Norwegian University
of Life Sciences

**Master's Thesis 2020 60 ECTS**
Faculty of Environmental Science and Natural Resource managment
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# Is Carbon Offsetting the Right Environmental Policy Choice for Norway?

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## Abstract

The Carbon Credit Procurement Program (CCPP) was launched by the Norwegian government in 2007 in order to ensure that it meets its emissions commitments under the Kyoto Protocol. The CCPP is part of the most extensive reduction-credit system in Europe, the Clean Development Mechanism (CDM), which guarantees certified emission reductions (CERs), thanks to investments in developing and least developed countries (LDCs). This thesis will address a central question: Is carbon offsetting the right environmental policy choice for Norway? The topic is treated in an interdisciplinary way: focusing on ethical, legal, and economic perspectives, since each of these aspects is deeply interconnected with environmentally sustainable growth. The research questions are addressed by using a mixed-methods approach, combining forecasting techniques with stakeholder interviews. The results indicated that the current Norwegian green policy is, first, highly unlikely to reach the emission reductions targets for 2030 and 2050. Second, the results made it clear that the limitations of carbon offsetting are, to a large extent, linked to the impossibility of carrying out measures in line with ethical considerations such as fairness, distributional and ethical justice, especially with regard to the southern countries. Altogether, it can be concluded that, despite the genuine attempt, on the part of Norway to contribute to global reductions emissions, through the CCPP, an increased cost-effectiveness should be meet through an environmental policy, where the needs of the developed and LDCs countries are at the center of the Norwegian political decisions, in line with the ethical principles on which political negotiations have been based since the Paris Agreement.

Key words: CCPP, offsetting, interdisciplinary study, cost-effectiveness, GHG.

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## Acronyms

| | |
|---|---|
| AAUs | Assigned Amount Units |
| AIC | Akaike Information Criterion |
| AIMs | Integrated Assessment Models |
| CCPP | Carbon Credit Procurement Program |
| CCS | Carbon Capture and Storage |
| CDM | Clean Development Mechanism |
| CER | Certificated Emissions Reduction |
| $CH_4$ | Methane |
| CMP | Conference of the Parties serving the Meeting of the Parties to the Kyoto Protocol |
| CO | Carbon Monoxide |
| $CO_2$ | Carbn Dioxide |
| CPLC | Carbon Pricing Leadership Coalition |
| DNA | Designed National Authority |
| EEA | European Economic Area |
| E-NDC | Enhanced Ambition Scenario simulated by the GCAM |
| ERPA | Emissions Reduction Purchase Agreement |
| ESR | Effort Sharing Regulation |
| ET | Emission Trading |
| EU | European Union |
| EU ETS | European Union Emissions Trading Scheme |
| EUE | Ecologically Unequal Exchange |
| EY | Ernst and Young |
| GCAM | Global Change Assessment Model |
| GCF | Green Climate Fund |
| GDR | Greenhouse Development Rights |
| GHG | Greenhouse Gas |
| GWP | Global Warming Potential |
| HCFC-22 | Difluorochloromethane |
| HFC | Hydrofluorocarbon |
| HFC-23 | Trifluoromethane |

| | |
|---|---|
| HFCs | Hydrofluorocarbons |
| HLEG | High Level Expert Group |
| IEA | International Energy Agency |
| IPCC | Intergovernmental Panel on Climate Change |
| ITMO | Internationally Transferred Mitigation Outcome |
| KL2 | Second Period of the Kyoto Protocol |
| KLK | Climate Adaptation and Local Climate Measures |
| LDC | Least Development Countries |
| LDF | LandFill Gas |
| LULUCF | Land use Land-Use Change and Forestry |
| MSR | Market Stability Reserve |
| MSW | Municipal Solid Waste |
| $MtCO_{2eq}$ | Metric Tonnes of Carbon Dioxide |
| $N_2O$ | Nitrous Oxide |
| NDC | Nationally Determined Contribution |
| NEFCO | Nordic Environment Finance Corporation |
| NENT | National Research Ethical Committee for Natural Science and Technology |
| NGO | Non Government Organization |
| NIBIO | The Norwegian Institute of Bio-economy Research |
| NICFI | International Climate and Forest Initiative |
| NIER | The National Institute of Economic Research |
| NIR | National Inventory Report |
| NMVOC | Non-Methane Volatile Organic Compound |
| NorCap | Norwegian Carbon Procurement Facility |
| NOx | Nitrogen Oxides |
| NPD | Norwegian Petroleum Data |
| NPD | Norwegian Petroleum Directorate |
| OECD | Organization for Economic Co-operation and Development |
| PDD | Project Design Document |
| PFCs | Perfluorocarbons |
| QA | Quality Assurance |

| | |
|---|---|
| QC | Quality Control |
| RD&D | Research, Development and Demonstration |
| SD | Sustainable Development |
| $SF_6$ | Sulphur Hexafluoride |
| $Sm^3$ | Standard Cubic Meters |
| $SO_2$ | Sulfur Dioxide |
| SSB | Statistics Norway |
| TEEB | Economics of Ecosystems and Biodiversity |
| UNEP | United Nations Environment Program |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WCED | World Commission on Environment and Development |

# Introduction

"The stock of natural capital is currently at risk, as it is deteriorating beyond its rate of renewal, not least due to policies that do not value it sufficiently" (European Commission, 2018, p.88). This is just one of several statements one can read in the second part of the "Final Report 2018, Financing a Sustainable European Economy" prepared by the High-Level Expert Group (HLEG) of the European Commission in 2018.

According to the "Natural Capital Risk – Top 100 Externalities of Business study", reducing GHG emissions plays a vital role in halting the exploitation process of natural capital. This is because 38% of environmental externality costs come from greenhouse gas emissions, causing climate change (Trucost PLC, 2013, p. 30).

During the last three decades, international law has attached special attention to the problem of climate change starting from the Kyoto Protocol in 1997 (UNFCCC, 1997), and since then it has been asked that countries must limit and reduce their greenhouse gas emissions. Aiming to provide and persuade States to undertake significant GHG reductions, the protocol included the following three market-based mechanisms as useful measures: the emissions trading, the clean development mechanism (CDM) and the Joint Implementation (JI). In the specific case of Norway, the government set up a separate program, the CCPP, within the CDM mechanisms, to ensure that its emission commitments meet the requirements of the Kyoto protocol.

It is uncertain whether Norway`s program fulfils the objectives specified in the international agreements from the point of view of a sustainable growth. Indeed, this is a difficult question to answer because there are ethical, legal, and economic aspects to it that have to be taken into account, and they are both of an empirical and a qualitative nature.

This thesis aims to achieve a broader understanding of the links that exist between the dimensions tightly intertwined with the environmental aspect of CERs offsetting through the CCPP and CDM mechanisms in general, and then to assess whether carbon offsetting is the right choice for Norway.

**Objectives**

The problem statement of my thesis is to determine whether carbon offsetting is the right choice for Norway in the long term from an environmental point of view. I see my topic as a puzzle that requires a more coherent understanding of the data provided and, at the same time, I believe that there is a need to generate a clear picture around the problem statement, taking into account different perspectives, such as the ethical, legal and economic ones.

There are three pillars at the center of my research. They serve the following purpose:

1. To gain a clear understanding of the expectations that Norway should meet in order to satisfy the legislative requirements of the European Union climate policy on the reduction of GHG emissions, as well as the measures that Norway has carried-out at a national and international level.
2. To evaluate carbon offsetting as a climate policy instrument as well as the importance of the cost-efficiency concept in alternative policy instruments.
3. To examine the link between the political and economic response to climate change from an ethical perspective.

Furthermore, I will show, with the help of two different studies, my own work on GHG emissions forecasts, the mitigation effects achievable through current carbon offsetting programs, as well as present an environmental assessment using a qualitative analysis that evaluates whether carbon offsetting is the right choice from an ethical point of view for Norway.

**Overview**

The interdisciplinary approach used in the writing of my research has three different aspects. The legislative, economic, and ethical aspects are closely interconnected with the environmentally sustainable growth meant as emission reductions.

The research takes place in Oslo, Norway.

The first part of the thesis provides the background to the problem through a review of three different dimensions of the climate change mitigation. First, I will present an overview of the legislative framework for climate policies through a review of the international and national agreements Norway has committed itself in the attempt to improve its green policy. I will also take a good look at the local agreements to highlight the role that the regions, municipal

infrastructures, and utilities play in this respect when planning in an ongoing climate change phenomenon. Information from two representatives of the public Norwegian sector obtained via e-mail, will be used for the purpose of this part.

Second, from an economic perspective, I will present carbon offsetting as a climate policy instrument, a review of alternative policy instruments, and the concept of energy efficiency in relation to international climate targets as well as Norway`s goals and National Domestic Contributions (NDCs).

Third, from an ethical point of view, I will present the ethical base of carbon offsetting of CERs and the principles linked to it. This section concludes with a brief evaluation of how the Norwegian approach to the climate change is seen from the South there most of the carbon credit projects are carried out.

The second part of the thesis contains two analytical studies. The first one is a meta-analysis study, which aims to provide forecasts for GHG emissions and quotas. The adaptation of GHG emissions forecasts for the elaborated quotas have been made in order to verify if the NDC of 50% mitigation effects expected for 2030 and carbon neutrality for 2050 are achievable with the current Norwegian carbon offsetting policy. An explanation of the methods adopted, the results obtained, and a discussion will follow. Mitigation effects achievable through current carbon offsetting program will be presented, as well.

The second study is a qualitative assessment, which evaluates whether carbon offsetting is the right choice from an ethical-environmental perspective. This part has been done through one-on-one interviews and an analysis of the answers provided. The six interviews have been conducted face-to-face whenever possible or, due to Corona, using digital platforms. To ensure transparency and balance during my research, I have interviewed stakeholders with different backgrounds within fields related to the use of flexible mechanisms under the EU ETS legislation, and academics as well.

In conclusion, I will present the key research findings and make eventual recommendations.

## Legislative Frameworks for Climate Policies

### Background: Emission Reduction and Carbon Offsetting in Norway

In this section, an overview of the emission reduction system in Europe is given and the link between the CCPP and the Clean Developed Mechanisms is explained.

The carbon market is a trade system that provides flexibility on how emissions are reduced. The EU ETS (European Union Emissions Trading System) is the largest carbon market in the world where over three-quarters of international emission trading are accounted by it. The paramount advantage of the system is financial (Watson, 2013a p. 2). In fact, the linkage between systems cuts the costs of reducing emissions (Jaffe et al. 2009, cited in Watson, 2013b p.2).

Cap-and-trade systems and reduction-credit systems are the structures that constitute the emission trading and that could be used interchangeably in the EU ETS.

The cap-and-trade systems define the volume of emissions under the cap. Portions of emissions or allowances are distributed by auction or the free government allocation to companies (UNFCCC, 1997). The assigned amount is called AAUs "Assigned Amount Units," which are sold and bought between Annex parties, namely, industrialized countries and countries with economies in transition. Emission allowances are called "Kyoto Units". Each one of them is represented as the Metric Tons of Carbon Dioxide equivalent ($MtCO_{2eq}$), a measurement that compares the warming effect of different GHG on the atmosphere. One $MtCO_{2eq}$ represents an AAU. Companies deliver to their respective government allowances based on their volume of emissions whereas the government takes them in consideration, keeping in mind, the reduction targets. The price of allowances increases if demand falls; in fact, reducing the cap leads consequently to a decrease of the quantity of available allowances.

On the other hand, the reduction-credit systems produce allowances as an exchange for carbon reductions or sequestrations (Flachsland et al., 2010, p. 1637-1647). The principle of additionality gives the basic structure to the systems. The reductions in these systems must be additional to the baseline of the emissions that would occur even if a particular activity were present. "Additionality is required to guarantee the environmental integrity of the project-based offset mechanisms, but difficult to establish in practice due to the counterfactual nature of the baseline" (Allwood et al., 2014, p. 1251). The allowances produced, in addition to the baseline, are assigned and sold in cap-and-trade systems, or to various companies to offset their emissions.

The largest reduction-credit system is the Clean Development Mechanism (CDM), which guarantees Certified Emissions Reductions (CERs) thanks to investments in non-Annex countries, namely, developing countries and least developed countries (LDCs). The Convention (United Nation Framework Convention of Climate Change, UNFCCC) recognizes those countries that are more vulnerable to climate changes due to desertification and drought or due to the economic impact that climate change could cause. Investments, insurances, and technology transfers are the means through which Annex Parties, help non-Annex countries and LDCs countries by using flexible mechanisms such as the CDM.

The governance of these measures is under the United Nation Framework Convention on Climate Change Secretariat, which holds a tight collaboration between States to combat climate change through actions. The Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CPM) is the rule making body for the CDM; it evaluates the suggestions of the Clean Development Mechanism Executive Board (CDM EB) (UNFCCC, 2006). The CDM EB is the meeting point between CDM project participants and the delivery of CERs. It is supported by the methodologies panel, accreditation panel, registration and issuance team, afforestation and re-forestation working group, and carbon dioxide capture, as well as, storage working group.

The global view about cutting GHGs is that, it does not really matter if emissions get reduced within Norway or in any other country, since, it is the comprehensive reduction in global emissions that counts. Not all projects are acceptable. Ineligible projects are considered the ones that produce trifluoromethane (HFC-23), as a by-product of difluorochloromethane (HCFC-22) those that reduce nitrous oxide ($N_2O$) from hexanedioic acid (adipic acid) used for producing nylon 6-6 and manufacturing other polymers, such as, polyurethanes. Finally, ineligible projects are also those projects that produce energy based on coal without carbon capture and storage (Norwegian Ministry of Climate and Environment, p. 2-3).

During the time span 2013-2020 (known as the second commitment period of the Kyoto Protocol, KP2), Norway has supported both vulnerable and new projects in order to encourage emission reduction activities with 60 million CERs through the CDM and the CCPP. Low interest in the market for CERs has produced flat prices and an exuberance of stock (Norwegian Ministry of Climate and Environment, 2018a, p. 160). As a result, there has been a decrease in the issue of credits and a lower number of projects. Therefore, the only projects that Norway would bring in are those at risk of closing their activities and new, not instruct, projects. At

present, (2013-2020), under the Kyoto procurement program, Norway does not accept any new proposals.

According to Norway's Seventh National Communication 2018, the projects for KP2 compliance under the CCPP are 62 in 25 different countries (Norwegian Ministry of Climate and Environment, 2018b, p. 79). Most of the small-scale programs, such as, cook stoves and water cleansing are to be found in Africa, whereas methane elimination from landfill gas (LDG) projects, which make up the base for more than half of the KP2 portfolio, are to be found in Latin America, especially in Brazil. One example is the Project UN 0171 in the San Paulo area, Caieiras, where the landfill was used for anaerobic decomposition of municipal solid waste (MSW). This project was a landfill gas-emission-reduction project that is now supposed to convey more than 6 million CERs to Norway. In this case, Norway helped by changing the project from a flaring one to a project generating electricity from 21 generators with a total installed capacity of 29.4 MW.

Pictures of this project, Nr. UN 0171, can be seen below.

**Picture 1:** Caieiras landfill gas-emission-reduction project (Sao Paulo area).

Every single and each on project goes ıough a transparent process described in the Crediting Period Renewal Request document (Table A.1, UNFCCC, 2013). Each year, the projects are monitored; besides, the CDM project activity reports describe, in detail, the strength of project activities, characterization of control systems, data and parameters, computation of emission reductions, calculation of project emissions, and comparison of emission reductions UNFCCC, 2010).

**International Legislation**

In this section, an overview of the international legislation, which functions as a basis for the Norwegian national climate policy, will be given.

The United Nations Framework Convention on Climate Change (UNFCCC) has a large universal membership. It counts 197 countries that make up the Parties to the Convention. It entered into force in 1994 with the aim of preventing "dangerous human interference with the climate system" (UNFCCC, 1992).

Despite the scientific uncertainty about climate change that still existed at that time, the role of the UNFCCC was crucial to promoting science and policy interactions after having recognized that climate change was a real problem **(**UNFCCC, Science in the Negotiations**).**

In fact, art. 3 of the UNFCCC states clearly that "the Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects…dealing with climate change should be cost-effective to ensure global benefits at the lowest possible cost". In 1997, the Parties to UNFCCC signed a protocol under the Convention, known as the Kyoto Protocol. It set up a carbon credit market with the aim of reducing carbon emissions worldwide. In 2001, the Marrakesh Accords defined the way the system would work (UNFCCC, 2001 COP7, part 1, j). The Kyoto protocol entered into force in 2005. It urged the Parties to commit themselves to reducing gas emissions internationally and to reaching their targets. The principle of commons but differentiated responsibilities is at the center of this legal document, which points to the responsibility that developed nations have in terms of GHG emissions level released in the atmosphere. In 2012, the Doha Amendment started the second commitment period of the Protocol, 2013-2020, and new emission reductions targets were set. In 2016, a few years before the end of the second commitment period of the Kyoto Protocol, almost 150 countries, Norway included, ratified the Paris Agreement, which took effect in November 2016. The Paris Agreement charts new efforts, concrete lines, and perspectives in the achievement of important goals such as:

1. Limiting the global temperature increase to well below two degrees Celsius (art. 2).
2. Achieving the peak of GHGs, and so, reaching a climate neutrality between sources and sinks.
3. Establishing mitigation measures that consist of nationally determined contributions (NDC), which strive to achieve ambitious results progressively (art. 4).

4. Getting the Parties to cooperate voluntarily in order to contribute to the sustainable development of both market and non-market-based approaches (art. 6).
5. Enforcing National adaptation Plans and reducing the vulnerability that every country faces with climate change (art. 7).
6. Cooperating in case of loss and damage caused by the effects of climate change (art. 8).
7. "Reaffirming the obligation of developed countries to support the efforts of developing countries to build clean, climate-resilient futures" by using simultaneously other means. (The Green Climate Fund, GCF Art. 9, 10, and 11).
8. Assessing global stocks so that the Parties to the Convention can be updated and enable themselves to make extra efforts to enhance their projects and, eventually, improve their actions every 5 years as of 2023 (Art. 14)
9. The Paris Agreement represents a turning point in the history of climate policy by setting as a goal the limitation of the global temperature rise to well below two degrees Celsius. In order to reach the Paris climate goals, States should reach the global net anthropogenic $CO_2$ emissions decline by nearly 45 per cent, get to the 2010 levels by 2030, and secure net zero emissions around 2050 **(**EU, 2009 Vol. 1, p.6).

The road to an even more environmentally aware world, climate change issues and active green policies continued in Kigali with the Montreal Protocol in 2016, which entered into force in January 2019, and tied Norway to cutting down hydrofluorocarbons (HFCs) (European Union, 2016).

The UNFCCC, the Kyoto Protocol and the Paris Agreement make up the international legal regime for addressing climate change.

**Implementation of international commitments in Norway**

This section will describe the way in which the Norwegian government has fulfilled its international commitments to date.

Since the late 1980s, climate change and GHGs have been on the agenda of the Norwegian climate policy. The scientific reports from the Intergovernmental Panel on Climate Change (IPCC) on greenhouse effects constitute the basis of the green policies of entire Europe. The data that have been provided, so far, show that Norway fulfilled and went beyond its

commitments for the period 2008-2012 under the Kyoto Protocol by about 13 per cent. In addition, with the Doha amendment of 12 June 2014, Norway enforced its commitments for the period 2013-2020 (Norwegian Ministry of Climate and Environment, 2018, p. 8).

The Prime Minister of Norway, Kjell Magne Bondevik, emphasized the crucial importance of sustainable development on the political agenda of the government through the action plan proposed in 2004. Some key principles were tied to sustainable development through both political processes and economic policy documents. The most notable of these principles are the principle of leadership responsibility, the precautionary principle, the ecosystem approach, the polluter-pays principle, and the common but differentiated responsibilities (Prime Minister of Norway, 2004a p. 19-21). The 2004 action plan document, proposed by Kjell Magne Bondevik, may be considered a milestone document of great importance. Its purpose is to "improve the general level of knowledge in Norway about important global and national development trends with a bearing on sustainable development" (Prime Minister of Norway, 2004b p. 4).

In order to fulfil its obligations linked to the Kyoto Protocol and the Paris Agreement with regard to climate change, the Norwegian government took on the task of succeeding in reducing the greenhouse gas emissions by the equivalent of 30 % of the1990 emissions by 2020. It also undertook the task of abiding by and enlarging its commitment by 20% by 2030. In fact, they were regarded as overachieving objectives (last updated to total 50% in February 2020).

In relation to those targets, certain factors make it difficult to secure predictable figures, especially when trying to have an accurate estimate of the greenhouse-gas-emission reductions in the coming years. For instance, the trend in carbon prices, technological advances and, in Norway's case, the developments of the Norwegian continental shelf are of great importance for the emissions level related to the petroleum sector.

Pursuing a more earnest international climate agreement, helping developing countries and growing economies such as China and India to lower their emissions, as well as reinforcing the efforts to reduce emissions within the country`s national borders is the main three-pronged action plan devised by the Norwegian government. Among some of the documents that underline this political line are: Report nr.13 to the Norwegian Parliament, 2008-2009, on "Climate Conflict and Capital-Norwegian Development Policy Adapting to Change,"(Norwegian Ministry of Foreign Affairs, 2008); the Climate Cure 2020, which makes an assessment based on a sector-by-sector analysis of the emission reduction procedures, and, at the same time, sets forth the tools that could be used for the achievement of the 2020 goals,

(Norwegian Ministry of Climate and Environment, 2010, p.12-18), and the Meld. St. 21 2011-2012 on the Norwegian climate policy. In this last document, one can read about the national strategy for lower emissions:

"The government aims to increase the use of power from land. This requires, at the same time, that development of enough new power be ensured or that a sufficient new network be carried out so that regional imbalances do not occur at the time of development. At the same time, the diversity of nature and the consideration for the cost of measures must be safeguarded" Norwegian Ministry of Climate and Environment (2006-2007).

In June 2017, a new act was adopted by the Parliament: The Climate Change Act. This document introduced an annual reporting mechanism with a recommended budget on GHG emissions and the projections of both emissions and removals. Moreover, it conveyed measures on how Norway equips itself for and adjusts to climate change, keeping in mind Norway`s climate target:

1. Reduction of emissions by 30 % by 2020
2. Reduction of emissions by at least 50 % by 2030 (updated to 50% in February 2020)
3. Low-emission society by 2050 (80-95 percent of emission reduction)

To date, as part of a cost-effective policy aimed to limit emissions in Norway, domestic emissions are subject to mandatory emissions trading or a tax on greenhouse gases, or both (Commission of the European Communities, 2009).

**Local agreements**

This section presents an overview of the response to national requests on the issue of emission reductions provided by the local authorities.

Municipalities and counties, under the guidance of the Environment Directorate, have the responsibility, by law, to plan both measures for cutting emissions and climate adaptation. To make all the projects, run by municipalities and regions, operational and to ensure that they work out well, the Norwegian Environmental Agency established the Climate Rate, known as Klimasats, in 2016 (Environmental Agency, 2016).

Up to now (2020), the Environment Directorate has received 587 applications from various municipalities asking for Climate Rate support. In total, the municipalities have applied

for more than NOK 723 million (Norway today, 2020). The economical effort, directed at boosting climate-friendly projects in public procurements, is regulated by the Planning and Building Act, which "promotes sustainable development in the best interests of individuals, society and future generations…facilitates the coordination of central government, regional and municipal functions and provides a basis for administrative decisions regarding the use and conservation of resources" (Ministry of Local Government and Modernization, 2008, p. 1).

It might be of interest to note that emissions produced by residents and local businesses can be reduced through the municipal planning work, especially through community developer-drivers, population and industry, as well as by providing a focus on transport, waste and land-use. Municipal and regional administrations can count on the Climate Adaptation and Local Climate Measures, which guide them through climate and energy planning as well as the financial aid schemes provided by the Climate Rate. Moreover, Climate Rate promotes the use of climate-friendly materials in construction, the reduction of food waste, as well as emission free construction sites. It also promotes the reduction of methane emissions from former landfills and the increase in the number of chargers for electric vehicles (Environment Agency, 2020).

The emission reduction projects that municipalities propose are supervised by the Norwegian Environment Agency. The NEA supports urban planning such as planning that helps to reduce the need for transport. It also helps to establish networks consisting of, at least, a cluster of four municipalities for learning and sharing experiences on emission reductions.

Results and experiences related to climate scheme aid from municipalities have been subject to control by Menon Economics that performed a three-year follow-up evaluation of the scheme on behalf of the Environment Agency. In the last report that applied to 2016-2018 emissions, Menon Economics declares that "the Environment Agency priorities are well in line with the objectives of contributing to reducing greenhouse gas emissions in the short and long term" (Menon Economics, 2019a, p. 4).

At the same time, the report showed that, due to differences in the way projects are reported, there was room for error and miscalculation in the way things were predicted. During the period 2016-2018, Climate Rate supported 582 projects with a total of about NOK 400 million within five different categories. The list below shows the five categories:

1. Climate-friendly land and transport planning (Area and transport planning).
2. Climate-friendly transport - implementation of measures (Transport measures).

3. Greenhouse gas reduction measures in other sectors - implementation (Measures in other sectors).
4. Pre-project for greenhouse gas reduction measures - come from words to action (Pre-projects).
5. Inter-municipal networks for competence-raising and sharing of experience (Network).

Figure 1 shows the distribution of granted amounts within the five application categories (adapted from Menon Economics, 2019b p.10).

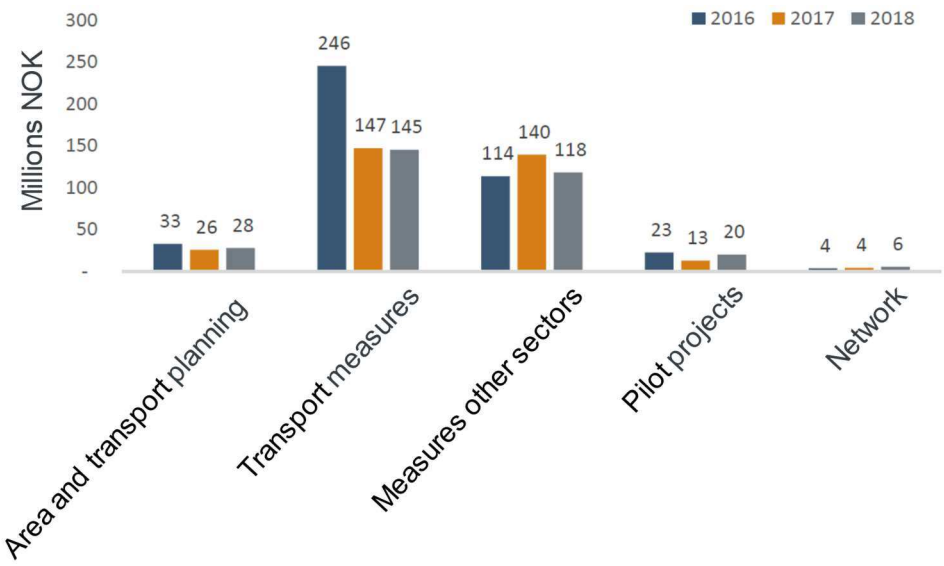


**Figure 1:** Distribution of granted amounts within the five application categories.

As mentioned above, one indicator that has been used in the assessments made is the reduction of emissions based on the final report. That report had gathered data from the municipalities. Unfortunately, it turned out not to be exhaustive. The problem had to do with the differences in the way the projects were reported, and there were doubts as to whether the Environmental Agency's calculator had been used correctly. That is why, in the Menon Economics' opinion, there was usually great uncertainty in the figures.

Other shortcomings pointed out in the report are:

1. Lack of capacity and expertise on the part of municipality.

2. Little or no obligations beyond establishing a climate and energy plan, which points to the absence of obligations and incentives to initiate and implement climate action from municipalities.
3. Lack of willingness to implement climate measures in governing bodies, such as municipal councils and/or administrative management.
4. Poor organization and poor communication across sectoral areas of the municipal organization.

Moreover, Pedersen and Bruvoll also confirmed that a lack of political will and financial considerations was an important reason behind the absence of specifications of climate plans (Pedersen and Bruvoll, 2014 cited in Menon Economic, 2019, p. 26).

In addition, it is not possible to translate the contribution that the Climate Rate makes into tonnes of GHGs emission reductions, as the reductions will be the sum of:

1. Direct emission cut using new technologies.
2. Indirect emission cuts using more technologies because of the support from Climate Rate contributing to the introduction of new technologies into the market.
3. Increased information and network dissemination.
4. Emission cuts ahead in time because of the part of the measures aimed at conversion to the low-emission community.

On the other hand, it seems clear that the grants are contributing to reduced emissions, especially in the transport sector, and that the spreading effect on other municipalities and county municipalities is working to a great extent. That means that other parts of the country can learn from the positive and negative experiences of these projects. Therefore, the dissemination of knowledge plays an important role in that the effect will be greater than the one linked to the direct allocations in the Climate Rate.

Finally, economists recommend that climate taxes or quota systems should be used as instruments for reducing greenhouse gas emissions. This is because the pricing of emissions is the cheapest way, overall, for society to reduce emissions. In Norway, we have received $CO_2$ taxes on an increasing number of emissions, and the fee is expanding. Most of the industries must buy permits to emit $CO_2$, which is another way of pricing emission. If emissions are properly priced, no other means should be used. On the other hand, if emissions were too high, the most effective measure would be increasing the $CO_2$ tax or tighten the emission quotas. In

the absence of cost-effective pricing of emissions, subsidies for emission reductions represented in the type of Climate Rate, are a second-best solution to achieving the emission targets.

GHGs that are not related to friendly green implementation measures are calculated according to the greenhouse gas statistics for municipalities based on the same principles as the national ones. Emissions of carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$) are calculated, but the fluorine gases (HFCs, PFCs and $SF_6$) are not included in the analysis (Environment Agency, 2020, p.4).

According to Thomas Seim, advisor to the Norwegian Environment Agency, section for emission accounting and measure analysis: "$CO_2$, $CH_4$ and $N_2O$ account for, approximately, 97% of the climate gases. The fluorine gases would probably influence the emissions differently in each municipality, but there is no information on where most of the gases are used, and thus, we would have to allocate the emissions to each municipality based on other pieces of information. If this should be done can be put up for discussion, but it will certainly not show the real emissions in most of the municipalities. This is one important thought behind the inventory – we want to reflect the reality in each municipality, and not just allocate national emissions based on population keys. There are also problems with placing the emissions from fluorine gases to the correct year, since companies can purchase large stocks that are meant to last several years."

Despite these uncertainties, he claimed that the emission inventory for municipalities is an effective tool in the hands of decision makers and people working on climate plans and climate budgets in the municipalities, and that it plays an important role in increasing the awareness among people of where the local GHG emissions come from.

However, he doesn`t deny that there is still a long way to go before the uncertainty is at the same level as the national inventory. Most emissions have a significant uncertainty when it comes to placing them in the correct municipality. By further developing the service, the emission estimates will be more certain year by year, but there are no existing perfect emission data, and thus, there is no perfect emission inventory. In addition, the emission inventory for municipalities and the national inventory are not correlated except for the fact that it utilizes some of the same data sources. For emissions, which come from agriculture, waste, industry, heating and mobile combustion, the same data sources are used, and so they can be compared to the national emissions. The other sectors use other data sources to be able to place emissions in certain municipalities. The total of all emissions in the inventory will, therefore, they are not equal to the national inventory.

It must be pointed out that everything that has been said in the above-mentioned paragraphs applies to the emissions that take place within a municipality's borders. Other emissions, which take place outside of the national borders, are not included in the municipal figures, for example, shipping, offshore oil, and gas extraction.

**Preliminary conclusions**

The CCPP is a measure adopted by the Norwegian government in 2007 with the aim of meeting the obligations on emission reductions from the international community and promoting sustainable development in developing countries through the CDM. According to my research, the Norwegian climate policy is in line with the EU legislative expectations. Norway is working with the aim of reducing GHG emissions with respect to the NDCs targets both at a national and local level.

It is worth highlighting the efforts made at the local level where new approaches are in place, as well as the collaboration between municipalities to implement measures aimed at reducing the impact of the individual and, at the same time, making the latter increasingly more aware of their role in emission reductions.

One factor requiring particular attention is the impossibility of quantifying the contribution that the Climate Rate gives in tons of GHGs reduction.

## Carbon offsetting as a climate policy instrument

### Carbon offsetting and climate change mitigation

The importance of a risk assessment in the evaluation of the economics of climate change is the core of this section. The transitional risk, which Norway seems to be having, is the potential negative impact that may derive from the close bond the country has with the petroleum market.

The CCPP is part of the market-based instrument portfolio that Norway has used to mitigate environmental problems. Over the last years, both economists and politicians have become more and more open-minded towards market-oriented environmental policy instruments in their drive to face environmental problems with a different attitude, not just as externalities, which need corrective taxes or more effectiveness figures. A constantly greater awareness around this issue makes it necessary for the Norwegian economy to consider the risks of a climate in change, as "the Norwegian economy, environment and society are vulnerable to climate change" (Norwegian Ministry of Climate and Environment, 2018, p.170).

According to the report NOU 2018:17, important insights can be provided from an economic perspective when there is a better understanding of the goals to be reached in face of the challenges brought forth by climate change (Ministry of Finance, 2018a p.9). In fact, investments, both in private and public sectors, can be the result of good decisions made. Those decisions are usually based on the acquired knowledge related to climate risks. However, decisions may have repercussions on international partnerships since they involved sustainable management and sharing of technical development as it happens in the case of the CCPP.

A deeper understanding of both opportunities and threats that stay hidden behind climate change would lead to a softer changeover towards a low-emission society and, at the same time, would help mitigate Norway`s economic moves in the long-term. Climate change involves financial risks, too. Therefore, it is important to reflect on the economics of climate change.

Priorities like population growth, a strong economic prosperity, and the development of petroleum extraction have led to a boost to fossil fuel consumption in Norway since 1990 (Ministry of Finance, 2018b p. 31). Consequently, the evolution of the price of, and demand for oil and gas are important factors that have to be considered in a risk assessment (considering also the fact that a direct consequence of the increased use of fossil fuels has led to higher $CO_2$ emissions, at a time when other GHGs have decreased). Supplementary climate risk factors for the Norwegian economy are, for instance, measures that can have a negative impact on climate

change itself, such as, technology improvement measures. Caution should also be exercised in those cases when fossil fuels are converted into renewable energy, as they can cause instability in global markets. In fact, the interconnection between economy and climate is very strong and it becomes clear when talking about "physical risk" and "transition risk". The physical risk is shown like a consequence of the interaction between climate change and economic activities. In the long-term, it affects both society, climate policy and technology development which, in turn, allow for a transition risk (Bank of England, 2015 cited in Ministry of Finance, 2018c p. 58). This means that, in the short-term, the risk linked to climate policy and technological development during the transition period towards a low-emission society, will be high, too.

The Climate Risk Committee highlights the extent of the risk, which could be very different to what one may have predicted or expected. It all depends on the scale of the production, for instance, in the fossil-based energy or renewable energy sector. The important thing is that the transitional risk will interest everyone. Nevertheless, it seems that Norway has a huge potential to influence the international petroleum market.

The most important climate risk factors for the Norwegian economy are neatly summarized in table 1 (adapted from Ministry of Finance, 2018d, p. 64).

**Table 1:** Climate risk factors for the Norwegian economy.

| | **DIRECT EFFECT** | **INDIRECT EFFECT** |
|---|---|---|
| **Physical climate risk** | Higher costs for prevention, maintenance and repair, reduced heating needs, increased production in primary industries, increased power generation. | Increased level of conflict collapses in international cooperation and changed migration patterns. Changes in food and other prices due to the impact of global production. |
| **Transition risk** | Reduced value of Norwegian petroleum resources as a result of tight global climate policy or major technological breakthroughs. Increased value of hydropower battery capacity in a European energy system characterized by unregulated wind and solar power. | |

| | | |
|---|---|---|
| **Combination of physical risk and transitional risk** | Climate-related lawsuits to stop activities or compensate for losses related to physical climate change or changes in business framework conditions. | Decline in the value of Norwegian financial capital as a result of financial instability or reduced productivity growth in the world economy. |

The Norwegian response to adapt to new situations on one hand and, being vulnerable to climate change on the other, is explained in figure 2 which takes into account financial considerations, management and social preparedness as the elements that define the adaptability of a country.

Figure 2 shows the exposure to climate change and the ability to adapt to it. Norway is represented by the red dot. (adapted from University of Notre Dame Global Adaptation Index, cited after Ministry of Finance, 2018e, p.67).

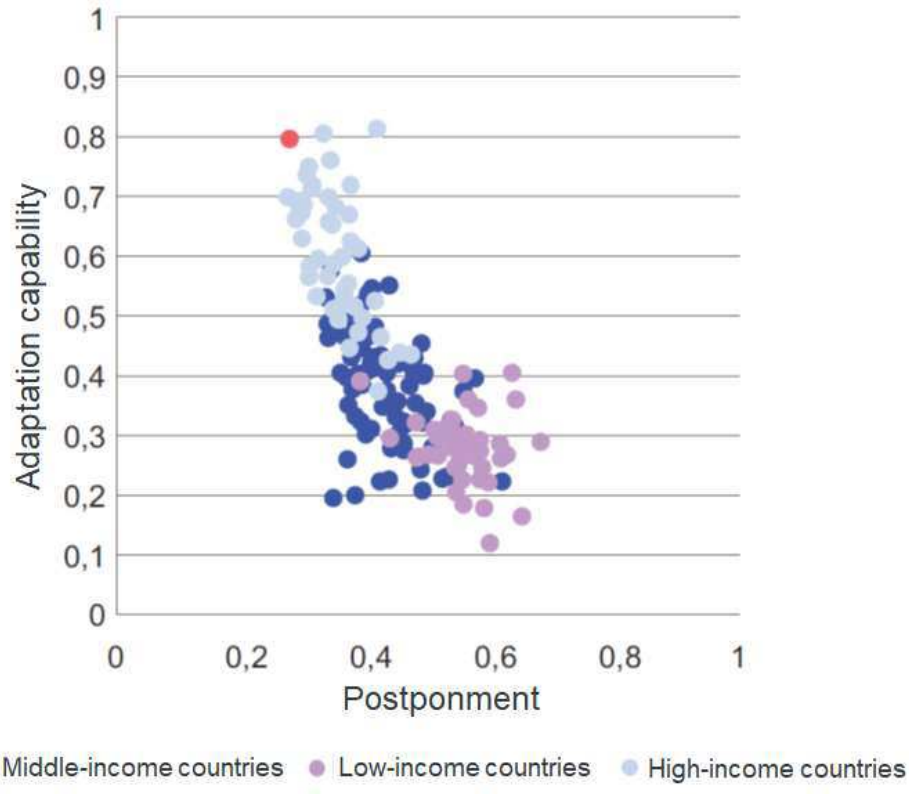


**Figure 2:** Norwegian response to adapt to climate change.

Nevertheless, one could say that the Norwegian economy together with the CCPP and the CDM systems in general, are affected by the global consequences of climate change despite the efforts made to limit them on an international scale. The investigation accomplished by the firm Ernest & Young, on behalf of the Environment Directorate (EY, 2018 cited in Ministry of Finance, 2018f p. 69), on the consequences of climate change in relation to Norway and other countries, draws the following important conclusions:

1. Physical risk jeopardizes different kinds of investments, both for Norwegian companies and private individuals.
2. Norway, as an asylum country, can suffer from an abnormal flow of refugees forced out of their countries due to climate change.
3. An escalation of agricultural product prices as the outcome of declining productivity can deeply touch Norway`s food prices.
4. Fisheries are an important production sector in Norway. Migrations of fish populations can move out of the Norwegian fishing zone because of warmer seas elsewhere.
5. Growth in the number of conflicts between various countries across the world can demand an active participation on the part of Norway.

There is no doubt that «the financial sector needs transparent and useable knowledge on climate change and related risks, both on the broad climate picture, as well as the specific issues dependent on their business area" (Torvanger et al., 2019).

**Alternative policy instruments**

In this section, an overview of the efficiency of the Nordic countries and their role in enhancing ambitious Nationally Determined Contribution (NDCs) through alternative policy instruments is given. To accelerate de-carbonization, the Nordic council of ministers has provided alternatives related to climate policies reviewed in the respective issued publications. The policies up for discussion are:

1. Climate Clubs.
2. New annulment mechanism by the Market Stability Reserve (MSR).
3. Carlen and Kristrom theoretical model.
4. CDM and RD&D (Rsearch, Development and Demonstration).

5. Kantian optimization.
6. Optimal combination of supply-and demand-side policy.

Bio-economy is also mentioned in this section as the efficient, long-term European strategy towards de-carbonization.

$CO_2$ emissions per capita had been growing since 1850 in all the Nordic countries, Norway, Denmark, Finland, and Sweden. A shifting trend was noticed in 2012, but unfortunately, that was not the case for Norway.

Norway`s climate neutral target is meant to be reached by 2050, mainly through buying emission credits from abroad, backing climate investments, and other policy instruments such as green electricity certificates, as well as carbon and energy taxation. Even though the emission reductions achieved by Norway go beyond the international climate goals, the contribution to the emission reductions is still small if thinking globally. To improve the climate policy, it is fundamental that Norway and all the other Nordic countries focus on efficiency.

The Norwegian climate policy could be more efficient, and, at the same time, it could inspire less ambitious countries with their emission reductions programs. To accelerate de-carbonization, some initiatives have been taken with regard to the role of Nordic countries. There is more to be said in the following paragraphs on this topic.

The alternative climate policies shown below consider the premises developed during the Paris Agreement and the gap that divides scientific conclusions, as well as an adequate policy reaction. In fact, while the Paris Agreement leads the legislative way towards a global de-carbonization, especially through more ambitious NCDs, the final effectiveness shows that, to close the gap, more serious efforts are needed (UN Environment Program, 2019, p. XIV).

Consequently, the international climate politics in the post Paris era has regarded the participation and cooperation of state and non-state actors, as well as public-private institutions, as needful in the drive to achieve climate ambitions. For instance, the Carbon Neutrality Coalition and the Fossil Free Sweden are the tangible result of concerted efforts in favor of climate actions.

Unfortunately, certain drawbacks deriving from erroneous politics can be easily recognized in the overlaying of mandates, lack of transparency, as well as in the complexity of the approaches to the climate issues. All of that could be avoided with the establishment of a new economic framework where resourceful and determined countries receive advantages by

taking on the responsibility of a coordinated and ambitious climate policy. With regard to the latter aspect, it is worth mentioning the way literature has historically focused, for example, on the largest countries such as China, the US, and Germany, which have underestimated the role that small countries play collectively, both in terms of emissions emitted and emissions reduced (Carter et al. 2019, p. 981).

According to Falkner (Falkner, 2015, p. 5) "the assumption that the unequal distribution of power is an inescapable fact of international life, and that if lasting international cooperation is to be achieved, then the process of negotiating international agreements must, in some way, reflect this power asymmetry."

The Nordic countries, through their enrolment in the Carbon Neutrality Coalition, can embody the need of this kind of leadership and encourage with their examples the use of more ambitious NCDs. In turn, this could help to strengthen the relevance and role of domestically climate policy in the Nordics (Thorhallsson et al., 2006, p. 654).

While NCDs are of great importance in the climate policy of individual countries, the MSR focuses on the problem of the surplus of allowances in the ETS. This reform started operating in 2019. Its goal is to stop the process of lowering carbon prices, which consequently, leads to the weakening of the incentives meant to reduce emissions during the period 2021-2030 by modifying substantially the dynamics of the Emissions Trading Scheme (ETS).

The new annulment mechanism, which has already been introduced, seems to have quite an impact in the long term. The ETS reform confirms the reliance on demand of the supply, and it is exactly this, which highlights the effectiveness of demand-reducing policies, versus annulment policies carried out by singular countries. The National Institute of Economic Research in Sweden, (NIER), has recommended a national annulment policy. In Sweden, this alternative is called "the emission brake". The effectiveness of annulling the MSR allowances within the ETS (annulment policy), the effectiveness of annulling allowances within the non-ETS sector (FM annulment), and the effectiveness of a demand reduction policy have been investigated by Silbye and Sørensen in 2018 (Silbye et al, 2018). They showed the results of their analysis in table 2, which compared the coefficients of emission reductions after the 2018 ETS reform policy (Nordic Council of Ministers, 2019b p. 84).

Table 2 shows the coefficients of emission reduction after the 2018 ETS reform. (Adapted from Nordic Council of Ministers, 2019b p. 84).

**Table 2:** Coefficients of emission reduction after the 2018 ETS reform.

| Policy horizon *(H)* | Demand reduction in year *t* $\left(CER^{D}_{t,H}\right)$ | | | Annulment in year *t* $\left(CER^{S}_{t,H}\right)$ | | | FM annulment in year *t* $\left(CER^{S}_{t,H}\right)$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | *t* = 2020 | *t* = 2025 | *t* = 2030 | *t* = 2020 | *t* = 2025 | *t* = 2030 | *t* = 2020 | *t* = 2025 | *t* = 2030 |
| *H* = 2030 | 1.00 | 0.99 | 1.00 | 0.00 | 0.01 | 0.00 | 0.09 | 0.06 | 0.01 |
| *H* = 2040 | 0.99 | 0.96 | 0.94 | 0.01 | 0.04 | 0.06 | 0.25 | 0.22 | 0.18 |
| *H* = 2050 | 0.97 | 0.91 | 0.83 | 0.03 | 0.09 | 0.17 | 0.59 | 0.56 | 0.52 |
| *H* = 2060 | 0.94 | 0.83 | 0.66 | 0.06 | 0.17 | 0.34 | 1.11 | 1.08 | 1.05 |

Briefly, we have three different national climate policies: demand reduction (demand reduced by 1 ton of $CO_2$), annulment (one allowance is annulled), and FM annulment, if the annulment is used to meet the country's obligation in the non-ETS sector. The different climate policies are believed to reduce demand by 1 ton of $CO_2$ in a single year. The effectiveness of these national policies in reducing the accumulated $CO_2$ emissions is based on the model that uses the Coefficient of Emission Reduction (CER) for the yearly cut in allowances supply and the allowances demand (Adapted from Nordic Council of Ministers, 2019b p. 74-75). In the figure 3 shown below, *t* is the reduction made in year, *H* represents the time horizon of policy makers, and *S* stands for the reduction in the supply of emission allowances.

$$CER^{S}_{t,H} = \frac{Accumulated\ fall\ in\ emissions\ from\ year\ t\ until\ year\ H}{Cut\ in\ allowance\ supply\ in\ year\ t}$$

**Figure 3**: Model on which the effectiveness of national policies in reducing the accumulated $CO_2$ emissions is based on.

The model suggested by Silbye and Sørensen arrives at the conclusion that the annulment of allowances before 2040 does not produce the best solution in relation to $CO_2$ emission reductions as compared to a carbon taxes policy. In the very long term, though, it becomes much more effective. In addition, they argue that a price floor and a price ceiling for emission allowances should be determined. That would prevent the complexity of the MSR rules from weighing on the costs calculated to achieve climate targets (also see Salant, 2016, p. 18).

Still, there is no denying that the climate policy in the Nordic countries has been more cost-effective than in other countries. This is the starting point in the Carlen and Kristrom analysis of the EU ETS (2019). In particular, they assert the importance of evening out the marginal costs of emissions in non-trading sectors, pointing out that the Paris Agreement does not live much room to the EU to diminish any cost differences in relation to the rest of the world. The theoretical model used by Carlen and Kristrom aims to identify the welfare effects of international ET. They put the goal of their research in this way "if there is a difference between the tax and the permit price, or between the tax levels in different countries, there is also a difference between marginal costs. If so, we can find re-allocations between emission sources that make climate policy more cost-effective" (Nordic Council of Ministers, 2019c p. 117).

Everything else equal, the marginal cost discrepancy between the Nordic countries and EU countries in non-ET sectors (transport, agriculture, buildings, waste, manufacturing, and petroleum sector) could be evened out by curbing emission abroad rather than domestically. The model proposed considers some important aspects, such as distribution issues, technical development, the Porter-hypothesis, carbon leakage and, consequently, the so-called Green Paradox, and finally, the bonus-malus scheme.

Carlen and Kristrom point out briefly that the asymmetric distribution of climate change effects has been approached economically in a utilitarian way by literature without considering the `distributional weights` which, in contrast, encounter changes of social welfare. Simply, "the specification of utilitarian weights is quite straightforward; these simply reflect the marginal utility of consumption/income," while distributional weights require "a further moral judgment regarding the appropriate degree of inequality aversion γ and the specification of a "zero point" (subsistence level) so that utility will be measurable on a ratio scale" (Adler, 2016, p. 280-281).

Technical development has always been the workhorse for the Nordic climate policy. Despite the difficulty in pinpointing analytically the results of technological developments (demonstration effects), the approach of the Nordics to climate issues is strongly characterized by a supportive policy mainly through technological development rather than extreme emission reductions at home. The promotion of public energy research, development and demonstration investments (RD&D) is at the base of national policies in the Nordics where the goal is the creation of green jobs as well as meeting markets that in the future will support low-carbon

options especially in transport, buildings and catering sectors (Nordic Council of Ministers, 2019d p. 9).

Figure 4 shows the total public energy RD&D budgets per thousand units of GDP by country for 2018 (adapted from IEA, *Total public energy RD&D budgets per thousand units of GDP by countries for 2018*, IEA, Paris).

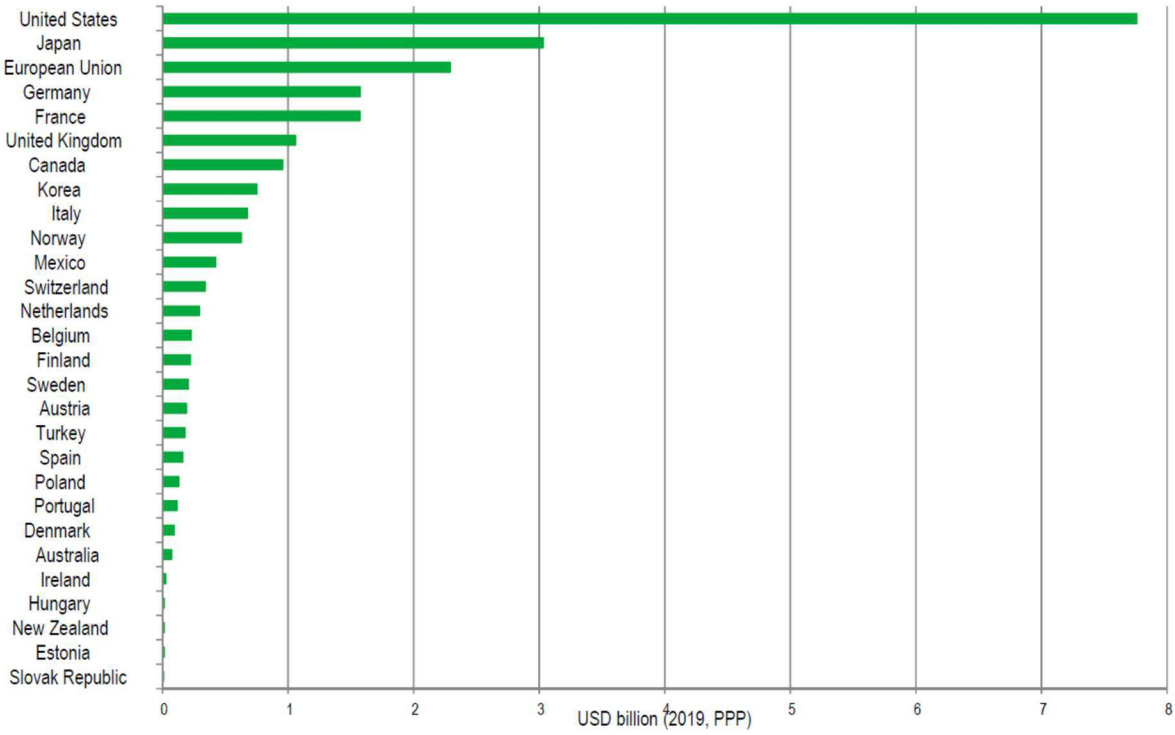


**Figure 4:** Total public energy RD&D budgets per thousand units of GDP by country for 2018.

This latter aspect, however, is in contrast with empirical evaluations according to which stricter climate policies may not increase jobs. Based on the Porter hypothesis, as this argument is known among economists, the commercial competitiveness will increase when stricter environmental regulations take place and, thus, lower the costs. On one hand, well-designed environmental regulations "help firms identify inefficient uses of costly resources…produce and disseminate new information (e.g., best-practice technologies) and help overcome organizational inertia" (Ambec et al, 2011, p. 4).

On the other hand, the problem lies with the evaluation of the definition of well-designed environmental regulations. Speaking of the consequences of stricter environmental regulations, the opposite case should be taken into consideration as well, like consequences where

environmental policy is less rigid. In this case, the introduction of stricter measures could cause an increase in emissions since oil producers would sell more before the application of the new policy. This Green Paradox tries to explain the phenomenon of inter-polar carbon leakage where today's increase in emissions is related to those, which could occur later. According to the Hotelling model, the extractions trend will slow down because of global savings (Sinclair, 1994, p. 869-877).

Finally, the bonus-malus policy used for vehicle tax and based on their carbon emissions works in the same way, but here, we assist with the overlapping of regulations, which influence the efficiency of climate policies.

The choice of alternative climate policies in the Nordic countries will have a global impact even if the direct effect of their reductions is globally very tiny, since their emissions cover less than 0.5% of the global emissions. At the same time, according to Greaker M., Golombek R., and Hoel M., Nordics could have a greater impact on global emission reductions by inspiring other countries through their examples, and by using the so-called Kantian ooptimization.

The first mechanism implies a deeper focus on the clean technology development and RD&D, through which Nordics could influence climate policy, and therefore, the NDCs of other countries annulling the standing-on-shoulder effect, which benefits, to a small degree, the research community. Since the clear technology is used to the same extent as the dirty one, we could assist in the "displacing of dirty technologies even without an environmental policy" (Nordic Council of Ministers, 2019e p. 169). This seems to be the case with the Nordics except for Norway, which, at the same time, has among its priorities the research in oil and gas extraction. Other positive aspects of the use of RD&D are the fall of the unit-cost during the phase of the accumulation of technology production, as is the case of the electric vehicles in Norway, where the cost of the batteries has significantly decreased and so, other car companies have been encouraged to produce their own electric vehicles. Through promoting a clean technological development, Nordics could get benefits and share their experience with other countries, so that more reasonable abatement opportunities become accessible.

The second mechanism is the "Kantian-optimization" model, which is based on the moral obligation of `doing the right thing`, in a moral sense. That has to be considered, especially, when looking at climate change from an international perspective. This model shows how the abetment efforts of a particular country increases to make up for another country with lower abetment efforts. Normally, "the reigning assumption in economic theory is that

individuals optimize in an autarkic manner" (as in Nash and Walrasian equilibrium) (Roemer, 2013 abstract), but, as researched by Roemer himself and Graeker, the Kantian approach could overcome some pitfalls such as the prisoner`s dilemma situation and the Nash equilibrium referred to above.

Greaker M., Golombek R., and Hoel M. conclude that if certain countries have alternatives to their climate policies, then, they should focus their efforts on maximizing the use of flexible EU mechanisms and develop their technologies so that they can resort to them and, thus, achieve emission reductions at a lower cost. If the alternative climate policies have a global focus, then, the Kantian model, together with a better coordination of the different measures, could enlarge the global impact of the Nordic policies.

As mentioned earlier in this thesis, Norway differs from the other Nordic countries in that, it's its mainly national revenues derive from the export of oil and gas. Therefore, one could rightly ask as to whether the reduction in oil extraction is the right climate policy for Norway.

The demand-side economics of Norwegian policy has been the object of many studies. Even if a demand-side or supply-side approach will not be determinant globally, a difference could be seen in relation to carbon leakage, which, as pointed out above, is a consequence of an increase in emissions abroad caused by domestic reductions in a particular country. "Norwegian lack of focus on supply-side policies has been questioned by media, analysts and NGOs at home, and has also attracted international attention;…the country accounts for around 2 per cent of global oil production, it contributes to less than 0.3 per cent of global oil consumption" (Fæhn et al., 2017a, p. 78).

Some scholars agree that, in Norway's case, the best solution in terms of efficiency and effectiveness is a combination of supply-and demand-side policy, where, the reduction in oil extraction represents a huge part (Nordic Council of Ministers, 2019f p. 219). The effects of policy instruments that aim to give more space to a supply-side policy have to be considered carefully. A carbon fee, for example, will lead to a decrease of the fossil fuel price internationally, as well as to an increase in demand and utilization abroad, hence, carbon leakage. The theoretical framework elaborated by Hoel (1994) shows how the cost of reducing, both, demand and supply, in terms of the export or the import of fossil fuels, as well as the size of the carbon leakage both from the supply-and demand-side policies, determines the optimal combination (Hoel, 1994, p. 259-274). In the same way, Fæhn et al. found out in 2017 that "it is the increasing marginal abatement cost, both on the supply side and on the demand side,

which implies that a combination of the two is optimal" (Nordic Council of Ministers, 2019f p. 219).

Figure 5 shows the combining leakage adjusted demand-, and supply-side marginal cost curves (adapted from Fæhn et al, 2017b, p. 92).

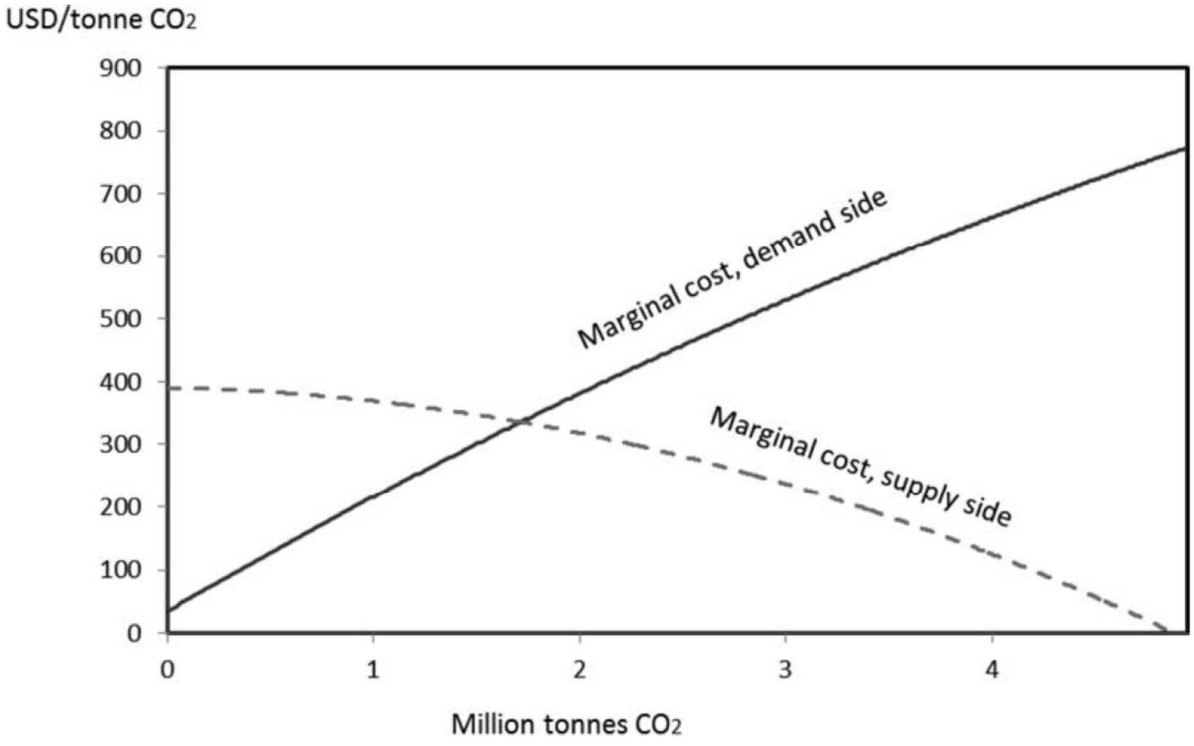


**Figure 5:** Leakage adjusted demand-, and supply-side marginal cost curves.

In this context, the effects of supply-side policy on technological development and distribution are so important that they should be taken into consideration. Some quite strong arguments in favor of the potential advantages of a supply-side policy are, among others, the political feasibility, and a wider and easier acceptance of the measures among individuals. In fact, studies show that a change in a supply-side policy has both political and economic advantages. Some of them are: "low administrative and transaction costs…, the mitigation of the `green paradox`…, the conduciveness of supply-side policies to international policy cooperation, and the potential to bring different segments of the fossil fuel industry into a coalition supportive of such policies" (Green et al., 2018a, p. 73).

Moreover, the costs that come with this type of policy are easy to be accepted by people, because it highlights the benefits that voters value a lot. Those policies, which, lead to less

polluted air, are favoured by voters, since it is commonly believed that oil and gas companies get the lion's share of the profits by selling their products (Green et al., 2018b, p. 80). However, it can be said that this perception does not probably apply to Norway since the revenue from oil and gas extraction is fairly distributed among the population through taxation.

As previously mentioned, the supply-side policy, together with the demand-side one, affect technological development in several ways. To this day, a learning-by-doing process has guided the demand-side Norwegian policy, which has invested in technological development, as well as in the oil and gas sector. This can produce two different results: firstly, the new technologies could transform fossil energy to a more competitive product with higher prices that could increment extraction and, therefore, emissions. Secondly, an improvement of efficiency in the energy use could lead to a situation where fossil fuels become unnecessary and redundant. That is immediately followed by a fall in prices and a considerable extraction decline, and consequently, in emissions as well. Acemoglu et al., considering the role of supply-, and demand-side policies in relation to technological development over time. They conclude that, if fossil energy can or cannot be replaced smoothly, in the long-term the supply-side policy will affect technological development, in such a way, that carbon leakage will be lower thanks to a reduction in price and value of the fossil fuels (Acemoglu et al., 2016, p. 100).

However, "whether or not this is the case differs across sectors, countries and fossil energy sources, and it is ultimately an empirical question that the economics does not yet give a clear answer to" (Nordic Council of Ministers, 2019g p. 225).

Furthermore, the design and implementation of the article 6 of the Paris Agreement is essential to achieve the NDCs. A new richly written version of the article, expected to be published in December 2020, could highlight its full potential in both economic and environmental terms. According to the Carbon Pricing Leadership Coalition (CPLC), the complete cost of implementing NDCs could be reduced by more than half by internationally producing mitigation outcomes (ITMO) based on cooperation between Parties or, alternatively, by fulfilling their ambitions (IETA 2019a, p. 1). The potential value of article 6 has been assessed by using the global change assessment model (GCAM) which simulates, among others, an enhanced ambitious scenario, E-NDC. This scenario demonstrates that higher mitigation and ambition levels could be achieved through cooperative implementation (IETA 2019b, p. 4).

Figure 6 shows the global fossil fuel and industrial $CO_2$ emissions in the reference, I-NDC, C-NDC, and E-NDC scenarios (adapted from IETA 2019b, p. 4).

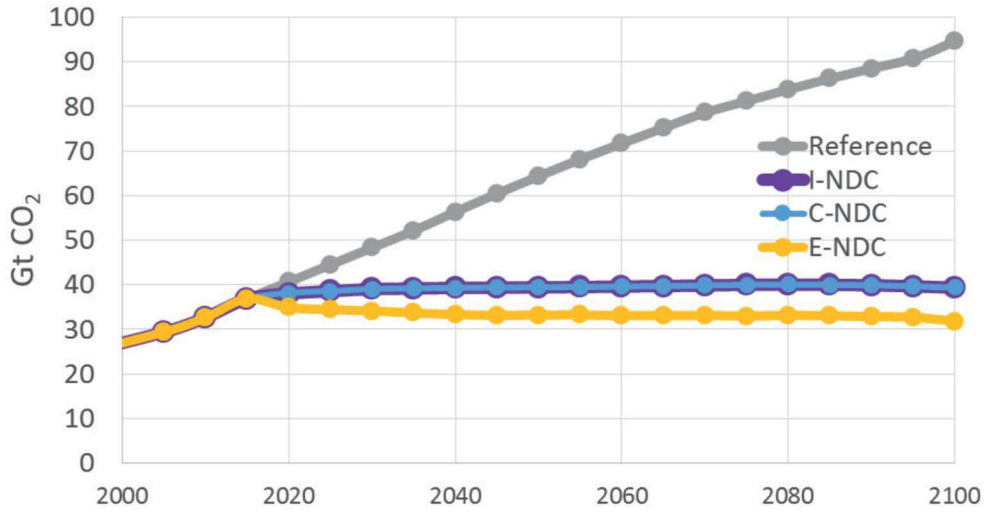


**Figure 6:** Global fossil fuel and industrial $CO_2$ emissions in the reference, I-NDC, C-NDC, and E-NDC scenarios.

In conformity with Paris Agreement, the EU and the Parties involved have been working towards climate neutrality by 2050 with bold long-term, low-greenhouse-emission strategies from an economic perspective. In line with the new European policy strategy adopted in 2012, otherwise called bio-economy, Norwegian Ministries are coping with the ecological, environmental and energy supply challenges by resorting to the document "Familiar Resources–Undreamt of Possibilities, the government's Bio-economy Strategy" (Norwegian Ministries, 2018a). The production of goods and energy from sustainable biological sources is at the heart of the idea of the bio-economy. Sustainability and circularity are the keys to the realization of the European bio-economy. Organic waste, animals, microorganisms, plants, and derived biomass are all comprised in the building of the bio-economy system. Certainly, the bio-economy is essential to the functioning and success of the EU economy. Its turnover reaches a value of €2.3 trillion, which accounts for 8.2% of the whole EU's workforce (Ronzon et al, 2018, p. 2). The Circular Economy Action Plan, updated from the EU commission in 2018, is among the documents that stress the importance it has for the EU members in order for them to embrace a sustainable and circular bio-economy and achieve a financial system with net-zero greenhouse gas emissions. In this way, they can also "strengthen and scale up the bio-based sectors, unlock investments and markets, deploy local bio economies rapidly across the whole

of Europe, and understand the ecological boundaries of the bio-economy". The above information contained in the directive provided by the European Commission makes up the three pillars that sustain this new economical approach (European Commission, 2018a).

Undoubtedly, economy growth and a healthy environment go side by side as well as fortify each other. That is why this crucial concept is borne in mind in the Norwegian bio-economic strategy. Thus, it could be said that the switch to a green Norwegian economy is characterized using renewable biological resources.

As already explained, the central tools of the Norwegian climate policy are fees on emissions and participation in the EU emissions trading system. In addition, the Norwegian Environment Agency has pointed out that the use of raw materials from renewable biological resources can help to reduce emissions. Moreover, the industrial emissions and substantial biomass resources across Norway can provide a solution wherever biofuels are used in $CO_2$ management with a view to achieve carbon-negative plants. Gas fermentation and $CO_2$ can also be used for the development of sustainable feed and chemicals. In this way, emissions from the transport sector, which globally represent 14% of climate gas emissions and 27% of the energy used today in Norway, can be reduced significantly. (Norwegian Ministries, 2018b p. 18).

**Energy efficiency**

In this section, the concept of energy efficiency and the ways of measuring it are introduced. The Climate Action Tracker is used as a comparison benchmark in order to evaluate the degree, to which, the international climate targets match Norway`s long-term 2030 and 2050 goals and NDCs. The role of LULUCF will be analyzed and some considerations about the proper level of contribution to the global effort, made to facilitate the path towards de-carbonization, will follow.

The concept of energy efficiency is difficult to define, therefore, many definitions have been considered to that effect. ''A ratio between an output of performance, service, goods or energy, and an input of energy'' is the description given by the European Council and the Parliament on Energy end Use Efficiency and Energy Services (European Union, 2006 art. 3a). Defining the measurement of the energy efficiency concept has also been quite a challenge. Data Envelopment Analysis (DEA) is one of the methodologies that was mostly used between 1999 and 2006 (Zhou et al., 2008, p. 1-18), but international organizations and national energy agencies have worked out their own analysis-, and monitoring systems.

The Norwegian climate policy regarding energy efficiency follows the Clean Energy for all European packages adopted by the European Union, between May 2018 and May 2019 with a view to meeting Europe's commitments under the Paris Agreement on climate change. The main EU target is to achieve, at least, 32.5% by 2030 (European Commission, 2019).

A fossil-fuel free economy is the main target that Norway intends to achieve through its climate policy, which is mostly based on EU legislation; it covers the European Economic Area Agreement (EAA). The emission-free electricity system, the banning of fossil fuels for heating buildings, the International Climate and Forest Initiative (NICFI), and GCF the among some of the initiatives that see Norway at the forefront of the emission cuts. However, there is no room for complacency here because the current data show that there is still a lot of work to do.

According to the NGO Climate Action Tracker (CAT), the Norwegian climate policy is "highly insufficient" and not in line with the Paris Agreement (CAT 2019a, Assessment). This can be seen in the NDCs for the timeframe 2021-2030, last updated on 7th of February 2020 (Ministry of Climate and Environment, 2020a p.3), as well as in the previous one updated on March 3rd, 2015. In other words, this climate policy has been rated as "insufficient" at dealing with the Paris Agreement's 1.5°C limit.

The use of LULUCF to accomplish Norwegian emission reductions seems to be the key to the mismatch between the NDCs Norwegian targets and the global cost-effectiveness pathways. The efficiency comparisons carried out by CAT are based on the information that can be found in the Norwegian NDC, which deems Norway committed to reaching the carbon neutrality target by 2030. Some unwillingness on the part of the Norwegian government is obvious even today. For example, there has been no thorough assessment or strategy underlying the 2030 climate neutrality target. Instead, the Government has simply expressed its intention of returning to Parliament with a review of the climate neutrality decision in due time (Energy and Environment Committee, 2017-2018, p. 2). If, on one hand, Norway clearly confirms the exclusion of the land sector, in order to achieve the 50% reduction by 2030 compared to 1990 (Ministry of Climate and Environment, 2020b p.3), on the other hand, the fulfilment of the commitment is conditional on the availability of flexible mechanisms (Ministry of Climate and Environment 2016-2017a, p. 111). This appears to be true despite the opening statement, according to which the Norwegian Government would be open to consistent domestic emission reductions in relation to the 2030s` climate strategy (Ministry of Climate and Environment 2016-2017b, p. 5). Due to the reasons mentioned above, the analysis of the current policy

projections from CAT regards the Norwegian NDCs as not compatible with the 1.5°C target set in the Paris Agreement (CAT, 2019b, Summary).

Consequently, Norway appears not to be in line with the fair share of global efforts.

This is strictly correlated with the fact that the current Norwegian climate policy enjoys the privilege of a "location" emission reduction view the cut of GHG overseas) rather than a cost-effective emission reduction view based on fairness. There is no denying that working under the European regulatory framework gives Norway the chance to honour its pledge in a cheaper way than if the country were to put into effect forceful climate national policies. Moreover, there is no international agreement that gives a definition of a fair contribution to global efforts. The cost-effectiveness itself has always been used as an economic principle rather than an estimation of fairness in the EU ETS, a fact some scholars comment in this way: "In the absence of effort-sharing frameworks, cost-effectively allocating emissions across countries would yield an uneven distribution of mitigation costs" (Clarke et al., 2014, p. 419).

The literature review adopted by CAT in its evaluations of effort-sharing, points to the fact that many factors, such as the equity principle implementation, affect effort-sharing approaches results (Hohne et al. 2013a, p. 122).

All approaches reported by scholars consider seven categories of specific effort sharing. The first three categories are equity principles: Responsibility is related to the historical contribution to global emissions or warming (article 3 of the UNFCCC), capability or `ability to pay for mitigation` ('basic needs' principle), and equality (equal emission allowances per person). Responsibility, capability, and needs plus capability/costs are the other two dimensions that combine the above-mentioned approaches. Another element is equally cumulative per capita emissions, which integrate equality into responsibility. Finally, the last category, staged approaches, is the result of principles considered at different times by countries. A mismatch between fig. 7 in CAT and fig. 8 in the literature appears in relation to one of the categories of effort sharing approaches. According to figure 6 in CAT, though, cost effectiveness does not make up a particular category, whereas the capability/costs category is not mentioned at all in the literature, which CAT refers to.

Figure 7 shows the categories of effort sharing approaches. Cost effectiveness is a concept included in the capability/cost category, but it is not a stand-alone category (adapted from CAT, 2019 Comparability of effort).

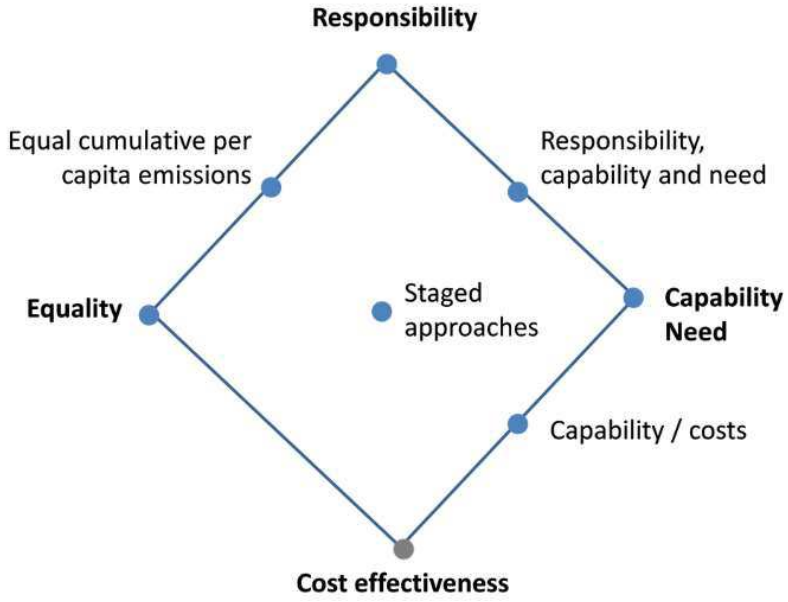


**Figure 7:** Categories of effort-sharing approaches according to CAT. Note: cost effectiveness is a concept included in the capability/costs category but isn't a stand-alone category.

Figure 8 shows the seven categories for effort-sharing approaches (adapted from Höhne et al., 2014, p. 125).

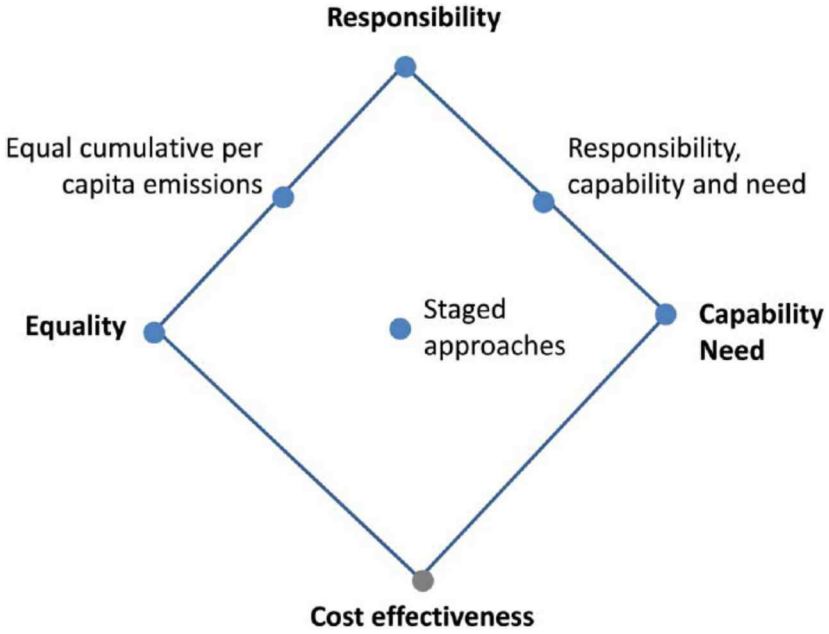


**Figure 8:** Categories of effort-sharing approaches according to literature.

In the attempt to deepen this aspect, CAT has been asked to offer a clarification (e-mail sent 06/07/2020), but a reply has not been received yet (12.10.2020).

"In 2018, the primary energy intensity - an important indicator of how much energy is used up by the global economy - improved by just 1.2%, the slowest rate since 2010" (IEA, 2019a).

Three factors, which have contributed to the actual trend, are the following:

1. There has been a greater demand for fuels since the industrial production increased of late in China and the United States. Secondly, there have been cooler winters and warmer summers in the United States. Thirdly, in recent years, winters have been quite mild in Europe. This has led to decreased demands for heating gas.
2. Energy intensity has risen by 1.4 per cent since to 2017.
3. The slowdown of global energy improvements depends on changes in transport modes and more building floor area per person; they are the so-called structural factors that damp the advantages of technical efficiency (IEA, 2019b).

Clearly, there is a trend in contrast with the environmental targets.

The dampening effect caused by structural factors could be tricked through "the digitalisation of our homes, businesses and transport systems, thus providing immense opportunities to improve energy efficiency in systems and end uses" (IEA, 2019c p. 109). Environmental considerations are also taken into account and, in the same report, IEA specifies that governments should follow a common framework of policy principles (2019, p. 91). A common framework of policy principles helps to minimise the rebound effects, such as, the depletion of metals and minerals that are used to produce various devices, and elements such as, lithium and cadmium that procure negative environmental impacts because of their toxicity.

**Preliminary conclusions**

Economy and climate change are two elements that deeply influence each other. A proper risk assessment of the challenges concerning environmental issues gives important insights into decision-making processes. Global energy efficiency enhancements are diminishing. The evaluation of different policies regarding the approach to serious concerns, such as the problem of efficiency, is carried out with the help of publications that offer several

alternatives to all the Nordic countries. In the specific case of Norway, cost-effectiveness could be strengthened by a combination of supply-and demand-side policies which Fæhn, (2017), explains by pointing out that: “it is the increasing marginal abatement cost both on the supply-side policy and on the demand-side policy which implies that a combination of the two is optimal”.

## Climate Policy from an Ethical Perspective

### The Linkage between Climate Change and the Political and Economic Response from an Ethical Perspective

In this section, the ethical dimension of carbon offsetting is discussed with a view to evaluating the connection between climate change and its ethical aspect. Carbon offsetting and the CCPP are the principal means through which Norway has been trying to reduce GHGs at a global level over the last years. Therefore, it is more than appropriate to ask whether this kind of choice is ethically correct, deepen the ethical environmental approach chosen so far, and analyse the ethical dimension of the Norwegian climate policy from the point of view of developing countries.

### The ethical base of the CCPP

In his op-ed article on climate change, entitled "Indifferent to Planet Pain" and published in the New York Times in 1999, Bill McKibben talks about "gut understanding". He used this expression to draw the attention of the society to the ethical aspect of global warming reporting: "I used to wonder why my parents` generation had been so blind to the wrongness of segregation; they were people of good conscience, so why had the inertia ruled so long? Now, I think I understand better. It took the emotional shock of seeing police dogs rip the flesh of protesters for white people to really understand the day-to day- corrosiveness of Jim Crow. We need that same gut understanding of our environmental situation if we are to take the giant steps we must take soon" (McKibben, 1999 cited in Brown, 2011, p. 1). Since then, the social debate that it has provoked has led to a greater recognition of the link that exists between climate change challenges and ethical issues in many countries.

There is no denying that climate change affects countries and generations both quantitatively and qualitatively. Undoubtedly, solutions to climate change problems force anyone to consider the responsibility of the developed countries for impacts on developing countries and the ethical liaison that exists between humankind and non-human world, a theme which has been widely treated by environment-ethical scientists since 1970s (Laal, 2009, p.1).

Since the 1980s, the international community has shown an interest in safeguarding the climate change system and consequently human safety. It is worth noting that principles like equity, common but differentiated responsibilities and respective capabilities, et cetera, have come to the fore in order to show the way to a common international response to climate changes, and their direct and indirect impacts. (UNFCCC, 1992, p. 4).

More recently, sustainable development goals (UNFCCC, 2015) and the Declaration of Ethical Principles in relation to Climate Change (UNESCO, 2017) have displayed the deep connection which exists between climate change and its ethical dimension.

In line with these principles, Norway has responded by supporting organizations, such as, the UN Environment Program (UNEP) and the World Bank with a view to setting up businesses in developed countries that are interested in using the CCPP (Norwegian Ministry of Foreign affair, 2009 p.59). As in all types of markets, there is balance when demand and supply acquire a structure that provides adequate goods- and services production. This applies also to talking of the exchange between CERs and tons of $CO_2$. Thus, the price of CERs in a climate problem context does not reflect the external impacts and intrinsic values of nature, but "external impacts" which reveal a flaw in the mechanism of the market. Just like in the case of atmosphere, free exploitation of goods turns out to have global disadvantages (Ministry of Finance, 2018 section 2.5). The recognition of the intrinsic value that nature has in its entirety at the legislative level, therefore, seems to go hand in hand with an assigned economic value. Externalities are the result of this interconnection, which demonstrates the imbalance between the intrinsic and economic value given to the nature system.

According to the Economics of Ecosystems and Biodiversity (TEEB), reducing our impact on the environment is mandatory if we are to avoid the fact that the economic and social costs will grow. Thus, one way to go about it is, for example, “to calculate the economic value of the ecosystem services” (Norwegian government, 2013, p.6).

However, there are certain ethical concerns over putting a price on the natural environment. There has been strong criticism, on ethical grounds, of the flexible mechanisms that enable the CDM to use natural resources, as well as have the right to treat them as properties (Caney et al., 2011a). To many, the act of buying GHGs and trading them is the equivalent of transforming them into commodities (Belliveau, 1998 cited in Hermann et al., p. 14). On the other hand, atmosphere, just as any other integral part of the bio-community is a priceless property that belongs to all humanity. Even if we think of the $CO_2$ traded in the CCPP, as a fee that allows using the right to do so, and therefore, it does not give ownership, the question about earnings remains. So far, no clearly ethical answers have been given to the issue of the right to earn revenues that have been internationally obtained from ET.

However, Peter Barnes in 1982 created a model called “The Trust Sky”. It is also referred to as ‘cap and dividend’ and it is based on the equal sharing of the income coming from

oil for all Alaskans. The proposal, which was approved by Congress never became law, even though, it outlines the possibility of alternative ethical solutions to the current ET model.

In addition to the ethical issue tied to the possibility of putting or not a price on a common good, such as the atmosphere, the argument of the justice of the ET becomes current also in relation to just incomes. The regressive impacts caused by controlling the GHGs emissions hits more strongly the poorest countries and, in general, households with low-income. According to Canvay S. and Hepburn, this is one of the reasons why "the ET…has had negative consequences on distributive justice" (Canvay S, 2011b p.28). Furthermore, unequal distribution shaped from international trade contributes to environmental harms and differences in human development observed in the disproportionate access to and use of natural resources between Global North nations and Global South nations (Givens E. J. et al, 2019, p.2). One could count as such concerns voiced about the distributional justice of the trading system and the mechanisms linked to it. Distributional injustice, which is closely linked to the trading of $CO_2$ from wealthier to poorer lands, is explained well in "The sociology of ecologically unequal exchange and carbon dioxide emissions" that support the ecologically unequal exchange theory (EUE).

According to the author, the relationship between high emissions and the percentage of exports sent to high-income countries increases over time; in particular, the "relationships between the Global North and Global South have become increasingly ecologically unequal, particularly, in the form of carbon dioxide emissions" (Jorgenson, 2011, p. 249-250).

**An Ethical Environmental Approach**

Peter I. Kaufman, in his study "The Instrumental Value of Nature" sums up Ralph Waldo Emerson's view on the anthropocentric, subordinate and instrumental consideration of nature in this way: "Nature is the pole with which man hurdles himself over his own finitude and limited rationality to understand the supernal forces at work within both nature and his person…Nature energizes the highest in man and vaults him to a new comprehension of the universe and of his place in it" (Emerson R.W. cited in Kaufman, 1980, p.33). Nature as commodity is ethically at the opposite corner of the nature-centric or intrinsic concept of natural resources. The recognition of the intrinsic value of nature is "rather a vital aspect of conservation of the biosphere; recognition of value entails the obligation to do what is right,

i.e., protect the good" (Piccolo, 2017 abstract). The debate over these two perspectives is not perceived as a philosophical discussion. At the heart of that, there are research, choice and implementation strategies that help to combat climate change from a political, economic and environmental point of view. There is also the development of the environmental justice together with its satellite concepts of distributional and procedural justice.

In fact, the idea that sharing the negative outcome of commercial strategies in an unbalanced way among humankind is deemed ethically and legally fair worldwide, alongside some principles that support an ethical environmental approach. Among them, worthy of being mentioned are the following: the precautionary principle, the principle of sustainable development and the principle of common but differentiated responsibility.

As reported by the Norwegian National Research Ethical Committee for Natural Science and Technology (NENT), the precautionary principle is the central part of the principle of sustainability. The breakthrough of this principle dates to the "Rio-declaration" on Environment and Development in 1992, which Norwegian legislation has incorporated (NENT, 1997a p. 18). However, the first delineation of the principle could be traced back to 1970 when a German bill aimed at securing clean air. The precautionary principle in article 15 of the Rio-Declarations states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." The connection of this principle with the sustainable development aim is as clear as a bell. There is no doubt, though, that it can be present in a human centered view especially when it is a question of thinking about succeeding generations. At the same time, one could argue that the protection of the environment, intended as a service for the future generations cannot be taken for granted (NENT, 1997b p. 25).

However, the moral, social, economic, and ecological dimensions of the principle of sustainability are inextricably intertwined with one other, whereas, the ethical principle that unfolds from this complex tangle regards, at least, the responsibility of humankind for nature. Sustainability addresses directly "the need to build peaceful, just and inclusive societies that provide an equal access to justice" (UNFCCC, 2015b goal 35) and carries within itself the ethical principle of differential responsibility. The common but differentiated responsibility principle has two aspects built on the solidarity between states. The first aspect is the common

responsibility that implies the obligation to cooperate, conserve, protect and restore the health and integrity of the Earth's ecosystem, as well as recalling fundamental principles such as justice and fairness connected to the efforts that countries have put into the fight against global environmental degradation (UNFCCC, 1992b p. 2).

The second aspect regards the deduction of the ethical right that developing countries have about using technology and financial resources originating from developed countries. The latter has made the greatest contribution to creating the conditions for the climate change, as we know it and, therefore, the climate crisis itself (Thaddeus, 2010 p. 14).

Accordantly, one of the touchstones that guides the degree of intervention of mitigation and adaptation actions is the financial and technological capacity that each country has. It is worth noting that attempts have been made to remedy situations that often occur during international negotiations. The reference is also known as the "prisoner's dilemma", where selfish solutions are the result of a lack of confidence in the solitary behavior amidst the parties.

The Greenhouse Development Rights (GDR) describes responsibility and capacity in terms of a development threshold, *"*a level of well-being that is modestly above a global poverty line, a threshold below which individuals are not required to bear the costs of addressing the climate problem, and are, instead, allowed simply to prioritize development" (Kartha et al., p. 10).

Countries, populations, and single individuals who live above the development threshold have the obligation to cover, in a sustainable way, the costs of their consumption associated with emissions. At the same time, they must ensure that they help and provide more for those who live below the development threshold. Ethically, the low-emission path should regard both Northern and Southern countries, and all the units in the principle of a two-fold obligation, where, the unequal distribution of income is dealt with through domestic mitigation and international mitigation efforts.

**Norwegian Climate Policy Seen from the South**

Norway is an energy and healthy nation challenged to face moral questions about its constant economic development based mainly on trading pollution rights. If Norway should or should not take its share of responsibility for its greenhouse gas emissions and its policy of buying emission quotas abroad, is an open question. Ending of poverty and supporting developing countries are part of the Norwegian policy. That policy highlights the unjust nature

of climate change, both in official documents and initiatives, as is shown in Report no. 13 to the parliament (2008-2009) and the Clean Energy Program action plan (2009-2012). Undoubtedly, Norway is emerging as one of the developed and industrialized nations of the world known for the efforts made towards solving the global climate crisis.

However, the question if the Norwegian climate policy is a climate justice policy between north and south is open to debate. From a global climate justice perspective, the debatable issues in question would be the role that Norway plays as an oil exporter, as well as its carbon trading climate policy. Some scholars maintain that using markets to reduce emissions is a way adopted by wealthy countries that helps them to bypass their responsibilities and, at the same time, and an excuse for avoiding strict measures at home. Much has been talked about the ethical debt that the Northern countries owe to the poor countries. That has to do with the contribution, in terms of resources, provided by southern countries to northern ones.

From the southern countries' perspective, the carbon trading and its offset strategies have the aim of shifting the responsibility for the impacts of climate change onto the South, as well as making profits from the carbon trading business (Unterstell et al., 2008a p. 12).

Broadly speaking, the policy of taking measures based on actions outside Norway reinforces the anti-democratic characteristic of this very same policy, as the contribution that every individual and each family unit can make, is completely ignored. This, on its part, causes an erroneous perception of the importance of the individual input. Other forms of criticism are levelled at the number of permits given for the exploitation of fossil fuels in Norway, digging under the North Pole, and the exploitation of new reserves in Brazil. The Norwegian Petroleum Directorate (NPD) has the responsibility to manage and maintain an overview of all the petroleum resources. In 2019, the "Exploitation License" was issued so that the storage of $CO_2$ could be secured in special reservoirs. The idea of success and progress attributed to the markets, which has led to the right to produce GHGs without any restrictions from the emerging economies, is perceived as negative. The authors of the report "Seen from the South: A Review of Norwegian climate policy" state clearly that "a huge gap appears in this policy document with the heavy focus on capital and a less vigorous emphasis on issues of the ethical, social and moral dimensions of climate change" (Unterstell et al., 2008b, p.9)

**Preliminary conclusions**

Examinations of the responsibility for the impacts developed countries have on developing countries and the ethical liaison that exists between nature and humankind are necessary when evaluating the connection between climate change and its ethical aspect. The ethical discussion about the CCPP and, therefore, carbon offsetting goes through the recognition of principles, such as, equity, common but differentiated responsibilities and respective capabilities, as well as the philosophical considerations on the intrinsic value that nature has.

Financial and technological capacities are the means used by developed countries to end poverty in the South while, from the southern countries' perspective, the carbon trading and its offset strategies have the aim of shifting the responsibility for the impacts of climate change onto the South, as well as making profits from the carbon trading business. The role that Norway plays as an oil exporter, as well as its carbon trading climate policy, have been seen through international lenses, and described as a green paradox.

## Research Questions

The following research questions indicate the direction of the inquiry in my thesis

The research gap I will try to fill up, through the following studies, aims to understand and evaluate whether the current Norwegian environmental policy will be able to reach the ambitious climate targets set for 2030 and 2050, and eventually, to what extent. Moreover, I will try to make up for the lack of results from the existing research by qualitatively analyzing the way that Norwegian policy decisions are perceived by experts, including their preferences in relation to future policies, through an ethical-environmental assessment.

In details:

The first question to be addressed in my empirical research is whether the current Norwegian carbon offsetting policy will be sufficient to help Norway achieve the NDC of 50% mitigation effects for 2030 and carbon neutrality for 2050. This will be the topic of Study 1, addressed by means of forecasts of GHG emissions.

The second research question is about which climate policy is preferable from the point of view of key stakeholders: is carbon offsetting the right choice for Norway from an ethical-environmental point of view? This will be the topic of Study 2, addressed by means of stakeholder interviews and qualitative analysis.

## Study 1: GHG emissions forecasts and achievable mitigation effects with current carbon offsetting programs

The first aim of this study is to elaborate on emission forecasts for six GHGs to verify the future trend. The second one is to elaborate on quota forecasts and adapt them to the emission forecasts previously made, to verify whether the NDC mitigation effects expected for 2030 and 2050 are achievable with the current Norwegian carbon offsetting policy. The section, related to policy alternatives, will be linked to this study as concretely as possible.

### Method

State space smoothing models (Hyndman et al., 2002, 2008) were fitted to the individual time series. The candidate models included five different additive-error models (no trend, additive trend, additive trend with damping, multiplicative trend, multiplicative trend with damping) and five different multiplicative-error models (no trend, additive trend, additive trend with damping, multiplicative trend, multiplicative trend with damping). For each individual time series, the best-fitting model was selected using the Akaike information criterion (AIC) as the model selection criterion. Based on the selected model, forecasts were generated for all years up to 2035.

### Results

Model architecture and parameter estimates of the best-fitting models for the individual GHG emission time series are shown in table 3.

**Table 3.** Model architecture and parameter estimates of best-fitting models.

| | $CO_2$ | HFK | $CH_4$ | $N_2O$ | PFK | $SF_6$ | GHG Total |
|---|---|---|---|---|---|---|---|
| *Model architecture* | | | | | | | |
| Error type | Multiplicative | Additive | Multiplicative | Additive | Additive | Multiplicative | Additive |
| Trend type | Additive | Multiplicative | Multiplicative | Additive | Additive | Additive | Additive |
| Damped | No | No | No | No | No | No | No |
| *Parameter estimates* | | | | | | | |
| $\alpha$ | 0.6272 | -1.4608 | 0.2637 | 1.0337 | 0.4667 | 0.4904 | 1.0618 |
| $\beta$ | -0.6824 | 2.5819 | -0.3793 | -0.8539 | -0.6161 | -0.6451 | -0.8949 |
| $l_0$ | 10.9216 | 1.8333 | 8.6950 | 8.37686 | 7.9747 | 8.6532 | 11.1482 |
| $b_0$ | -0.06 | 1.32 | 1.00 | -0.03 | 0.06 | -0.62 | -0.04 |

The visualisations in figure 9 show long-term emission forecasts for the six most important greenhouse gases, measured in terms of log kilotons $CO_2$-equivalent, based on the respective best-fitting model for each time series. Each visualisation shows the original series (line plot), the forecasts (blue line) and the forecast intervals (the blue shadow), covering the time window from 1990 to 2035.

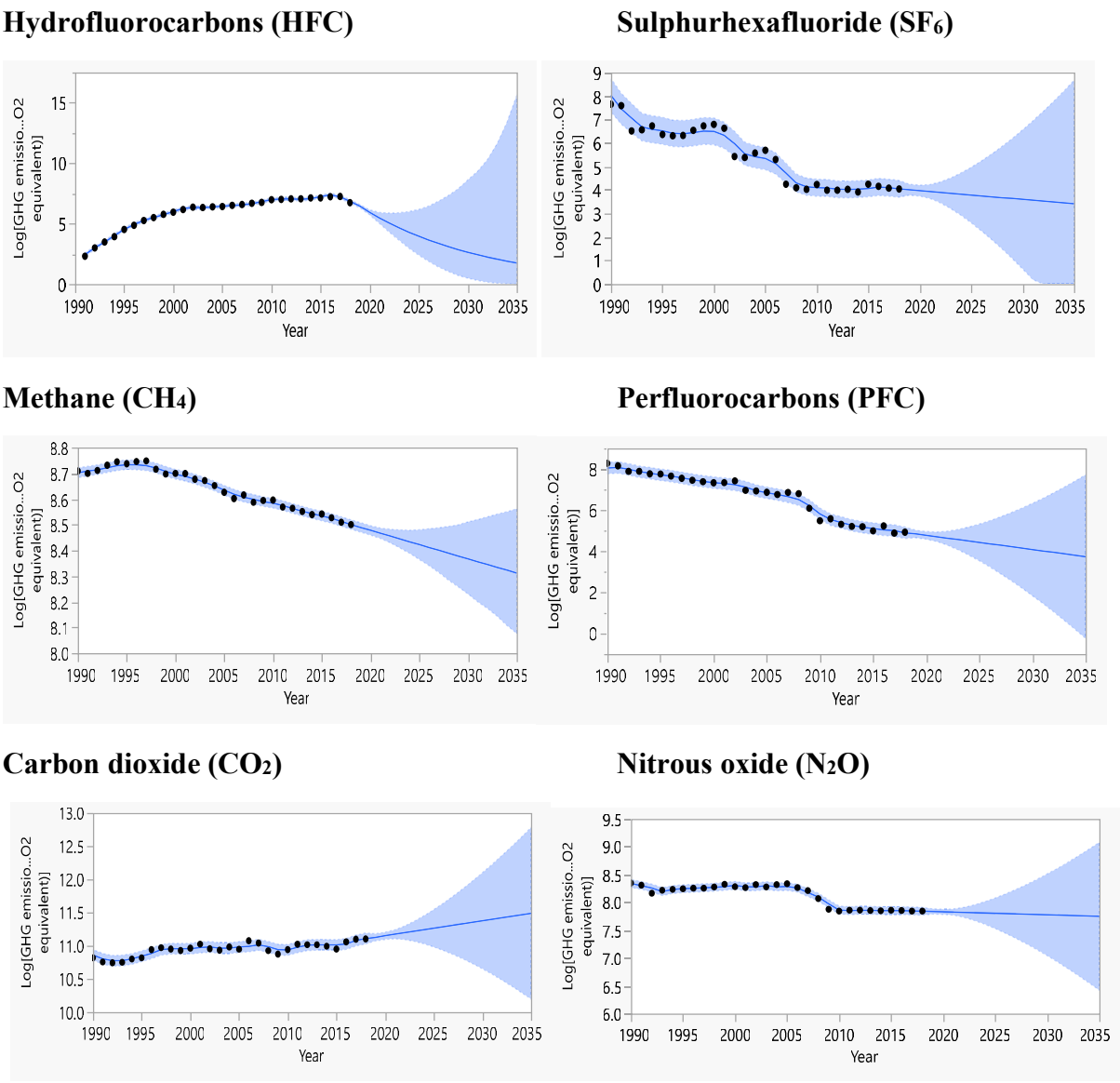


**Figure 9:** Long-term forecasts for Norwegian emission of the six most important greenhouse gases (measured in log kt $CO_2$-equivalent).

The fitted models of $CH_4$, HFK, PFK, and $SF_6$ have a downward trend. The strongest reduction applies to $CH_4$ and HFC with a decrease in the early 2000s for the methane and a

more recent decrease, 2018, for the hydrofluorocarbons. In this very same year, a moderate contraction is observed in PFC and $SF_6$. $CO_2$ and GHG total have an upward trend. Curiously, and especially during the same period, we witness an increase of $CO_2$ and GHG in total. The case of $N_2O$, which shows a stable linear trend, is unique. The fitted model of $N_2O$ shows a very interesting trend reversal that occurs in two different periods. In fact, the first clear change occurs around 2006 when the curve decreases sharply. The second one occurs in 2010 when the curve becomes stable.

The future trend related to six GHGs shows a slow, but constant increasing of GHGs until 2035 as the fitted model of GHGs total below demonstrates (Figure 10).

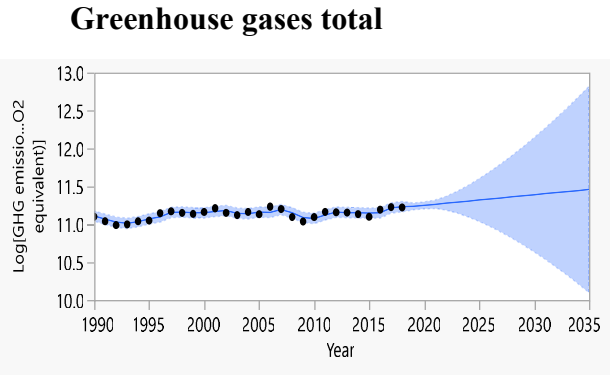


**Figure 10:** Future trend of GHGs total until 2035 (measured in log kt $CO_2$-equivalent).

**Elaboration of quota forecasts and their adaptation to emission forecasts**

The data utilized for generating quota forecasts are taken from EU Transaction Log (EUTL), modified last the 13th of August 2020 (EEA, 2020). The total amount of CERs sold in the ETS by Norway has been deducted from the total emissions and the result combined with the emission forecasts previously made.

Figure 11 shows the predicted amount of residual GHGs until 2035 and the relation between them and the Norwegian emission reduction targets for 2030 and 2050.

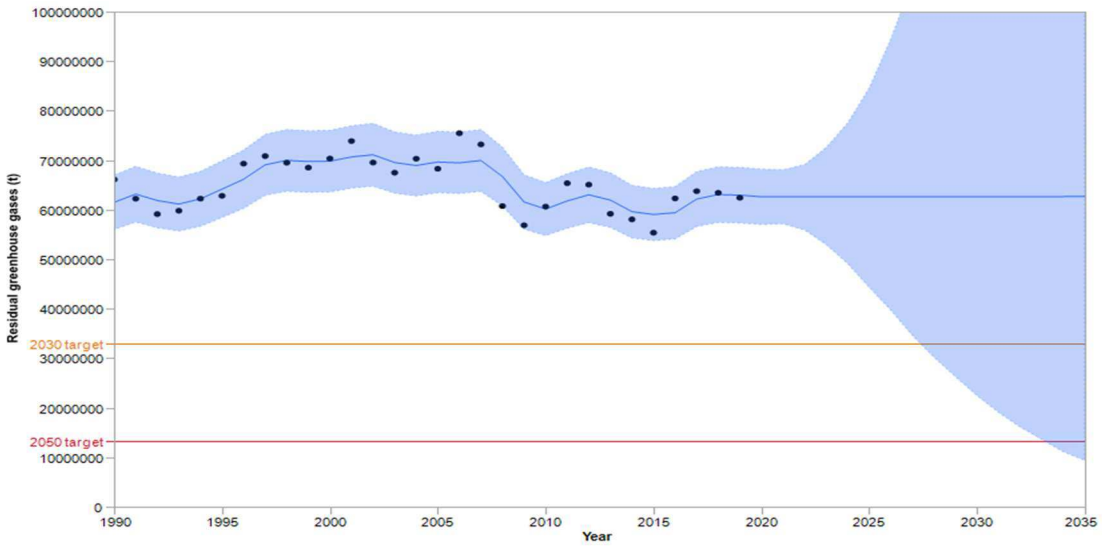


**Figure 11:** Predicted amount of residual GHGs until 2035 and their relationship with the Norwegian emission reduction targets for 2030 and 2050.

**Discussion**

According to the results obtained from Study 1, the level of GHGs appears stable over time. Since 1990, which is the base year for following the domestic emissions' progress, the measures adopted to decrease the emissions through carbon offsetting made it possible to stabilize the emissions. The blue line in figure 11 clearly shows that no increasing of GHGs has occurred since 1990 and that the future trend for the next years until 2035 is expected to be characterized by a stability of GHGs in terms of increasing.

However, the stability shown in figure 11 explains also that the emissions are not going to decrease until 2035. This is the main conclusion of study 1. It means that, if the current

regime continues unchallenged, both in terms of quotas percentages and emissions, despite the mechanisms that will be used in the Norwegian environmental policy, the emissions scenario will be stable.

According to the ETS units that have been shown in the database, obtained from the EUTL since the beginning of the second period of the Kyoto Protocol (see Table A.2) we witness an increase of 8 percentage points, which, except for slight fluctuations, existed until 2019. This trend appears to be consistent under the estimated residual greenhouse gases forecast needed to reach the 2030 and 2050 targets. In fact, the percentage of CERs reduction from ETS should be three times as much considering that the aim is to cut emissions by at least 50% in 2030 and reach climate neutrality in 2050.

This last conclusion from Study 1 lays the foundations for deepening the climate policy instruments Norway can adopt to accelerate the pace towards the achievement of the committed environmental targets. As mentioned above, even though the emission reductions accomplished go beyond the international climate goals, the Norwegian contribution to the emission reductions is still small. Considering the results of the elaboration of emission and quota forecasts, and the effort required to cover the climate needs in terms of emission reductions in Norway, it seems that the cost-effectiveness based proposals, presented in the paragraph related to alternative policy instruments, should be urgently and simultaneously adopted in the numbers they are today. Certainly, an overlapping of interventions is undesirable as they can result in unfocused actions and, eventually, delay the results. At the same time, a series of different operations can lead to more cost-efficient climate policies. Among scholars, the most debated ones are the use of climate clubs, supply-side policy, and R&D technology. Therefore, they will be further deepened in this section. For example, climate clubs, or coalitions of countries, could affect the relation between costs of mitigation and environmental benefits by making bigger grants, both, on supply-side and demand-side. This policy will reduce carbon leakage and abate global price changes through a cost-efficient approach, which applies to both policies.

On one hand, changes on the demand-side will reduce market prices; on the other hand, changes on the supply-side will increase them. In detail, a numerical analysis was conducted by Fæhn and colleagues since 2017 (Fæhn et al., 2017, p. 87a). They compared demand-, and supply side policies in Norway`s case with focus on the abatement options in the near future, such as the one happening in the year 2020. The analysis combines the findings to realize the optimal combination of demand and supply side policies. To sum up, although the uncertainties are rather large, it seems more likely that the marginal costs of supply side measures around

2020 lie below the curve shown in figure 12 referred to the marginal costs of foregone oil extraction in Norway (Adapted to Fæhn et al., 2017, p. 87a).

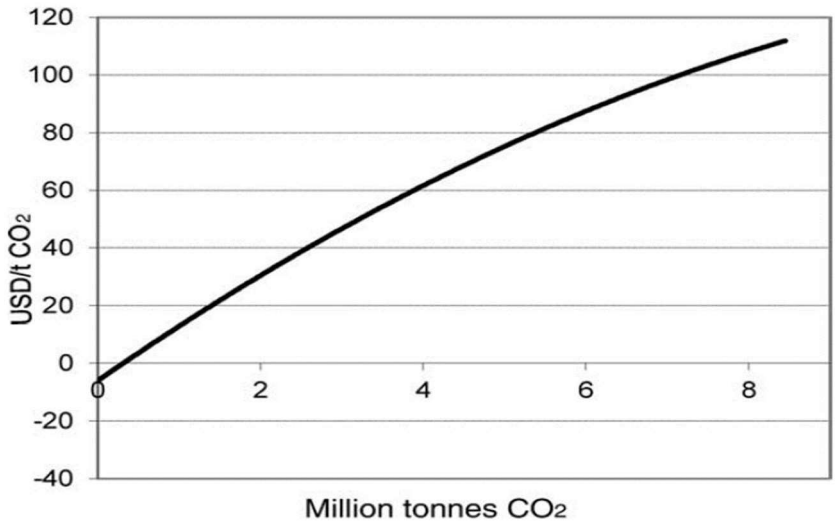


**Figure 12:** Marginal Costs of Foregone Oil Extraction in Norway.

In fact "measures should be implemented on the supply side, namely, by reducing Norwegian extraction of oil…the optimal combination of demand and supply side measures involves annual cuts in the Norwegian oil extraction of around 3.5 million Sm3 (around 3 per cent of current Norwegian oil production), and annual domestic reductions in $CO_2$ emissions of 2.5 million tonnes of $CO_2$ (almost 5 per cent of current Norwegian $CO_2$ emissions)" (Fæhn et al., 2017, p. 87b).

A benefit that a country's coalition could bring in the market of carbon offsetting is the high fossil fuel prices. In fact, fossil fuel prices are important in a policy, which wants to reduce emissions because the prices affect the investments in low-carbon R&D technologies. The higher the prices are, and expected to be so in the future, the more investments in low-carbon R&D technologies will probably be realized by all countries; this applies also to polluters that don`t cooperate within the coalition. Normally, if a coalition reduces its demand for fossil fuel, the world fuel prices decline at a time when the non-participating countries will be consumed more. The opposite is true if a coalition narrows its supply of fossil fuel, then the non-participants increase their supply. However, if both demand- and supply side policy change, prices of fossil fuels will increase, the consumption decrease, and green technologies are supposed to be the choice for reducing emissions at a low cost.

**Preliminary conclusion**

The main conclusion of study 1 shows that the future trend of emissions is stable and in line with the emissions that have occurred since 1990. At this outcome, there follows the result of the elaboration of quota forecasts and their adaptation to emission forecasts. They prove that Norway should triple the percentage of CERs reduction from ETS to accomplish the green targets. The combination of alternative climate policies as climate clubs, supply-side policy and R&D are thought of as some of the best policies, although the trend shown above, can be reversed.

## Study 2: Is carbon offsetting the right choice? An environmental-ethical assessment

A qualitative study was conducted in order to evaluate an environmental-ethical assessment of the Norwegian choice of carbon offsetting through an analysis of six interviews. The study was not intended to be a systematic analysis, but it was meant to utilize the interviews to get qualitative insights into different perceptions on the key concepts, which are used to map policy decisions.

### Method

The approach utilized consisted of individual face-to-face interviews, and online interviews that were conducted through different platforms (Skype, Zoom, Teams, etcetera…). The transcriptions of the interviews were made through Trint, a high-quality software for transcriptions of academic materials. Then, they were coded according to the selected key concept. The work was developed in three steps: these are the three steps.

1. Research design: interview guide
2. Selection criteria: respondents and key concepts or domains
3. Analysis and condensation

Responses that did not fit in any of the categories were ignored, and therefore, they were not used for further analysis. However, each of the different categories revealed links to other relevant aspects, for example, environmental integrity, additionality, NDC, article 6 of the Paris agreement, and technological developments. These helped to understand the role that Norway could play, both in the global reduction framework and in meeting national reduction goals.

Overall, the questions stimulated a vivid and heterogenic discussion about the choice of offsetting seen from different perspectives, and very different viewpoints came to light, all based on the interviewee's background.

**Research design: interview guide**

The interview guide was divided into three general parts: introduction, main part, and conclusion.

The open structure of the research design made it possible to start with general questions and then continue following the interviewees premises. The general questions were structured in such a way that it was possible to have the necessary elasticity to open to new and interesting comments on the topic. The purpose of the semi-structured form was to build a natural conversation around the topic and make it easier for the informant to give a clear picture of his or her opinion. In this way, aspects that the interviewee believed to be important could be highlighted.

In the first part of the interview, an open technique was used. Each interview began with an icebreaker question, which allowed the participants to deepen the conversation. The interviews lasted from 20 min to 1 hour and 10 min and audio recordings were taken of each interview. Before the interview, the experts received a written description regarding the purpose of the study and some questions that were prepared keeping in mind the different areas of expertise of those who were interviewed.

**Selection Criteria: respondents and key concepts**.

The interview guide was built on key concepts concerning the three-dimensional character of the study (legislative, economic, and ethical), and on the curricula of the interviewees.

Regarding the latter, altogether six experts participated in the study. The interview period lasted throughout several months, from March 2020 to October 2020, and involved environmentalists (Greenpeace), representatives of the private sector (Equinor, NHO), representatives of the public sector (Norwegian Environment Agency, Department of Climate and Environment), academics from different Universities, in Norway and abroad. A list of the interviewees can be found in the appendix ("Key Informants").

The key concepts that were used as guidelines for the interviews were chosen so that the interviewees could express their point of view from both a broad and a more general position, but also allowed a deeper response to the topics when needed. The focus during the interviews was on three main domains:

1. Sustainability.

2. Ethics.

3. Economics.

Transcript coding of these three different domains was carried out using the following keywords:

- Domain sustainability: sustainable, sustainable development.
- Domain ethics: ethical, fair, unfair, distributional effect, poverty, moral.
- Domain economics: money, cost, finance, efficiency, effectiveness, efficient.

**Analysis**

The analysis of the statements consisted in the transcription of the interviews and coding of the different points of view expressed by the interviewees on the various issues (Kvale et al., 2010). Each transcript interview was reviewed, and comments and reflections on the three key concepts were first highlighted and later on compared. The interchangeability of the three dimensions that characterizes the approach of this study came out very clearly and brought out a deeper meaning in the data material (Johannessen et al., 2011).

**Results**

Overall, the participants demonstrated a variety of responses, but also showed some common traits despite their different backgrounds.

*First domain: sustainability*

An equal access to justice derived from solidarity between states, is based, among other things, on cooperation. These are the political and ethical roots of sustainability, which should be applied, when referring to the emission reduction policy of climate change issue. The criticisms levelled at carbon offsetting as an efficient emission reduction policy instrument, show that the structure this tool lays on is permeated of multiples variables and scientific uncertainties.

The integrity of the emissions reduction process was questioned by the environmentalist taking part in this study. He queried whether the basic principles on which the entire carbon offsetting structure lies were sufficient:

> "In principle, if the cap was low, was tight enough, this could be a good approach in line with common but differentiated responsibilities and could achieve the overall sustainability. Because the targets of the overall cap have never been remotely close to what is needed to achieve sustainability and sufficient emission reduction globally, and because most activities inside the carbon markets are both on the supply-, demand-side and have been more interested in cheap credits and green reductions, the whole system has very little integrity left."

The root of these criticisms can be linked to the lack of assertiveness by the developed countries and their unwillingness to embrace the principle of sustainability in ethical and economic terms (UNFCCC, 2015c goal 35). This issue was also raised by the two academics interviewed, as illustrations of the missing link between the quota system and the implementation of the principle of sustainability. Both experiences show a clear split between the concept of sustainability and the concretization of its content. The first commented:

> "All criticisms to the system were precisely related to the carbon market operating outside these principles".

While the second affirmed:

> "I think when we talk about sustainability, we have always three aspects: social, environmental and economic issues. The trading system is an economic construction trying to optimize the economic efficiency. It has very little to do where it comes to distributional effects."

The responses provided illustrated different perspectives on the political approach towards the use of carbon offsetting. However, recognising the operationality of the trading system, in these terms, means to introduce the need, above all, from a political point of view, to review the trading process. While the environmentalist and the academics found it difficult to see the repercussions in the carbon offsetting system as sustainable, and found it not in line

with the democratic characteristics expressed from a legislative point of view, the representative of the public sector highlighted:

> "We pay attention to making a sustainable lasting economic impact, we work on the policy level trying to change the policy structure, the economies in the countries where we are involved. This is much more ambitious than the goals in the Kyoto Protocol...the two conditions, namely, sustainable development and emission reduction (Marrakech agreement) are fundamental when accords are formulated under the penalty of cancellation. The co-benefits are, therefore, an important part of the projects that are realized under the CMD umbrella, as the Norwegian CCPPs are. We make a difference in terms of emission reduction as documented through this system".

At first glance, one might perceive the intervention of the representative of the public sector as disconnected from the implementation difficulties that revolve around the applicability of the principle of sustainability in the trading system previously mentioned. However, it should be stressed that when he was asked to describe the long-term risk of the interventions through projects carried out through CDM, he expressed a quite direct and clear judgment:

> "The risk is that the mitigation measures are not permanent, we monitor during the period of the project, after that is impossible to know".

Finally, the representative of the private sector showed a more optimistic and determined point of view, recognising the central role that the private sector has in finding new solutions through innovation, and the development of new projects with the aim of abating emissions both nationally and globally. This showed a willingness to deal with the topic from a more general political level and what the private Norwegian sector is trying to achieve, and how, in relation to emission reduction. The outcome was an extremely positive view of the enormous capabilities to contribute technically, and of the commitment that the Norwegian private sector can put into practice:

> "We take it very seriously. Norway is pushing very hard to have these plans realized: carbon storage in the North Sea, emissions from the cement industry, landfill (burning garbage), so, with transportation mechanisms, infrastructures, all are 25 billion crowns. I mean, it should be done now. That can help to reduce emissions from other countries and at home, but it means also testing this technology so that it can be exported and copied. Hydrogen is also a market that can contribute to the cut and strategically to the growth of Norwegian businesses. It could be a way to separate the country from oil and gas, there still is a transition from coal, but in the end, we will have green energy. My prognosis is that we can have green and blue hydrogen (a new project in England produces hydrogen from natural gas, they hope they can convince Europe about the cost-effectiveness of the project) from natural gas through carbon capture and storage. The roadmap gives us the strategic direction and license to operate, which is, you know, reaching sustainability and climate goals."

Perhaps one could expect a more active role from the private sector regarding taking national initiatives or having a more critical view about Norway's use of carbon offsetting, but, once again, the representative of the private sector commented:

> "We support the approach that the government has within the system, the way that it works…. These are global challenges, and we need to work internationally to solve them. So, we need to be part of an international framework to do that. ut at the same time, obviously, we need to work nationally with this, and obviously, we also have huge sectors that are not part of the quota program, but we have officially supported those goals. It is extremely ambitious, and it is like a huge menu where you have to eat everything. You cannot just pick and choose. You must do everything, because if not, we are just not going to cheap in.

*Second domain: Ethics.*

Interviewees alluded to a variety of different ethical issues. One of the academics who works with Integrated Assessment Models (AIMs) suggested that the ethical component in climate change policy be at the very core of the intervention:

> "The ethical component in climate change policy is present now more than ever. AIMs models have a strong ethical component and one can use the AIM to game it out… Climate-economy models as IAMs help to understand how to balance the externalities caused by climate change and the costs of measures we use to limit these externalities. It is important to find the right way to balance these aspects if we are to find the social optimum. The AIM models are not in use in the CDM, not explicitly, not in an upfront way. The usefulness of AIMs depends on the institutional environment and this can change, so you can have the perfectly good model and then the politics change somehow, and you cannot really use the models, even if you have it. The models will never work on the inspiration and example targets they have in a meaningful way, in the way negotiations would."

Procedural flaws, political negotiations, procedures, and strategies of the environmental administration are all factors that mathematics models cannot consider when trying to map out the right climate policy. The moral and inspiration aspects, which are an integral part of the international and national principles on which environmental legislation is based, places emphasis on the political will to determinate the best climate policy to follow. The debate around the role played by Norway in the international context as an oil exporter could be used to reinforce the Southern countries` perspective about the unfair effects of carbon trading. When asked about this, the position of a representative of the public sector was very clear:

> "It is ethical and fair to buy CERs from the developing countries to abate $CO_2$ emissions in Norway. What we can do abroad can be an addition to what we do here, as it has been proven to be the case".

The above-mentioned reply can be contrasted, somewhat, with the previous reply of the interviewee about the attempts made to work on a political level in the countries that accept to buy CERs from Norway. The difficulties, which concern the trading system, was also raised by one of the academics:

> "Of course, it has distribution effects and there is an ethical issue, and it could be also an environmental issue because it will have different effects in different countries at a different welfare level meaning, also social effects."

The representative of the private sector (Equinor) was vaguer when asked about distributional effects:

> "Funds are allocated to support communities and societies abroad through, for example, education, art projects and programs in different countries, such as Brazil and Afghanistan".

Fairness, distributional and ethical justice linked to the ET, are increasingly under the spotlights of both private and public sectors, and it would appear from interviews that there is a profound reflection on how to improve Norwegian climate policy with respect to national and international socio-economic needs. However, responses suggest discrepancy in the perception of the urgency of trying new approaches. The need to rethink ethically the emission reduction system and the challenges of conversion of environmental values to a monetary value are at the core of political choices. Recognizing that Norwegian politicians, and the public and private sectors could do more is a start, but it is not sufficient to meet the social unbalance caused by carbon offsetting. As the environmentalist stated:

> "Nobody should be compensated or allowed to emit more just because they do their share of the international fight against climate change, I think is unethical...Every country should do more about their own emissions, investments and trade, and also should help others so that they can also take part in the global effort. I think that it is also logical that within the common but differentiated responsibilities principle for rich countries like Norway, which have based their welfare system on oil exportation, to do more both domestically and abroad through international cooperation to reduce emissions as much as possible. The logic of using carbon markets to postpone your own domestic reductions is flat".

A similar opinion, on the ethical dimension of carbon offsetting, was expressed by one of the academics:

> "CDM has proven to be quite bad for poverty, in fact, the carbon trading system, even the European one, with the new discussion on article six needs to be substantially modified and reformed because it has not proven to be an efficient solution to poverty, and it was not really meant to be an efficient solution to poverty".

She concluded:

> "So, to me, all this is about the receiving country, and for now this has been designed to benefit companies not necessarily the recipient, and that is why poverty alleviation mechanisms have been so far removed from the reality of poor people's lives. I think Norway should take responsibility for paying gas emissions by stopping oil production, it is what Norway needs to simply recognize because we need to, sort of, fade away from the oil industry and maybe leave more space to domestic emissions".

The difficulty to quantify the correct contribution that Norway should make, in order to meet its effort sharing commitment, was also stressed by the economist:

> "There are other countries that are well behind the targets they should reach, such as China and middle-income countries, and many other countries that do not put up any efforts at all."

*Third domain: Effectiveness.*

The last domain concerns the effectiveness linked to the ET in general and, more specifically, the Norwegian carbon offsetting approach. All the participants in the interviews, including the academic who works with the AIMs, stressed the importance of that effectiveness:

> "Cost-effectiveness is at the core of the economic strategic decisions."

Talking about AIMs, he added:

> "Decision makers demand control and evaluative mechanisms before adopting a climate policy. Often the result is an impasse."

In general, the interviewees showed not just their opinions around the efficiency of the current Norwegian environmental policy, but also shared their views about future political decisions that can make a difference, environmentally speaking. The oil and gas sector were

often mentioned as a starting point from where it will be possible to move toward other alternatives that make up more efficient climate policies.

An acknowledgment of the cost-effectiveness as an aspect that needs to be optimized is detected in comments made both by the representatives of the private and public sectors. However, differences between the interventions can be underlined. On one hand, the positive view around the successful recipe of the Norwegian carbon offsetting, rooted in the current political choices, is shown through data referred to by the representative of the private sector.

> "The EU system is very efficient when it comes to reducing emissions; it has reduced the cap by 1.72% each year and it is predicted that as of 2021the emissions will be reduced by 2.2% each year."

On the other hand, the Norwegian private sector seemed to be more interested in facing the challenges that the market offers through an eventual more cost-effectiveness-based approach in their projects and programs.

> "Companies should be open to a shift in model because it is not possible to count on the oil sector in the future. The future will see the private sector committed to working with cost-effectiveness more intensely. Those oil and gas producers that stay on the side-lines and resist a bigger shift in model may find they have missed the boat later on."

> "Diversification and investments are the key words the private sector should have focus on to reach the climate goals through their businesses. The way towards sustainability has, as a starting point, the market mechanisms, the cost-efficiency competitions, which are the means that we will all resort to in order to reach it….It is important to consider innovation and the development of new projects, but also a radical change in the way we operate if we want to lead the way, strategically, to the growth of the Norwegian businesses. Carbon capture and storage could be the solution to having green energy and lead the transition, both from coal and oil. We can have green and blue hydrogen from natural gas through carbon capture and storage, a new project, H2H Saltend, in

England aims at producing hydrogen from natural gas. The hope is to convince Europe about the cost-effectiveness of the project".

At the same time, cost-effectiveness politics would not be reliable without the obligation for everyone to pay for externalities according to one of the academics:

"All companies must pay for the externalities they cause, or they will continue to deliver to the market in a cheaper way. Companies have to put climate change at the core of their risk management".

What the political priorities are, and what is practically feasible will determinate the future of the Norwegian climate policies. The public sector reinforced the Norwegian demand-side policy as shown by the following data (Table 4 adapted from an e-mail from the public representative) which affirm that, to date, the use of the CCPP is increasing the CERs delivery, demonstrating that this kind of policy is aimed at reducing emission abroad.

**Table 4:** Increasing CERs delivery through the CCPP from 2014 to 2019.

| Year | Amount of CERs |
|---|---|
| 2014 | 57 460 |
| 2015 | 4 997 649 |
| 2016 | 4 267 389 |
| 2017 | 4 373 499 |
| 2018 | 5 487 939 |
| 2019 | 6 868 976 |

The efficiency of several kind of climate polices were commented by some of respondents. Climate clubs, supply-side policy, and research and development were among the most shared alternatives even if the experts acknowledged the difficulties connected to the choice of the very best climate policy for the country in relation also to the effects a radical change could have on other countries' economies. The way politics is implemented in different countries must also be considered when talking of effort sharing and responsibilities in the carbon-offsetting framework.

The economist was not sure that climate clubs could be a good climate policy for Norway since the countries that would eventually be involved, the Nordics, are maybe not big enough. He showed more enthusiasm about the necessity to subsidize RD&D, especially generating green RD&D packages, and a moderate supply-side policy:

> "It is important because in Norway we are exporting a lot of emissions, and it depends on how extensive the supply policies are. Having a moderate reduction in extraction and not developing more fields will have a greater impact than exporting less missions. I think a moderate supply-side policy will not have a big economic impact on Norway, but this implies implementing high enough $CO_2$ prices, at least, in all sectors, and I think it is politically difficult."

A shift toward a supply-side policy in Norway was seen positively also by one of the academics:

> "Reconnecting to the impact that Covid-19 has also had in the Norwegian economic dimension in the short-term, we have to think that, right now, we are polluting less than ever. The long-term effect is that we will stop looking for more oil. Now, we are given tax reliefs because long-term expectations are lower than they used to be, and we need subsidies from the state in order to continue drillin but this is not a good policy for the environment. In fact, cutting all the costs for these projects will make the exploration projects more economically feasible and then, they will explore and find more oil. On the contrary, we should impose higher taxes, increase green renting, which means that the companies and the state also have to pay for the fact that the oil resource is a common property that they privatize. I think it's necessary to have a supply-side policy."

My perception is that most of the interviewees share the view that the cap and trade policy in the carbon market is just one among the solutions available and it cannot be the main policy instrument. The carbon market is not properly integrated into the existing development plans of developing countries and this global mechanism is only a part of an integrated environmental strategy. As one of the academics mentioned:

> "I don`t think we have a real market mechanism right now, but bits and pieces of the mechanism that should be combined along with mitigation strategies and adaptation to climate change, integrated into development trajectories if we want it to be efficient".

**Preliminary conclusions**

The legitimacy of political negotiations as the base that leads to environmental decisions, forces the political authority to face, ontologically speaking, the social-ecological parallelism that literature on carbon offsetting had treated since 1970s (Laal, 2009b p. 1). How and to what extent ethics has been used as a tool to guarantee the adequacy of political decisions is still not clear.

A broad awareness of the limitations of carbon offsetting concerns the failure to carry out harmoniously developing the dimensions on which it rests and is called to operate, even if in principle, the intent for which the system was created, is perceived as genuine. The need to increase the focus on cost-effectiveness within the Norwegian climate policy emerges as the supply-side policy meant as one of the most cited alternative climate policies at national level. In fact, many of the interviewees do not see the reason for postponing a clear distance from extraction and export of oil, the first source of national livelihood, especially now that the climate crisis requires courageous actions in terms of measures and timing.

## Discussion

The quantitative and qualitative analyses reported in this thesis aimed to probe the convenience of the Norwegian carbon offsetting policy, from an environmental point of view.

Firstly, an elaboration of emissions and quota forecasts were made to demonstrate the real possibility of achieving the green targets in relation to the current Norwegian NDCs.

Secondly, the feedback obtained from six interviews conducted with experts gave the possibility to come up with an environmental-ethical assessment based on the perceptions of the key concepts related to carbon offsetting as a climate strategy aimed at abating emissions.

Working out the data gathered in the qualitative and quantitative surveys, keeping in mind the literature review related to the legislative, ethical, and economic parts, some major findings can be shown here.

Based on the first study, it can be said that the Norwegian efforts to achieve the NDCs targets within the European climate policy, should be three times larger than the current ones. In fact, in line with the results shown in figure 11, the gap between the 2030 and 2050 targets and the residual GHGs is impossible to be covered with the current Norwegian green policy.

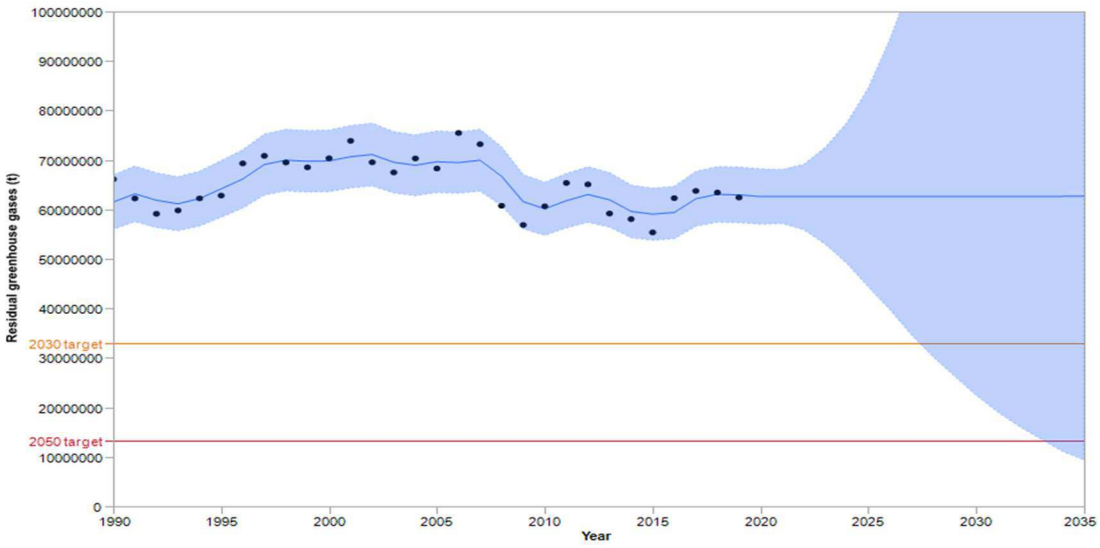


**Figure 11:** Amount of residual GHGs until 2035 and the relation between them and the Norwegian emission reduction targets for 2030 and 2050.

The emissions reduction view, based on the overseas cut of GHGs, has been expressed by the Norwegian government in several documents, such as the Meld. St. 41 Norway's Climate

Strategy for 2030: A Transformational Approach within a European Cooperation Framework (Ministry of Climate and Environment 2016-2017b, p. 111) and the update of Norway's nationally determined contribution (Ministry of Climate and Environment 2020a, b). These statements demonstrate the conditionality to flexible mechanisms and the will to exclude the LULUCF from the strategy used by the government to achieve the targets.

Norwegian policy decision-makers have had also to deal with ethical dilemmas that can influence the use of carbon offsetting in Norway. The results of the ethical-environmental assessment reveled that academics, environmentalists, and both private and public representatives are aware of the vital importance of the three-dimensional structure that moves around the choice of carbon offsetting. Mapping the awareness and the impressions of experts around the CCPP and carbon offsetting through the qualitative study, unveiled the common feeling that the Norwegian society is ready to embrace changes in the national and international climate framework. Political negotiations are the premises for a change towards a more supply-side policy. This is the main finding in study 2 alongside the positivity, consciousness and urgency expressed by the interviewees to do so.

Legislatively speaking, Norway started implementing its commitment internationally in the early `00s based on the same principles on which the Paris agreement is built up, namely, e.g. the precautionary principle and the common but differentiated responsibilities principle (Prime Minister of Norway, 2004b, p. 19-21). Nevertheless, the CCPP and CDM mechanisms have been heavily criticized for the distributional effect on the South. Shifting the accountability for the climate change impact, profiting from it, and the demonstrated insufficient effectiveness of obtaining the expected results in terms of GHG reductions, especially now that the goals have become more ambitious (February 2020), are the main reasons why the Norwegian carbon offsetting approach had been criticized. Hence, the need to develop alternative climate policies with focus on cost-effectiveness, as underlined by most of the interviewees.

I think that this thesis achieved its purpose and was faithful to the research expectations expressed in the objectives. The topic of the Norwegian CCPP and, more specifically, the use of carbon offsetting, turned out to be somewhat a puzzle that needed to be examined from all three above-mentioned aspects. The results of study 1 and 2 are consistent with the knowledge published in recent literature on the subject. The analysis shown by Fæhn and colleagues (2017) with regard to the combination of supply-side and demand-side policies is numerically demonstrated (figure 12) to be a valid alternative policy instrument (Fæhn et al., p. 87a).

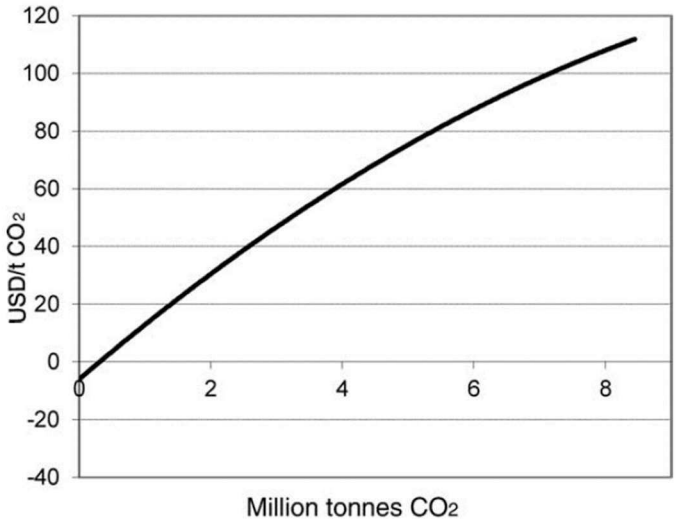


**Figure 12:** Marginal Costs of Foregone Oil Extraction in Norway.

Moreover, I believe that these results are significant in the way they can influence our common understanding of the Norwegian offsetting approach, as well as some issues and limitations I struggled with during my research.

From a legislative point of view, the difficulty of having a general overview of the enormous amount of laws and regulations that have come and gone since the Kyoto treaty on both international, national and local level (national and local level with respect to Norway). In my opinion, the genuine effort put up by the Norwegian government and its representatives to obtain guidelines in different sectors and at different levels, has turned into a jungle that, at times, proves to be counterproductive to the very aims of reducing emissions, creating overlapping, difficulties in control verification and coordination.

From an economic point of view, the difficulty lay in finding models that had at their core the broad acceptance of the link between economics and ethics. As already mentioned, the linkage between climate change and the ethical dimension from a legislative point of view had been recognized decades ago. Despite this, many mathematical and economic models continue to be developed with the aim to identifying the best economic strategy, and therefore, the best political approach to phasing out GHGs without including concrete ethical parameters for evaluation. Exceptions such as the Kantian optimization (Roamer, 2013), the GDR (Kartha S.) and the proposal to calculate the economic value of the ecosystem service (Norwegian Government, 2013) could be found in literature.

All considered, the limitations and issues I was faced with during this thesis did not affect the validity of the results. On the contrary, through them I had the opportunity to deepen the critical issues mentioned above.

## Conclusions and recommendations

Putting everything into perspective, I discreetly offer three recommendations considering that the offset era post 2020 will provide the possibility to think over the priorities and criteria of cutting GHGs internationally.

My first recommendation is a practical suggestion within international relationships between Norway and LDCs-, developing countries. I recommend that Norway contribute to the monitoring and improvement of the installations even after the conclusion of the projects. This is essential for assessing the real success of the projects, both in terms of emission reductions and impact on the societies that live and work in the areas interested by the projects. Through sharing of R&D technology Norway can make a difference in LDCs and developing countries that will be more and more able to follow-up the reduction process independently. A deal that consists in biennial or triennial evaluations between these countries and Norway can be made with the aim to assess the reductions obtained and the social response.

The second recommendation is of a purely national character. It is of vital importance, from my point of view, to fill the existing gap regarding the lack of a long-term plan that sees Norway more striving to develop green energy and therefore to become less dependent from oil. Political will is needed here. The requirement is to get agreements that turn the legislative efforts into actions. I think this thesis has, in a limited, but in a genuine way, shown the possibility that alternative solutions can replace the actual green policy, and that the Norwegian society is positive about change. How can everyone contribute to this political change? By voting. Politicians have to feel the pressure from the people, and a clear message needs to be sent to them about the direction which needs to be followed. Tangible actions, such as petitions or social media campaigns, are also a way of putting pressure to governments. Strong leadership is required to make decisions to go into unexplored areas. It would be interesting to investigate upstream steps taken by the Norwegian government in this direction, especially now that a new chapter in the history of carbon offsetting is emerging and that the next Norwegian parliamentary election will take place on 13 September 2021.

The last of my endorsements considers the importance of having local approaches. $CO_2$ emission reductions is a global problem, which requires an international approach as well as a local-based one. Community-based approaches are essential to creating a sustainable and successful society. If people in need are empowered, it is my belief that they will participate with their own solutions. Why not directly support the innovators who, as insiders, know well

their community problems, instead of turning to governments? Both the private and public sectors of the developed countries can do that, and both can put pressure on the local utilities to be more progressive and stimulate local workers to be part of the emission reductions. If the governments of the developed countries recognize the potential of the local communities, for example, by offering loans and creating the right micro-market conditions, each citizen can be a cog in the machine and a piece of the change we are looking for. Raising awareness of the importance of the contribution towards achieving a global sustainable growth, as well as the significance of the direct efforts made by citizens at all levels, are the key to reaching the green targets.

## Concluding remarks

The ethical, economic, and legislative dimensions of climate change are open to the question whether, from an environmental point of view, carbon offsetting is the best solution for Norway. This thesis analyzed and assessed this statement.

Norway is known as a green nation for the efforts made in supporting LDCs and developing countries through several funds and CDMs projects, but it is dependent on oil, which its wealth is based on. Special attention in this dissertation is paid to the CCPP, the program that has been used by Norway to offset CERs since 2007.

In the first part of my thesis, a review about the three dimensions on which carbon offsetting and, therefore, the CCPP rests, was carried out with the aim of understanding in depth the connections between the three dimensions and the approach taken by the Norwegian government at a national and international level. To summarize, the Norwegian government is in line with the EU legislative expectations, but issues come to the surface when attempting to compute the national reductions contributions. Norway has to focus on efficiency and plan a detailed alternative strategy both at a national and international level, which has set more independence from oil production. In addition, Norway has to deal with the green paradox. This can be done by helping developing countries, both financially and through the transfer of technical and technological knowledge, with the aim of making these countries more independent and giving them a central role in carbon offsetting.

The second part of this thesis, studies 1 and 2, offers an elaboration of the statement in quantitative and qualitative terms.

Carbon offsetting will not be the right instrument for achieving the Norwegian commitments for 2030 and 2050. Efficiency, as well as a more extensive use of supply-side policy, are considered the keys to the success of the Norwegian green goals. The economic dependence on oil puts Norway at the centre of a green paradox where principles, such as equity and common but differential capabilities, contrast with the profit derived from offsetting. A change is desirable, and the experts interviewed are positive that these changes will happen now. The urge to reach the climate targets exposes Norwegian policy makers and it will make rethink about the use of carbon offsetting as one among many others policy instruments to be adopted. In addition, the thrust, especially from the private sector, and the increasing individual awareness of the Norwegian citizens, are the key to building a new emission reduction approach.

My last thought is a very pragmatic one: the Norwegian society is waiting for a clear answer from the political establishment. Therefore, will policymakers avail themselves of the opportunity and take decisions on what the country wants to stand for? Will they go beyond the financial approach or will they continue to be exposed to the oil sector?

This will be a historical, and unique political decision.

## Acknowledgment

I would like to thank fully the people who helped me throughout the writing of this thesis. I`m grateful to my supervisors Prof. Joachim Scholderer, School of Economics and Business, Dr. Rosa Manzo, Department of Public and International Law, and Prof. Deborah Outghon, Faculty of Environmental Science and Nature Management, for providing indispensable guidance and motivation.

Warm thanks go out to my family and friends for being understanding and supportive along the way.

Gratitude goes to all my interviewees who agreed to participate in this project and generously shared their opinions and thoughts with me.

All errors or misjudgements are my own responsibility.

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## Appendix

**Table A.1:** Crediting Period Renewal Request

| | |
|---|---|
| **Project** | 0171: Caieiras landfill gas emission reduction<br><br>- (4633 KB) (**approved** - - 28 Aug 2018 - view previous)<br>- crediting period renewal form (233 KB) (4633 KB) (**approved** - - 28 Aug 2018 - view previous)<br>- crediting period renewal form (233 KB) |
| **Methodologies Used** | ACM0001 ver. 13 - Flaring or use of landfill gas |
| **VVS Version** | |
| **Standardized baselines used** | N/A |
| **Amount of Reductions** | 1,213,522 metric tonnes CO2 equivalent per annum |
| **Validation Opinion** | Validation opinion (1133 KB)<br>Validation opinion on post-registration changes (1465 KB) |
| **Renewal Date** | 13 Dec 13 (view history) |
| **Crediting Period (requested for renewal)** | 13 Dec 13 - 30 Mar 20<br><br>Other crediting period(s): 31 Mar 06 - 30 Mar 13 |
| **Requests for Issuance and related documentation** | **Monitoring report**: 13 Dec 2013 - 12 Jun 2014 (1130 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 252412<br>**Serial Range**: Block start: BR-5-106754640-2-2-0-171 Block end: BR-5-107007051-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 13 Jun 2014 - 31 Dec 2014 (1317 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 360815<br>**Serial Range**: Block start: BR-5-103890692-2-2-0-171 Block end: BR-5-104251506-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jan 2015 - 15 May 2015 (1493 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 158131 |

| | |
|---|---|
| | **Serial Range**: Block start: BR-5-107007052-2-2-0-171 Block end: BR-5-107165182-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 16 May 2015 - 31 Dec 2015 (1385 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 374022<br>**Serial Range**: Block start: BR-5-116175078-2-2-0-171 Block end: BR-5-116549099-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jan 2016 - 30 Jun 2016 (1344 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 328135<br>**Serial Range**: Block start: BR-5-122740537-2-2-0-171 Block end: BR-5-123068671-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jul 2016 - 31 Dec 2016 (2138 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 452186<br>**Serial Range**: Block start: BR-5-143268913-2-2-0-171 Block end: BR-5-143721098-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jan 2017 - 30 Jun 2017 (2099 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 582996<br>**Serial Range**: Block start: BR-5-143721099-2-2-0-171 Block end: BR-5-144304094-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jul 2017 - 31 Dec 2017 (1991 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 520354<br>**Serial Range**: Block start: BR-5-144787654-2-2-0-171 Block end: BR-5-145308007-2-2-0-171<br>[Full view and history] |

| | |
|---|---|
| | **Monitoring report**: 01 Jan 2018 - 30 Jun 2018 (1993 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 482388<br>**Serial Range**: Block start: BR-5-145370943-2-2-0-171 Block end: BR-5-145853330-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jul 2018 - 31 Dec 2018 (1755 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 482335<br>**Serial Range**: Block start: BR-5-149377511-2-2-0-171 Block end: BR-5-149859845-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jan 2019 - 30 Jun 2019 (1809 KB)<br>**Issuance request state**: Issued<br>**CERs requested from 01 Jan 2013**: 616997<br>**Serial Range**: Block start: BR-5-152379733-2-2-0-171 Block end: BR-5-152996729-2-2-0-171<br>[Full view and history]<br><br>**Monitoring report**: 01 Jul 2019 - 31 Dec 2019 (2042 KB)<br>**Issuance request state**: Awaiting issuance request<br>[Full view and history] |

**Table A.2** Total amount of CERs sold in the ETS by Norway.

| Year | Placeholder | | | Forecast | | | | Target | |
|---|---|---|---|---|---|---|---|---|---|
| | Greenhouse gases total (1000 t) | ETS units surrendered (1000 t) | Reduction from ETS % | Residual greenhouse gases (1000 t) | Greenhouse gases total (1000 t) | ETS units surrendered (1000 t) | Residual greenhouse gases (1000 t) | 2030 (1000 t) | 2050 (1000 t) |
| **1990** | 66136 | | 0,00 % | 66136 | | | | 33068 | 13227 |
| **1991** | 62249 | | 0,00 % | 62249 | | | | 33068 | 13227 |
| **1992** | 59142 | | 0,00 % | 59142 | | | | 33068 | 13227 |
| **1993** | 59815 | | 0,00 % | 59815 | | | | 33068 | 13227 |
| **1994** | 62254 | | 0,00 % | 62254 | | | | 33068 | 13227 |
| **1995** | 62821 | | 0,00 % | 62821 | | | | 33068 | 13227 |
| **1996** | 69324 | | 0,00 % | 69324 | | | | 33068 | 13227 |
| **1997** | 70854 | | 0,00 % | 70854 | | | | 33068 | 13227 |
| **1998** | 69516 | | 0,00 % | 69516 | | | | 33068 | 13227 |
| **1999** | 68527 | | 0,00 % | 68527 | | | | 33068 | 13227 |
| **2000** | 70358 | | 0,00 % | 70358 | | | | 33068 | 13227 |
| **2001** | 73889 | | 0,00 % | 73889 | | | | 33068 | 13227 |
| **2002** | 69548 | | 0,00 % | 69548 | | | | 33068 | 13227 |
| **2003** | 67496 | | 0,00 % | 67496 | | | | 33068 | 13227 |
| **2004** | 70321 | | 0,00 % | 70321 | | | | 33068 | 13227 |
| **2005** | 68293 | | 0,00 % | 68293 | | | | 33068 | 13227 |
| **2006** | 75460 | | 0,00 % | 75460 | | | | 33068 | 13227 |
| **2007** | 73213 | | 0,00 % | 73213 | | | | 33068 | 13227 |
| **2008** | 65824 | 5063 | 8,00 % | 60761 | | | | 33068 | 13227 |
| **2009** | 62042 | 5166 | 8,00 % | 56876 | | | | 33068 | 13227 |
| **2010** | 65714 | 5062 | 8,00 % | 60652 | | | | 33068 | 13227 |
| **2011** | 70415 | 5037 | 7,00 % | 65378 | | | | 33068 | 13227 |
| **2012** | 69965 | 4882 | 7,00 % | 65082 | | | | 33068 | 13227 |
| **2013** | 69810 | 10612 | 15,00 % | 59198 | | | | 33068 | 13227 |
| **2014** | 68440 | 10365 | 15,00 % | 58074 | | | | 33068 | 13227 |
| **2015** | 65974 | 10598 | 16,00 % | 55376 | | | | 33068 | 13227 |
| **2016** | 72643 | 10337 | 14,00 % | 62306 | | | | 33068 | 13227 |
| **2017** | 75026 | 11258 | 15,00 % | 63767 | | | | 33068 | 13227 |
| **2018** | 74697 | 11257 | 15,00 % | 63440 | | | | 33068 | 13227 |
| **2019** | 73306 | 10875 | 15,00 % | 62430 | | | | 33068 | 13227 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2020** | | | | | 73892 | 10827 | 62627 | 33068 | 13227 |
| **2021** | | | | | 74147 | 10788 | 62630 | 33068 | 13227 |
| **2022** | | | | | 74403 | 10749 | 62633 | 33068 | 13227 |
| **2023** | | | | | 74661 | 10710 | 62635 | 33068 | 13227 |
| **2024** | | | | | 74919 | 10671 | 62638 | 33068 | 13227 |
| **2025** | | | | | 75178 | 10632 | 62641 | 33068 | 13227 |
| **2026** | | | | | 75438 | 10594 | 62644 | 33068 | 13227 |
| **2027** | | | | | 75698 | 10555 | 62647 | 33068 | 13227 |
| **2028** | | | | | 75960 | 10517 | 62649 | 33068 | 13227 |
| **2029** | | | | | 76223 | 10479 | 62652 | 33068 | 13227 |
| **2030** | | | | | 76486 | 10441 | 62655 | 33068 | 13227 |
| **2031** | | | | | 76751 | 10403 | 62658 | 33068 | 13227 |
| **2032** | | | | | 77016 | 10365 | 62660 | 33068 | 13227 |
| **2033** | | | | | 77282 | 10328 | 62663 | 33068 | 13227 |
| **2034** | | | | | 77549 | 10290 | 62666 | 33068 | 13227 |
| **2035** | | | | | 77817 | 10253 | 62669 | 33068 | 13227 |

*Key informants interviewed*

Local agreements:
Representative of the public sector: Herdis Laupsa, section leader at the Norwegian Environment Agency, Oslo.

Representative of the public sector: Thomas Seim, section advisor for emission accounting and measure analysis at the Norwegian Environment Agency.

Study 2:

Academic: Dr. Henrik Thoren, Postdoctoral Researcher in Practical Philosophy at Helsinki Institute of sustainable Science (HELSUS), Helsinki.

Academic: Prof. Asuncion Lera St. Clair, Senior Principal Scientist at DNV GL Group Technology and Research, Barcelona.

Academic: Prof. Knut Einar Rosendahl, Social Economy, School of Economics and Business, Oslo.

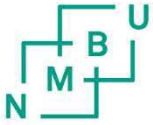
Academic: Prof. Sjur Baardsen, Principal at Norwegian University of Life Sciences, Ås, Oslo.

Environmentalist: Truls Gulowsen, previous leader at Greenpeace. Oslo.

Representative of the private sector, Equinor, Oslo.

Representative of the private sector: Prof. Mari Sundli Tveit, Political Director at NHO, Oslo.

Representative of the public sector: Sigurd Klakeg, Deputy Director General for the Norwegian CCPP, Oslo.

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