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Problems, Policy and Politics: Using the Multiple Streams Framework to Analyse the Biochar Policy Process in Norwegian Agriculture

Stine Lilleby
International Environmental Studies

Abstract

Over the past decade, biochar has been proposed as a solution to climate change in the agricultural sector because of its potential to sequester carbon. Although there is evidently interest from both farmers and the Norwegian government, there is to date no implemented biochar policy in Norway that grants farmers payment for carbon storage. This thesis utilises John W. Kingdon's (2014) theory of Multiple Streams Framework to analyse what is required to adopt and implement the biochar policy proposal as a climate measure in Norwegian agriculture. The thesis argue that in an ongoing policy process to implement new climate measures in the agricultural sector a window of opportunity is opening to adopt a biochar policy proposal from 2021, when the agricultural sector will reduce emissions towards their emission reduction target in 2030. The chances for adopting a biochar policy may increase if a number of identified challenges are managed and transformed into a feasible policy design that is ready for implementation. However, results from this study indicate an overall complexity that constrains the ability of involved actors to manage the challenges and coordinate the biochar policy proposal towards implementation. Moreover, the presence of leadership that could steer the policy process may enhance the success of the biochar policy proposal.

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Abbreviations

AFOLU	Agriculture, Forestry and other Land Use
CDM	clean development mechanism
CE	Certification Mark
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CO_2	carbon dioxide
COP	Conference of the Parties
CCS	Carbon Capture and Storage
DM	dry matter
EU ETS	EU Emissions Trading System
GHG	Greenhouse Gases
IBI	International Biochar Initiative
IPCC	Intergovernmental Panel on Climate Change
MSF	Multiple Stream Framework (Of John W. Kingdon)
NAA	Norwegian Agricultural Agency
NB	Norges Bondelag (the Farmers Union)
NBS	Norges Bonde- og Småbrukarlag (the Smallholders Union)
NDC	Nationally Determined Contributions
NEA	Norwegian Environment Agency
NFSA	Norwegian Food Safety Authority
NIBIO	Norsk institutt for bioøkonomi (The Norwegian Institute of bioeconomy research)
NIR	National Inventory
NOU	Noregs offentlige utredninger (Norways public reports)
PPP	polluter pays principle
pH	measure of acidity
Sp	Senterpartiet (Norwegian Center party)
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change
WTO	World Trade Organization

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1. Introduction

Climate change is one of the most urgent environmental issues of our time. Although the long-term impacts of climate change are not fully understood today, scientists predict negative effects on complex natural and human systems such as biological diversity, water cycles, and food security (Hoegh- Guldberg et al., 2018). Likewise, the causes of climate change are complex and have several layers. One explanation for this complexity may be the mere technical aspects, such as rising levels of carbon dioxide in the atmosphere originating from human activity. Another explanation for this complexity may be that weak regulations and cooperation have allowed human activity to cause climate change. Former Intergovernmental Panel on Climate Change (IPCC) scientist Mike Hulme argues "climate change is not a crisis of the environment or a failure of the market [but rather] a crisis of governance" (2009: 310). If the climate change issue essentially derives from failing governance, then the solutions must come from new governance efforts.

According to Arild Vatn, solving environmental problems requires that we coordinate our actions, which is a central aspect of governance (2015). Hence, a coordination process to address climate change may start with new policy initiatives. Nevertheless, proposing solutions is not enough. John W. Kingdon (2014) points to that both *actors* and *institutions* involved in the governance processes affect the success of a policy proposal. Moreover, the solution must meet certain selection criteria such as *acceptability* and *feasibility* in order to be implemented. As a consequence, many tangible policy proposals fail in the governance process and completely fade from the governmental agenda, while others rise to compete for enactment, but have yet to succeed.

Biochar, the carbon rich solid obtained from pyrolysis of biomass, has been proposed as a solution to climate change because of its carbon sequestration properties and potential long-term stability in soil (Woolf et al., 2010). While many climate solutions reduce anthropogenic emissions, biochar removes carbon dioxide from the atmosphere by storing carbon that normally flows in the natural carbon cycle (Steen, 2017). The IPCC (2018) have stated that we must rely on such carbon dioxide removal technologies in order to limit global warming to 1.5 C. Despite the climate mitigation potential of biochar, and the importance such technology is given by the IPCC, implementation of policy to prosmote and regulate biochar has been slow in Norway. In 2010, the Norwegian government conducted an assessment of

biochar as a climate measure in the agricultural sector (Leffertstra & Fjeldal, 2010). However, 10 years later, the policy proposal remains unadopted, except for an economic support program to invest in reactors for biochar production. Based on this observation, the main objective of this thesis has been to understand what is holding back the enactment of a biochar policy in Norwegian agriculture. Hence, the main research question is: *What is demanded to make biochar accepted and implemented as a climate measure in the Norwegian agricultural sector?* The following sub-research questions were developed to answer the main research question:

- SUB RQ1: What are the current challenges to adoption of a biochar policy in the agricultural sector? What are the potential solutions to overcome these challenges?
- SUB RQ2: How are the challenges managed in the policy-making process during and after the climate negotiations between the Norwegian government, the Farmer's union, and the Smallholder's union?

The underlying premise of this study is that biochar *can* contribute to emission reductions as found in scientific studies. Hence, this study does not take a critical position towards studies that argue climate effects occur from biochar application to soil.

The research questions will be analysed and discussed based on data collected through document analysis and semi-structured interviews with various actors who are experts and positioned in key institutions in the Norwegian agricultural policy regime.

As the above research questions indicate, the core theme of this study is adoption of biochar as a climate policy measure in the Norwegian agricultural sector. In order to gain a broad understanding of the topic, the thesis will start by drawing up a contextual background in chapter 2 by reviewing literature on 1) Biochar as a climate measure, 2) Agricultural politics in Norway, and 3) The international climate regime. Chapter 3 describes the theoretical framework by John W. Kingdon, followed by chapter 4, which explains the methodological choices.

Chapter 5 presents the results of the study. Because the policy process under investigation is an open process, the content of what will be referred to as the biochar policy proposal is given much attention. Thus, the results section is dedicated entirely to investigate potential

challenges of the biochar policy proposal to meet Kingdon's selection criteria (described in chapter 3). The full analytical framework by Kingdon is applied in chapter 6 where the results are analysed in light of the contextual background from chapter 2. The conclusion from this analysis is presented in chapter 7.

2. Background

The following chapter will introduce essential background information. The chapter is divided into four parts. The first part, section 2.1 reviews literature on biochar, focusing on its potential as a climate measure. The second part, section 2.2, focuses on the Norwegian agricultural policy regime. Section 2.3 explains a turn to 'climatization' of the agricultural politics in Norway. The last section looks into the international climate regime and how it affects choice of climate measures in Norway.

2.1. Biochar

2.1.1. What is biochar?

Biochar is a carbon rich material produced through heating of biomass in the limited presence of oxygen (Lehmann & Joseph, 2009). Biochar may be produced naturally and deposited in the soil as a result of vegetation fires, or through controlled production processes using various types of technology (Steen, 2017). Production and use of biochar-type substances is not a recent phenomenon. Indeed, historical traces of charred organic materials are found in soils around the world. In Norway, it is not uncommon that archaeologists find coal pits originating from iron production in the Viking age (Joner et al., 2017).

Figure 1: Biochar. Source: Jære, 2017.

The scientific discovery of biochar as a potential soil enhancer and carbon storage is often associated with the late soil scientist Wim Sombroek who studied Amazonian dark earths in the 60s. This type of fertile and carbon rich soil is called *Terra Preta* and are ancient cultivated plots of land in between the otherwise unproductive yellow-whitish soil type most commonly found in the Amazonian regions. Sombroek identified large amounts of biochar in the Terra Preta soil that he believed originated from pre-Columbian populations (Sombroek, 2004; Sombroek et al., 2004). Inspired by Sombroek's observations, Glaser et al. (2001)

studied the impact of biochar on Terra Preta soil fertility and high carbon levels, concluding that it had a positive effect on both. These pioneering studies triggered a scientific interest in biochar that has nearly exploded over the past decade (Lehmann & Joseph, 2009; Thomassen et al., 2017). Today, many studies aim to evaluate different aspects of the climate impact from biochar amendment in soil, such as carbon content of feedstock, stability in various types of soils and life-cycle impact assessments of biochar systems (Rasse et al., 2019).

2.1.2. Production method and climate potential

The basic process involved in the production of biochar is pyrolysis. The word pyrolysis refers to a process of breaking down materials by heating at elevated temperatures. Pyrolysis technology may vary from small and simple reactors to more advanced units that fit industrial scales, but commonly convert the material inside a closed container in the limited presence of oxygen (IBI, 2018). The end products are various amounts of gas, bio-oil and charcoal, depending on temperature and residence time. The biproducts may be used for various energy purposes. Pyrolysis reactors may also allow for utilization of excess heat from the production process, which will enhance the total climate effect of a biochar system (Thomassen et al., 2017).

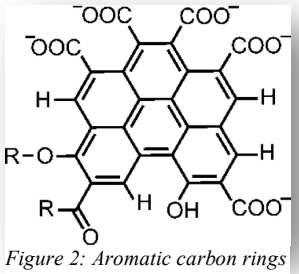

Figure 2: Aromatic carbon rings
Source: Mao et al. 2012

During pyrolysis, the structure of ligin and cellulose molecules converts to stable, aromatic molecules that take the shape of a hexagonal pattern. These aromatic molecules are recalcitrant to biological decomposition (Pommeresche et al., 2018). Scientific studies suggest that biochar remains in the soil for centuries, however, production factors such as pyrolysis temperature and residence time affect its persistence in soil (Rasse et al., 2019). The exact fraction of the carbon content that remains in the soil at any given time is challenging to track and establish scientifically, because biochar decomposes in very small portions each year, over hundreds of years (IPCC, 2019). Moreover, the climate mitigation potential of biochar depends on whether sustainability is ensured at all levels in the designed biochar system. For example, if feedstock is collected using fossil fuel based transportation this will reduce the total climate effect.

2.1.3. Prevalence

In Norway, there is no governmental biochar policy or market that grants payments for carbon storage with biochar (NEA et al., 2020). However, a governmental scheme offers economic support to farmers who invest in biochar reactors. This arrangement is part of a strategy to promote the use of renewable energy in the agricultural sector. The government may subsidize as much as 45 % of the costs and maximum 8 000 000 kroner (Innovation Norway, 2020). In Sandnes, the municipality has invested in a biochar reactor at a waste and recycling station that runs on garden and park waste. The reactor provides heating for buildings on site, and biochar for both citizens and utilization in public greenery and parks. It is estimated that the plant produces enough biochar to store 400 t/CO_2-e annually (Sandnes Muncipality, 2020).

Biochar has previously been considered a niche product (Steen, 2017), and there are no official estimates of the prevalence of volunteer implementation on farms around the country. The facebook group *Biokull i Norge- erfaringer og diskusjon* (Biochar in Norway- experience and discussion) currently have around 1 000 members who exchange information and personal experiences with biochar production and use (Facebook, 2020a). However, it is unclear how many of these that actually produce and apply biochar to soil.

In 2019, the interest organization *Norsk biokullnettverk* (Norwegian biochar network) was established and currently consists of 30 member organizations with different interests and stakes in biochar value chains (Rassat, 2020). Several members of Norsk biokullnettverk are now investing considerably in the production of biochar. In June 2020, Oplandske Bioenergi began building the first commercial pyrolysis plant in Norway. The plant will utilize agricultural wastes and materials from virgin wood and may provide up to 3.2 GWh district heating for a Nortura production facility and 320 residents in Ringsaker Muncipality. The plant is also expected to produce 2 100 t of biochar annually for commercial sale (Norsk Biokullnettverk, 2020). Lindum AS is currently setting up a pilot plant in Drammen where they will make biochar from waste wood, garden and park waste, biogas residues, and sewage sludge. The plan is to investigate and measure the properties and quality of biochar from different fractions of waste and emissions from these production processes (Wilsgaard, 2020).

2.2. The Agricultural Policy Regime

In Norwegian agriculture, policies are created in cooperation between the government and the private agricultural industry (Brobakk, 2018). This unique form of cooperation between the public and private goes all the way back to the 1930s and the passing of *Markedsreguleringsforskriften* (The Marketing Act) that formally established the practice to set annually agreed target prices and allow farmer-owned cooperatives (co-ops) to regulate the market of key agricultural commodities. With the Marketing Act, Norwegian farmers became dependent on the authorities to secure their income (Omholt, 1982). The cooperation was further institutionalized with the 1951 *Hovedavtalen* (Basic Agricultural Agreement) that established the practice of annual negotiations for industry settlements between the state and the agricultural industry (Bunger & Tufte, 2016). This institutionalization laid the groundwork for what is today considered the agricultural policy regime. This regime consists of central actors who participate in the annual negotiations and includes the Ministry of Food and Agriculture and its sub-directorates, the Farmer's Union, the Smallholder's Union and the farmer owned co-ops (Brobakk, 2018; Omholt 1982).

Over the years, cooperation in the agricultural policy regime has evolved into a deeper mutual dependence and takes the form of a contracted compromise that grants farmers certain rights along with duties to follow up multifunctional political goals set for the agricultural sector (Almås, 2002; Brobakk, 2018; Omholt, 1982). For example, with the white paper, St.meld nr.14 (1976-77) *Om jordbrukspolitikken (About the agricultural politics),* farmers were given responsibility not only for the production of food, but also for sustaining important collective goods, such as settlement in the districts and environmental benefits in return for agricultural policies that secured their economic interests (Omholt, 1982).

2.2.1. Organizational arrangements

The Basic Agricultural Agreement determines the actors, the legitimate problems and solutions, and how negotiations should be carried out in the annual settlement (Omholt, 1982).

A governmental appointed committee represents the state, which by tradition is led by the Ministry of Agriculture and Food (Veggeland, 2000). The Ministry of Finance has also been involved since the beginning of the cooperation, following the Marketing Act in the 1930s.

The Norwegian farmers are permanently represented by the Farmer's Union and the Smallholder's Union. In 1965, a committee assessed whether additional actors or organizations should be given access to the annual settlement, but no organization was suggested at the time (Omholt, 1982). Today, the two agricultural unions remain the only representatives of the agricultural sector and negotiate as two separate parties. In 1984, the Basic Agricultural Agreement was changed so as to allow the state to settle negotiations with only one agricultural union, in case of breach with the other (Almås, 2002).

Each year, negotiations are initiated with a claim from the agricultural unions on behalf of Norwegian farmers to the state, in which the state responds with an offer. A settlement is expected before May 17th and must be accepted by the Parliament. If the parties do not come to an agreement, the Parliament may approve the governmental offer (Berger et al., 2018).

The negotiations may only touch upon two types of problems: prices and other regulative measures (Omholt, 1982). Hence, the annual negotiations settle economic support in two forms: budget transfers and target prices in the domestic market (Veggeland, 2000). These matters impact the potential income and private economy of farmers, but do not guarantee a specific income (Omholt, 1982). For example, the settlement determines target prices on pork, dairy, grains and 10 vegetables, welfare arrangements, economic support for climate measures, the size of various subsidies, and how these should be distributed across the districts, farming scale, and systems (Berger et al., 2018; Bunger & Tufte, 2016). Taxes, levies, and tariffs are not the subject of negotiations (Omholt, 1982).

2.2.2. Cooperation and power

The Basic Agricultural Agreement grants the agricultural unions right by law to negotiate and influence parts of the policy making process in the agricultural sector all the way from initiative to implementation of policy (Omholt, 1982). The co-ops are important in order to implement the agricultural politics related to market regulation. Hence, the Farmer's Union, Smallholder's Union, and co-ops exercise formal power within the agricultural policy regime. Consequently, it is in their interest to secure their own position and ability to influence the agricultural policies by maintaining and supporting the regime, which they regularly do by publicly defending both political regulations and subsidies (Brobakk, 2018).

The institutionalized cooperation between the private and the public in the agricultural policy regime has been characterized as a form of a corporative system (Veggeland, 2000). In the past, it has been publicly questioned whether the corporative ties have been too close between the regime actors. Indeed, the first Norwegian Power and Democracy study between 1972-1981 found that agricultural politics were developed in closed networks by key actors in the agricultural regime at the time, consisting of the Ministry of Agriculture and Food, the Parliament's agricultural committee, and the two agricultural unions. The close cooperation was reportedly a result of similar political interests and goals. The study argued that small networks formed and steered agricultural politics in such a way that it limited other actors and the rest of the Parliament's ability to involve and influence the agricultural politics at the time (Almås 2002; Omholt, 1982). This form of close network cooperation was described by Egeberg et al. (1978) as a *segment* and by Hernes (1983) as an "*Iron triangle"* (in Brobakk, 2018:11).

In 1993, a reform of the committee structure for the most important decision-making arena in the Parliament contributed to "de-segmentise" the agricultural policy regime. Indeed, the corporative structure at the time was weakened after the Agricultural committee was dissolved and transferred to the committee of Finance and Economic Affairs (Almås 2002; Veggeland, 2000). According to Almås (2002), the discontinuation of the agricultural committee in the Parliament clearly intended to weaken the segments and influence of the agricultural unions in agricultural politics.

According to Brobakk (2018), the agricultural policy regime remains stable in the face of de-segmentation and other changes over time. Indeed, the institutions of the regime still stand strong, and the regime actors have managed to preserve their position and ties to the agricultural industry, while adjusting to political changes that require adoption of new political elements, such as trade policy and climate politics. Brobakk goes on to argue that the advantage of a corporative form of cooperation is that it may lower the prospects of conflicts between the actors and contribute to a stable regime (2018: 12).

2.2.3. Economic policy instruments

Norwegian farmers' income is protected with economic policy instruments such as subsidies, tariff protection, and market regulation (Berger et al., 2018). The following section briefly explains the three economic policy instruments.

Subsidies

Subsidies are annual budget transfers to Norwegian farmers, which can be divided into direct and indirect subsidies. Examples of direct subsidies are subsidies per livestock and size of acreage that do not depend on production size. Farmers may also receive subsidies on product prices, however, the size of the subsidy will then depend on production size. An example of an indirect subsidy is funding of research (Berger et al., 2018).

Tariff protection

In line with the WTO-agreement, Norway has implemented agricultural protectionist policies such as tariff protection, which serve to secure the farmers' economic interests in the domestic market (Berger et al., 2018). Key agricultural commodities are subject to high import tariff protection, such as meat, milk, cheese, and cereals (Government of Norway, 2016).

Market regulation

As granted by the Marketing Act, designated market regulators are obliged to collect and supply all agricultural commodities throughout the country. This regulation of the domestic market secures farmers' income. The markets for grains, meat, and dairy are regulated by the farmer owned cooperatives (co-ops) Felleskjøpet, Nortura, and Tine (Markedsreguleringsforskriften (jordbruksvarer), 2008). Together, these actors balance the market in order to keep prices as close to the annually agreed target price for dairy, pork, grains, apples, potatoes, and 10 vegetables (Berger et al., 2018).

Despite these economic policy instruments, the agricultural unions argue that there is an income gap between farmers and other wage earners in Norway (Norges Bondelag, 2018). Closing the income gap has been a central matter for farmers since the 1930s, when the Farmer's Union for the first time set a defined income goal target. In the post-war period, this problem was high on the political agenda in Norway (Almås, 2002). Indeed, with *opptrappingsvedtaket* (income-increase decision) in 1976, the Norwegian Parliament's ambitions were to close the income gap within six years. A specific income goal was set that acknowledged the farmers' right to an income equal to the average wage of an industrial worker at the time. In 1982, the government declared that the goal was achieved (Almås, 2002). However, in 1993, the government abandoned the politics with specific income goals for farmers and replaced it with a general income goal. Since that time, the income level gap

has increased between farmers and other groups, and prospects of the government renewing the specific income level politics from the 70s is rather low. Hence, Norwegian farmers' income level has gone from being politically regulated with specific income goals to become more deregulated with general goals over time (Veggeland, 2000).

2.3. Stability and Change: Climatization of Agricultural Politics in Norway[1]

The agricultural policy regime and its institutions remain stable through years of internal and external changes and in the face of an increasing pressure to deregulate Norwegian agriculture (Brobakk, 2018). Indeed, political goals have changed and adjusted according to changes in the national and international context, but what can be identified as four pillars of cooperation between the state and agricultural unions remains to this day: border protection, the basic agreement, legal framework, and market regulations (Bunger & Tufte, 2016). Nevertheless, Brobakk (2018) argues that the regime has undergone a partial change and may continue to do so as a result of what he identifies as an ongoing climatization of agricultural politics. Followed by a short historical flashback, this section will focus on the climatization of agricultural politics.

In the 70s, there was an upsurge in criticism of the industrial food production. The focus of the critique was on the negative effects of industrialization, such as runoff from chemical fertilizers and herbicides into lakes and rivers. According to Almås (2002), the critique contributed to a legitimacy crisis for the agricultural industry in Norway. Perhaps as a reaction to this crisis, the government included environmental protection as a political goal for the sector in St.meld.nr. 14 (1976-77) *About the agricultural politics* (Omholt, 1982). However, it was not until the 80s that environmental degradation from the agricultural industry had political consequences in the form of environmental regulations. The governmental appointed Stubsjøen committee recommended development of new policies such as fertilizer programs and stricter regulations for application rate of animal manure, although the committee did not recommend environmental fees.

In the 90s, however, economic policy instruments were implemented to reduce environmental degradation from food production. For example, farmers who fall-plowed faced reduced subsidies and environmental fees were added on chemical fertilizers and herbicides. In

[1] Part of the title is borrowed from Lars Rønning (2011) *'Klimatisering' av landbrukspolitikken.* NF- note nr. 1009/2011

addition, the government set up stricter control with emissions (Almås, 2002), and in 1991, the Brundtland III government implemented a CO_2- tax on gasoline and mineral oil (Nguyen, 2015). From the 1970s throughout the 90s there were few regulations and policies in Norwegian agriculture aimed at emission reductions, other than the general CO_2 tax (St.meld. nr. 34 (2006-2007)).

Around 2007, both the national and international climate politics were upscaled. On the international level, the expected negative effects of climate change on food production and the potential socio-economic costs of climate change were the focus of the Stern report and the IPCC fourth assessment report (Brobakk, 2018). In Norway, the Stoltenberg II government published the white paper nr. 34 (2006- 2007) *Norsk klimapolitikk (Norwegian climate policy).* Two ambitious long-term goals for emission reductions were set out: at least 30 % reductions compared to 1990-levels by 2020, and by 2050, Norway should be carbon neutral (100 % reductions) (St.meld. nr. 34 (2006-2007)). Moreover, the government made important clarifications of the basic principles behind Norwegian climate politics and climate instruments across sectors.

First, the *polluter pays principle* (PPP) is the key principle (St.meld. nr. 34 (2006-2007)). With the PPP, it is the polluter who has the responsibility for emissions and should compensate for polluting (Vatn, 2015), which means that responsibility will reside within the sector where greenhouse gases are emitted (Brobakk, 2018). Furthermore, the government stated that all emissions from greenhouse gases are subject to *Forurensningsloven*[2] *(the Norwegian pollution Act).* Consequently, the annual 4.9 million tonnes of CO_2- e[3] emissions from the agricultural sector at the time (St.meld. nr. 34 (2006-2007)), including biological emissions, were now by law defined as pollution (Brobakk, 2018). Second, the *sector principle* holds the sectors accountable to meet governmental goals, such as national environmental- and climate targets. Together, the two principles of PPP and sector principle require the agricultural sector to take responsibility for both its emissions and reductions (Brobakk, 2018:26). Lastly, the principle of *cost-efficiency* was determined as the main criteria behind the government's environmental instruments. Cost-efficiency means that the governmental instruments shall provide measures that can provide the highest emission

[2] LOV-1981-03-13-6
[3] Carbon dioxide equivalent

reductions (maximize outputs) for the minimum expenses (minimum input) (St.meld. nr. 34 (2006-2007)).

The upscaling of climate change politics both internationally and nationally, together with the 2008 global food crisis, applied new pressures on the agricultural sector to both reduce emissions and increase food production. As a response, the former Minister of Agriculture and Food, Lars Peder Brekk (Sp), presented St. meld nr. 39 (2008), *Klimautfordringene- landbruket en del av løsningen* (Climate change- agriculture as a part of the solution). With the white paper, the government proposed to reduce 1.1 mill t/CO_2-e as the agricultural sector's contribution to Norway's commitments under the first phase of the Kyoto Protocol (2008-2012). Moreover, the global stresses of climate change and the food crisis were framed as connected problems, which required parallel action through an intensified and effective agriculture that could produce more food while emitting less greenhouse gases (St.meld. nr. 39 (2008-2009)).

The suggested measures were in line with the principles in Norwegian climate politics: PPP, cost- efficiency, and the sector principle as described in St. meld. nr. 34 (2006-2007). Indeed, with the new proposed direction in agricultural politics, the agricultural sector would take responsibility for its own emissions for the first time by contributing to the national climate targets in a cost-efficient way. Brobakk (2018) argues that the agricultural policy regime did undergo a partial change as the climate policies were integrated into a multifunctional policy approach in agricultural politics. Moreover, he sees this change as the start of an ongoing climatization of Norwegian agricultural politics (2018:25).

This is evident in several policy documents and events succeeding the new direction in 2008. In the white paper Meld. St. 9 (2011-2012) *Landbruks- og matpolitikken. Velkommen til bords (Agriculture- and food politics. Welcome to the table),* the Stoltenberg II government included *sustainable agriculture* as one of the four overreaching political goals for the sector (p.14). In 2016, the Solberg I government modified the political goal of sustainability to include *reduced emissions of greenhouse gases* in the white paper Meld. St. 11 (2016-2017) *Endring og utvikling - en fremtidsrettet jordbruksproduksjon* (Change and development- a future oriented agricultural production).

Besides signs of climatization of the multifunctional policy approach in agricultural politics, the 2014 governmental appointed *Grønn Skattekommisjon (the Green Tax Commission)* suggested new environmental pricing in the agricultural sector, such as carbon taxes on red meat (NOU, 2015:15). Many in the agricultural industry opposed this suggestion on the argument that taxes on red meat may lead to increased imports of meat, which was believed to have a larger climate impact than meat originating from Norwegian cattle (Grønlund & Mittenzwei, 2016). The leader of the Farmer's Union, Lars Petter Bartnes, predicted a decline in Norwegian food production as a result of carbon taxing on red meat, which in turn would reduce employment in the agricultural sector (Norges Bondelag, 2015). The Norwegian government did not go through with the suggestion from Green Tax Commission at the time and the agricultural sector is today tax-exempt from methane and nitrous oxide emissions. However, the government states that emissions not currently subject to environmental pricing are continuing to be evaluated, indicating that the issue is not settled (Government of Norway, 2020b).

2.3.1. A historical climate agreement

In Meld. St. 11(2016-2017), the government signalled that the agricultural sector could expect to face demands of quantifiable reduction targets, in line with Norway's 2030 commitments under the Paris Agreement. However, the government also clarified that new climate measures should not require increased subsidies to agriculture (p.146). In the white paper Meld. St. 41(2016-2017), *Klimastrategi for 2030- norsk omstilling i europeisk samarbeid* (*Norway's Climate Strategy for 2030: a transformational approach within a European framework)*, the Solberg I government invited the agricultural unions to participate in volunteer climate negotiations to settle a quantifiable emission reduction target for 2030 (p. 76).

This was followed up in early 2018 by the former Minister of Agriculture and Food, Jon Georg Dale, who invited the two agricultural unions and the Minister of Climate and Environment at the time, Ola Elvestuen, to climate negotiations (Dale, 2018). During that year, the parties met several times, set up a joint technical working group for agriculture and climate, and corresponded by letters[4]. In addition, the government gathered a committee of experts in *Teknisk beregningsutvalg* to suggest methodological improvements of emission accounting in agricultural sector (Government of Norway, 2019c).

[4] A number of these letters are available in e-innsyn.no upon request

A year after the climate negotiations were initiated, the two agricultural unions published their climate negotiations document in February 2019, assessing several climate solutions potentially suitable as agriculture's contributions to emission reductions under Norway's commitments to the Paris Agreement in 2030. In the document, biochar was described as having a "potential for carbon storage" (NB & NBS, 2019: 46). In addition, the unions perceived the benefits of biochar to exceed carbon storage, such as positive agronomic effects and heat production for buildings (excess heat from pyrolysis). However, at the time, the unions also expressed a need for more knowledge and practical experience with biochar. As a general criterion, the two unions underlined that the climate measures must not challenge food production goals and create carbon leakage by reducing production in Norway, and hence, increase import as a substitution (NB & NBS, 2019: 33, 46).

In June 2019, the government and the two agricultural unions signed an intentional climate agreement to reduce 5 mill t/CO_2-e by 2030, with the two unions as the main responsible. The central terms of the agreement are that subsidies and increased budget transfers cannot be expected. Furthermore, economic tools and policy instruments will be the subject of annual agricultural settlements. Lastly, the agricultural unions have the power to choose the specific climate measures. However, only climate measures that can be reflected in Norway's official climate budget, the National Inventory, will count as emission reductions towards the target in 2030. A so-called *shadow budget* to the official climate budget will be established. This budget is unique because it allows for accounting of all contributions (that count) across several sectors. The climate measures that are not accepted in the shadow budget will be accounted in an Annex II of the climate agreement to demonstrate the total climate effort by agriculture (Government of Norway, 2019a).

2.4. The International Climate Regime

The upcoming choice of climate measures by the agricultural sector is directly influenced by Norway's participation and commitments in the international climate regime. Indeed, the agricultural sector's emission reductions between 2021 and 2030 will serve as a part of the commitment under the Paris Agreement. The international climate regime set the rules as to the exact climate measures that can be reflected as the member countries contributions to their commitments in the regime. Hence, it is decisive that the agricultural sector's reductions are implemented in accordance with certain rules on climate measures set forth by the

international climate regime. In what follows is a short description of the four components in the international climate regime and how they influence the member countries choice of climate measures.

The international climate regime currently consists of four components, the IPCC, the United Nations Framework Convention on Climate Change (UNFCCC), The Kyoto Protocol, and the Paris Agreement. Norway is a member of all four components of the regime. As the Kyoto Protocol ends in 2020, this component of the regime will be mentioned only briefly.

2.4.1. IPCC

The IPCC is an intergovernmental organization comprised of 195 member states to the United Nations (UN). The UN established the IPCC in 1988, and since then it has published assessments of scientific research on climate change. As such, the IPCC does not conduct its own scientific research but assembles and assesses scientific data. The objective is to help governments develop climate policies that foster both adaptation and mitigation, in line with the expected impacts and future risks of climate change (IPCC, 2020a). In total, the IPCC has published five assessment reports from 1990, 1995, 2001, 2007, and 2014 (IPCC, 2020b).

The IPCC also prepares methodological guidelines on how member countries may calculate national inventory of Greenhouse Gases (GHGs). A climate measure must be consistent with the IPCC's methodological guidelines in order to be included in the official climate budget, the National Inventory. Since 1996, the IPCC has produced four reports and revisions on methodological guidelines (IPCC, 2020c). In 2019, the IPCC included Tier 2 and 3 methodologies for biochar in their latest update on methodological guidelines *The 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2019).*

The IPCC Tier 1,2,3 Classification

IPCC operates with three methodological levels for inventory reporting. The levels are classified according to their level of complexity in a Tier 1, 2, or 3:

- Tier 1 is the simplest level. The countries are allowed to estimate emissions and removals based on default emission- and stock change factors.
- Tier 2 is the intermediate level of advancement. A Tier 2 requires that emissions and stock-change factors are based on regional or national data.
- Tier 3 is the most advanced estimation system. In Tier 3, the countries apply complex methodological approaches (models) that provide more data accurancy. For example, it may require collection of field samples repeated at a certain time-interval.

The countries may choose the preferred Tier level. However, in some cases all three Tiers are not provided, leaving the member countries with only one or two levels to choose from (IPCC, 2019).

Figure 3: The IPCC Tier 1,2,3 classifications

As an UN-based organization with 195 member countries, the IPCC is a powerful actor and agenda setter that defines both the global climate change problem and its impacts. Indeed, the IPCC has the power to shape our perception of climate change as a global problem. Furthermore, through the assessment reports, the IPCC communicates a close to scientific consensus on the effects of anthropogenic emissions to the world, which legitimizes the IPCC's problem definition and agenda setting. Lastly, the IPCC also has the power to decide what climate measures that may count as the countries emission reductions by what is included and excluded in the methodological guidelines. However, the IPCC's power ultimately lies with the member states. Hence, both participation and support from the member countries is important. For example, the governments are involved in the report development process from start to end, from selection of scientific experts, reviewing, and approval of final draft reports (Andresen & Boasson, 2012).

2.4.2. UNFCCC

The UNFCCC is a multilateral environmental agreement that was ratified by Norway in 1993. The overall objective of the agreement is to "prevent dangerous anthropogenic [human induced] interference with the climate system" by stabilizing greenhouse gas emissions (Andresen & Boasson, 2012: 52). A central principle is the *Common but Differentiated Responsibilities and Respective Capabilities,* which acknowledges all countries as responsible, yet not equally responsible and capable to address the climate change crisis.

Thus, respective burdens of the member countries are divided into two parties, Annex-I (industrialized countries) and Non-Annex I (developing countries) (Andresen & Boasson, 2012).

The UNFCCC lays the normative foundation and formal structure for cooperation in the international climate regime but does not establish quantifiable targets and formal rules for emission reductions. Indeed, Annex-I countries were expected to reduce their emissions to 1990-levels by 2000, but this was not a legally binding target. However, the UNFCCC set forth formal regulations by requiring all parties to report on their climate change mitigation- and adaptive activities (Andresen & Boasson, 2012). Non-Annex I parties report more generally and less regularly, while Annex-I parties submit specific reports both annually and biannually (UNFCCC, 2020a). The biannual report describes climate policies and the measures implemented by the countries. The annual report, also known as The National Inventory report (NIR), reflects the countries inventory of anthropogenic emissions and removals by sinks of GHGs, compared to the baseline year 1990. This report is prepared by the national greenhouse gas inventory system in Norway, which consists of the Norwegian Environment Agency (NEA), Statistics Norway, and the Norwegian Institute of Bioeconomy Research. The NEA has the overall responsibility and submits the report to the UNFCCC (NEA, 2019a).

The member countries are required to calculate their inventory of GHGs in accordance to the IPCC methodological guidelines. Decisions pertaining to the exact version of the methodological guidelines the member countries shall use are decided in the annual Conference to the Parties (COP). Currently, Annex-I and Non-Annex I countries adhere to different methodological guidelines. Annex-I countries are required to use the 2006 IPCC guidelines, while Non-Annex I countries use the 1996 IPCC guidelines in their reporting (UNFCCC, 2013; UNFCCC, 2003).

2.4.3. The Kyoto Protocol and the Paris Agreement

While the UNFCCC is the normative authority in international climate cooperation, the Kyoto Protocol and the Paris Agreement operationalize the UNFCCC's overall objective to stabilize GHG emissions with specific, formal rules to climate cooperation (Andresen & Boasson, 2012). Indeed, both the Kyoto Protocol and the Paris Agreement commit parties to quantifiable emission reduction targets.

The Kyoto Protocol was adopted in 1997 and entered into force in 2005. Building upon the UNFCCC principle of *Common but Differentiated Responsibilities and Respective Capabilities,* the Kyoto Protocol only committed the Annex-I parties to reduce their emissions. In addition, targets were country-specific and varied considerably. On average, emission reductions were 5 % compared to 1990 levels (UNFCCC, 2020b). During the first commitment period between 2008-2012, Norway's maximum amount of emissions could not exceed 1990 levels by more than 1 % (Government of Norway, 2015). For the second commitment period between 2013-2020, Norway committed to reduce emissions by 30 % compared to 1990 levels (NEA, 2020).

The Paris Agreement was ratified by Norway in 2016 and will replace the Kyoto Protocol from 2020. When the Paris agreement entered into force in 2016, it legally committed all parties to emission reductions for the first time. As such, the previous separation into Annex-I and Non-Annex I parties was discontinued. The Paris Agreement requires that the parties determine their own commitments and register these as Nationally Determined Contributions (NDCs). Furthermore, as a sign of countries strengthening their efforts, increased NDCs are expected every five years. Norway's NDC for 2030 is an emission reduction of 40 % compared to 1990 levels (Meld. St. 41 (2016-2017)). Recently, Norway's NDC was increased to 50-55 % compared to 1990 levels (Government of Norway, 2020a).

Every five years from 2023, all parties are expected to report on their progress in the National Inventory Report (UNFCCC, 2020c). Hence, similar to the UNFCCC, the Paris Agreement establishes rules on how emissions should be estimated. These decisions are made in a *Conference of the Parties serving as the meeting of the Parties to the Paris Agreement* (CMA), which is set up under the annual COP. In 2018, CMA decided that all parties should calculate estimations of emissions and removals by sinks in accordance with the 2006 IPCC Guidelines. Any subsequent version or refinement of the IPCC guidelines shall be used if the CMA decides so (UNFCCC, 2018a).

2.4.4. How the international climate regime affects choice of climate measures in Norway

The three future components of the international climate regime, IPCC, UNFCCC, and the Paris Agreement both develop and determine the exact methodological guidelines the member countries may use in their National Inventory report. Hence, these three actors have the

power, deriving from member states, to decide what climate measures count as emission reductions in the international climate regime.

First, as author of the methodological guidelines, the IPCC has the power to include or exclude climate measures in their guidelines. Second, the parties to the UNFCCC and the Paris Agreement choose the exact version of the IPCC methodological guidelines the countries may use to calculate their inventory of GHGs. Hence, the final decision on what climate measures the member countries may apply to reach their targets are made by the UNFCCC and the Paris Agreement. For example, even though biochar was included in the newly updated IPCC methodological guidelines in 2019, both the UNFCCC and the Paris Agreement currently use the 2006 IPCC guidelines. Therefore, the countries may not yet reflect the carbon storage effect from biochar in the National Inventory report. Moreover, with today's rules the effects of carbon storage with biochar may not be accounted for in agriculture's shadow budget, but in the Annex II to the agricultural climate agreement.

As Norway is a member of both the UNFCCC and the Paris Agreement, the country has reporting obligations under both agreements. However, when reporting under the Paris Agreement starts for the year 2023, it is decided that the National Inventory shall be prepared only in accordance with the methodological guidelines decided by the parties to the Paris Agreement (UNFCCC, 2018b: §42, p.6). In light of this information, the exact version of the IPCC methodological guidelines applied by both the UNFCCC and the Paris Agreement will continue to guide the choice of climate measures in the National Inventory, and hence, the shadow budget, at least until 2023.

3.Theory

This chapter begins with an introduction to the concepts of governance and institutions. Next, an overview of John W. Kingdon Multiple Streams Framework (MSF) will be presented to provide the context for the methodology used in this thesis. It is followed by a more detailed description of the analytical framework utilized in this thesis: Problem Stream, Policy Stream, Politics Stream, Policy Window, and finally policy entrepreneur. The three streams are explained with examples to show how Kingdon's theory can be useful as an analytical tool. The chapter ends with an explanation of some limitations to using MSF in this thesis and how the MSF framework has guided the arrangement of Chapter 5 on results and Chapter 6 on analysis.

3.1. Governance and Institutions

Vatn (2015) defines governance as: "[...] shaping social priorities- the formulation of goals- and how these should be realized" (p.7). Governance, then, refers to the steering of coordinated processes that take place within structures, involving a form of authority. The concept encompasses a complexity of actors, objectives, and forms of interaction both inside and outside of government (Vatn, 2015).

Institutions are the structures that enable steering of the processes where priorities are made and actions are coordinated (Vatn, 2015). Institutions can be defined as "[...] the conventions, norms and formally sanctioned rules of a society" (Vatn, 2005: 60). Conventions are established, informal practices that guide our behaviour, such as customs and habits. Norms are the value-based rules that justify our actions, such as a belief in what is right or wrong behaviour in a given situation. Finally, formally sanctioned rules influence our behaviour by requiring, or forbidding, certain actions. Formal rules are written and issued by a third party that may sanction actors who violate them (Vatn, 2015).

The definition above points to that institutions limit our ability to act by imposing informal and formal rules to our behaviour and thereby restricting our choices. Ways in which institutions do this is by allocating power: defining roles and interactions of actors through rights (access or denial) and responsibility. Hence, institutions enable some actors to reach their goals while others are disempowered or even excluded. Moreover, institutions are dominated by different types of rationality that shape preferences and motivate particular

actions. For example, a type of social *we* rationality is when we are expected to behave in a way that is best for the group or a community. For example, we may apply *we* rationality when we interact with our family or friends concerned with the wellbeing of all. In contrast, the market supports individual rational action because we are expected and able to choose options according to the highest individual utility. Hence, certain institutional structures, such as the market, motivate us to act in our own best interest (Vatn, 2015).

Institutions do not just form us and influence our choices by limiting actions and shaping preferences. Institutions are social constructs that are constantly shaped by our actions either as we reproduce internalized rules (Vatn, 2015) or at other times even change them. Anthony Giddens (1984), argues that structure and agency are interdependent and cannot be studied as separate notions. While the institutions have the power to shape our preferences and actions, actors have the capacity to make choices that reproduce or change the structures. Hence, it is not either structure or agency that shape human behaviour, but both (Vatn, 2015). It is clear from the above that not only do we need to learn about how the institutional structure impacts outcomes in governance processes when we want to explain policy change, but we should also pay attention to the actors within the structure and how their actions affects the outcome.

3.2. Overview of Kingdon's Multiple Streams Framework

Kingdon's (2014) MSF is a theory that combines the notions of structure and agency as explanations to understand why some policy proposals are implemented while others fade from the agenda. By integrating both structure and agency, the MSF theory allows for a complementary analysis that reveals the complexity involved in policy making. Indeed, rather than portraying policy making as a systematic and straightforward process, adoption of policies is rather a result of "structured randomness" (Atupem, 2017: 10-11) involving people, their motivations, and power residing within the structure.

Kingdon (2014) describes policy making as a process all the way from agenda setting to implementation. However, the MSF is concentrated on the first two stages of this process: agenda setting and the alternatives for governmental decision-making. Consequently, the theory leaves out the last two stages where the actual decision and implementation takes place. Regarding agenda setting, Kingdon distinguishes between the *governmental agenda* and the *decision agenda*. The governmental agenda refers to a list of important problems set

by governmental officials, while the decision agenda is a list of potential solutions (proposals) to problems that are seriously evaluated for adoption and implementation (Kingdon, 2014).

A combination of sub processes and actors influence the two steps, agenda setting and specification of alternatives. Hence, the MSF operates with three separate analytical processes of problems, policies, and politics. In the Problem stream, a pressing problem is detected and moved onto the governmental agenda. The Policy stream resembles a think tank. Ideas are created, recreated, and developed into policy proposals that may eventually solve problems. Finally, developments in the Politics stream influence the prospects for enactment and policy change by either impacting or setting agendas (Kingdon, 2014).

Although the three streams are analytically separate and unique, developments in one or two streams are usually not enough to bring about policy change. First, a window of opportunity must open in either the Problem or Politics stream. For example, the recognition of pressing issues in the Problem stream demand solutions. In the Politics stream, windows open because political priorities move in a certain direction or change abruptly, influencing the setting of agendas. Hence, a window of opportunity is basically a development in either the Problem or Politics stream that enables the three streams to join, creating a single package. When the streams perfectly align, a pressing problem is identified, a solution is ready for implementation, and the political climate is receptive. This alignment facilitates policy change by creating highly favourable circumstances for a policy proposal to move high on the decision agenda. However, in some cases the three streams do not join when the window is open. For example, the problem might be recognized as pressing and the political climate is supportive of the policy change, but there is no solution ready for implementation. In such cases, the window may close before a viable solution is ready, and the opportunity is lost (Kingdon, 2014).

The developments within the streams do not occur by chance, nor do the streams join without agency involved. Concerning developments within the streams, visible or hidden actors work either as an impetus or as a constraint to the prospects of policy change. Visible participants may be high profiled or elected politicians, while hidden participants are in positions such as academic specialists and political staff. The most central actors in Kingdon's theory are the policy entrepreneurs. These are "special" actors that advocate for adoption of their favourite proposal. In the process of preparing the proposal for implementation and softening up

decision makers, the policy entrepreneurs may join the three streams. For example, policy entrepreneurs may invest considerable time and resources to attach their proposal to an important problem, coupling solutions and problems. If the political receptivity and support is low, they might try to educate about their proposal in the political stream, softening up the key actors. In those cases, they couple political forces to their proposal (Kingdon, 2014). While recognizing the importance of both hidden and visible individual actors, their motivations, and their power to influence policy change within the streams, this thesis will focus mainly on the structural process of the three streams and the policy entrepreneur as one central actor within the structure.

3.3. Detailed Description of the Multiple Streams Framework

3.3.1. The Problem stream

In the Problem stream, people in and around government identify problems that demand governmental involvement. The problem may appear on the radar from various governmental and nongovernmental sources and move onto the governmental agenda. For example, a governmental agency that systematically monitors disease rates find indicators that these have changed from the "normal" pattern. Problems may also be detected through feedback mechanisms in existing governmental programs that routinely evaluate implementation. Finally, a dramatic event such as a crisis or shock captures the attention of decision makers (Kingdon, 2014). There are many problems on the governmental agenda; whether the problem is a priority depends on how the problem is framed and presented (Kingdon, 2014).

3.3.2. The Policy stream (solution stream)

In the Policy stream, ideas are born, circulating around and eventually generating policy proposals (solutions). The ideas originate within a community of specialists in specific areas, such as academics, researchers, and bureaucrats that work closely with certain policy problems and interact with each other (Kingdon, 2014). The participants in the policy stream mainly focus on the content of the policy proposal (Atupem, 2017). For example, policy specialists invest their time to provide evidence and arguments that support their ideas. The goal is to reach a consensus in the policy community to move the proposal on the short list of solutions (Kingdon, 2014).

Kingdon (2014) describes the process of generating policy proposals in this stream as the "policy primeval soup" (p.116), to illustrate how the ideas float around bumping into another. There are many possibilities at this point as ideas confront one another and some are renewed in the process. Most important to our case, Kingdon argues that the ideas that survive to rise on the decision agenda tend to meet certain criteria in a selection process, such as technical feasibility, value acceptability, tolerable costs, and public acceptance (2014). The selection process has an important function in creating order from the chaos in the policy primeval soup:

> "Through the imposition of criteria by which some ideas are selected out for survival while others are discarded, order is developed from chaos, pattern from randomness" (Kingdon, 2014: 200).

Selection criteria

According to Kingdon, policy makers evaluate a policy proposal according to the selection criteria in order to test their potential on the governmental decision agenda later on in the process (2014). Below is a description of the four criteria.

Technical feasibility refers to the practicality of implementing a policy proposal. Are there challenges or details that need to be worked through in order for the proposal to be administered? The degree of technical feasibility reveals how ready the proposal is for implementation. Kingdon points to that it does not matter how "good" a proposal is, if it is not "ready to go" (2014: 131). The policy proposal must be perceived as a coherent package that is feasible for implementation in order to be seriously considered (Kingdon, 2014).

Value acceptability refers to whether the policy proposal is consistent with the values of decision makers. Proposals that do not meet the prevailing values will have less chance than those that correspond to the established values. Kingdon highlights principles such as equity and cost-efficiency, and argues that the latter has become increasingly important for policy makers through the years, as a tool to anticipate both the costs and benefits with implementation of policy proposals (Kingdon, 2014).

Anticipation of future constraints is the final set of selection criteria. According to Kingdon, proposals considered for implementation are evaluated according to common constraints such

as *costs* and *public acceptance*. Considering *costs*, these must be financially acceptable within the budget constraints of decision makers (Kingdon, 2014).

Regarding *public acceptance*, Kingdon emphasizes that policy proposals must be perceived as acceptable in order to stand a chance in the selection process. However, he does not operate with a fixed definition of who the public is. Rather, it depends on the context. Indeed, the public may be a large or narrow set of people from a broad or specialized group of people who have a certain position and stake in the outcome (Kingdon, 2014).

3.3.3. The Political stream

While the Policy stream is focused on the content of the policy proposal, developments in the Political stream affect the political climate surrounding a proposal. Indeed, political forces both inside and outside of government directly impact agenda setting, opening the door to support some proposals over others (Kingdon, 2014).

The opinions of political forces outside the government may either advance or inhibit the possibility for policy change by mobilizing support or building opposition. For example, the political climate surrounding an issue in the mass public, social movements, organized political elites, and interest groups can press for a policy change if they are powerful enough, enabling certain proposals to rise on the agenda. In some cases, political actors completely shift their focus or direction because of considerable pressure from outside the government (Kingdon, 2014).

The climate within the government also affects the prospects for policy change. For example, government actors with authorative positions nuture their political convictions, supporting the issues that correspond to their values and opinions. Sometimes the priorities change after a government turnover, setting completely new agendas and enabling certain proposals to rise on the agenda. Overall, the success of a policy proposal is influenced by the orientation and priorities inside government. As such, governmental events and processes impact policy changes (Kingdon, 2014), and this will be the main political force of our focus.

3.3.4. The window of opportunity

At certain times, a development in either the Problem- or Political stream opens a window of opportunity for policy enactment. According to Kingdon, it is usually a change in the Political

stream that actually opens the window. Indeed, the problem must be politically recognized as important and the solution offered by the proposal must be politically acceptable to be seriously considered by decision makers. However, the actual event that opens the policy window may be either predictable or unpredictable. For example, a crisis or shock can open a window quite unpredictably over night by setting a new agenda. When the window opens predictably, the government signal changes well in advance. For example, scheduled changes such as annual renewal of budgets and new political plans signalled in white papers can be predictable windows for many types of proposals (Kingdon, 2014).

In the Policy stream, proposals are evaluated according to a number of selection criteria. According to Kingdon (2014), policy proposals that meet these criteria have good chances to survive the policy primeval soup and rise out of the chaos onto the decision agenda. The policy window is the actual opportunity in the policy system to move an initiative (solution to a problem) to an active position on a decision agenda. Although the items on the decision agenda are more seriously considered, there are no guarantees for acceptance and implementation. Indeed, the capacity may be limited if the number of solutions exceeds what the open window calls for, creating a competition. The chances for a proposal to reach a prominent status at the decision agenda increases when the three streams of Problems, Policies and Politics align. For example, a certain conception of a problem is recognized, a viable solution ready for implementation is proposed, and the political climate is receptive (Kingdon, 2014).

The duration of the policy window is usually short, making it critical to couple the streams at the right time. For example, the process may come to a saturation point because the issue has been addressed sufficiently, even if it is not completely solved. Other reasons may be sudden changes in political strategy or a governmental turnover that moves key supportive actors out of positions to enact on the proposal. Not only is the window open for a short duration, it may take a while before a new opportunity presents itself and the window reopens. Hence, participants must be attentive to timing (Kingdon, 2014).

3.3.5. Policy entrepreneurs and their role in joining the streams

Policy entrepreneurs are actors who advocate solutions, policy proposals, that they want decision makers to implement. Kingdon (2014) does not operate with an absolute definition of the policy entrepreneur, as they may range from people with high to low standing positions

within and outside the formal structure. In general, their motivation to advocate for specific solutions is a potential future gain on the professional or personal level (Kingdon, 2014).

In order to understand the activities and success of the policy entrepreneur we must look at their resources and qualities. Regarding resources, the policy entrepreneur has some sort of "claim to a hearing" (Kingdon, 2014: 180). Examples of people who typically have access to address key decision-making people are experts, leaders of interest organizations, or those who hold a decision-making position themselves. In addition, the policy entrepreneur may also have resources in the form of important political connections that they may influence (Kingdon, 2014).

Concerning the qualities of policy entrepreneurs, the two most distinctive characteristics are negotiation skills and the ability to be persistent. Kingdon stresses that persistency is the most important quality of the policy entrepreneur, and this is what separates the successful from the unsuccessful entrepreneurs. Indeed, it takes a lot of patience and willingness to invest time and resources to advocate for a proposal through what can seem like endless meetings, connecting to people, giving talks, adjusting policy drafts etc. (Kingdon, 2014).

The policy entrepreneur plays an important role in the status and success of a policy proposal in two ways: paving the way for its acceptance in a softening up process while awaiting an opportunity to move their "pet" proposal high on the decision agenda when a window opens (Kingdon, 2014:179-81).

The softening up process refers to various actions taken by the policy entrepreneur in an attempt to take control of the outcome. Rather than allowing the proposal to float freely in the policy primeval soup, the policy entrepreneur continuously adjusts the proposal to fit potential windows and build acceptance with key actors. Considerable time and resources are invested in softening up the system. Some policy entrepreneurs spend years of speaking, writing, and educating people about the issue in strategically chosen arenas. Keeping the issue widely known and relevant may increase chances that the proposal is taken seriously when an opportunity finally arises (Kingdon, 2014).

In the softening up process of pursuing their ultimate goal, adoption of their pet proposal, the policy entrepreneurs couple solutions to problems, proposals to political acceptance, and

problems to political attention. Thus, the key function performed by the policy entrepreneur in the system is joining of the three streams. For example, if the policy proposal is already linked to an important problem, but the political climate is not receptive, the policy entrepreneur may attempt to soften up acceptance from politicians and other key actors. However, it is not the policy entrepreneur who creates the window of opportunity:

> "The window open because of some factors beyond the realm of the individual entrepreneur, but the individual takes advantage of the opportunity"
> (Kingdon, 2014:182).

With this statement, Kingdon explains policy change through the combination of both structure and actors. The window opens up independently of individual actors, but the policy entrepreneur joins the streams by overcoming constraints within them, launching when the window is open (Kingdon, 2014).

3.3.6. How the theory is utilized

In the book *Agendas, Alternatives and Public Policies (2014)*, Kingdon applies the theory to explain the outcome of past policy processes. However, this case study deals with an open policy process and the outcome is not known. Hence, the theory is used retrospectively and the factors that may have contributed to policy enactment or not over time will be discussed. The MSF will also be applied to analyse what may be demanded in the near future to move biochar as a policy proposal higher on the decision agenda for acceptance and implementation by the agricultural policy regime.

A central focus is on the content of biochar as a policy proposal, and whether biochar is ready for implementation. As a consequence of the policy content focus, the results section is structured according to potential challenges to Kingdons selection criteria in section 3.3.2. However, the analysis chapter is arranged similarly to the set up that is presented in this chapter. Although the different components in Kingdon's analytical framework are arranged separately in this chapter, the transition between them is somewhat more fluid and intertwined in the analysis chapter.

4. Methodology

The first section of this chapter provides an overview of the methodological framework underlying this study, followed by a description of the methods that were applied to data collection and analysis. The next section discusses research challenges and ethical considerations. Finally, the chapter rounds off with an explanation of how the theory is utilized in this thesis.

4.1. Methodology

The design of a study may be oriented either towards a deductive or inductive approach to the relationship between theory and research. A deductive research approach usually begins with the formulation of hypothesis originating from theory. The study objective is then to test the hypothesis through observations. In contrast, an inductive study approach begins with the development of research questions, allowing the researcher to explore these with an open mind through data collection. The study objective is to generate new theory from the observed data. The main difference between the two approaches is that while a deductive approach is aimed at hypothesis testing and is common in quantitative research, an inductive approach allows new theories to emerge from the collected data and is most commonly used in qualitative research strategies (Bryman, 2016).

This study is oriented towards an inductive research approach. Hence, it follows the steps of an inductive qualitative approach: formulating general research questions→ selection of relevant subjects→ collection of relevant data→ interpretation of data→ conceptional and theoretical work→ specification of research questions→ followed by new rounds of collection and interpretation of data (Bryman, 2016: 379). This was a non- linear process, continuous and intertwined.

4.1.1. Epistemological and ontological considerations

Epistemology

Epistemological considerations are about the principles of knowledge. What can we know and how can we know it? The researchers position in these questions influences the research design and the criteria of what constitutes the desirable source of knowledge. The two central epistemological positions are positivism and interpretivism. According to positivists, the only acceptable knowledge is empirical experience, gained through observation and measurements.

Positivism may embody elements of both inductive and deductive approaches, because although the purpose of research is to test hypotheses in order to assess and develop established laws, these laws are based on knowledge that was gathered inductively to begin with. Lastly, positivism emphasizes that scientific objectivity can be conducted without the influence of values, bias, or perspectives of the researcher and participants (Bryman, 2016).

Interpretivism takes the opposite stance from positivism by embracing the subjectivity (views) of study participants and acknowledging that the researcher has a voice and perspective that may influence the research. According to an interpretivist stance, acceptable knowledge of the world is gained through description and interpretation of social phenomena. Interpretivism takes on an inductive research approach, allowing the research observation and findings to generate theories. The two positions have distinctly different scientific logics. Positivism is a natural science epistemology that emphasizes explanation of observations, while interpretivism is a social science epistemology that seeks to understand by interpreting (Bryman, 2016).

Although the constructivist logic is recognized as a meaningful approach to the scientific production of knowledge in social science, the results chapters of this study has not undergone a deep interpretation. Rather, the results of data collection follow a more positivist logic by explaining the observations made in interviews and document analysis.

Ontology

Ontological theories about the nature of social entities' existence underlie choices in the research process from formulations of research questions to explanations of the social phenomena that is found. Two central ontological positions are objectivism and constructivism. Objectivism explains social phenomena as having a reality independent of human understanding and interpretation. There exists a social reality that is definitive. In contrast, the tenets of constructivism maintain that social entities are indeterminate and under continuous construction by social actors. From a constructivist perspective, social phenomena do not exist independently from our experience and understanding of them (Bryman, 2016). This study has a constructivist approach to the research process despite its positivist way of presenting the results. I recognize that people do play an active role in the construction of our reality. Hence, what is demanded to make biochar an accepted climate measure is not an objective truth; an answer to that question is constructed both by the study participants

perceptions' and views along with the researcher's choices in every aspect of the research such as theory, research design, data collection, and analysis.

4.2. Methods

Research strategy

Data collection was conducted using a qualitative research strategy for the reason that this approach allows for an in-depth understanding of views and perceptions in this case study. A qualitative research strategy emphasizes words in the collection and analysis of data (Bryman, 2016), which was considered the only meaningful way to answer the main research question.

Research design

This study is based on a specific unit of analysis, biochar as a climate measure, in the specific setting and location of the agricultural sector in Norway. Hence, this study is a case study. The advantage of applying case study as a research design is that it allows for the in-depth and detailed investigation of a single case in a specific setting. However, a limitation associated with case studies is that the results and conclusion is context specific and cannot be used to generalize the results as representative of other cases (Bryman, 2016). In addition, policy process implies that changes make take place all the way to the end. Hence, a limitation to this study is that the conclusion may only apply to the time and place of this unique case and cannot be generalized outside of the object of study.

4.2.1. Document analysis

Data was collected via document analysis and semi-structured interviews. The document analysis was carried out before and after the semi-structured interviews both as a preparation of background knowledge and to expand knowledge after the interviews. Bryman (2016) refers to the combination of different sources of data in research as a technique called triangulation. Triangulation is a useful way to cross check the data, and thus, provides a more balanced explanation of the social phenomena. According to Lincoln and Guba (1985) and Guba and Lincoln (1994), triangulation also strengthens the credibility of the research (in Bryman, 2016: 384).

The reviewed material in the document analysis included official documents, deriving both from the state and private sources, such as state documents, official news and press release,

reports, scientific articles, and other relevant documentation. In a few cases, unofficial information from governmental letters was also reviewed. Bryman (2016) argues that the advantage of using external documents is that they are non-reactive. Because the reviewed material in this study was not produced as a part of this research, the data reviewed has not been influenced or impacted in any way by this study.

Following the suggestion by Scott (1990), the documents were assessed according to four quality criteria:

- "Authenticity: Is the evidence genuine and of unquestionable origin?
- Credibility: Is the evidence free from error and distortion?
- Representativeness: Is the evidence typical of its kind, and if not, is the extent of its untypicality known?
- Meaning: Is the evidence clear and comprehensible?"
  (Scott 1990: 6 in Bryman, 2016: 546)

In my assessment of the origin and meaning of the documentation, I find that the authenticity is indisputable. As regards to the credibility and representativeness, it is clear that some document sources have an agenda. For example, information published on the website of organizations such as the Farmer's union are written with their political views and perspectives in mind. Such agendas have been carefully considered to secure appropriate use.

4.2.2. Semi-structured interviews

The semi-structured interview is a type of qualitative interview that starts out with a prepared interview guide (to various degrees) but allows the researcher to be flexible by modifying questions and adjusting to how the conversation naturally evolves during the interview. For example, if the interviewee's answer provides new and interesting information, the researcher has the opportunity to ask follow-up questions or inquire the interviewee to elaborate more on the subject of interest. Hence, through the semi-structured interview method, it is possible to access the views, thoughts, and ideas of the participants, including those that were initially unexpected (Bryman 2016).

The preparatory process prior to the interviews involved a thorough design of the questions in the interview guide as a solid base for the otherwise flexible interview. The themes applied in the interview guide were inspired both by the initial document review and theory. Following suggestions by Bryman (2016), certain elements were considered during the design of the interview guide, such as the logical order of topics, keeping in mind the research question when formulating the interview questions, simplify language, avoiding leading questions, and lastly, formulating open-ended questions to obtain meaningful answers.

Between October 2019 and January 2020, eight semi-structured interviews were carried out (Table 1). One pilot interview was conducted both to test the interview guide, recording device, and interview skills. Seven of the eight interviews were conducted in person, while one interview was carried out via e-mail. The interviews lasted between one and two hours. The informants were strategically handpicked through criterion sampling. The criteria were developed on the basis of findings in a literature and document review that was conducted early in the study. In this preparatory process, a number of potential challenges to the acceptance and implementation of biochar were identified. The plan was to recruit at least one prominent expert in each scientific field where the identified challenges resides.

Moreover, it was also necessary to sample informants from the most central actors of the agricultural policy regime because of their ongoing policy process of implementing climate measures between 2021 and 2030. The informants from the Farmer's Union, the Smallholder's Union and the Ministry of Agriculture and Food, were chosen according to their position and involvement in the process from the climate negotiations. None of the leaders of these regime actors were interviewed, but rather advisers and directors that were working closely with their leaders in the negotiation process, and that were trusted with positions in the technical working group set up between the parties, were interviewed. These informants had inside information on the climate agreement process, cooperated with the other regime actors on assessing potential climate measures, and had some level of knowledge about biochar (which reportedly their leaders did not have).

As a result of the necessity to interview different experts with different expertise, it was not possible to write one blueprint interview guide that could be applied in all interviews and improved during the interview phase. Completely different questions were required in the different expert interviews. In contrast to this, it was both possible and necessary to ask the

three informants from the agricultural policy regime identical questions. However, because the experts were asked different questions, it was not possible to summarize the most important insights from these results in a compressed manner. This has implications for the size of the results chapter, as it is far more extensive than if all participants in the study were asked the same questions.

Table 1: Informants, their affiliation and reference number

Position	**Affiliation**	**Reference number**
Senior adviser	Norwegian Environment Agency (NEA)	NEA1
Senior adviser	Norwegian Environment Agency (NEA)	NEA2
Head of a department	NIBIO	NIBIO1
Senior scientist	NIBIO	NIBIO2
Senior advisor	Mattilsynet (Norwegian Food Safety Authority (NFSA))	NFSA
Lawyer	Føyen Torkildsen AS (FT)	FT
Subject director	Landbruks- og matdepartementet (LMD) (Ministry of Agriculture and Food)	LMD
Adviser	Norges Bondelag (NB) (Farmers union)	NB1
Project leader	Norges Bondelag (NB) (Farmer's Union)	NB2
Political advisor	Norges Bonde- og Smårbrukarlag (NBS) (The Smallholder's union)	NBS

To ensure that the informants were as comfortable as possible, the interviews were conducted in a setting that was familiar to the informants, either in their office or work location. All participants agreed to be recorded. Prior to the interview, the interviewees were asked to read a study information sheet and sign a consent form (Appendix A & B). Lastly, the informants were offered quote- and info- check before submission, of which they all requested.

4.2.3. Data analysis

The collected data from the semi-structured interviews was analysed by coding. In qualitative research, coding refers to a process where the researcher labels and organizes the data collected (Bryman, 2016). Adu (2019) identifies five basic steps of coding qualitative data: "collecting raw data→ choosing relevant information from the data→ labelling the selected

information→ and grouping the labels (i.e. codes) into mostly abstract concepts→ generating categories and themes" (Adu, 2019: 26-27). The data in this study was first read many times, coded, and some re-coded with inspiration from this general method. The initial labels were coded into condensed categories, which in turn were influenced by the themes from the interview guide (that originated from the preliminary research stage). Finally, these condensed categories were coded by a short description of the essence of the data, which is now presented in the findings chapters. Table 2 below illustrates steps in the coding process, and only serves as an example.

Table 2: Example of coding process

Initial codes	Condensed codes	Essence category
Have not discussed feedstock for biochar internally or externally	Manage challenge 3: feedstock	Challenge 3 not managed
Have not discussed biochar feedstock internally or externally		
Have discussed feedstock but no conclusions or actions were taken		
We must come to a clarity... We must have a closer look at this.	Thoughts on challenge 3: Choice of feedstock	Choice of feedstock important to the participants
Very important		
The discussion on feedstock for biochar is important		
We need an evaluation of resources.		

4.3. Research Challenges

Some participants were challenging to get a hold of. At the beginning of the interview phase a couple of potential expert interviewees turned down the request to participate in the study on the grounds that they were too busy. There were two types of experts that took between one and two months to find. Consequently, this delayed the progress on this thesis.

As a group, the academic background of the informants was diverse, however, they all had many years of experience in their occupations. Most of the informants were male, only three female. A few interviewees had strong opinions on subjects that were not relevant for this

thesis. Extensive elaborations on these irrelevant subjects were a bit challenging to work around in the interview, because it was clear that expressing these opinions was of importance to these participants. A solution was to politely listen and try to move on in the interview when possible. That being said, most interviews were uncomplicated and easy to conduct without too much sidetracking.

4.4. Ethical Considerations

During the research process, a number of moral dilemmas may arise. These are ethical issues that must be addressed in order to establish the integrity and quality of the study (Bryman, 2016). Hence, practicing ethical guidelines is important to ensure that the study conforms to sound ethical standards.

Diener and Crandall (1978, as cited in Bryman, 2016: 125) identify four common ethical issues in social research:

1. "Whether there is harm to participants
2. Whether there is a lack of informed consent
3. Whether there is an invasion of privacy
4. Whether deception is involved"

Attempts to avoid these ethical issues have been applied as guiding ethical principles. The following section describes the precautionary actions that were taken throughout this study.

The subjects that participated were all resourceful people who were, to my knowledge, not too vulnerable in any way to participate in this study. Securing the participants confidentiality and right to privacy by protecting their identity (Bryman, 2016) has been given significant attention as they are anonymised throughout this study. Moreover, the interviewees personal information is not stated in the recordings, nor does the written transcripts reveal their identity. As this study does not process personal data about the participants, there was no need to notify the Norwegian Centre for Research Data.
The participants have been informed that the recorded material will be deleted upon submission of this thesis in order to secure that there is no possibility of having the records lost or misused in the future. Hence, participation in this study will not affect the involved subjects negatively in any way after publication.

Prior to the interviews, participants were asked to read a study information sheet to ensure that they were fully aware of the study topic and study objective and what the objective of this study is. The information given to the interviewees was correct at all times, and no one was deceived in any way. In addition, the participants were asked to read and sign an informed consent form, which established and clarified the rights of both the participants and researcher (Appendix A & B). In the informed consent form, it was made clear that the interviewee has the right to withdraw at any time, without any further explanation to the researcher. Lastly, all participants were offered the opportunity to read through the information and statements given by them in the contexts in which their information was used and is presented. Respondent validation not only prevents misuse of the information given by interviewees but also works as a quality check for potential misinterpretation or misunderstanding, ensuring that their views are correctly understood. Hence, respondent validation as a technique strengthens the credibility of research findings (Bryman, 2016).

It is evident from above that actions have been taken to ensure that this study has not posed any real or potential harm to the participants. This can be argued on the grounds that full anonymity and confidentiality was guaranteed securing the participants rights to privacy. Moreover, the informants were fully informed about the study and consented to participate. Lastly, the informants were not deceived in any way. The information they recieved was accurate and sincere.

4.5. Methodological Limitations to the utilization of Theory

In chapter 3, the theory of John W. Kingdon was presented to the reader. A detailed description of The Multiple Streams Framework was provided and it was described how it is utilized in the analysis & discussion chapter. However, there are some limitations that must be noted. Because there was limited time and resources to do interviews with potential policy entrepreneurs, the material for this part of the analysis and discussion is based on published sources. This had implications for the information available to carry out an analysis and discussion of potential policy entrepreneurs.

5. Results

5.1. Introduction

Since we are dealing with an open policy process, the content of what will be referred to as the biochar policy proposal is given much attention. Thus, this chapter is dedicated entirely to investigate whether biochar as a policy proposal may meet Kingdon's (2014) selection criteria of feasibility, acceptability, future constraints and political acceptance. A literature review was carried out based on these criteria. The review revealed several potential challenges. The following section provides an explanation of the challenges. Section 5.1. ends with an overview of how the rest of the chapter is organised, along with a short note on informants.

Concerning whether biochar is *feasible* for implementation, several potential challenges are identified. As mentioned in the background section, the existing rules of the international climate regime do not fully accept that the carbon storage effect from biochar is reflected in Norway's National Inventory (official climate budget). Consequently, these rules apply to agriculture's main shadow budget as well. The fact that biochar cannot be accounted for in the National Inventory have been described as a central barrier for biochar implementation in the 2017 scientific biochar study CAPTURE + (Thomassen et al., 2017). The next challenge is that biochar has a range of possible forms of use (Steen, 2017:6), and it remains to choose from these. Furthermore, there is no agreed international or national standardized feedstock for a biochar product. Actually, there are a number of considerations to evaluate when choosing feedstock, such as content of contaminants, availability, costs, and competition for resources (NEA et al., 2020: 472, part b: 332). In their negotiations document, the agricultural unions describe the climate potential of biochar to be directly connected to the type of feedstock (NB & NBS, 2019: 45), signifying that the choice of feedstock is central for the design of a biochar policy they can accept. Finally, the Norwegian Environment Agency (NEA) state that they will require documentation, on-site control, and reporting from farmers who receive subsidies for biochar (NEA et al., 2020: 473), which indicates a need to clarify rights and responsibilities in a biochar policy.

Turning to the *acceptability* criterion, cost-efficiency was mentioned as a central principle in Norwegian environmental politics in the background chapter (St.meld. nr. 34 (2006-2007)). A potential challenge for a biochar policy in relation to establish cost-efficiency is that the costs

are found to be uncertain and are sensitive to factors such as the type of feedstock and scale (Leffertstra & Fjeldal, 2010: 38; NEA et al., 2020: 332; Steen, 2017: 11).

On the matter of *future constraints,* it was found that the costs of carbon storage with biochar are somewhat uncertain. Moreover, production of biochar is currently not privately profitable (NEA et al., 2020: 232), which is related to the fact that no one is willing to pay for emission reductions that result from carbon storage with biochar (Thomassen et al., 2017: 15).

Finally, the *political acceptance* in our case is mainly dependent on the central actors in the agricultural policy regime that signed the intentional climate agreement in 2019. Indeed, the agricultural unions are mandated with the power to choose climate measures in the intentional climate agreement. However, the Ministry of Agriculture and Food may also be considered important in relation to the choice of climate measures as the central representative for the government during the annual negotiations where subsidies and economic support for climate measures will be settled. The two agricultural unions and the Ministry of Agriculture and Food may have separate views on biochar as a climate measure. Moreover, their thoughts on the potential challenges to the *feasibility, acceptability,* and *future constraints* of biochar implementation may affect their acceptance in a selection process.

These categories *feasibility*, *acceptance & future constraints*, and *political acceptance* make up sections in *Results* and are arranged under either of the two sub research questions:

SUB RQ1 is discussed in section 5.2.: "What are the current challenges to adoption of a biochar policy in agricultural sector? What are the potential solutions to overcome these challenges?". Focus is on feasibility, acceptance & future constraints and political acceptance on international level by the international climate regime.

SUB RQ2 is discussed in section 5.3: "How are the challenges managed in the policy-making process during and after the climate negotiations between the Norwegian government, Farmer's union and the Smallholder's union?". It focuses on political acceptance on national level by the agricultural policy regime.

5.2. Feasibility

5.2.1. Forms of use

The potential uses of biochar on farm are many. As mentioned in the background section, the *2019 IPCC Refinement* includes the first IPCC methodology for biochar. Even though this methodology cannot be reflected in the National Inventory today, the report offer insight into what will be required in a future methodology. Both the Tier 2- and 3 methodology excludes all other forms of biochar use other than in cropland and grassland mineral soils (IPCC, 2019). Consequently, this finding shapes the focus in this chapter, as I assume that acceptance of biochar as a climate measure is connected to its probability to be reflected in Norway's official climate budget, the National Inventory Report.

In what forms can biochar be amended to soil? There are two ways to do this: either as pure biochar product or a fertilizer product (Interview, NIBIO1, 2019). While pure biochar does not add nutrients to the soil, a biochar fertilizer product will have a two-fold climate benefit, as it will both store carbon and boost crop yields. Currently, no commercial biochar fertilizer product is available. However, the Norwegian company Standard Bio is now in the process of developing a biochar fertilizer product. Moreover, the IPCC Tier 2- and 3- methodologies does not require anything more than a pure biochar product.

5.2.1.1. Challenges

Pure biochar is essentially nutrient-poor, nevertheless, it is found to retain water and existing soil nutrients and increases pH in the soil (Interview, NIBIO1, 2019). These properties of biochar may boost crop yields, however, effects depend on climatic zones and soil conditions such as levels of precipitation, pH, and fertility prior to amending biochar (Jeffrey et al., 2017; Interview, NIBIO1, 2019). A global scale meta-analysis from 2017 found that on average, biochar amendment increases yields as much as 25 % in the tropics. In temperate latitudes, however, no effects on yield were found (Jeffrey et al., 2017). This finding is supported by a four-year field experiment in Norway that did not find any effect on yields of oat and barley (O´Toole et al., 2018).

The expert on biochar explains that the cultivated soils in Norway, in general, contain sufficient levels of organic matter (and carbon) and a balanced pH. In addition, we have

abundant precipitation, and so the need for water retention is not as critical (Interview, NIBIO1, 2019). It is evident from this information that amending a pure biochar product in the soil will not contribute to agronomical benefits that most Norwegian farmers expect from soil amendments (as confirmed by O´Toole et al., 2018). A possible solution to this problem is to benefit food production by combining pure biochar with "raw" nutrient-rich organic material. As mentioned earlier, biochar is found to retain water and nutrients, and this property of biochar is one of the reasons why it is believed to be well suited as a carrier base fertilizer product (Rasse et al., 2019). Biochar has high carbon content but is low in nitrogen. Furthermore, when mixed with nitrogen-rich organic material, biochar will bind the nitrogen by medium strength. The advantage of this is that the nitrogen is not washed out, and is available for plant-uptake (Interview, NIBIO2, 2019).

A biochar fertilizer product would have a two-fold environmental benefit as a climate measure, because it would both store carbon and reduce the need for chemical fertilizers by adding nitrogen and nutrients to the soil (Rasse et al., 2019). Given the benefit a biochar fertilizer product would provide Norwegian farmers, it is the natural choice when put up against a pure biochar product. The challenge is that currently there are no commercial, ready-to-use biochar fertilizer products available in Norway. Currently, it is not possible to say exactly when such a product will be available. However, there is both activity and interest around a biochar fertilizer product in the country both from scientists and commercial actors. For example, the Norwegian company Standard Bio is reportedly working on a biochar fertilizer product (Interview, NIBIO1, 2019), at the same time as leading scientists on biochar are researching a biochar-fertilizer solution in the project CARBO- FERTIL that span from 2018-2021 (NIBIO, 2020).

5.2.1.2. Solutions

The potential solution to this challenge is to accept and implement a pure biochar product while awaiting a biochar fertilizer product that is ready for distribution. This is because, even though a pure biochar product is not found to increase yields in Norwegian soils, it provides a benefit to the society as a whole, by storing carbon. A pure biochar product is adequate in order to meet the IPCC requirements for Tier 2- and 3- methodologies (IPCC, 2019), and as such, it will be sufficient for reflection in the National Inventory (and that is what the agricultural sector needs in order to meet their target in 2030).

5.2.2. Choice of Feedstock

Scientists have suggested several types of feedstock for biochar, mainly from different by-products originating from logging and production of virgin wood products, as well as agricultural residues (Rasse et al., 2019). As biochar is not currently accepted or implemented as a climate measure in the agricultural sector, no choice of feedstock has been made so far. Table 3 illustrate that there are many potential feedstocks for biochar. What feedstock are the most suitable for biochar as a carbon soil sink? The answer is complex because the policy-direction for biochar as a climate measure may influence the choice of feedstock(s). For example, is the goal to maximize environmental benefit, by storing carbon using certain types of waste? What feedstock is allowed to use in Norwegian soils? In the official climate budget, carbon storage with biochar would be reflected in the forest sector (LULUCF) (NEA et al., 2020). Is it considered problematic or beneficial if a type of feedstock "belongs" to a different sector in the official climate budget, such as agriculture or waste? A possible solution to the complexity of considerations is to start with a scientific evaluation according to requirements of the IPCC methodology as described in the *2019 IPCC Refinement*, and then evaluate the most suited feedstock up against the most important considerations for policymakers.

5.2.2.1. Challenges

This chapter begins with Table 3 that describes 9 potential feedstocks for biochar according to available amounts and competitive use. Following the table the considerations that illustrate the challenge of complexity are presented: competition for feedstock, scale of production, accounting in the National Inventory, the influence of feedstock on climate effect of biochar and regulations. The row on *competitive use* in Table 2 will be commented under *competition for feedstock*.

Table 3: 9 Potential feedstocks

Type of feedstock	Estimated amounts Dry matter = DM	Competitive use	Comments
Straw	400 000 t *Represent availability for biochar production in 2019 (3)	Fodder, animal bedding, heating (1, 2)	- Mainly used as fodder during years of drought (1)
Bark and woodchips from wood industry (virgin wood)	Bark: 95 000 t Sawdust: 80 000 t *Both numbers represent availability for biochar production in 2019 (3)	**Woodchips:** Wood based boards and panels (6) Bioenergy, biofuel, animal bedding, briquettes, pellets, and diverse bio based products (4) **Bark:** bioenergy, soil improvement, sanitary bark and compost (4)	- Closures in domestic paper- and wood industry recent years, cause more export of wood chips (4, 6)
Logging residues (virgin wood) (Norwegian: GROT)	740 000 t *Represent availability for biochar production in 2019 (3)	Bioenergy (4)	- There are currently no use of logging residues in Norway (4)
Wood waste	769 000 t (2018) *Key use of this resource was: 54 000 t for material recycling and 704 000 t for bioenergy (5)	Bioenergy, second generation biofuel, and bio based products (4)	- The use of wood waste for biogas increased by 40 % from 2017-2018 (7) - Mixed degree of purity (6)
Horse manure compost (with wood chips)	250 000 t *Represent availability for biochar production in 2019 (3)	Organic fertilizer product	- Horse manure is not regulated in Norway. Large amounts are therefore assumed available (1, 3)- Low market demand as fertilizer product (8)
Biogas residues from food waste (separated in fluid and solid fractions)	275 000 t * 238 000 t fluid fraction and 36 000 t solid fraction in 2017 (10)	Organic fertilizer product *Solid fraction suitable as a phosphorous- fertilizer and fluid fraction suitable as Nitrogen-fertilizer for grains (9)	- Contaminants such as plastic and micro plastic in solid fraction (1) Rich in P and N (9)
Fish slurry	15.000 t (DM) in 2016 from hatcheries (13) In 2018, a 26 000 t combination of fish slurry and other maritime waste was used for biogas production and 2 000 t for composting (12)	Organic fertilizer product (13) Biogas (12)	- Rich in phosphorous (13) - Not accounting for fish slurry from open pens. - Amount expected to increase (1)
Sewage sludge	130 000 t (DM), 2015 (11) - In 2018, 86 000 t was used for production of biogas, and 51 000 t for compost.	Organic fertilizer product (9) Biogas (9)	-Rich in phosphorous, organic materials and nitrogen (11) - Contains heavy metals (1)
Park- and garden waste	178 000 t (2018) * from this amount 4 000 t was used for material recycling, 3 000 t for biogas and 164 000 t for compost (14)	Biogas, bio products and compost (14)	

Sources: (1) Interview, NIBIO2, 2019; (2) Interview, NIBIO1, 2019; (3) Rasse et al, 2019; (4) Alfredsen et al., 2018; (5) SSB, 2020a; (6) Askeland et al., 2017; (7) NEA, 2019b; (8) Brod & Haraldsen, 2017; (9) Haraldsen & Føreid, 2015; (10) SSB, 2018; (11) Farestveit et al., 2015; (12) SSB, 2020b ; (13) Cabell et al., 2019; (14) SSB, 2020c

Competition for feedstock

Producers of biochar intended for carbon storage may encounter two types of resource competitions for feedstock. First, biochar may replace fossil coal in the ferroalloy industry (Leffertstra & Fjeldal, 2010). Recently, the IPCC included biochar for fugitive emissions (emissions from pressure equipment) in the *2019 IPCC Refinement* (IPCC, 2019), so this may increase demand for biomass feedstock from the ferroalloy and other industries. Second, it is reasonable to expect that virgin biomass will be key in an increasing number of new, environmentally friendly product value chains in the future (Johnsen et al., 2019). In addition, the shift from linear to circular economy means that we will also transform the way we utilize waste. Indeed, it is expected that waste will be important as a secondary resource for new value chains (Norsk Gjenvinning et al., 2016).

Table 3 above show that currently straw, residues from logging, and horse manure are the three feedstocks that stand out with low or no competition and in considerable available amounts. In addition, domestic demand for by-products from the wood industry is low at the moment, therefore it is mostly exported (Askeland et al., 2017). As such, this feedstock should be available in large amounts at a fairly low price. Total amounts of fish slurry are expected to increase as authorities will demand more closed pens in the future (Farestveit et al., 2015). At the same time this resource is known to be challenging and costly to collect (Cabell et al., 2019), which can result in high costs for collecting and transportation. Fish slurry, sewage sludge, and biogas residues are rich in P and N, and therefore the most environmental friendly use of these feedstock are as a "raw" (not undergone pyrolysis) combination with biochar in a fertilizer product. In this way the "raw" ingredients will preserve nutrients ready for plant uptake, while the biochar stores carbon. However, certain fractions of biogas residues may be too contaminated with plastic, which prevents their use as raw amendments in soil. Conversion to biochar provides a solution to that problem as these contaminants will be eliminated during pyrolysis (Interview, NIBIO2, 2019).

Scale of production

In relation to the fact that biochar is currently not accepted or implemented as a climate measure in the agricultural sector, the production scale is currently not determined. Should production of biochar be implemented on a small, medium, or large scale? Indeed, who will produce biochar? Is it the farmer, a commercial business, or a governmental production

facility somewhere? The reason why these questions may be of importance, is that a farmer who produces biochar on farm will most likely use whatever residues available from production, logging etc. that are close by. Then that will influence the choice of feedstock on a small scale. But if the production is medium or large scale, the feedstock must be available in larger quantities and so the criteria for choice of feedstock have changed. Depending on where the large-scale production facilities are located, other feedstock might be available than on a small scale, and it may also be possible to set a standard combination of feedstock for a biochar product. However, the downside of medium to large scale will be the need for transportation and increased collection effort and costs, which in turn may affect the environmental effect and benefit of biochar as a climate measure in total (Interview, NIBIO2, 2019). Lastly, production costs vary according to production scale, and this will be discussed in chapter 5.3.1.

Accounting in the National Inventory

Due to the accounting system in the National Inventory, new emissions and removals occur when feedstock is converted to biochar. Indeed, many potential feedstock listed in Table 2 are accounted as GHG emissions or removals in different source categories of the National Inventory. As soon as the feedstock is converted to biochar, it is accounted as carbon stock changes in Forestry and Other Land Use sector (NEA et al., 2020: 167). Hence, the conversion creates new emissions or removals of GHGs in the original source category of the feedstock. For example, the use of waste materials for biochar reduces the total input in the waste streams that is accounted in the waste sector (IPCC, 2019).

Another example is when conversion of feedstock to biochar creates a temporarily *carbon debt period* in the accounting system. For example, logging residues (GROT) are already accounted as dead plant material decomposing at a rate between 10 and 20 years (Rasse et al., 2019). Let us say that half of the carbon in GROT remains stored "permanently" in biochar, while the other half of the carbon is immediately released during pyrolysis. Then, by producing biochar, 50 % of the carbon that was registered in the Inventory has disappeared, and it takes between 10 and 20 years before the climate effect is positive (Interview, NIBIO1, 2019). As such, feedstock that has extensive carbon payback periods such as GROT may represent a challenge in cases where the purpose of biochar implementation is to reduce emissions within a defined time frame shorter than the carbon payback period.

Type of feedstock influence the climate effect of biochar

Feedstock originating from wood is found to have higher levels of carbon and stability in soil than resources rich in minerals (Rasse et al., 2019). Consequently, feedstock from wood will create climate effects that will avail considerably more than mineral rich feedstock in the National Inventory.

Regulations

Feedstock content of heavy metals

It is legal to amend biochar in Norwegian soil (Interview, NFSA, 2019), however, application of any product containing biochar in arable soil is primarily regulated by *Forskrift om gjødselvarer mv. av organisk opphav*[5] *(Regulation on organic fertilizer)*. Certain feedstock for biochar may be subject to additional regulations as well, such as *Forskrift om fremmede organismer*[6] *(Regulation on foreign organisms)* and *Animaliebiproduktforskriften*[7] *(Regulation on animal by- products)* (Interview, NFSA, 2019). For example, animal manure is regulated both in the regulation on organic fertilizer and regulation on animal by-products. Consequently, biochar products containing animal manure must comply with both regulations.

The regulation on organic fertilizer specifies a set of requirements pertaining to matters such as quality, internal control, materials, branding, and use. The quality requirements for feedstock content are the most relevant consideration for choosing the feedstock for biochar production. For example, certain organic and inorganic contaminants are either banned or regulated with maximum limits (Forskrift om organisk gjødsel, 2003). A pyrolysis process of 400 degrees is found to eliminate organic contaminants and plastic, however, inorganic substances such as heavy metals remains after pyrolysis (Interview, NIBIO2, 2019). Hence, the content of heavy metals in the potential feedstock for biochar will determine the allowed application site, rate, and size of any biochar product. Table 4 below describes four quality classes and how these categories regulate application site, rate, and size.

[5] FOR- 2003-07-04-951
[6] FOR-2015-06-19-716
[7] FOR-2016-09-14-1064

Table 4: Quality classes

Quality classes				
Quality class (From lowest to highest maximum limits of heavy metals)	Application on arable land	Application size (DM= Dry matter)	Application rate	Product definition
0	Yes	Max. plants nutritional need	No limit	Fertilizer (*)
I	Yes	Max. 4 t DM pr. decar	10 years interval	Soil improvement (*)
II	Yes	Max. 2 t DM pr. decar	10 years interval	Soil improvement (*)
III	No	Max. 5 cm	10 years interval	-
Source: Forskrift om organisk gjødsel, 2003; * Haraldsen & Føreid, 2015.				

As shown in Table 4, only biochar products in class 0 will be defined as fertilizers that can be applied according to the plants need for nutrition. As such, the intended use and application rate of the biochar product as either fertilizer or soil improvement may affect the feedstock choice.

Feedstock in grey and red zone

There are certain types of feedstock that are either not clarified as safe or unfit as amendment in arable soil. This is mainly different fractions of waste. First, in what can be seen as a not clarified, grey zone, we have waste materials that contain plastic, paint, glue, and impregnation substances. The reason these materials have status as not clarified is that there is not enough research and reliable documentation on the quality of the materials and how these will react to high temperatures such as pyrolysis (Interview, NFSA, 2019; Interview, NIBIO2, 2019). Apparently, it is unclear whether it is permitted to use these "grey zone" waste materials. To be sure, the Norwegian Food Safety Authority states that they will require heavy metal analyses of some types of materials both before and after pyrolysis (Interview, NFSA, 2019). Also, the regulation on organic fertilizer imposes a duty of care on the producer of a product to prevent harmful levels of organic contaminants (Forskrift om organisk gjødsel, 2003).

Second, there is a "red zone" of waste materials that is undoubtedly unfit as a soil amendment. These are outdated impregnated materials with poisonous contaminants such as chromium, copper, and arsenic. Surely, they are not produced in Norway anymore, however, they may still be found in old constructions that will need renovation at some point. Hence, these

materials may end up in waste disposal and receiving stations for some time to come (Interview, NIBIO2, 2019).

New regulations

Norwegian authorities are working on a new regulation for soil amendments that will replace the regulation on organic fertilizer. Most relevant to the feedstock choice for biochar is the suggestion to operate with a positive list for feedstock that excludes anything not listed (Interview, NFSA, 2019). I find that waste wood is not included in the suggestion for a new positive list. However, it will be possible to make special requests for feedstock that are excluded from the list (NAA, 2018).

A new EU regulation recently accepted biochar as a soil amendment in a new regulation on organic fertilizers; however, the acceptance is only for biochar from plant material (Commission Implementing Regulation (EU), 2019). Currently, a suggestion for approval of biochar in the CE- fertilizer products regulation is on the table in EU, and if this goes through, biochar fertilizers with a CE- mark can be sold throughout the European Economic Area unless there are specific national restrictions (Interview, NFSA, 2019).

5.2.2.2. Solutions

The Tier 2 methodology proposes to consider multiple feedstock and evaluate them according to certain criteria such as stability in soil (IPCC, 2019). Hence, to let IPCC methodology provide guidance is one possible solution to the complexity of considerations. This type of evaluation will determine what feedstock proves to be the most suited in Norwegian soils. The results could then be evaluated up against factors that are important for policymakers (such as competition for feedstock etc).

5.2.3. Clarifying Rights and Responsibilities

The Norwegian Environment Agency (NEA) recently stated that a potential biochar policy granting farmers economic support for carbon storage in soil with biochar will require documentation, on-site control, and reporting (NEA et al., 2020: appendix I, p.335). The statement suggests that there will be several terms attached to governmental payments for carbon storage with biochar, and that there is a need to clarify and manage these in some way in order to make biochar feasible for implementation. This chapter is about the latter. The challenge is that there is currently no settled or suggested institutional structure to clarify and manage rights and responsibilities for a potential biochar policy in the agricultural sector. One potential solution is individual contracts that open for specific contractual terms depending on context and location. Another potential solution is to establish terms and management of the exchange through a set of general governmental regulations.

5.2.3.1. Challenges

Establishing rights and responsibilities in environmental governance is important because it distributes power between the involved parties as well as coordinates their environmental actions through the establishment of certain rules. For example, rights may clarify who has access to resources and what type of access, while settling responsibilities defines who has duties to protect the resource and who shall pay for the service. Hence, rights and responsibilities also affect income of involved parties (Vatn, 2015).

The nature of the exchange, payment for the service of storing carbon, is basically an agreement that gives rise to rights and obligations between the parties (Interview, FT, 2020). However, there are currently no scientific studies or official reports that suggest how rights and responsibilities should be settled and managed in a potential Norwegian biochar policy in agriculture. Establishing and running institutional structures to manage an interaction is associated with costs to ensure delivery of the agreed outcome and enforcing compliance with the regulatory requirements (Vatn, 2015). As mentioned in the background section, a central principle in Norwegian environmental politics is cost-efficiency. Vatn (2015), points to that the type of institutional structure affects the cost-efficiency (p.198), and this may be relevant for policy makers choice of institutional structure to manage the exchange of payments for carbon storage with biochar.

5.2.3.2. Solutions

This section describes two potential institutional structures that may be both convenient and cost-efficient in different ways to settle and manage terms of the exchange of payments for carbon storage with biochar.

One potential solution is individual contracts between farmers and the government. Individual contracts are standard procedure in various schemes where the exchange is payments for ecosystem services or emission reductions, such as projects in the UNs Clean Development Mechanism (CDM). The rationale for managing rights and responsibilities with individual contracts in such schemes is the various complexities involved. For example, there might be social and cultural complexity as the parties to the contract may have different cultural backgrounds, knowledge and power. Hence, ensuring that the contract is equitable is important. Moreover, the contractual terms might be complex. Indeed, the contract duration can be extensive in some projects, spanning up to 20 years. This requires the parties to settle a fixed price, sometimes adjusted for the anticipated future inflation rate. Finally, in cases of extensive contract durations, there might also be a certain delivery risk for the buyer who relies on a certain amount of emission reductions in the future. Hence, some buyers require enforcement with financial sanctions such as penalties in the contract (UNDP, 2003).

Individual contracts can be convenient in order to minimize risks that may arise from various types of complexities as exemplified above, although the contracts can be perceived as complicated by the parties. However, in case of high complexity, it may be far more cost-effective to manage a complicated and detailed contract, than to manage consequences of sudden problems that may arise from unclarified or unanticipated issues after the contract is signed.

A second potential solution is to establish terms through regulations. In Norway, the government has a system that settles and manages rights and responsibilities for farmers who receive ordinary production subsidies, but also for farmers who receive payments for environmental services from *Regionale miljøprogram (RMP) (Regional environmental program)*. This system is built on governmental and regional regulations that set standard terms for each type of subsidy. Hence, farmers are not required to sign an individual contract, nor is the term contract mentioned. However, upon sending the application for a subsidy, the

farmers automatically enter an agreement by consenting to a number of terms that are described in a regulation. For example, when applying for the nationally set production subsidies, farmers are subject to the *Forskrift om produksjonstilskudd mv.i jordbruket*[8] *(Regulation on production subsidies etc. in agriculture).* Similarly, when farmers apply for environmental subsidies in the RMP, the farmers agree to regional set regulations, such as *Forskrift om regionale miljøtilskudd i jordbruket, Oslo og Viken*[9] *(Regulation on regional environmental subsidies in agriculture, Oslo and Viken)*.

The applicants are obligated to learn and follow the terms of the regulation that applies to the type of subsidy they are receiving (NAA, 2020). However, Norwegian authorities only require short-term maintenance that fits within their system of annual payments to farmers. For example, farmers who receive payments for sowing cover crops in RMP for Oslo and Viken are required to leave the soil completely and not apply fertilizer or pesticides until the first of March the following year (Forskrift om regionale miljøtilskudd i jordbruket, Oslo og Viken).

Establishing and managing terms through regulations may be convenient and also cost-efficient when the terms of the agreement are standard, easy to understand, and to follow up for the farmers along with a perceived uncomplicated social and cultural context.

Based on the above information, the most convenient and cost-efficient institutional structure may depend on the overall design of the biochar policy such as terms and complexity of context and actors involved. For example, will the farmer enter short-term agreements that must be renewed annually, or will there be long term contracts? Will there be upfront payments, annual payments or a one-time payment? The answer to these types of questions may lead policy makers to design a new institutional structure or adjust to the existing system to manage the terms of the interaction in order to make biochar feasible for implementation.

[8] FOR-2014-12-19-1817

[9] FOR-2020-06-12-1197

5.3. Acceptance & Future Constraints

5.3.1. Costs & Cost- Efficiency

As we learned in chapter 5.2.1., a commercial biochar fertilizer product is not ready for distribution. Moreover, a combination recipe is not yet provided by scientists for those farmers who wish to make their own fertilizer biochar product. Hence, this chapter will focus on costs and economic compensation for a pure biochar product.

Over the years, it has been found, repeatedly, that biochar is not profitable, mainly because it has no economic value as a soil carbon sink[10]. In an attempt to work around this problem, different calculations have been tried with alternative income sources from biochar production, but as long as the main purpose is to store biochar in soil, it remains more costly than profitable. Looking more closely at the cost calculations, I find that the undetermined scale of production and lack of transparency in cost calculations makes it challenging to compare the different publications[11]. Nevertheless, the lack of economic value for biochar as a soil carbon sink seems to be the most central challenge that requires a political solution. Currently, there seems to be a possibility that the parties to the recent agricultural climate agreement may accept and implement biochar as a climate measure in agricultural sector, and if that happens, biochar will be assigned an economic value. However, the parties will negotiate on economic support for new climate measures during the annual settlements from 2020 (for the year 2021), and therefore it is not possible for the parties to say if or potentially when an acceptance of biochar will happen.

The structure of this chapter deviates from the standard form of other chapters. Costs are first presented in Table 5, followed by challenges and solutions.

5.3.1.1. Costs

Table 5 presents three publications that calculate the cost pr. t/CO_2-e reduction using biochar: Climate Cure 2020 (Leffertstra & Fjeldal, 2010), Erstad et al. (2011) (a study ordered from the Norwegian Agricultural Agency), and Climate Cure 2030 (NEA et al., 2020).

[10] This claim is further explained with references in section 5.3.1.2.
[11] This claim is further explained with references in section 5.3.1.2.

Table 5: Costs

Source	Year	Feedstock	Scale	Abatement costs KR t/CO_2-e (2019-prices)
Climate Cure 2030	2020	Bark, woodchips, horse-manure, straw	Small, on farm	<500
Erstad et al. 2011	2011	Woodchips	Small, on farm	714 (848)
"	2011	Straw	Small, mobile oven	991 (1,177)
"	2011	Straw	Large	271 (321)
"	2011	Woodchips	Large	384 (456)
Climate Cure 2020	2010	Straw	Small scale	800 (962)
Climate Cure 2020	2010	Logging residues	Small scale	250 (300)

5.3.1.2. Challenges

Costs

As table 5 above shows, the three cost calculations are conducted within a 10- year time frame. Results vary, but overall, costs are below 1200 kr t/CO_2-e when converted to 2019-prices. In all three publications it is explained that production scale impacts cost considerably. However, both small- and large- scale production may turn out to be low cost and high cost depending on feedstock and other factors. Hence, it is difficult from these publications to say if there is any trend to costs for either production scales. In general, small-scale production is associated with low feedstock- and transportation costs, while large scale is found to drive these costs up. However, large scale is more efficient and therefore it may come out as low-cost in the end (Erstad et al., 2011: 106; Leffertstra & Fjeldal, 2010: 42; NEA et al., 2020: 334).

Further investigation of the basis for the estimation of costs above show that the studies are not comparable. Indeed, there is no agreed standard cost formula. In addition, some cost calculations are not transparent and accessible to the reader. The components that are included in the estimations vary, and in one publication the details for costs calculation are not included at all, making it challenging to compare. For example, in Erstad et al. 2011, all costs are listed in detail, and from here we can see that expenditures for personnel (salaries) are included even for small-scale estimations (p. 151). However, it is not clear if these are included in small-scale estimations of costs in Climate Cure 2020 and Climate Cure 2030.

Second, both Climate Cure 2020 and Erstad et al. include the value of bio oil, represented as an discount in the total operational costs (Erstad et al., 2011: 158; Leffertstra & Fjeldal, 2010: 40-41), while it is not clear from available information, whether bio oil is discounted in the calculations done by Climate Cure 2030. Actually, in contrast to Climate Cure 2020, there is no calculation sheet of costs included in Climate Cure 2030. Sources are listed, but the included and excluded values from these sources are not explained. For these reasons, it is not possible to compare the three studies.

Economic value

Pure biochar is not valued as a soil carbon sink. Indeed, there is no market or place where a farmer can "sell" the climate service provided by biochar amended in soil (NEA et al., 2020; Thomassen et al., 2017). Through the years, scientists have tried to find ways to go around this problem, by considering the value of biochar and its by-products from production in a commercial market. Examples are sale of biochar as a local barbeque coal, by-products such as bio oil, syngas, and reduced heating expenditures for buildings (Bardalen et al., 2018; Erstad et al., 2011). Although the alternative income sources drive costs down, the main problem still remains: biochar is not profitable as a climate measure because the climate service it provides has no economic value in our society.

5.3.1.3. Solutions

As long as certain factors such as production scale and exact feedstock are not determined for a potential implementation of biochar, costs calculations may remain uncertain. Therefore, there is no immediate solution to that challenge. Likewise, there is no immediate solution to the lack of a standard cost formula for biochar and strengthening transparency, other than that policymakers and scientists may coordinate their calculation methods and improve transparency. In the following section, I will focus on a potential solution to the challenge of no economic value for biochar as a climate measure that stores carbon.

Political incentives for economic support

Who should pay for the soil carbon sink service provided by biochar amended in soil? As a benefit to society that can help us reduce emissions and meet our international climate commitments, a potential "buyer" of the carbon sink service could be society. What are the chances that Norwegian authorities will grant economic support for implementation of biochar as a climate measure? In search for an answer I will look at two relevant factors that

may affect decisions pertaining to economic support for biochar: cost-efficiency and plans for domestic emission reductions.

First, the perceived cost-efficiency of biochar can be related to alternatives found both domestically and internationally. Compared to other domestic climate measures for agricultural sector, biochar is cost-effective. Indeed, in Climate Cure 2030, biochar was found to be one of only four low-cost measures at a cost of < 500 pr. t/CO_2-e (NEA et al., 2020: 167). However, compared to the international alternative of quotas in EU Emission Trading Scheme (ETS), biochar is currently not cost-effective. The current price of quotas in EU ETS is 23,4 Euro t/CO_2- e, which are about 236 kroner converted to NOK (January 2020). Hence, compared to the most recent cost calculation from Climate Cure 2030, assuming maximum 500 NOK, it is currently 264 kroner more costly to reduce one tonne of CO_2-e with biochar than with quotas from EU ETS. However, as the price on quotas is expected to increase towards 2030, this result may change (Carbon Tracker, 2018; Energi og klima, 2020).

Second, as described in the background section, there is one current plan to reduce emissions domestically in the agricultural sector. The parties to the agricultural climate agreement have committed to reduce 5 mill t/CO_2-e between 2021 and 2030. As the Farmer's Union and the Smallholder's Union have evaluated biochar as one potential climate measure to meet their commitment, economic support for carbon storage with biochar seems possible for the first time in Norway. However, final decisions on the specific climate measures, and economic tools to fulfil the commitments are a matter of negotiations during the agricultural settlement each year from 2020 (Government of Norway, 2019a). What are the potentials for economic compensation in general for new climate measures through the annual agricultural settlement? In the intentional climate agreement, there are no signs of prospects for economic compensation of new climate measures. Indeed, it is rather clear that the agricultural sector should not expect increased subsidies:

> "The climate agreement does not commit to future implementation of tools or agricultural negotiations, and the climate agreement does not grant increased subsidies"[12] (Government of Norway, 2019a: 5).

[12] The quote in its original language can be found in appendix C. Quote 1

Furthermore, the Farmer's union has, over the last years, expressed the need to establish a climate fund that activates tax relief for climate-friendly investments made in soil and buildings. The request has been supported by The Standing Committee on Business and Industry of the Parliament of Norway (Innst. 404 S (2017-2018)). Nonetheless, this was not followed up in the National Budget for 2020 (Interview, LMD, 2019).

In addition, the issue of the agricultural sector's CO_2- tax-exempt on red meat has been a subject during negotiations. The government clarified its standpoint in the intentional climate agreement by stating that the CO_2 tax-exemption is discontinued if the agricultural sector fails to meet climate targets by 2030. The threat of CO_2 tax on red meat and the fact that no increased subsidies can be expected, gives rise to the question of whether the tax-exemption on red meat is exchanged for emission reductions? To answer this question and acquire information on the prospects of economic compensation for climate measures in general, I met with informants from all three parties.

First, all three informants agree that it is not a part of the climate agreement that the agricultural unions will reduce their emissions without economic support in exchange for CO_2 tax-exemptions on red meat (Interview, LMD, 2019; Interview, NBS, 2019; Interview, NB, 2019). Second, it is indeed possible that the agricultural sector will receive increased economic support to implement climate measures that will help them reduce emissions. However, existing subsidies are expected to play an important role as a source of economic support for climate measures. Moreover, the informants share the common understanding that, while not guaranteed increased transfer of funds, economic support will be granted from case to case, if the parties agree over the annual settlement.

Lastly, when asked about the chances of choosing biochar as a climate measure, the informants could not answer specifics at the time of the interviews. However, they were able to say something about what is important to their organizations in relation to a forthcoming choice of climate measures. It must be noted that the informants expressed clearly that their answers were their opinion at the time of the interviews, and that things may change quickly in politics. Consequently, these answers are mere indications of the forthcoming priorities of climate measures.

Similar to the signalled position by the agricultural unions in their negotiations document from February 2019 (see section 2.3.1.), both unions underline the importance of continuing to produce food, and that climate measures must not conflict with the farmer's ability to produce food (Interview, NB, 2019; Interview NBS, 2019). But there was also a focus on adapting production methods in line with consumer demands, also coming from the informant in LMD (Interview, LMD, 2019; Interview NBS, 2019). This signifies that it is the consumer that has the power to change the current production of food, not the climate measures. The climate measures must not conflict with production goals, and the farmer's ability to produce food as before.

Based on the findings above, the most potential solution to the challenge of no economic value for biochar as a climate measure is an acceptance by the farmer unions and the government during the annual agricultural settlement. However, an implementation of biochar will cost something, even if the costs are low. Currently, it is not exactly clear who should finance an implementation of biochar and other climate measures. Will the farmers pay from their existing subsidies or will the government increase budget transfers?

5.4. Political Acceptance on International Level

5.4.1. The International Climate Regime

The recent commitments to reduce emissions in Norway's agricultural sector actualize a long-time challenge for biochar as a climate measure. Indeed, due to rules in the international climate regime, emission removals from biochar production and storage may not be reflected in Norway's Inventory Report (NIR) (NEA et al., 2020). Furthermore, only emission reductions and removals from climate measures that can be reflected in NIR count as contributions in the agricultural sector's shadow budget (Government of Norway, 2019a). In order to overcome the barrier to inclusion in NIR and the shadow budget there are two challenges that must be solved. First, the member countries (parties) to either or both the UNFCCC and the Paris Agreement must adopt the new methodological guidelines provided by the IPCC, that for the first time now includes biochar. Second, the right type of documentation is required in order to reflect biochar in NIR.

There is no immediate solution to the first challenge. However, at some point in the future, the parties to the UNFCCC or the Paris Agreement may adopt the new IPCC methodological guidelines, and the challenge will be resolved. The second challenge of obtaining the right type of documentation may be solved by developing the exact methods as they are described in the *2019 IPCC Refinement*.

5.4.1.1. Challenges

Adoption of the 2019 Refinement

The IPCC publication of methodological report *The 2019 IPCC Refinement* enables the member countries to learn what will be required of a future methodology. In the *The 2019 Refinement*, biochar belongs to the sector Agriculture, Forestry and Other Land use (AFOLU), under the category 'soil carbon'. The countries may only develop methodologies on a Tier 2- or 3- level. Originally, a Tier 1 methodology for biochar was included in *The 2019 Refinement*, but because several countries expressed concerns during the 49th session of the IPCC in May 2019, the part describing a Tier 1 methodology was moved from the main text to Appendix 4 (ENB, 2019: page 5-6; Interview, NEA2, 2019).

Despite the inclusion of Tier 2- and 3- methodologies for biochar in the 2019 Refinement, there are currently no plans in the NEA to develop a methodology for biochar in Norway (Interview, NEA1 & NEA2, 2019). As the mandate of the IPCC is only to develop the guidelines and not to put them into effect, an inclusion of biochar in the 2019 IPCC Refinement does not automatically allow the countries to include effects of biochar activity in Norway's National Inventory Report. In order to do that, either or both the parties to the UNFCCC and the Paris Agreement must adopt the 2019 IPCC Refinement formally:

> "IPCC provide guidance in their methodological report. However, for this to come into effect it [the report] must be adopted in climate negotiations, by the parties to the Climate Convention and the Paris Agreement..."[13] (Interview, NEA1, 2019).

As such, any decision to replace the 2006 IPCC guidelines with the 2019 Refinement must take place in either or both the COP and the CMA. It is likely that the parties to the Paris Agreement will adopt the 2019 Refinement in their CMA first, due to the fact that the UNFCCC operates with different methodological guidelines for Annex-I and non-Annex countries. However, it is perceived as only natural that if CMA adopts the 2019 IPCC Refinement guidelines, it will affect COP to consider adoption as well (Interview, NEA1, 2019).

COP and CMA

UNFCCC arrange annual meetings in their Conference to the Parties (COP). Parties to the Paris Agreement meet annually during COP in their own Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA). Both COP and CMA are considered to be the supreme decision-making bodies of both UNFCCC and the Paris Agreement (UNFCCC, 2020d; UNFCCC, 2020e). Read more about the international climate regime in the background section.

Figure 4: COP and CMA

What are the future prospects that the 2019 Refinement will be put into effect? In December 2019, COP25 was arranged in Madrid. This was an opportunity in this respect. However, there were no new decisions regarding adoption of the 2019 Refinement either by the COP or the CMA (UNFCCC, 2020f; UNFCCC, 2020g). Nevertheless, it is expected that the Common Reporting Format (tables for sectors and subcategories for the NIR) will be developed further

[13] Quote number 2

on in 2020. In relation to that, there may be some sort of facilitation for those countries who wish to use the 2019 Refinement (Interview, NEA1, 2019).

Documentation

As mentioned in the background section, both Annex-I parties to the UNFCCC and all parties to the Paris Agreement currently report their annual inventory of emissions and removals in accordance with the 2006 IPCC guidelines. Looking more closely at the rules of inventory reporting, I find ambiguous statements that can be understood as introducing flexibility to the rules.

In 2013, COP decided:

> "Annex- I parties may also use national methodologies which they consider better able to reflect their national situation, provided that these methodologies are compatible with the 2006 IPCC Guidelines and are well documented and scientifically based" (UNFCCC, 2013, C.methods, paragraph 10, page 7).

Similarly, in 2018 CMA decided:

> "Each Party may use nationally appropriate methodologies if they better reflect its national circumstances and are consistent with the IPCC guidelines referred to in paragraph 20 above [2006 IPCC Guidelines]. In these cases, each Party shall transparently explain national methods, data and/or parameters selected" (UNFCCC, 2018a, C. Methods, paragraph 22, page 23).

Both paragraphs imply that in order to gain acceptance to reflect effects of a climate measure in NIR that is not included in the 2006 IPCC Guidelines, there are two requirements that must be fulfilled. First, the methodology used in the calculation of effects from the climate measure must be well documented. Second, the methodology must be compatible with the 2006 IPCC guidelines. What is meant by *compatible* is not defined or clarified further. In any case, how flexible these rules are in reality is a difficult question with no clear answer (Interview, NEA1, 2019). However, previous experience proves that there is some flexibility to the rules. Indeed, through considerable campaigning, Norway managed to gain acceptance for Carbon Capture and Storage (CCS) technology before it was included in the IPCC guidelines:

> "...Norway has put great effort into acceptance for that [CCS] measure. We have participated in international processes and guideline development both in EU and in the Paris Convention [Agreement] etc. We dealt with the resistance that were present in other countries"[14] (Interview, NEA2, 2019)

This incident gives rise to the question of what the potential is for a similar process for biochar? As it turns out, such a scenario is unlikely at the moment. First, the controversies during the 49th session of the IPCC, and the following disapproval for a Tier 1 methodology for biochar, is mentioned as a factor that makes it more risky to initiate a similar process to that of CCS:

> "...[There was] something in Tier 1 that was rejected from the original draft and moved to the Appendix, which contribute to a lower "standing". This is a thing [concern] that influence us when we do our evaluation...How confident the methodological report is on the different pieces"[15] (Interview, NEA2, 2019).

Second, the required methodological documentation that is pointed to in the paragraphs cited above (COP: §10 & CMA: §22) is lacking at the moment (Interview, NEA1, 2019). Thus, documentation is mentioned as the key to progress for biochar as a climate measure:

> "... If anyone, whether it is governmental authorities or someone else who wish to establish biochar as a measure and reflect it in the [climate] budget, then it must be documented... to document it [biochar] and have reviewers in the system [of the international climate regime] to look at it will be a start[16] (Interview, NEA1, 2019).

> "We [NEA] think it is good to include as much as possible when it [climate measure] is well documented. However, what is in the grey zone usually needs more research and pilot testing etc."[17] (Interview, NEA2, 2019).

[14] Quote 3
[15] Quote 4
[16] Quote 5
[17] Quote 6

5.4.1.2. Solutions

Currently, it is not possible to determine when the 2019 IPCC Refinement will be adopted by either or both the parties to the UNFCCC and the Paris Agreement. However, when the new methodological guidelines of the *2019 IPCC Refinement* is adopted, carbon storage in soil with biochar can be reflected in Norway's NIR. As it is expected that some sort of facilitation to make use of the new guidelines may take place in the near future, it is just a matter of time before this long-time barrier for biochar will be solved. In the meantime, there do not seem to be any loopholes in the existing rules for biochar. However, documentation is the key solution for inclusion of biochar in the NIR. What is the right type of documentation? The answer to that question is found in the *2019 IPCC Refinement*. Indeed, requirements for the IPCC Tier 2- and 3 methodology describe exactly what is demanded, not more, not less.

A Tier 2 methodology for biochar has two main requirements. First, the total amount of biochar distributed in the country is required, disaggregated by production types. Production type is defined as the exact feedstock used, and how it is converted through pyrolysis, such as temperature, residence time etc. The member countries are not required to report on the exact location where biochar has been applied to soil (IPCC, 2019). For example, activity data may be collected from sales numbers if a biochar product is sold from a retailer or shop (Interview, NEA1, 2019).

Second, data on the stability of different production types of biochar in Norwegian soil types within a 100-year time frame is required (IPCC, 2019). Factors such as the production type, surrounding conditions, and soil quality will affect the fraction of biochar that is stable after 100 years (Interview, NIBIO1, 2019; Rasse et al., 2019). It is not expected that member countries do 100-year experiments. Hence, scientists can estimate the remaining fraction after 100 years using a method called extrapolation. Generally, extrapolation allows us to access unknown data by extending the values we currently have into the future, and this can be done using a few years' experiments with the chosen production types in different soil types (Interview, NIBIO1, 2019).

With a Tier 3 methodology the countries can access more advanced information from the national data with modelling (Interview, NIBIO1, 2019). For example, a Tier 3 model of biochar can account for the effects of land use and management on the gains and losses of soil

carbon in an extensive time frame. In addition, it is possible to capture biochar effects on nitrous oxide and other GHG gases such as methane (IPCC, 2019).

5.5. Political Acceptance on National Level

5.5.1 The Agricultural Policy Regime

5.5.1.1. No challenges were managed by the parties

Have the challenges presented in chapter 5 been managed so far by the parties to the climate agreement in the agricultural sector?

At the time of the interviews, I find indications that none of the challenges presented in 5 were managed by the informants and their organizations in any way, either by discussing solutions or initiating investigations. Indeed, the informants answered coherently that the challenges were not, to their knowledge, handled internally or between the parties during or after the climate negotiations. Several informants had at some point discussed a few of the challenges internally, but not to the point that action to manage them was taken (Interview, LMD, 2019; Interview, NB, 2019; Interview, NBS, 2019). This finding signifies that at the time of the interviews, there was no actor or institution that was taking leadership in the pursuit of solving the challenges to acceptance and implementation of biochar as a climate measure in the agricultural sector.

5.5.1.2. Unsolved challenges perceived as documentation gap

A dominant view among the informants NB1, NB2, LMD and NBS was that while all three regarded biochar positively as a climate measure, they perceive documentation to be unclear or missing. In most cases, this is related to the fact that the challenges presented in chapter 5 remain unsolved. Consequently, the perceived documentation gap creates a barrier for biochar as the preferred solution for them to fulfil their emission reductions by 2030. This is evident in the way the informants assess the potential of biochar as a climate measure:

> "...I think that biochar has great potential, but we need more knowledge, or the existing knowledge must come to us, if there is such knowledge, then we must also get that information. And transform that knowledge into measures and tools"[18] (Interview, LMD, 2019).

[18] Quote 7

"It [biochar] is the hottest you can find...we know too little about how it works and it is a long way to go before the method can be documented according to the IPCC-rules... It [biochar] is really directly beneficial to the farmer. If it is not too expensive or too difficult..."[19] (Interview, NBS, 2019).

"There are both pros and cons when weighing how much we should go for biochar. Technologically, the code remains partly unsolved and it [biochar] is not reflected in the climate budget [National Inventory], and that is factors that pull down. But the potential effect is very large, so that pulls up, if I were to balance it"[20] (Interview, NB1, 2019).

5.5.1.3. The importance of solving the challenges

During the interviews, I observed that the challenges presented to the informants were of importance to them, in the sense that they expressed the need for the issues to be managed before they could accept biochar as a climate measure. Their answers confirmed this regarding all challenges presented to them. In the following, three examples are presented.

First, all three informants expressed the need for an assessment of feedstock that can prove useful in decision- making:

"...We need an evaluation of resources"[21] (Interview, NB2, 2019).
"...We need a critical evaluation of the alternative use of feedstock"[22] (Interview, NBS, 2019).
"...A clarity must be established, and it is possible that we are open to use several types of feedstock, but this must fit into a regulation, that's how this system is rigged, that we must have some frames as to what you can receive subsidies for. This is something we should look more closely at"[23] (Interview, LMD, 2019).

Second, when asked about their views on the usefulness of contracts in a Norwegian context, the informants had dissimilar ideas. However, a common trait is that they all signified the

[19] Quote 8
[20] Quote 9
[21] Quote 10
[22] Quote 11
[23] Quote 12

importance of the challenge to determine rights and responsibilities in the sense that it should be managed:

> "It is not common to have contracts, because it has to do with the farmer's private property rights also. The right to private property is firmly established in Norway. On the other side, in regional environmental programs one may enter into environmental agreements...it is more the positive way of doing agreements. It [contracts] is quite unlikely in Norway, but one never knows. It must be possible to manage as well"[24] (Interview, LMD, 2019).

> "...one can certainly see the potential need for contracts. Especially when considering that the farmer is doing a job on behalf of the larger community by storing carbon. Hence, it is clear that it is not unthinkable to consider legally binding contracts, for example. It is therefore a relevant problematization"[25] (Interview, NB, 2019).

Informants from both parties to the climate agreement suggested that if contracts turn out to be the right solution, then using the existing system is the preferred:

> "...In regional environmental programs you may have environmental agreements (an agreement on subsidies where one commits to do measures), that some counties have practiced, where you for example have a 5- year contract on reducing fertilization..."[26] (Interview, LMD, 2019).

> "...We can take it [the contract] into our KLS system. That is our quality system. It is a good idea to use the system we are familiar with already"[27] (Interview, NB2, 2019).

One informant also expressed the need to be further informed through documentation, and that recommendations should come as a part of documentation "package" that is currently missing:

> "... It [the issue of responsibilities and rights] is a part of the thinking of a request for documentation"[28] (Interview, NBS, 2019).

[24] Quote 13
[25] Quote 14
[26] Quote 15
[27] Quote 16

Third, as explained in the background section, the rules of the shadow budget are that only climate measures that can be reflected in the National Inventory will count as contributions towards agriculture's target in 2030. Hence, it was of importance to all the informants to prioritize climate measures that officially count as inventory:

> "My advice to the parties of the climate agreement is: look at what counts in the official climate budget..."[29] (Interview, NBS, 2019).

> "...We have a quantitative target for 2030, so one must sort of work towards that"[30] (Interview, LMD, 2019).

> "...It is natural to start the work [measures] that one knows will count... It is an advantage if we, the Smallholders union and the government, that we manage to reduce [emissions] already early in the period [2021-2030]. That we don't wait with everything until the end. Then it will become almost impossible"[31]
> (Interview, NB1, 2019).

The comments above confirm the challenge presented in chapter 5.4.1. Indeed, a challenge for acceptance of biochar as a climate measure is that it cannot be reflected as National Inventory owing to the current rules in the international climate regime.

[28] Quote 17
[29] Quote 18
[30] Quote 19
[31] Quote 20

5.6. Overview of Results and Closing Remarks

Figure 5 below provides an overview of the results presented in this chapter.

SUB RQ 1:

What are the current challenges to adopt biochar as an official Norwegian climate measure as a soil carbon sink? What are the potential solutions to overcome these challenges?

5.2. Feasibility

5.2.1. Forms of Use

5.2.1.1. Challenges
- Pure biochar do not increase yields in Norwegian soils
- Biochar fertilizer product not ready for use

5.2.1.2. Solutions
- Only pure biochar is required for IPCC methodology

5.2.2. Choice of Feedstock

5.2.2.1. Challenges
- Complexity of considerations

5.2.2.2. Solutions
- Let IPCC methodology provide guidance

5.2.3. Clarifying Rights and Responsibility

5.2.3.1. Challenges
- No institutional structure to settle and manage terms

5.2.3.2. Solutions
- Individual contracts
- Regulations

5.3. Acceptance & Future Constraints

5.3.1. Costs and Cost- efficiency

5.3.1.1. Costs

5.3.1.2. Challenges
- No standard cost formula
- Lack of transparency
- No economic value as a climate measure

5.3.1.3. Solutions
- Cost-efficiency
- Economic support

5.4. Political Acceptance on International Level

5.4.1. The International Climate Regime

5.4.1.1. Challenges
-2019 Refinement not adopted by COP or CMA
-No loopholes for biochar in existing rules

5.4.1.2. Solutions
-Documentation required for IPCC methodology

SUB RQ 2: *How are the challenges managed in the policy-making process during and after the climate negotiations between the Norwegian government, Farmers Union and The Smallholders Union?*

5.5. Political Acceptance on National Level

5.5.1. The Agricultural Policy Regime

5.5.1.1. No challenges were managed by the parties

5.5.1.2. Unsolved challenges perceived as documentation gap

5.5.1.3. The importance of solving the challenges

As figure 5 demonstrates, chapter 5 has described an identified number of potential challenges for a current biochar policy proposal to meet Kingdon's selection criteria of feasibility, acceptance, future constraints, and political acceptance. The nature of these challenges has been described in detail in this chapter, and was based both on the views of informants and document analysis.

Nevertheless, the results of this chapter illustrate more than the actor's views of challenges and its content. Several of the informants clearly express a positive attitude either towards biochar as a climate measure or as a part of new climate measures in general:

- NEA1 took the initiative to suggest a solution for biochar such as to provide the right documentation and have that evaluated by reviewers in the international climate regime (chapter 5.4.1.)
- NEA2 stated that the NEA in general is positive to include as much as possible in the National Inventory (Chapter 5.4.1.)
- LMD perceived biochar as having a great potential (chapter 5.5.2.)
- NBS described biochar as an appealing climate measure that provides the farmer with direct benefits (Chapter 5.5.2.)
- NB1 expressed that the potential effect weighs positively (Chapter 5.5.2.)

These statements indicate that there is a will among these actors to contribute in solving the described challenges. However, several of the informants also express either directly or indirectly concerns with perceived missing information or documentation, but also regarding different regulations on an international and national level that a biochar policy must harmonize with. For example:

- NEA2 explained that the rejection of a biochar Tier 1 in the IPCC component of the international climate regime did lower the status of biochar and nurtured a scepticism with the confidence of the scientific basis for the IPCC methodology (Chapter 5.4.1.).
- NFSA say that any application of biochar to soil is subject to national regulations. The current undetermined choice of feedstock will determine both its legality and use. Some feedstocks are in a grey or red zone and put a responsibility on the producer (Chapter 5.2.2.).

- LMD requested more knowledge about biochar but adds that there might be existing knowledge out there that has not been communicated well enough to the Ministry of Agriculture and Food (Chapter 5.5.2.).
- NBS also requests more knowledge, especially on the IPCC methodology. He also expressed a number of uncertainties such as whether biochar is costly or difficult (Chapter 5.5.2.).
- NB1 believes that there are unsolved technical issues (Chapter 5.5.2.).

These types of concerns involve different governance scales and processes, along with the fact that the information known to the actors are rather limited to their area of expertise or political position. Hence, the totality of the circumstances creates uncertainties that constrain the informant's capacity to act on the challenges. Indeed, there is something larger than the actors themselves that has an inhibitory effect on the involved actors. As a consequence, the actors seem to hesitate to solve the challenges and await the actions of other actors and institutions.

6. Analysis and Discussion

6.1. Introduction

The following section provides an explanation of how Kingdon's structure and actor-based explanations may be utilised in order to answer the main research question. A disposition for the rest of the chapter will then follow.

The main research question for this thesis is: *What is demanded to make biochar accepted and implemented as a climate measure in the Norwegian agricultural sector?* The following sub-research questions were developed to answer the main research question:

- SUB RQ 1: What are the current challenges to adoption of a biochar policy in the agricultural sector? What are the potential solutions to overcome these challenges?
- SUB RQ 2: How are the challenges managed in the policy-making process during and after the climate negotiations between the Norwegian government, Farmer's Union, and the Smallholder's Union?

Chapter 5 presented challenges and potential solutions to meet Kingdon's selection criteria of *feasibility, acceptance, future constraints and political acceptance*. In chapter 5.5. we learned that none of these challenges were, to the knowledge of the informants from the agricultural policy regime, managed at the time of the interviews. However, the informants confirmed the importance of managing the challenges presented to them. Hence, based on the current content of biochar as a policy proposal it could be concluded that *what is demanded to make biochar accepted and implemented as a climate measure* is that these challenges must be managed. Solving the challenges would certainly improve the content of the biochar policy proposal and its readiness for implementation. But is it that simple? According to Kingdon (2014), the success of a policy proposal is usually a result of three separate streams of Problems, Policy, and Politics processes that are coupled at the right time, when a window of opportunity is open:

> "A problem is recognized, a solution is available, the political climate makes the time right for change, and the constraints do not prohibit action" (Kingdon, 2014: 88).

Moreover, an advocate of the policy proposal in question, a policy entrepreneur, usually does the coupling of these three streams when the window is open (Kingdon, 2014). Keeping in mind that we are dealing with an open-policy process, Kingdon's Multiple Streams Framework allows us to investigate more than current challenges to meet the selection criteria, such as how structures and actors may affect the success of the biochar policy proposal.

The rest of the chapter is divided into five sections that cover the MSF framework. The focus of the first and second section is that the political incentives to adopt biochar have increased recently, opening a window of opportunity. Nevertheless, a political barrier still remains on the international level. The third section will explore the capacity of the window, and how the biochar policy proposal fulfils the selection criteria, potentially affecting movement to the decision agenda. The fourth section discusses the need for a biochar policy design and coordination. The fifth section examines the importance of the policy entrepreneur. The chapter ends with closing remarks that summarize the analysis.

6.2. Biochar: A Solution to Climate Change

In Norway, biochar has been presented as a solution to the problem of climate change since 2008, but there seem to have been few political incentives in the past to implement biochar as a climate measure in the Norwegian agricultural sector.

In the Problem stream, the climate change crisis has been a malign environmental problem that remains more or less unsolved to this day due to its complex nature. Although anthropogenic climate change has been on the international agenda since the 80s (Andresen & Boasson, 2012), it is reinforced as a pressing political issue every time new reports describe the crisis as escalating further, rather than declining. In recent years, Norway has regularly announced new climate strategies to strengthen the country's climate action. Indeed, Norway's NDCs in the Paris Agreement were made into a designated climate law in 2018[32], and recently, the country further enhanced its climate target for 2030 from 40 % to 50 -55 % (Government of Norway, 2020a; Klimaloven, 2017). These events indicate that the climate change crisis being an important and active problem on the governmental agenda in Norway.

[32] LOV-2017-06-16-60

In the Policy stream, scientists in *Norsk institutt for bioøkonomi (Norwegian Institute of Bioeconomy Research)* have studied the climate benefits of biochar since 2008 (Grønlund et al., 2008). On the basis of this information, policy makers in the NEA assessed biochar in the report Climate Cure 2020 (2010) and found that biochar had a considerable reduction potential. However, nothing happened after the official investigation, although climate change was perceived as an important problem on the governmental agenda. Why was biochar not prioritised as a solution to climate change in the agricultural sector at the time?

In the Political stream, there are two potential explanations that may have contributed to reducing the political incentives to proceed with the biochar policy proposal after Climate Cure 2020. First, rules in the international climate regime did not accept that member countries accounted for climate effects from biochar as part of emission reductions in the National Inventory. Hence, the rules of the international climate regime were mentioned as one of the main barriers for biochar implementation in Climate Cure 2020 (Leffertstra & Fjeldal, 2010: 42). Second, although agriculture was pressured into taking more sector responsibility after the two global shocks of food crisis and climate change in 2008, the sector managed to avoid strong climate commitments requiring implementation of climate measures that would threaten the sectors' economic viability (Brobakk, 2018). In St. meld nr. 34 (2006-2007) *Norwegian climate politics,* the government did indeed suggest sectoral emission reductions in agriculture for the first time and estimated that the sector had a technical potential to reduce 1.1 mill. t/CO_2-e by 2020. However, the suggested target cannot be understood as a commitment and it was made clear that reaching the goal in practice was sensitive to future developments in a number of factors, such as costs and technology. Hence, when the former Minister of Agriculture and Food, Lars Peder Brekk, suggested emissions reductions in the magnitude of 1.1 mill. t/CO_2-e by the end of the first Kyoto period in 2012 (St.meld nr. 39 (2008-2009)), it was not a strictly required quantifiable climate target with a definite timeframe.

Moreover, Brobakk (2018) argues that Brekk and his supporters in the agricultural policy regime met the pressure for sectoral climate responsibility by suggesting the exact climate measures with the lowest costs and thereby gaining control of the situation. According to Brobakk (2018), the approach to climate reductions was to select climate measures on the basis of their cost efficiency and sum up the expected effect in the National Inventory into a target for the sector. Hence, what can be understood as the first planned emission reductions

target in the agricultural sector were rather weak commitments and left a limited need to implement new climate measures. Together with the fact that biochar would not count as emission reductions in the National Inventory at the time, these circumstances explain why there have been few political incentives to implement biochar as a part of the agricultural sector's planned emission reductions in the past.

6.3. A Window of Opportunity

Recent political events are creating new political incentives to implement an increasing number of climate measures in the agricultural sector, which presents new possibilities for the biochar policy proposal.

The emission reduction target proposed in St. Meld nr. 39 (2008-2009), has been identified by Brobakk (2018) as the start of a 'climatization' of agricultural politics in Norway. Since then, the Norwegian agricultural sector has lived under a constant threat of taxes on biological emissions after the report from the Green Tax Commission, along with a signalled future demand of emission reduction commitments in various governmental white papers (see chapter 2). Still, the sector remains tax-exempt on biological emissions and has managed to balance an increasing pressure to take sectoral climate responsibility in the past. The recent strengthening of Norway's climate commitments to the Paris Agreement has nevertheless contributed to push the search for climate solutions higher onto the political agenda of the agricultural policy regime.

However, the 2019 intentional climate agreement is the real gamechanger for agricultural politics because it operates with a committing reduction target within a limited time frame. Compared to the emission reduction target proposed by Brekk and associates in 2008, the intentional climate agreement is a strong commitment that does not protect the agricultural sector in the same way. This time, the target is set before the measures are chosen, and the Ministry of Climate and Environment is actively involved as a party to the agreement (Government of Norway, 2019a), which leaves less room for the agricultural policy regime to control the process. Hence, the intentional climate agreement represents something new: a further climatization of agricultural politics in Norway. It is in this intersection of agriculture and climate politics that a window of opportunity is opening for biochar when the agricultural unions choose climate measures to meet their target.

Still, a barrier to political acceptance remains on the international level until member countries to the UNFCCC and the Paris Agreement formally accept the *2019 IPCC Refinement*. It is possible that the undetermined date this will take place will lower the political incentives to adopting the biochar policy proposal in agriculture. On the contrary, while awaiting the full acceptance of the *2019 IPCC Refinement*, its publication enables policy makers to learn what the international climate regime requires of documentation to reflect carbon storage with biochar in the National Inventory. This may provide political incentives to, at a minimum, give the biochar policy proposal more attention because a solution is identified and possible.

According to Kingdon, the three streams of Problem, Politics and Policy must align in order to take advantage of the open window. These three streams do not seem to have aligned in the past or current biochar policy proposal. In Kingdon's terms, there seems to be only partial coupling of streams (2014: 202), because biochar as a solution is not fully accepted in the Political stream where a barrier remains on the international level. Nevertheless, this barrier may dissolve at an unknown point in the future.

6.4. Competition for an Opportunity

According to Kingdon, when a policy window opens, policy proposals compete for acceptance. Indeed, the window has room for a limited number of solutions. As such, policy proposals are subject to a selection process according to some criteria (2014). This may be true also when the window of opportunity opens for biochar between 2021 and 2030. However, chapter 5 revealed that there are several potential challenges in the Policy Stream that must be solved before a biochar policy proposal is ready for implementation.

The previous chapter on costs and cost- efficiency showed that potential climate measures will be evaluated in a selection process conducted by the agricultural policy regime during the annual agricultural settlements. When the agricultural sector’s emission reduction target is considered to be fulfilled, motivation to implement more climate measures that run costs may cease because costs is an issue for both parties, and it is not firmly established who will pay. Hence, it is possible that the window will close when the commitments are fulfilled, even before 2030.

Although this analysis will not provide a comparison between a biochar policy proposal and competing proposals for the agricultural sector, it should be noted that there are several other options for the agricultural policy regime to choose from. Among them is the use of animal manure for biogas, reduction of red meat production, cover crops, and reducing the conversion of wetlands to other land uses (NEA et al., 2020). Indications of forthcoming priorities of the agricultural policy regime can be found both in chapter 5.3.1. and 5.5. Three criteria stand out: production goals, acceptance by the international climate regime, and costs. How does the biochar policy proposal fit these criteria?

First, when the informants from the agricultural climate regime were asked to elaborate on what they think is important for their organizations when choosing climate measures, maintaining the sector's political production goals stand out. If this reflects their organization's view also in the future, then a climate measure that would require the sector to cut or limit their current production methods would not fit these criteria. As mentioned in chapter 5.2.1., carbon storage with biochar in the agricultural sector will take the form of a soil amendment, either in a fertilizer combination or as pure char. Hence, implementing the biochar policy proposal does not seem to challenge the existing production goals of the sector.

Second, the informants from the agricultural policy regime expressed the importance of choosing climate measures that could count as emission reductions in the agricultural sector's shadow budget, so that they could fulfil their commitments. Consequently, climate measures that do not have any prospects of being included in the shadow budget before 2030 may not be prioritized. With today's rules in the international climate regime, biochar would have to be accounted in Annex II to the intentional climate agreement. Hence, a biochar policy proposal does not meet this criterion at present, although a solution is expected when the *2019 IPCC Refinement* is fully adopted in the international climate regime.

Third, it remains unclear who pays for implementation of new climate measures. Will the farmer pay from their existing budget transfers or will the government increase subsidies? The informants from the agricultural climate regime say that the issue of governmental grants will be decided from case to case during the annual agricultural settlement. Hence, costs may be an important consideration on both sides of the table. As NBS explained: "It [biochar] is

really directly beneficial to the farmer. If it is not too expensive or too difficult..." (Interview, NBS, 2019), signifying that costs may be an important selection criterion.

The recent placement of biochar in a low-cost category by Climate Cure 2030 may weigh positively for biochar in a potential selection process. At the same time, the challenge to establish exact costs remains an issue. Chapter 5.3.1. discussed that decisions pertaining to production scale and available feedstock affect costs considerably. This finding is supported in a recent statement by the Farmer's Union, who identified feedstock as the main challenge to establish the costs for biochar implementation (Norges Bondelag, 2020). Moreover, carbon storage with biochar does not have an economic value in our society (Thomassen et al., 2017), which makes it challenging to estimate what the costs will be. Indeed, as long as the farmers do not know what income carbon storage with biochar could bring them, they may only estimate costs and no income from "sales" of that service.

Considering the uncertainties mentioned above, it is not possible to say whether biochar would meet potential cost criteria. This is also because it is not possible to determine what the maximum limit of cost criteria of the agricultural policy regime is. However, comparing the most recent estimation of < 500 kr t/CO_2-e up against cost calculations by Climate Cure 2020 (chapter 5.3.1.), biochar costs have dropped at least 462 kroner the last 10 years, which may weigh positively for biochar.

In an anticipated selection process by the agricultural climate regime, there are indications that the biochar policy proposal may partly meet the suggested criteria above on the grounds that biochar as a climate solution does not challenge the production goals of the sector and it is estimated to be low cost. In addition, producing and amending biochar to soil has the potential to reduce as much as 800, 000 t/CO_2 of the emissions in the agricultural sector by 2030 (NEA et al., 2020). Conversely, it is currently not possible to reflect effects of carbon storage with biochar in the main shadow budget or the National Inventory, and costs remain unclear. If these central challenges are not managed, it may affect prospects of a high position on the decision agenda of the agricultural policy regime in future selection process.

6.5. A solution in need of Policy Design and Coordination

As chapter 2.1. showed, biochar is considered a solution to climate change because of its potential long-term carbon sequestration qualities. However, the window of opportunity may call for more than solely documentation of the carbon storage effect. Indeed, Kingdon argues that in order to respond to the circumstances that open up the window, a policy proposal must be a coherent package ready for implementation (2014). Considering the challenges to Kingdon's selection criteria found throughout chapter 5, the current biochar policy proposal does not seem ready for implementation. Solving the challenges may help to complete a biochar policy design, and thus, improve its feasibility for implementation. However, the current complexity of the case indicates that the whole policy process, and especially to act on the challenges, must be coordinated well, which is discussed in this chapter.

The range of challenges uncovered in chapter 5 indicate that there are a diverse set of actors who currently are, or may need to be, involved in the ongoing policy process of the biochar policy proposal. Vatn (2015) highlights that institutions are the structure where the governance processes take place. Moreover, the institutions are made up of norms, conventions, or formally sanctioned rules that shape actors behaviours and interactions by enabling or constraining their choices. In light of this, the actors involved in this case bring along their knowledge, perspectives, and agendas but also agency from the institutions they represent when they participate in the process of the biochar policy proposal. Not only does this shape their perception of the challenges and what they think are good solutions, but it is possible that it might bring more complexity into the case when there are many actors that must come to an collective understanding of challenges and solutions.

For example, what is considered *feasible* might not be the same to everyone. When the informants from the agricultural policy regime were asked to elaborate on the challenge of how rights and responsibilities could be clarified and managed, their suggestions illustrate that the involved actors may have dissimilar views on what is the most convenient solution:

- LMD said that it is not common to have [individual] contracts in Norway, on the grounds that it might conflict with property rights. She also said it was unlikely, but not completely impossible.
- NB1 thought that there may be a need for [individual] contracts and that it is a relevant problematisation.

According to Vatn (2015), coordination is imperative in order to solve environmental problems. It was noted in the introduction that a coordination process might start with a policy proposal, but proposing solutions is not enough because, as Kingdon (2014) explains, there are both actors and institutions involved in the process that may affect the outcome of the policy process. In other words, for a policy proposal to succeed, the process must be coordinated from the start to the end. The challenges identified in chapter 5 indicate that the policy process of the biochar proposal was not very well coordinated at the time of the interviews. Furthermore, the complexity revealed in chapter 5, both when it comes to governance scales and processes as well as the complexity of actors involved, point to that coordination is necessary in order to act on the challenges in this case.

However, in light of Vatn's (2015) understanding of institutions as both enabling and constraining agency, it is also understandable that the informants in this case are not taking much action to solve the challenges. Indeed, their agency is embedded in the institutional structure and this affects what they are allowed to do in their positions, but also what it is possible to do within those structures. For example, a part of the mandate given to informants in NEA is to see that the rules of the international climate regime are followed and managed correctly in the National Inventory. Their mandate is not to solve the challenges of the biochar policy proposal.

Furthermore, as chapter 5.4.1. showed, there are political processes within the international climate regime that follow formal rules and procedures for adopting new methodological guidelines. In this case, it does not seem very likely that a single actor may influence these rules or processes to hasten political acceptance of biochar on an international level. However, the 2019 IPCC Refinement was published for all to see the future requirements for a biochar methodology, enabling actors to influence political processes on a national level in order to gather the necessary documentation. The above signifies that some level of action is possible, but it is nevertheless complex for one actor in one part of the governance process.

6.6. The Importance of Policy Entrepreneur(s)

According to Kingdon, the three streams cannot be expected to couple by themselves at the critical time. Indeed, the success of policy proposals rarely happen by pure coincidence within structures. Agency is also involved (Kingdon, 2014). Hence, the importance of a policy entrepreneur is emphasized greatly in Kingdon's theory of Multiple Streams Framework. Is there a policy entrepreneur involved in the ongoing policy process for the biochar policy proposal in Norway?

Due to the nature of an open-policy process, it is not possible to conclude as to whether there in fact was a policy entrepreneur in retrospect. It is challenging to identify all actors who may be working behind the scenes at the moment, as they may come forth later on in the process. In addition, interviews with potential policy entrepreneurs should be conducted to establish what their role is/was. Nevertheless, we may investigate the current signs of a policy entrepreneur based on what we may learn from official records and the conducted interviews with informants from the agricultural policy regime.

In recent years, several advocates have publicly supported biochar. First, from the official records of the Norwegian government, it is evident that a few Norwegian politicians have tried to place biochar on the governmental agenda. In 2016, Gunnar Gundersen from The Conservative Party of Norway asked the former minister of Agriculture and Food, Jon Georg Dale, about the prospects of implementing biochar as a low-cost climate measure in both the forest and agricultural sector. He did not receive any clear answer from Dale at the time (Negotiations in Norway's Parliament, 2016). The incident seems to be a one-time event, as there are no signs of Gundersen pushing further for biochar after that.

In 2018, Ole André Myhrvold from The Center Party did on two occasions question the former Minister of Climate and Environment, Ola Elvestuen, about his effort to place biochar higher on the agenda both within the EU and the IPCC (Negotiations in Norway's Parliament, 2018a & b). Similar to Dale, Elvestuen did not have a clear answer either. However, in 2019, while Elvestuen was still the Minister of Climate and Environment, the government officially supported biochar by stating in their political program *Granavolden Plattform* that they planned to "...support the development of simple carbon capture and storage technologies

such as biochar..."[33] (Government of Norway, 2019b: 86). Whether Myhrvold's inquiry in fact influenced this governmental statement is unclear. Myhrvold has not officially pushed the government on biochar policy after the two incidents in 2018.

Second, Norwegian biochar network is an active interest organization that may have the ability to influence the agricultural policy regime's climate agenda. The organization is comprised of established and well-known scientific and commercial actors that may have both resources and relevant experience to influence the political agenda. It is likely that many of the members in the Norwegian biochar network have powerful acquaintances, both in the political arena, in general, and the agricultural policy regime, specifically. In addition, the Farmer's Union is a member, which provides a direct link to the agricultural policy regime. However, the motivation of the members within the Norwegian biochar network is diverging. Some members pursue biochar as a potential replacement of fossil fuel in the industrial sector, while other members want to store carbon in the agricultural sector. Hence, it is questionable whether the members of the Norwegian biochar network collectively will push for biochar as a climate measure in agricultural sector. Nevertheless, some members may try to influence the agricultural policy regime on their own.

It is apparent that the Norwegian biochar network is making an effort to push for biochar on the political agenda. Indeed, the organisation is active in the agricultural politics arena, writing articles in the agricultural newspaper *Nationen* (Rassat, 2020), arranging seminars, and facilitating networking between people with common interests in implementing biochar as a climate measure (Facebook, 2020b). In that way, the members of the Norwegian biochar network that are the most active in agricultural politics may fit with Kingdon's description of a policy entrepreneur.

On the other hand, the information given by informants in the agricultural policy regime indicate that there is no one taking the lead or pushing from outside or inside the regime to manage the challenges presented in chapter 5. As the window will open within the agricultural sector, the agricultural policy regime is the main decision making arena where biochar will be adopted or not. Hence, one could expect that a policy entrepreneur would be working from the inside or outside to influence the agricultural policy regime.

[33] Quote 21

A policy entrepreneur in Kingdon's definition does not leave anything to chance, and strategically works to fit their pet proposals to the window that is opening before the window closes (2014: 201). The way this description is understood here is that the policy entrepreneur is something more than an actor that is involved in a part of the policy process of the biochar policy proposal. Indeed, the policy entrepreneur either leads and steers the process, or works intentionally to influence those actors who have the power to steer the process and affect the outcome of the policy process.

Hence, the policy entrepreneur(s) we are looking for in this case are working to succeed in bringing all the loose threads together and place biochar high on the decision agenda of the agricultural policy regime before the window closes. The informant's answers in chapter 5 do not indicate such a person(s) at the time the interviews were conducted in fall 2019. From both agricultural unions, I spoke with informants who were considered the organizations most knowledgeable of biochar in their respective organizations. One could expect them to be informed about people making inquiries to the organization about cooperating and managing the challenges to biochar acceptance and implementation. Besides, if the policy entrepreneur resided within their organizations, one may assume that some of the challenges would be managed already.

From the available information, there is definitively a potential policy entrepreneur who may enter the scene in the near future. So far, it is not possible to say whether there is a policy entrepreneur(s) who will succeed in making the biochar policy proposal successful. At the same time, one may question whether biochar needs a policy entrepreneur at all to become a successful policy proposal. Kingdon argues that the role of the policy entrepreneur in joining the three streams of problems, politics and policy can be critical. Indeed, the policy entrepreneur performs important tasks by adjusting the proposal for the window, pushing for it in the right political arenas in a softening up process to place it high on the decision agenda, and coupling the streams before the window closes. Despite this, Kingdon admits the outcome does not follow a deterministic pattern, allowing for a certain degree of randomness. Some proposals can be accepted without the touch of a policy entrepreneur (Kingdon, 2014: 204-206)

It is not possible to conclude in an open policy process whether a policy entrepreneur, working their "magic", is demanded for biochar adoption and implementation. In the case

study by Brobakk of the St. meld nr. 34 (2006-2007), the agricultural policy regime managed to take advantage of two global shocks in order push their agricultural politics through and at the same time avoid costly demands of emission reductions. This was possible because the former Minister of Agriculture and Food, Lars Peder Brekk and his associates in the agricultural policy regime took the roles as policy entrepreneurs (Brobakk, 2018). The case illustrates how the outcome of the policy process can be influenced by policy entrepreneurs who steer towards a specific goal and take advantage of a window of opportunity.

Considering the challenges and complexity of this case, completing the biochar policy proposal may require, or certainly benefit from, having a leader to steer the proposal forward. Also, recalling that the open window is limited and that it may even close before 2030, it could increase the chances of the biochar policy proposal's success if there was such a person(s) with full overview dedicated to taking advantage of the window before its passes.

6.7. Closing Remarks: It's Complicated

In chapter 5, Kingdon's selection criteria proved to be useful in uncovering challenges, but also solutions, to the biochar policy proposal's readiness for implementation. In this chapter, we have seen that within the political landscape, windows of opportunities open and policy entrepreneurs may take advantage of these windows to steer the outcome of the policy process. However, it is not that simple for the actors involved. Throughout this case, we have learned that there is a lot of insecurity involved from undetermined forms of use, feedstock, costs, contract type, and politics. Moreover, the challenges and their potential solutions are situated within institutional apparatus, such as the public sector and the international climate regime that have rules which enable and constrain the actors' ability to act on the challenges in different ways. It makes the case complex and it seems to be preventing the informants to act.

Kingdon (2014) argues that agency is almost essential in order to make things happen. Brobakk (2018) showed how the policy entrepreneurs in the agricultural policy regime took advantage of a window of opportunity in order to push their agricultural policies through, while taking control of outside pressure to take sectoral climate responsibility. In this respect, Brobakk's study supports Kingdon's theory that actors play an important, and sometimes vital role in the outcome of a policy process. However, what capacity do actors have to influence policy processes when there are many uncertainties concerning technical premises, the landscape of actors and institutions are defragmented, and some institutions constrain actions to solve the challenges? I propose that while actors do have some capacity to influence policy processes, the ability to coordinate and steer these decisions is ultimately enabled by the institutional structures that constitute the framework in which policy processes take place.

7. Conclusion

The objective of this study has been to evaluate what is demanded to adopt and implement biochar as a climate measure that stores carbon in the agricultural sector of Norway. Research concerning potential challenges and solutions to meet Kingdon's selection criteria of feasibility, acceptability, future constraints, and political acceptance has been conducted with both semi-structured interviews and document analysis. The results from this research were analysed together with background information in chapter 6, through the lens of Kingdon's Multiple Streams Framework.

Who can confirm the importance of the challenges to Kingdon's selection criteria? The answer is the actors who are currently considering implementing new climate measures in the agricultural sector, which is the agricultural policy regime. During interviews, informants from the regime confirmed that the challenges presented to them were not, to their knowledge, managed at the time of the interviews, and that managing them is important in their view. But is that enough to establish what is demanded to adopt and implement biochar?

First of all, there is a forthcoming window of opportunity for adoption and implementation of a biochar policy proposal between 2021 and 2030. This window is opened by a further climatization of agricultural politics with the intentional climate agreement in the agricultural sector. However, the three streams of Problems, Policy and Politics are not aligned at the moment, partly because the challenges in the Policy stream are not solved and because the adequate and formal acceptance of the international climate regime remains in the Political stream.

Identifying challenges and potential solutions to the biochar policy proposal's selection criteria is important because solving these challenges is essentially about creating a biochar policy design that is ready for implementation. Nevertheless, it is not necessarily easy to act on the challenges when the window is open. Indeed, we have uncovered that institutions in the political landscape surrounding the biochar policy proposal are both constraining and enabling actors' capacity to affect the outcome of the policy process. Moreover, the content of the challenges identified in chapter 5 all creates uncertainty among the involved actors. Finally, actors and institutions in this case seem defragmented because coordination is rather

weak and has not succeeded in bringing all the actors and knowledge together. However, considering the complexity involved in the biochar policy proposal, it is understandable that it may be challenging to coordinate the process.

Hence, leadership that could steer the biochar policy proposal process, such as a policy entrepreneur, may increase the chances of adoption and implementation of biochar in the agricultural sector. Indeed, there are many loose threads to gather, and timing is everything. A policy entrepreneur may help bring the three streams of Problems, Policy and Politics together before the window closes.

An adoption and implementation of the biochar policy proposal by the agricultural policy regime will be a political decision. Moreover, we are dealing with an open policy process. Nor the informants or the leaders of their organization are able to say with certainty what is demanded for the agricultural policy regime to accept and implement biochar. Nevertheless, the informants from the agricultural policy regime were all involved in their organizations climate negotiations in different ways and knew their organizations strategies at the time.

The interviews, which was conducted in fall 2019, indicated that if the challenges are managed and transformed into a feasible and acceptable policy design before the window closes along with the presence of the right leadership and coordination, the biochar policy propsal will have an increased chance of being adopted and implemented in the Norwegian agricultural sector from 2021.

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9. Appendix A

Study information sheet

Thank you very much for agreeing to participate in this study. This information sheet explains what the study is about and how I will use your information.

The main purpose of this study is to find out *what is demanded to make biochar accepted as a climate measure in Norway*. In order to find answers to that question, I am researching a number of potentially unsolved issues related to implementation of biochar in the Norwegian agricultural sector. Finally, I am investigating whether, and how these issues are handled in the ongoing climate-negotiations between the Norwegian Government and the two agricultural interest-organisations Norges Bondelag and Norges Bonde- og Småbrukarlag. The reason for the latter investigation is that biochar have been proposed by the agricultural interest-organisations as one of several climate-measures with potential for implementation in Norwegian agricultural sector.

In order to elicit your views, I would like you to be interviewed by me, Stine Lilleby, masterstudent at the LANDSAM faculty, Norwegian University of Life Sciences, Ås.
If you agree to this, the interview will be audio-recorded. For you to take part of this study I will ask you to sign an informed consent form.

The information provided by you in the interview will be used for research purposes only. You will be referred to by your work title and/or organisation. Submission for this thesis is planned 15. February 2020. Personal information given by you and the audio-recorded interview will be deleted right after submission of this thesis.

Once again, I would like to thank you for agreeing to take part in this Study. If you have any questions about the research at any stage, please do not hesitate to contact me:

Stine Lilleby,
Mobile: XXXX
E-mail: XXXX

This form is based on examples from Bryman, A. 2016. *Social Research Methods*, page 132.

10. Appendix B

Interview consent form

- I, the undersigned, have read and understood the Study information sheet provided by Stine Lilleby.
- I have been given the opportunity to ask questions about the Study.
- I understand that taking part in the study will include being interviewed and audio-recorded.
- I have been given adequate time to consider my decision and I agree to take part in the study.
- I understand that my personal details such as my name will not be revealed in the thesis that will be the end result of this study.
- I understand that my words may be quoted in publications, reports, Web pages and other research outputs, but my name will not be used.
- I agree to assign the copyright I hold in any material related to this project to Stine Lilleby.
- I understand that I can withdraw from the Study at any time and will not be asked any questions about why I no longer want to take part.

Name of Participant: .....Date:

Researcher Signature:.....Date:

This form was copied from Bryman, A. 2016. *Social Research Methods*, page 131.

11. Appendix C

This section display the original quotes in Norwegian that was translated to English in the main text. The quotes are arranged according to reference number given in the footnotes.

1. "Klimaavtalen skal ikke gi bindinger for framtidig virkemiddelbruk eller jordbruksforhandlinger, og klimaavtalen kan heller ikke forutsette økte subsidier" (Government of Norway, 2019a: 5).
2. "IPCC lager en metoderapport hvor de utvikler retningslinjer, så for at dette skal få full kraft så krever det også en behandling i klimaforhandlingene, av de som håndterer klimakonvensjonen og Parisavtalen" (Interview, NEA1, 2019)
3. "...Norge har gjort en stor jobb for å få internasjonal aksept for det tiltaket. Vi har deltatt i internasjonale prosesser og laget retningslinjer i EU og i Paris konvensjonen osv. Vi har jobbet med den motstanden som har vært i andre land (Interview, NEA2, 2019).
4. "[det var] noe som stod i Tier 1 i det opprinnelige utkastet som ble flyttet til Appendix, som da gir en svakere "standing". Det er ting som kommer inn når vi gjør vurderingen .... Det har jo noe å si hvor trygg metoderapporten er på de ulike bitene" (Interview, NEA2, 2019)
5. "... hvis noen, om det er statlige myndigheter eller noen andre som ønsker å kjøre biokull som et tiltak og ønsker å få det inn i regnskapet, så må man dokumentere det; å dokumentere det og få reviewers til å se på det vil kunne være en start" (Interview, NEA1, 2019).
6. "Vi synes det er bra å inkludere så mye som mulig når det er godt dokumentert. Men ofte er det slik at det som ligger litt i gråsonen må forskes mer på og kjøre piloter osv." (Interview, NEA2, 2019).
7. "Jeg tror at biokull har et stort potensial, men vi må ha mer kunnskap, eller hvertfall kunnskapen må komme til oss, hvis det foreligger kunnskap, så må vi også få den kunnskapen. Og gjøre den kunnskapen om til tiltak og virkemidler" (Interview, LMD, 2019).
8. " det[biokull] er det hotteste du kan finne...vi vet for lite om hvor godt det virker og det er langt igjen til metoden kan dokumenteres inn mot IPCC-reglene... Egentlig er det direkte positivt for bonden. Hvis det ikke er for dyrt eller for vanskelig..." (Interview, NBS, 2019)

9. "Det kan være litt sånn for og imot på vekting av hvor mye vi skal satse på biokull. Man har teknologisk sett ikke helt knekket koden og det fanges ikke opp i utslippsregnskapet, det er jo ting som trekker ned. Men den potensielle effekten er veldig stor, så det trekker jo veldig opp, hvis jeg skulle ha balansert det". (Interview, NB1, 2019)
10. "...Vi savner en ressursvurdering" (Interview, NB2, 2019)
11. "...vi må ha med oss en kritisk vurdering av alternativ bruk av det råstoffet" (Interview, NBS, 2019)
12. "det må foreligge en klarhet, og det kan godt være at man kan åpne for flere typer råstoff der, men det skal jo inn i en forskrift, det er sånn det er rigget, at vi må ha noen rammer for hva du kan få tilskudd til. Dette er noe vi må se nærmere på" (Interview, LMD, 2019)
13. "Det er ikke vanlig å ha kontrakter, for det har med den private eiendomsretten til bonden også. Den private eiendomsretten i Norge står sterkt. På den andre siden kan man i regionalt miljøprogram ha miljøavtaler... Mer den positive avtale måte. Det [kontrakter] er ganske usannsynlig i Norge, men man vet jo aldri. Det skal være forvaltbart også" (Interview, LMD, 2019)
14. " ...Man kan godt se for seg at man har må ha kontrakter. Særlig hvis man tenker sånn at bonden gjør en jobb på vegne av storsamfunnet (Interview, NB1, 2019)
15. "I regionalt miljøprogram (kan man) ha miljøavtaler (tilskuddsavtale hvor man forplikter seg til å gjøre tiltak) som noen fylker har tatt i bruk, hvor du kanskje har en 5- årig avtale på kanskje gjødsle litt mindre..." (Interview, LMD, 2019)
16. "Vi kan ta den inn i KSL systemet vårt. Det kvalitetssystemet vi har. Det er lurt i forhold til det å bruke det systemet vi er kjent med" (Interview, NB2, 2019)
17. "...det [rettigheter og plikter] ligger inne i tenkingen på kravet til dokumentasjon (Interview, NBS, 2019).
18. "Mitt råd til avtalepartene er: se på hva som teller i det offisielle klimagassregnskapet" (Interview, NBS, 2019)
19. "...Så har vi jo et måltall på 2030, så man må på en måte jobbe mot det" (Interview, LMD, 2019)
20. "...Det er naturlig å sette i gang med det arbeidet man vet at teller... Det er jo en fordel hvis både vi, Småbrukarlaget og regjeringen, at vi klarer å få til noen kutt allerede tidlig i perioden. At vi ikke venter med alt til slutt" (Interview, NB1, 2019)

21. "Bidra til å utvikle enklere teknologier for karbonfangst- og lagring som bruk biokull..." (Government of Norway, 2019b: 86).

Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitskapelege universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway