Bio-fuelling the energy transition in Nordic countries:
Explaining overachievement of EU renewable transport obligations

Jon Birger Skjærseth, Per Ove Eikeland, Tor Håkon Inderberg,

Pre-proof version
(Final version available at: https://doi.org/10.1007/s10784-022-09587-2)

Abstract

Following the 2009 EU Renewable Energy Directive (RED), Finland, Norway and Sweden have overachieved their 10% renewable transport-fuel obligations by 2020, mainly by increasing biofuel consumption. This seems puzzling from explanatory perspectives focused on EU adaptation pressure and changes in domestic politics. These perspectives can partly explain implementation, but the policy context – actual and potential biofuel industry development and 'green growth' opportunities – appears central for explaining overachievement of EU obligations. Moreover, the composition and explanatory power of the three perspectives differ. In Norway, the combination of EU adaptation pressure, changes in domestic politics and potential industry development promoted overachievement; by contrast, actual industry development and supportive domestic politics, as well as new opportunities from EU policies, proved more important in Sweden and Finland. These findings speak to the literatures on EU implementation, energy policies and leadership.

Keywords
EU, energy policies, implementation, biofuels, Nordic countries

1. Introduction

In 2007, the EU leaders decided that at least 20% of energy consumption should come from renewable energy by 2020. The 2009 EU Renewable Energy Directive (RED) included a separate mandatory target of at least 10% renewables in transport for each member-state.[1] In 2017, Finland, Norway (through the European Economic Area Agreement) and Sweden were the only countries to achieve the 10% target. Since then, Finland, Norway and Sweden remained at the top. By 2020, the EU narrowly reached the 10% target, due largely to overachievement among these Nordic countries (EEA, 2020; 2022).[2] They had multiplied their share of renewable transport fuels mainly by increasing the share of biofuels in road transport (Eurostat, 2019).

These achievements can hardly be explained by a specifically Nordic 'need' to reduce greenhouse gas (GHG) emissions from transport: such emissions represent the main climate

[1] Renewable Energy Directive (229/28/EC).

[2] The EU collective achievement of the 10% targets was also probably 'strongly affected by pandemic-related shifts in transport behaviour' (EEA, 2021a:17).

challenge across the EU (EEA, 2021b). Nor did these achievements result from 'easy' EU targets – particularly concerning Norway and Finland, which had to double their shares of renewables in transport. These ambitions were not reflected in national plans prior to the RED deliberations and significant efforts were required to fulfil the new targets (below). How can we explain implementation and this significant overachievement in the three Nordic countries?

The literature on EU implementation has focused on explaining 'failures' and 'successes' (see Knill & Lenschow, 1998, 2000; Knill, 2001; Treib, 2008; Di Lucia & Kronsell, 2010; Thomann, 2015; Skjærseth et al., 2016). Explanatory perspectives include Europeanization through EU adaptation pressure and domestic politics. However, scant attention has been paid to the role of the industrial policy context in explaining implementation and overachievement of EU requirements. This is also the case for the vast scholarship on leaders, pioneers, frontrunners, and entrepreneurs (Skjærseth, 2017; Wurzel et al., 2020) [3]

We find that including 'green' industry development and growth aspirations contributes significantly to explaining why Finland, Norway and Sweden implemented and overachieved EU renewable transport obligations. All three countries have huge forest resources and forest-based industries to foster national production of advanced biofuels (Midttun et al., 2019; Hedeler et al., 2020). The significance of industrial development for overachievement may also apply to other countries with domestic resources and ambitions in energy and climate policies.

Our study contributes mainly to the EU implementation and energy policy literature by developing and applying an analytical framework for combining EU adaptation pressure, domestic politics, and industry development as the major policy context for explaining implementation of EU renewable-energy legislation. This combination draws on two bodies of literature: the study of EU implementation processes, and innovation systems related to 'green growth'. Further, we present a novel comparative study of renewable transport policies in the Nordic countries.

Data are based mainly on comparable EU implementation statistics and national reports, public consultations on national policies, governmental white papers, research papers and media articles. Written sources are supplemented by interviews.[4] Collected data were verified through triangulation, to ensure data validity.

2. Analytical point of departure

Implementation of EU legislation refers to legal transposition and application – the process of converting EU-adopted policies into national policies and measures, resulting in behavioural change, like binding obligations or tax exemptions for biofuels that lead to greater

[3] This literature has focused on policymaking and international cooperation (rather than implementation) and on actors' guidance or direction of others (followers).

[4] Data analysed during this study are included in this published article. Due to lack of written sources, we conducted eight interviews with energy authorities and stakeholders in Finland. Interviews are based on confidentiality and are used as background information.

consumption (Treib, 2008; Skjærseth et al., 2016). *Legal transposition* concerns the formal aspects of EU implementation, such as the adoption of new laws, or regulations. *Application* concerns the adoption of new policies and measures. EU goal attainment is used as the main criterion for implementation achievement.

The first explanation of implementation concerns *processes of Europeanization*. Here we focus on EU influence over domestic policy choices. Differences between EU requirements and governmental policies and preferences or administrative traditions may lead to low alignment, pressuring countries to agree to a change from the status quo. The EU institutions will be involved here, to make EU implementation more uniform among member-states (Egeberg, 2006). This *adaption-pressure* perspective builds on the assumption that countries will resist implementation of EU policies that require fundamental changes to their own status quo (Knill & Lenschow, 2000; Knill 2001; Treib, 2008).[5] Here we expect that high alignment between pre-existing biofuel policies, preferences, and the final EU RED outcome will increase the likelihood of policy implementation in line with goals: specifically, high alignment that corresponds to implementation 'success' in line with EU goals in the three countries. However, the adaptation-pressure perspective appears less suited for explaining their significant overachievement.

Second, the *complementary domestic politics* approach relaxes the assumption that countries are necessarily motivated to preserve the status quo (Treib, 2008; Di Lucia & Kronsell, 2010; Skjærseth et al., 2016). A simple 'model' of domestic politics is applied to explain responses to common EU policies by the state, society and the relationship between state and society. Although the Nordic countries are characterized by a consensual policy style and similarities in their political and administrative systems (see Treib, 2008), domestic politics may change after EU-induced targets and policies are adopted, affecting implementation. New governments or energy authorities may introduce new priorities when policies are implemented. Affected societal actors may be strengthened or weakened by EU and related national policies, influencing political decision-making. Changes in domestic politics after EU-induced targets and policies are adopted are generally expected to challenge the status quo. Here, we expect that changes in domestic biofuel politics in Finland, Norway and Sweden have spurred overachievement.

Third, the *policy context* can affect implementation, particularly when adaptation pressure is 'moderate' (Knill & Lenschow, 1998). A favourable policy context will support policy implementation; a negative policy context may result in implementation failure.

Industry development constitutes an underexplored part of the policy context for explaining EU implementation of climate and energy policies with industrial implications. This perspective opens for a complementary explanation of overachievement: that industry development can affect implementation in the absence of domestic political change and change in domestic politics can affect implementation in the absence of industry development. Industry development emerges from complex interactions between actors and institutions involved in creating commercial value chains from basic R&D (Edquist, 1997). Industrial value chains for biofuel industries comprise several types of upstream production

[5] The 'goodness-of-fit approach' has been criticized for weak explanatory power, for excluding actor interests and for being static (Treib, 2008). When this approach is applied to implementation in the Nordics, energy interests and preferences and dynamic development are included.

and downstream end-use technologies based on various resources, e.g., agricultural and forest feedstock (Hedeler et al., 2020). Commercialization of such value chains may generate 'green growth'. Green growth concerns technological change and the ecological efficiency of the economy which may create new opportunities for e.g. employment (Hickel and Kallis, 2019; Czako, 2020).[6] We focus on political aspirations for industry development and green growth related to biofuel value chains as an alternative perspective for explaining national implementation and overachievement of the EU RED.

We expect that pre-RED biofuel industry development will promote higher policy implementation ambitions than EU goals, as decision-makers will stimulate national industries in anticipation of further national green growth opportunities (in contrast to import). With high industrial development of biofuels, we expect greater initial policy implementation ambitions than RED requirements and more ambitious targets and policies towards 2030. In examining the industrial development perspective, we explore mainly the biofuel engagement among refiners, retailers and industrial forest companies, and employment in the three countries. [7]

3. Implementing EU renewable-transport fuel policies

In 2003, the EU adopted a Biofuels Directive (2003/30/EC) that included non-binding targets of 2% and 5.75% biofuels in 2005 and 2010, based on the energy content in petrol and diesel. Member-states were encouraged to adopt 'indicative' targets in line with these EU targets. This was followed by the RED in 2009, with its mandatory target for member-states and EEA countries of at least 10% renewables in all consumption of road-transport fuels.[8]

As per the RED, biofuels must comply with sustainability criteria to restrict biofuel production on land with high carbon content, such as wetlands, and high biodiversity status, such as nature protected areas. To prevent 'gold-plating', countries must offer access to all compliant biofuels, and are not allowed to add sustainability criteria. If biofuels are produced from feedstocks defined as 'advanced', fuel suppliers could double the count vis-à-vis compliance with the 10% target.[9] The aim is to provide incentives for advanced biofuels based on wastes, residues and non-food material.

The RED did not include the risk of increased GHG emissions due to indirect land-use changes (ILUC). Biofuel production may lead to extension of agriculture land into forests and wetlands, releasing CO_2 stored in trees and soil and countering the GHG savings from higher biofuel consumption. In 2015, after nearly three years of contentious political negotiations, new rules were adopted to reduce this risk and accelerate the transition towards advanced biofuels. The ILUC Directive (2015/1513) set the maximum share of biofuels from crops grown on agricultural land to 7% of total energy consumption and obliged member-states to establish

[6] The 'resource-curse' literature has identified several mechanisms that dampen expectations of regional employment effects from the bioeconomy (see Andersen et al., 2022; Stanford, 2020).

[7] Direct, indirect and induced employment effects (Czako, 2020).

[8] The EU also revised the Fuel Quality Directive requiring that the fuel mix in road transport should be 6% less carbon-intensive by 2020 compared with a diesel/petrol baseline. This was followed up in the National Renewable Energy Plans based on the RED.

[9] Each litre of 'advanced' biofuels counts as two in fulfilling the 10% target (RED Art 21(2)).

indicative national targets for advanced biofuels for 2020.[10] The 2018 revised EU REDII (2018/2001) for 2030 strengthens the sustainability criteria, including ILUC.

Thus, EU renewable transport legislation incentivized production and consumption of advanced biofuels. However, new legal changes and complex sustainability rules also created major uncertainties – as to the future role of biofuels, which biofuels, from which feedstock, how to calculate climate benefits, and the specific design of support schemes for the 'right' biofuels (Åhman et al., 2018).

3.1 The rise of biofuels in Finland, Norway and Sweden

Finland and Sweden adopted indicative national targets in response to the 2003 Biofuels Directive. All three countries transposed the RED and the ILUC Directive in national legislation and submitted their National Renewable Energy Action Plans (NREAPs) for meeting the 10% renewable transport obligations by 2020.

Finland responded to the RED by doubling the EU target through a stepwise increase from a 6% share for biofuels to 20% by 2020 (Commission, 2021), to be achieved mainly by a mandatory biofuel sale obligation and a tax reform of the Transport Fuels Act. Norway's goal was in line with the EU target – 10% of transport fuels from renewable sources by 2020 (Commission, 2021) – to be achieved by a combination of biofuels and electric road vehicles. Biofuels would be stimulated by road-tax exemptions and a stepwise increase in a mandatory sale obligation. Sweden adopted a trajectory that would lead to 13.8% renewable transport fuels by 2020 (Commission, 2021). As in Finland, the target would be achieved mainly by biofuels. Exemptions from energy and CO_2 taxes were the chief pillar of Swedish biofuel policy. In 2018, Sweden adopted a GHG reduction mandate for petrol and diesel.

Table 1: Renewable transport ambitions and status: Finland, Norway and Sweden

	EU 2020 OBLIGATION	INITIAL NATIONAL TARGET	STATUS[11]	MAIN SOURCES, POLICIES AND MEASURES
FINLAND	10%	20%	14.7%	Biofuels. Road tax exemptions and mandatory sale obligation
NORWAY	10%	10%	20.0%	Biofuels and electrification. Road tax exemptions and mandatory sale obligation
SWEDEN	10%	13.8%	29.7%	Biofuels. Exemptions from energy and CO_2 taxes until 2018.

Table 2 shows that all three countries have increased their share of biofuel consumption (mainly bioethanol and biodiesel) substantially after the RED. In Norway, for example, the record-high consumption of biofuels in 2017 accounted for 18% of fuel consumption in road

[10] It also harmonizes the list of feedstocks that would double the count and requires fuel suppliers to report annually on the estimated ILUC emissions from traded biofuels.

[11] For 2018. See explanations and qualifications related to Table 2

transport and a marked decrease in CO_2 emissions. Compared to their NREAPs, Norway and Sweden were ahead of their 2018 trajectory targets; Finland was roughly in line with its target (Commission, 2021).

Table 2: Renewables in transport and total compliant biofuels (ktoe)[12]*

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SWEDEN											
	RES-T (%)	7	8	9	13	17	19	24.0	30.3	26.8	29.7
	Total biofuels	396	429	475	607	827	985	1190	1479	1376	1500
FINLAND											
	RES-T (%)	4.0	3.8	6.4	7.9	9.6	21.6	22.0	8.4[1]	18.8	14.7
	Total biofuels	134	134	196	198	224	499	500	179	369	341
NORWAY											
	RES-T (%)			4.1	4.6	1.6	4.8	8.8	17.0	19,0	20,0
	Total biofuels		–	121	139	118	129	149	344	493	371

*ktoe = kilotonne of oil equivalent. RES-T = bioethanol, biodiesel, renewable electricity, biogas. Total biofuels = mainly bioethanol and biodiesel. [1]The drop in 2016 is related to accounting flexibility (IEA, 2018:76)

Source: Commission, 2021.

Sweden double-counts considerably more biofuels than Norway and Finland but has the highest consumption even when this is controlled for (Commission, 2021).[13] A clear shift in composition of biofuels was seen in Sweden: biodiesel gained and bioethanol lost shares from 2011 onwards. After the major increase in biofuels in 2016, Norway saw a drop in consumption in 2018 due to more stringent sustainability criteria: less biofuels produced from palm oil and more advanced biofuels, and an increasing share of electric vehicles.[14] Also in Finland, the drop in biofuels in 2018 was related to more stringent sustainability criteria.

Thus, all three countries have stepped up their national biofuel targets and policies, overachieving the EU target with good margins. More stringent EU sustainability criteria have affected the composition of raw materials in all three, and reduction in compliant consumption of biofuels from 2017, particularly in Finland and Norway. How can we explain observed implementation and overachievement in Finland, Norway and Sweden?

[12] Data are reported according to standardized EU procedures and include double counting for advanced biofuels. Although methodologies may vary for converting advanced biofuels, the data appear sufficiently reliable to indicate general trends.

[13] In 2016, Sweden double-counted 70% of reported biodiesel; Norway 40%; Finland did not report double-counting.

[14] In 2018, there were 195,000 electric vehicles in Norway. That electric cars accounted for only 1% of total energy consumption from road transport is partly related to the higher efficiency of electric engines.

4. Explaining implementation and overachievement

4.1 Europeanization and adaptation pressure

First, alignment with the RED has varied. *Norway* did not transpose the 2003 Biofuels Directive, and Norwegian biofuel policies were weak and unstable prior to the RED. Since 1999, biodiesel has been exempted from fuel- and CO_2 taxes, but consumption did not start to increase until 2005/2006. In spring 2009, the government introduced a mandatory biofuel sale obligation of 2.5%, increasing to 3.5% in 2010. However, policy ambitions were reduced in 2009 – the government decided to remove the road-use tax exemption for biofuels (Fevolden & Klitkou, 2017). From 2008, a bioenergy strategy included R&D on advanced biofuels and support for demonstration projects. However, biofuel technologies were removed as a targeted area when the strategy was revised in 2011 (Fevolden & Klitkou, 2017).

From 2009, Norway began the RED transposition process through the EEA procedure which grants Norway a longer deadline compared to EU members. Since then, Norwegian biofuel policies have closely followed EU rules (Norwegian White Paper, 2017). In Norway's NREAP, the government intends a stepwise increase in the mandatory sale obligation to 10% by 2020 (Ministry of Petroleum and Energy, 2012). In 2016, this target was raised to 20%, with no corresponding changes in EU targets. In line with EU sustainability criteria, minimum obligations for advanced biofuels from non-eatable feedstock have gradually increased (Riksrevisjonen, 2018). According to the Minister of the Environment in 2017: 'the EU legislation is extremely important for the Norwegian biofuels sustainability policy' (Ministry of Climate and Environment, 2018:1). Low alignment between the Norwegian status quo and the RED led to high EU adaptation pressure until 2016.

Finland has had a binding biofuel obligation since 2002. Around the same time, Finnish R&D efforts emerged around various resources to produce Hydrotreated Vegetable Oil (HVO, see below). Following the 2003 Biofuels Directive, Finland aimed for 0.1% biofuels share in 2005 and 4.0% by 2010. After the RED, the ambition was raised to 20% in the 2010 NREAP – twice the EU requirement. The RED's sustainability criteria and the ILUC Directive have ramped up Finland's sustainability criteria.[15] That alignment between Finnish biofuels targets and policies and the RED was higher compared to Norway led initially to relatively lower EU adaptation pressure (see below).

Sweden has a long history of biofuels policy (Hedeler et al., 2020). Main policy instruments were exemption from energy and CO_2 taxes for all biofuels and R&D programmes. Sweden implemented the EU Biofuels Directive by setting an indicative target of 2% for 2005, later increased to 3%. In 2005, Sweden adopted the Pump Act, mandating sales of high-blended biofuels. As cheaper imported bioethanol was increasingly seen as a threat to domestic production, import duties were raised (Statens energimyndighet, 2012; Hedeler et al., 2020). By 2009, the share of biofuels in Swedish transport fuel consumption was among the highest in the EU (SPBI, 2021).

[15] Interviews, Finland

The RED entailed less pressures on Swedish biofuels policy ambitions compared to Finland and Norway. Sweden achieved the 10% target already in 2012 but had to adapt to the EU sustainability criteria by a hesitant shift towards non-edible feedstock in biofuels. Thus, alignment between Swedish biofuels targets and policies and the RED was relatively high, whereas EU adaptation pressure was relatively low, except for policies related to EU sustainability criteria.[16]

Second, as to varying adaptation pressure and implementation, we find a weak match, as all three countries have successfully implemented and overachieved the EU requirements in the RED. Still, EU adaptation pressures prove particularly important for explaining Norway's implementation up to 2016 and for initially triggering Finland's higher policy ambitions. EU adaptation pressure had relatively little effect on Swedish policy ambitions until 2018, when national policy support shifted to the current GHG reduction mandates for fuel suppliers. In all three countries, more stringent EU sustainability criteria have brought policy changes towards more sustainable feedstock and advanced biofuels.

Table 3: Europeanization and adaptation pressure

	Adaptation pressure	*Implementation*	*Correspondence: expectations vs. observations*	*Main EU effect*
Finland	Medium/t*	Overachievement	Low/medium	Sustainability criteria/ policy ambition in 2010.
Norway	High/t*	Overachievement	Low	Sustainability criteria/ policy ambitions until 2016
Sweden	Low	Overachievement	Medium	Sustainability criteria

t/* = temporary effect on policy ambitions

Thus, to varying degrees, Europeanization and EU adaptation pressure can explain implementation – but not overachievement of EU targets.

4.2 Domestic politics

In *Norway*, the change from a Red/Green coalition to a Conservative minority government (Conservative/Progress Party) in 2013 led to a more positive attitude to biofuels. The new government gradually introduced policies more favourable to advanced biofuels (Fevolden & Klitkou, 2017).

From 2015, the minority government decided to reintroduce the road-use tax exemption for all biofuels exceeding the mandatory sale obligation. This made biofuels competitive with fossil fuels, bringing a significant increase in biofuel consumption in 2016 (Norwegian White Paper, 2015; see also Table 2). In negotiations on the 2017 state budget, the Liberal Party, surprisingly, received backing for the 20%-by-2020 biofuels target. This party had never prioritized biofuels to cut transport emissions – preferring higher petrol and diesel

[16] Main pressure from the EU came from State Aid Guidelines which increasingly called for phasing out tax exemptions for biofuels.

taxes *(Aftenposten*, 2017). Regardless, Norway's increased biofuel ambitions came because of a shift in government and the need for majority support in the Parliament.

All major Norwegian environmental NGOs were sceptical or opposed to the new 20%-by-2020 obligation except *Zero* (Ministry of Climate and Environment, 2017). *Zero* had high hopes for biofuels, viewing its potential for replacing diesel and petrol as technically unlimited. The Norwegian Forest Owners' Federation (NFOF) also responded positively, together with biofuel producers, although support for sustainability criteria differed in line with their preferred technologies and feedstocks. The petroleum industry was negative. Statoil (now Equinor) opposed any increase in the mandatory sales-obligation requirement, targets for advanced biofuels and tax exemptions. The new biofuels target also had surprisingly few supporters among political and administrative actors – the Norwegian Green Party voted against 20%, and the Ministry of the Environment as well as the Ministry of Petroleum and Energy argued that 7% to 8% – not 20% – would be appropriate. This low enthusiasm added to the opposition from the petroleum industry and nearly all environmental NGOs.

The key to unlocking this puzzle lies in the 2016 budget negotiations, which led to deadlock and a sense of crisis. Zero and the NFOF lobbied strongly for the 20% target as a measure for solving the budget deadlock, sending written statements directly to the stalled budget negotiations *(Aftenposten,* 2017). The rush to achieve a biofuels deal was further reflected in the lack of impact assessments. Statistics Norway later concluded later that the 20% target would increase global GHG emissions (Holtsmark, 2017). Zero and NFOA, however, both argued that an ambitious biofuel policy would stimulate a viable advanced, wood-based Norwegian biofuel industry by 2020, leading to GHG emissions cuts in the transport sector (Ministry of Climate and Environment, 2017). Thus, the change in government and lobbying from societal actors can largely explain why Norway's biofuels target and consumption became more ambitious than required by the EU: the deal reflected conflictual domestic politics on biofuels.

Finland also experienced governmental changes when the 20% biofuels decision was taken. After the 2007 elections, Matti Vanhanen's Centre-Right coalition steered climate and energy policies until 2010. They were replaced by the Kiviniemi cabinet in June 2010, which held government until the general elections in 2011.

In 2009, the Vanhanen government adopted the Foresight Report on Long-term Climate and Energy Policy. This report prioritized transportation and forest activities and 'future promise in the area of biorefineries' to reap benefits from combining forestry with biofuels for transport (Finnish Government, 2009: 73). This government prepared Finland's NREAP, formally submitted to the Commission by the Kiviniemi cabinet on 30 June 2010. This indicates that it was not the change in government that led to the new 20% target, as there was no major disagreement on biofuel policy. Apart from PM Sipilä's cabinet 2015–2019, which included the Finns Party and Blue Reform, the same parties have been members of several post-2000 coalition governments.

Coalition governments since 2011 have largely agreed on biofuel policies and supported the 20% target. However, the government has expressed concerns for regulatory uncertainties related to the ILUC Directive (Finnish Government, 2013: 10).

The preferences of societal actors generally reflect political-party consensus on biofuels policies. For example, in the 2018 public consultation on a new 30%-by-2030 biofuels

target, most public authorities, business associations and the biofuel industry were either supportive or neutral, despite concerns for the environmental and market consequences – as well as timing, because the REDII negotiations were not completed (Finnish Government, 2018). In contrast to Norway, Finnish environmental NGOs largely did not engage in the public consultation. In sum, changes in governments can hardly explain Finland's 20% target and implementation towards this target. The preferences of societal actors have generally been supportive: Finnish domestic politics on biofuels appear consensual since the RED.

In *Sweden*, change in governments is also a weak explanation of changes in policies and related increase in the composition of biofuel consumption. Around 2010, Swedish political parties across the Conservative/Social Democratic bloc had achieved considerable consensus on a more ambitious national climate policy which included the need to decarbonize the transport sector and reduce imports of diesel and petrol. Governments gradually adjusted the taxation system to promote higher consumption of biofuels eligible for double counting.

Political parties disagreed somewhat on the role of biofuels in decarbonization, but the shift from a Conservative coalition government to a Social Democratic coalition government in 2014 did not bring major policy changes. Nearly all political parties favoured policies that would promote biofuels (Gröna Bilister, 2010). Only the Liberal Party opposed, opting for reallocating tax exemptions and R&D towards electric vehicles (Gröna Bilister, 2010). The introduction of the emissions reduction obligation by the Social Democrat/Green Party government in 2018 was supported by all political parties except the right-wing Swedish Democrats. The obligation had significant similarities with the mandatory sale obligation in Finland and Norway: different binding targets for life-cycle emissions reductions for petrol and diesel.[17]

The ILUC Directive strengthened the sustainability criteria to limit feedstock with alternative use as food, putting pressure on Sweden to continue transitioning the composition of biofuels in the market from agricultural-based bioethanol to waste-based HVO. However, with growing volumes of HVO-fuels in the market based on palm-oil waste, NGOs contested their sustainability and demanded that they be reclassify ed as 'by-products', requiring stricter verification for compliance with EU sustainability criteria. Two main policy changes – ILUC implementation and the shift from tax exemptions to the emissions reduction obligation – affected fuel suppliers. Instability in the policy mix created regulatory uncertainty, unlike the gradually increasing blending obligation in Finland (Hedeler et al., 2020).

Societal actors generally supported the increase in biofuels and the policy changes. Responding to the 2005 Pump Act, fuel distributors lobbied for more ambitious biofuels policies to increase demand and thus recoup the mandated investments. The national car industry got incentives to sell flex-fuel models in the Swedish market and lobbied to ensure that the state would continue supporting demand for these models in the future. Consultations on the emissions reduction obligation proposal showed near-unison support among the state agencies, industries, and environmental NGOs (Government of Sweden, 2017b). However, most respondents contested the short-termism of the proposal which had

[17] 2.6% and 20% in 2019, 4.3% and 21% in 2020. The system would continue tax exemptions for high-blended biofuels until 31 December 2020.

listed reduction levels only for the years 2018–2020. Consultations on ILUC showed support for advanced biofuels aimed at reducing the climate footprint, but opinion varied, depending on industry actors' interests in specific technologies and feedstock.

Thus, change in governments cannot explain the policy changes and the increase in biofuel consumption in Sweden. Societal actors have generally been supportive of biofuels policies. As in Finland, Swedish domestic politics on biofuels post-RED have been largely consensual, despite differing preferences on sustainability criteria.

Table 4: Domestic politics

	Change in governmental preferences on biofuels	*Mobilization of societal actors*	*Correspondence: expectations vs. observations*	*Main domestic politics effect*
Finland	No, supportive	Generally supportive	Low/medium	Stable and consensual support to biofuels
Norway	Yes, more positive	Generally opposing: some persuaded the government.	High	Biofuels promoted by some societal actors 'solved' budget crisis
Sweden	No, supportive	Generally supportive	Low/Medium	Stable and consensual support to biofuels

Thus, post-RED change in domestic politics can largely explain overachievement in Norway – but to less extent in Finland and Sweden.

4.3 Industry development

In Norway, forests are the major land-based source of energy raw material, as expanded use of scarce agricultural land is not desirable. Norway's renewable-energy industrial basis was mainly confined to hydropower production technologies, which have played a major role in the country's industrial and economic development.

Until 2009, Norway had hardly any viable biofuel-producing industry, but several emerging industry initiatives. The removal of the road-tax exemptions in 2009 dealt a blow to many of these. Only Borregaard had some success in producing bioethanol from forest-based feedstock. Other attempts failed, despite benefiting from public EU and national R&D policy programmes (Fevolden & Klitkou, 2017). Weak industrial development was reflected in Norway's first NREAP: all biodiesel would be imported (Ministry of Petroleum and Energy, 2012).

Despite increasing incentives for advanced biofuels, Norwegian biofuel industries have remained weak. Borregaard continued as the only forestry company engaged in producing biofuels: it responded to more stringent EU sustainability criteria by investing in capacity increase for bioethanol – from 7 to 20 million litres (Ministry of Climate and Environment, 2017). Norway's upstream oil companies have not engaged in biofuel production or refining.

The main industrial effect of more ambitious biofuel policies has been diversification from petroleum among dominant retailers, which have imported cheap biofuels that make forest-based biofuel industry unable to compete (Midttun et al., 2019). In 2017, only 0.4% of the biofuels consumed came from Norwegian feedstock; nearly half of the total consumed volume was palm oil imported from Indonesia (Energi og Klima, 2018). The reintroduced road-tax exemption represented a subsidy of ca. €100 million – which stimulated palm-oil import, not industrial development in Norway. By 2020, import remained at 99%, but palm oil had been nearly phased out and the share of advanced biofuels had increased significantly due to more stringent sustainability criteria (Norwegian Environment Directorate, 2020). With no national value-chains, and biofuel consumption based almost exclusively on import, the employment effects have been negligible.

However, more ambitious EU and national biofuel policies and stringent sustainability criteria have stimulated industrial plans for increased production of advanced biofuels from forest-based feedstock, such as Biozine AS.[18] In 2020, Norway increased the mandatory sales obligation to 24.5%, including 9% advanced biofuels. The aim now is to retain the biofuel sales obligation, to contribute to halving GHG emissions from transport by 2030 (Norwegian White Paper, 2021).

Thus, Norway had no substantial biofuel industry before the RED and did not adopt national ambitions above EU requirements. More ambitious policies from 2016 have not led to new biofuel-based industry development – they have mainly benefited retailers' imports of cheap biofuels. Whether new industrial initiatives based on forest-based biofuels will materialize remains to be seen – the government has stepped up policies for 2030 slightly.

In *Finland*, the initial 4%-by-2010 biofuels target triggered a wave of investments in biofuels technology. Actors included the public research agencies, the oil refiner Neste and the Swedish-Finnish forest company Stora Enso, with investments directed mainly towards biogas, biochemical and HVO (Hedeler et al. 2020). The first commercial HVO facility was established in 2005; Neste created biodiesel as a separate business area in 2006. Between 2005 and 2011, Neste invested over €1.8 billion in biofuel production in Finland and Singapore based on palm oil, used cooking oil and other wastes (Midttun et al., 2019). The forest company UPM developed technology to convert tall oil (pulp and paper by-product) to HVO.

This emerging industry development became directly linked to the ambitious 20% Finnish target triggered by the 2009 RED.[19] The RED provided a long time-horizon towards 2020 based on advanced biofuels for double-counting, which could generate a large market for Neste and others. The target, intended to stimulate national industry development, was initiated by an industry programme developed by the Ministry of Economy and Employment with support from other ministries (Finnish Ministry of Employment and the Economy, 2014). The Finnish NREAP also aimed for ca. 15% of the biofuel share to be covered by domestically produced cereal-based bioethanol (Finnish Government, 2010). Significant R&D initiatives continued, and three projects were applied for under the EU NER-300 programme (Åhman et al., 2019).

[18] http://biozin.no/

[19] Interviews, Finland

Regulatory uncertainty concerning sustainability criteria put industry development on hold until the 2015 ILUC Directive (Hedeler et al., 2020). Since then, Neste has become the world's leading renewable fuel company based on HVO and other technologies; and the largest producer of renewable diesel, with a world market share of 60% in 2018 (NESTE, 2019).

Liquid biofuel production linked to the forest industry has been lacking, except for a UPM biorefinery started in 2015 to produce diesel from tall oil (UPM, 2019). The refiner St1 plans to open another bioethanol plant, and UPM intends to add yet another plant to its biodiesel production (Flach et al., 2018, Finnish Ministry of Employment and the Economy, 2014:8). Actual industry development based on Neste's fully commercialized HVO value-chain, other development plans and the significance of the Finnish forest and bioeconomy underpinned the new target of 30% biofuels by 2030, including 10% advanced biofuels (Finnish Ministry of Employment and the Economy, 2014: 8). However, employment in the biofuel industry decreased between 2016 and 2018, to below 5000 jobs (Cheka, 2020). Neste will locate its future HVO production facilities in Rotterdam and Singapore, constraining new jobs and tax income to Finland.

Thus, industry development underpinned Finland's ambitious national target triggered by the RED to expand biofuel markets. Development resulting from implementation has been successfully related to HVO but slow in connection with the forest industry. The 30% target appears as a new effort for expanding the Finnish biofuels industry.

Like Finland *Sweden* developed a national biofuels industry. Two industrial clusters based on forestry- and agricultural feedstock were strengthened by government funding of pilot projects in the 1980s and 1990s towards full supply-chains for biofuels (Sjölander et al., 2014). A first large-scale agro-bioethanol production plant was started by Lantmannen Agroetanol AB in 2001, followed by a biodiesel plant in 2006. Swedish automobile manufacturers Volvo and Saab introduced flex-fuel cars in 2005; and in 2007, the chemical conglomerate Perstorp started large-scale production of biofuels for blending into diesel at Preem's two Swedish refineries. In 2008, 33.3 % of new cars sold in Sweden were registered as 'environmental cars', about 70% of these using ethanol (Gröna Bilister, 2010). However, large-scale production of biofuels based on forestry feedstock did not materialize. The increase in biofuels consumption from 2000 was due mainly to imports of bioethanol (Econ Pöyry, 2008; Government of Sweden, 2010).

Further growth in biofuels based on the RED 10% target was expected to be covered mainly by national production of biofuels from agricultural feedstock (Government of Sweden, 2010:116). The government also prepared for greater production of forest-based fuels by increasing support for R&D and demonstration projects (Government of Sweden 2009). By 2009, ambitious industry plans had been launched for investments in national biofuels production: 18 new large-scale plants altogether (Bioenergi, 2018).

The government's expectations were put to shame due to major market changes – the introduction of Finnish-innovated HVO in 2011 was a game-changer. Neste's HVO gained a near-monopoly position in Sweden and elsewhere. This change in biofuel technology and the shift in tax regime can largely explain the increase in consumption of biodiesel: HVO could be blended into ordinary diesel at high rates, without creating technical problems. HVO was first introduced in Sweden by the largest refiner Preem, using tall oil as feedstock, then a by-product from Swedish forest companies. HVO challenged established Swedish industry

interests in bioethanol and flex-fuel cars, leading towards collapse of this market segment. Major industry plans for expanding biofuel production in Sweden never materialized. By 2018, only six out of 18 planned large-scale projects had been realized (Bioenergi, 2018). Shifting sustainability criteria and lack of policy stability meant regulatory uncertainty for the biofuels industry.

As in Finland and Norway, Sweden's retailers engage heavily in import-based biofuels (Midttun et al., 2019). Swedish value-chains have been based mainly on import of biofuels and technology (Hedeler et al., 2020). By 2017, national production of biofuels covered 15% of total biofuels consumed (Energimyndigheten, 2018). New industrial initiatives and pilot plants testing other second-generation alternatives have been established, without large-scale commercialization (Energimyndigheten, 2018). Still, employment in the Swedish biofuel industry increased from 2016 to 2018, from below 10,000 to nearly 12,000 jobs (Cheka, 2020).

The 2018 change to an emissions-reduction obligation responded partly to instability in tax deduction policies and partly to the gradually emerging industry development. For 2030, energy and CO_2-taxes have been imposed on all fuels in low-blends with petrol and diesel, whereas full tax exemption is granted for all high-blended fuels. The emissions reduction obligation and the new tax system should serve as key instruments for achieving the transport-emissions reduction goal of 70% by 2030 (Government of Sweden, 2017).

National biofuel industry development underpinned national policies from 2010 and Sweden's RED implementation. However, plans materialized only to a limited extent. New targets and the new emissions-reduction obligation seem partly the result of policy difficulties, but also of new efforts to expand national industry development for advanced biofuels.

Table 5: Industry development (ID)

	ID underpins initial ambitions and implementation	*ID promote more ambitious targets and policies towards 2030*	*Correspondence: expectations vs. observations*	*Main ID effect*
Finland	High	Partly (+)	Medium/High	Domestic value chains and 'green growth' propelled overachievement.
Norway	Low	No	High	Retailers based on import and 'green growth' anticipation.
Sweden	Medium/high	Partly (-)	Medium/High	Value chains based on import and 'green growth' propelled overachievement.

Thus, industry development aspirations and actual industry development can to a significant extent explain overachievement in Finland and Sweden – to less extent in Norway.

5. Conclusions

How can overachievement of EU renewable transport-fuel obligations from biofuels in Finland, Norway and Sweden be explained? First, the main explanatory factors have interacted differently towards overachievement in each country. In Norway, a combination of EU adaptation pressures and changes in domestic politics can largely explain the significant increase in biofuel consumption and overachievement. In Finland, the EU target served as a trigger for stepping up national ambitions – unlike the case in Sweden, where domestically driven policies, and double-counting of advanced biofuels have been more important in promoting the increase in consumption. Domestic politics have been more supportive and consensual in Sweden and Finland than in Norway. Actual and/or potential industry development have to varying degrees underpinned these explanatory interactions.

Second, the explanatory power of the three perspectives varies across the countries. From an *EU adaptation pressure* perspective, the ramp-up of national ambitions can be explained variously – from genuine pressures to step up the initial target in Norway, to triggering Finland's desire to accelerate biofuel industries to expanding markets. Sweden's targets and policy mix were less shaped by the EU RED, although stringent EU sustainability criteria affected policies and the composition of biofuel consumption. However, the expected relationship between national alignment to the EU target and implementation proved generally not in line with our observations. With biofuel consumption regulated by increases in mandatory sale obligations (Finland and Norway), implementation is largely ensured by law as to minimum sale requirements. EU *pressures* can generally not explain overachievement – but such pressures promote new market opportunities to which technology frontrunners may respond with highly ambitious policies.

From a *domestic politics* perspective, only the case of Norway confirmed our expectation of changes in governments and societal actors linked to implementation. Norwegian domestic politics on biofuels have been marked by changes and conflict, which also constitute the main explanation of overachievement. In contrast, Swedish and Finnish domestic politics have remained fairly stable and consensual, and can explain increased biofuel consumption and overachievement only to a limited extent. The relationship between consensual and supportive domestic politics and biofuel policies is also weak, as Finland and Sweden adopted different policy mixes that led to overachievement. That does not mean that domestic politics are irrelevant for explaining implementation – only that change in domestic politics proved most important for explaining overachievement in Norway.

From a policy-contextual industry development perspective, both Finland and Sweden support the expectation that pre-RED biofuel industry development would promote higher policy ambitions than EU goals. Conversely, the absence of this factor in Norway contributes to explaining initial policy ambitions in line with EU goals. These cases also show that the relationship between industry development and policy instruments varies: Finland chose to create long-term stability by gradually stepping up the sales obligation to promote domestic industrial value-chains, whereas Sweden relied on a tax regime that mainly benefited value-chains based on import of technologies and biofuels.

These cases indicate that industry development has propelled more ambitious biofuel policies and targets for 2030 despite policy difficulties and missed opportunities. However, Norway strengthened its biofuel policies based on (unrealistic) aspirations of industry development, and increased its biofuels target somewhat beyond 2020. Actual employment

in the biofuels industry has risen towards the highest level in Sweden. These observations indicate that industry development ambitions are relevant for explaining overachievement and policy reform.

Summing up, the policy context of potential and actual industry development appears as a significant common explanation for overachievement. This finding contributes to the EU implementation and energy-policy literatures in two ways. First, it shows that industry development as a policy-contextual factor may significantly affect implementation and overachievement under varying (not only 'moderate') adaptation pressure (Knill & Lenschow 1998). This observation may apply to other countries with domestic resources and industry ambitions linked to energy and climate policies. Second, we have nuanced earlier findings from EU implementation studies that emphasize similarities – the Nordic countries have been characterized by a 'culture of compliance' resulting from similarities in their political and administrative systems (Treib, 2008). Our study shows that various combinations of explanatory factors have produced similar outcomes in terms of overachievement. This is also in line with the notion of 'differentiated implementation' (Thomann, 2019).

There is room for further analytical improvements. First, the link between renewable transport policies and other EU climate policies, deserve more attention for explaining biofuel policies. For example, EU effort-sharing legislation (which includes transport) mandates the most ambitious national reduction targets based on GDP/cap for the wealthy Nordic states. Second, a framework that take international biofuel markets and the distinction between potential and actual industrialization more into account may better explain differences in overachievement. Finally, in a dynamic perspective, the literatures on leadership may help to explain how implementation processes may facilitate subsequent leadership when policies are reformed, as with EU RED II.

The proposed EU 'Fit for 55' package aims for 40% renewable energy consumption by 2030, increased CO_2 uptake in forests and land-areas, and stricter biodiversity legislation and forest protection as part of the European Green Deal. How this will affect biofuels is uncertain, but bio-resources will certainly come under greater pressure towards net-zero emissions.

Acknowledgements

We would like to thank two anonymous reviewers, Mikael Skou Andersen and the NOWAGG team for extremely helpful comments.

Interviews in Finland, 2019–2020

Name	Organization	Interview date
Jukka Heiskanen; **Ilkka Toijala**	Fortum	24 Oct. 2019
Tage Fredriksson	Bioenergia	24 Oct. 2019
Nichola; Sovka Kaitu	Energy Authority	25 Oct. 2019
Antti Saastamoinen	Verohallinto / Tax Administration	24 Feb.2020
Nils-Olof Nylund	VTT Research Institute	24 Feb.2020
Jukka Saarinen	Ministry for Economy and Employment	3 March 2020

References:

Aftenposten, 2017. Slik var spillet bak det omstridte biovedtaket. 14 March. https://www.aftenposten.no/norge/i/LzebQ/slik-var-spillet-bak-det-omstridte-biovedtaket. Accessed 17.06.2022

Andersen, M.S., Christensen, L.D., Donner-Amnell, J., Eikeland, P.O., Hedeler, B., Hildingsson, R., Johansson, B., Khan, J., Kronsell, A., Inderberg, T.H., Nielsen, H.Ø., Pizzol, M., Sairinen, R., Skjærseth, J.B., Söderholm, P., Teräväinen, T., Thomsen, M., (2022). To facilitate a fair bioeconomy transition, stronger regional-level linkages are needed. *Biofpr, Biofuels, Bioproducts and Biorefining.* DOI: 10.1002/bbb.2363

Bionergi, 2018. Industrin tar täten i renässans för produktion av biodrivmedel i Sverige, 4 July 2018. https://bioenergitidningen.se/industrin-tar-taten-i-renassans-for-produktion-av-biodrivmedel-i-sverige/. Accessed 17.06.22

Commission, 2021. Progress reports from Member States: Finland, Norway, Sweden. 1st (2009–2010); 2nd (2011–2012); 3rd (2013–2014); 4th (2015–2016) and 5th (2017–2018).

Brussels: DG Energy. https://ec.europa.eu/energy/en/topics/renewable-energy/national-renewable-energy-action-plans-2020

Czako, V. (2020). *Employment in the energy sector – Status Report 2020*. Brussels: European Commission/JRC, 2020

Di Lucia, L. & Kronsell, A., 2010. The willing, the unwilling and the unable – explaining implementation of the EU Biofuels Directive, *Journal of European Public Policy*, 17 (4), 545–563.

EconPöyry, 2008. Virkemidler for andregenerasjons biodrivstoff, *Econ-rapport* 2008-127, https://www.miljodirektoratet.no/globalassets/publikasjoner/klif2/publikasjoner/2476/ta2476.pdf

Edquist, C. (ed.), (1997). *Systems of innovation: Technologies, institutions and organizations.* London: Pinter/Cassell Academic.

EEA (European Environmental Agency) (2020). Trends and projections in Europe 2020 Tracking progress towards Europe's climate and energy targets. file:///C:/Users/jbskjaerseth/Downloads/Trends%20and%20projections%20in%20Europe%202020%20(2).pdf. Accessed 02.06.22

EEA (European Environmental Agency) (2021a). Trends and projections in Europe 2021. file:///C:/Users/jbskjaerseth/Downloads/No13_Trends-Projection%20TH-AL-21-012-EN-N%20-2%20(1).pdf. Accessed 02.06.22

EEA (European Environmental Agency) (2021b). Greenhouse gas emissions from transport in Europe. https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport. Accessed 02.06.22

EEA (European Environmental Agency) (2022). Use of renewable energy for transport in Europe. https://www.eea.europa.eu/ims/use-of-renewable-energy-for. Accessed 02.02.22.

Egeberg, M. (ed.), 2006. *Multilevel Union administration: the transformation of executive politics in Europe.* Houndmills: Palgrave Macmillan.

Energi og Klima (2018). Elvestuen må rydde opp. 4 May 2018. https://energiogklima.no/meninger-og-analyse/debatt/biodrivstoff-elvestuen-ma-rydde-opp/. Accessed 17.06.2022

Energimyndigheten, 2018. Energiläget i siffror. https://www.energimyndigheten.se/nyhetsarkiv/2018/nu-finns-energilaget-i-siffror-20182/

Eurostat (2019). Renewables in transport. https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190222-1

Fevolden, A.M. & Klitkou, A. (2017). A fuel too far? Technology, innovation, and transition in failed biofuel development in Norway. *Energy Research & Social Science*s, 23, 125–235.

Finnish Government (2009). *Government Foresight Report on Long-term Climate and Energy Policy: Towards a Low-carbon Finland*. http://globaltrends.thedialogue.org/wp-content/uploads/2015/01/en1.pdf

Finnish Government (2010). *Finland's national action plan for promoting energy from renewable sources pursuant to to Directive 2009/28/EC*. http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans%0D

Finnish Government (2013). *Finnish National Energy and Climate Strategy*. https://tem.fi/documents/1410877/2769658/National+Energy+and+Climate+Strategy+2013/630dc2c6-4a23-4f2e-b304-3cd69daf8265/National+Energy+and+Climate+Strategy+2013.pdf

Finnish Government (2018). Proposal for change in biofuel law. https://www.finlex.fi/sv/esitykset/he/2018/20180199.pdf

Finnish Ministry of Employment and the Economy (2014). *Sustainable growth frobioeconomy: The Finnish Bioeconomy Strategy*. https://biotalous.fi/wp-content/uploads/2014/08/The_Finnish_Bioeconomy_Strategy_110620141.pdf

Flach, B., Lieberz, S., Lappin, J., & Bolla, S. (2018). *EU-28 Biofuels Annual 2018*. https://doi.org/GAIN Report Number:NL4025

Government of Sweden (2009). En sammanhållen klimat- och energipolitik – Prop. 2008/09:162, 11 March 2009.

Government of Sweden (2010). Swedish National Action Plan for the promotion of the use of renewable energy in accordance with Directive 2009/28/EC and the Commission Decision of 30.06.2009, https://www.buildup.eu/sites/default/files/content/national_renewable_energy_action_plan_sweden_en.pdf

Government of Sweden (2017). Ett klimapolitisk ramverk för Sverige. Prop. 2016/17:146. https://www.regeringen.se/rattsliga-dokument/proposition/2017/03/prop.-201617146/

Government of Sweden (2017b). Lagrådsremiss Reduktion av växthusgasutsläpp genom inblandning av biodrivmedel i bensin och dieselbränslen, Stockholm, 8 June. https://www.regeringen.se/49c8c5/contentassets/6de728c9ca7a4833b03481a9c09e86fb/lagradsremiss-reduktion-av-vaxthusgasutslapp-genom-inblandning-av-biodrivmedel-i-bensin-och-dieselbranslen.pdf

Gröna Bilister (2010). Press Release: Miljöbilsbästa parti 2010, http://www.gronabilister.se/press/pressmeddelanden/8/7-miljobilsbasta-parti-centerpartiet-och-miljopartiet-ba

Hedeler, B., Hellsmark, H., Söderholm, P. & Donner-Amnell, J. (2020). Dynamic between policy mixes and the emergence of sustainable value chains: Comparative perspectives from biofuel development in Finland and Sweden. Paper presented at the 2020 International Sustainability Transitions (IST) Conference, Vienna, 18–21 August

Hickel, J. & Kallis, G. (2019). Is Green Growth Possible? *New Political Economy*, DOI: 10.1080/13563467.2019.1598964

Holtsmark, B. (2017). Kostnader og utslipp av CO2 som følge av budsjettavtalen for 2017. Report 16, Statistics Norway.

IEA, 2018. Policies of IEA countries: Finland 2018 Review. Paris: International Energy Agency

Knill, C. (2001). *The Europeanisation of national administrations: patterns of institutional change and persistence.* Cambridge: Cambridge University Press.

Knill, C. & Lenschow, A. (1998). Coping with Europe: the impact of British and German administrations on the implementation of EU policy. *Journal of European Public Policy* 5(4), 595–614

Knill, C. & Lenschow, A. (eds) (2000). *Implementing EU environmental policy: new directions and old problems*. Manchester University Press.

Midttun, A; Næss, KM & Piccini, PB (2019) Biofuel policy and industrial transition? A Nordic perspective. *Energies*, 12(14) Doi: 10.3390/en12142740

Ministry of Climate and Environment (Norway) (2017). Public consultation. https://www.regjeringen.no/no/dokumenter/horing-av-endringer-i-produktforskriften/id2564514/

Ministry of Climate and Environment (Norway) (2018). Endring i produktforskriften om biodrivstoff. https://www.regjeringen.no/no/aktuelt/produktforskrift/id2620430/

Ministry of Petroleum and Energy, 2012. National Renewable Energy Action Plan under Directive 2009/28/EC: Norway. Oslo: Ministry of Petroleum and Energy.

NESTE. 2019. *Passion for renewal. Annual Report 2018*. http://ir-service.funkton.com/download/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgNDhr6ynCAw/Neste Annual Report 2018.pdf?action=open

Norwegian Environment Directorate, 2020. Biofuels. https://www.miljodirektoratet.no/ansvarsomrader/klima/fornybar-energi/biodrivstoff/

Norwegian White Paper, 2015. Revidert nasjonalbudsjett 2015. Meld. St. 41 (2016–2017). Oslo: Ministry of Finance

Norwegian White Paper, 2017. Klimastrategi for 2030 – norsk omstilling i europeisk samarbeid. Meld. St. 41 (2016–2017). Oslo: Ministry of Environment.

Norwegian White Paper, 2021. Klimaplan for 2021–2030. Meld. St. 13 (2020–2021). Oslo: Ministry of Environment.

Riksrevisjonen (Office of the Auditor General of Norway), 2018. Undersøkelse av myndighetenes satsning på bioenergi for å redusere utslipp av klimagasser. Oslo: Riksrevisjonen.

Sjölander, A.E., Ekerholm, H., Eklöf, J., Lång, H. & Mårald, E.(2011). *Motorspriten kommer! En historia om etanol och andra alternativa drivmedel*, Stockholm: Gidlunds Förlag.

Skjærseth, J,B. (2017). The European Commission's shifting climate leadership. *Global Environmental Politics,* 17(2), 84–104.

Skjærseth, J.B., Eikeland, P.O., Gulbrandsen, L.H. & Jevnaker, T. (2016). *Linking EU climate and energy policies: decision-making, implementation and reform.* Cheltenham: Edward Elgar.

SPBI, 2021, Andel förnybara drivmedel i transportsektorn, Svenska Petroleum & Biodrivmedel Institutet, https://spbi.se/statistik/andel-fornybart-i-transportsektorn

Stanford, J. (2020). Mel Watkins and the continuing evolution of staples theory. *Studies in Political Economy* 101(3), 280–287.

Statens Energimyndighet (Swedish Energy Agency) (2012). Analys av marknaderna för biodrivmedel - Aktuella marknadsfrågor för första och andra generationens biodrivmedel, ER 2012:29, Eskilstuna.

Thomann, E. 2015. Customizing Europe: transposition as bottom–up implementation. *Journal of European Public Policy*, 22 (10), 1368–1387. https://doi.org/10.1080/13501763.2015.1008554

Thomann, E. 2019. *Customized implementation of European Union food safety policy: United in diversity?* Cham: Palgrave Macmillan.

Treib, O. 2008. Implementing and complying with EU governance outputs. *Living Reviews in European Governance*, 3 (5), 1–30.

UPM. 2019. UPM Biofuels | UPM.COM. https://www.upm.com/businesses/upm-biofuels/

Wurzel, R.K.W., Liefferink, D. & Torney,D. (2020). *Pioneers, Leaders and Followers in Multilevel and Polycentric Climate Governance.* London: Routledge

Åhman, M, Skjærseth, J.B. & Eikeland,P.O. (2018). Demonstrating climate mitigation technologies: An early assessment of the NER 300 programme. *Energy Policy*, doi.org/10.1016/j.enpol.2018.02.032:100-107