

Sectoral expansion of the EU ETS

- A Nordic perspective on barriers and solutions to include new sectors in the EU ETS with special focus on road transport





Sectoral expansion of the EU ETS

- A Nordic perspective on barriers and solutions to include new sectors in the EU ETS with special focus on road transport

Bragadóttir Hrafnhildur, Magnusson Roland, Seppänen Sampo, Sundén David and Yliheljo Emilie

Sectoral expansion of the EU ETS
- A Nordic perspective on barriers and solutions to include new sectors in the EU ETS
with special focus on road transport

Bragadóttir Hrafnhildur, Magnusson Roland, Seppänen Sampo, Sundén David and Yliheljo Emilie

ISBN 978-92-893-4363-3 (PRINT)

ISBN 978-92-893-4364-0 (PDF)

ISBN 978-92-893-4365-7 (EPUB)

<http://dx.doi.org/10.6027/TN2015-574>

TemaNord 2015:574

ISSN 0908-6692

© Nordic Council of Ministers 2015

Layout: Hanne Lebech

Cover photo: Imageselect

Print: Rosendahls-Schultz Grafisk

Printed in Denmark



This publication has been published with financial support by the Nordic Council of Ministers. However, the contents of this publication do not necessarily reflect the views, policies or recommendations of the Nordic Council of Ministers.

www.norden.org/nordpub

Nordic co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland, and Åland.

Nordic co-operation has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

Nordic co-operation seeks to safeguard Nordic and regional interests and principles in the global community. Common Nordic values help the region solidify its position as one of the world's most innovative and competitive.

Nordic Council of Ministers

Ved Stranden 18

DK-1061 Copenhagen K

Phone (+45) 3396 0200

www.norden.org

Contents

Foreword.....	7
Executive summary.....	9
Expanding the sectoral scope of the trading scheme.....	9
Conclusions.....	11
Conclusions for the road transport sector.....	12
1. Introduction.....	15
1.1 The EU perspective.....	15
1.2 The Nordic perspective.....	16
1.3 The purpose of this report.....	18
2. Prospective candidates for inclusion.....	21
2.1 The EU perspective.....	21
2.2 The Nordic perspective.....	25
2.3 The sectoral perspective.....	37
2.4 Conclusions.....	47
3. Inclusion of road transport in the EU ETS.....	49
3.1 The EU perspective.....	49
3.2 The Nordic perspective.....	50
3.3 Main barriers to inclusion.....	58
3.4 Conclusions and extrapolation of the main barriers for road transport to other sectors.....	66
References.....	69
Sammanfattning.....	75

Foreword

With this report The Nordic Council of Ministers would like to contribute to the ongoing discussions on how the EU ETS ought to develop in the future. While several models for how an improved system better can meet its goals have been proposed, this report focuses on how the current scope of emissions within the system can be extended. This would mean including even more sectors to those already in the system. More specifically the report looks at the road transport sector, and analyses the opportunities for, and barriers to, its inclusion in the EU ETS.

The project has been commissioned by the working group Environment and Economy under the Nordic Council of Ministers (MEG).

The analysis carried out in this project is useful in several policy contexts, both with regards to domestic and EU-level policymaking. Moreover, the interests for this type of analysis have recently increased due to the new set of climate goals, 2030 framework for climate and energy policies, agreed upon by EU leaders in 2014.

A group of consultants led by GreenStream Network Ltd was chosen to write the report. Lakeville Economic Consulting and Environice assisted GreenStream. The authors of the report are responsible for the content as well as the recommendations which do not necessarily reflect the views and positions of the governments in the Nordic countries.

August 2015

Fredrik Granath

Chairman of the Working Group on Environment and Economy under the Nordic Council of Ministers

Executive summary

The purpose of the EU ETS from its commencement in 2005 was to enable the EU to meet its emission reduction targets in a cost efficient manner. The aim was to prepare the EU for international emissions trading in 2008 by learning-by-doing, creating a trading market with sufficient liquidity, and with a strong foundation of monitoring, reporting and verification procedures.

Although the system initially had a limited scope covering a limited number of sectors, the intention was to gradually extend the system. In 2008 Iceland, Liechtenstein and Norway chose to join the EU ETS. In 2012 aviation was included. Furthermore, in the beginning of the third trading period industries such as aluminium and, in part, the chemical industry were included, as well as nitrous oxide and perfluorocarbons.

Currently the EU ETS covers about 45% of the total CO₂e emissions both in the Nordic countries and in the EU. The emission reduction target within the trading system is 21% for the period 2005 to 2020. Most of the remaining emissions are covered by the Effort Sharing Decision (ESD) with binding emission reducing targets for each Member State. For the EU as a whole the target is 10%. For EU ETS and ESD combined, the target is 14% in the period 2005–2020, which is equivalent to 20% in the period 1990–2020.

Expanding the sectoral scope of the trading scheme

The scope of the EU ETS can be extended in two ways. Either at the community level, by amending the EU ETS Directive, or on Member State level, by an individual opt-in after approval through the comitology procedure. The criteria used by the Commission for assessing suitable sectors to include in EU ETS for the third trading period included, among others, significance of the emission source, the possibilities for monitoring, reporting and verification, and the proportionality of transaction costs. Similar criteria are used when approving unilateral inclusion of activities if individual Member States, installations and gases not listed in the ETS Directive.

Opportunities in expanding the sectoral scope

Expanding the sectoral coverage of the EU ETS implies a unified carbon price across sectors, which lays a foundation for increased cost efficiency. The potential of the cost efficiency increase in any given sector is reflected by the difference between the EU ETS carbon price and the carbon taxes of the given sector, assuming that inclusion entails a removal of the carbon tax. The average price in Sweden, Norway and Finland received by auctioning emissions allowances during 2013 was in the range of EUR 4 per tCO_{2e}. This can be compared to EUR 3 to 124 per tCO_{2e} in carbon taxes. The level depends on the country and the sector. The difference indicates significant possible cost efficiency gains from inclusion.

Barriers for expanding the sectoral scope

The barriers for inclusion have different sources. Firstly, there are a number of technical criteria that need to be fulfilled. These concern the legal framework and current environmental instruments used. This is especially important in the Nordic countries which have an extensive instrument mix that serve a multitude of policy goals.

Secondly, the fiscal aspects are very important since some sectors are subject to heavy taxation. Moving a sector into the EU ETS and changing the taxation in the sector may impair the fiscal budget, which in turn dictates an introduction of a revenue compensation mechanism or at least a fiscal impact assessment of including a sector in the EU ETS.

Thirdly, increased cost efficiency may also come with behavioural changes as relative prices change. This in turn may increase the toll on other parts of the environment such as emissions of co-pollutants.

The purpose of this report is to discuss these barriers in the context of four major sectors currently not included in the EU ETS: transport, heating, agriculture and fisheries, and waste. The discussion is expanded and deepened for the road transport sector, which is currently the largest emission source outside the EU ETS.

Conclusions

Size of emissions vary significantly between sectors

The heating, waste, and transport subsectors are relatively minor emitters of GHG, in the Nordic countries. Road transport and agriculture stands for almost 70% of emissions not included in the EU ETS. Therefore, an inclusion of either of them implies moving a substantial part of non-ETS emissions into the trading system.

Policy consistency is an issue in the transport and heating sector

The Commission has previously assessed the consistency of existing instruments with the EU ETS to evaluate whether a sector is appropriate for inclusion or not. Consistency with existing instruments is mainly a question of whether existing policy pricing carbon emissions distort the EU ETS price signal. Carbon pricing instruments are most prevalent in the transport and heating sector in the Nordic countries but less so in agriculture and fisheries, and the waste sector. For the transport sector, the risk of distortions is significant, due to the multitude of both carbon taxes and fiscally motivated tax instruments.

Source of emissions as the point of regulation is a legal barrier for sectors with a large amount of small emission sources

Emissions from the sectors currently covered by the EU ETS are regulated at the point of release to the atmosphere, pursuant to the principle of direct emissions. For transport or agriculture this implies that the individual vehicle or farm should be the subject of regulation. The costs associated with including a large amount small emission sources are significant, both for sources as well as the regulators. To address this, the Commission has considered an upstream regulation, where fuel distributors or vehicle producers could be the subject for regulation and compliance.

Monitoring, reporting and verification is significant challenge for agriculture

The MRV requirements are technically feasible both for transport and heating sector. The agriculture and fisheries sectors still lack a sufficient level of MRV. The complexity of MRV for the waste sector remains unsolved.

The fiscal barriers are relatively minor, except for road transport

The fiscal revenues from environmental taxation are significant in the Nordic countries, with the major part stemming from taxing the transport sector. Besides road transport the fiscal impact of including any of the other sectors in the EU ETS are minor.

Conclusions for the road transport sector

Risk for policy congestion in the road transport sector

The current policy space for reducing carbon dioxide emissions from road transport is occupied by three sets of instruments. The first set is mandatory EU fuel efficiency standards, the second set is individual countries' fixed vehicle taxation through registration fees and direct annual motor vehicle taxation, and the third set is national fuel taxation systems, which typically include carbon tax component. Introducing the EU ETS as a fourth set of instruments to this already crowded policy space will increase instrument congestion. The major issue concerns the Nordic countries' current high fuel tax rates and significant carbon components within these tax rates. There is a risk that these taxes may distort the EU ETS carbon price signal, and consequently reduce the cost efficiency of reducing GHG emissions.

Road transport MRV and up- or downstream regulation

Monitoring, reporting and verification (MRV) is not a direct barrier to including road transport in the EU ETS. However, given the large amount of small mobile emitters, the cost of imposing the EU ETS regulatory framework on the emitting vehicles or owners is disqualifying. This calls for necessary amendments to the EU ETS Directive for inclusion of upstream entities, i.e. entities higher up in the supply chain. Examples of

such upstream entities are fuel suppliers and vehicle producers. A national amendment allowing for an upstream point of regulation may be necessary should a Member State opt-in the road transport sector in the EU ETS. This is the approach of the Californian cap-and-trade system, where some sectors are regulated downstream and other upstream, e.g. chemical industry is regulated downstream, whereas in road transport is regulated upstream.

The fiscal budget is a major obstacle for including road transport

The inclusion of road transport in the EU ETS implies replacing carbon taxes with the pricing mechanism of the trading system. This opens up the possibility of higher cost efficiency in reaching the GHG emissions targets by allowing for transport emissions to be priced at market rates. Failure to remove the carbon taxes implies double carbon taxation and reduces the possibilities of reaping any cost efficiency benefits.

Replacing current taxes with auctioning of emissions allowances presents a serious fiscal problem. The total revenues collected from carbon taxes in the road transport sector are considerable in all Nordic countries, with tax rates spanning from EUR 13 per tCO₂e in Iceland to EUR 124 in Sweden. The average auctioning price in the Nordic countries was EUR 4 per tCO₂e in 2013.

There are at least three possibilities to alleviate the negative fiscal impact. Firstly, by increasing the share of emissions allowances auctioned for all sectors, will increase fiscal revenue, which will to some degree compensate for the income loss. Secondly, parts of the carbon taxes can be attributable to fiscal reasons and not to environmental concerns. This suggests that the carbon tax rate component, e.g. of the fuel tax, is set too high. Moving the fiscal part out of the carbon tax reduces the difference between the current EU ETS price and the effective carbon tax. This fiscal part of the carbon tax can still be levied. However, estimating the fiscal share of the carbon tax is not straightforward. Thirdly, a top up carbon tax above the market carbon price is justifiable, as such mechanism could be designed as a price-floor which guarantees a minimum tax rate irrespectively of the market price. By securing revenues from both auctioning of allowances and from the price floor mechanism the fiscal revenues can be upheld and guaranteed. The price floor can be applied to the whole scheme or just in one sector.

1. Introduction

The EU ETS commenced in 2005 and its purpose has been to allow for the EU to meet its international emission reduction targets in a cost efficient way (EC, 2003). The Commission opted for a learning-by-doing approach to prepare the Community for the start of international emissions trading under the Kyoto Protocol in 2008 (CEC, 2000, p. 10). To start with, the aim was to create the critical mass for a liquid trading market and establish the necessary monitoring, reporting and verification infrastructure. For this reason, the EU ETS Directive focused, like all successful applications of cap-and-trade systems in various environmental domains have done, mainly on large stationary sources and only on CO₂ emitters, while in principle the EU ETS Directive covers all greenhouse gases, see Annex II of the Directive (CEC, 2008, p. 32). The limited scope covering power generation and energy-intensive industrial sectors meant starting off with a small number of economic sectors but with significant emissions for which monitoring and verification of emissions was feasible. The intention was, however, for the system to be open for gradual geographical, sectoral and gas coverage extension (CEC, 2000, p. 10).

1.1 The EU perspective

Since the start in 2005, the scope of the EU ETS has been extended several times, both by the Community and unilaterally by Member States, through the so-called opt-in mechanism. Of the Nordic states, Finland and Sweden opted-in small installations in the heating sector below the set minimum threshold, already in the first trading period of the EU ETS.¹ Norway included gas nitrous oxide (N₂O) associated with production of nitric acid in 2009.

¹ In Finland district-heating plants with a capacity of 20 MW or less that operate in district-heating networks where one or more installation fall under the EU ETS are under the scope of the Finnish Emissions Trading Act. Sweden has opted-in installations having a rated thermal input below 20 MW but being connected to a district heating network with a total rated thermal input above 20 MW. Both Finland and Sweden started by opting-in separate installations in 2005 and 2004 respectively but the opt-in was extended to cover all installations fulfilling the criteria.

The first expansion of the coverage of the EU ETS took place during the second trading period. The geographical scope was extended when Iceland, Liechtenstein and Norway chose to join the EU ETS in 2008 and the sectoral scope was extended through inclusion of aviation in 2012. Aviation was seen as a large contributor to climate change, especially if the emissions would continue to increase. International aviation is not included in the scope of the Kyoto Protocol and the lack of legal implications from the growth of emissions from international aviation was seen to require actions. Emissions trading was considered the most cost efficient way of curbing emissions (CEC; 2006). International aviation has, however, as of 2013 been temporarily excluded from obligatory participation in the EU ETS following an agreement under the International Civil Aviation Organization in 2013 regarding the development of an international scheme covering emissions from international aviation. Currently only flights within the EEA are subject to the EU ETS.

The scope of the EU ETS was further extended in the beginning of the third trading period by inclusion of new industries, such as aluminium and, in part, the chemical industry, as well as two new gases, nitrous oxide and perfluorocarbons. The included sectors and gases constitute significant emission sources, which motivated their inclusion. In addition the monitoring, reporting and verification of the emissions from these sectors and gases was feasible and sufficiently accurate for inclusion in the ETS (EC, 2008b).

1.2 The Nordic perspective

In 2013, the EU ETS covered about 44% of total CO₂ equivalent emissions in the Nordic countries, which is in line with the EU level of 45%. The coverage varies between from 35% in Sweden to about 50% in Finland and Norway. Almost half of the Nordic emission allowances were auctioned in 2013. However, there is significant variation. Iceland allocated all allowances for free, whereas Denmark auctioned 66% of the allowances. In the EU, the measures for allocating free allowances were harmonised in 2013, which leaves no national discretion with respect to how many allowances to auction.

In Phase 3 of the EU ETS, which runs from 2013 to 2020, half of all allowances will be auctioned. Power producers in most Member States are required to acquire all of their emission allowances from auctions, while industrial manufacturers continue to receive the majority of allowances for free (80% in 2013). However, the share of free allocation to

industrial manufactures will reduce sequentially to 30% by 2020, leaving free allocation only for sectors subject to international competition (CEC, 2015a). According to the EC (2014a) free allocation will continue after 2020 to prevent the risk of carbon leakage, as long as no comparable efforts are undertaken in other major economies.

Table 1: CO₂e emissions and fiscal revenues from GHG emission reducing taxes and EU-ETS-auctions 2013

Country	EU-ETS sectors				Non-EU-ETS sectors	
	Emissions (2013) ¹ (MtCO ₂ e)	Auctioning (2013) ¹ (MtCO ₂ e)	Auctioning revenue (2013) ² (EUR million)	Revenues per tonne (in EUR per tCO ₂ e)	Emissions in (2012) ³ (in MtCO ₂ e)	Carbon tax (EUR per tCO ₂ e) ⁴
Denmark	21.6	14.2	56.1	4.0	30.0	22
Finland	31.5	17.2	67.0	3.9	29.5	60
Iceland	1.8	0	0	0	2.7	16
Norway	24.7	0	0	0	28.0	3–53
Sweden	20.1	9.2	35.7	3.9	37.5	124
Nordic countries	99.7	48.1	158.8	.	127.7	

Note: Because of technical delays in reporting greenhouse gas inventories to the UNFCCC, economy-wide GHG emissions data was not available for 2013 at the time of writing. Verified emissions from the EU ETS were available for 2013 at the time of writing. This report relies on a combination of 2012 and 2013 data. This is not optimal but using 2013 data for the EU ETS is essential because of changes to the scope of the EU ETS at the start of Phase 3.

Source: ¹ European Union Transaction Log (EUTL).

² EC (2014c) and Norwegian Ministry of Climate and Environment.

³ European Environment Agency (2015b).

⁴ Danish Ministry of Climate, Energy and Building. (2013), Finnish Ministry of the Environment and Statistics Finland (2013), Icelandic Ministry for the Environment and Natural Resources. (2014a), Norwegian Ministry of Climate and Environment. (2014), Swedish Ministry of the Environment. (2014).

In 2013 and 2014, the auctioning price varied between EUR 2.75–7.09 in EU's primary market auctions and the average auctioning revenue for the Nordic countries was approximately EUR 4 per tCO₂e; cf. Table 1 (EEX, 2015). The implementation of the Market Stability Reserve along with the 40% reduction target in EU greenhouse gas emissions by 2030 is likely to drive up the market price in the future. Current estimates of the price of allowances in 2020–2030 is in the range of EUR 17–53.²

² Based on estimates presented by the European Commission, Thomson Reuters and ICIS Tschach Solutions.

1.3 The purpose of this report

Expanding the sectoral coverage of the EU ETS poses both opportunities and threats, both for Nordic governments as well as individual companies. The opportunities materialise through a single CO₂ price, which is the same for all economic agents. A comparison of the Nordic countries shows that carbon taxes in the sectors outside the EU ETS varies between EUR 3 per tCO₂e in Norway for (natural gas in the manufacturing sector) to EUR 124 in Sweden. Replacing carbon taxes with the pricing mechanism of the EU ETS thus poses a significant possibility for increasing the cost-efficiency of emission reductions in the sector, even with the projected increase in allowance prices.

The threats are related to technical issues of inclusion in the existing EU ETS, the effects of inclusion on state budgets the effect of inclusion on the environment. This report discusses these issues in the context of four major sectors currently outside the scope of the EU ETS: transport, heating, agriculture and fisheries, and waste. The discussion is given depth by a detailed analysis of road transport.

The technical aspects concern the current setup and legal framework of how current policy instruments. For example, there are a number of economic instruments in place such as cross sectoral CO₂ taxes and annual vehicle taxes in the transport sector. In addition, the Nordic countries extensively use non-economic instruments, such as emission targets for new vehicles, reductions of GHG intensity of fuels, and life cycle CO₂ reduction targets in vehicle production. The technical aspects discussed herein involve the interaction of these instruments and their possible collision with the EU ETS.

The fiscal aspects concern the impact on central government revenues. Some of the sectors, especially road-transport, are subject to heavy taxation. The Nordic countries use different tax instruments, tax bases and tax rates to achieve these goals and not all of them are cast in terms of a direct CO₂ tax to reduce emissions. Depending on the setup, fiscal revenues may be at risk if the taxes are only replaced by income from auctioning allowances. The scope of the discussion of fiscal aspects is to analyse the effects of different combinations of taxation and emissions trading, i.e. possible compensation mechanisms to guarantee fiscal revenues, and draw from best practice of how reasonable fiscal neutrality can be achieved. There is no separate discussion on cost-efficiency because the fiscal considerations ultimately determine which taxes can or cannot be removed. The possible increase in cost

efficiency is thus dependent on the extent to which a sector can be exempted from current carbon taxes.

The environmental aspects go beyond the specific goal of the EU ETS to regulate emission of greenhouse gases and limit global warming. Including a sector in the trading system may have other dynamic effects on the environment and may intensify other environmental impacts e.g. particulate emissions or noise.

The EU legislative framework and future intentions are the basis for how individual Member States can opt-in, and add, new sectors to the EU-ETS. The EU requirements and issues for doing so are discussed in Section 2.1 for each of the four sectors. The Nordic countries all have different backgrounds and frameworks for regulating the four sectors within the EU regulatory framework. This implies different types of barriers depending on the country level. In Section 2.2 the country specific barriers are discussed. The technical, fiscal and environmental barriers and possibilities to overcome them are discussed sector by sector in Section 2.3.

The major part of emissions in the transport sector are from road transport, which has several specific barriers that need to be overcome before inclusion can be considered. The possibilities for including road transport in the ETS are analysed and discussed in Section 3.

Section 4 summaries and concludes the report.

2. Prospective candidates for inclusion

This section explores the possibilities for expanding the Nordic coverage of the EU ETS in the existing regulative framework, which is a combination of EU and national regulation. Subsection 2.1 discusses the EU perspective, specifically the process of expanding the EU ETS, the Effort Sharing Decision (ESD) and the EU-wide policies targeted at the non-ETS sectors. Subsection 2.2 discusses the Nordic perspective, specifically the national circumstances relevant for GHG emissions and their regulation, and the mix of instruments currently used to regulate the non-ETS sectors. Subsection 2.3 discusses barriers to inclusions of four major sectors currently outside the EU ETS: transport, heating, agriculture and fisheries, and the waste sector.

2.1 The EU perspective

GHG emissions from activities included in the EU ETS are regulated by a cap on aggregate emissions, while emissions from activities not included in the EU ETS are regulated by a mix of policy instruments, both on the EU and the national level. The framework for the reduction efforts in the non-ETS sectors is set by the Efforts Sharing Decision, which establishes binding GHG targets for Member States for the period 2013–2020. Norway and Iceland have not adapted specific targets for the non-ETS sectors. However, EU and Iceland have signed an agreement for the joint fulfilment of the second commitment period of the Kyoto Protocol (CEC, 2015h).

Table 2: Coverage of the EU ETS per Nordic country in 2013

Country	Emissions from ETS sectors in 2013 in MtCC2e ¹	Emissions from non ETS sectors in 2012 (in MtCO ₂) ²	Reduction target for the non-ETS sectors based on the ESD (between 2005 and 2020)
Denmark	21.6	30.0	-20%
Finland	31.5	29.5	-16%
Iceland	1.8	2.7	No separate target for the non-ETS sectors
Norway	24.7	28.0	No separate target for the non-ETS sectors
Sweden	20.1	37.5	-17%

Note: The ESD do not apply to the EEA-EFTA countries (i.e. Norway and Iceland). Iceland is expected to adopt a reduction target for non-ETS sectors in an agreement with the EU

Source: ¹ European Union Transaction Log (EUTL), ² European Environment Agency (2015b).

2.1.1 Mechanisms for extending the scope of the EU ETS

There are two ways in which the scope of the EU ETS can be extended. An amendment of the EU ETS Directive extends the scope in all countries belonging to the EU ETS, while an application of the opt-in clause extends the scope within individual Member States.

Currently, all activities, installations and gases subject to compliance obligations on a Community wide level are listed in Annex 1 of the EU ETS Directive and an extension of the sectoral scope is achieved by amending the Directive through inclusion of new activities in Annex 1. The MRV rules lay the foundation for the selection of which sectors can be included (CEC, 2008a, pp. 32–33). In connection with the revision of the scope of the EU ETS for Phase 3, the Commission stated that the ETS should cover emissions which can be monitored, reported and verified with the same level of accuracy as the emissions covered by the Directive already included in the EU ETS (CEC, 2008b, p. 4). When assessing the suitability of a sector to be included into the EU ETS the Commission assessed the effectiveness, efficiency and consistency of the different policy options for the sector in question. The screening was done using the following criteria:

- Significance of the emission source (mainly the share of the source in EU GHG emissions and trend of the sector in the EU i.e. is the sector in question a fast growing source that risk becoming significant in the future).
- Feasibility to monitor the emissions (i.e. achievable level of uncertainty, difficultness of data collection and difficultness of

defining installations boundaries to determine what belongs to the scope).

- Proportionality of transaction costs (e.g. number and size of emitters, administrative costs under the EU ETS for emitters³ and complexity of MRV).
- Interaction with existing policies and regulation.
- Compliance costs (abatement availability) (CEC, 2008a, pp. 35–36).

The other mechanism for extending the coverage is for individual Member States to unilaterally opt-in specific activities, sectors and gases (per and on initiative of Member States) under Article 24 of the ETS Directive. Individual Member States can apply for unilateral inclusion of activities, installations and gases not listed in Annex I of the ETS Directive and the inclusion is approved through the comitology procedure. The opt-in must fulfil similar criteria similar as those used by the Commission for extension of the coverage of the EU ETS. The Member States have to take into account relevant impacts of the inclusion of sectors or installations such as effects on the internal market, potential distortions of competition, the environmental integrity of the Community scheme and the reliability of the planned monitoring and reporting system.

Several Member States have applied opt-in mechanism. Both Finland and Sweden have a relatively large number of small installations with a capacity below the minimum threshold of 20 MW and has chosen to opt-in part some of these installations. Finland chose to opt-in district heat installations below the threshold to avoid a situation whereby the installation owners favour connecting several small installations to the district instead of large unit, in order to avoid compliance obligations under the EU ETS. This would potentially have increased the emissions from electricity and heating utilities (Government of Finland, 2004). In this case, the opt-in of installations below the threshold of the EU ETS Directive was therefore motivated by country specific circumstances to avoid distortions in the heating sector.

³ The administrative costs included costs incurred by operators and regulators for the establishment and operation of the system. They do not include compliance costs, defined as costs incurred when buying and selling allowances to surrender and fulfill compliance obligations.

2.1.2 The EU Effort Sharing Decision

The ESD establishes binding emission reduction targets for EU Member States for activities not covered by the EU ETS. The targets are defined as a percentage changes between 2005 and 2020. Cumulatively over Member States, these national targets amount to a reduction of 10%. Combined with the 21% reduction target for the EU ETS, the overall EU emission reduction target adds to 14%, relative to 2005, which is equivalent to a reduction of 20%, relative to 1990 (EC, 2009).

The responsibility for introducing policies to reduce emissions from the non-ETS sectors lies with the Member States (EC, 2009). However, for most non-ETS sectors, there are EU-wide policies that Member States are required to implement. A selection of EU-wide policies is presented in Table 3.

Table 3: EU wide policies per non-ETS sector

EU wide policies per non-ETS sector	
Cross-sectoral	The Energy Tax Directive Energy Tax Directive 2003/96/EC sets minimum for all energy products, including coal and coke, natural gas and electricity.
Transport	CO ₂ targets for new vehicles. A legal framework to reduce CO ₂ emissions from new light-duty vehicles. Fuel Quality Directive requires a 6% reduction in the greenhouse gas intensity of transport fuels by 2020, relative to the EU-average of life cycle greenhouse gas emissions per unit of energy from fossils fuels in 2010. EU Member States are required to ensure that relevant information is provided to consumers, including a label showing a car's fuel efficiency and CO ₂ emissions, 10% share of renewable energy in the transport sector by 2020.
Heating	The Energy Efficiency Directive obligates energy distributors or retail energy sales companies to achieve 1.5% energy savings per year through the implementation of energy efficiency measures. Under the Energy Performance Building Directive Member States are required to put together plans to increase the number of nearly zero-energy buildings. Ecodesign Directive require manufacturers to decrease the energy consumption of their products by establishing minimum energy efficiency standard. Energy Label Directive help consumers choose energy efficient product. The Renewable Energy Directive, which sets renewables targets for 2020 across the EU, is also reducing the emissions in heating sector.
Agriculture and fisheries	There are not so many EU wide policies in agriculture sector, which are specifically aimed to reduce the greenhouse gas emissions. However, there are multiple policies that results at climate mitigation actions, even the main purpose of the regulations actions is to deal with concerns on other environmental issues. For example Nitrates Directive reduces both nitrogen input and emissions of GHGs.
Waste	There are also multiple policy measures that are cutting the greenhouse gas emissions in the waste sector, even that the main purpose of the legislation is to deal with other environmental issues, e.g. Landfill Directive, which the Member States must fully implement by the end of 2016, Directive on waste (Directive 2006/12/EC), Waste Management Framework Directive (2008/98/EC), Packaging and packaging waste Directive (2005/20/EC).

Source: AEA (2012), European Commission Taxation and Customs Union (2015), CEC (2015b, 2015c, 2015d, 2015e, 2015f, 2015g).

2.2 The Nordic perspective

The Nordic countries are to a large extent a homogenous group of countries, but they differ in some aspects due to geographical location, access to and composition of natural resources. In addition, Nordic countries differ in how they have set up their regulatory framework for mitigating emissions. In this section, the country specific barriers for inclusion are assessed, the environmental instruments used and the differences in environmental policies.

2.2.1 Denmark

In comparison to Sweden and Norway, Denmark has insignificant access to hydro power. Until the 1980s Denmark's energy supply was almost entirely dependent on imports. Since 1997 Denmark has been self-sufficient with respect to energy supply due to extraction of oil and gas in the North Sea production (Danish Ministry of Climate, Energy and Building, 2013).

As in the other Nordic countries, except Iceland, the majority of GHG emissions from the Danish economy originate from the combustion of fossil fuels, which is responsible for approximately 76% of total emissions, excluding emissions from land use, land-use change and forestry (LULUCF) from the total emissions. Denmark is an integral part of the Nordic electricity market, with hydro power in Norway and Sweden as a backbone. As a result, there is significant inter-annual variation in Denmark's GHG emissions, with increased emissions in years with low precipitation in Norway and Sweden and vice versa (Danish Ministry of Climate, Energy and Building, 2013).

The second largest source of emissions is agriculture, responsible for 19% of total emissions, mainly in the form of emissions of methane and nitrous oxides. Denmark is relatively small and densely populated with a large share of the population living in cities (Danish Ministry of Climate, Energy and Building, 2013). Despite this, transport is responsible for 24% of total emissions, which is more than the 20% EU average. The waste sector is responsible for 2% of total GHG emissions, which is expected to decrease as a result of the obligation to incinerate combustible waste (Danish Ministry of Climate, Energy and Building, 2013).

Less than half, 42%, of total GHG emissions are included in the EU ETS. Denmark's target under the ESD is to reduce emissions in the non-ETS sectors by 20% relative to the 2005 levels. The mix of non-economic and economic instruments used to achieve this target is reported in Table 4.

Table 4: Main policy instruments in Denmark for reducing GHG emissions in the non-ETS sectors

Sector	Economic instruments	Non-economic instruments
Cross-sectoral	Energy tax on fuels and electricity, including road transport fuels. CO ₂ tax (on top of the energy tax).	Energy Efficiency Action Plan (as require by the EU). Campaigns targeted at increasing public awareness about energy efficiency.
Transport	Motor vehicle registration tax. Motor vehicle weight tax. Duty on motor vehicle compulsory insurance.	Labelling of passenger cars based on energy consumption CO ₂ emissions. Provision of better public transport (by strengthening the railway system).
Heating	Feed-in-tariffs for onshore and offshore wind power.	Heat Supply Act (a ban on electric heating in buildings that are located within a district heating or natural gas supply network). Implementation of the EU Energy Performance of Buildings Directive (EPBD) which contains a range of requirements (labelling, certification, etc.).
Agriculture and fisheries		Action Plan for Joint Biogas Plants and subsequent follow-up programmes. Measures that primarily target other environmental effects, e.g. reduction of nitrogen run-off, but reduce GHG as a co-benefit.
Waste		Municipal obligation to assign combustible waste to incineration, in force since 1997.

Source: Bragadóttir *et al.* (2014), Landis *et al.* (2012) and Danish Ministry of Climate, Energy and Building (2013).

The most significant economic instruments are the energy tax introduced in 1977 and the CO₂ tax introduced in 1992. Initially, the energy tax was levied only on oil products but as of 1982 it has been levied also on coal and as of 1996 on natural gas. The CO₂ tax was levied in 1992 on top of the existing energy taxes. Sectors included in the EU ETS are exempt from paying the CO₂ tax. The tax base of both instruments is the amount of fuel, in terms of weight, volume or energy content (Bragadóttir *et al.*, 2014).

In the agriculture and fisheries and waste sector the policy objectives are driven by other environmental concerns than those related to global warming. These objectives include reducing the nitrogen and phosphorous losses from agriculture, and thus eutrophication and oxygen deficits in the coastal waters, and reducing the amount of waste through recycling, and thus negative environmental effects of landfills.

Denmark has not applied the opt-in provision, and has not like Finland and Sweden opted-in small installations within a single district heating network. 80% of the district heat is co-produced with electricity,

making the Danish heat and electricity system the most extensive co-generated one in the EU (Landis *et al.*, 2012).

One challenge for Denmark for opting-in other sectors, especially the transport sector, is the cross sectoral energy and CO₂ tax. Not only is the CO₂ tax levied on top of the energy tax, but the energy and the CO₂ tax are based on the amount of fuel (in volume, weight or energy content) and not on CO₂ content. The political ambitions of this set up may be hard to uphold, with targeted tax rates on different energy sources setting the relative price between different energy sources. Including a sector into the EU ETS with a goal of keeping the relative tax rates between energy sources constant and guaranteeing the size of environmental tax revenues would be a difficult task.

2.2.2 Finland

The ESD sets a 16% reduction target for Finland between 2005 and 2020. According to the baseline scenario of the National Energy and Climate Strategy, Finland will largely meet the target, set by the EU for 2020. However, achieving EU's low-carbon objective for 2050 requires a switch to a more ambitious development path from the baseline scenario (Government of Finland, 2013).

National circumstances; cold climate, long distances and energy-intensive industries, all contribute to the high emissions volumes of the energy sector. The energy sector's share (including transport) of the total greenhouse gas emissions has been around 80% in recent years. However, the CO₂ emissions per total primary energy unit are lower than in many other European countries due to the high share of non-fossil energy sources in power and heat generation (Finnish Ministry of the Environment and Statistics Finland, 2013). The transport sector amounted to 20.8% of total greenhouse gas emissions in 2012, of which road transport was 88.6%. The total number of freight tonne-kilometres in Finland is almost double the EU average. The biggest source of CO₂ emissions from households and the public and service sectors is indoor heating. A significant share of indoor heating in Finland relies on district heating, which is already included in the EU ETS. Emissions from the agricultural sector corresponded to 9.3% and emissions from waste sector to 3.3% of the total greenhouse gas emissions in 2012 (Finnish Ministry of the Environment and Statistics Finland, 2013).

The general objective of Finland's energy policy is to ensure energy security at competitive prices with the lowest possible environmental impacts. The domestic measures to cut greenhouse gases in the non-

ETS sectors focus mainly on transport and heating and the policy tools vary from economic instruments such as investment grants, taxation, feed-in-tariffs to non-economic instruments such as energy efficiency measures and quota obligations. In the waste and agriculture sectors the policy instruments are driven by environmental concerns other than global warming.

Table 5: Main policy instruments in Finland for reducing GHG emissions in the non-ETS sectors

Sector	Economic instruments	Non-economic instruments
Cross-sectoral	Excise taxes based on energy content and CO ₂ emissions of the fuel.	
Transport	Motor vehicles in Finland are charged with both a one-time registration tax and an annual tax based on CO ₂ emissions.	Finland has nationally increased its quota to 20% of energy used in the transport sector to be from renewable sources by 2020. The energy efficiency agreements with operators both of goods and public transport. Providing information to consumers about the CO ₂ emissions of passenger cars. Training in eco-driving has been provided to bus and coach drivers.
Heating	Grants for investments in RES production facilities and research projects related to it. Grants for different research purposes and promote different energy efficiency measures. Feed-in tariffs for renewable energy production. The energy grants for residential buildings cover up to 15–25% of the costs of energy audits, energy consumption reducing repairs etc. Interest subsidy system promoting loans for renovations that improve energy efficiency.	Energy efficiency agreements: a voluntary scheme for industry and municipalities. The Energy Audit Programme to analyse the energy use of the facility being audited. Building codes and regulations for new and existing buildings. Information provision and the campaigns to influence the behaviour of building users and owners.
Agriculture and fisheries	Agri-environment payment program: the long-term cultivation of grass on organic soils.	The support for rural development to increase the proportion of grass crops on organic soils is also reducing the GHG-emissions.
Waste	The purpose of the Waste Tax Act is to collect tax from those waste fractions that could be technically and environmentally recovered but are currently being disposed in landfill sites.	Restrictions on the landfilling of biodegradable municipal waste. Legislation, which contributes to greenhouse gas reductions as well are largely based on the EU's Landfill Directive, the Waste Directive and most recently, the Waste Framework Directive Restrictions on the landfilling of biodegradable municipal waste.

Source: Finnish Ministry of the Environment and Statistics Finland. (2013), Government of Finland (2013b), European Environment Agency. (2015a).

One of the major barriers for inclusion of the non-ETS sectors in the ETS in Finland is the fiscal revenues generated by environment taxes, which account for 6.5% of the tax revenue. The concern is of special importance in the transport sector, which covers over 79% of the entire environmental tax revenues. The taxation of transport fuels (motor gasoline and diesel oil) accounted altogether for EUR 2.3 billion in terms of revenues in 2013 and other vehicle related taxes for EUR 1.8 billion. Another important environmental based tax revenue source is the other energy products with total tax revenue of EUR 1.6 billion. Part of that revenue comes from the excise duties on heating fuels (Statistics Finland, 2013b).

Many of the activities in the non-ETS sector generate also have environmental effect not related to global warming, which unlike the global CO₂ emissions have local and regional scope. For example, the transport sector accounted for nearly half of the nitrogen oxide emissions and one-fourth of the carbon dioxide emissions in 2011. Another example is the agriculture sector, wherein livestock farming accounts for about 40% of the total methane emissions. In addition to greenhouse gas emissions, the nitrogen and phosphorus emissions from the agriculture sector cause eutrophication (Statistics Finland, 2013a). Possible changes in current policy instruments and measures may increase local environmental damages.

2.2.3 Iceland

The abundance of renewable energy and the isolation of the Icelandic energy network make the GHG emissions profile in Iceland unusual compared to the other Nordic countries. Around 76% of the country's total energy consumption is based on renewable resources and nearly all space heating utilizes geothermal hot water (Icelandic Ministry for the Environment and Natural Resources, 2014a, p. 71). Domestic electricity production relies solely on renewable sources; 73% are generated with hydroelectric power and 27% with geothermal energy (Icelandic Ministry for the Environment and Natural Resources, 2014a, pp. 47). Unlike most countries, there is thus little need for mitigation efforts in the heating and energy sector and, as a consequence, governmental actions have almost entirely focused on other sectors (Icelandic Ministry for the Environment and Natural Resources, 2010).

The largest share of GHG emission in Iceland comes from industrial processes, accounting for approximately 42% of the total emissions (Environment Agency of Iceland, 2014, p. 30). All energy generated in Iceland is used domestically, and a substantial part of it, about 75%, is con-

sumed by a small number of heavy-industry installations (Environment Agency of Iceland, 2014, p. 47). These installations, three large aluminium smelters and one ferrosilicon plant were included in the EU ETS in 2013 (Icelandic Ministry for the Environment and Natural Resources, 2014a, p. 69).

The remainder, i.e. emissions that fall outside the scope of the EU ETS, are expected to be covered by an agreement between the EU and Iceland on joint fulfilment in the second commitment period of the Kyoto Protocol (CEC, 2015g). Iceland is not bound by EU's ESD but has instead agreed to an emission target for sectors outside the scope of the EU ETS, based on criteria comparable to those that were used to calculate national targets under the ESD (Icelandic Ministry for the Environment and Natural Resources, 2014b).

In 2007 the Icelandic government defined a long-term aspirational goal of reducing net emissions of greenhouse gases by 50–75% by 2050 compared to 1990 levels (Icelandic Ministry for the Environment and Natural Resources, 2007). In order to reach that goal, as well as to keep emission within the target defined by international obligations, the government adopted a Climate Change Action Plan in 2010. The Action Plan, which is reviewed annually by a special committee, focuses on ten key actions to reduce emissions from major sources. These actions include carbon tax, changes in the tax system to encourage the use of low-carbon fuels and cars that use such fuels, environmental procurement procedures, measures to strengthen public transportation, promotion of use of biofuels in fisheries, electrification of fishmeal factories, increased afforestation and re-vegetation and restoration of drained wetlands (Icelandic Ministry for the Environment and Natural Resources, 2010).

As Icelandic heavy industry is now subject to the centralized control of the EU ETS, the main focus in terms of regulatory activities to curb emissions has been on the second largest contributor, transportation, which accounts for about 19% of the total emissions (Environment Agency of Iceland, 2014). Economic incentives have increasingly been adopted in recent years to promote the use of renewable energy in transportation, such as excise duties and taxes based on CO₂ emission and tax exemptions and reductions for climate-friendly vehicles and fuels. In addition, legislation from 2013 requires at least 5% of fuels for road transport to be of renewable origin from 1st January 2015 (Althingi, 2013).

Examples of instruments to control emissions outside the scope of EU ETS are given in Table 6.

Table 6: Main policy instruments in Iceland for reducing GHG emissions outside the EU ETS

Sector	Economic instruments	Non-economic instruments
Cross-sectoral	Carbon tax.	Periodical revision of the government's action plan. Environmental assessment of public plans and programs. Legislation to control the use of fluorinated GHGs.
Transport	Excise duty on vehicles based on CO ₂ emissions. Car tax based on CO ₂ emissions. Lowered excise duty and car tax on methane vehicles. No VAT on zero-emission vehicles (with a cap). Non-fossil fuels exempt from a levy on fuels.	Requirement of 5.0% biofuels of fuel consumption in road transport. Official procurement of low-carbon and fuel efficient vehicles. Increased share of public transport, walking and bicycling.
Heating	Energy tax.	
Agriculture and fisheries		Measures to increase the use of electricity in the fishmeal industry. Research grants on energy-shift in shipping.
Waste		National plan for waste management. Measures to reduce organic waste destined for landfills. Measures to collect and use landfill gases.

Source: Icelandic Ministry for the Environment and Natural Resources (2014a).

The possibility of opting-in new sectors in the EU ETS has not been publicly addressed by the Icelandic government. In addition to the more typical technical and fiscal barriers the main foreseeable problems of opting-in new sectors in Iceland are the limited resources of government agencies and the small scope of the economy, which can lead to high administrative costs per each participant in the system. Another important factor is that annual reports of the special committee which annually reviews the Climate Change Action Plan show that Iceland is well on track to meet its current emission targets. Opting-in new sectors in the EU ETS is thus unlikely to gain political support in the near future.

2.2.4 Norway

Norway's climate and economy is to a large degree influenced by its position by the Atlantic Ocean, with a relatively warmer climate than the latitude would otherwise dictate, and an abundant access to natural resources such as hydro-power, fish and off-shore oil. Harvesting these resources has clear impacts on the Norwegian energy mix, exports, and

the environmental impact in the form of emissions, as well as on the use of GHG emission reducing instruments.

The access to oil in the North Sea has led to a rapid increase of emissions in the petroleum sector, and the petroleum activities is the largest source of emissions in Norway and responsible for almost one third of the total GHG emissions. On the other hand, nearly all electricity production is from hydro-power. A large proportion of the generated electricity is used for heating of buildings and water. The electricity intensive industries, consisting among others of metal, chemical and fertiliser producers, consume large amounts of electricity, part of which is used for heating. The decentralised nature of Norway's population centres and long travel distances, in combination with large exports of goods and extraction of natural resources, makes transport the second largest emitting sector, with approximately 28% of total GHG emissions (Norwegian Ministry of Climate and Environment, 2014).

To reach the ambitious goal in 2020 of cutting emissions of GHG to 30% of the level in 1990, Norway relies heavily on two general instruments: the EU ETS and the CO₂-tax. Almost 50% of emissions are covered by emissions trading as of 2013 when the system was extended to cover new sectors and gases. In total more than 80% of Norway's emissions are covered by emission allowances, a CO₂ tax, or both (Norwegian Ministry of Climate and Environment, 2014).

The carbon tax is an important measure to cost effectively reduce emissions in Norway and is differentiated based on energy products and usage. About 60% of all GHG emissions are subject to the tax and some sectors, such as the petroleum sector, are covered by both the EU ETS and the CO₂ tax. In total the CO₂ tax on mineral products and on petroleum activities represents about 10% of the total environmental fiscal revenues in 2012, but only 0.5% of total fiscal revenues (Norwegian Ministry of Climate and Environment, 2014).

In addition to the CO₂ tax, emissions are regulated by the Pollution Control Act. The Pollution Control Act is a general pollution prohibition except for actors granted a permission to pollute. The Act also applies to GHG emissions.

Table 7: Main policy instruments in Norway for reducing GHG emissions in non-ETS sectors

Sector	Economic instruments	Non-economic instruments
Cross-sectoral	Differentiated CO ₂ tax. Tax and recycling schemes on HFCs.	Regulation by the pollution control act.
Transport	CO ₂ -dependent registration tax for new passenger cars. Tax exemptions for electric and hybrid cars and EU emission standards for passenger cars. Road usage tax on auto diesel and on petrol. Motor vehicle registration tax. Annual tax on motor vehicles. Annual weight-based tax on motor vehicles. Subsidised public transport.	Requirement of 3.5% bio fuels of fuel consumption in road transport.
Heating	Basic tax on mineral oil. Electricity consumption tax. Electricity certificates system.	
Agriculture and fisheries	Regional agri-environmental programme. Strategy for biogas.	Regional agri-environmental programme.
Waste	Basic tax on disposable packaging. Product tax on beverage containers. Tax on the final treatment of waste.	Requirement to collect landfill gas. Prohibition of depositing waste. Agreement with industry to minimise waste. Measures to increase waste recycling.

Source: Bragadóttir *et al.* (2014), Norwegian Ministry of Climate and Environment (2014).

To reduce emissions further the Norwegian government also applies sector specific instruments, shown in Table 7. Economic measures in the transport sector are prevalent, such as the motor vehicle registration tax, which generates close to 30% of the tax revenue from environmental taxes. Other taxes that apply to the road transport sector are an annual tax on motor vehicles and a road usage tax on diesel.

Norway has a substantial number of economic instruments in place in the transport sector, which generate more than 3% of total fiscal revenue. Removing these taxes altogether by opting-in the transport sector into the EU ETS constitutes a significant fiscal challenge. Even if some of the taxes are kept, but with a lower rate, the many different taxes with different tax bases may complicate matters and skew the incentives away from promoting the politically set targets in the road transport sector.

2.2.5 Sweden

The Swedish industry is characterized by an abundance of natural resources such as forests and iron ore. The processing of raw materials in the forest, iron and steel industries demands access to a continuous and high supply of energy. It follows that the processing and the energy use in Swedish industry represents a large share of Sweden's GHG emissions. Sweden's geographical location and size also has an impact, and transport of exported final goods as well as personal road transport adds a significant share to total emissions.

Sweden's energy supply is based on domestic biofuels and hydro-power, complemented with imports of uranium, oil, natural gas, coal and biofuels. The actual energy mix is dependent on winter weather conditions as well as the economic situation. As an example, district heating accounts for more than 90% of the energy use for heating in multidwelling buildings. District heating is mainly based on biofuels, complemented by fossil fuels during winters, making district heating a major GHG emitter, especially during cold winters (Swedish Ministry of the Environment, 2014).

Industrial processes in Sweden are almost entirely covered by the EU ETS; approximately 80% of emissions within the trading system originate from industrial plants. The rest originates from power and district heating installations. In 2013, the EU ETS covered around 36% of Sweden's total GHG emissions. The remainder, based on activities falling outside the scope of EU ETS, originates from the transport sector (approximately 50% of total CO_{2e} emissions outside EU ETS), the agricultural sector (approx. 20%), and mobile machinery (approx. 10%).⁴

To reduce emissions in sectors outside the EU ETS, Sweden has adopted a more ambitious target than its commitment under the ESD, calling for a 40% reduction in emissions by 2020 compared with 1990. Other priorities are a fossil fuels independent vehicle fleet by 2030, and a vision of no net emissions of GHG by 2050. To reach the targets and reduce emissions Sweden relies on a taxation system, with a mix of taxes, on e.g. energy, CO₂, nuclear power and consumption of electricity, and a range of supplementary economic and non-economic instruments. Two of the main economic instruments are the energy tax and the carbon tax.

⁴ Calculations based on Swedish Ministry of the Environment (2014).

The energy tax consists of a tax on fossil fuels and a tax on electricity consumption. The tax levied on fossil fuels is differentiated by dividing products into environmental classes, and by taking account of the use of the fuel. The energy tax is an important source of fiscal revenues for the Swedish Government, but is increasingly also used to reduce energy consumption and increase energy efficiency. The fiscal revenues based on the energy tax amounted to SEK 41 billion (EUR 4.7 billion) in 2013, or just above 5% of total central government tax income (Swedish National Financial Management Authority, 2014).

The carbon tax is levied on energy use, and is basically set as a price on emissions from fossil fuels, with some sectoral and fuel exemptions, e.g. agriculture and forestry or peat. The objective is to achieve cost-effective reductions of CO₂ emissions. Industries within the EU ETS do not pay any CO₂ tax. The tax collected amounted to SEK 24 billion (EUR 2.8 billion) in 2013, or just above 3% of total central government income. Combined, the energy and carbon taxes represents a share of more than 8% of total fiscal revenues in 2013, which shows their importance as source of income government.

There are a number of cross-sectoral instruments in use to supplement the energy and carbon taxes. Research and development is one major economic cross-sectional instrument aimed at improving the conditions for reduced emissions in the long term. Climate and energy advice is used as an informational instrument to disseminate facts about climate issues, the problems and solutions, and on sharing Swedish experience internationally. The Planning and Building Act and the Environmental Code are the legal instruments in place with the purpose of promoting an ecological sustainable development of the society. Table 8 summarises the main policy instruments used in Sweden to reduce GHG emissions outside the EU ETS.

Table 8: Main policy instruments in Sweden for reducing GHG emissions outside the EU ETS

Sector	Economic instruments	Non-economic instruments
Cross-sectoral	CO ₂ tax. Energy tax. Research and development.	Climate and energy advice. Planning and building act. Environmental code.
Transport	Support for research and demonstration. CO ₂ based motor vehicle tax. Incentives for green vehicles. Increased energy tax on diesel. Targeted instruments to promote introduction of renewable transport fuels. Congestion taxes. Subsidised public transport.	Emission standards for new vehicles.
Heating	Electricity certificates system. Special support for wind power. Central government support for installation of solar cells.	
Agriculture and fisheries	Support for biogas. Targeted agri-environment payments under Rural Development Programme.	Sustainable cities support. Ecolabelling.
Waste	Landfill tax.	Rules on municipal waste planning and on producer responsibility for certain products. Ban on disposal of burnable and organic waste.

Source: Bragadóttir *et al.* (2014), Swedish Ministry of the Environment (2014).

The possibilities of significantly increasing the coverage of the EU ETS in Sweden by opting-in new sectors depends on very much on the transport and the agricultural sectors, which represent approximately 70% of GHG emissions outside the EU ETS.

Opting-in the transport sector would require an overall review of all economic instruments, both cross-sectional and sector specific, in order to understand and assess the fiscal impact of a new regulatory set up for taxing the sector. Not adjusting the taxes as a result of inclusion will put cost-efficiency at risk. Removing both the tax on carbon and energy for the sake of inclusion will on the other hand seriously threaten the fiscal budget balance. The risk of not finding a way to neutralise the fiscal effects of opting-in transportation, combined with the complexities of the many other economic instruments used in the transport sector, constitutes a major barrier that needs to be addressed. This also holds true for the other sectors, but only to a lesser extent, where the cross sectional energy tax and carbon tax may complicate how the sectors may be included in the EU ETS.

2.3 The sectoral perspective

This subsection discusses barriers for inclusion of the main non-ETS sectors in the Nordic context.

2.3.1 Emissions and fiscal revenues

When assessing suitability for inclusion of sectors into the EU ETS the Commission has used the significance of the source as one of the screening criteria. The EU ETS covers around 44% of total emissions in the Nordic countries, as shown in Table 9. In Sweden 35% of emissions are covered by the EU ETS, compared with 52% in Finland.

In total, environmental taxes collected in the Nordic countries amounted to approximately EUR 35 billion in 2012, many of which are targeted at the road transport (Bragadóttir *et al.*, 2014). Besides the sector specific instruments there are significant cross sectoral instruments such as carbon and energy taxes. The revenues from the cross sectoral taxes are difficult to subdivide per sector. However, a large share of the revenue from the cross sectoral taxes can be attributed to the transport sector.

Table 9: CO₂e emissions outside the EU ETS per sector 2012/2013 in MtCO₂e

Country	Transport	Heating	Agriculture & fisheries	Waste	Other sectors	Non-EU ETS emissions	Total emissions excl. LULUCF
Denmark	12.2	3.1	9.6	1.1	4.0	30.0	51.6
Finland (2012) ²	12.7	2.7	5.7	2.1	6.3	29.5	61.0
Iceland	0.9	0.0	0.7	0.2	1.0	2.7	4.5
Norway	15.2	1.2	4.5	1.2	6.0	28.0	52.7
Sweden ¹ (2012)	19.1	1.6	7.6	1.6	7.5	37.5	57.6
Nordic countries	60.0	8.6	28.1	6.1	24.8	127.7	227.4

Note: Here the emissions from heating are equal to the sum of IPCC categories “1.A.4.A. Commercial/Institutional” and “1.A.4.B. Residential” and, thus, excludes among others, emissions attributable to district heating (not part of the EU ETS) and the use of heating fuels in agriculture. Actual emissions from heating are thus larger than presented here. Complete data is available only for Finland and Sweden. However, for comparability, only the sum of the IPCC categories 1.A.4.A. and 1.A.4.B. are presented here.

Source: European Environment Agency (2015b).

Transport sector

Of the sectors currently not included in the EU ETS, transport is the largest. It stands for approximately 26% of total emissions in the Nordic countries.⁵ The share is higher than the EU average of 20% (see Table 10). Within the transport sector, road transport is by far the largest contributor with a share of 85%. Emissions from rail transport and domestic sea transport are insignificant, with the exception of higher levels in the Norwegian domestic sea transport due to offshore oil and gas extraction industry (Norwegian Environment Agency, 2014).

Table 10: Transport sector emissions in 2012 in MtCO₂

Nordic country	Civil aviation (incl. in the EU ETS)	Road transportation	Railways	Navigation	Other transportation	Sum (relative to total emissions excl. LULUCF)
Denmark	0.1	11.4	0.3	0.5	0.0	12.2 (23.7%)
Finland	0.2	11.2	0.1	0.5	0.6	12.7 (20.8%)
Iceland	0.0	0.8	0.0	0.0	0.0	0.9 (19.1%)
Norway	1.2	10.1	0.0	2.0	1.8	15.2 (28.8%)
Sweden	0.5	17.9	0.1	0.3	0.3	19.1 (33.2%)
Nordic countries	2.1	51.4	0.5	3.3	2.7	60.1 (26.4%)

Note: In EU-28, 19.6% of total emissions are attributable to transport. Fuels consumed for international transportation are reported separately and excluded from national total (UNFCCC, 1998).

Source: European Environment Agency (2015b).

In addition to being a very significant source of emissions, the transport sector is a very significant source of tax revenue. On the Nordic level, EUR 17 billion was collected in environmental taxes in 2012 by sector specific fees and taxes such as motor vehicle registration taxes, different kinds of vehicle taxes and road usage fees (OECD, 2014). This type of taxes and excises on petrol and diesel are on top of the list of every Nordic country in the ranking of most revenue generating taxes motivated by environmental concerns (OECD, 2014). This excludes some of the more significant cross sectoral tax instruments used in the Nordic countries such as the carbon tax and the energy tax especially levied on fossil fuels like petrol and diesel in the road transport sector.

⁵ Excluding LULUCF.

Heating sector

Emissions from heating not included in the EU ETS represents 4% of total emissions in the Nordic countries. The emissions from Finland and Sweden not covered by the ETS would be larger if Finland and Sweden had not opted-in small combustion installations connected to a district heating network. There is no data publicly available that states how large the sector specific environmental tax revenues are from the heating sector.

Agriculture and fisheries sector

The emissions from agriculture represent 12% of total emissions in the Nordic countries, as shown in Table 11. A large share of these, 54%, originates from the breakdown of organic materials in agricultural soils, 33% from the digestive processes of livestock and the remaining 12% from methane and nitrous oxide emissions from manure. Denmark is the largest agricultural emitter despite the countries limited size. In total the sector specific environmental taxes amounted to approximately EUR 150 million in 2012.

Table 11: Emissions from agriculture in 2012 in MtCO_{2e}

Nordic country	Enteric fermentation	Manure management	Agricultural soils	Sum (relative to total emissions) ¹
Denmark	2.9	1.7	5.0	9.6 (18.6%)
Finland	1.5	0.7	3.5	5.7 (9.4%)
Iceland	0.2	0.1	0.4	0.7 (1.2%)
Norway	2.0	0.3	2.1	4.5 (8.5%)
Sweden	2.5	0.8	4.3	7.6 (13.3%)
Nordic countries	9.3	3.5	15.3	28.1 (12.4%)

Note: Excluding LULUCF.

Source: European Environment Agency (2015b).

Waste sector

The GHG emissions from the waste sector represent 3% of total emissions in 2012. Most part of the emissions originates from solid waste disposal, as shown in Table 12. Emissions from solid waste disposal has seen, and is still experiencing, a significant reduction due to non-GHG related measures such as the EU Landfill Directive, national waste management plans and landfill taxes. Since 2000, the emissions have decreased with 40% (European Environment Agency, 2015b). The efficiency of the instruments already in place can be expected to drive down emissions in the sector in the future and thus reducing the need for including the sector in the EU ETS.

The waste sector specific environmental taxes amounted to almost EUR 2 billion in 2012 for the Nordic countries in total (OECD, 2014).

Table 12: Emissions from waste sector in 2012 in MtCO₂e

Nordic country	Solid waste disposal on land	Wastewater handling	Waste incineration	Other	Sum (% relative to total emissions) ¹
Denmark	0.7	0.1	0.0	0.2	1.1 (2.1%)
Finland	1.7	0.2	0.0	0.1	2.1 (3.4%)
Iceland	0.2	0.0	0.0	0.0	0.2 (4.1%)
Norway	1.0	0.2	0.0	0.0	1.2 (2.3%)
Sweden	1.1	0.5	0.1	0.0	1.6 (2.8%)
Nordic countries	4.7	1.0	0.1	0.4	6.1 (2.7%)

Note: Excluding LULUCF.

Source: European Environment Agency (2015b).

2.3.2 Consistency with existing policies and regulation

When extending the EU ETS the Commission has previously used the consistency of the existing instruments with the EU ETS to conclude whether a sector is appropriate for inclusion or not. Existing instruments may distort the prices set by the EU ETS and, as a consequence, reduce its efficiency.

Transport

Emissions from road transport are regulated with a wide spectrum of policy instruments both on the EU level and the national level. The current policy instruments are both economic (such as CO₂ taxes) and non-economic (such as CO₂ standards for new vehicles). Many of these are set by the EU, like the fuel efficiency standards for new cars. The Commission has previously concluded that the consistency between these instruments and the EU ETS require a thorough analysis before a possible extension of the EU ETS to the road transport (CEC, 2008a, pp. 53–55). However, it was not concluded that the existing policies would entirely prevent the inclusion of the road transport into the scheme. The interaction and consistency between the EU ETS of the existing policies and regulatory measures governing the road transport will be further discussed in Section 3.

Heating

Like transport fuels, heating fuels are subject to taxation in all Nordic countries and other policies that reduce the fuel demand, e.g. energy efficiency standards for new buildings. Unlike transport, part of the heat-

ing sectors is already included in the EU ETS. Large stationary combustion installations with a capacity over 20 MW are included and some of the smaller installations through an application of the opt-in procedure. Thus, for heating, extending the EU ETS is a question of lowering the capacity threshold for inclusion. The cost efficiency of decreasing the threshold has so far been the reason why small installations are excluded on an EU wide level from the EU ETS (CEC, 2008a, p. 23).

It is claimed that relying on CO₂ pricing alone will not reduce emission from heating, because of mismatches of incentives and benefits between those that construct buildings, those that own them and those that occupy them. There is empirical evidence that these mismatches can be overcome with energy efficiency measures (Institution for European Environmental Policy, 2013).

Agriculture

As discussed above, the emissions from agriculture are subject to a range of non-ETS regulations and policies. In addition, emissions from the agriculture sector are included in the ESD, under which an emission reduction target for the period 2013–2020 is posed for the non-ETS sectors (EC, 2009). Production and transportation activities in the sector are subject to taxes and subsidies on e.g. energy, CO₂ emissions or vehicle taxes. Many of the regulations concerning agriculture aim primary at reducing other pollutants (e.g. nitrogen and phosphorus run-offs) but as a side effect the policies also reduce GHG emissions. Thus the consistency between the EU ETS and these other policies should be further assessed. As soon as technical conditions allow, the Union aims to start preparing policy for inclusion of the Land Use and Land Use Change and Forestry (LULUCF) sector into the 2030 policy framework. There are different policy options for inclusion of the LULUCF-sector, such as inclusion of the sector into the ESD or merging LULUCF and non-CO₂ emissions from agriculture into one new and independent pillar in the EU's climate policy. The aim is to have the sector included by 2020 in the policy framework (EC, 2014a).

Waste

The waste sector is also subject to a range of economic and non-economic GHG reducing instruments both under the EU and national legislation. In 2008, the Commission assessed the suitability of inclusion of the waste incineration sector. Waste incineration is subject to the regulatory framework under the Waste Incineration Directive and the Integrated Pollution Prevention Control (EC, 2008a). The conclusion was that waste incineration generates other pollutants, both airborne other

than GHG as well as waterborne, from the treatment of waste gases, and that there is a need to control these other pollutants by other measures than the EU ETS. Accordingly, the waste incineration sector was left out from the third trading period of the EU ETS (CEC, 2008a, p. 36). Co-incineration of waste, is however, included in the EU ETS (EC, 2003) but differences in the interpretation what constitutes co-incineration between Member States has effectively led to differences in the coverage of the EU ETS between Member States. In Sweden all waste incineration plants whose main purpose is to generate energy are classified as co-incineration plants whereas in Finland a more narrow interpretation of co-incineration is applied (Pöyry, 2012).

2.3.3 Risk of increasing emissions of co-pollutants

Increase of emission of GHG from non-ETS sectors as a result of inclusion is not a concern, since emissions from activities included in the EU ETS are capped. The aggregate cap is adjusted once, to accommodate the emissions from the included activities, after which an emissions increase in one ETS sector must be accompanied by an emissions reduction in another ETS sector.⁶

However, an increase of emission of co-pollutants is a concern, since co-pollutants like particulate matter (from transport) and nitrogen and phosphorus runoff (from agriculture) are not covered by the EU ETS. In economic terms, the problem is that in the presence of co-pollutants marginal abatement benefits across sources of GHG is not equal. The EU ETS only values the benefits from GHG reductions. Emissions of co-pollutants may increase as a result of inclusion, if inclusion shifts emissions from one sector to another, e.g. from electricity generation to transport. The extent to which emissions of co-pollutants increase depends on the price elasticity of CO₂ emissions. Currently there are very large differences in the price of emitting CO₂ between individual sectors in the Nordic countries.

Due to the cold climate, the price elasticity of CO₂ emissions in the heating sector is arguably low. It is arguably low also for the agricultural sector and the waste sector because operational decisions in these sectors rely on other factors than the cost of emitting carbon dioxide, e.g. on preventing groundwater contamination.

⁶ A related question is that how the inclusion would affect the rate at which the transport sector reduces emissions over time.

In an extensive review of past research, Dahl (2012) finds that gasoline price elasticities vary between -0.33 and -0.11, while diesel price elasticities vary between -0.38 and -0.13.⁷ Given the low price elasticities, only a total abolishment of fuel taxes could result in a noticeable increase in the use of transport fuels, and emissions of CO₂ and co-pollutants. Thus, the risk of an increase of co-pollutants is very small for road transport.

2.3.4 Monitoring, reporting and verification (MRV)

The framework for monitoring, reporting and verification of emissions is essential for the credibility of the EU ETS. As a consequence, the condition of feasible monitoring, reporting and verification (MRV) has been a fundamental requirement for inclusion of new sectors in the EU ETS. So far the Commission has taken the approach that only sectors for which the emissions can be monitored, reported and verified with the same accuracy as for emissions already under the scope of the EU ETS are to be included in the system.

As emissions from the transport sector represent a large share of the total emissions from the EU countries, shipping and road transport have been considered by the Commission for inclusion. Aviation was already included in 2012. Both shipping and road transport have been considered suitable candidates as MRV is technically feasible with sufficient level of level of accuracy.⁸ International shipping is not included in the EU ETS but a regulation for MRV of GHG emissions from the maritime transport enters into force in the beginning of July 2015 (EC, 2015).

The barriers for inclusion of road transport will be subject to a fuller analysis in Section 3 but to summarize the challenge is to design a cost efficient framework for MRV. The transport sector consists of a large amount of small emissions sources. In the event that the road transport is included, the MRV framework should be designed so that both the costs that accrues to the compliance entity and the costs of administration of the regulators and implementing agencies in proportion to the environmental benefits of inclusion. A downstream approach whereby every road vehicle is included and given compliance obligations would result in high transaction costs for the vehicle owners and the regulators. An upstream approach whereby larger entities higher up in the

⁷ Dahl (2012) reports that price elasticities were higher at high prices for both gasoline and diesel fuel.

⁸ For shipping see EC (2008b, p. 4) and for road transport see CEC (2008a, p. 54).

supply chain would be included (e.g. fuel suppliers) would result in lower transaction costs but has so far faced barriers relating to incompatibility with the current Directive, which in its current wording covers only direct sources of emissions.

There are examples of other trading schemes that have included small-scale sources in the scheme through the upstream approach. A prominent example is California's cap-and-trade programme, which covers transport and residential and commercial buildings through an upstream inclusion of fuels suppliers.

MRV for heating is very similar as MRV for road transport and thus technically possible. Installations with a capacity of over 20 MW are already included in the EU ETS. Finland and Sweden have also included smaller installations. Extending the EU ETS to the entire heating sector faces the same problems as including road transport in the scheme. A downstream approach generates high transaction costs due to the very large number of small emitters, high costs for MRV and small emissions per combustion unit. The high transaction costs for MRV has so far made the ETS a less cost-efficient tool than other policy tools for reducing emissions on an EU-level.

In connection with the previous revision of the EU ETS, the Commission concluded that emissions from the agricultural sector could not be subject to sufficiently accurate MRV to be included in the EU ETS (CEC, 2008b, p. 4).⁹ The development of a MRV framework with a sufficient level of accuracy would on the other hand generate disproportionate transaction costs for MRV (CEC, 2008a, p. 58). In the agriculture sector production activities are dispersed and disaggregated to a large number of farmers and other producers of agricultural products and livestock, and emissions are to a large extent produced by downstream small emitters. As a consequence, not only feasibility of the MRV is a challenge but in addition it can be assumed that MRV would come with high transaction costs for farmers.

Feasibility of MRV has also been a barrier for inclusion of the waste sector in the EU ETS. There is large variability in the waste streams that is incinerated. As a consequence, a MRV framework for the sector would be very complex. The foreseen complexity of the MRV was one of the criteria for not including the waste sector in connection with the last revision of the EU ETS (CEC, 2008a, p. 36). New Zealand has included waste

⁹ The problem is significant and of all the emissions trading schemes in the world only the Kazakhstan ETS included agriculture in its early legislative state in 2013, but this will not likely hold in practice (World Bank, 2014).

in its trading system. In New Zealand, landfill operators are obliged to report their emissions and surrender emission units, but the price impact in the sector is assessed to be limited (New Zealand Climate change information, 2015).

2.3.5 Risk of emissions increase outside the EU as a result of expansion of the EU ETS

The risk of carbon leakage depends on the possibilities to relocate the polluting activity to countries outside the EU with a less strict or non-existing climate policies. In domestic transport and heating there is no risk of carbon leakage. With current technology, the fuel is combusted and the CO₂ released by the vehicle and relocating the vehicle is not an option. Similar arguments apply for heating. With current technology, emissions from heat generation must occur relatively close to where the heat is consumed. In waste, agriculture and fisheries the risk carbon leakage is present. Agricultural activity in the Nordic countries faces tough price competition from imports and a unilateral increase of the costs without e.g. a compensating increase in agricultural subsidies may result in carbon leakage, as a result of which global emissions may increase. A unilateral increase of costs may also undermine food security. A similar reasoning applies to waste.

Even if the risk of carbon leakage is associated with including either transport or heating in the EU ETS is low, their inclusion may trigger carbon leakage in other EU ETS sectors, e.g. in the iron and steel sector or paper and pulp sector, both of which are of high economic importance in the Nordic countries. Indirect carbon leakage is a concern especially for road transport because of the current high fuel taxes. If fuel taxes are lowered as result of inclusion, it is likely that the road transport sector will be a net buyer of emission allowances from other sectors. The additional demand will put an upward pressure on the allowance price.

The risk of carbon leakage is already mitigated by free allocation to sectors subject to competition from industries in third countries. It is also notable that a lower a CO₂ cost for transport activities may benefit the iron and steel and pulp and paper sectors. In addition, currently a large number of carbon price schemes outside the EU are emerging, among others a national scheme in China. Some, like the Korean ETS and Californian cap-and-trade are already operational. The prospect of emerging new CO₂ pricing schemes should deter relocating ambitions.

2.3.6 Other barriers for inclusion

In addition to the aforesaid barriers also other factors, such as efforts to regulate emissions internationally, should be considered when discussing an extension of the EU ETS. Shipping and aviation are examples of sectors constituting significant emission sources for which MRV is feasible and aviation was effectively included in the EU ETS already in 2012. Both international shipping and international aviation are mentioned in the Kyoto Protocol as sectors that should be regulated under auspice of the International Commercial Aviation Organization (ICAO) and the International Maritime Organization (IMO) respectively (United Nations (1998). Due to the slow progress of the international scheme under ICAO aviation was nonetheless unilaterally included in the EU ETS in 2012. The inclusion of international aviation raised resistance and objections from both non EU-Member States and companies.¹⁰ As a consequence of the negotiations for a global approach under the International Civil Aviation Organization advancing in September 2012, the Commission temporarily chose to exclude international aviation from the EU ETS (EC, 2013). The purpose of the so called “stop-the-clock” was to secure a possible international agreement on GHG emissions from aviation (EC, 2014b).

The international nature of the industry and need for an international approach is also the reason why shipping has not yet been included in the EU ETS (CEC, 2008a, p. 55). As efforts under both IMO and the UN-FCCC so far have not resulted in regulatory measures to limit or reduce emissions from international shipping, the Commission published in June 2013 a strategy for integration of maritime emissions into EU’s policy for reducing domestic greenhouse gases. The MRV regulation for international shipping mentioned in Subsection 2.3.4 is the first step in the strategy and the possible following steps include setting intermediary emission reduction targets for the maritime transport and to apply effective and efficient market-based measures (CEC, 2013b). Any following steps in relation to shipping should, however, be aligned with the approach under the IMO. The experiences from aviation and shipping

¹⁰ See e.g. C-366/10 Judgment of the Court (Grand Chamber) of 21 December 2011 *Air Transport Association of America and Others v Secretary of State for Energy and Climate Change*. The House of Representatives and the Senate of the United States of America even adopted a Bill to prevent the extension of the EU ETS to international aviation see the European Union Emissions Trading Scheme Prohibition Act of 2011 (Enrolled Bill [Final as Passed Both House and Senate] ENR)[S.1956.ENR].

demonstrate the close linkage between the EU ETS, its coverage and the international efforts to regulate emission reductions.

2.4 Conclusions

In terms of significance of emissions, the transport sector, agriculture and fisheries are of major significance, whereas heating and waste is of less significance. The significance of emissions is a strong argument in favour of inclusion of road transport. Conversely, the insignificance of emissions is a strong argument against including heating and waste in the EU ETS.¹¹ However, any expansion of the EU ETS would reduce distortions in the economy, assuming that the expansion inclusion creates a level playing field. Creating a level playing field is likely to require adjustment of existing policy instruments.

The transport sector is a significant source of tax revenue, whereas the other sectors are not. Approximately half of all revenue collected by taxes motivated by environmental concerns can be attributed to the transport sector. The tax revenue constitutes a barrier to inclusion to the extent that taxes are overlapping with the EU ETS.

With respect to the consistency with existing policies and regulation, the question is how the EU ETS interacts with the existing policy space. None of the four sectors are in an unregulated state so the question of interaction with existing policies is relevant for all. The worst overlap is with energy and carbon taxes, which are prevalent in the transport and heating sector, but less so in the agriculture and fisheries sector and the waste sector. Energy and CO₂ taxes distort the prices set by the EU ETS, and thus reduces efficiency.

Currently, all emissions covered by the EU ETS are regulated downstream. To reduce transaction costs for small emitters, upstream inclusion has been suggested as an alternative for downstream inclusion. Upstream inclusion is however incompatible with the EU ETS Directive and constitutes a barrier for including sectors with many small emitters.

MRV is technical feasible for the transport sector and heating sector. For the agriculture and fisheries sector the lack of accuracy of MRV is a barrier to inclusion and for the waste sector the complexity of MRV is a barrier to inclusion. The very large number of large number of small

¹¹ Admittedly, the emissions data for the heating sector is incomplete. Actual emissions are likely to be higher. However, even if actual emissions from heating were, say, 50% higher, the share of total greenhouse gas emissions remains small.

emitters in the heating and transport sectors makes downstream inclusions infeasible as downstream inclusion would result in disproportionately large transaction costs.

Table 13: Barriers to inclusion per sector

Category	Transport	Heating	Agriculture and fisheries	Waste
Significance of emissions	Road transport: very significant source. Other subsectors: insignificant source.	Insignificant source of emissions.	Significant but not as significant as road transport.	Insignificant source of emissions.
Significance of fiscal revenue	Transport and road transport in particular is a significant source of tax revenue.	Insignificant.	Insignificant.	Insignificant.
Consistency with existing policies and regulation	Existing energy and CO ₂ taxes are a barrier to inclusion.	Existing energy and CO ₂ taxes are a barrier to inclusion.	A barrier to the extent that current regulation targets GHG emissions.	A barrier to the extent that current regulation targets GHG emissions.
Compatibility with current Directive	Upstream inclusion is incompatible with the Directive.	Upstream inclusion is incompatible with the Directive.	Upstream inclusion is incompatible with the Directive.	Upstream inclusion is incompatible with the Directive.
Risk of an increase in emissions of co-pollutants	Low.	Low.	Low.	Low.
Monitoring, verification and reporting	Technically feasible, but downstream inclusion incurs very high transaction cost.	Technically feasible, but downstream inclusion incurs very high transaction cost.	Lack of accuracy of MRV is a barrier.	MRV complexity is a barrier.
Risk of carbon leakage	Very low.	Very low.	Present but mitigated by a number of existing policies.	Present but mitigated by a number of existing policies.

3. Inclusion of road transport in the EU ETS

This section explores the barriers and the solutions for including road transport in the EU ETS. Subsection 3.1 summarises the community level discussion and rational why road transport has not already been included in the EU ETS. Subsection 3.2 presents the taxes that road vehicles are subject to in each Nordic country. Subsection 3.3 discusses the main barriers to inclusion. Subsection 3.4 concludes and discusses the relevance of the barriers identified in Subsection 3.3 for other non-ETS sectors.

3.1 The EU perspective

Road transport and small mobile emitters (e.g. private cars) were discussed already upon establishment of the EU ETS but were left out as the approach was to start off with large stationary sources (CEC, 2000, p. 10). The road transport sector was further considered in connection with the revision of the ETS Phase 3. Increased environmental efficiency spoke for inclusion of the sector but the Commission concluded that further analysis was needed as to the effects on other ETS sectors, of the high abatement costs for road transport, as well as to the interaction with the existing policies. The sector was to be considered for inclusion in the long term (CEC, 2008a, p. 161).

In 2012, the Commission revisited the option of including fuel consumption in the current non-ETS sectors, as a means to balance demand and supply within the EU ETS (CEC, 2012b).

In October 2014, the European Council recalled in its Conclusions on the EU's 2030 Climate and Energy Policy Framework that under the existing ETS Directive, individual Members States can opt to include the road transport sector in the scheme. As discussed in the previous section, road transport is a significant emissions source in the EU and the reduction of emissions from transport fuel combustion is a priority. Reducing the dependency of fossil fuels for the transport sector is also seen by the Council as a priority target (EC, 2014a, Article 2.13). One argument often presented in this context is that petroleum taxes cannot

guarantee that emissions from road transport are reduced by a certain amount, whereas inclusion in the EU ETS does, see e.g. Heymann (2014).

In the Nordic countries the emissions from transport fuels represents a larger share of total emission than the EU average. Emissions from certain transport sub-sectors are already included in the EU ETS. Aviation was included in 2012 and the emissions from railway-transport are included to a large extent, through the electricity producers. The inclusion of railway-transport through electricity producers means that the sub-sector has been included in the ETS implicitly and automatically through the electrification of the railway-transport rather than through a separate administrative decision to do so.

Globally there are examples of operational cap-and-trade systems covering road transport. The largest of these is the California cap-and-trade programme, which has been operational since 2013 (California Environmental Protection Agency, 2013). In the beginning of the second compliance period,¹² in 2015, the coverage was extended to road transport by inclusion of suppliers (position holders and importers) of RBOB (reformulated gasoline blend-stock for oxygen blending) and distillate fuel oil as well liquefied petroleum and natural gas as well as petroleum refineries (California Environmental Protection Agency, 2015). The transport sector is responsible for approximately 37% of the Californian emissions (California Environmental Protection Agency, 2015). Similar to the EU ETS, the Californian system has an absolute cap and mandatory participation for entities above a certain threshold. Other ETS systems that have included transport include New Zealand and Shanghai.

3.2 The Nordic perspective

3.2.1 Denmark

The transport sector accounts for 12.2 MtCO₂e (23.7%) of total GHG emissions in Denmark in 2012. Of this, 11.4 MtCO₂ was due to road transport. In the beginning of 2015, the total number of motor vehicles in Denmark was 3.0 million, of which 2.3 million were passenger cars, 1.6 million petrol driven and 0.7 million diesel driven (Statistics Denmark, 2015).

Road vehicles and road transport in Denmark are subject to a registration tax, an ownership tax, fuel taxes and road user charges. The reg-

¹² In the Californian cap-and-trade a trading period is referred to as a compliance period.

istration tax is paid once at first registration and is not dependent on the fuel efficiency of the vehicle.

Table 14: Tax rates on transport fuels in Denmark in 2013

Product	Tax	Eurocents per litre	EUR per tCO ₂
Motor gasoline	Energy tax	32.96	138.81
	CO ₂ tax	5.27	22.19
	<i>Total tax</i>	38.23	161.00
Diesel oil	Energy tax	35.06	131.66
	CO ₂ tax	5.83	21.90
	<i>Total tax</i>	40.90	153.56

Note: Conversion factors from Motiva (2010).

Source: Danish Customs and Tax Administration.

Owners of passenger cars are liable to pay a green ownership tax (“grøn ejerafgift”). The tax depends on the fuel efficiency (km per litre) of the car and it is paid periodically, in periods of 3, 6 or 12 months. The tax rate is different for petrol and diesel.

The fuel taxes comprise an energy tax, a NO_x tax (omitted here) and a CO₂ tax. The tax rates are given in Danish øre/litre. Table 14 shows the tax rates for petrol and diesel in 2013, in EUR per litre and EUR per ton of CO₂ emissions. Table 15 shows the tax revenue from the different taxes levied on road transport in Denmark.

Table 15: Revenues from taxes levied on the road transport sector in Denmark 2013

Tax	Revenues (million EUR)	Share of entire tax revenue by the state (%)
Petrol	977	0.8
Certain oil products (fuel oil, heating tar and diesel oil)	1,248	1.0
Motor vehicle registration duty	2,041	1.7
Road charges	51	0.0
Motor vehicle weight duty from households	1,086	0.9
Motor vehicle weight duty from producers	374	0.3
<i>Total</i>	5,777	4.8

Note: Diesel is the main components in the category “Certain oil products, fuel oil, heating tar and diesel oil”.

Source: Statistics Denmark.

3.2.2 Finland

The Finnish transport sector accounts for 12.7 MtCO₂e (20.8%) of total GHG emissions in 2012. Of this, 11.2 MtCO₂ (88.2%) was due to road transport. The total number of automobiles registered in Finland was approximately 3.6 million in 2013, of which 3.1 million passenger cars, 2.4 million petrol driven and 0.7 diesel driven (Statistics Finland, 2014). The remaining 0.5 million automobiles consisted mainly of diesel powered vans.

Table 16: Tax rates on transport fuels in Finland 2013

Product	Tax	Eurocents per litre	EUR per tCO ₂
Motor gasoline	Energy content tax	50.36	212.10
	CO ₂ tax	14	58.96
	Strategic stockpile fee	0.68	2.86
	<i>Total tax</i>	65.04	273.92
Diesel oil	Energy content tax	30.7	115.27
	CO ₂ tax	15.9	59.70
	Strategic stockpile fee	0.35	1.31
	<i>Total tax</i>	46.95	176.29

Note: Conversion factors from Motiva (2010).

Source: Finnish Customs.

In addition to VAT, road transport in Finland is subject to a car tax, an annual vehicle and a fuel tax (Finnish Information Centre of Automobile Sector, 2015a). The car tax is paid once during the lifetime of a vehicle, at first registration. It is based on the vehicle's value and the vehicle's fuel efficiency, measured in grams of CO₂ emissions per kilometre.

The annual vehicle tax depends on the type of vehicle and fuel; for passenger cars, vans and recreational vehicles it is determined by the fuel efficiency of the vehicle. Diesel powered passenger cars are charged, in addition, a tax on motive power dependent on the vehicle's weight.

The fuel tax consists of an energy content tax, a carbon dioxide tax and a strategic stockpile fee. The tax rates are given in EUR per litre or kilogram. Originally, the tax rate of the CO₂ tax was calculated based on a CO₂ price of EUR 50 per tCO₂ (Government of Finland, 2013a).

Table 16 shows the tax rates for petrol and diesel in 2013; the last column shows the tax per ton of CO₂ emissions. It shows that the energy content tax is higher for diesel. Table 17 shows the tax revenue from road transport fuels in 2013 both in absolute terms and relative to total taxes collected in 2013.

Table 17: Revenues from taxes levied on road transport in Finland 2013

Tax	Revenues (million EUR)	Share of entire tax revenue by the state (%)
Registration tax	932	1.1
Annual tax	866	1.0
Fuel tax	2,777	3.1
<i>Total</i>	<i>4,575</i>	<i>5.2</i>

Note: Revenue from VAT on vehicles and transport fuels is excluded.

Source: Finnish Information Centre of Automobile Sector (2015b).

3.2.3 Iceland

While CO₂ emissions from road transport have declined considerably after 2007, the transport sector is still the largest contributor of GHG emissions in Iceland outside the scope of the EU ETS, accounting for 19% of total GHG emissions in 2012 (Environment Agency of Iceland, 2014, pp. 30 and 32). Private car ownership is common in Iceland; in 2012 the country had 653 passenger cars per 1,000 inhabitants, the second highest ratio in the European Economic Area (CEC, 2014c). Mitigation efforts in the transportation sector therefore play an important role in the Icelandic climate policy and in recent years the government has initiated extensive studies to identify possibilities of reducing transport emissions in a cost-effective manner.¹³

Table 18: Tax rates on transport fuels in Iceland 2013

Product	Tax	Eurocents per litre	EUR per tCO ₂
Gasoline	Excise duty (general and special)	39.4	165.94
	Carbon tax	3.08	12.97
	<i>Total tax</i>	<i>42.48</i>	<i>178.91</i>
Diesel oil	Excise duty	33.8	126.91
	Carbon tax	3.54	13.29
	<i>Total tax</i>	<i>37.34</i>	<i>140.20</i>

Note: Conversion factors from Motiva (2010).

Source: Althingi (1993), Althingi (2004), Althingi (2009).

¹³ See for example Davíðsdóttir *et al.* (2009).

One of the major objectives of both the Icelandic climate and energy policy is to increase the use of renewable energy in transportation.¹⁴ In line with this objective, a new carbon tax on gasoil, diesel oil, gasoline, residual fuel oil and petroleum gas was imposed in 2009, as an addition to existing excise duties on diesel oil and gasoline (Althingi, 2009). The tax is based on the carbon content of each fuel type and was initially intended to reflect the price of emission allowances in the EU ETS market in the previous year (Althingi, 2009). Since 2011, excise duties on vehicles, as well as the semi-annual tax on vehicles, have been based on CO₂ emissions (Althingi, 1988a, 1993). Other economic incentives have been introduced to promote the use of low-carbon or zero-carbon cars and fuels. For example, a substantial discount is granted from the excise duty on methane driven vehicles and such cars are subject to the minimum semi-annual car tax (Althingi, 1988a, 1993). Furthermore, vehicles powered by electricity and hydrogen are up to a certain limit exempt from VAT, and sellers of such cars are eligible for tax deductions (Althingi, 1988b). Non-fossil fuel oils are not subject to an excise duty, and if oils and fuels that are not of fossil origin are blended with conventional oils and fuels, the mixture is exempt up to the extent of the additive (Althingi, 2004).

In order to accelerate the shift to renewable energy in transportation, as well as to fulfil international commitments on GHG emissions and on use of renewable sources in transport, renewable additives in land transport fuels were mandated in 2013. From 1 January 2015, a minimum of 5% of all fuels sold to land transportation has to be of renewable origin (Althingi, 2013).

The Climate Mitigation Action Plan includes other measures to reduce GHG emissions from transportation, including public procurement of low-carbon and fuel efficient vehicles within both the state government and the city of Reykjavik (Icelandic Ministry for the Environment and Natural Resources, 2010, pp. 27–28). The government and local municipalities have also initiated projects to increase the share of public transportation, walking and bicycling (Icelandic Ministry for the Environment and Natural Resources, 2014a, p. 75).

Table 18 shows the tax rates for gasoline and diesel oil in 2013; the last column shows the tax per ton of emissions of CO₂. Table 19 shows the tax revenue from road transport fuels in 2013 both in absolute terms and relative to total taxes collected in 2013.

¹⁴ See Icelandic Ministry of Industries and Innovation (2012, p. 4–5) and Icelandic Ministry for the Environment and Natural Resources (2010, p. 35).

Table 19: Revenues from taxes and charges levied on the road transport sector in Iceland 2013

Tax	Revenues (million EUR)	Share of entire tax revenue by the state (%)
Semi-annual car tax	42	1.1
Kilometres charge	5	0.1
Carbon tax	20	0,5
Excise duty on vehicles	27	0,7
Excise duty on gasoline (and oil products)	29	0,7
Excise duty on diesel oil	48	1.2
<i>Total</i>	<i>171</i>	<i>4.3</i>

Note: Revenue from VAT on vehicles and transport fuels is excluded.

Source: Icelandic Financial Management Authority (2013). Treasury accounts for 2013.

3.2.4 Norway

Total transportation emission in Norway was 15.2 MtCO₂e in 2012 or 29% of total emission. Norway had approximately 3 million registered automobiles in 2013 of which 2.4 million were passenger cars and 0.6 were vans and goods vehicles (Statistics Norway, 2013, Table 415). The GHG emissions from transporting goods and people on roads were 10.1 MtCO₂e in 2012, or 66% of transport sector emissions.

Road transport in Norway is subject to a registration tax, an annual motor vehicle tax, a fuel tax and a carbon tax.

The motor vehicle registration tax is based on four different components; vehicle weight, engine effect, CO₂ and NO_x emissions. All the elements, except the NO_x element, are progressive. The engine effect component has been reduced over time. There is a deduction for low emission cars (less than 120 g/km). However, total registration tax cannot be negative. High emissions vehicles (more than 250 g/km) are penalized by the tax system (Bragadóttir, 2014). The tax is substantial and revenues collected amount to EUR 2.3 billion or 2.1% of total fiscal revenues 2013.

Table 20: Tax rates on transport fuels in Norway 2013

Product	Tax	Eurocents per litre	EUR per tCO ₂
Motor gasoline	Road usage tax	66	276
	CO ₂ tax	13	54
	<i>Total tax</i>	79	330
Diesel oil	Road usage tax	52	196
	CO ₂ tax	8	31
	<i>Total tax</i>	60	227

Note: Conversion factors from Motiva (2010).

Source: Norwegian Ministry of Climate and Environment (2014, p. 66).

The annual motor vehicle tax is also a significant source of revenues and represents approximately 1% of total fiscal revenues. The tax consists of a weight component and an environmental component. The weight-related component is dependent on the total weight of the vehicle, suspension system and number of axles and is meant to cover wear and tear of the roads. The tax is divided into an excise duty for lightweight vehicles (less than 7,500 kg) and an excise duty for heavyweight vehicles (7,500 kg or more). The environmental part is computed according to weight and emission standards following the EURO classification.

To finance road construction and bridges, tunnels etc. there are several toll roads around the country where vehicles have to pay to use the road, bridge or tunnel. Some larger Norwegian cities also have toll rings where all vehicles entering the city centres have to pay a fee (OECD, 2011).

Table 20 shows the 2013 tax rates for petrol and diesel. The Norwegian road usage tax constitutes a significant portion of the total taxes levied on transport fuel use, whereas the carbon tax plays a minor role, especially for diesel use.

Table 21: Revenues from taxes levied on the road transport sector in Norway in 2013

Tax	Revenues (million EUR)	Share of entire tax revenue by the state (%)
Annual motor vehicle tax	1,296	1.0
Motor vehicle registration tax	2,692	2.1
Re-registration tax on motor vehicles	281	0.2
Excise duty on fuel	2,264	1.8
Carbon tax	657	0.5
<i>Total</i>	<i>7,191</i>	<i>6.3</i>

Source: Statistics Norway (2015).

3.2.5 Sweden

In total the transport sector in Sweden emitted 19.1 MtCO₂e or 33% of total emission in 2012. Road transport counted for 94% of these emissions through approximately 5.0 million registered vehicles in 2013, of which 4.5 million were passenger cars and the remaining 0.5 million automobiles consisted mainly of vans (Statistics Sweden, 2014).

Road transport in Sweden is subject to an annual vehicle tax, a fuel tax, a carbon tax, congestion taxes and road charges.

The vehicle tax is based on a base fee of EUR 42 and the vehicle's fuel efficiency, measured in grams of CO₂ emissions per kilometre (Swedish Tax Authority, 2013). Cars, campers, light trucks and light buses that meet specific environmental demands and are put into service for the first time are exempt from vehicle tax for the first five years from the time the vehicle was introduced. The revenues from the vehicle tax amount to EUR 1.5 billion or 1.5% of total fiscal revenues.

Table 22: Tax rates on transport fuels in Sweden 2013

Product	Tax	Eurocents per litre	EUR per tCO ₂
Motor gasoline	Energy content tax	36	151
	CO ₂ tax	29	124
	<i>Total tax</i>	<i>65</i>	<i>274</i>
Diesel oil	Energy content tax	20	76
	CO ₂ tax	36	124
	<i>Total tax</i>	<i>56</i>	<i>200</i>

Note: Conversion factors from Motiva (2010).

Source: Swedish Ministry of the Environment (2014).

Road charges in Sweden are levied for financing the construction of new roads. However, the charges also have a steering effect and may be used e.g. to restrict traffic in certain areas or on certain routes. Since 1st February 1998, all domestic and foreign heavy goods vehicles (HGV) above 12 tons driving on Swedish roads are levied with a road charge (CEC, 2013c). The charges depend on the exhaust class of the vehicle (EUR 0, 1, or 2), and how many axles the vehicle has.

The cities of Stockholm and Gothenburg have introduced congestion taxes in order to reduce congestion in and around the central parts of city, and to reduce emissions of pollutants that are harmful to health and the environment. The tax also has a fiscal purpose since most of the revenues are intended for investment in public transport (Swedish Transport Agency, 2011).

Table 22 shows the tax rates for petrol and diesel in 2013. In contrast to the other Nordic countries, the carbon tax is significantly higher. But the total tax levied, including the lower complementary energy tax, is in accord with the rest of the Nordic countries.

Table 23: Revenues from taxes levied on the road transport sector in Sweden 2013

Tax	Revenues (million EUR)	Share of entire tax revenue by the state (%)
Annual tax on vehicles	1,320	1.5
Road charges	86	0.1
Congestion taxes	171	0.2
Carbon tax on fuel	1,016	1.1
Excise duty on gasoline	1,275	0.2
<i>Total</i>	<i>4,808</i>	<i>2.9</i>

Source: Swedish National Financial Management Authority (2014).

3.3 Main barriers to inclusion

3.3.1 *Barriers due to policy congestion*

The EU's has set two overarching goals for the transport sector, defined in the Transport White Paper (CEC, 2011), to reduce Europe's dependence on imported oil and to reduce CO₂ emissions from transport. The two goals are highly correlated since there is a one-to-one correspondence between combusted oil and emissions of atmospheric CO₂ emis-

sions. Current policy instruments in the EU, and the Nordic countries, can be divided in the three categories as follows:¹⁵

1. Compulsory fuel efficiency standards for new road vehicles, set by the EU.
2. One-off registration taxes and recurring ownership taxes set by national governments, which in the Nordic countries are typically tied to the fuel efficiency, or equivalently CO₂ efficiency, of the vehicle.
3. Fuel taxes, set by national governments and which typically include different components, e.g. an energy component and CO₂ components, as in every Nordic country.

The first two categories affect the fixed cost, whereas the third category affects the variable cost of using road vehicles. Introducing the EU ETS as fourth category to this already crowded policy space will increase instrument congestion. Majone (1989) describes the concept as follows: “in an already crowded policy space, solutions beget new problems in the form of policy overlaps, jurisdictional conflicts and unanticipated consequences”. The largest overlap is with the fuel taxes, i.e. the third category, which vary between EUR 161–330 for petrol and EUR 140–227 for diesel per tCO₂. The CO₂ component of it varies between EUR 13–123 per tCO₂ for both petrol and diesel. The fuel taxes may distort the price signals of the EU ETS, and consequently reduce cost efficiency if road transport is included in the EU ETS. Cost efficiency is reduced because emissions are not reduced in order of ascending marginal abatement cost.

The question of policy overlap, between the three existing categories of policy instruments and the suggested fourth category, raises the more fundamental questions of policy reform. Are all current policy instruments needed? What purpose do they serve? Currently there is significant weight on the fixed costs of acquiring and owning road vehicles. Would a shift towards the variable cost of operating road vehicles result in a better alignment of the incentives of the consumers and the regulator? Proponents of compulsory fuel efficiency standards claim that customers severely discount the value of future fuel savings, which prevents them from carrying any upfront costs for fuel efficiency technologies. As

¹⁵ Some of the current policy instruments, such as road user charges and information based instruments, do not fit into any of these categories.

a result, the technologies do not diffuse through the society or do so only very slowly, see e.g. Greene *et al.* (2013).

Ideally the policy space should be determined by the objectives and the objectives by political priorities. Thus, the discussion of a policy reform should be placed in the context of the objectives. Historically, the objective of tax revenue has been high on the political agenda in the Nordic countries.

3.3.2 Fiscal barriers

Revenues from environmental taxes are significant in the Nordic countries. The OECD estimates that the total amount in 2013 was in excess of EUR 35 billion. Carbon taxes in the road transport sector alone can be estimated to stand for more than 10% of the revenues, approximately EUR 3.7 billion, as is shown in Table 24.

There are significant differences in the Nordic countries' political valuation of how large the carbon tax should be to offset the negative externalities of GHG emissions. Sweden has the highest tax rate on CO₂ emission with EUR 124 per tCO₂ while Iceland values the CO₂ emissions externality to EUR 13 per tCO₂.

Double taxation or lower fiscal revenues?

In principle an inclusion of road transport into the EU ETS implies that carbon taxes in the sector should be replaced by the pricing mechanism of the trading scheme. Doing so will increase the cost efficiency of reaching the GHG emissions targets by allowing transport emissions to be priced at market rates.

An inclusion of road transport that does not come with an abolishment of the carbon tax implies exposing the sector to double taxation. Paying the market price for CO₂ and on top of a carbon tax forces the sector to pay for the emission externality twice. Even though the market price for emissions for the time being is relatively low, this may change in the future, making the double taxation a significant issue that needs to be addressed.

Table 24: CO2 taxes, emissions and CO2 tax revenues in the Nordic countries 2013

Country	CO ₂ tax (EUR per tCO ₂)	Emissions in transport (MtCO ₂ e)	Revenues ¹ (million EUR)
Denmark	22	11.4	251
Finland	60	11.2	672
Iceland	13	0.8	10
Norway	54	10.1	543
Sweden	124	17.9	2,213
<i>SUM</i>		51.4	3,690

Note: Revenues estimated based on CO₂ tax and reported emissions in the transport sector.

Source: The World Bank (2014), European Environment Agency (2015b), Norwegian Ministry of Climate and Environment (2014), Icelandic Ministry for the Environment and Natural Resources (2014a).

On the other hand, ensuring single taxation by replacing the fiscal revenues from the current CO₂ taxes with income from auctioning of emissions allowances poses a serious fiscal problem. The total revenues collected from carbon taxes in the road transport sector are considerable in the Nordic countries. Abolishing the carbon tax implies significant income losses for all countries, especially for Sweden with a high tax rate and large emissions in the transport sector.

The size of the problem can be illustrated in terms of the fiscally neutral EU ETS price. Such a price shows the level to which the EU ETS price of CO₂ has to increase in order to offset the fiscal revenues lost by removing of the carbon taxes. The calculation is based on the assumption that the emissions from the road transport do not change as a result of inclusion (i.e. increase in cap is equal to current emissions) and that all of the permits are auctioned.

In Norway and Iceland the fiscally neutral price is the same as the CO₂ tax rate in the respective countries. That is, to offset the removal of the CO₂ tax the price has to increase to the same level as the tax. This relation holds because no emission allowances are auctioned in Norway and Iceland. Auction revenues only come from road transport auctioning, which has to cover the loss in carbon taxation revenues.

Sweden, Finland and Denmark have a non-zero level of auctioning. A price increase, increase auction revenue from all sectors, both old and new. As an example the price does not need to increase to the tax rate of EUR 124 per tCO₂ in order for Sweden to cover the fiscal loss. It suffices if the price increases to EUR 83 per tCO₂.

Table 25: Fiscal neutral CO₂ price for including transport in EU ETS per Nordic country 2013

Country	Fiscally neutral EU ETS price (EUR per tCO ₂)	Fiscally neutral EU ETS price, 100% auctioning (EUR per tCO ₂)
Denmark	12	9
Finland	26	17
Iceland	13	4
Norway	54	16
Sweden	83	59

Source: Own calculations.

For both Denmark and Finland with relatively large shares of auctioning (66 and 55% respectively) the necessary increase in the CO₂ price from the current market price are relatively modest. This indicates that a possible route to circumvent the fiscal and double taxation problem is to include road transport in EU ETS, and at the same time increase the share of auctioning and lower the share of free allowances. As an example, if both Denmark and Finland auctioned all allowances the necessary CO₂ price to neutralise the fiscal loss in CO₂ taxation is only EUR 9 and EUR 17 per tCO₂. For all Nordic countries, increasing the share of auctioning at the same time as including road transport into the EU ETS may be a feasible way to mitigate the fiscal risks of removing carbon taxation on road transport.

Furthermore, auctioning also includes market price uncertainty. The volatility of carbon prices, as compared to a stable tax rate, directly spills over into general government income uncertainty.

How to mitigate the problems?

The differences in the carbon tax rate levels between the Nordic countries and the differences in the fiscally neutral price raises the question of how much of the carbon tax that actually adjusts for the emission externality and how much that are fiscally motivated. Combined with other taxes in the transport sector, such as energy taxation or road usage taxes based on consumption, the tax on fuel consumption in road transport is significant in all Nordic countries. The question is how much of these taxes that are motivated from an environmental perspective and how much for fiscal reasons. For the case of Sweden it has been estimated that 70% of the CO₂ tax in 2013 can be attributable to fiscal or other reasons (Carlén, 2014). This implies that the correct carbon tax, pricing the emission externalities, is only EUR 37 per tCO₂ instead of the current tax level of EUR 124, which is more in line with the other Nordic countries. Such evaluations of the carbon tax opens up for other compensation

mechanisms to cover for the drop in fiscal revenues if road transport is included in the EU ETS and at the same time the carbon tax is abolished.

Firstly, moving the parts of the current carbon tax that can be attributable to fiscal or other reason out of the carbon taxation lowers the discrepancy between the current EU ETS market price on CO₂ and the actual carbon tax rate. The tax, less the carbon component, can still be levied, one way or another, based on the underlying reasons. For the case of Sweden, where 70% of the CO₂ tax revenues can be attributable to reasons other than adjusting for the emissions externality, a significant share of today's carbon tax revenues will be unaffected by an inclusion of road transport into EU ETS.

Secondly, there may be other reasons for a continued high taxation. The political valuation may deem the current market price too low or too volatile to incentivise rapid technology advancement in the transport sector. A government intervention may be necessary to provide more certainty and stability to investors by supporting a higher and more stable carbon price. A possible mechanism to guarantee the fiscal revenues is then to introduce a top up carbon tax above the market CO₂ price which is switched on if the market price is below the desirable level, i.e. the necessary fiscally neutral carbon price. Such a price-floor, with a minimum carbon price within the EU ETS, is in place in the United Kingdom for fossil fuels supplied to all types of UK electricity generators. By securing revenues from both auctioning of the allowances in the road transport sector and from the price floor mechanism the fiscal revenues can be upheld and guaranteed to be on the desired level.

A price floor mechanism will also reduce the volatility and uncertainty of general government revenues by securing a minimum price or tax rate on carbon.

3.3.3 *Barriers related to monitoring, reporting and verification of emissions*

As discussed in Subsection 2.3.5 the framework for MRV guarantees the environmental integrity of the emissions trading scheme and only sectors for which the emissions can be monitored with sufficient accuracy can be included in the EU ETS. The data on emissions, should in addition, be easy to collect (CEC, 2008a, p. 43).

Currently, entities included in the scope of the EU ETS are required to apply for a permit to issue GHG. The entities monitor their emissions in accordance with an approved monitoring plan and report the emissions annually to the national authorities. The emissions are verified by

accredited independent entities. The surrender, holding and transfer of emission allowances and international carbon credits as well as the reporting of emissions takes place in the Union Registry (CEC, 2013). The principles governing the MRV are included in the EU ETS Directive and have been transposed into separate Commission regulations concerning monitoring and reporting and accreditation and verification applicable in all Member States¹⁶ and complemented by national legislation. Should a Member State opt-in additional sectors the Commission can adopt specific MRV regulation.¹⁷ The Union Registry is subject to the Union Registry Regulation and administered by the Commission jointly with national administrators. Thus the infrastructure and legislation relating to MRV is to a large extent harmonized and joint for the entire EU ETS and complemented as needed nationally.

An inclusion of the transport sector would thus require the adoption or regulation relating to MRV of emissions from road transport as well as necessary changes to the Union registry. Also the question of the method of allocating the allowances corresponding to the cap for the road transport would need to be solved.

The technical feasibility to monitor emissions from transport fuel combustion is not a barrier to include the road transport sector into the EU ETS (CEC, 2008a, p. 54). Monitoring of emissions from transport fuel combustion is relatively straightforward, merely a question of converting the amount of fuel consumed into CO₂ using the corresponding carbon intensity factor, in terms of CO₂e per litre or kilogram of fuel. This is also the approach taken for the monitoring under the California cap-and-trade, where the emissions for the annual quantity of fuel served by the fuel supplier are reported based on standard equations for different fuels (California Environmental Protection Agency, 2013).

As the road transport sector consist of multiple small emission sources (separate vehicles), the question of cost efficiency of MRV is central. MRV entails costs for the participants as well as the administrators and implementing agencies and these should be proportionate to the significance of the source and not outweigh the benefit of extending the coverage of the ETS. As an example the fee in Finland for an emission permit for emitting less than 50,000 CO₂ annually is EUR 1,500 (Finnish Ministry of Employment and the Economy, 2014). The fee is reasonable for large stationary sources but in relation to a private vehicle owner it constitutes a large burden. Also the costs for administra-

¹⁶ See Article 14.1 of the EU ETS Directive and CEC (2012a).

¹⁷ See Article 24.3 of EU ETS Directive.

tion rise substantially if a large amount of monitored entities are included in the system.

In connection with the previous revision of the scope of the EU ETS the Commission therefore considered including the entire sector as one participant. Monitoring of emissions would take place upon fuel sales and each vehicle owner would be allocated emissions allowances to “pay” with. This would require new infrastructure and the total administrative costs would likely still be very high. The upside of this approach is that it includes the direct source of emission into the system and is thus in line with the current wording and principles of the EU ETS (CEC, 2008a, p. 53).

The second option that has been considered is an upstream approach whereby an entity higher up in the supply chain is the point of regulation, e.g. a fuel supplier or even the vehicle producers. In the case of fuel suppliers the monitoring could e.g. be based on the system for energy taxation (CEC, 2008a, p. 54, see also CEC, 2014a, p.233). While this would increase the cost-efficiency of the MRV and entail lower administrative costs, upstream inclusion is in conflict with the principle regulating emissions at the point of release to the atmosphere. The Californian cap-and-trade has taken this second approach and included fuel suppliers and importers as the point of regulation for the road transport sector (California Environmental Protection Agency, 2013, sections 95100–95158, § 95810–§ 95811).

To conclude, MRV is not an absolute barrier for inclusion of road transport in the EU ETS but the nature of the sector would likely require including upstream emitters for the road transport in order to fulfil the requirement of proportionality of the transaction costs of MRV in relation to benefits of extending the scope of the ETS. The inclusion of upstream entities will be further examined in the following section.

3.3.4 *Barriers related to upstream inclusion*

The point of regulation in an ETS can be downstream or upstream. In a downstream system, like the EU ETS, emissions are regulated at the point of release to the atmosphere. If upstream, as in the New Zealand ETS, emissions from fossil-fuels are regulated higher up in the supply chain, e.g. at the point of production or import (Kerr & Duscha, 2014). The Californian cap-and-trade is an example of a mixed system whereby the point of regulation in certain sectors e.g. in the chemical industry is downstream whereas it in other sectors such as road transport is upstream. This demonstrates that a mixed system is feasible.

A common denominator for all sectors currently included in the EU ETS is that they express the principle of direct emissions and that the point of regulation is downstream. The current wording of the EU ETS Directive is built around large stationary sources and aircraft operators. An inclusion of upstream level in all of the EU ETS states would require an amendment of the current wording of the ETS Directive, in addition to adding the activity to the list of activities covered by the scheme. Should separate Member States opt-in the transport sector the national legislation might require amendment to reflect the inclusion of an upstream point of regulation.

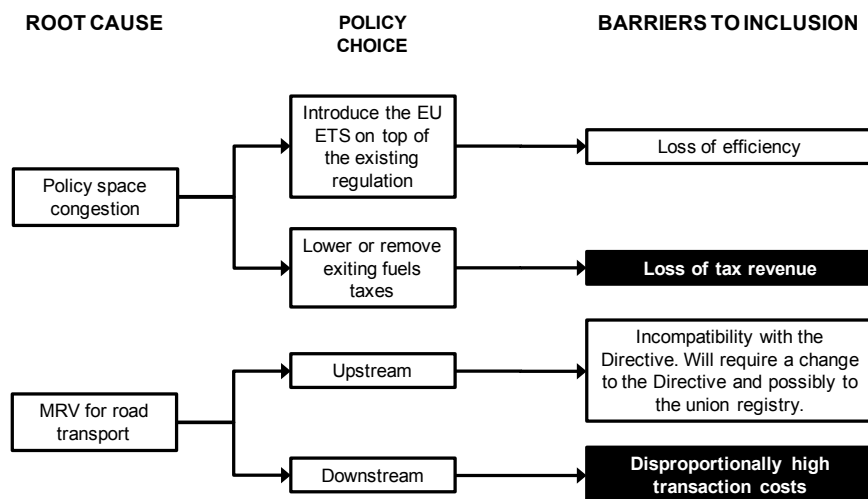
There are several options for upstream point of regulation; the fuel suppliers (position holders and importers), refineries, the vehicle manufacturers or even oil extractors. The Commission has in addition to fuel suppliers also mentioned tax warehouse keepers and excise duty points (CEC, 2014a, p. 233) Including oil extractors could, however, be difficult as it would affect Member States very differently. In California, the fuel suppliers are the point of regulation. An upstream approach has been considered to contain many advantages, one of them being the reduction in administrative complexity (CEC, 2014a, p. 233). Under upstream inclusion road vehicles would indirectly be part of the EU ETS. Whatever the price of allowances is, it is likely that the large share of it would be passed on to the consumers. This is very similar to the electricity market and the pass through of the allowance price to the electricity consumer.

To summarize including upstream point of regulations into the EU ETS is possible but it requires amending the legislation governing the EU ETS. It also requires further assessment as to which entities in the supply chain would be most suitable for inclusion.

3.4 Conclusions and extrapolation of the main barriers for road transport to other sectors

Road transport is a very significant source of GHG emissions in the EU, and especially so in the Nordic countries. The significance of emissions and technical feasibility of MRV makes road transport a prospective candidate for inclusion in the EU ETS. The main barriers for inclusion are related to the interaction with the existing policy space, loss of fiscal revenues, high administrative costs of downstream inclusion and incompatibility of upstream inclusion with the EU ETS Directive. The barriers are closely linked, as is illustrated in Figure 1.

Figure 1: Main barriers to inclusion of road transport in the EU ETS



While the efficiency loss from overlapping instrument is something that the Nordic countries can accommodate, the loss of tax revenue from lowering or removing existing fuel taxes is not. Thus, the loss of tax revenue must be compensated. If the allowance price increases as a result of inclusion of road transport, auctioning revenue from all sectors will increase and offset at least partly the lower transport fuel taxes. One potential route to fiscal neutrality is a higher allowance price as a result of inclusion, as a consequence of which auction revenue from all sectors increase.

Upstream inclusion and the need to revise the EU ETS Directive is something that the Nordic countries, and the EU, can accommodate, whereas the low cost-efficiency of downstream inclusion is not. Downstream inclusion of individual road vehicles and their operators is not realistic since it would result in transaction costs that are disproportionately large to the benefits of inclusion.

Heating faces similar barriers to inclusion as road transport. The use of heating fuels is taxed in every Nordic country, albeit less than transport fuels. Removal or lowering existing taxes on efficiency grounds leaves a hole in the state budget, which may or may not be filled by higher auction revenue. Downstream inclusion of heating faces the same transaction cost barrier as road transport as a consequence of the large number of small fossil fuel-fired boilers in the Nordic countries.

The waste sector is subject to a regulatory framework that is driven by other environmental concerns that global warming, e.g. for the waste incineration sector there is a need to regulate co-pollutants from waste incineration activities, which makes deregulation of existing policy instruments difficult should the sector be considered for inclusion in the EU ETS.

Inclusion of agriculture and fisheries faces very different barriers than road transport. The fundamental barrier for agriculture and fisheries is MRV. Emissions from these sectors cannot be measured with the same accuracy as emissions under the current scope of the EU ETS. Land Use, Land Use Change and Forestry is, similarly, only being considered for inclusion into the policy framework for 2030.

References

- AEA. (2012). *Next phase of the European Climate Change Programme: Analysis of Member States actions to implement the Effort Sharing Decision and options for further communitywide measures: A report for DG Climate Action*. Appendix 1: Greenhouse gas emissions projections, emissions limits and abatement potential in ESD sectors. http://ec.europa.eu/clima/policies/effort/docs/esd_emissions_projections_en.pdf
- Althingi. (1988a). *Act No 39/1988 on vehicle tax, with later amendments*.
- Althingi. (1988b). *Act No 50/1988 on value added tax, with later amendments*.
- Althingi. (1993). *Act No 29/1993 on excise duties on vehicles, fuels etc., with later amendments*.
- Althingi. (2003). *Act No 40/2013 on renewable fuel in transportation*.
- Althingi. (2004). *Act No 87/2004 on oil and kilometres charge, with later amendments*.
- Althingi. (2009). *Act No 129/2009 on environmental and resource taxes, with later amendments*.
- Althingi. (2013). *Act No 40/2013 on renewable fuels in transportation*.
- Bragadóttir, H., von Utfall Danielsson, C., Magnusson, R., Seppänen S., Stefansdotter, A. & Sundén, D. (2014). *The Use of Economic Instruments In Nordic Environmental Policy 2010–2013*. TemaNord 2014:549. <http://dx.doi.org/10.6027/TN2014-549>
- California Environmental Protection Agency. (2013). *California Code of Regulations Title 17 Subchapter 10 Climate Change, Article 5, Sections 95800 to 96023 California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms*. <http://www.arb.ca.gov/cc/capandtrade/ctlinkqc.pdf>
- California Environmental Protection Agency. (2015). *Overview of ARB Emissions Trading Program*. http://www.arb.ca.gov/cc/capandtrade/guidance/cap_trade_overview.pdf
- Californian Environmental Protection Agency. (2015). *17 CCR § 95811 Regulation for the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issues by Linked Jurisdictions*.
- Carlén, B. (2014). *Värdering av koldioxidutsläpp från svenska transporter – en kommentar*, VTI rapport 835.
- CEC. (2000). *Green Paper on Greenhouse gas emissions trading within the European Union*, COM(2000)87 final.
- CEC. (2006). *Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community*, COM(2006) 818 Final.
- CEC. (2008a). *Commission Staff Working Document, accompanying document to the Proposal for a Directive of the European Parliament and of the Council Amending Directive 2003/87/EC so as to improve and extend the EU greenhouse gas Emission allowance trading system, Impact Assessment*, SEC(2008) 52.

- CEC. (2008b). *Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community*, COM (2008) 16 Final.
- CEC. (2011). *White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*, COM(2011) 144 final.
- CEC. (2012a). *Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council Text with EEA relevance and Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council Text with EEA relevance*.
- CEC. (2012b). *The State of the European Carbon Market 2012*, COM(2012) 652 final.
- CEC. (2013a). *Commission Regulation EU No 389/2013 establishing a Union Registry pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Decisions No 280/2004/EC and No 406/2009/EC of the European Parliament and of the Council and repealing Commission Regulations (EU) No 920/2010 and No 1193/2011, OJ L 122, 3.5.2013*. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R0389>
- CEC. (2013b). *Integrating maritime transport emissions in the EU's greenhouse gas reduction policies*, COM(2013) 479 final, Brussels, 28.6.2013.
- CEC. (2013c). *Road Infrastructure Charging – Heavy Goods Vehicles*. http://ec.europa.eu/transport/modes/road_charging/charging_hgv_en.htm
- CEC. (2014a). *Commission Staff Working Document Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions “A policy framework for climate and energy in the period from 2020 up to 2030”*, SWD(2014) 15 final p.233 <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0015&from=EN>
- CEC. (2014c). *EU Transport in Figures, Statistical Pocketbook 2014*.
- CEC. (2015a). *Climate Action: Auctioning*. http://ec.europa.eu/clima/policies/ets/cap/auctioning/index_en.htm
- CEC. (2015b). *Climate Action: CO₂ labelling of cars*. http://ec.europa.eu/clima/policies/transport/vehicles/labelling/index_en.htm
- CEC. (2015c). *Climate Action: Fuel Quality*. http://ec.europa.eu/clima/policies/transport/fuel/index_en.htm
- CEC. (2015d). *Climate Action: Road transport – Reducing CO₂ emissions from vehicles*. http://ec.europa.eu/clima/policies/transport/vehicles/index_en.htm
- CEC. (2015e). *Energy: Buildings*. <http://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>
- CEC. (2015f). *Energy: Energy Efficiency Directive*. <http://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive>
- CEC. (2015g). *Energy: Energy Efficient products*. <http://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficient-products>
- CEC. (2015h). *EU and Iceland sign agreement for joint fulfilment of second phase of Kyoto Protocol*, 1st April 2015. http://ec.europa.eu/clima/news/articles/news_2015040101_en.htm

- Dahl, C. (2012). Measuring global gasoline and diesel price and income elasticities. *Energy Policy*, Volume 41, February 2012, Pages 2–13. <http://dx.doi.org/10.1016/j.enpol.2010.11.055>
- Danish Ministry of Climate, Energy and Building. (2013). *Denmark's Sixth National Communication and First Biennial Report under the United Nations Framework Convention on Climate Change*.
- Davíðsdóttir, B., Loftsdóttir, Á., Hallsdóttir, B., Skúladóttir, B., Kristófersson, D.M. & Rúnarsson, G. Mitigation options for greenhouse gas emissions in Iceland - Overview of results from expert committee. Ministry for the Environment, Iceland..
- EC. (2003). *Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending the Council Directive 96/61/EC OJ L 275 as amended by Directive 2009/29/EC of 23 April 2009*.
- EC. (2008a). *Directive 2008/89/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*.
- EC. (2008b). *Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community COM(2008) 20 final*.
- EC. (2009). *Decision on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, No206/2009/EC*. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2009.140.01.0136.01.ENG
- EC. (2013). *Decision No 377/2013/EU of the European Parliament and of the Council of 24 April 2013 derogating temporarily from Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community Text with EEA relevance OJ L 113, 25.4.2013*.
- EC. (2014a). *Conclusions, EUCO 169/14, 23 and 24 October 2014*. http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145397.pdf
- EC. (2014b). *Regulation (EU) No 421/2014 of the European Parliament and of the Council of 16 April 2014 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in view of the implementation by 2020 of an international agreement applying a single global market-based measure to international aviation emissions Text with EEA relevance*.
- EC. (2014c). *Report from the Commission to the European Parliament and the Council – Progress towards achieving the Kyoto and EU 2020 objectives COM(2014) 689 final Annex 1*.
- EC. (2015). *Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC (Text with EEA relevance) OJ L 123, 19.5.2015*,
- EEX. (2015). *Results EUA Primary Auctions*. <http://www.eex.com/en/market-data/emission-allowances/auction-market/european-emission-allowances-auction/european-emission-allowances-auction-download>
- Environment Agency of Iceland. (2014). *Emissions of greenhouse gases in Iceland from 1990 to 2012, National Inventory Report 2014*. Submitted under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.
- European Commission Taxation and Customs Union. (2015). *Excise Duties – Current Energy Tax Rules*. http://ec.europa.eu/taxation_customs/taxation/excise_duties/energy_products/current_energy_tax_rules/index_en.htm

- European Environment Agency. (2015a). *EEA database on climate change mitigation policies and measures in Europe*. <http://www.eea.europa.eu/data-and-maps/pam>
- European Environment Agency. (2015b). *EEA GHG Data Viewer*, updated on the 19th of March 2015. <http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>
- Finnish Information Centre of Automobile Sector. (2015a). *Motoring Taxation*. http://www.autoalantiedotuskeskus.fi/en/road_transport/motoring_taxation
- Finnish Information Centre of Automobile Sector. (2015b). *Valtion tulot tieliikenteestä 2007-2013*. http://www.aut.fi/tilastot/verotus_ja_hintakehitys/valtion_verotulot_tieliikenteesta
- Finnish Ministry of Employment and the Economy. (2014). *Työ- ja elinkeinoministeriön asetus Energiaviraston maksullisista suoritteista 57/2014*.
- Finnish Ministry of the Environment and Statistics Finland. (2013). *Finland's Sixth National Communication Under the United Nations Framework Convention on Climate Change*.
- Government of Finland. (2004). *HE 49/2004 Hallituksen esitys Eduskunnalle päästö-kauppalaiksi sekä laeiksi ympäristönsuojelulain 43 §:n ja Energiamarkkinavirastosta annetun lain 1 § muuttamisesta*.
- Government of Finland. (2013a). *Hallituksen esitys eduskunnalle energiaverotusta koskevan lainsäädännön muuttamiseksi*. <http://217.71.145.20/TRIPviewer/show.asp?tunniste=HE+110/2013&base=erhe&palvelin=www.eduskunta.fi&f=WORD>
- Government of Finland. (2013b). *National Energy and Climate Strategy - Government report to Parliament on 20/3/2013*. https://www.tem.fi/files/36292/Energia-ja_ilmastostrategia_netijulkaisu_ENGLANNINKIELINEN.pdf
- Greene, D., Evans, D. & Hiestand, J. (2013). Survey evidence on the willingness of U.S. consumers to pay for automotive fuel economy. *Energy Policy*, Vol. 6, pp. 1539–1550. <http://dx.doi.org/10.1016/j.enpol.2013.05.050>
- Heymann, E. (2014). *CO₂ emissions from cars Regulation via EU Emissions Trading System better than stricter CO₂ limits December 15, 2014*. Deutsche bank – Research.
- Icelandic Financial Management Authority. (2013). *Treasury accounts for 2013*.
- Icelandic Ministry for the Environment and Natural Resources. (2007). *Iceland's Climate Change Strategy*. http://eng.umhverfisraduneyti.is/media/PDF_skrar/Stefnumorkun_i_loftslagsmalum_enlokagerd.pdf
- Icelandic Ministry for the Environment and Natural Resources. (2010). *Aðgerðaáætlun í loftslagsmálum (Climate Change Action Plan)*.
- Icelandic Ministry for the Environment and Natural Resources. (2014a). *Iceland's Sixth National Communication and First Biennial Report under the United Nations Framework Convention on Climate Change*.
- Icelandic Ministry for the Environment and Natural Resources. (2014b). *Ísland og ESB semja um sameiginlegt markmið innan Kýótó-bókunarinnar, June 19 2014*. <http://www.umhverfisraduneyti.is/frettir/nr/2610>
- Icelandic Ministry of Industries and Innovation. (2012). *The Icelandic National Renewable Energy Action Plan for the promotion of the use of energy from renewable sources in accordance with Directive 2009/28/EC and the Commission Decision of 30 June 2009 on a template for the national renewable energy action plans*.
- Institution for European Environmental Policy. (2013). *Review of the Cost and Benefits of Energy Savings*. <http://energycoalition.eu/sites/default/files/Energy%20Savings%202030%20IEEP%20Review%20of%20Cost%20and%20Benefits%20of%20Energy%20Savings%202013.pdf>

- Kerr, S. & Duscha, V. (2014). *Going to the Source: Using an Upstream Point of Regulation for Energy in a National Chinese Emissions Trading System*. Motu Working Paper 14-09. <http://dx.doi.org/10.2139/ssrn.2503721>
- Landis, F., Schenker O., Reaños, M. A. T., Vonnahme, C. & Zitzelsberger, S. (2012). *An Overview on Current Climate Policies in the European Union and its Member States*. Centre for European Economic Research, ZEW Mannheim. http://entracte-project.eu/uploads/media/ENTRACTE_Report_Current_Policies.pdf
- Majone, G. (1989). *Evidence, Argument, and Persuasion in the Policy Process*, New Haven, CT, and London, Yale University Press.
- Motiva. (2010). *Polttoaineiden lämpöarvot, hyötysuhteet ja hiilidioksidin ominaispäästökertoimet sekä energian hinnat*. http://www.motiva.fi/files/3193/Polttoaineiden_lampoarvot_hyotysuhteet_ja_hiilidioksidin_ominaispaastokertoimet_seka_energianhinnat_19042010.pdf
- New Zealand Climate change information. (2015). *How is the waste sector affected by the ETS?* <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/waste/>
- Norwegian Environment Agency. (2014). *Greenhouse Gas Emissions 1990-2012, National Inventory Report*.
- Norwegian Ministry of Climate and Environment. (2014). *Norway's Sixth National Communication, Under the Framework Convention on Climate Change*. Status report as of January 2014.
- OECD (2014). *Database on instruments used for environmental policy*. Updated on the 24th of March 2014. <http://www2.oecd.org/econinst/queries/>
- OECD. (2011). *OECD environmental performance reviews: Norway 2011*. OECD Publishing. <http://dx.doi.org/10.1787/9789264098473-en>
- Pöyry. (2012). *Selvitys jätteen energiakäytöstä ja päästökaupasta. Raportti*. http://www.tem.fi/files/33506/Selvitys_jatteen_eneriakaytosta_ja_paastokaupasta_25.6.2012.pdf
- Statistics Denmark. (2015). *Fem gange så mange personbiler som i 1961 - Motorparken 1. januar 2015*. <http://www.dst.dk/da/Statistik/NytHtml.aspx?cid=19198>
- Statistics Finland (2013a). *Environment Statistics, Yearbook 2013*. http://www.stat.fi/tup/julkaisut/tiedostot/julkaisuluettelo/yymp_ymp_201300_2013_9920_net.pdf
- Statistics Finland. (2013b). *Environmental and Energy Taxes 2013*. http://www.stat.fi/til/yev/2013/yev_2013_2014-11-06_en.pdf
- Statistics Finland. (2014). *Environment Statistics – Yearbook 2014*. Online source: http://www.stat.fi/tup/julkaisut/tiedostot/julkaisuluettelo/yymp_ymp_201400_2014_12020_net.pdf
- Statistics Norway (2013). *Statistical Yearbook of Norway 2013, Table 415: Registered road motor vehicles and trailers, by type of vehicle*.
- Statistics Norway (2015). *General Government revenue and expenditure. Table: 10721: General government. Revenue and expenditure, by sector and type (NOK million)*.
- Statistics Norway. (2015). *Statsregnskapets inntekter og utgifter*.
- Statistics Sweden. (2014). *Fordon i trafik efter län och kommun samt fordonsslag. År 2002 – 2014*.
- Swedish Ministry of the Environment. (2014). *Sweden's Sixth National Communication on Climate Change, Under the United Nations Framework Convention on Climate Change, Ds 2014:11*.

- Swedish National Financial Management Authority. (2014). *Rapport. Tidsserier, statens budget m.m. 2013 ESV 2014:41*.
- Swedish Tax Authorities. (2014). *Trängselskatt*. <https://www.skatteverket.se/privat/skatter/biltrafik/trangselskatt.4.383cc9f31134f01c98a80001292.html>
- Swedish Tax Authority. (2013). *Handledning för punktskatter 2013. SKV 504 utgåva 16*.
- Swedish Transport Agency. (2011). *Nu har vi börjat gräva*. <http://www.transportstyrelsen.se/sv/Vag/Trangselskatt/Driftsinformation1/Nu-har-vi-borjat-grava/2011-04-15-Nu-har-vi-borjat-grava/>
- UNFCCC. (1998). *Handbook on energy sector: Fuel combustion*.
- United Nations. (1998). *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Bonn, Germany: United Nations.
- World Bank (2014). *State and Trends of Carbon Pricing 2014*.

Sammanfattning

Det europeiska systemet för handel med utsläppsrätter infördes år 2005. I början var systemets omfattning begränsat men har sedan början stegvis expanderats, geografiskt, sektoralt och gasmässigt. Denna rapport analyserar möjligheterna till ytterligare sektoral expansion av handelssystemet i de nordiska länderna. Analysen görs i förhållande till hinder och lösningar för att inkludera fyra sektorer av betydelse som för tillfället inte hör till handelssystemet: transport, uppvärmning, jordbruk och fiskeri samt avfall. Analysen fokuserar på vägtransportsektorn. Vägtransport är en mycket betydelsefull källa av växthusgasutsläpp i de nordiska länderna. De huvudsakliga hindren identifierade i denna rapport för att inkludera vägtransporten i handelssystemet har att göra med överlapp med existerande styrmedel, höga administrativa kostnader för så kallad downstream-inklusion samt potentiell förlust av skatteintäkter. Erfarenheter från andra handelssystem visar att dessa barriärer kan övervinnas.

Sectoral expansion of the EU ETS

The European Emissions trading Scheme (EU ETS) was launched in 2005. The scheme started off with a limited scope, but has gradually expanded, in terms of geographical, sectoral and gas coverage. This report analyses the possibilities for further sectoral expansion in the Nordic countries. The analysis is done in terms of barriers and solutions for inclusion of four major sectors currently outside the scope of the scheme: transport, heating, agriculture and fisheries, and waste. Focus is on the road transport sector, which is a major source of greenhouse gas emissions in the Nordic countries. The main barriers identified for inclusion of road transport are related to the overlap with existing policy instruments, high administrative costs of downstream inclusion, and potential loss of fiscal revenue. Experiences from other trading schemes show that the barriers can be overcome.

TemaNord 2015:574
ISBN 978-92-893-4363-3 (PRINT)
ISBN 978-92-893-4364-0 (PDF)
ISBN 978-92-893-4365-7 (EPUB)
ISSN 0908-6692

