources**	☒

Personal protection

Personal Data Act

Research projects that processes personal data according to Personal Data Act, should be notified to Data Protection Services (NSD) for consideration.

Has the research project been considered by NSD? ☐**yes** ☒**no**

- If yes:

Reference number:

- If no:

I/we hereby declare that the thesis does not contain personal data according to Personal Data Act.: ☒

Act on Medical and Health Research

If the research project is affected by the regulations decided in Act on Medical and Health Research (the Health Research Act), it must be approved in advance by the Regional Committee for Medical and Health Research Ethic (REK) in your region.

Has the research project been considered by REK? ☐**yes** ☒**no**

- If yes:

Reference number:

Publication agreement

ECTS credits: 15

Supervisor: Morten Svindland

Agreement on electronic publication of bachelor thesis

Author(s) have copyright to the thesis, including the exclusive right to publish the document (The Copyright Act §2).

All thesis' fulfilling the requirements will be registered and published in Brage HiM, with the approval of the author(s).

Theses with a confidentiality agreement will not be published.

I/we hereby give Molde University College the right to, free of charge, make the thesis available for electronic publication: ☒**yes** ☐**no**

Is there an agreement of confidentiality? ☐**yes** ☒**no**

(A supplementary confidentiality agreement must be filled in)

- If yes:

Can the thesis be online published when the period of confidentiality is expired? ☒**yes** ☐**no**

Date: 02.06.2020

Preface

This thesis concludes my Supply Chain Management Bachelor's degree and marks the end of my study at Molde University College. Due to constraints caused by government measures regarding the global pandemic, planned interviews and information access from a large state-owned energy company were cancelled late in the process, and a subject pivot was necessary. Still, the chosen subject *the effects of taxation as a measure to improve sustainability in the Norwegian energy sector* has a fascinating complexity, and even though my research is a small contribution to the enormous field of study, my goal is, and has been, to provide a thesis that adds value to the discussion, for private sector, for public sector, and for the society.

I would like to thank my supervisor, PhD Morten Svindland, and all lecturers from my previous courses. I am grateful for all the knowledge you have shared during these years I have attended Molde University College. I would like to thank my fellow student Sunniva Knudseth for motivation, and my interviewees, Ketil Solvik-Olsen, Sigurd Enge and Rune Hersvik for their time and contributions. I would like to thank Joen Erik Kobbelhuus for linguistic guidance, Ove Raugstad with family for their support, and last but not least, Iselin Therese Holmefjord for her tolerance and patience.

Betre byrdi du ber 'kje i bakken
enn mannavit mykje.
D'er betre enn gull
i framand gard;
vit er vesalmanns trøyst.

- Håvamål

Contents

1.0 Introduction

The balance in the use of natural resources, collection of taxes and distribution of welfare benefits is one of the core foundations in the way our society works. There is a multitude of ongoing political discussions regarding taxes, economy, society, and the environment. All of which will have an impact on sustainable development. With oil prices being halved from May 2019 to May 2020 (Oslo Børs, 2020) and the effects of Covid-19 worsening the downturn (Fernandes, 2020), the petroleum sector wants lower taxes to stimulate growth. Additionally, according to the Norwegian Oil and Gas Association (NOROG), wind power at sea and carbon capture are dependent on the petroleum industry. As a result of the demand from NOROG, representing among others Aker, Aibel, and Equinor (Stavanger Aftenblad, 2020), the Norwegian government has proposed a change in the Petroleum Act for further growth and to boost the economy in the petroleum industry (Prop. 113 L, 2020). In the renewable energy sector, there are a lot of ongoing discussions regarding the economic and environmental effects of wind power.

Environmental organizations are focusing on the negative local, regional and global externalities of wind power (Naturvernforbundet, 2020), and advocate for increased taxes to be placed on the wind energy industry to equate wind power with hydropower, and to build an economic model that profits the government more than foreign owners. Changes in the tax levels of fossil- and renewable energy will have a large impact on the companies in those sectors, both for their current economic situation and for their future commitment and development. It will also have a large impact on the government as an increase, or reduction, in tax revenue will affect the budget and the possibility to subsidize positive environmental measures. It will also have a large impact on society as taxation and fees, and other regulatory measures, are one of the primary methods used to combat climate change. It may seem paradoxical that it is the petroleum industry that gives the government the necessary economic leeway to invest in environmental measures.

The primary objective of this thesis is to get a deeper understanding of these topics by exploring the use of taxation to improve sustainability and to mitigate climate change. With the use of different research methods to find and gather qualitative data, the main focus will be the energy sector in Norway, how the non-renewable energy sector is taxed, how the

renewable energy sector is taxed, and the authorities effect on the direction the society takes with regards to sustainability and environmental issues. Even though the primary focus is Norway, this subject should be of relevance for other countries as well since many governments are dealing with the same issues. Additionally, some scenarios are transferable as case studies and a lot of the externalities discussed are global.

1.1 Research questions

The subject of the thesis, *the effects of taxation as a measure to improve sustainability in the Norwegian energy sector*, opens a field of study with comprehensive data available. There are a lot of different directions possible, but to get a better understanding of the big picture a broad approach was chosen. Some topics, that are found to be of a higher relevance and importance to the main subject, are addressed more in detail. According to Bryman and Bell (2011), the research questions need to be researchable (being able to collect data), be linked to each other and add value to the already existing theory. Four research questions are formulated in order to collect and convey information to analyze the main subject as good as possible. The first question is constructed to address the importance and relevance of taxation as an environmental measure and the latter three are constructed to address the tax measures on societal, financial and environmental factors, using the triple bottom line (people – planet – profit) framework (Elkington, 1998) in a macro-level perspective.

1. How important are environmental taxes in order to improve sustainability in the Norwegian energy sector?
2. How is the economy affected when using taxation as a measure to improve the sustainability in the Norwegian energy sector?
3. How are the people and social equity affected when using taxation as a measure to improve the sustainability in the Norwegian energy sector?
4. How is the environment – local, regional, and global – affected when using taxation as a measure to improve the sustainability in the Norwegian energy sector?

1.2 Structure

The thesis structure is three larger chapters consisting of literature review, methodology and results and discussion before the end conclusion.

2.0 Literature Review

The literature review presents the theoretical framework that is used in the thesis, it refers to a lot of different sources such as textbooks, reports, journals, and news pages to support the identification of specific research questions (Rowley & Sack, 2004). This contributes to the thesis by adding validity and value to the discussion, assumptions, and the conclusion.

2.1 Taxes and fees

In the book "Green Logistics" (2015), Piecyk states that it is only fair that companies pay for the damage they inflict on the environment since the environment should not be seen as a "free good" that businesses and people can exploit without consequences. The most common measure towards exploiting the environment is the "polluter pays" principle (Pigouvian tax), also known as internalizing an externality, meaning that the environmental cost gets added to the activity in form of a tax or fee. The "polluter pays" principle dates all the way back to 1920 as a method to equalize the marginal private cost and the marginal social cost, so that the producer would have to pay for the non-pecuniary externality that it created (Pigou, 1920). Reformed over the time, strongly influenced by Coase (1960) with his "cheapest cost-avoider" analysis, the basic principles of the "polluter pays" principle are still the same (Schmidtchen, et al., 2007).

Looking at Norway, the "polluter pays" principle is considerably implemented in laws and regulations. As early as December 1990, Norway introduced the carbon tax states that companies must pay carbon tax when burning petroleum and by emission of natural gas in petroleum activity at the continental shelf (Lovdata, 2015). Furthermore, taxation on greenhouse gases, including carbon tax, together with the emission trading system are stated as the government's most important methods to secure a cost-effective reduction in emissions of greenhouse gases (Norwegian Goverment, 2020). This is substantiated by the Green Tax Commission, in NOU 2015:15, that advocated for the positive environmental effects caused by a multitude of environmental fees. It is worth mentioning that all of these taxes and fees are recommendations by a commission and not explicitly implemented in laws of regulations. NOU reports recommended fees on use of natural and recreational areas in 1996, 2013 and 2015 (Borge, et al., 2015), without it being implemented in laws. Environmental taxes create financial incentives for companies to reduce their pollution and also for the government to raise additional revenue in order to subsidize sustainable projects (Piecyk, et al., 2015). There

exist research showing the positive environmental effects (Fischer & Newell, 2008; Ciccone, 2018), the positive economic effects (Williams, 2016; Lageaga & Labendeira, 2020), and the positive effects on innovation (Ambec, et al., 2013; Galeotti, et al., 2020), but the social acceptance for what levels of taxation that are acceptable is still unclear (Sundtoft, 2015; Vestre Sem, 2017).

2.2 European Union Emissions Trading System

Tradable quotas are an alternative to Pigouvian taxes when there is uncertainty in finding the right number for marginal damage (Weitzman, 1974). According to the European Union, the EU emissions trading system (EU ETS) is one of the most important measures in their policy to combat climate change. It was the world's first major carbon market and is a cost-effective way to reduce greenhouse gas emissions. In addition to all EU countries, the EU ETS also operates in Iceland, Liechtenstein, and Norway (European Comission, 2020). Roughly fifty percent of Norwegian emissions are covered by the EU ETS. In addition to domestic measures, Norway has historically fulfilled its commitment by purchasing quotas from United Nations approved projects, primarily from emission reducing projects in countries without climate obligations (Ministry of Climate and Environment, 2014; Borge, et al., 2015).

The lack of efficiency of the EU ETS has been documented in several reports, mainly regarding allowance surplus and carbon leakage (Sandbag, 2011; Wyns, 2012). Following the financial crisis in 2008 the demand dropped significantly causing a huge surplus and price drop for allowances (Wettestad, 2014; Jiang & Guan, 2017). The surplus was 1.65 billion allowances in 2017 (European Comission, 2018). Still, measures are being taken such as the implementation of the market stability reserve in 2019, which counteracts the surplus of allowances and secures a stable market. In addition, the ceiling for allowed emissions will be changed from today's 1.74 % yearly reduction to a 2.2 % yearly reduction from 2021 (Bruninx, et al., 2019).

Even though the EU ETS is struggling with a variety of challenges, there is some research proving that the emissions of greenhouse gases have been reduced due to the EU ETS (Ellerman, et al., 2010; Egenhofer, et al., 2011). Other positive effects include innovation. Like other environmental taxes and fees, the EU ETS incentivizes innovation of sustainable technologies, and there is evidence that investment and innovation responses are stronger in companies that face a shortage of allowances than in those with surplus allowances (Liang, et

al., 2013). With this in mind, according to Muuls (2016), the EU ETS could boost economic growth as it is stated that long term-growth is entirely driven by innovation and technological progress.

2.3 Non-renewable energy

Non-renewable energy is defined as energy sources that are stored in nature and which, within a human perspective, are not renewable and thus must be regarded as a resource that can be depleted (SNL, 2018). In Norway there is currently an absence of nuclear power, and there are only two coal power plants, so the non-renewable energy industry is almost exclusively petroleum. This section has three subcategories that will address coal, petroleum, and nuclear as non-renewable energy sources.

2.3.1 Coal

The two Norwegian coal power plants are both located on Svalbard and supply electrical energy to roughly 2300 people. The CO2 emissions from the coal power plants amount to 200,000 tons yearly, constituting almost 50 % of the total emissions from Svalbard, equivalent to the same amount as the yearly emissions from 100,000 gasoline cars (Teigen, 2019). The coal power plants are supplied with coal from the nearby mine “Gruve 7”, with the government owned company “Store Norske Gruvedrift” estimated to extract coal for the next twenty years (NTB, 2019). The negative environmental externalities are both local and global. The local negative externalities on health may be considered marginal due to the small settlement compared to the large areas. Due to the large emission of CO_2 compared to the energy created (Dekhtyareva, 2019), a shift towards wind energy has been recommended (Mathers, et al., 2017).

2.3.2 Petroleum

The petroleum industry is by far the largest industry in Norway. In the Norwegian national budget for 2020 the prognosis for the petroleum industry was a 14 % share of the GDP (gross domestic product), a 19 % share of government revenues, a 19 % share of total investments and a 37 % share of total exports (National Budget, 2019). The consequences caused by the reduction in oil prices and the Covid-19 pandemic have impacted these numbers greatly, with current estimates for 2020 from the Oil and Energy Department being a 10 % share of the GDP, a 10 % share of government revenues, a 20 % share of total investments and a 31 % share of total exports (OED, 2020). In 2019 the net government cash flow from petroleum

activities was 256.9 billion NOK, made up from 133.5 billion NOK from taxes, 6.9 billion NOK from environmental taxes and area fees, 96.5 billion NOK from net cash flow from SDFI (State's Direct Financial Interest) and 20.0 billion NOK from Equinor dividend. In the revised national budget for 2020 the net government cash flow is estimated to 97.8 billion NOK, made up from 32.5 billion NOK from taxes, 7.3 billion NOK from environmental taxes and area fees, 42.3 billion NOK from net cash flow from SDFI and 15.7 billion NOK from Equinor dividend (Revised National Budget, 2020). The net cash flow had a 62 % decrease while the cash flow from taxes had a 76 % decrease. Looking at the taxation of the petroleum industry, the total tax level is 78 %, consisting of 22 % ordinary company tax and 56 % special tax due to the extraordinary returns on production of petroleum resources, it is worth noting that reimbursement for exploration as well as depreciation of investments are included in these figures. In addition, there are area fees and environmental taxes. The petroleum industry is affected by carbon tax, NO_x tax, and EU ETS (OED, 2020).

The petroleum industry is the industry with the largest impact on the Norwegian economy and environment, the industry employs 225,000 persons (Fjose, et al., 2019). In 2018 the petroleum industry accounted for a total of 13.7 million tons of CO_2 emissions, almost a third of the total CO_2 emissions in Norway. It is worth noting that the CO_4-emissions (Methane) from the petroleum industry were merely 19.7 million tons compared to the 104.7 million tons of CO_4-emissions from agriculture (SSB, 2019), an interesting discussion when using taxation as an environmental measure, but a different industry and outside of the scope for this thesis. The CO_2 equivalent number is larger than the CO_2 emission number as it also includes other greenhouse gases like CO_4, N_2O etc. These numbers, from the petroleum industry, give an indication of the environmental impact related to the extraction of petroleum, and compared to the world average Norway's emissions are about 50 % (extraction of oil and gas in Norway leads to emissions of 55 kg CO_2 per ton oil equivalent while the world average is 132 kg of CO_2 per ton oil equivalent) (Gavenas & Rosendahl, 2014). But it does not take into accounts the emissions due to the use of petroleum. According to Randers (2019), the emissions caused by petroleum products exported from Norway are 530 million tons of CO_2 equivalents, which is 37 times more than the 14.2 million tons of CO_2 equivalents from the production itself. Under the assumption that the need for petroleum in the market is unchanged, this discharge would have happened independently of Norwegian petroleum export since other countries would have supplied the petroleum instead.

There are local, regional, and global externalities from petroleum production. The seismic shooting used in exploration of petroleum causes exceedingly high sounds that spread over large distances in the water. The externalities include, but are not limited to, death of microorganisms, negative impact on fish reproduction, and damages on sea mammals' hearing (Hassel, et al., 2004; Stemland, et al., 2019). There are also emissions directly to the sea, mainly from produced water contaminated with oil, chemicals, and radioactive substances. These chemicals may cause damage and death to all sea life affected, but are limited to geographically small areas (Scoma, et al., 2017; Carpenter, 2018). Even though the local externalities have serious consequences for life below water, the air pollution is the biggest challenge with petroleum production. The large emissions of CO_2, mainly from gas turbines, diesel turbines, and flaring (NOROG, 2018), have a global effect on the climate change. The biggest threats are global warming (Anderson, et al., 2016; Hao, et al., 2018) and ocean acidification (Doney, et al., 2009), while there are upsides such as increased growth in plants on land (Hunter, 2007). In addition to CO_2 emissions, the petroleum production also causes emissions of nitrogen oxide (NO_x) which has damaging effects on ecosystems and vegetation (Fowler, 1992).

2.3.3 Nuclear

There is an absence of nuclear power plants in Norway despite large instances of thorium deposits (nuclear fuel) (SNL, 2019). Due to large accidents such as the Three Mile Island-accident in 1979 and the Chernobyl-accident in 1986 there is a lot of opposition against nuclear power, and the documentation regarding nuclear power in Norway is limited. In 2008, the Thorium Commission, on assignment from the Ministry of Oil and Energy, published their report being positive towards further research in order to develop nuclear power in Norway. With an estimate of 170,000 tons of thorium available in Norway, the energy content would be 100 times larger than all oil, extracted and in reservoirs, in Norway (Thorium Commission, 2008). Lately the estimates of thorium reserves in Norway have decreased and the updated estimates are 87,000 tons according to the International Atomic Energy Agency (IAEA, 2019).

2.4 Renewable energy

Renewable energy is defined as an energy source which originates in nature's own cycle and which, within a human perspective, is constantly renewed and can thus be considered inexhaustible (SNL, 2019). Renewable energy accounts for 96 % of the electrical power generated in Norway (NVE, 2019) and is, even with some degree of negative environmental externalities, considered the sustainable option (Shafiei & Salim, 2014). According to the International Renewable Energy Agency (2017), renewable energy and energy efficiency can meet 90% of the decarbonization needed to stay within the target of the Paris Agreement (an international climate agreement with a temperature goal to keep the increase in global average temperature below 2 °C above pre-industrial levels).

2.4.1 Hydropower

Comprising 94.4 % of the power production, hydroelectric power is the cornerstone of Norwegian power production. This ratio is six times higher than the global average of 15 % (Wang, 2019) and is a result of the unique Norwegian topography. Large mountainous regions form the peak of the water circulation system. This enables the construction of water magazines which can harness this power and provide energy to all mainland regions in Norway. There are currently over 1000 of these hydroelectric power plants in use today. The hydroelectric power industry in Norway is over 125 years old and most of the hydroelectric power plants were built before 1990. In 1991 the Norwegian power market was deregulated (Ministry of Oil and Energy, 2020) in order to rationalize the production, distribution, and sale of electricity in an economic sense (Kjærland, 2009).

Hydroelectric power has been criticized for negative local externalities such as; changes in hydrological flow regimes, reduced water quality, and loss of biological diversity. Despite of this, a lot of reports still conclude that the positive global externalities outweigh the negative local externalities (Botelho, et al., 2018; Mussa, et al., 2018). In addition to the environmental impacts mentioned above, negative and positive, there is research which shows that energy consumption from hydroelectric power boosts economic growth, and economic growth in turn causes an increase in consumption from hydroelectric power (Bildirici, 2015).

2.4.2 Wind power

While the share of power produced by wind sources is merely at 5.6 %, it is worth noting that power production from wind power had a 93.1% increase from April 2019 to April 2020, while total power production increased by 25.9 % (SSB, 2020). This comes in a time where the opposition towards windmills is increasing (Motvind, 2020). Even though wind power mitigates negative externalities from fossil energy, the wind power itself entails negative externalities such as loss of biological diversity, sound pollution, visual pollution, and the damage of natural CO_2 storages (Zerrahn, 2017). Still, excluding the damage of natural CO_2 storages, all of the externalities mentioned above are local and can be monetarily compensated (von Mollendorff & Welsch, 2015).

Like hydropower, wind power also benefits from the Norwegian topography, combined with new technology (in 2012 the average production from a new wind turbine was 7 GWh, while in 2019 it is 14 GWh), there is a potential large market for windfarms in Norway. A hint of this is shown by the 37 windfarm projects that were approved but not yet started at the end of 2018, which would double the number of windfarms in Norway when operative (NVE, 2019). This is under the assumption that companies are willing to invest in wind power, with the profitability being affected by the price of electricity and governmental economic stimuli (Krøvel, et al., 2019). The current development of windfarms has been on land, but there is a lot of research on, and incentives for, wind farms at sea. Not only to supply electricity to offshore installations but also to avoid some of the local externalities caused by windfarms on land. Research by Kløw (2019) shows that there is a willingness to pay in the form of increased taxation to move existing and new windfarms from land to sea. With environmental concern being one of the reasons, it proves that there are socio-economic costs associated with the environmental costs of onshore windfarms.

2.4.3 Solar power

Being the fastest growing power generation technology worldwide, solar power is also growing rapidly in Norway with the energy production going from 15 GWh in 2015 to 80 GWh in 2019 (NVE, 2020). Still, this is just one thousandth of the total production of electricity in Norway (SSB, 2020), and as such, currently has a negligible effect in Norway as a measure to combat climate change.

3.0 Methodology

A methodology is any mean that serves the purpose of solving problems and approach new knowledge (Aubert, 1972). Different methodologies are categorized in either quantitative or qualitative methodology. Quantitative methodology generates numeric data while the qualitative methodology generates textual data that is more aimed at capturing opinions and experiences that cannot be quantified or measured (Dalland, 2007).

According to Teddlie & Tashakkori (2008), a lot of researchers have found it fruitful to combine different research methods. When choosing methodology, the main focus was to collect data that would add value to the thesis with thorough and complementary information about the chosen subject. For that purpose, document collection as a research method was chosen. In addition, it was desirable to understand and be able to convey the broader picture of a complex subject. To achieve that, interview as a research method was chosen. The subjective understanding of the author is that the combination of the methods above would provide the necessary information needed to be able to discuss and conclude.

3.1 Document collection

The document collection has exclusively been from written public documents such as textbooks, reports, journals, and news pages. Documents have been found by internet search for relevant words, and combinations of words, related to the subject, and by navigating through web pages of the government and the different ministries of the government. The majority of academic papers have been found by using the google scholar search engine, made specifically for scientific purposes. In order to develop empirical knowledge and understanding of the subject the documents have been examined and interpreted (Corbin & Strauss, 2008) as thorough as possible with limited time.

3.2 Interviews

The purpose of the interview is to get detailed information about the topic studied (Dalen, 2011). When choosing interviews as a data collection method, the opportunities are to go for either structured-, semi-structured, or unstructured interviews (Johannessen, et al., 2010). Since the goal of the interview was to gather a variety of data about a comprehensive subject and not only test a specific hypothesis, semi-structured interviews was chosen (David & Sutton, 2004). This means that the interview topic was agreed beforehand, but the interviewer could ask new questions during the interview. Also, the person being interviewed could add additional information or bring up new relevant topics (Thagaard, 2009). Two of the interviews were performed by physical meetings and one through video conference, both audio recording and written notes were being used. Afterwards, the interviews were transcribed and the interviewees were given the opportunity to correct and strengthen the transcript in order to improve the detail and accuracy of the interview as recommended by Baum (1977).

The persons who are interviewed are referred to as interviewees, they add value to the research with their extensive knowledge about the interview topic (Johannessen, et al., 2010). All three interviewees have long and valuable experience and extensive knowledge in their respective fields. Interviewee number one, informing from a government perspective, is Ketil Solvik-Olsen, former Norwegian Minister of Transport and Communications. He has eight years of experience from the Norwegian Parliament and six years of experience as member of the Standing Committee of Energy and Environment. Interviewee number two, informing from an environmental organization perspective, is Sigurd Enge, manager shipping, marine and arctic issues at Bellona. He has over 30 years of experience from Bellona within several fields of study, including environmental issues in the Norwegian petroleum industry. Interviewee number three, informing from an energy sector point of view, is Rune Hersvik, partner at Norsk Vind AS. He has 37 years of managerial experience from the Norwegian energy sector, with nine of those years working with energy chains and environmental issues at Statoil/Equinor, and 18 years working with wind energy for Norsk Vind AS. He also has six years of experience as project director for the United Nations fund for agricultural development focusing on energy and food security for Sub-Saharan Africa project.

3.3 Quality

When evaluating the quality of the research design, internal validity, external and reliability has been used as criteria as recommended by Bryman and Bell (2011). Internal validity is used about the opportunities the study provides for the assumed hypothesis to explain the findings, also known as cause-effect relationship. The findings and conclusion are based on empiric data, with clear indications for the causation. But due to the complexity of the subject and the challenge of covering all variables, most statements are moderate.

External validity means that the results of a limited study can be generalized, and thus be applicable to a larger amount of data than the study examined. When generalizing from qualitative research, the claims need to be moderate in terms of the strength and scope (Payne & Williams, 2005). Even though the subject is concentrated around the Norwegian energy sector, some of the findings may be transferable to other sectors and other countries.

Reliability is the degree to which the chosen research method produces consistent results, and if the findings and conclusion would be the same if the study were repeated. Two qualitative research methods have been used along with several sources of data when possible, the use of more methods and sources adds credibility to the findings and secures that the collected data is reliable (Yin, 1994; Hoepfl, 1997).

When going through large quantities of data, there was a concern that the collected data was biased by political views or economic interests. Data obtained through document collection has been checked against similar sources, data supplied from interviews has been checked against theory, and reviewed by the interviewees. The interviews are still representative of the interviewee's opinion and in case of any factual errors this will be corrected in the discussion section. As for the objectivity of the researcher, the purpose of the thesis is solely to convey findings from empiric data without the influence of the researcher's biases or subjectivity. According to Lincoln & Cuba (1985), these measures establish confirmability.

4.0 Results and discussions

This chapter consists of four parts in order to answer each of the four research questions. In each part, the results from the literature review and the interviews will be presented, analyzed, and discussed in order build the foundation for a conclusion in the next chapter based on the similarities and differences of gathered data. The results presented from the interviews are empiric data based on the interviewee's observations and experience. All interviews were semi-structured and based on the effects of taxation as a measure to improve the sustainability of the Norwegian energy sector with a natural shift of direction to the interviewees main field of competence. The excerpts used from the interviews are chosen with the intent to accentuate the most relevant information for the subject. The interview itself only conveys information shared by the interviewees, so the information has to be processed by interpretation and analysis in the discussion section. In order to increase the readability, the following abbreviations are used when referring to the interviewees; Ketil Solvik-Olsen is referred to as KSO, Sigurd Enge is referred to as SE and Rune Hersvik is referred to as RH.

4.1 The importance of environmental taxes

Research question one dealt with the importance of environmental taxes in order to improve the sustainability in the Norwegian energy sector. Findings from the theory show that the "polluter pays" principle is heavily implemented in Norwegian laws and regulations and increases the states revenue significantly (the revenue based on environmental taxation from the petroleum industry alone is estimated to be 7.3 billion NOK). This revenue can be used to subsidize sustainable projects in order to mitigate negative externalities, subsidize a transition to environmentally friendly technologies or as a monetary compensation to those negatively affected by externalities. In addition to the generated revenue to the state, an environmental tax itself causes an incentive for companies to reduce their emissions and is an accelerator for a transition from non-renewable energy to renewable energy. According to RH, when looking at the development of renewable energy like wind power, the use of Green Certificates led to an increase in revenue and more profitable projects and made investing in windfarms and wind energy technology more attractive. The Green Certificates work with the government assigning Green Certificates to the producers of renewable energy, the consumer is then required to purchase a given proportion of certificates based on electrical consumption.

In his interview, KSO states that environmental tax measures have forced a restructuring in Norwegian businesses and not only made them more sustainable, but also boosted the development of environmentally friendly technologies such as autonomous buses, hydrogen ferries, and electric airplanes where Norway is now able to compete in a global market.

The exemption of taxes may also be an effective tool to improve sustainability. With the VAT exemption, the government has reduced the price on electric cars significantly and caused a major replacement of fossil fueled cars in favor of electric cards. There are uncertainties if this transition would have happened to this extent if it were not for the VAT exemption.

The EU ETS has had some, yet limited, environmental effects, and the efficiency has been questioned. In his interview, SE mentions that emissions from the petroleum industry account for an ever increasing share of Norwegian emissions. In January 2020 Equinor and the Norwegian petroleum industry announced their ambitious emissions strategy which entails a fifty percent reduction by 2030 and basically zero emissions in 2050. It proves that EU ETS works. Equinor stated, based on their economic analysis, that the price of CO_2 quotas would increase so much that investments in electrification and offshore wind will be less than continuing running gas turbines and compensating the emissions with purchase of quotas.

Even though the theory confirms that there is a correlation between the reduction of issued quotas, the increase of quota price, and the environmental effects, there are contradictions between some of the theory and the interviews regarding the efficiency of EU ETS.

Based on these findings one may state that to be able to improve the sustainability in the Norwegian energy sector, the environmental tax is the government’s main measure and of high importance.

4.2 Profit – financial factors

Research question two dealt with how the economy got affected when using tax measures to improve the sustainability in the Norwegian energy sector. Findings in the theory show that environmental taxes and fees from the petroleum industry alone increases the states revenues by 7.3 billion NOK, revenues that are an important factor for the population's welfare benefits and the possibility to subsidize sustainable measures. Still, the petroleum industry is defined as an extraordinary profitable industry. Looking at the industry as a whole, the environmental taxes do not hinder economic growth for petroleum companies. Though taxes, such as the carbon tax and EU ETS, make companies in the petroleum and coal industry less profitable, and companies in the renewable energy industry more profitable due to the absence of similar taxations.

In his interview, RH, to the interviewer's surprise, states that Norsk Vind AS wants an increased taxation on wind energy in Norway. A natural resource tax, or concession fee using the same model as hydroelectric power, would benefit the host-municipality and host-county. Their main reason for this is that they would like for a larger value to be returned to the societies that have been positive to and accepted the development of windfarms. This is opposed by the Ministry of Finance which favorizes the resource rent that generates more tax revenue to the state, as opposed to a natural resource tax/concession fee, which would benefit local authorities. The distribution of a natural resource tax could be an important tool for getting a larger share of revenues to the host municipalities. Therefore, it is necessary that the state's proportion of the revenues should be reduced, and the local authorities' proportion increased accordingly.

With the combination of an increased profitability of wind energy and an increase in the opposition toward wind energy on land, there may be a development where the government will use increased taxation as a measure to monetarily compensate for negative externalities caused by onshore windfarms. There are also other arguments for taxation of wind energy as to compensate for the reduction of the state's revenue from taxes caused by downscaling of the petroleum industry. In addition, a natural resource tax will force businesses in the renewable energy industry to develop even more sustainable technologies, the same way as the carbon tax has caused a development of more sustainable technology in the petroleum industry.

When considering an increase in taxation on wind energy, factors such as stagnating the development of sustainable technology due to reduced profitability for investors should be taken into account, but according to RH, in today's energy market there are factors favorizing renewable energy even without additional taxation of the petroleum sector. One of these factors, and probably the most important driver for a transition, is the supply chain to the end consumer. Using the fueling of cars as an example. In to fuel a gasoline car one first has to do exploration by ship, do some seismic shooting and then drill an oil well with the cost being hundreds of millions NOK, including the risk of drilling dry holes. When oil has been found, an oil rig which costs several billion NOK has to be used. The oil then must be transported by ship to land, refined, transported with trucks to gas stations before finally being ready to fill up the tank of the car. All of these different steps in the supply chain are resource intensive, both economically and environmentally.

By comparing this to an electric car the supply chain can be as easy as the development and construction of a windfarm, generation of power into the power grid, from the power grid to homes and to an electric charger and then charging the battery of the electric vehicle. Another wind vs petroleum comparison can be made by looking at the gas power plant at Kårstø which required the equivalent of six TWh (terawatt-hours) of gas to produce three TWh of electricity. The owners (Statkraft and Statoil) shut the gas power plant down due to lack of profitability, even when taking into account a significantly reduced CO_2 tax. The environmental consequence, the CO_2 emissions being reduced by 1 million tons yearly, is just a bonus. Today, even without Green Certificates, the gas power industry has not managed to create profitability as a competing business to wind power.

He continues by mentioning that by summing all costs in the value chain, even the enormous Johan Sverdrup oilfield will not be profitable compared to wind and sun power. In her opening speech, prime minister Erna Solberg said the oilfield would generate 900 billion NOK for the community. By calculating a lifetime of 50 years, and assuming most of the petroleum will be used as fuel for gasoline cars (approximately 2,3kg CO_2 emissions are generated from 1 liter of gasoline), then the total CO_2 emissions from the oilfield would be 1 billion tons. When it is stated that Norway has half the CO_2 emissions of other oil producing countries, the reality is that Norwegian CO_2 emissions are ten times that, the emission cost is only connected to the production, but not the end user. The IPPC (United Nations

Intergovernmental Panel on Climate Change) wishes to tax the fossil value chain. If this were the scenario in Norway, the CO_2 tax for Johan Sverdrup would be 1000 billion NOK, changing a 900 billion NOK profit to a 100 billion NOK loss.

As theory shows, the oil companies are reimbursed for costs related to exploration of petroleum reservoirs. SE states that Bellona believes the exploration reimbursement scheme is unfortunate. The Norwegian policy has been that a diversified petroleum industry with large and small companies is desirable. The small companies, also known as oil mosquitos, are a risk because of their lack of broad competence, which also affects how the companies look at risk (the chance of a successful exploration strategy).

When comparing the robustness of the supply chain in the petroleum industry and the wind energy industry, the wind energy industry seems less vulnerable to a potential increase in taxation or a reduction of subsidies. Still, there is a societal desire for a transition from non-renewable energy to renewable energy. Thus, an increased taxation, or removal of subsidies, in both the petroleum industry and wind energy industry should be considered.

KSO mentions that if the government becomes too generous with subsidies, it may hinder a natural market to develop. So, one has to be aware that one must not fall so much in love with the measures that the subsidy itself becomes a target and the sight of what is trying to be accomplished is lost, namely get a greater prevalence of a given technology.

Based on findings from these interviews, supported by the theory, subsidies to the wind energy industry should lapse, and increased taxation should be considered.

According to KSO the Norwegian society as a whole has been aware of the need for a more environmentally friendly energy policy, transport policy, and the needs of the environment itself. This has accomplished that there is a more different culture in Norwegian companies to think sustainable and develop green technology, than what one might find many other places. He states that this culture will give a competitive advantage to companies due to enforcing technological development, the disadvantage is if the government in that transition is so strict with the regulations, that companies will go bankrupt. If they go bankrupt in a market where everyone had to readjust, then that is understandable. But if Norwegian companies go bankrupt, while foreign competing companies do not, because they have different conditions,

it becomes unreasonable. When setting requirements to Norwegian businesses, the government has to be aware if the requirements are set in a market where everyone gets the new higher cost and the new stricter requirement, or if there is international competition and only Norwegian companies get hindered by the demands.

KSO also mentions that if the politicians see the benefits of every measure of equal importance that requires immediate action, and do not have a relation to the cost side and the usefulness, they will risk applying enormous costs to businesses without being able to show results. They may win arguments short term but will over time lose legitimacy and engagement of those who finance these measures long term. Sometimes it is businesses, other times it is the taxpayers.

By internalizing the externalities in the form of environmental taxes the government imposes a cost on the businesses while increasing the states revenue. The economic effects of taxes forces businesses to develop and use more environmentally friendly technology. The increased revenue for the state can be used to subsidize measures that improve sustainability or subsidize measures that mitigate emissions and other environmental externalities, it can also be used as a monetary compensation.

4.3 People – societal factors

Research question three dealt with how the people and social equity were affected when using tax measures to improve the sustainability in the Norwegian energy sector. When the government is not willing to cover the increased cost of environmental measures, the cost gets pushed on to the population

In his interview, KSO uses ferry rates on battery ferries as an example. When he was a minister, he was involved with deciding that certain national roads should have battery ferries. But on some national roads they ended up choosing hybrid ferries, because when calculating the cost, the cost became so large that either the ferry rates would need to increase a lot, or it would be an enormous cost in the state budget. This was not something they were willing to prioritize, as they felt that the money had better use other places. In some county ferry routes, the introduction of battery ferries caused an increase in the ferry rates by 80-90 %. He states that the society should demand environmentally friendly and energy effective ferries to reduce emissions. But if the tempo is too high, the technology too expensive, the scope too large, and on top of it all politicians are not willing to cover the cost over their budgets, we will end up with a popular opposition against battery ferries and increased ferry rates.

Another measure that affects social equity is the combination of toll roads and the VAT exemption on electric cars, according to KSO these measures have proven to work with the goal being a transition from fossil fueled cars to electric cars and the reduction of emissions. He mentions that when people have a transportation need, increasingly more people have chosen to purchase electric cars voluntarily because they trust the car will give them the transportation service needed, and it has been financially profitable. The electric car policy has proven to be an expensive endeavor for the government, but the parliament has been willing to cover those costs without pushing them on to the consumer. This is an example of a positive measure where the politicians are willing to face the consequences of the decisions they had made in the form of less revenue to the government. He mentions that in the ferry policies, the results were the same on a parliamentary level, but when the cost got pushed on to the consumers at county level, it caused a backlash.

Continuing on examples that caused backlash, KSO states that there is no doubt that low income families get hit harder than high income families with the current toll road system.

And that maybe it is the people with lower income that should have a greater opportunity to travel at a lower cost in order to get to a job market where they can function better, but now experience an economic wall that also hinders their social activities. This leads to a growing resistance against toll road payments, which in turn destroys the entire credibility of the city growth agreements. He says that the current toll road system is unfair because there are people who do not have an alternative like reasonable public transportation or the funds to buy an electric car. He also mentions that the government should spend a little more time building up the good alternatives, and then see that a lot of people voluntarily choose differently.

When studying the findings from the theory and the interviews there are indications that there is some social acceptance for environmental taxes, but also a significant risk of backlash and riots when the change is too fast, or the cost gets too high. There is willingness to pay in order to achieve a transition from onshore to offshore windfarms, but measures like toll roads and increased ferry rates have backlashed and caused a growing opposition. The removal of taxes (VAT exemption) on electric cars have proven very successful in the transition from fossil fueled cars to electric cars.

There are 225,000 employees in the Norwegian petroleum industry that are affected by changes in the taxation of the industry. When taxation measures cause a transition to sustainable technology the demand for petroleum decreases. Reduction of petroleum production, and reduction of petroleum related jobs, will incur enormous costs on the government if employees in the industry are to receive monetary compensation in order to maintain their financial wealth. When the petroleum industry at the same time is the industry that generates the most revenue to the state, it is difficult to imagine a large downscaling of the petroleum industry being financially viable without a decrease in financial wealth for the people. Even with the labor needs in other industries, and the increase of job opportunities generated by the growth in the renewable energy sector, the society has to accept that the current job market will change in a transition from non-renewable energy to renewable energy. With the reduction of jobs and the reduction of financial wealth, measures such as the introduction of six hour working days in Norway is worthy of discussion. A bit outside the scope for this thesis, but a reduction of working hours will increase the demand for employees in order to perform the same amount of labor. This demand may be reduced due to productivity growth as a result of technological development. With the effect being a fair

distribution of jobs, this is of relevance when looking at ways to mitigate the negative consequences caused by the downscaling of the petroleum industry. Even with an income reduction due to the reduction of working hours, the results of increased employment improve the social equity.

In addition to the economic effects, the theory shows that externalities from the energy sector affects the people's health and wellness. The local externalities from wind energy that affect people's health are visual pollution and to some extent sound pollution. The combination of these and other externalities (without direct influence on people's health) has caused a growing opposition towards wind energy and a polarization of the society that affects people's wellness.

The tax measures affect people in both a negative and a positive manner. Even though there is an increased awareness of environmental issues, not all people have a real alternative to choose the greener option. And it may seem that the wealthier you are, the easier it is to accept increased taxes (like toll roads) or exploit the removal of taxes (like the VAT exemption on electric cars). But for low income families, a lot of the taxes become a heavy burden, for example having transport opportunities being hindered by toll roads while not having the funds to purchase an electric car.

4.4 Planet – environmental factors

Research question four dealt with how the environment – local, regional, and global – were affected when using taxation as a measure to improve the sustainability in the Norwegian energy sector. In the results and discussion of research question one (the importance of environmental taxation), the conclusion was that taxation as an environmental measure is of high importance.

This is because taxation works as a measure to reduce negative externalities. The theory shows that the externality that causes the biggest threat to the global environment is the emission of CO_2 that contributes to global warming and ocean acidification. The main emission source of CO_2 in Norway is from the production of petroleum, which alone stands for 13.7 million tons of CO_2 emissions. When taxation measures cause a shift from non-renewable to renewable energy, the CO_2 emissions are reduced.

Further findings in the petroleum literature review show that the emissions of CO_2 equivalents caused by the petroleum export are 37 times larger than the emissions from the production itself. In order to reduce CO_2 emissions on a global scale by tax measures there is a need to use taxation of the whole fossil value chain in order to reduce the demand for petroleum products. This is supported by the interview with SE stating that it is the consumer who must report for the emissions, and not the producer.

Measures like the gasoline fee and VAT exemption on electric cars give the population incentives for a transition from fossil fueled cars to electric cars. This contributes to reduce the global demand of petroleum, and thereby reduces
CO_2 emissions. It also reduces the emissions of nitrogen oxide (NO_x) which has damaging effects on ecosystems and vegetation.

With the transition from non-renewable to renewable energy, tax measures can be a double-edged sword (a situation than can be both negative and positive). Even if the global effect is a reduction of CO_2 emissions, the local externalities such as loss of biological diversity, sound pollution, and visual pollution are negative. With taxation, the government has the means to change the market and steer the production of energy into the direction chosen by the government. In the future, and dependent of technological development, we might see the use

of tax measures to steer the market towards nuclear energy. A transition nuclear energy not only mitigates a lot of the externalities from petroleum and coal, but also mitigates many of the local and regional externalities from hydropower and wind power, but it has externalities of its own.

Even with the rapid development of sustainable technology and transition towards the use of electricity as an energy source during transport, it does not necessarily that electricity will be the main transportation fuel in the future. In his interview, SE mentions that future energy sources can be deep-sea produced biofuel to not suppress food production or sea areas on land, and that further development of deep-sea technology at subsea installations will be of importance in the extraction of seabed minerals. He also states that when it comes to ocean area, Norway is a superpower in European context and should have the ambitions to be an energy superpower in the future, and that is necessary to build the foundation based on the already existing infrastructure.

Based on findings from the interviews, tax measures that boost the transition from non-renewable energy to renewable energy reduces the global demand of petroleum. This is confirmed by DNV's Energy Transition Outlook (2018), forecasting the demand of petroleum to decrease by 50 % from 2020 to 2050. The reduction in demand of petroleum will cause a reduction in extraction of petroleum that increases the lifetime of the reservoirs.

The environmental effects of current tax measures are a reduction in emissions of CO_2 equivalents, reducing the global warming. This is necessary in order to reach the temperature target from the Paris agreement. The tax measures boost the development of renewable energy such as windfarms, causing an increase in local externalities such as visual pollution and sound pollution.

5.0 Conclusion

The subject of this thesis was to analyze the effects of taxation as a measure to improve the sustainability in the Norwegian energy sector. The four research questions elaborated the importance of tax measures and their financial, societal, and environmental effects. Relevant theory has been studied in the form of literature reviews and data has been collected in the form of information from interviews. This forms the following conclusion.

Taxation as a measure to improve the sustainability of the Norwegian energy sector is of high importance and has a notable effect on the economy, social equity, and the environment.

By using taxation as a measure to improve the sustainability of the Norwegian energy sector:

- the economic effects are a redistribution of capital from the businesses to the government, giving the government the opportunity to subsidize other environmental measures.

- the societal effects will vary in level based on people's financial situation and where they reside, whether they live in an urban or rural area. There are findings that substantiate that the financial wealth will be reduced short term, with health, wellness, and social equity to improve long term.

- the environmental effect is a gradual transition from non-renewable energy to renewable energy, causing a reduction in emissions of greenhouse gases.

The improvement of sustainability, not only in the Norwegian energy sector, but in the global society, is one of the key factors to mitigate damages to the climate and environment. If the use of taxation may be the most effective measure to achieve this, then the government, the businesses and society in general need to know the effects of these measures.

6.0 References

Ambec, S., Cohen, M. A., Elgie, S. & Lanoie, S., 2013. The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness?. *Review of Environmental Economics and Policy,* 7(1).

Anderson, T. R., Hawkins, E. & Jones, P. D., 2016. CO2, the greenhouse effect and global warming: from the pioneering work of Arrhenius and Callendar to today's Earth System Models. *Endeavour,* 40(3).

Aubert, V., 1972. *The hidden society.* Oslo: Universitetsforlaget.

Baum, W. K., 1977. *Transcribing and editing oral history.* Walnut Creek: Altamira Press.

Bildirici, M., 2015. The Relationship Between Hydropower Energy Consumption and.

Borge, L. E. et al., 2015. *NOU 2015:15 Norway's Public Investigations,* Oslo: Departementenes sikkerhets- og serviceorganisasjon Informasjonsforvaltning.

Botelho, A. et al., 2018. Assessment of the environmental impacts associated with hydropower.

Bruninx, K., Ovaere, M. & Delarue, E., 2019. *A First Analysis of the Market Stability Reserve in the European Emission Trading System,* New Haven: Yale University.

Bryman, A. & Bell, E., 2011. *Business Research Methods.* Oxford: Ofxford University Press.

Carpenter, A., 2018. *Oil pollution in the North Sea: the impact of governance measures on oil pollution over several decades,* Ostend: North Sea Open Science Conference.

Ciccone, A., 2018. Environmental effects of a vehicle tax reform: Empirical evidence from Norway. *Transport Policy,* Volume 69.

Coase, R. H., 1960. The problem of social costs. *Journal of Law and Economics.*

Corbin, J. & Strauss, A., 2008. *Basics of Qualitative Research. Techniques and Procedures for Developing Grounded Theory.* 3rd ed. Thousand Oaks: Sage.

Dalen, M., 2011. *Intervju som forskningsmetode - en kvalitativ tilnærming.* Oslo: Universitetsforlaget.

Dalland, O., 2007. *Methodology and assignment writing for students.* 4th ed. Oslo: Gyldendal.

David, M. & Sutton, C. D., 2004. *Social Research the Basics.* Thousand Oaks: Sage.

Dekhtyareva, A., 2019. *On local and long-range transported air pollution in Svalbard,* Tromsø: UiT Norges Arktiske Universitet.

DNV GL - Oil & Gas, 2018. *Energy Transition Outlook 2018 - Oil and Gas - Forecast to 2050,* Høvik: DNV GL.

Doney, S. D., Fabry, V. J., Feely, R. A. & Kleypas, J. A., 2009. Ocean Acidification: The Other CO2 Problem. *Annual Review of Marine Science,* Volume 1.

Egenhofer, C., Alessi, M., Georgiev, A. & Fujiwara, N., 2011. *The EU Emissions Trading System and Climate Policy Towards 2050: Real Incentives to Reduce Emissions and Drive Innovation?,* Brussel: Centre for European Policy Studies.

Elkington, J., 1998. *Cannibals with Forks: The Triple Bottom Line of 21st Century Business.* 2nd ed. Vancouver: New Society Publishers.

Ellerman, A. D., Convery, F. J. & Perthuis, C. D., 2010. *Pricing Carbon: The European Union Emissions Trading Scheme,* Cambridge: Cambridge Univesity Press.

Enge, S., 2020. *Interview with Sigurd Enge, Bellona* [Interview] 2020.

European Comission, 2018. *European Commission, Report on the functioning of the European carbon market,* Brussel: European Comission.

European Comission, 2020. *European Comission.* [Online]
Available at: https://ec.europa.eu/clima/policies/ets_en
[Accessed 14 05 2020].

Fernandes, N., 2020. *Economic Effects of Coronavirus Outbreak (COVID-19) on the World Economy,* Navarra: University of Navarra, IESE Business School; European Corporate Governance Institute (ECGI).

Fischer, C. & Newell, R. G., 2008. Environmental and technology policies for climate mitigation. *Journal of Environmental Economics and Management,* 55(2).

Fjose, S., Erraia, J. & Pedersen, S., 2019. *Bakgrunnsnotat om database over olje- og gassrelaterte inntekter i kommunene,* Oslo: Menon Economics.

Fowler, D., 1992. *Athmospheric Acidity - Sources, Consequenses and Abatement - Effects of acidic pollutants on terrestrial ecosystems.* London: Elsevier Science Publishers.

Galeotti, M., Salini, S. & Verdolini, E., 2020. Measuring environmental policy stringency: Approaches, validity, and impact on environmental innovation and energy efficiency. *Energy Policy,* Volume 136.

Gavenas, E. & Rosendahl, K. E., 2014. Hva påvirker CO2-utslippene på norsk sokkel?. *Samfunnsøkonomen,* Volume 8.

Hao, Y., Chen, H., Wei, Y. & Li, Y., 2018. The influence of climate change on CO2 (carbon dioxide) emissions: an empirical estimation based on Chinese provincial panel data. *Journal of Cleaner Production,* Volume 131.

Hassel, A. et al., 2004. Influence of seismic shooting on the lesser sandeel. *ICES Journal of Marine Science,* 61(7).

Hoepfl, M. C., 1997. Choosing Qualitative Research: A Primer for Technology Education Researchers. *Journal of Technology Education,* 9(1).
Hunter, P., 2007. The impact of CO2. The global rise in the levels of CO2 is good for trees, bad for grasses and terrible for corals. *Embo Reports,* 8(12).
IAEA, 2019. *World Thorium Occurrences, Deposits and Resources, IAEA-TECDOC-1877,* Vienna: IAEA.
International Renewable Energy Agency, 2017. *RENEWABLE ENERGY: A KEY CLIMATE SOLUTION,* Abu Dhabi: International Renewable Energy Agency.
Jiang, X. & Guan, D., 2017. The global CO2 emissions growth after international crisis and the role of international trade. *Energy Policy,* Volume 109.
Johannessen, A., Tufte, P. A. & Christoffersen, L., 2010. *Introduksjon til samfunnsvitenskapelig metode.* Oslo: Abstrakt Forlag.
Kjærland, F., 2009. *Norwegian hydropower - heirloom on cheap sale?,* Bodø: Econa.
Kløw, E., 2019. *Preferanser for havbasert vindkraft - En betinget verdsettingsstudie ,* Oslo: Universitetet i Oslo.
Krøvel, K. R., Kalstad, K. M. & Hemmingsen, J., 2019. *Investment analysis of land based wind power in Norway.,* Sogndal: Høgskulen på Vestlandet.
Lageaga, J. M. & Labendeira, X., 2020. *Economics of Environmental Taxes and Green Tax Reforms,* Vigo: Universidade de Vigo.
Liang, T., Sato, M., Grub, M. & Comberti, C., 2013. *Assessing the effectiveness of the EU Emissions Trading System,* London: Grantham Research Institute.
Lincoln, Y. S. & Guba, E. G., 1985. *Naturalistic Inquiry.* London: Sage.
Lovdata, 2015. *Norway's law about fees on emissions of CO2.* [Online]
Available at: https://lovdata.no/dokument/NL/lov/1990-12-21-72
[Accessed 19 05 2020].
Mathers, A. et al., 2017. *Svalbard Clean Energy,* Uppsala: Uppsala Universitet.
Ministry of Climate and Environment, 2014. *Norway's sixth National Communication under the Framework Convention on Climate Change,* Oslo: Norwegian Ministry of Climate and Environment.
Ministry of Oil and Energy, 2020. *Power production.* [Online]
Available at: https://energifaktanorge.no/norsk-energiforsyning/kraftforsyningen/
[Accessed 18 05 2020].

Motvind, 2020. *Motvind Norge.* [Online]
Available at: https://motvind.org/om/historikk/
[Accessed 15 05 2020].
Mussa, M., Teka, H. & Hussein, A., 2018. Environmental Impacts of Hydropower and Alternative Mitigation Measures.
Muuls, M., Colmer, J., Martin, R. & Wagner, U. J., 2016. *Evaluating the EU Emissions Trading System: Take it or leave it? An assessment of the data after ten years,* London: Imperial College.
National Budget, 2019. *Meld. St. 1 (2019–2020),* Oslo: Norwegian government.
Naturvernforbundet, 2020. [Online]
Available at: https://naturvernforbundet.no/vindkraft/
[Accessed 22 05 2020].
NOROG, 2018. *MILJØRAPPORT,* Stavanger: The Norwegian Oil and Gas Association.
Norwegian Goverment, 2020. *CO2-tax.* [Online]
Available at: https://www.regjeringen.no/no/tema/okonomi-og-budsjett/skatter-og-avgifter/veibruksavgift-pa-drivstoff/co2-avgiften/id2603484/
[Accessed 19 05 2020].
NTB, 2019. *E24.* [Online]
Available at: https://e24.no/naeringsliv/i/naB2Md/gruveselskap-skal-utvinne-kull-i-20-nye-aar-paa-svalbard
[Accessed 25 05 2020].
NVE, 2019. *Forslag til nasjonal ramme for vindkraft,* Oslo: Norges vassdrags- og energidirektorat.
NVE, 2019. *Norwegian Water Resources and Energy Directorate, National Declaration 2018,* Oslo: Norwegian Water Resources and Energy Directorate.
NVE, 2020. *The Norwegian Water Resources and Energy Directorate, Solar Power.* [Online]
Available at: https://www.nve.no/energiforsyning/kraftproduksjon/solkraft/
[Accessed 29 05 2020].
OED, 2020. *Norwegian Petroleum.* [Online]
Available at: https://www.norskpetroleum.no/en/economy/governments-revenues/
[Accessed 25 05 2020].
Oslo Børs, 2020. *Oslo Børs, Brent Oil 2019.05.22-2020.05.22.* [Online]
Available at:
https://www.oslobors.no/markedsaktivitet/#/details/C:PBROUSDBR%5CSP.IDCENE/overvi

ew
[Accessed 22 05 2020].
Payne, G. & Williams, M., 2005. Generalization in Qualitative Research. *Sociology,* 39(2).
Piecyk, M., McKinnon, A. & Allen, J., 2015. *Green Logistics, Chapter IV, Arguments for and against the internalization of environmental costs.* 3rd ed. London: Kogan Page.
Pigou, A., 1920. *The Economics of Welfare, Part II, Chapter IX. Divergences between marginal social net product and marginal private net product.* 1st ed. London: Palgrave Macmillan.
Prop. 113 L, 2020. *Prop. 113 L, proposition to the parliament, proposed legislative resolution, temporary amendments to the petroleum tax act,* Oslo: Ministry of Finance.
Randers, J., 2019. Green growth in Norway towards 2050. *Magma,* Volume 05.
Revised National Budget, 2020. *Meld. St. 2 (2019–2020),* Oslo: Norwegian Government.
Rowley, J. & Sack, F., 2004. Conducting a Literature Review. *Management Research News,* 27(6).
Sandbag, 2011. *The Environmental Outlook for the EU ETS, 3rd annual report,* Brussel: Sandbag.
Schmidtchen, D. et al., 2007. *The Internalisation of External Costs in Transport: From the polluter pays to the cheapest cost avoider principle,* Saarland: Saarland University.
Scoma, A., Yakimov, M. M., Daffonchio, D. & Boon, N., 2017. Self-healing capacity of deep-sea ecosystems affected by petroleum hydrocarbons. *Embo reports,* 18(6).
Shafiei, S. & Salim, R. A., 2014. Non-renewable and renewable energy consumption and CO2 emissions in OECD countries: A comparative analysis. *Energy Policy,* Volume 66.
SNL, 2018. *Non-renewable energy sources.* [Online]
Available at: https://snl.no/ikke-fornybare_energikilder
[Accessed 25 05 2020].
SNL, 2019. *Nuclear Power in Norway.* [Online]
Available at: https://snl.no/kjernekraft_i_Norge
[Accessed 27 05 2020].
SNL, 2019. *Renewable energy sources.* [Online]
Available at: https://snl.no/fornybare_energikilder
[Accessed 25 05 2020].
SSB, 2019. *Statistics Norway, Emissions to Air.* [Online]
Available at: https://www.ssb.no/en/natur-og-miljo/statistikker/klimagassn
[Accessed 27 05 2020].

SSB, 2020. *Statistics Norway, Electricity Balance, Monthly, GWh.* [Online]
Available at: https://www.ssb.no/energi-og-industri/statistikker/elektrisitet
[Accessed 15 05 2020].
Stavanger Aftenblad, 2020. *Stavanger Aftenblad.* [Online]
Available at: https://www.aftenbladet.no/aenergi/i/Wb5mJQ/olje-og-leverandrindustrien-ber-om-krisepakke-til-flere-titalls-mill
[Accessed 05 22 2020].
Stemland, H. M., Johansen, T. A., Ruud, B. O. & Aniceto, A. S., 2019. Measured sound levels in ice-covered shallow water caused by seismic shooting on top of and below floating ice, reviewed for possible impacts on true seals. *First Break,* 37(1).
Sundtoft, T., 2015. *New emission commitment for 2030 - a joint solution with the EU.* [Online]
Available at: https://www.regjeringen.no/no/aktuelt/ny-utslippsforpliktelse-for-2030/id2397859/
[Accessed 19 05 2020].
Teddlie, C. B. & Tashakkori, A., 2008. *Foundation of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behaviour Sciences.* Thousand Oaks: Sage.
Teigen, E., 2019. *Nettavisen.* [Online]
Available at: https://www.nettavisen.no/okonomi/norsk-kullkraft-slipper-ut-like-mye-som-100000-biler--det-er-pinlig-for-norge/3423896696.html
[Accessed 25 05 2020].
Thagaard, T., 2009. *Systematikk og innlevelse: en innføring i kvalitativ metode.* Bergen: Fagbokforlaget.
Thorium Commission, 2008. *Thorium as an Energy Source - Opportunities for Norway,* Oslo: Thorium Commission.
Vestre Sem, I., 2017. *Holdninger til Grønn skattekommisjons foreslåtte klima- og miljøavgifter,* Ås: Norwegian University of Life Sciences.
von Mollendorff, C. & Welsch, H., 2015. *Measuring Renewable Energy Externalities: Evidence from Subjective Well-Being Data,* Berlin: The German Socio-Economic Panel Study.
Wang, T., 2019. *Global electricity generation by energy source 2017,* -: Statista.
Weitzman, M., 1974. Prices vs. Quantities. *Review of Economic Studies,* 41(4).

Wettestad, J., 2014. Rescuing EU Emission Trading: Mission Impossible? Global Environmental Politics. *Global Environmental Politics*, 14(2).

Williams, R. C., 2016. *Environmental Taxation*, Cambridge: National Bureau of Economic Research.

Wyns, T., 2012. *The EU allowance surplus problem in Europe's Emissions trading system,* Brussel: Vrije Universiteit.

Yin, R. K., 1994. Discovering the Future of the Case Study. Method in Evaluation Research. *American Journal of Evaluation*, 15(3).

Zerrahn, A., 2017. Wind Power and Externalitie.