

Policy and practice in Norwegian green transition

A literature and policy review

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Summary

This literature review and policy overview attempts to set out the ways in which the green transition is understood, presented and implemented in the Norwegian context. The driving forces and characteristics of a green transition in Norway can be seen as being embedded within the country's ambition to assume global leadership in technology development. The national directions for the green transition are all-encompassing, with a predominant focus on green competitiveness – from regional connectivity through to skills development and climate technology leadership. Industry and business actions and strategies are ambitious within waste management, transport and logistics and marine and maritime sectors, but also reliant on the national context to provide a stable framework that compensates for an otherwise bumpy risk landscape.

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1. Introduction

This report is part of the Green Transition in the Arctic (GROM) project 2019–2021, financed by the regional research fund (RFF) Nord and with NORCE institute as the Lead Partner.

The aim of the project is to strengthen NORCE's collaborative approach and dialogue with the private sector on regional sustainable innovation for value creation, and on industrial transition towards a more climate-friendly business sector. GROM will strengthen the knowledge base for a sustainable transition by providing applied and relevant knowledge for decision-making in the private sector, in management, and in politics. The project aim is three-fold:

1) Strengthening the collaborative capacity between research institutions, commercial and industrial actors in Northern Norway, in order to enable the industrial green transition. Collaboration surrounding environmental innovation processes will also contribute towards increasing capacity in the use of research as a tool to support company-driven innovation processes in Northern Norway.

2) Building the knowledge capacity of private and semi-private companies' actions regarding choice of technology, production methods and energy sources as an alternative to fossil fuels and traditional production methods, while clarifying the connections between profit, innovation and the green transition in product and service provision.

3) Increasing knowledge around the ability of businesses and industries to act for sustainable development: namely, their room to manoeuvre in relation to barriers and innovation processes.

The project's main research question is: 'What are the driving forces behind the green transition, and what is "the green transition" in relation to innovation in businesses working in sectors such as maritime industries, waste treatment and logistics in an Arctic context?'

This literature review, prepared by Nordregio for NORCE, provides input to the specific research question of GROM: ***In what way can experiences from Mid- and Southern Norway provide increased knowledge capacity for the necessary framework conditions for sustainable and environmental innovation in an Arctic/Northern Norway context?*** For this we looked at regional plans and measures, the national context, and industry responses to enabling green transition.

The literature review was executed in 2020, with final revisions made in early 2021.

1.1. Green transition in Norway

The green transition and its components were carefully laid out in the previous GROM project literature review by Nordregio, examining green transition in Finland and Sweden. The preceding literature review also looked at key questions surrounding the driving forces behind green transition, and the characteristics of the innovation processes in businesses working in the green segment. It also set out the meaning of the green transition in different settings, and the barriers that surface in relation to this. This literature review will now attempt to answer the following questions:

- 1) In what way is the green transition framed in the Norwegian context?
- 2) What are the national directions for green transition in Norway?

- 3) What are the industrial actions and strategies in place?
 - a. What does the 'green transition' mean in relation to Norwegian industries and businesses operating in the transport and logistics sector, in the maritime sector and in waste management industries?
- 4) How do regions in the Mid- and Southern Norway work with the green transition?
 - a. In what way can experiences from these regions, their projects and initiatives, provide increased knowledge capacity for the necessary framework conditions pertaining to sustainable and environmental innovation in an Arctic/Northern Norway context?
- 5) What are the driving forces and characteristics of green transition in Norway?

The first section of this literature review sets out to investigate the framework conditions in place across Norwegian regions for enabling a green transition. It also takes account of the industry's response, as well as the ambitions set out by the Norwegian government. The first section is followed by an overview of a regional policies, projects and initiatives as they have developed in relation to the national context, before concluding with some of the main findings from the literature overview and review.

1.2. Methodology

This literature review provides an extensive overview of current legal acts, regulations and policies in place to support and enable green transition in Norway. The literature review was conducted on the basis of delimiting the policy research to the two most recent governmental periods, 2013–2017 and 2017–2021. Relevant policies were identified through the administering Ministries for the specific topics (transport and logistics, maritime and marine, and waste management). Due to overlapping policy areas, some of the strategies and policies were collaborative efforts. The search was conducted in Norwegian, and subsequently plotted into a matrix in order to offer an overview. A similar approach was adopted for the regional policy and project search, where each region was investigated with regard to their policies connected to the thematic areas of interest.

In addition to providing an overview of current policies, strategies and actions, this report has included a number of peer-reviewed articles. Considering the growing literature on the green transition and the various 'green' concepts across Europe, this literature review first sets out to incorporate relevant general discourse about the green transition in Norway between 2010 and 2020. The search was conducted using Google scholar, and it employed broad search terms such as '*green + transition + Norway*' and '*green + growth + Norway*'. These searches had limited returns in terms of the topics we sought to investigate in this literature review. Conducting a similar search, but in Norwegian ('*Grønn + omstilling + Norge*'), provided more promising results (2,670 results on Google scholar, including a significant number of Master's theses, which were not included in the literature review). In general, there is a strong emphasis on energy transition within the existing body of research on green transition in the Norwegian context, at least in terms of what is available in English. Norway's energy supply is defined by renewables (99 % of the electricity production¹). It has the potential to be a reliable partner in the EU's long-term climate goals, since it may help support the development of a clean energy system (Egging & Tomasgaard, 2018, p. 99). Renewable

¹ Eggers and Tomasgaard state that renewable energy supply in Norway, in terms of gross final energy consumption, is approximately 67.5%. This places Norway within the RES directive (2018: 99).

electricity supply (and its sources) is a pertinent part of transitioning a system. In the EU, the substitution of polluting energy sources is key to creating a carbon-neutral or zero-emissions development in transport, power production, the heating sector and industry (2018: 99). There is therefore a significant opportunity for Norway to become the green battery of Europe, especially since there is an upward pressure on the total demand for electricity (2018: 99–100). The majority of the literature found was thus connected to ‘forestry’, ‘energy’ and ‘building and construction’, none of which was wholly relevant to this literature review. Wijkman and Skånberg pointed this out in their report on Circular Economy. Climate change mitigation is often seen in relation to silo-solutions, by focusing on energy, for example, they said. This often draws us away from a more holistic perspective involving material production, material use, and inter-sectoral linkages (Wijkman & Skånberg, 2017). It also seems to be the predominant focus of literature produced on the topic of climate change and green transition in Norway.

However, a few articles from journals about energy policy took a broader approach, and certain other articles were deemed interesting in terms of their structural investigation into the frameworks of policies and political choices supporting the potential for a green transition in Norway. Here we present the most appropriate articles and reports on the maritime and marine industries, waste management, transport and logistics. The citations for these reports and articles were generally between 0–4, according to Google Scholar. They ranged from so-called ‘grey literature’ from key Norwegian research institutes (e.g. SINTEF, CICERO, and DNV GL) to peer-reviewed articles in journals such as *Energy Research & Social Science*, *Energy & Environment*, *Energy Strategy Reviews* and *Energy Policy*.

2. Frameworks driving the green transition in Norway

2.1. Directions for the green transition

It is clear from the literature search and review that perhaps the most appropriate starting point for investigating the green transition in Norway is through text analyses of public documents and policies. The subsequent sections therefore take a closer look at policies guiding the green transition. Norway is committed to both the United Nation's Sustainable Development Goals (UN SDGs), and to the Paris Agreement, through the nationally determined contributions (NDCs) (UNFCCC, 2020). NDCs sit at the core of the Paris Agreement. They encompass each region's emission reduction targets, which are reported on every five years.

According to the Norwegian government, the enabling units for successfully transitioning to a greener economy are those at the regional and municipal levels, providing the framework for regionally and locally embedded industries and businesses (Ministry of Local Government and Modernisation, 2019).

We will first point towards a few key legal acts and regulations in order to illustrate how some of the intersections between climate policies, sustainability and governance play out in the legal context. We will then take a closer look at the current government's policies, guiding actions and measures (2013–2017, 2017–2021).

2.1.1. Legal Acts and regulations setting the context

Sustainability has become part of some of the key legislation concerning governance at regional and municipal levels, guided by overall national objectives. The Norwegian state, and its regions and municipalities, are guided by the intersection of laws and regulations linked to the implementation and framework for mitigating greenhouse gas emissions, enabling a green transition, and becoming a low emission society. The Climate Change Act and the Planning and Building Act are two of the main guiding laws creating the framework for working towards a low-emission society and the green transition, for example.

The Norwegian Climate Change Act was adopted in 2017. It has an action plan approved by parliament in 2018. In Section 1.1., the Climate Change Act states that:

The purpose of this Act is to promote the implementation of Norway's climate targets as part of its process of transformation to a low-emission society by 2050.

The purpose of the Act is also to promote transparency and public debate on the status, direction, and progress of this work.

The Act is not intended to preclude joint fulfilment with the EU of climate targets set out in or adopted under the Act (Lovdata, 2018).

In other words, the Act is setting aims and targets to direct and encourage the actions required for a transition towards a low emissions society. (For instance, targets for the reduction of GHG emissions are stated in sections 3 and 4). The Act also includes the rest of Norwegian society. It also ensures transparency by featuring updated climate targets every five years after 2020 (Section 5).

Section 6 of the Climate Change Act indicates how the government needs to declare its actions (Sections 3–5), development and necessary adjustments to the Norwegian parliament on an annual basis (Lovdata, 2018). The involvement of the Norwegian parliament ensures broad political commitment to the climate cause.

The Act also stipulates that Norwegian emissions should be reduced by 40 % compared to the emission levels pertaining in 1990, and by 50 % through to 2050 (Sections 3 and 4 of the Climate Change Act). However, the Norwegian NDC to the Paris Agreement was updated in February 2020. This includes an increase in their contribution to reducing emission by 40 % compared to 1990 levels by 2030, moving to ‘reduce emissions by at least 50 per cent and towards 55 per cent compared to 1990 levels by 2030’ (UNFCCC, 2020b). Moreover, the Norwegian update points towards collaboration with the EU as essential, and it uses Article 6 of the Paris Agreement (voluntary cooperation) to fulfil parts that go beyond cooperation with the EU. The EU, Norway and Iceland agreed to cooperation on reducing their emission reduction targets by at least 40 % back in October 2019.

Regional and municipal augmented roles

The Planning and Building Act 2008, which is the guiding legal act for land and area use and regulation, aims to reduce GHG emissions through the mechanisms of regional planning. In Section 1.1., the Act states that: *‘The law will advocate sustainable development for the benefit of the individual, society and future generations’*.² Additionally, it provides guidance on the efficient and rational area and land usage, while stipulating directives for construction materials and building constructions, for instance. It is pursuant to the Building Code (Lovdata, 2008).

Regions and municipalities are therefore important for implementing the UN Sustainable Development Goals, and for operationalising governmental policies and ambitions towards becoming a greener society. That can be seen in the recently revised Municipal Act, for example. This includes the focus on sustainable development as the purpose of the law. In Section 1.1., it clearly states: *‘The purpose of this law is to create a foundation for functional municipal and regional democratic governance, and for a rational and efficient management of municipal and regional common interests, within the framework of the national community, through sustainable development. The law lays the foundations for confidence-building management, building on high ethical standards’*³.

The Ministry of Local Government and Modernisation also developed an additional strategy entitled ‘National Expectations to regional and municipal planning 2019–2023’. Its purpose is to help frame regional and municipal development in the aftermath of the regional and municipal reforms that took place from 2018–2020 (Ministry of Local Government and Modernisation, 2019a). This regional reform adds to the respective region’s areas of responsibilities, including an augmented role in presiding over social and regional development. National expectations clearly outline the role of regions and municipalities in implementing the UN SDGs. They use SDGs to guide future regional

² In Norwegian: Plan- og bygningsloven 2008: § 1.1 Loven skal fremme bærekraftig utvikling til beste for den enkelte, samfunnet og framtidige generasjoner.

³ In Norwegian: Kommuneloven 2018: § 1.1. Lovens formål: Formålet med denne lov er å legge forholdene til rette for et funksjonsdyktig kommunalt og fylkeskommunalt folkestyre, og for en rasjonell og effektiv forvaltning av de kommunale og fylkeskommunale fellesinteresser innenfor rammen av det nasjonale fellesskap og med sikte på en bærekraftig utvikling. Loven skal også legge til rette for en tillitskapende forvaltning som bygger på en høy etisk standard.

and municipal planning documents, also setting out how these are to be the foundation for future planning documents (Ministry of Local Government and Modernisation, 2019a). Placing SDGs within the framework of regional planning documents is a way of anchoring them and ensuring their implementation (Sandkjær Hansen, 2020).

According to Sandkjær Hansen (2020), the SDGs are supporting the regions' increased societal mandate. Regional and municipal actors are key enablers of the new political trajectory set out by the United Nations. This requires a new understanding of economics, equality and the environment, and the interconnection between them on both a regional and municipal level. Sandkjær Hansen points out that the connections between these three dimensions are what determines whether something will be sustainable or not (Sandkjær Hansen, 2020).

Supranational and international regulations

Norway is part of the European Emissions Trading System (EU ETS), which is considered to be 'a cornerstone of the EU's policy to combat climate change', whilst keeping an eye on cost-efficiency (EU Commission, n.d. a). Emissions trading is also regarded as a highly important feature of Norwegian climate policies, and the EU ETS covers approximately half of Norwegian GHG emissions (UNFCCC, 2020: 7). The EU ETS is essentially a carbon market, working under the banner of 'cap and trade'. Businesses and companies trade emission allowances, and there is a limit on the total number of these allowances. This ensures that emission allowances retain appropriate levels of value.

The sectors included in the EU ETS are defined by their greenhouse gas emissions, which need to be monitored and reported. Participation is mandatory, with a few exceptions pertaining to (e.g.) the size of certain plants, and smaller installations where emissions can be cut through alternative methods. Also, until 2023, these obligations are only applied to the aviation sector within the European Economic Area (EEA). The sectors included are CO₂ (carbon dioxide) intensive industry ones (including steel works, iron production, aluminium and other metals, cement, lime, ceramics, pulp and paper production, cardboard, acids and bulk organic chemicals, oil refineries and glass), along with commercial aviation, and power and heat generation. Also, industries producing N₂O (nitrous oxide) and aluminium production industries, which emit PFCs (perfluorocarbons) (EU Commission, n.d. a). A recent amendment to the EU ETS (DIRECTIVE (EU) 2018/410, amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814), also explicitly mentions the International Maritime Organisation's targets to reduce GHG emission from international shipping. It specifies how the European Commission '*should keep this under regular review, and should report at least once a year to the European Parliament, and to the Council, on progress achieved in the IMO towards an ambitious emission reduction objective, and on accompanying measures to ensure that the sector duly contributes to the efforts needed to achieve the objectives agreed under the Paris Agreement*' (EU Commission, 2018, p. 2). Actions concerning this will be taken as of 2023.

The EU ETS is currently in its third phase (2013–2020), and for the forthcoming fourth period (2021–2030) it will focus on strengthening the ETS as an investment driver by 1) increasing the pace of annual reduction allowances, and 2) reinforcing the market stability reserve, which was put in place by the EU in 2015 to reduce a surplus of emission allowances in the carbon market.

However, the EU's Effort Sharing Legislation (ESL) sets targets for emissions connected to the sectors that fall outside the EU ETS – such as transport, waste, agriculture, and buildings. The EU

ESD is part of the overall Climate and Energy policy framework for 2020, which specifies national emissions targets for 2020 ‘expressed as percentage changes from 2005 levels’ (EU Commission, n.d. b). These targets are based on the members state’s GDP. As this is not regulated at the EU level, each member state must implement national policies and actions which positively mitigate emissions from sectors within the EDS. However, this may be incentivised and aided indirectly by the EU ETS.

The IMO-MARPOL Convention was first adopted in 1973 and has since undergone several updates and amendments. IMO-MARPOL consists of six annexes. These cover pollution by oil, noxious liquid substances in bulk, harmful substances carried by sea, sewage on ships, garbage from ships, and air pollution from ships. The latter sets limits for the emission of SO_x, NO_x and PMs. Another chapter was adopted in 2011, covering mandatory energy efficiency measures for reducing GHG emissions (IMO, 2020). However, it should be pointed out that the overall measures set out by MARPOL are not sufficient to meet the 2 degrees Celsius target set out by the Paris Agreement in 2015 (Steen, 2018).

There were four (sulphur) emissions control areas (S/ECA) established as of 2011, which set strict limits to permitted levels of emission. In Europe, these comprise the North Sea and the Baltic Sea⁴ areas which fall under these controlled zones. Regarding the North Sea, this area is defined as a SECA within the following parameters (IMO, 2020):

The North Sea area means the North Sea proper including seas therein with the boundary between:

- 1. the North Sea southwards of latitude 62°N and eastwards of longitude 4°W;*
- 2. the Skagerrak, the southern limit of which is determined east of the Skaw by latitude 57°44.8' N; and*
- 3. the English Channel and its approaches eastwards of longitude 5°W and northwards of latitude 48°30' N.*

The conventions therefore encompass that sea area which connects with the Norwegian Sea. The Polar Code, the international code for ships operating in polar waters (IMO, 2017), entered into force in 2017. This covers both the international convention for the safety of life at sea, and the MARPOL convention. Both conventions are mandatory. The Polar Code was drawn up to protect vulnerable and pristine environments in the Arctic; as well as safeguarding against potential human risks for life at sea, where weather conditions are harsh and often poor (IMO, 2017).

As for marine life, Norway, as a major exporter of seafood, has significant responsibilities towards sustainability of the oceans. Intersecting with the SDGs, the FAO’s report ‘2018: The State of World Fisheries and Aquaculture – Meeting the Sustainable Development Goals’ focusses on measures to meet the UN SDGs. Norway is one of the few individual countries pledging to support the FAO’s work in achieving the SDG 14 target directly. SDG 14 refers to ‘life below water’. Norway, alongside other countries bordering the Arctic, has additionally banned fishing catches in certain areas of the Arctic, in order for researchers to study the marine environment and ecology (FAO, 2018).

⁴ The MARPOL text here refers to the Baltic Sea area as the ‘Baltic Sea proper with the Gulf of Bothnia, the Gulf of Finland and the entrance to the Baltic Sea bounded by the parallel of the Skaw in the Skagerrak at 57°44.8' N” (IMO, 2020).

2.1.2. National policies 2013–2020

The green transition is guided by the intersection of different particular policies, and there are several policy documents which lay the groundwork for enabling a sustainable green transition. This section will list and summarise some of the most important policy documents from the timeline 2013–2020.

In relation to the discourse outlined above, it is clear that a green transition is framed and contextualised in terms of linking climate change and economic development. In 2015, the Norwegian government appointed an expert group and commissioned a report on green competitiveness. The report was finalised by this expert group in 2016. It points towards a range of contextual changes, providing the backdrop to future policy development, and considering potential scenarios which might develop on this basis. The expert group points to Norway's commitment to the Paris agreement, setting out to cap emissions by 40 % by 2030 (compared with 1990 levels), and aiming to become a low emissions society by 2050. The expert group also acknowledges the short time horizon involved, together with the urgency of enabling a green transition (Hedegaard & Kreutzer, 2016, p. 6). The report also highlights the changing demographic composition of Norway, and the reality that the petroleum sector will be of less importance in the future. This factor is heightening the need to generate green jobs and enhance green value creation, in order to bridge the transition away from a dwindling petroleum sector over time. Furthermore, the report recognises the costs of green transition, and does not allude to scenarios where costs will not be incurred (*ibid.*). The expert group reaches its conclusions based on dialogue with Norwegian companies and other actors in society, all of whom are challenged to draw up a roadmap for green transition (Hedegaard & Kreutzer, 2016).

The expert report concludes by providing several guiding principles for policy development in relation to the green transition: ones which will both enable increase levels of innovation and investment. These guiding principles are as follows (Hedegaard & Kreutzer, 2016, p. 28):

- Polluter pays.
- Pricing emissions and other externalities.
- What we do not want should attract higher taxes. What we do want should be taxed less.
- Public procurement should be green.
- Planning and investment should be framed with a view to creating a low emissions society by 2050.
- Lifecycle analysis should be the guiding principle for public procurement and investment.
- New laws should include an assessment of CO-emissions, where this is relevant.
- Green competitiveness should build on well-functioning markets.
- There should be reporting on what we want to achieve and what we want to avoid.

In creating and realising these principles, the room for manoeuvre is duly increased. The report also concludes that the potential of these principles is based on a willingness to use them, and upon political agreement.

The government followed up on this report by publishing a strategy entitled ‘Better growth, lower emissions’⁵ in 2017. It added to, amended or concretised the list as follows (The Norwegian Government Offices, 2017, p. 15):

- The government is to provide predictable frameworks, and to be the driving force in work on the transition to a low emissions society.
- Polluter pays is part of a general, holistic approach to promoting green competitiveness.
- Planning and investment should be framed with a view to creating a low emissions society by 2050.
- There should be a targeted emphasis and focus on climate and the environment in publicly financed research, innovation and technology development, where relevant.
- Ensuring that the public sector, as a customer, contributes towards using and developing new environmental and climate friendly technologies, products, and solutions.
- Ensuring that consumers, businesses and investors all have the information needed to be able to choose green products and solutions.
- Green competitiveness should build on well-functioning markets.

The government report also places emphasis on the need to re-skill the labour force, and build appropriate competences within it, in order to support the green transition. Although the Norwegian population is highly educated (and this is seen as a crucial advantage for the green transition in general), it is necessary to recognise the role of skills governance in overcoming skills mismatches in the labour market and for bridging towards a green transition. Competence development is also necessary for ensuring that consumers, businesses and investors are able to make green choices, and that they understand the information they have been provided with. The report’s principles also allude, indirectly, to the need for increasing competences within the public sector, since the public sector is seen to be the driving force in creating a low emissions society. The role of the green transition, skills development, and competence in light of increased automation and digitalisation is particularly evident in the *Report to the Storting no. 27 (2016–2017)*⁶ (Ministry of Trade and Fisheries, 2017). This report presents the government’s future politics regarding Norwegian industry, with opportunities and challenges framed by sustainable development. It takes stock of the fact that the prevailing understanding of Norway’s industrial future is deeply affected by the phasing out of the petroleum sector, and by the concomitant transition to greener businesses. It also considers other important changes – such as climate change, an ageing population, and rapid technological development. All of these factors have an impact on Norwegian industry. The report additionally considers the development of new materials, automation, and the respective impacts of digitalisation and R&D&I.

Alongside this policy document, there is a scheme in place to prevent the offshoring of industrial production to countries with more relaxed climate policies. The CO₂-compensation scheme came into place on the 1st July 2013. It will continue until the 31st December 2020. The scheme is aimed at industrial sectors which particularly need large amounts of power (exceeding 10GWh per year), and where production is part of the defined NACE-codes, fulfilling the EU’s criteria of industries especially vulnerable to carbon leakages (Miljødirektoratet, 2020). The legal regulation here states that one of the main reasons for implementing the CO₂- compensation is as a result of increasing

⁵ In Norwegian: ‘Bedre vekst, lavere utslipp’.

⁶ Meld. St. 27 (2016–2017) Industrien – grønnere, smartere og mer nyskapende.

electricity prices in the EU. The opportunity to receive compensation is decided by Section 7 in the regulation (cf. Lovdata, 2013). In a recent article published by the Norwegian Broadcasting company, NRK, industry pleads its case for the continuation of this scheme after 2020 (NRK, 25.06.2020). The article also illustrates how industry is demanding that government use the Covid-19 pandemic as an opportunity to kickstart the green transition by focusing on innovation, energy access and infrastructure. The Norwegian Labour Organisation alongside actors such as e.g. Industri Energi and the Confederation of Norwegian Enterprises (NHO – Industri), is behind a collective industry proposal on the government's role in transitioning to a greener economy (NRK 25.06.2020).

Marine industries

The *Report to the Storting no. 20 (2019–2020)*,⁷ entitled 'Comprehensive management plans for the Norwegian marine areas – the Barents Sea and the marine areas off Lofoten, the Norwegian Sea, and the North Sea and the Skagerrak', looks to develop a framework for value creation from sustainable use, and to maintain important ecosystems services in oceanic areas. It takes into account the intersection between the three dimensions mentioned above (economics, equality and the environment) in setting out to renew Norwegian industries such as fisheries and aquaculture, shipping, and petroleum. It also provides important preconditions for new industries, such as ocean mineral mining, carbon capture, hydrogen production and ocean-based wind power plants. A new definition of the marginal ice zone is also raised in the document. There was a good deal of debate about this in the media during Q1 and Q2 of 2020 (Ministry of Climate and Environment, 2020).

The ocean, ocean resources and SDGs are also discussed and formulated in *Report to the Storting*⁸ *22 (2016–2017)* in relation to Norway's foreign policy and the politics of development. It emphasises and highlights 'sustainable use of value creation, clean and health oceans, and blue economy in development politics'. It also actively states the need to mitigate, and fight against, environmentally damaging practices (Ministry of Foreign Affairs, 2017). In the updated Ocean Strategy, *Blue Opportunities (2019)*, sustainable growth in new and established businesses, plus a viable local labour market and the synergies created across these different efforts, are all highlighted (Ministry of Trade and Fisheries, 2019).

The world is consuming increasingly more seafood and fish products, and aquaculture is playing an important role in this growth (FAO, 2018). In addition to China, Norway is listed amongst the major aquaculture producers of the world, and Norway is noted as the second largest global exporter of fish and fish products. This particularly means salmon, but also an extensive fishing fleet catching cod, herring, mackerel and other pelagic species, and white fish (FAO, 2018:55). Fish exports rose by 17.2 % between 2015 and 2016, and a further 5.1 % in 2017 (due to increases in cod and salmon prices, primarily).

Blue growth is undoubtedly an area of great potential for Norway. With a long history of traditional fisheries, and with more recent developments in aquaculture, there is significant scope for a different path forwards. One of the most important issues for the state to attend to in years to come is ensuring that Norway takes and keeps the lead in matters of technology related to aquaculture

⁷ Meld. St. 20 (2019–2020) Helhetlige forvaltningsplaner for de norske havområdene — Barentshavet og havområdene utenfor Lofoten, Norskehavet, og Nordsjøen og Skagerrak.

⁸ Meld. St. 22 (2016–2017) Hav i utenriks- og utviklingspolitikken.

and marine industries. With all the natural resources necessary, and a favourable policy framework linked to this, marine and ocean industries in Norway are well placed to lead the future of global aquaculture.

Maritime industries

The maritime industry is a very important one in Norway. It has long, historic roots. With an ambitious plan to maintain its position as a prime technology broker and leader in the world of international shipping, Norway is already well positioned to spearhead the development of green shipping.

There have been several government reports and specified policy intentions in relation to the maritime sector in recent years. The most recent – and most concrete – of these is the government’s Action Plan for Green Shipping (Ministry of Climate and Environment, 2019). This report highlights, among other things, the various frameworks and regulations enabling green transition – including public procurement policies, regulations regarding pollution, biofuel blending targets, the IMO’s MARPOL and Polar Code, and the Harbour and Fairways Act (Ministry of Climate and Environment, 2019: 55–58). The IMO’s recently devised Polar Code, and its environmental considerations, are also addressed in the Report to the Storting 35 (2016–2017). Entitled *On the right course – Preventative oceanic security and acute pollution preparedness*⁹, this lists the precarious issues and risks surrounding short sea shipping. It suggests a range of actions to overcome these in particular times of need (Ministry of Transport and Communications, 2016).

The Action Plan for Green Shipping also points towards the role of the state funding agency Enova in supporting the transition to a low or zero-emissions fleet, as well as continuing support for the Green Shipping Programme coordinated by DNV GL (DNV GL, 2019). The government suggests by its action plan that it intends to initiate a dialogue with relevant stakeholders on the ability of shipowners to renew their fleets. This is particularly pertinent for the ability to renew the short sea shipping fleet, due to short term contracts and subsequent difficulties in obtaining investment capital. The strategy highlights the complexity of the task ahead, but also the significant opportunities in the maritime sector to take the lead not only domestically but also internationally. The action plan aims to create a culture of ‘winners’, and to establish Norway as a leader of green transition in the world of shipping. As part of this, it is important to ensure that new technology supports global climate emission goals. A new report to the Storting on the maritime industry was due in the autumn of 2020.

Another action plan connected to the maritime industry is the ‘Maritime opportunities – blue growth for a green future’ strategy, published in 2015 (Ministry of Trade and Fisheries, 2015). This strategy considers sustainable growth and value creation within roaming areas (*fartsområder*), shipping administration and its need for simplification, R&D&I, blue growth, the arctic and northern areas, the environment, skills and competence, and international framework agreements. The maritime industries are defined in this instance as petroleum and gas, maritime, and marine industries, and their synergies (The Ministry of Trade and Fisheries, 2015; 2019). This report was updated in 2019, and it identified three areas of increasing importance for maritime policy in the years to come. These are: 1) skills and digitalisation, to ensure that we have the technology and competence to create, and make use of, new opportunities; 2) climate and green shipping, in order

⁹ Meld. St. 35 (2016-2017) På rett kurs — Forebyggende sjøsikkerhet og beredskap mot akutt forurensning.

to reach the target of being a low emission society by 2050; and 3) coastal and local value creation, building on a concerted national and regional industrial and social policy in order to achieve a systematic policy mix (Ministry of Trade and Fisheries, 2019, p. 45). These three areas are intended to strengthen a systemic approach to policy making in the future. As such, the updated strategy also embeds maritime strategy in a regional context, which in turn is to be reflected in both the Ministry of Local Government and Modernisation's Report to the Storting 5 (2019–2020) Rural report¹⁰ (Ministry of Local Government and Modernisation, 2019b) and the updating of the Strategy of the Northern areas¹¹ (Government offices of Norway, 2017) in the autumn of 2020. The updated strategy (Ministry of Trade and Fisheries, 2019) also supports the government's ocean strategy 'New Growth, Proud History' of 2017 (Ministry of Trade and Fisheries & the Ministry of Petroleum and Gas, 2017).

Transport, logistics and infrastructure

Infrastructure is one of the main pillars supporting Norwegian society, enabling the possibilities of working and living on the same terms across the whole country. It buttresses regional labour markets, value chains, products and services, as well as enabling fair competition among businesses. In a country spanning relatively large distances, these need to be negotiated through excellent communications and transport services. Chapter 14 in the current government manifesto, the Granavolden Platform, sets out the coalition's overall politics for transport and infrastructure. The platform is based on a national transport plan, which will be spelled out below. Working towards discovering low emission solutions for heavy transport services, as well as buses, is an explicit goal. There is also potential to use new technology to reduce emissions in the transport and logistics sector. This includes overcoming the impediments caused by distance, by focussing on digitalisation and the internet of things to improve mobility. This may also help further integrate the rural and the urban.

Capping emissions plays a large role in the government platform dating from 2018. The government is therefore committed to developing an infrastructure for enabling zero emission vehicles, as well as increasing the use of biofuels. According to the platform, many of the incentives will be derived from tax regulations. Biofuels is generating debates over environmental justice, social and global justice (Borras, McMichael, & Scoones, 2010). This is also sparking further discussions in Europe over the use of palm oil as a source of advanced biofuels – something which was widely debated in the Norwegian parliament and in the media, leading to a ban on biofuels from palm oil in Norway as of 2020 (Martiniussen, 2019). The share of biofuels from palm oil increased in 2019, and this helped to cut Norway's CO₂-emissions by 1.3 million tonnes, an increase of nearly 20 % from the year before (TU/NTB, 2020). However, given its negative impact globally, Norway is taking a lead ahead of the EU, which aims to phase out biofuels by 2030 (Ghani, S.S.A., 2019).

National transport plan

The most important policy document for the transport sector in Norway is the National Transport Plan (NTP), which is redrafted every four years. The most recent plan, the National Transport Plan for 2018–2029,¹² sets out long term and overarching policies for the transport policy, and traces

¹⁰ Meld. St. 5 (2019–2020) Distriktsmeldingen.

¹¹ Nordområdestrategien.

¹² Meld. St. 33 (2016–2017) Nasjonal transportplan 2018 – 2029.

the development of the transport and infrastructure sector over the next 12 years. The aim here is to fulfil the overarching goals of transport policy by 2050.

The NTP also discusses the green transition for commercial transport (Ministry of Transport and Communications, 2017, p. 188). At the suggestion of Parliament, the government has been asked to consider establishing a CO₂-fund, resembling the NOx-fund,¹³ for the maritime sector, alongside the relevant industry organisations (e.g. the Confederation of Norwegian Enterprises – NHO) and the industry-wide roadmap developed for commercial transportation (Stakeholder AS, 2016). The NTP also explores the ambition to electrify ports and harbours, and also the government's need to work internationally to press for wide-reaching standards in enabling this to happen (Ministry of Transport and Communications, 2017, p. 24). In many ways, the NTP has considerable potential for becoming a key tool in green transition. But for this to happen, a systematic and holistic approach is needed, especially with regard to infrastructure for low or zero-emission vehicles. The ambition of the NTP 2018–2029 is to transfer 30 % of what is currently being transported over a distance of 300 km by road freight to the sea ways, with a significant amount also being transferred to rail freight.

The government's Green Competitiveness Strategy from 2017 (*Bedre vekst, Lavere utslipp*) additionally highlights the potential of the transport sector in terms of digitalisation. Digitalisation has the potential to improve traffic flows, and in this way to reduce emissions and improve communications. It also uses big data to analyse and improve overall user-friendliness, and the transport system as a whole. Transport and infrastructure are considered key factors in competitiveness and not least green competitiveness. The strategy sets out the following actions for ensuring future green competitiveness (Ministry of Climate and Environment, 2017, p. 33):

- Investigating measures for strengthening rail and sea transportation.
- Developing a national plan for alternative fuels for infrastructure (including fuels for short sea shipping).
- Ensuring favourable conditions for testing autonomous vehicles.
- Contributing towards the realisation of a demo-plant for CO₂-management.

The Report to the Storting 5 (2019–2020), the rural report, also mentions the importance of good infrastructure and transportation. With regard to the green transition, it devotes a section to the specifics of a green transition in transport and communication. For the regions and municipalities, the government has established the 'Klimasatsordning' (the Climate focus scheme) to aid the development of green transportation systems. This includes charging points for electrical vehicles (Ministry of Local Government and Modernisation, 2019b).

Regional infrastructure responsibilities encompass approximately 80 % of the total road network. The responsibility also extends to the ferry network, and fishing harbours are also mentioned as a key infrastructure for societal development overall. The management of fishing harbours was in the process of being transferred to the regional level in 2020, and these harbours will now be viewed in light of overall business development within the region (Ministry of Local government and modernisation, 2019: 109). The regions are also supposed to facilitate freight terminals, and efficient logistical nodes.

¹³ See more about NOx-fund on page 26 in this literature and policy review.

Transportation, logistics and infrastructure are considered key to green competitiveness. But they can also play a significant role in developing local communities across the country as a whole. Increased responsibilities for infrastructure at a regional level may require strengthening the relationship between the national and the regional level.

Waste Management

The government published a Report to the Storting on waste management in 2016, Report 45 (2016–2017), ‘Waste as a resource – waste politics and the circular economy’ (Ministry of Climate and the Environment, 2017). With the circular economy being the framework for this white paper, waste is understood in terms of how to better tackle and ensure improved targets for the reuse and recycling of materials, as well as nipping waste in the bud by preventing it from the outset. The focus on better utilisation of secondary resources was also mentioned in the government strategy on ‘Better Growth, Lower Emissions’ (The Norwegian Government Offices, 2017, p. 47).

In the light of a commitment to the circular economy, the use of waste and recycling seems to be ever more evident on the policy agenda. By using the UN SDGs as a guiding principle in regional and municipal planning, addressing waste becomes a greater priority.

Box 1. Circular economy concepts

Sharing economy is defined as a short-term, peer-to-peer transaction. It usually revolves around idle items which can easily be shared between people, mediated through an online platform (Investopedia, 2020).

Performance economy is the approach of selling the services of a product rather than the product itself. Stahel and Reday first coined this idea, and they argue that the idea of a circular economy is providing the framework for its conception (Ellen MacArthur Foundation, 2017).

The **dematerialisation of the economy** is the optimisation of materials used by way either of producing the same product with less resources, or of digitalising the product (e.g. from paper to electronic services), or of servitisation – which is a product service rather than the product (Circular Economy Practitioner Guide, 2018)

Report to the Storting 45 (2016–2017) also connects waste to the marine industries, with an increased focus on microplastics, marine waste management, and the problem of plastic in the oceans. Waste is an issue addressed in a range of industries and sectors, related to the all-encompassing notion of waste and the fact that its prevention needs to happen from the get-go. This means that waste management policies need to be considered in the wider context of its existence, and the specific policies guiding sectors producing waste need to be considered in this light. The circular economy as an overarching policy objective is therefore closely connected to waste management, and one cannot exist without the other. One of the most important reasons for the lack of reuse or use of secondary resources today is the concomitant lack of profit for the actors involved (Ministry of Climate and the Environment, 2017, p. 10), but also a steady supply of secondary resources (EY,

2019). In other words, there is an incentive to strengthen the market for secondary resources.

Some of these issues are also linked to the supranational level by the EU considering the requirements surrounding, for example, the reuse of building materials in the building and construction sector. The Norwegian Building Products Regulation sets the standard for reporting, and also the conditions for product trading (Direktoratet for Byggkvalitet, 2017). According to an interview conducted by the Trondheim-based reuse and recycling materials company GreenStock AS, the way this regulation (TEK17) focusses on product conformity through the manufacturing process of the product, constitutes somewhat of a hinderance to reusing and recycling building

materials (Skanche, 2020). The building and construction sector were responsible for 39 % of global energy related emissions in 2018 (International Energy Agency, 2019, p. 16).

The Report to the Storting 45 (2016–2017) also examines the potential of various emerging platform economies, which can be part of preventing waste from the outset. These are key in terms of the prevention of waste (Ministry of Climate and the Environment, 2017). The sharing economy, the performance economy and the dematerialisation of the economy are new concepts which are challenging the status quo on use and waste (See Box 1). This can also be seen in relation to the notion of ‘decoupling the economy’, facilitating ‘the ability of an economy to grow without corresponding increases in energy and resource use (source limits) and in environmental pressure (sink limits) (Wijkman and Skånberg, 2017, p. 13). Ultimately, circular economy practices are challenging today’s prevailing business models (Wijkman and Skånberg, 2017).

However, as the Report to the Storting 45 points out (2017, p. 30), *‘a higher degree of a performance or sharing economy will not automatically reduce the total amount of products purchased or consumed in an economy. In this scenario, change might unleash part of people’s disposable income, which may mean that people will use ‘unleashed’ funds to increase the consumption of other products’* (Ministry of Climate and the Environment, 2017, p. 30). This was also reported in Wijkman and Skånberg’s Club of Rome report, ‘Circular economy and Benefits for Society’. Here they state that: *‘While relative decoupling has been happening, and is happening, the gains made so far have been rapidly eaten up by a combination of economic growth and the so-called rebound effect, i.e. that the resources freed up by increased efficiency are used up very soon afterwards through increased consumption’*. This scepticism was also detected among the interest groups in Gullberg’s (2013) article, where renewables replacing coal as an energy source were perceived only to have resulted in the shifting of the freed-up ‘pollution quota’ onto other polluting industries, such as cement production.

Hence, there is no ‘silver bullet’, and behavioural change plays a major part in enabling this transition (Wijkman and Skånberg, 2017). It also comes down to a general, renewed understanding of waste and material productivity – but also changed business models, in which circular economy practices focus on the preservation of material value, energy and labour.

Box 2. Avfall Norge

Avfall Norge is an umbrella organisation and network for business within the waste management sector and the circular economy. It originates from Norsk renholdverks-forening (NRF). Its main activity is to conduct R&D&I within waste management and develop circular economy approaches through the “Avfallforsk” project. The organisation also launches projects, seminars and events concerned with waste management and the circular economy. For example, Bio2020 is a project that aims to enhance the use of biowaste, and to raise awareness about biowaste at a political level. Today the organisation has more than 200 members (Avfall Norge 2020a, Avfall Norge 2020b).

According to a recent report by EY, investigating the speed of the green transition in different industries in Norway, the government score in terms of its response rate to the sector’s demands is rather low. The government is seen as being very active in certain areas, such as plastic recycling and food waste. But in other areas needing a response, concrete action seems to be lacking. Moreover, there have been few measures in place to incentivise the creation of corresponding markets, and the sector also points to the lack of an overall, concerted approach to understanding waste as a key enabler for the circular economy (EY 2019, p. 29). A strategy for a green and circular economy was published in June 2021 (Government Offices of Norway, 2021). This will take a more holistic approach to the waste management – understanding the circular economy as both a frame of thought and a policy development (Government Offices of Norway, 2021; Ministry of Climate and

Environment, 2020). Guiding this strategy document is a pronounced declaration by the government in the Granavolden policy platform:

‘Norway is to be a pioneer in the development of a green, circular economy that better utilise resources, and shall develop a national strategy of circular economy’ (Government of Norway, 2019, p. 86)

Waste management is organised at a municipal level or by private companies in Norway, and is a mix of public and private companies, often in a public–private partnership. To further strengthen the waste management sector in Norway, waste management actors have formed consortia to better handle the increasing demands for circular economy practices, and to invest in common infrastructure. There are several regional ‘waste management forums’, which have all been collected onto one platform, AvfallNorge.no (See Box 2).

2.1.3. Geopolitics and climate change leadership

The Arctic areas are important for Norway, both for geopolitical reasons and because of their vast natural resources. The government published a strategy for the Arctic in 2017 (Government offices of Norway, 2017). This refers to areas of growth such as seafood, petroleum, renewable energies, maritime industries and tourism, seeing them as integral to Arctic areas. The strategy further stipulates that primary expectations for transport and logistics in the area will be connected to the oil and petroleum sector. It is therefore necessary to continue to build competences in developing maritime transport opportunities, which today are centred around the Centre for High North Logistics in Kirkenes (part of Nord University). As the polar ice is rapidly shifting, the North–East and North–West passages are opening up as real contenders for transport routes between Asia and Europe. The report further notes that the Russian authorities are also looking to the ‘Northern Seaway’ as a transport route. But it says that the commercial use of this passage remains relatively low, due to a range of factors. These include climate, resources, insurance, and ice-breaker assistance (Government offices of Norway, 2017, p. 46).

Report to the Storting 20 (2014–2015) also refers to the management of the northernmost areas, with changes to Arctic conditions drawing attention to vulnerable ecosystem areas. As the temperature has risen rapidly in the Arctic over the past decade, so the polar ice is melting at a high rate. The Barents Sea is most acutely impacted by these rapid changes, and the IPCC is attributing these to human activities (Ministry of Climate and Environment, 2015).

The issue of melting polar ice is challenging Norwegian interests from both sides of its climate change narrative: as a producer of clean fossil fuels, and also in terms of Norway's proclaimed climate leadership. The recent debate regarding the marginal ice zone heightens this issue. The debate about the definition of this zone demonstrates the dichotomy of preserving biodiversity in vulnerable oceanic areas, such as the Barents Sea, and the continuing desire to explore oil and gas fields. The Norwegian Broadcasting Company (NRK) says that this conundrum is 'political dynamite', labelling it such in an article on the background for discussion of the marginal ice zone in the Norwegian Parliament during the spring of 2020 (cf. NRK 22.04.2020). In May 2020, the parliament agreed to the government's definition of the marginal ice zone as 15 %, which moves the ice edge somewhat further south than the previous zonal definition. The definition of this zone determines where oil and gas exploration can and cannot be conducted (see Box 3). According to the Norwegian Polar Institute, the further south the marginal ice zone is drawn, the better it is for vulnerable ecosystems (Norwegian Polar Institute, 2017).

The Arctic Council, an intergovernmental body comprising of Nordic countries and Russia, Canada, and the USA, as well as permanent participants representing civil rights of indigenous people, has drawn up a maritime strategic plan for 2015–2025. This strategic plan is concerned both with short- and long-term challenges and opportunities in the area, and includes several strategic actions. These are grouped under four overarching goals, which are as follows:

1. Improve knowledge of the Arctic marine environment, and continue to monitor and assess current and future impacts on Arctic marine ecosystems.
2. Conserve and protect ecosystem functions and marine biodiversity in order to enhance resilience and the provision of ecosystem services.
3. Promote safe and sustainable use of the marine environment, taking into account cumulative environmental impacts.
4. Enhance the economic, social and cultural well-being of Arctic inhabitants, including Arctic indigenous peoples, and strengthen their capacity to adapt to changes in the Arctic marine environment.

The Arctic Council is promoting a strategic plan which concerns the linkages between well-functioning ecosystem services and the wellbeing of the Arctic population. Recognising the

Box 3. The marginal ice zone

The marginal ice zone (MIZ), or ice edge, is defined as the 'transitional zone between open sea and dense drift ice' (Norwegian Polar Institute, 2017). It encompasses those areas where 15% of the sea's surface is covered by ice, through to an area where there is 80% ice concentration. The 'ice edge' is the southern border of this zone.

As the zone is not a static area, the ice edge is drawn up so as to shape policy action and the management of the Arctic Oceans, particularly the Barents Sea. The definition of the ice edge and its location determines policies connected to oil and gas exploration and nature and ecosystem conservation (NRK, 22.04.2020). However, this definition and the placement of the ice edge is also said to influence geopolitical power and the role of climate change (NRK, 2020).

preceding decades as some of the most environmentally challenging ones to date, the Arctic Council is taking steps and actions to capitalise on newfound opportunities for sustainable development, environmental protection, and enhanced collaboration in regional and international fora (Arctic Council, n.d.).

Discussing the geopolitical role of the green transition

The discursive framing of the green transition is an interesting aspect of Norway's journey towards a greener economy, particularly in terms of the geopolitical climate leadership role that Norway espouses. Eckersley (2016) dissects the identities and roles of Norwegian and German climate leadership. This is particularly interesting in terms of Norway's ambition to be a climate leader, alongside its role as an economic and technological pioneer in the oil and gas industry. According to Eckersley, the tension between these is concentrated and approached through two discourses: international responsibility (climate change and poverty – global justice), and the 'technological pioneer' frame. The technological pioneer frame is understood through Norway's history of modernisation following the discovery of oil and gas. The 'pioneer' aspect is 'knitted into a larger narrative of Norway's industrial from a nation of poor farmers and fishers' (Eckersley, 2016, p. 193). It is also balanced out by acknowledging a degree of luck, as well as the creativity and inventiveness of Norwegian politicians and industries. This balance, and its historical trajectories, is what enables Norway to be both a climate leader and technological front runner.

Another important aspect of this story is the narrative about being an 'environmentally friendly' petroleum and gas producer, which plays a pertinent role in the leadership story – since it rests on environmentally sound and ground-breaking technological developments, as well as good management (Eckersley, 2016; Gullberg, 2013). Carbon capture and storage is part of this narrative, and plays an important role in the climate leadership narrative for Norway. It is not only understood as a way to bridge the current situation towards a low-emissions future, but it also resolves the tricky conundrum of combining the desire to be a climate leader and remaining an oil and gas producer. It is about enabling a global justice perspective through the economic leadership role that Norway has claimed in the battle against climate change. Green growth therefore sits comfortably with the general Norwegian discourse (Eckersley, 2016, p. 194). As noted by Gullberg in 2013, there is, however, a prominent economic growth versus environmental protection divide in the national discourse, and it is clear from Eckersley's study that the discourse on green growth and ecological modernisation is playing a major role in legitimating domestic policies on climate and energy (2016).

Gullberg's article takes a look at Norway's potential for becoming a green battery for Europe. It examines the possibility of shifting the status quo in a way which tends to be characterised as incremental change. In the short term, Gullberg argues, the status quo is not likely to change; but it may be challenged in the future. However, what is interesting in this regard is the policy debate dissection conducted by Gullberg, in order to define the status quo. According to Gullberg, all political parties in Norway (2013) can be concentrated within two groups in the renewables debate. Interestingly all political parties seem to lean towards a discourse centred around 'renewables' rather than 'nature conservation'. Another interesting divide in the renewables and climate change debate is the grouping of political parties within the international-versus-domestic emission capping divide (Ap, H, FrP vs. SV, Sp, V, KrF). The international leadership debate, and global justice framing, is also reflected here. The larger political parties represent the economic growth frame, the global justice frame, and international leadership frame together. This interesting duality is also repeated in the chapter by Dale and Andersen in Haarstad and Rusten's (eds.) book, *Green transition – Norwegian road map*. In their chapter, Dale and Andersen point out that the focus on cost-efficiency

is one important reason why the petroleum industry has not been challenged to the extent it perhaps needs to be, in order to conform to the main Norwegian narrative focussing on mitigating emissions at home rather than abroad (Dale & Andersen, 2018). These are often framed within the idea of international leadership and global responsibility (Eckersley, 2016).

The press also plays an important role in shaping policy discourse on climate change and Norwegian leadership. Midttun *et al.* (2015) state that 'the use of national newspapers as a lens allows us to penetrate beyond the rhetoric of official national perspectives on climate issues, into the broader climate debate, for which the press acts as one of the critical public spaces' (2015, p. 1272). The frame analysis conducted by Midttun *et al.* rests on Nelkin (1987) and Goffman (1974), through their commanding work on the role of mass media in informing people's understanding of science, global warming and interpretative schemas, respectively. According to Goffman, these interpretative schemas serve as a method to both simplify, and build unified perceptions of, a social reality (1974). For Midttun *et al.* (2015), using these frames to analyse Norway's position and approach to the climate debate uncovers two main trends: 1) the inclination to leave domestic oil and gas, and its adherent wealth, untouched; and 2) to transfer climate policies onto the global market and to engage with the 'global south', instead. The latter was often portrayed through an ethical perspective in media coverage between 2008–2010, placing an emphasis on the role of the global north in terms of pragmatic issues such as technology transfer and moral obligations towards the global south (2015, p. 1279).

Moreover, this is buttressed by another geopolitical perspective which hinges on the role of the Arctic. Although this was primarily framed as a power struggle between Russia and China in 2008 and 2010 (Midttun *et al.*, 2015, p. 1280), the current debate is about the ice edge, defining the ability for further exploitation of undiscovered oil and gas fields in the Barents sea. This is bringing the political issue closer to Norway, as the role in 'answering' Russian oil exploitation in the north, or managing the Barents' Sea, becomes paramount. This is because it ties geopolitics to the environment through a perception of 'clean oil and gas' (see e.g. NRK 08.06.2020; Midttun *et al.*, 2015).

Coming back to Gullberg (2013), aside from the interesting policy frame analysis, this article debates the potential of Norway being Europe's green battery, and supporting the transition to a renewable energy system. According to Gullberg, this is technically feasible, but the policy framing and the role it plays in supporting the status quo – or indeed overcoming it – is situated between economic benefits accruing as a technology leader in the oil and gas industry, and the climate leadership divide, all while maintaining the welfare state. Gullberg's article argues that this dichotomy, and thus present policies, are characterised by incremental change, since all new interconnections are negotiated and decided on an individual basis. This means that, in the long term, there is a possibility that Norway will become a green battery; but in the short-term things are unlikely to change due to the nature of incremental change. Incremental change is usually seen in connection to path dependency, and the inability to reinvent your position as you follow the status quo. Furthermore, there is a crucial difference in the interpretation of the nature of what a green battery constitutes as far as the EU and Norway are concerned. Whereas the EU is looking to Norway for its existing hydropower and the potentials connected to its pump-storage, Norwegians were interpreting it in terms of developing wind power, and 'exporting hydropower when the wind is still. Pumped-storage hydropower is not part of the equation' (Gullberg, 2013, p. 619). Coming to understand and bridge this difference in interpretation would potentially also increase the likelihood of turning Norway

into the green battery of Europe, since it would rely less on political factions and on appeasing interest groups, and more on existing, incremental changes (Gullberg, 2013).

As we have previously seen, in the role of the policy framing, the dichotomous place of Norway as, concurrently, a climate leader and as an oil and gas producer, still holds. The status quo still dominates, and change is primarily happening incrementally. Fevolden and Klitkou conclude that there is evidence to suggest that there are indeed 'inconsistent and unpredictable' government incentives at play here, and that this is the most obvious evidence for limited success in developing an advanced biofuels sector; indeed that 'this failure put several biofuel companies out of business and scared off investors' (2017, p. 126). This is particularly evident in the inconsistent biofuels policies in place from the beginning of the 2000s until now, related to the fact that this is a heavily debated topic in the Norwegian Parliament. The debate has particularly centred around incentives for levels of fuel blending, double counting for the fuel to compete with regular fuels, tax exemptions, and definitions of 'polluter and user pays'. More recently, the debate has concentrated on the nature of the biofuels and their sources (TU/NTB, 2020).

3. State of play: Green transition strategies and action in Norwegian industries

Having traced out the Norwegian Government's policy approaches to enabling a green transition, this section will look at the status, speed, and possible future scenarios for the green transition in Norwegian industries. Menon Economics and EY both undertook extensive research around this topic, and published their reports on the status and potential of the greening of Norwegian sectors back in 2019. Menon Economics report that approximately 50 % of value creation happening in Norway's private sector can be defined as green. This is due to a growing service sector, which in comparison to industrial production, for example, has lower CO₂-emissions. Offshoring industrial production is also a development buttressing the growing service sector, as industries move to countries with cheaper production requirements. According to Menon Economics, this trend is seen across OECD states. It can be further confirmed by observable growth in industrial production across emerging economies in, for example, Asia (Menon Economics 2019, p. 16). However, offshoring demands increased levels of global cooperation in order to meet Paris Agreement targets and the aim of capping greenhouse gas emissions. Menon Economics points to the withdrawal from such global agreements as ever more precarious and problematic, as the greatest emitters of GHG emissions are no longer committed to following through with active measures.

Menon Economics (2019) also questions Norway's level of ambition with regard to capping GHG-emissions. This is spelled out in the Menon Economics report, which points towards the lower levels of commitment and monitoring, for instance. It is also entailed by concrete goals being at a low level, and measures being modest compared to Swedish, Danish and British counterparts. This is because strategies tend to be formulated in line with the principles of strengthening Norway's competitive advantage, rather than concrete climate goals. Furthermore, Menon Economics points to a relatively short-term policy commitment. Without a stronger focus on long-term goals, Norway's competitiveness may be weakened, states Menon Economics (ME 2019, p. 55).

Box 4. Circular accounting cluster (Den sirkulære regnskapsklynge)

Den Sirkulære Regnskapsklynge was established in January 2019 by Regnskap Norge. It is focused on the application of circular economy principles within accounting. The aim of the cluster is to develop practical tools for the accounting sector, in order to assess circular economic operations from an accounting perspective. The cluster also tries to enhance changes in regulations and laws which are favourable for the development of a circular economy (Høgskolen i Innlandet 2020, Regnskap Norge 2020a, Regnskap Norge 2020b).

Another report published in 2019 was the EY report on mapping the speed of green transition in Norway, commissioned by the Ministry of Climate and Environment (EY 2019, p. 3). This report followed up on the government's commissioned report '*Green Competitiveness*' (Hedegaard & Kreutzer, 2016), and uses as a benchmark the roadmaps developed by industries in the aftermath of the strategy's development. As previously mentioned, the green competitiveness strategy challenged 17 sectors to develop their roadmap towards green competitiveness. According to EY, these roadmaps were relatively ambitious, and they demonstrate how emissions can be capped by 2050. EY's report considers 11 overarching sectors across three headlines, with adhering scores ranging from 1–5 (5 being the best). These are *company specific measures*; *collaboration for green transitions*; and finally, *government responses*. These sectors are

responsible for 58 % of total direct emissions from Norway. EY further posits that these are the most

important sources of both direct and indirect emissions from the private sector throughout the country. For the purpose of this literature review, only the relevant sectors included in the report are mentioned here (waste management, transport, and short sea shipping). The finance sector and short sea shipping tend to be ahead of the curve (2019, p. 9).

When it comes to short sea shipping, the industry is charging ahead in terms of upscaling technology and zero-emission solutions. It has used public sector opportunities actively – for example, public tenders, and funding for R&D&I in technology. The industry is also characterised by high levels of collaboration. The finance sector scores high in EY's report, too. The financial sector is tackling its emissions through green products, investment analysis and ownership structures, but also through cluster initiatives (See Box 4). However, the authority's response to these efforts is not correlating with the recommendations found in the financial sector's roadmap. This is because the recommendations seem to be based on vested interests connected to the integration of climate risks in processes and strategies to protect existing capital values (EY 2019, p. 9). When it comes to accessing funding capital, the Norwegian Official Report 'Capital in the age of transitions – the business sector's access to capital'¹⁴ recommends increased systematisation of funding bodies managing public funding, loans or equity. It also looks at ensuring that there is a limit to the number of overlapping schemes that essentially provide the same services. This includes focussing the role of Innovation Norway, and evaluating the role of Enova, for example.

Generally, EY found that the speed of change is not high enough to implement the measures which the sectors present in their roadmaps, often due to a lack of focus on the main emission sources. However, focus is also lacking when it comes to indirect sources, too – such as tackling emissions along the value chain. This may eventually impact on the potential market for green products and services, because it ultimately refrains from demanding changes down the value chain. According to the report, most of the initiatives are too small, or else in a pilot phase. This does not allow for real impact yet. It is also notable that it is mainly the larger companies that have been pulling the industry forward the most thus far. The vast majority of companies are only just about starting out. The main focus for both those spearheading change and the vast majority are often the more obvious sources of GHG emissions, such as energy utilisation. This tend to dominate, albeit while not always being the most important or precarious sources of GHG emission that we are required to handle.

There is also some correlation between the government's responses and the industry's wish lists in its roadmaps, alongside specific measures and the actual completion rate. EY point to the likelihood of this being an indicator of the need for more favourable framework conditions. This would be a driving force for the implementation and activity level in most industries and sectors. The level of collaboration also plays an important role in this. EY note that the sectors which are ahead of the curve are also the ones that are either moderately or actively engaging in collaborative settings.

Summing up the EY report, a number of areas should be taken into consideration. Regarding strategy and knowledge development, there seem to be too few businesses engaged in setting ambitious climate goals. Too few are considering a range of impacts and emissions along value chains: they should engage more with indirect emissions and circular economy practices. Efforts to cap emissions by using transformative measures are needed in those businesses that have high

¹⁴ NOU 2018:5 Kapital i omstillingens tid — Næringslivets tilgang til kapital.

emissions. Innovations tend to be stuck in the pilot stage and need upscaling. The industries themselves are requesting tougher restrictions and making more demands on the government including for higher public spending. More public procurement is significant, as this is considered a push factor for industrial change. Finally, skills and competence are highly pertinent, both within different industries, and within the public sector.

Looking at the speed of change, it is also important not to lose sight of the significance of bridging the future value creation gap which is likely to appear with the phasing out of the oil and gas industry. The green transition is thus not one dimensional in terms of its positive effects on the environment; but the inherent worth of the products, services and industries at large plays an important role in ensuring the future viability of a well-functioning welfare society. Looking at the future trade situation, Menon Economics (2019) has investigated scenarios in consideration of what 'green' industries and sectors might contribute towards bridging a potential emerging trade gap. Menon Economics conducted this analysis based on three criteria: emissions intensity, productivity, and the degree of internationalisation. They found that renewables, the maritime industries, aquaculture/marine industries, and process industries appear particularly promising. Menon Economics do, however, point out that other innovative companies outside of these four particular industries may also play an important role.

When it comes to access to capital for potential businesses, the Norwegian Official Report (NOU), 'Capital in the age of transitions – the business sector's access to capital', points out that access to venture capital is seemingly particularly difficult for businesses which have to invest significant amounts in the initial phase of their operations, before being able to capitalise on commercial income. This is particularly evident in the light of commercialising research results. The report also points to a relatively well-functioning equity market, but says that the petroleum sector and related businesses are positioned in such a way that makes it difficult for other sectors to get access to capital, for example. According to the expert group, it may be appropriate to consider how best to align and strengthen schemes connected to export financing (*eksportfinansieringsordninger*), both to the benefit of customers and for their relevance and access in the SME-segment of the economy.

Both the report from Menon Economics and from EY examine industry specifics in light of the green transition, albeit from slightly different scopes and angles. Below we present the findings from the relevant sections in the two reports.

3.1. The green transition in selected Norwegian industry sectors

3.1.1. Transport, logistics and infrastructure

The commercial transportation sector drew up a roadmap to the green transition on behalf of several industry organisations (including the Confederation of Norwegian Enterprise [NHO] – Transport and Logistics, NHO aviation, and the Norwegian Truck owner Association) in 2016 (Stakeholder AS, 2016). The EY (2019) report highlights the roadmap's emphasis on fuels, both in terms of zero-emission alternatives and biofuels, truck upgrades, appropriate type of freight, increased efficiency in loading and off-loading, and also how to present environmental demands to suppliers. The majority of the emissions from this sector are connected to direct emissions from the transportation fleet (whether commissioned drivers or own drivers, although this might shift the responsibilities slightly). Other emission factors are connected to energy consumption in storage buildings, terminals, and headquarters (EY, 2019).

The roadmap for this sector says that the most important factors currently are focussing on how to incentivise the transition into green fuel alternatives by ensuring access to alternative energy carriers – such as electrification, biofuels and biogas (Stakeholder AS, 2016, p. 8). As some of the zero-emissions technology remains somewhat immature, and the investment risk is high, funding alternatives need to be put in place (Stakeholder AS, 2016, p. 8).

Aspects of the issue surrounding adequate policy frameworks for the development of alternative fuels were discussed in Fevolden and Klitkou's article from 2017, 'A fuel too far? Technology, innovation, and transition in failed biofuel development in Norway'. This investigated whether existing and old



Timber moved by rail. Photo: Robert Larsson, Unsplash.

industries are hampering the development of new, green industries using a technological innovation systems (TIS) approach. The TIS approach is primarily concerned with the systemic mechanisms which enable technology to develop and spread (Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007). It furthermore states that, 'Technology development is not an autonomous process and, therefore, management of technological change is necessary' (2007, p. 414). This is particularly important when seen in relation to sustainable development, as technologies may have both negative and positive impacts on the environment.

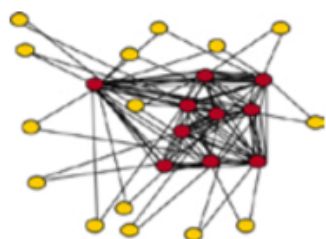
As the title suggests, Fevolden and Klitkou look at this issue in terms of the biofuels sector in Norway. However, they say that they believe the analysis holds true for green industries more generally. Fevolden and Klitkou suggest that there are three dominant, but competing, explanations as to why Norway is lagging behind in the development of a dynamic biofuels industry, and green industries more generally. These are: 1) that the oil and gas sector has a *de facto* monopoly on the available risk capital; 2) that the oil and gas sector has captured the majority of the technological expertise available, and finally 3) there is a lack of real government support measures and incentives (2017, p. 125). In other words, this is a 'policy insufficiency' failure (2017, p. 133). Fevolden and Klitkou show that the existing literature tends to point to the fact that the two former explanations, based on the all-encompassing nature of incumbent industries, tend to be those that prevent new industries, including green industries, from emerging. The negative impact of these old or existing industries is usually expressed in terms of their competitive abilities and their political lobbying. There are, however, also positive sides arising from old, incumbent industries for new, green industries. They are mainly seen through the ability to facilitate technology access, market access and capital. Although Fevolden and Klitkou suggest that there is little evidence to support the two former theories, the role of path dependency and incremental change, as well as the dominant discourse, are all contributing to creating a system in which the oil and gas sector receives stronger and more stable incentives, frameworks and policy measures. It is important to recognise that this is not something which happens in a vacuum. However, the oil and gas sector are not the primary

or sole reason for a lack of risk capital flowing into green industries. Rather, it is the policy regime insufficiency that is most to blame (2017, p. 134).

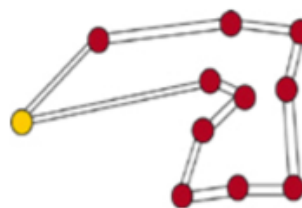
The speed of the green transition

As previously mentioned, the EY report scored the speed of industries in the process of green transitioning on a scale of 1–5, where 1 was low and 5 was high. For the transport sector, the business-related measures were considered relatively good, with a score of 3 out of 5. The industry has identified the most precarious areas of improvement, such as emissions from the transportation

Alternative A: Current situation.



Alternative B: New situation



Source: Veikart for Næringslivets transport (2016, p. 36)

Figure 1. Roadmap for efficient city logistics

fleet. However, there seems to be less focus on this when looking at measures put in place for hired transportation services. Other measures connected to direct emissions from the transportation of commercial goods in itself are considered important (e.g. optimisation of driving routes and co-freight efforts). However, the overall contribution to mitigating emissions is quite low. As for alternative vehicles and fuels, there are currently too few to make a radical difference. Most of these measures are in piloting phases, and are only being implemented by certain actors. The climate and environment demand on suppliers are also limited in actual fact. There is also a tendency for larger companies to take the lead in testing alternative fuels and the like, while smaller actors are lagging behind (EY 2019, p. 62).

Logistics is also suggested as a way to reduce emissions, by changing the purchasing routines through collective orders and lower order frequencies (Veikart 2016, p. 36, see Figure 1). The industry imagines that this would mean larger deliveries but less transport, while simultaneously challenging businesses to find new logistical models. The roadmap illustrates that a more efficient city logistics is needed to go from the illustration's alternative A to B (Veikart 2016, p. 36). Alternatives in cities are also envisioned to include bikes and smaller electrical vehicles, in order to fulfil logistical services.

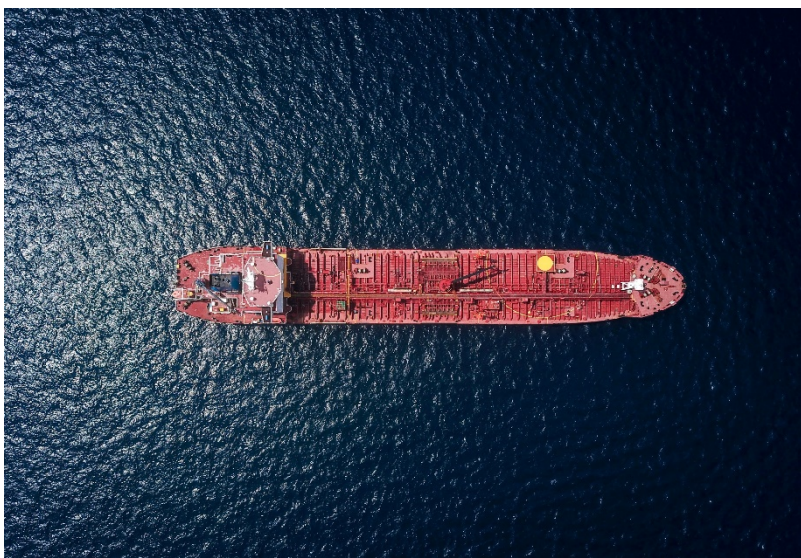
Clusters are also playing an important role for the part of the transportation sector that encompasses logistics. The Oslo-based business cluster smartPack, focusing on packaging and distribution, combines the concrete notion of commercial transportation to the service purchasers who also depend upon enhanced knowledge for the purposes of green procurement. The focus areas of the smartPack cluster are food safety, sustainability, the circular economy, and smart solutions. The cluster management team organise events and seminars for member companies in order to enhance networking and knowledge exchange between their members (smartPack 2020a, smartPack 2020b). The SAMS cluster, based in the region of Vestfold and Telemark, is another

network worth noting in terms of transportation. Part of the ARENA-programme, this cluster specialises in autonomous transport on land, by sea, or by aviation. The cluster incentivises collaboration for enhancing the autonomous vehicle transportation segment, both in terms of R&D&I and regulations. Two such examples are the 'AUTOSHIP' project, which aims to realise autonomous vessel systems, and the 'Yara Birkeland'-project, which tries to implement a zero-emission and fully autonomous container feeder (SAMS 2020a, 2020b, 2020c, 2020d). Another ARENA cluster in the transportation segment is the Fornybarklyngen (Renewable Cluster), in Trøndelag. This cluster focusses on renewable energy and energy systems, as well the practical application of technologies within these research fields. It initiates research projects within different relevant sectors, such as the use of renewable energy within cargo and passenger transportation. Today the cluster has more than 70 members (Fornybarklyngen 2020a, Fornybarklyngen 2020b).

Developing a climate-friendly commercial transportation sector is costly. It encompasses investment in infrastructure, the development and upscaling of technology and fuels, and the upgrading of vehicles. For this to become a reality, collaboration is essential. Here, the sector scores 3 out of 5. The larger actors are collaborating with research institutions, industry and energy companies to try to speed up green transition; but there is a lack of collaboration across the sector in terms of including smaller actors. Smaller actors need to be involved to be able to keep up with changes and demands, and to be able to partake in – and ensure – ownership of their own sector's development. The report also points out that the sector and the authorities lack a coordinated view and focus for launching the development of low emission technology in an ambitious way. The government response in this area is therefore also given a score of 3 out of 5. There has been some implementation of measures which were raised by the sector itself, we should note. These include the implementation of low or zero emission zones, green demands in public tenders, a CO₂-fund and to some degree, a CO₂ tax. The sector as a whole is dependent upon more targeted funding opportunities.

3.1.2. Maritime and marine Industries

Norway has long held the position of an important maritime power; and despite being a relatively sustainable industry on the global scene, short sea shipping (SSS)¹⁵ is responsible for approximately 7 % of the total CO₂-emissions in Norway, according to Steen (2018). In contrast to road transport, which accounts for approximately 10 %, short sea shipping is somewhat more



Shipping. Photo: Shaah Shahid, Unsplash.

¹⁵ Short sea shipping is defined as 'the movement of cargo and passengers by sea over short distances' by the ECSA, and it often also encompass offshore supply services, too (ECSA, 2016).

environmentally friendly. But even here, there is room for significant mitigation. Moreover, in order to continue to stay competitive as a water-based transport alternative to road and rail, SSS need to continue to develop and to be the preferred transport and logistics alternative in the future. This is particularly pertinent in cases where the value chain is increasingly under scrutiny. In Steen's report it is also clear that a significant part of the ability to drive environmental technologies in this, according to ship owners, is the purchasers of logistical services – which in these terms are characterised as 'conservative and with little incentives to purchase green [solutions]' (Steen, 2018, p. 53). Steen therefore draws the conclusion that one of the main impediments to taking part in the green transition is low demand for green logistics in the market. This was brought to the attention of the government through the Green Shipping Programme, too. It was pointed out that a willingness to pay for green services is low, and that concrete measures are needed for enabling this to change (DNV GL, 2016, p. 14).

Moreover, Steen points to two dimensions which need to be considered in relation to the greenification of the Norwegian fleet. The first dimension hinges on specific changes which need to happen to the vessel in particular, making room for the use of new energy technologies or energy carriers. Steen indicates that this may also mean changing business models. The second dimension is the context-dependent one. Here, the issue is both infrastructure (e.g. electrical grids) and changes in general industries. In this way, the maritime industry is bound to dual developments which are mutually interdependent. On the one side, there is the development of new technologies; and on the other, the contextual maturity for its implementation. Additionally, Steen points out that there might be differing energy technologies, and thus also different energy regimes. Another factor is therefore 'the extent to which new technologies are competing with, or completing, old technologies' (Steen, 2018, p. 48), as well as the system that these technologies are able to operate (Rogge & Reichardt, 2016).

The Norwegian maritime industry covers the entire value chain, from research and development through to design, ship building, services and equipment, control systems, and autonomous systems. It is also ahead of the curve when it comes to green and environmental technologies (Steen, 2018, p. 4; Ocean Autonomy cluster, 2020). This is particularly evident in Mid-Norway and the region of Møre og Romsdal. This area is known for its strength within innovation, technology, and knowledge development. This is due to the presence of strong institutions. Møre og Romsdal is home to a complete set of value chain stakeholders, organised in a maritime cluster. The GCE¹⁶ cluster, Blue Maritime Cluster in Ålesund, is a good example of the level of competence available in the region. The main objective of the Blue Maritime Cluster is to conduct R&D, and to develop technologies that are related to the maritime industry. Besides conducting R&D, the cluster also initiates events for communication, information flow and knowledge exchange. In 2020, the cluster had more than 130 members (Blue Maritime Cluster 2020a, Blue Maritime Cluster 2020b, Blue Maritime Cluster 2020c). This GCE also comprises sub-cluster networks, such as the Norwegian Cruise and Ferry group, for example. It aims to shorten the road to market, but also to participate in larger international partnerships, such as the Ocean Energy Scale-up Alliance. The OESA

¹⁶ Global centres of excellence, Arena pro and Arena are part of the publicly-funded cluster programme called 'Norwegian Innovation Clusters' – a collaboration between Innovation Norway, the Research Council of Norway, and SIVA (the Industrial Development Corporation of Norway). The Ministry of Trade and Fisheries funds the programme, alongside the Ministry of Local Government and Modernisation (Innovation Norway, 2019a). NCE – Norwegian Centre of Excellence – is no longer a programme of the NIC. The label is still available to use and to qualify for (Innovation Norway, 2019b).

partnership focuses on accelerating green transition in the North Sea Region through pilot projects funded by Interreg North Sea Region (Interreg North Sea Region OESA, 2020). SFI Smart Maritime is another project which falls under this GCE. Smart Maritime is supported by the Research Council of Norway and SINTEF. It specialises in the development of energy efficiency and emission reduction capacity within the maritime industry, including R&D&I within areas such as propellers, fuel, or ship system integration. Its main goal is to conduct research for energy efficiency and emission reduction, and to strengthen the competitiveness of the maritime industries belonging to the Blue Maritime Cluster (Smart Maritime 2020a, Smart Maritime 2020b).

Reducing emissions

The maritime industry is one of the most polluting industries globally, both in terms of CO₂ emission, but also nitrogen oxides (NO_x), sulphur oxides (SO_x), and particle matter (PM). The International Maritime Organisation's International Convention for the Prevention of Pollution from Ships (MARPOL) is one of the most important conventions setting standards for the maritime industry. The convention covers both routine operational causes and accidents connected to pollution (IMO, 2020a). Following the International Maritime Organisation's decision to reduce emissions by 50 % by 2050 (compared to 2008 levels), the Norwegian maritime industry has both an opportunity and an incentive to jump on the bandwagon, and to take a lead in the global maritime industry's development. It has already made significant strides with the establishment of the NO_x fund (See Box 5).

Box 5. The NO_x Fund

Following the Gothenburg Protocol in 2007, the Norwegian government made concessions for establishing a NO_x-tax (15 NOK per kg NO_x emitted). This relatively high tax led industries and companies to struggle in finding mechanisms for implementing emission reducing mechanisms, leading interest groups to recommend the establishment of a NO_x-fund. The NO_x-fund has been a widely recognised mechanism for supporting businesses and industries in implementing emission-reducing measures through green technologies. The NO_x fund additionally enabled the development of new green technologies in (e.g.) the fisheries and maritime industries. It has helped Norwegian industries position themselves as world leaders on such technologies – a position that is likely to be strengthened with the increasingly strict regulations coming from the international level (NO_x-Fondet, 2020). Of technologies worth mentioning, there have been significant investment in, for example, battery driven ferries, LNG-ships, and NO_x specific measures (NO_x-Fondet, 2020). The NO_x-fund has been conducive to pondering the possibilities of establishing similar funds for, e.g., CO₂ emissions (Steen, 2018). The current fund was established and owned by 15 Norwegian trade organisations, and all members pay a fee to the fund rather than taxes to the states. This is subsequently fed back to the businesses and industries concerned through investment support for green technologies. According to the NO_x-fund's websites, the fund has supported 1,330 projects, and supported NO_x reduction measures with 4.4 BNOK. In other words, this is a sector with significant comparative and competitive advantage in terms of the green technologies of the future.

The government's action plan for green shipping (2019) is another document furthering the potential of the maritime industry, following a mapping of the industry's financial impediments to investing in a new, environmentally friendly fleet. According to the government, the reason for this was to be able to judge to which degree profitability in short sea shipping was too low to enable investment in a new fleet, and to what extent it is a market failure that prevents investments – in which case, is this market failure the reason for the inability of ship owners to take on the necessary financial obligations for investing in a new and environmentally friendly fleet?

The Norwegian maritime sector followed up on this challenge by drawing up a roadmap, or a 'sea chart', setting out the ambition for the green transition in the industry (Norsk Industri, 2019). The

chart emphasises new and strengthened levels of competence to lift the industry up, so that it can meet the requirements that come with transition, and ones for ensuring future competitiveness. To fulfil the climate and environment targets of a 50 % reduction in GHG emissions by 2030, the maritime industry will require framework agreements that enable investment in green solutions. technology development, and infrastructure for renewable energy (Norsk Industri, 2019).

In addition, the chart does not just consider the maritime industry in terms of vessels alone, but includes their role in general industrial development. This includes the future of seafood, where new vessels will be required, and ocean wind power, which will rely on new technology. and on CCS and its role for vessels in terms of transporting CO₂, mineral extraction, and the decommissioning of offshore installations, all of which will require big maritime operations and activities (Norsk Industri, 2019, p. 6). The GCE Node cluster helps position Norway as a global leader in the service and technology segment of the maritime industry. The cluster works to enhance R&D&I, knowledge and technology diffusion within the energy and maritime sector, and enhances the competitiveness of local firms. Besides R&D&I in equipment technologies, the cluster conducts research projects which aim to develop a tracking system for the ecological footprint of companies in the maritime industry (e.g. the “Ecotrack” project) (GCE Node 2020a; GCE Node 2020b; GCE Node 2020c). This emphasis on energy and technology corresponds with the Agder region’s strategic regional planning document, building on smart specialisation (Agder Region, 2020).

EY’s report on the speed of the green transition looks at the development of this transition in the short sea shipping segment. The sector developed a specific roadmap for green transition through the ‘Green shipping programme’, aiming to reduce emissions by 2030 and achieve zero emissions by 2050. The roadmap focusses primarily on freight (from highway to the waterway), collaboration surrounding busy sea routes, and a greater focus on low- and zero-emission fleets (EY 2019, p. 92). According to EY’s analysis, the maritime industry is moving speedily towards green transition. The emission capping and green transition measures put in place within the sector have scored relatively high on EY’s scale (4/5). Operational measures have had the greatest focus, but there have also been important measures connected to fuels and technological changes, too. The aforementioned electrification of the ferries is significant. It has also inspired change in general for private boats, freight, and offshore supply vessels. There has also been a considerable spread of knowledge throughout the value chain, though general collaboration for the green transition scores somewhat lower (3/5). The main collaboration seems to be occurring through the green shipping programme, a public–private partnership which sees primarily larger shipowners collaborating in these groups. The Shipowners’ Association has also pointed out that the shipowners are not procuring research, but tend instead to make use of existing technologies for incremental changes and improvements to their fleets. The authorities, however, have been seen as active players in procuring research and development through public tenders and financial aid (4/5). The action plan connected to the green shipping programme is also seen as being highly proactive. What seems to be missing is a greater focus on land-based electricity grids, and on infrastructure for alternative fuels.

Menon Economics (2020) recently released a report mapping the existing Norwegian short sea shipping fleet, considering ‘the composition, age, economical aspects and challenges connected to a fleet renewal’. The report was commissioned by the Ministry of Trade and Fisheries to gain a better understanding of the shipowners’ relative financial ability to renew their fleet, and whether economic considerations are understood as being too low to incentivise such a renewal. It considers shipowners, banks and purchasers of transport services. The latter was thought of as particularly important, because ‘it affects the long-term economic and financial possibilities’ (2020, p. 4)

connected to fleet renewal. This is connected with low- and zero-emission solutions. Menon Economics were to investigate the attitudes towards such technologies among bankers and transport purchasers, too, as this also affects desire and willingness to invest in a new fleet. The report shows that bankers are emphasising climate risk when providing investment loans for securing funds for climate-friendly technologies, as well as the level of equity and future prospects. However, despite the given level of profitability and equity, climate risk considerations do not increase the likeliness of loans for such climate technologies. What they do, however, is to reduce the likelihood of securing funding for traditional technological investments (2019, p. 6).

The Menon Economics report also considers three possible methods for incentivising a fleet renewal. These are:

- 1) Higher duties on land-based transport.
- 2) Increasing public financing for fleet renewal.
- 3) Introducing emission requirements for the shipping sector.

Menon Economics have found that the latter will be the most efficient tool for fleet renewal (2020, p. 6). This will place the shipowners in a position where they eventually have to renew their fleet. Menon Economics also point out that, in terms of incentivising transport service purchasers to use (short sea) shipping solutions for their products, there needs to be (simultaneously) stricter requirements on land-based commercial transport if stricter emission requirements are placed on the shipping segment. If not, this would mean that freight is simply moved from the seaways to the highways.

As we have seen, fleet renewal as a requirement for lowering emissions and for more efficient shipping is increasingly making its way into legislation, either nationally or internationally. This will therefore be the key to maintaining the competitiveness of the Norwegian maritime sector in the long run, while keeping up with the key terms that mark this crucial time for the maritime sector and its transition. Identified by SINTEF Ocean, these are: digitalisation, autonomous technology, and technology for a climate and environmentally friendly shipping sector (Kvamstad-Lervold, Holte, & Johansen, 2019, p. 19).

The maritime industry was also mentioned as one of the key industries in Menon Economics' report on the green transition of Norwegian industries (2019). In addition to pointing out the strength of the industry, Menon state that the sector also has the potential to support other sectors. They point specifically to renewables in terms of offshore wind power. As

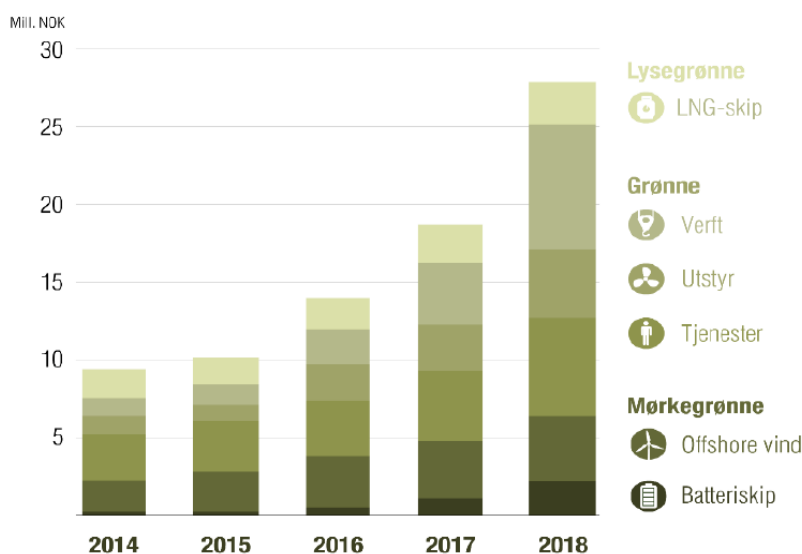


Figure 2. Turnover in green maritime industries 2014–2018. Source: Menon Economics 2019: 45.

we have already noted, the maritime sector is very ambitious with regard to mitigating their GHG emissions, and considerations related to establishing themselves as a leading international actor (Menon 2019, p. 24). Looking at Figure 2, it is clear that there has been a formidable turnover in terms of green technologies in the years between 2014–2018 (Menon Economics, 2019, p. 45). This might be a strategic focus for the future, as the global demand for green technologies may increase significantly (Menon Economics, 2019, p. 45).

Clusters are perceived as being important for the development of the competitiveness of the industry, and there are several maritime clusters in place. Clusters are meant to enhance innovation and increase access to knowledge and competencies, but they also serve to encourage competition and cooperation. According to Porter, ‘competition can coexist with cooperation, because they occur on a different dimension and among different players’ (Porter, 1998). This is, by and large, confirmed by the many clusters formed around the Norwegian maritime industry.

Marine industries

The global amount of seafood consumed per capita has increased steadily since the 1950s. Menon Economics (2019) suggest that this is due overall to the expanding global middle class and to economic growth. Fish is an important source of proteins, and will play an important role in the change needed in our diets (Stockholm Resilience Centre, 2019). Fish production is also embedded in Nordic food production systems (Stockholm resilience centre, 2019, p. 18), and Norway has occupied the top segment in terms of quality and price, and is thus not competing against land-based food production (Menon Economics, 2019). In the future, land-based aquaculture is considered a ‘game changer’. It may enable more environmentally friendly practices, while it may also challenge global export chains, because it can move production closer to the regional markets (e.g. Asia, and elsewhere in Europe). This links transport to the marine industry as well, since it needs to develop in tandem, or ahead of, increasing climate requirements within the market (Menon Economics, 2019, p. 42). As such, land-based aquaculture is both a threat and an opportunity for future marine businesses.

Marine industries, including aquaculture and fisheries, have more moderate emissions connected to their production than their livestock production counterparts – though on the local level there might be lakes and seas which are suffering from production practices that lead to eutrophication, for example (Stockholm Resilience Centre, 2019, p. 12), and on a global level to unsustainable fishing practices. In this respect, green growth in fishing is dependent upon a general change in the maritime industry, both for the purposes of meeting future environmental demands, and also for remaining relatively competitive. Some electrical fishing fleets are already in play, illustrating the feasibility of change in the maritime industry.

There are also cluster efforts to marry the strengths of the maritime and the marine industries. The Norwegian Centre of Excellence (NCE), Blue Legasea, is a cluster focusing on ‘catalysing unique interdisciplinary collaborations to strengthen value creation and competitiveness’, and to raise the profile of the export of marine products even further. Innovations within catching, fishing and processing technologies, as well as knowledge and competence development, are at the heart of this National Centre of Excellence. It is also committed to the UN’s SDGs, focusing primarily on SDG 2 (Zero hunger), 3 (Good health and well-being), 9 (Industry, innovation and infrastructure), 12 (Responsible consumption and production), 14 (Life below water), and 17 (Partnerships for the goals) (NCE Blue Legasea, 2020).

Another NCE cluster in mid-Norway, accelerating in the area of maritime and marine industries, is the Aquatech Cluster. This cluster focuses on seafood production. Its main goal is to develop sustainable technology within the production of seafood, to enhance the competitiveness of regional seafood suppliers, and to increase sea farm production. The cluster works with R&D&I in the areas of open sea fish farming, closed facility fish farming on land, and maintenance services for fish farming. The cluster management and its members are also participating in the “Brohode Havbruk 2050” platform, in order to stimulate education and knowledge exchange (NCE Aquatech Cluster 2020a, NCE Aquatech Cluster 2020b, NCE Aquatech Cluster 2020c).

Waste management is also demonstrating some synergic overlaps with the maritime and marine industries (Deshpande, Philis, Brattebø, & Fey, 2020) (Falk-Andersson, Berkhout, & Abate, 2019). Deshpande *et al.* (2020) have looked into material flows to determine the share of Abandoned, Lost or Discarded Fishing Gear (ALDFG) from marine plastics, in order to improve the management of fishing gear. Deshpande *et al.* found that commercial fishing contributes approximately 380 tonnes of plastics per year mass through ALDFG – often due to specific practices, but also on account of ground deployment and gear design (2020, p. 6). It is also worth mentioning that approximately 4,000 tonnes of waste (i.e. derelict plastic fishing gear) is collected. Around 21 % of this is used for energy through incineration, and 24 % is landfilled (Deshpande, Philis, Brattebø, & Fey, 2020, p. 6). The article also suggests that using a method such as material flow analysis, as deployed in their own research, may hold potential for supporting more systemic decision-making for both the industry itself and for policy makers. Deshpande *et al.* also suggest the necessity of understanding the life cycle of fishing gear to realise the Norwegian Government’s consideration of using Extended Producer Responsibility (EPR) measures to reduce waste at a regional level. Furthermore, this would require a more concerted collaboration along the value chain, due to the regionally situated nature of waste management facilities. Today, commercial fishing fleets are required to report fishing gear losses to the Coast Guard Central, which supports the annual ocean clean-up operations organised by the Norwegian Directorate of Fisheries, and the ‘Fishing for Litter’ project. The Fishing for Litter project has enabled fishing vessels to deliver marine litter free of charge at a few, specific Norwegian harbours (Deshpande *et al.*, 2020). Marine litter is also part of the Ministry of Foreign Affairs’ agenda. The Ministry published a new programme to combat marine litter in May 2020 (Ministry of Foreign Affairs, 2020). Other efforts worth mentioning include a range of voluntary actions, such as Hold Norge Rent (2012), demonstrating citizen engagement. This engagement grew particularly after a whale was stranded on Norwegian shores, with a stomach full of plastic waste. This prompted a clean-up along Norwegian shores (Jakobsen, 2018). The NCE Energy Valley technology cluster is taking part in a project focussing on stimulating the development of environmental technologies which spring from the need to reduce ocean plastics (Energy Valley 2020a, 2020b).

3.1.3. Waste management

The waste management sector in Norway is approaching the green transition through circular economy practices. It launched a roadmap in 2016, with actions specified, and objectives established to comply with and enable such practices. Minimising waste at the outset is an important step towards reducing emissions. It requires changing the mindset of households with regard to what waste is, but also a similar change of outlook among industrial actors. Connecting to these actors requires a broad approach and mutual willingness.

The sectoral roadmap that has been developed states that securing sustainable development by 2050 depends upon significant societal decoupling (Avfall Norge, VESAR and Norsk Gjenvinning,

2016a, p. 2). It furthermore posits that this demands a 'a decoupling where we achieve increased welfare and economic growth, whilst the use of resources and greenhouse gas emissions are reduced'. The concept of a circular economy is considered key to enabling this decoupling, and 'the transition to a circular economy is crucial for competitiveness and value creation in Norway'. The waste and recycling sector consider themselves 'key to catalysing this



Recycling. Photo: Pawel Czerwinski, Unsplash.

change', and this positions the sector as being, first and foremost, a supplier of recycled resources for the production of new materials and products (Avfall Norge, VESAR and Norsk Gjenvinning, 2016a, p. 3). They also point to a great number of new jobs (approximately 50,000), to reducing CO₂ emissions, to improving the trade balance by moving towards a circular economy, and to decoupling welfare and resource use.

According to the roadmap, the main goal is to increase collaboration between actors in the sector and throughout the value chain, to increase recycling, to set standards for recyclables, to improve efficiency, to focus on technology development, and to achieve exports (Avfall Norge, VESAR and Norsk Gjenvinning, 2016b). In EY's report on the speed of transition, and how far the sector has come, it is clear that there is still a long way to go to fulfil the expectations and goals set by the sector itself. The upshot is scoring 2 out of 5 on all three main headings (sectoral measures; collaboration for ensuring the green transition; government response) (EY, 2019).

Emissions from the sector are primarily connected to incineration linked to fossil materials, and the EY report from 2019 points to how the potential for recycling of plastics, for example, will have a positive effect on these emissions. The aforementioned mindset changes among those who initially waste materials and foods is also important for this change to be able to take place. Collaboration along the value chain is happening to some extent, but there is potential for systematising this further, since most of these collaborative approaches are happening through project-based consortiums. Avfall Norge ('Waste Management Norway') is creating a platform for innovation and collaboration which was due in 2020 (EY, 2019, p. 28).

Waste collection in Norway is organised by both private and public actors, and there is great variation as to how it is managed between municipalities. Private actors tend to be the ones dealing with waste from the private sector and businesses, whereas household waste is usually coordinated through inter-municipal collaboration. According to EY, this leads to great variation between the different municipalities, what practices are upheld in terms of waste and recycling, and what services are offered. This division of practices is perhaps also why actors in the waste management industry tend to focus on their traditional roles and activities, despite their conscious pledge to enable a circular economy. At the same time, the ambitions and action plans across the sector are too low for Norway to take the leading role globally in enabling a circular economy, and few claim this position (EY, 2019). EY does indicate the existence of such ambitious levels and practices, but there are insufficient numbers of these to affect the national waste trends. Norway is also seemingly far from reaching international goals for recycling.

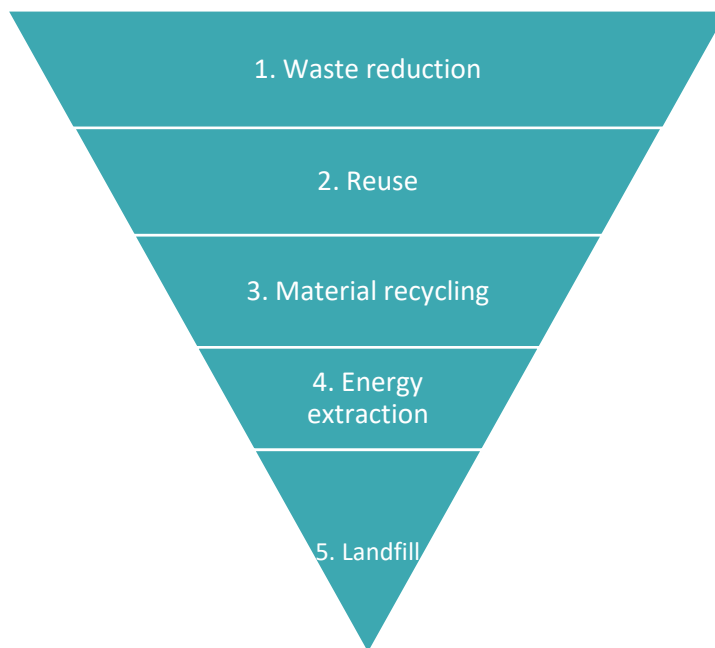


Figure 3. Resource pyramid or waste hierarchy according to EU and Norwegian policies. Source: (Avfall Norge, VESAR and Norsk Gjenvinning, 2016a, p. 7).

Waste management can be divided in two types of activity. The first pertains to the previously mentioned ‘traditional activities’, which refer to recycling, energy extraction and the reuse of materials. The second type is activity connected to green transition and green growth, such as finding methods, technology, measures to tackle and reduce emissions surrounding landfills, and waste reduction (EY, 2019). There is a lot of potential connected to the development and implementation of measures in the second type of activity listed here, such as the development of biogas and power. There is also potential connected to extracting value from the upper layers of the resource pyramid (Cf. Figure 3¹⁷). This resource pyramid, often referred to as the waste hierarchy, is what is currently guiding policy discourse on waste management in Norway and the EU. The primary goal is to focus on those areas which are as close to the top of the pyramid as possible (waste reduction, reuse and material recycling). However, the waste and recycling sector in Norway admits that the primary focus has so far been on the latter part of the pyramid (landfill, energy extraction and material recycling), and that a change of focus is needed (Avfall Norge, VESAR and Norsk Gjenvinning, 2016a). The national sectoral goal is that ‘the total volume of waste shall be lower in comparison to the overall economic growth of the state’ (Avfall Norge, VESAR and Norsk Gjenvinning, 2016a, p. 6).

Some further examples of collaboration worth mentioning along the value chain are, for example, Norsk Senter for Sirkulærøkonomi, Circular Norway, and the Magic Factory (a biogas plant in

¹⁷ Model copied and translated to English from the waste and recycling sector’s roadmap to a circular economy.

Tønsberg), which is a project in the *No Waste!* cluster. The Magic Factory turns food waste and manure into green CO₂, biofertiliser, and biogas. These new substances are then used to grow crops, such as tomatoes (No Waste! 2020a, 2020b). Circular Norway is an institution which tries to increase sustainability within waste management through innovation, knowledge sharing, and policy work. Its goals are to support businesses to convert from a linear to a circular business model, and to act as a network hub for entrepreneurs within waste management and the circular economy. Three key activities of the institution are to conduct 'city scan' activities, and to provide a 'circularity gap report', as well as establishing a leadership programme through a meeting platform. The 'city scan' activity provides an analysis of potential for the circular economy in different geographical areas. The 'circularity gap report' assesses the degree of transition towards a circular economy in the regions. The leadership programme is a platform of key stakeholders, enabling networking and knowledge exchanges (Circular Norway 2020a, 2020b, 2020c, 2020d). The Avfall Norge value chain also comprises academic collaborations such as REdu, which focusses on ensuring competence, how to transition into a circular economy, and MIPBærekraft – a collaboration with Mo Industrial park and the research institute SINTEF, Nordlandsforskning, Nord university, SIVA and the Knowledge Park at Helgeland (EY 2019, p.29).

Material recycling is also an important feature of the future circular economy, and the company Infinitum will run the first deposit system in the Nordic Region to recycle both plastic bottles and cans when the recycling plant in Fetsund is ready (Infinitum, 2020). There are approximately 3,700 deposit systems operating across Norway, and although most of these will not accept foreign bottles and cans, Infinitum's deposit system accepts them as part of their duty to recycle. However, the deposit of foreign bottles will not be remunerated. The very first deposit system in Norway was introduced in 1999, though the deposit system had already been approved by the Directorate for the Environment in 1995 (Infinitum, 2019).

As for the state's engagement with the waste management sector, it is evident that this is primarily happening with regard to the recycling of plastics and preventing food waste. EY also point out how the state is less active in promoting a market for recyclable resources. However, there are high expectations connected to the government's national strategy for circular economy when this is launched.

4. Regional aspects of the green transition

Following the policy overview, this literature review will turn its efforts towards describing policies at the regional level. There is an emerging spatial aspect to the green transition. The role of the region and the municipality is crucial – through their development role within society, how they deal with regulatory frameworks, and their obligatory planning and strategy development role. Plans are also anchored in the *National expectations regarding regional and municipal planning 2019–2023* (Ministry of Local Government and Modernisation, 2019). This includes a strong focus on Agenda 2030 and the UN's SDGs. With increased collaboration between actors involved in multilevel governance, and its manifestation in various triple and quadruple helix-constellations, it is clear that governing the green transition requires greater attention to the level of agility and flexibility in institutional dynamics. Communication and collaboration are central to overcoming not only regulatory barriers to unlock the green transition, but are also essential for overcoming cultural, technological, structural and knowledge-related barriers (Nordland Fylkeskommune, 2018a).

4.1. Knowledge-sharing for new opportunities

The increased responsibility connected to the region, following the regional reform in 2020, is relevant for the creation of opportunities and road-mapping for the future. Norwegian regions utilise a wide range of targets, measures, initiatives and projects in order to work towards an innovative green transition within logistics and transportation, the marine and maritime industry, and the waste management sector. Particularly interesting is the region's use of its regional strengths as a focus for regional development plans. However, it seems as though the green transition is taking on a role in buttressing the future competitiveness of the region, too. Even so, the extent to which each of these thematic areas (logistics, transport, marine, maritime, and waste management) are subjects of regional policies, initiatives and projects varies between the regions. Each region builds on the prevailing settings and contexts in order to handle the green transition in its own way. For example, the region of Innlandet, which has Norway's largest forest areas, has a strong focus on green transition with respect to bio- and circular economy in their regional policies, and specific policies concerning R&D&I (Innlandet Fylkeskommune and Statsforvalteren, 2017). Møre og Romsdal, on the other hand, a region with a long tradition of maritime and marine industries, can demonstrate many business and industry initiatives (especially clusters) that reflect this tradition (Møre og Romsdal Fylkeskommune, 2016).

From an institutional standpoint, the governance of green growth may also mean that the regions work simultaneously with both 'old' and 'new' economic pathways – including through circular economy perspectives, as regional strength and prioritisation leads to new combinations and niches in the regional economic make-up. Following the Guidelines to Smart Specialisation, developed by the Ministry of Local Government and Modernisation (2018), regions are increasingly steering the development of R&D&I strategies.

One example is the synergy and knowledge transfer happening in the Rogaland-based maritime and energy sector. The oil and gas sector plays an important role here, due to its competitive technological developments – from which knowledge and competence may be transferred to other sectors taking part in the green transition. This is particularly important for the energy sector, taking Rogaland from being an 'oil and gas region' to becoming an 'energy region'. For example, the development of existing hydropower systems for the industry will draw on existing knowledge in

the oil and gas sector. Turning to offshore wind will be an important game changer for the maritime sector, which continues to play an important role for Rogaland. Here, staying ahead will be crucial for establishing a leading role in the development of new maritime energy technology (Rogaland Fylkeskommune, 2020). Moreover, Rogaland is also a dominant agricultural region. Transferable knowledge from the oil and gas sector has been important for the development of biotechnology in the region, for instance. One of the region's objectives is establishing a closer links between green and blue sectors, as it is home to complete value chains in these two sectors. Research, innovation and development is particularly interesting for the region, and these sectors have strong competence, production and industrial associations to support and draw upon synergies from each other in this area. Another important part of this is ensuring that waste from the two sectors are used to reduce waste gaps. Mapping these in order to move closer to realising a circular economy is important, therefore. Fermentation also plays an important role, and the region is in a favourable position to develop a regional stronghold within fermenting processes. One of the efforts to realise this has been to turn the gas centre at Risavika into a bio-centre capable of handling a wider range of raw waste materials. This has led to the development of Norwegian Centre of Bioprocessing and fermentation, with a view to commercialising research towards full-scale production (Rogaland Fylkeskommune, 2018).

The regions and regional networks play an important part in the green transformation, and the importance of green co-creation and innovation through these networks is evident. Torvanger *et al.* (2016) point to the pertinence of supply and demand for innovation, and for realising the green transition in their future scenario report. This relies on the ability of regional and local communities to incentivise such change (Torvanger *et al.*, 2016). With the recent, previously mentioned role of UN SDGs in guiding regional plans, there should be room for formulating systemic solutions and breaking down silos. This can happen by understanding the interconnections between equity, economics, and environment (Sandkjær Hansen, 2020). That is also the foundation for Wijkman and Skånberg (2017), who declare that climate change strategies with regard to mitigation tend to be rather sector based, and perhaps not as extensive and systemic as they need to be in order to transition to a green economy supported by circular economy practices. Therefore, a green transition requires innovation not only in the industry itself, and in the framework established by the authorities, but also innovation in the mechanisms of governance itself – so as to become more integrated and interdisciplinary. In this respect, regions, through their societal and regional development mandate, have the opportunity to coordinate and communicate across regional funding agencies, support frameworks, and tools for regional business development. Taking on this role can actualise the role of innovation for governance purposes too, and in this way contribute to the development of greener regions.

Oslo stands out as a region which has very high ambitions, stating in 2016 that it aims to cut 95 % of all greenhouse gas emissions by 2030, to make the transportation sector emission free by 2028, and to increase the amount of electrically driven ships to 70–80 % (Oslo Kommune, 2016). Although no other regions can point to emissions mitigation that is quite as ambitious, steps are being taken to reduce carbon footprints more widely. A reduction in emissions and greenhouse gases often seems to be contingent upon the economic and industrial profile of a region. Rather than focussing solely on emissions cuts, regions such as Nordland, Rogaland, Innlandet Viken and Trøndelag attempt to use the circular economy as a way to capture and incorporate waste streams and emissions through new practices.

Regions are strategically focussing on enhancing the role of clusters and networks. This focus may reflect a general trend within regional and national institutions to use collaborative and collective approaches to deal with green transition. Cluster organisation through Arena, the Norwegian Centre of Excellence, or the Global Centre of Excellence, are supported by both national institutions and regional policy documents. That some regions build their policy plans around these clusters, or other existing knowledge parks and networks, is natural, as they already constitute key regional stakeholders and expertise (see e.g. Nordland Fylkeskommune, 2014; Trøndelag Fylkeskommune, 2017). Initiatives and clusters in the regions are often partly funded (or enabled through platforms) by the regional administration, together with national support institutions – such as Innovation Norway, the Research Council of Norway, the Industrial Development Corporation SIVA, Enova, or other funding agencies. This high level of government funding for green transition projects indicates the persistent importance of stimulus measures on the governmental side in order to drive the green transition forward.

4.2. Transport, logistics and infrastructure

Transport, logistics and infrastructure offer several different, but often intersecting aspects relevant to a green transition. For regions, public procurement has become an important tool for achieving a more sustainable public sector profile, along with low emission municipalities, smarter logistics, research and development for alternative fuels, and inter-regional collaboration in cross-border areas. The UN SDGs also play an important role here, as horizontal actions that transcend a variety of sectors. This is seen in both Nordland and Viken regions, for example (Nordland Fylkeskommune, 2021; Viken Fylkeskommune, 2019). Nordland's plans for a sustainable and climate-friendly region (2018a), involve knowledge-based public procurement, with a view to purchasing circular products with low emissions when it comes to, e.g., building and construction, food, and transport. Communication between the market and the authorities is considered vital in achieving this. The region also recognises the extra risk and pressure that this introduces to the actors involved. The push to concentrate on the circular economy as a starting point for public procurement to promote the green transition comes from national authorities, but also from new regulations in the EU and EEA (European Commission, 2020). Nordland region's ambition is to stay ahead of the curve, and to ensure that it remains competitive in the new circular market (Nordland Fylkeskommune, 2018a).

Another strategy devised by Nordland region is centred around infrastructure and energy systems as a carrier for future technologies, transport systems and industries (Nordland Fylkeskommune, 2018a; Nordland Fylkeskommune, 2018b). The energy sector is an important factor in achieving targets set within sectors such as the maritime and marine industries, transport, and waste management. The electrification of the maritime or transport sectors depends upon the capacity and status of the existing power grid. To achieve this, the region is dependent on good collaboration and communication with power grid actors in the planning processes. One of the main barriers to electrifying the different sectors is the high cost associated with transition, which is currently based on a user model which also includes investment in power grids. The region is working to find alternative solutions to financing this, along with other regions, as well as alternative ways of ensuring greater grid flexibility (e.g. batteries). Electricity remains one of the most important energy carriers for the future transport fleet, and charging stations will have to be addressed carefully in municipal plans, according to the Planning and Building Act. However, alternatives are still needed for certain segments within heavy freight transport, shipping, aquaculture, and fishing trawlers. There are already some options for land power for docking ships in Nordland, to avoid docking using

diesel engines. This has several environmental benefits, including less air pollution. Building such land-based power stations is costly, and larger ships, and cruise ships, need large capacity on the grid. Nordland region is technology neutral, however, and presumes that new and existing renewable energy will come from different sources – including hydrogen, biofuels, biogas, etc. The most important legal tool here is to require zero or low emission solutions.

Although energy carriers through (for instance) the development of alternative and sustainable fuel types is what seemingly dominates the general discourse surrounding transport and infrastructure, the national level is also concerned with the regional and spatial role of road and rail networks for buttressing regional development and competitiveness, as we have seen. Another dimension that is important to mention here is the role of public procurement. Public procurement was the main factor behind two first-mover events in 2000. That is, the world's first LNG-driven ferry (MF Glutra), and the world's first electrical ferry, Ampere in 2014. However, it is important to mention and recognise the relative purchasing power of different regions in this. Regions are often the ones in charge of ferry lines, as these often are part of the regional road infrastructure. With increasing responsibility as societal actors, regions have limited funds for prioritising to the extent they should in order to play a significant supporting role for a maritime green transition (Steen, 2018).

Regarding transport, logistics and infrastructure, it is clear that the region of Rogaland, for example, has benefitted from being one of the most important industries for Norwegian value creation (Rogaland Fylkeskommune, 2017). The logistics structure is considered one of the best in Norway, and the development of that logistics structure has been a collaboration between public and private actors (*ibid.*). The public sector has contributed significantly to the infrastructure, and actors in logistics have continuously followed up to ensure a well-functioning route and terminal structure. Sea freight is important for the region at large, and there are well-functioning private and public harbours being used for various purposes. Stavanger also has one of the largest cruise ship harbours in Norway. Nonetheless, road freight has increased, due to improved roads and increased competition. The regional objective is to ensure that all freight transport is conducted in the most environmentally friendly way possible, centralising the largest transshipment areas to avoid freight trains in the most densely populated areas, while also being able to connect these to rail and sea freight transport options.

Willingness to employ new technologies can also help break barriers. For example, drones may help reduce the pressure on roads, and thereby reduce emissions (Viken Fylkeskommune, 2020). Synergies between technologies and the objective of reducing the number of heavy trucks on the road have positive implications for reduced emissions, particle matter, and noise. Making room for new technologies and actors that were not previously part of the transport sector is considered added value, and thus 'Partnerships for the goals' (SDG 17) will be key to achieving the future, greener transport system. Some of these new technologies are highlighted by the new region, Viken. Its ambitions are tied to SDG 9 innovation and infrastructure, and we may gather the outlook for transport and logistics in Viken Region under the heading of 'mobility' (Viken Fylkeskommune, 2020). The premises for mobility are not just green value creation, but also innovation and collaboration. The shared economy is another possibility recognised by the region in developing 'mobility' as a service, and by using public procurement to promote sustainable business development, new ideas and new methods. Roads are still important for industry, as the geography of the region is such that it requires them for the transport of goods. Yet increased use of rail and sea are still important policy goals. The former Østfold region is an important freight corridor to the

continent (by sea and road), and finding ways to derive important synergies is significant for the business and industrial areas here.

Infrastructure for zero-emission vehicles is a necessity for realising zero- or low-emission communities. Enabling a city-wide logistics that enables zero-emission vehicles and other modes of transporting goods is part of Oslo municipality's ambitious climate plans (Oslo Kommune, 2016). Focussing on transport through an infrastructure lens is natural for the Innlandet region, as a main connecting region between the central eastern part of Norway and the north. Some of the main transport routes are E16 and E6 and Riksvei 3 (Rv3 – 'national road 3'). The latter was nicknamed The Green Shortcut in 2016, as cars and trucks drive more economically through Østerdalen than via Gudbrandsdalen, travelling north towards Trondheim – 'saving 45 minutes, fuel and the environment' according to their website (Den grønne snarvei, n.d.). A local initiative by the Visit Elverum Region tourism company, with funding from Hedmark region municipality, the stakeholders involved includes restaurants, tourism sites and local shops capitalising on the road and commercial transportation passing through Østerdalen (see more: Den grønne snarvei, n.d.). Small changes, such as considering the available transport corridors, may have greater effects than merely saving time.

The region of Agder is also focusing on 'sustainable choices' regarding public transport, as part of their smart specialisation strategy. Updating the Southern railway and connecting it with the railway systems in Vestfold and Telemark is a natural step towards both linking the regions further together, and to ensuring better use of sustainable transportation systems. The region aims to lobby the Norwegian Parliament to prioritise this in the planning process before the next NTP in 2022 (Agder Fylkeskommune, 2020).

4.3. Waste management

By employing circular and systems thinking, waste may be reduced significantly, and therefore waste management becomes an increasingly important aspect of regional green transitions. Finding new purposes for waste streams, recycling, and new sharing and lending services – these are all part of waste management as part of the circular economy. By focusing on circularity and new opportunities in waste, waste management becomes one with the overall objective of managing resources. This is seen in Trøndelag and Innlandet, for example, where the bioeconomy provides a regional advantage. The sharing economy and digitalisation are also increasingly seen as potential ways to reduce consumption and waste (Nordland Fylkeskommune, 2018a).

Norwegian regions are playing their part in incentivising improved waste management, though it is important to note that the management of household waste is in the hands of local and municipal operators. Household waste processing may also be indicative of wider regional developments. For example, in Viken region, there has been a reduction in household waste in both the former regions of Østfold and Akershus – but an increase in the former Buskerud. This is generally attributed to the expansion of Buskerud as a cabin-area, demonstrating the impact of second homes as an additional consideration in municipal and regional planning. Understanding the connections between sustainable tourism and the capacities of these cabin areas, as well as other sustainability issues connected to biodiversity and other ecosystems, will be key moving forward. Preserving ecosystems is important in Oslo, too, and efforts are taking place to reduce the inflow of both plastic and microplastic into the environment generally, and into the Oslo Fjord, specifically (Oslo Kommune, 2019).

Marine waste is also a concern in Nordland. Marine waste generally includes plastic waste, such as bags, bottles and Styrofoam, but also microplastics from car tyres. As these are all land-based waste issues, Nordland region considers land- and sea-based waste together. Local and regional actors work collaboratively to reduce and prevent this type of littering, as it affects both fish and birds to a great extent. Working with both the business sector and the tourism sector to promote sustainability and recycling, and to reduce marine littering, are therefore important components of the overall work on preventing waste.

Industrial waste is also of major concern, and several regions are working to find ways of reducing it. One major concern in Viken is the building and construction sector, where concrete, tiles and wood refuse are major waste streams for the sector. It is also one of the sectors growing most in terms of the number of employees, and has seen the highest level of value creation (Buskerud and Østfold) over the last decade (2008–2017). Viken will work with SDG 12 (Responsible consumption and production) to overcome the issue of waste management and to find sustainable ways to continue the positive development of this sector. However, when it comes to waste in the building and construction sector, no single body has the overarching authority, and an overview of the magnitude of waste from this sector across the region is lacking. Setting targets in planning strategies, by reaching out to key actors on the matter, are first steps in the right direction (Nordland Fylkeskommune, 2021; Nordland Fylkeskommune, 2018a).

Waste management is also found to be an integrated part of the circular and bioeconomies. This includes waste management from various industries, as well as the ability to extract high value materials from bio-based resources. Although the new region of Vestland has no regional plans pertaining to waste management yet, their objective is to work on green competitiveness, green technology, waste as a resource, and zero emissions by 2030 (Vestland Fylkeskommune, 2020). Looking at the former region of Hordaland's climate plans 2014–2030, waste management is part of the conversation regarding biogas (Hordaland Fylkeskommune, 2014). Although second generation biofuels are not currently as interesting for the business and industrial community in this part of Vestland region, there have been some initiatives regarding a biogas plant based on sewerage in the city of Bergen, for instance. This biogas plant supplies the biogas-based bus fleet owned by the public transport company Skyss (Skyss, 2020). The regional objective is to have a fossil free public transportation fleet (Vestland Fylkeskommune, 2020).

5. Findings

5.1. Green growth and competitiveness – climate leadership

The political debate and the international commitment to climate change mitigation is positioning Norway between the role of an internationally responsible actor on the one hand, and a source of new technology and leadership on the other. It is through its role as a technology leader within the maritime sector (encompassing the oil and gas sector, as well as maritime and marine segments of the economy) and the energy sector (both as a green ‘battery’ and as a technology pioneer within oil and gas) that Norway derives its geopolitical mandate for climate leadership. Although the discourse in Norway juxtaposes climate leadership with the role of being a leading technology developer through its oil and gas resources, national policies in Norway are nevertheless framed in light of the need to *move away* from petroleum and gas production in the future. The policies currently being developed are framed so as to phase out oil and gas in the long term. However, as this sector has been the backbone of the Norwegian economy since the 1960s, and the source of Norway’s formidable wealth, so the green transition is being framed as needing to match productivity and profitability from oil and gas sector, in order to maintain the level and nature of Norway’s welfare society.

The green transition in Norway is therefore approached from a relatively systemic perspective, where (for example) skills development and local governance are placed at the core of tackling and structuring changes brought by industry 4.0. – namely, digitalisation. This broader take on modernisation and the green transition is also seen across most government policies (the key thematic areas of interest for this literature review). It frames the green transition as an opportunity to take a global lead through green competitive industries and businesses. This is supported, at the national level, by a comprehensive and extensive institutional funding structure for stimulating green development.

There is also seemingly a great reliance on the role of clusters and networks for supporting and mobilising resources for the green transition. Both geographically and non-geographically bound cluster networks are seen as the key to knowledge transfer, and as being unique collaborative constellations. That may indicate that the green transition in Norway is not wholly self-sustained, but rather needs the support and incentive of a collective whole to shoulder the risk involved, and to push the green transition forward collectively. As Torvanger *et al.* (2016) point out in their future scenarios study on a low-emission Norway: though favourable public measures and funding are considered invaluable to the development of a low emission society, it is still paramount that carbon-neutrality, both domestically and internationally, becomes the norm (Torvanger *et al.*, 2016).

5.2. Enabling and impeding factors for Norwegian industries

Following this summary of the state of play in Norwegian industries, a few enabling and impeding factors can be detected. As we can see from the analysis above, the common denominator is the role of government in incentivising change. It is clear that in sectors such as the maritime one, the reason for its relatively speedy transition is due to a well-defined and relatively systematic focus on framework agreements, funding agencies and industry. With regard to waste management, for example, the idea of a circular economy is lagging behind somewhat, both in the industry’s own

approaches and organisation, and at the national level. What is common across all sectors, however, is the desire to see stricter regulations in place, to facilitate and motivate a more rapid response to green transition.

The Paris Agreement on climate establishes the starting point for transformation towards a green economy in Norway. Vangelsten *et al.* (2018) point out that, although that the Paris Agreement sets targets which require a large-scale transformation, the current roadmaps established by the Norwegian business sector are hardly ambitious enough to meet these targets. One interesting observation is that the roadmaps are generally framed in a rather top-down way, placing their emphasis on the role of the authorities in green transformation. It is also clear that the dominant understanding of innovation towards a green transition is primarily happening through incremental change, since Norway is somewhat tainted by path dependent behaviour. This is particularly evident when looking at innovation through a TIS approach. The exception is perhaps the maritime industry, and the role of the NOx fund. The NOx fund was a response to rapid external changes, and also external regulations that the initial national regulations was suffocating through NOx taxes. The transfer of the NOx tax into a NOx fund, in order to support green technology development, is seen as a possible model for driving innovation in other sectors as well – such as a CO₂ fund for Norwegian power and process industries.

Furthermore, this section took a look at the academic contributions surrounding the main thematic areas of this project – namely, transport and logistics, maritime and marine industries, and waste management. From what can be uncovered in relation to these topics, it is clear that the majority of the literature produced concerns the dominant policies in place in Norway for these sectors; that is, energy bearers and plastics recycling. In addition to these particular aspects, labour productivity and the welfare state are important factors we have mentioned that need to be considered carefully.

The industries themselves are dependent upon being able and willing to see a potential profit from turning towards a more circular economy. Profitability and cost-efficiency are important factors that should not be disregarded. With a turn towards digitalisation and autonomous equipment and vehicles, there is room for significant cost-savings. But, at the same time, this requires competence development among employees. As such, the green transition, due to its intersecting nature, relies not only on government incentives and stable frameworks and investment, but also investment in people. A circular economy necessitates a marriage between the traditional focus on labour productivity and a more recent perspective on material productivity. The ability to seek out new business models builds on this marriage, because waste management in the age of green transition necessarily also entails a circular economy, as we have seen. The Club of Rome thinktank found that there was significant potential in creating jobs, and in general value creation, by turning towards circular economy practices (Wijkman and Skånberg, 2017). However, this requires a shift in focus towards understanding the incremental value of the product and existing resources, and realising the potential for recycling materials over and against the costly and potentially environmentally degrading practice of virgin resource extraction. Considering how competition is understood in terms of productivity, and the ways in which companies compete rather than collaborate in their particular sector, there is room for expansion. This means ensuring increased efficiency not only in terms of labour productivity, but also in relation to material productivity (Porter, 1998; Wijkman & Skånberg, 2017). This requires both a solid business case and also behavioural change.

5.3. Spatial aspects and the role of the region

The role of the regional and the spatial aspect of a green transition has increased with the onset of regional reform. Green growth is necessarily embedded within regional development and business planning. Correspondingly, industry's needs are increasingly dependent upon an interdisciplinary regional authority which understands the need for systems thinking when planning for the green transition. The concept of 'governance' needs to be considered in the context of enabling the green transition. Smart governance, from the perspective of enabling relative regional autonomy to choose and prioritise, in turn rests upon the concept of trust (Morgan & Marques, 2019). According to Morgan and Marques (2019), in order to implement and effectively use tools devised by (for example) the European Union, such as smart specialisation strategies, a smart state is a prerequisite. As we have seen, the regions position themselves by honing regional competitive advantages, and then continue by building on these. This may perhaps be reminiscent of a *de facto* smart specialisation approach, which can be seen to some extent in regions which have not explicitly developed such a regional development tool.

What we have seen from the section on spatial aspects of the green transition is that regions have been approaching this new policy frame from different angles. Some have been concentrated more on seeing competitive opportunities through the lens of their regional areas of strength. Others are focused primarily on achieving the common GHG emission mitigation from various angles, through incremental changes to the status quo.

6. Conclusion

This literature review and policy overview has attempted to set out the ways in which the green transition is understood, presented and implemented in the Norwegian context. The driving forces and characteristics of a green transition in Norway can be seen as being embedded within the country's ambition to assume global leadership in technology development. As we have seen, national directions for the green transition are all-encompassing, with a predominant focus on green competitiveness – from regional connectivity through to skills development and climate technology leadership. The industries' actions and strategies are somewhat ambitious, but also reliant on the national context to provide a stable framework that compensates for an otherwise bumpy risk landscape. The green transition for business, and for industrial sectors such as the maritime and marine industry, transport and logistics and waste management are heavily reliant both upon a change of mindset and on behavioural change. Also important are push and pull policies to incentivise green development. Since the regional reform adopted on 1 January 2020, the regions have become key implementors of green policy directions. This is shaping regional development in line both with the UN SDGs and with national expectations. Whether these policy directions are concentrated around the greening key industries, or whether they operate as a general emissions cap across all industries, depends upon the particular profile of a given region. However, using tools to strategise the regional focus areas and funding, while setting standards for sustainability through the active use and implementation of the SDGs, might be one way to unlock the potential of green transition as a catalytic converter for regional (green) competitiveness. Finding methods of smart governance may be even more important after the global pandemic, when new priorities may be needed in the face of a potentially more stringent economic reality.

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