Policy options for greenhouse gas reduction

A quick scan to identify potentially successful policy measures in nine European countries

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Committed to the Environment

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Content

Summary

Background

Climate policies are implemented in all countries of the European Union to achieve the 2020 and 2030 ambitions and targets and the Paris climate agreement. While each country has its own climate policy framework, there could be benefits in joining forces in some areas to speed up the necessary developments. The aim of this report is to explore this topic further and provide a broad overview of potential policy measures where synergy effects from cross-border coordination could be achieved.

The starting point of this analysis is the current Dutch coalition's ambitious CO_2 reduction target for the European Union of 55% in 2030 relative to 1990 (Rijksoverheid, 2017). If this EU target is not feasible, the Dutch coalition suggests to pursue more ambitious goals together with other, likeminded North-West European countries. By coordinating and aligning policy measures within a group of neighbouring countries, climate policies can be more effective while leakage effects and competitive disadvantages for the Dutch economy are reduced.

In this context the Dutch Ministry of Economic affairs and Climate Policy has requested CE Delft to:

- present an overview of the most effective existing and announced climate policy instruments and measures in the North-West European countries;
- identify effective climate mitigation measures which have been implemented in other countries but not yet in the Netherlands;
- assess the synergy effects if (packages of) these measures are coordinated between the group of countries;
- identify potentially successful policies and measures that have not been implemented in the North-West European countries yet.

The countries included in this study are the Netherlands, Belgium, Luxembourg, the United Kingdom, France, Germany, Austria, Switzerland and Denmark.

The result of this quick scan is the identification of a large variety of policy measures for each of these topics and an indication of synergy effects that could be achieved through international coordination. A detailed assessment of these measures and synergy effects was outside the scope of this study.

Methodology

We first developed an inventory of the main climate policies in the nine countries based on recent reports and interviews with policymakers. This served two purposes: similar policies implemented in different countries could be identified, as well as any important reduction policies in the other countries not implemented in the Netherlands.

Second, we analysed overlapping policies to highlight potential synergy effects of a coordinated approach within the group of countries. The main synergy effects include a reduction of carbon leakage, fewer competitive disadvantages and economies of scale benefits. In addition, cooperation with these countries may address the issue that CO_2 reductions in other countries are not being counted towards the national greenhouse gas (GHG) reduction target. This can also result in more cost-effective policies.

Third, we identified new climate policy opportunities that could benefit from cooperation and coordination within these countries. To achieve the highest impact, additional to the current climate policy framework, these policy efforts should focus on the sectors that are not yet expected to achieve the GHG reductions needed to meet the longer-term climate goals: the industry and transport sectors, followed by the built environment and agriculture.

Main conclusions

Policies not yet implemented in the Netherlands

An overview of policies implemented in other countries but not yet implemented or planned in the Netherlands, with potentially significant climate benefits, is presented in Table 1.

Table 1 - Important reduction policies not implemented or planned in the Netherlands

Sector	Measure	NL	AT	DK	DE	UK	FR	CH	BE	LU
Industry	Tenders for electricity and heat-saving measures				X			X		
	CO_2 tax on energy products (including UK's climate change levy)			X		X	X	X		
Transport	50% of car replacements for public authorities must be low emission vehicles						X			

NB. Crosses indicate which countries have implemented these measures.

Policies with potential synergy impacts

Policy measures where potential synergy effects could be achieved if (packages of) these measures would be coordinated between the group of countries are summarised in Table 2.

Table 2 - Policy measures with potential synergy effects

Sector	Policy measures
Energy	Coordination of subsidies for renewable energy
	Phasing out coal-fired power stations
	Carbon price floor
	Coordination of increasing of energy taxes and withdrawing exemptions and special measures for industry
	Taxes on incineration and landfilling
	Green funding/grants for industry
	Carbon capture and storage (CCS) or utilisation (CCU) support policies
Built environment	Coordination of the national implementation of the EU regulation on energy efficiency in buildings
Transport	Coordinated increases of transport fuel excise duties
	Cooperation in kilometre charging

Areas with potentially successful policies and measures

There are several areas where significant GHG reduction potential could be achieved through new policies and measures, if implemented in the North-West European countries. Some examples:

- in industry and energy, the development of policies for new technologies like power-to-hydrogen and energy storage (to enable the increase of wind and solar energy), adaptation of energy markets and joint support for R&D for the circular economy;
- in transport, strengthening of efforts in aviation and maritime shipping through coordination of the ICAO and IMO positions, and enhanced cooperation for regulations on international railway transport to facilitate international cargo transport;
- in the built environment, knowledge sharing can speed up developments, as there are many common issues the various countries need to resolve;
- in agriculture, GHG reduction can benefit from joint implementation of agricultural and consumer policies and coordination of definitions and regulations, such as the regulations for residual streams of food production and agriculture in fodder.

Recommendations

The results of this quick scan can be used as a basis for discussions with countries that share the Dutch ambition to speed up CO_2 mitigation in the coming decade. These discussions can be initiated in the various international platforms and meetings that the Netherlands is already part of, to assess which countries are interested in pursuing this route of cooperative climate policies. The areas where cooperation would have the most benefits and political support can then be identified. The next step can then be to further develop and implement the main policy measures of interest in close cooperation with this group of countries.

1 Introduction

This study presents a broad overview of the main climate policy measures implemented in nine North-West European countries, and identifies which of these policy measures could benefit from increased cooperation and policy alignment across these countries. Furthermore, as there is still a long way to go towards meeting the longer-term climate goals agreed on in the Paris climate agreement, the key gaps in the current policy framework are also identified, and potential policy measures are suggested which could fill these gaps .

1.1 Background

In October 2017 the Dutch Coalition Agreement was presented, which included a greenhouse gas (GHG) reduction target of 49% in 2030 for the Netherlands compared to 1990 levels. In addition, the government proposes a more ambitious reduction target for the European Union: a 55% reduction of emission levels in 2030 compared to 1990.[1]

If this more ambitious EU level goal is not achieved the Agreement states that the government intends to cooperate with other North-West European countries towards more ambitious climate policies. By coordinating policies and implementing instruments and measures simultaneously, climate policies can be more effective while leakage effects and competitive disadvantages for the Dutch economy are reduced.

In this context, the Dutch Ministry of Economic Affairs and Climate Policy has requested CE Delft to develop a broad inventory of potential successful measures which could be implemented in cooperation with North-West European countries, and assess the potential synergy effects. The group of countries to be investigated is Belgium, Luxembourg, France, Denmark, Switzerland, Austria, Germany, the United Kingdom and the Netherlands.

1.2 Project objectives and scope

The aims of the research are:

- to present an overview of the most effective existing and announced climate policy instruments and measures in the North-West European countries;
- based on this overview, to identify effective climate mitigation measures which have been implemented in other countries but not yet in the Netherlands;
- to assess the synergy effects if (packages of) these measures are coordinated between the group of countries;
- to identify areas with potentially successful policies and measures that have not yet been implemented in the North-West European countries.

The result of this quick scan is a large variety of policy measures for each of these topics and an indication of synergy effects that could be achieved through international coordination. A detailed assessment of these measures and synergy effects was outside the scope of this study.

[1] Instead of the 40% reduction target which has been agreed upon under the EU 2030 Climate and Energy Framework.

As the overview will show, there are many climate mitigation policies and measures implemented in the various sectors of the economy (energy, agriculture, industry, built environment, waste, etc.). We focus in this study on the most effective measures in terms of greenhouse gas reductions. Measures with little reduction impact are out of the scope.

A wide range of cooperation initiatives are already ongoing
In many of the policy areas discussed in the various chapters of this report, some form or cross-border cooperation between some or all of the nine countries is already ongoing. Besides the day-to-day forms of cooperation on specific issues, relevant examples of more formal cooperation platforms are the Pentalateral Energy Forum (with the Benelux countries, Germany, France, Austria, Switzerland) (Secretariaat-Generaal Benelux, 2018), the Strategic Forum for Important Projects of Common European Interest (IPCEI) (EC, 2018) and the energy-related work in the OSPAR Commission (OSPAR Commission, 2018).

In this report we do not attempt to develop a complete overview of ongoing initiatives, nor do we provide recommendations in which platform cooperation on the various policy measures can best be discussed. These issues are outside the scope of the study.

1.3 Methodology and report outline

The research was carried out as follows:

1. In the first step, we identified, based on a literature review, the current GHG emission targets in the nine North-West European countries, and the existing or announced policies and measures to meet these targets. Important sources were the European Environment Agency (EEA) database of policies and measures and the national communication reports under the United Nations Framework Convention on Climate Change (UNFCCC). Based on this literature research, we created a first overview of emission targets and policies and measures in the countries, with data on emission reductions per measure where available.
2. In the second step, we carried out interviews with climate policy experts in the respective countries. The main goals of these interviews were to (1) ensure that the list of measures was up to date and complete and (2) select the most important measures in terms of greenhouse gas reductions.
3. In the third step, we compared the policy measures in the nine countries and assessed which measures are overlapping, i.e. are implemented in two or more of these countries. We also identified which successful measures in other countries have not been implemented in the Netherlands.
   The results of the first three steps can be found in Chapter 2 and the two Annexes.
4. In the fourth step, we analysed the potential synergy effects of implementing policy measures simultaneously in the North-West European countries. Potential synergy effects are a reduction of carbon leakage effects, improved cost-effectiveness of the policies and less competitive disadvantages for the economy. See Chapter 3 for these results.
5. In the fifth step, we identified areas with potentially successful mitigation measures which have not been implemented in the countries and which could benefit from a coordinated approach of North-West European countries. This research has been based on a literature review, interviews with experts and CE Delft's own expertise; results are shown in Chapter 4.
6. Conclusions and recommendations are presented in Chapter 5.

2 Main climate policies in the nine countries

2.1 Introduction

The main climate measures of the nine countries investigated in this study are presented and assessed per sector:

- energy generation and industry (Section 2.2);
- the built environment (Section 2.3);
- transport (Section 2.4); and
- agricultural and land use (Section 2.5).

Energy generation and industry were combined because of the overlap of some of the key policies.

EU policies are not included in this overview (e.g. the Emissions Trading System, CO_2 targets for new cars), unless differences in their implementation mean that cooperation can be a means to achieve synergy benefits.

More background information on the climate targets and policies in the nine countries can be found in Annex A (targets) and Annex B (policy measures).

2.2 Energy generation and industry

The nine countries all support renewable energy, via feed-in tariffs, feed-in premiums (such as the Dutch subsidy scheme SDE+) or contracts for difference, reducing emissions in this sector. Another important climate measure adopted by a number of countries is the phasing out of coal plants such as the Netherlands, Austria, Denmark, the UK and France.
The German government is currently negotiating its own coal phase-out.

A short-list of the main climate policies for the energy generation sector is presented in Table 3. Renewable energy subsidies like feed-in tariffs, feed-in premiums and contracts for difference have been bundled together as they are all variations of financial support for renewable energy. Blank cells indicate that the policy is not implemented in the specific country according to the EEA database and the country's UNFCCC national communication report, and it was not mentioned in our contacts with a policymaker from the selected country. X indicates that the measure is currently implemented and X* indicates that there are (official) plans to implement the policy measure[2].

[2] For the Netherlands, the plans outlined in the 2017 Coalition Agreement were used as a basis for this assessment (Rijksoverheid, 2017).

Table 3 - Key GHG reduction measures in the selected countries in the energy generation sector

Energy generation	NL	AT	DK	DE	UK	FR	CH	BE	LU
Renewable energy subsidies (FIT, FIP, CfD)^	X	X	X	X	X	X	X	X	
Phasing out coal-fired power stations	X	X	X	Currently being negotiated	X	X	No operational coal plants	No operational coal plants	No operational coal plants
Carbon Price Floor	X*				X				

^ Feed-in tariff, feed-in premium, contract for difference.

* Proposed policy.

Table 3 shows that no major policies have been implemented yet in other countries which are not in place or proposed by the Dutch government.

Table 4 presents an overview of the main policy measures in the nine European countries for the industry sector. All countries levy energy taxes, while taxes on incineration and landfilling as well as green loans[3] or tax exemptions (for investments in energy efficiency, for example)[4] are implemented in most countries. In this table we distinguish between energy taxes for small and medium enterprises on the one hand and large consumers on the other since some countries, including the Netherlands, differentiate these rates considerably, with much higher tax rates for small-scale consumers than for large-scale consumers. It should be noted that exemptions of energy taxes for large-scale consumers were not included in our analysis[5]. Voluntary agreements on energy efficiency are also common. Research and development in carbon capture and storage (CCS) and utilisation (CCU) is currently supported in the UK where some € 145 million[6] has so far been invested, while Denmark has set aside € 13 million[7] for research in CCS. The Netherlands has stated its ambition of reducing emissions via CCS and CCU, however it is still deciding on how to support this concretely.

[3] E.g. in the UK it is provided by the UK Green Investment Bank.

[4] E.g. in the Netherlands the Energy Investment Allowance (EIA).

[5] Germany for instance exempts energy taxes for the following sectors: iron and steel, non-ferrous metals, non-metallic minerals, chemical and petrochemicals.

[6] £ 130 million at £ 0.89 per €.

[7] DKK 100 million at DKK 7.46 per €.

Table 4 - Key GHG reduction measures in the selected countries in industry[8]

Industry	NL	AT	DK	DE	UK	FR	CH	BE	LU
Energy tax SMEs	X	X	X	X	X	X	***	X	X
Energy tax large consumers	**	X	X	X	X	X	***	X	X^
Voluntary agreements and/or in combination with fiscal measures	X		X		X		X	X	X
Taxes on incineration and landfilling	X	X	X		X	X	X	X	X
Green loans/tax exemptions	X	X	X	X	X	X	X	X	
Subsidies and tenders for energy efficiency measures	X			X			X	X	X
Support policies for CCS	X*		X		X				
Support policies for CCU	X*				X				
CO_2 tax on energy products (including UK's climate change levy)			X		X	X	X		

* Proposed policy.

** The rate in the Netherlands is not zero, however it is a factor 150 lower for businesses consuming more than 10 GWh electricity per year relative to businesses consuming less than 10 MWh.

*** In Switzerland a CO_2 tax is levied instead of an energy tax.

^ Luxembourg levies the same rate for the consumption of electricity by SMEs and large consumers, but for instance differentiates rates for the consumption of natural gas.

Subsidies granted directly to industry are present in the Netherlands, Belgium and Luxembourg, while in Germany and Switzerland a tender procedure determines which companies receive subsidies to invest in electricity and/or heat-saving measures. In Germany this tendering procedure (STEP up!) was started in 2016 for electricity saving measures for all sectors with an open tender, combined with a closed tender system that targets specific sectors, target groups or technologies, focussing on investment projects that achieve savings in both electricity and heat. In Switzerland the tendering procedure focusses on electricity saving measures which would not have been taken without subsidies (to prevent free-riders) (Swiss Federal Office of Energy, 2017). The subsidies and tenders for renewable energy, included in Table 4, also apply to industry and are not repeated here.

Another policy not specifically implemented in the Netherlands is a CO_2 tax on energy products as in Denmark, France, Switzerland and the UK (where it is called a climate change levy). See the following textbox for an overview. Even though the Netherlands has a high implicit CO_2 tax rate covering around 94% of emissions of energy use in 2015 (OECD, 2018), a more direct form of taxation would be a better way to target emissions (PBL, 2014).

[8] The short-list is not exhaustive, but rather aims at bundling the most important PaMs, which are relatively similar. For instance, the subsidies for renewable energy such as feed-in tariffs, feed-in premiums and contracts-for-difference are bundled together, even though they differ in how they are implemented.

CO_2 taxes

The Dutch government has recently proposed to increase the energy tax on natural gas and decrease taxes on electricity to reflect the life cycle GHG emissions of natural gas (Rijksoverheid, 2017).
This policy is however not explicitly based on the carbon content of the energy source.

In other countries fuel taxes are directly linked to the (fossil) carbon content of the fuel.
Denmark's CO_2 tax applies to oil products, natural gas and coal and coke products. EU ETS companies are exempted (OECD, 2018a), and rates vary in proportion to the fuels' carbon content. It covers around 45% (Partnership for Market Readiness (PMR), 2017) of Denmark's GHG emissions and was around € 23/tonne[9] CO_2 in 2017.

In **France** the CO_2 tax[10] applies to oil products, natural gas and coal and coke consumption, at rates varying in line with the fuels' carbon content. It does not apply, however, to natural gas consumed by large industrial users or firms which participate in the EU ETS (OECD, 2018b). The tax covers around 35% of France's GHG emissions (Climate Transparency, 2016) and was € 40.5/tonne CO_2 in 2018 (Ministère de la Transition écologique et solidaire, 2018). According to the French government (2016)[11] the tax was expected to lead to 3 Mtonne CO_2 eq. reduction in 2017, resulting from 1 Mtonne CO_2 eq. reduction in the transport sector, and 2 Mtonne CO_2 eq. in the built environment.

Switzerland's CO_2 levy applies to oil products, coal, coke and coal products, and natural gas when used outside of road transport, at rates varying in proportion to fuels' carbon content (OECD, 2018c).
In 2018, the levy was set at around € 112 per tonne of CO_2[12].

In the **UK** the climate change levy (CCL) was introduced in 2001 to encourage energy efficiency by taxing the supply of energy in industry, commerce and the public sector. It is also linked to the fuel's carbon content (EEA, 2016). The levy rates differ between electricity, gas, solid fuels and liquefied petroleum gas and are meant to incentivise business to reduce energy consumption. Some energy-intensive industries can pay lower rates if they enter into a Climate Change Agreement with the government by signing to a target for energy efficiency or carbon reduction (UK Department for Business, Energy and Industrial Strategy, 2017).

2.3 Built environment

All countries employ an energy or CO_2 tax, fiscal incentives or support for energy efficiency measures for existing buildings and have energy efficiency standards for existing and new buildings in place. As obligated by the EU's Energy Performance of Buildings Directive new buildings built in the EU in 2021 have to be nearly zero-energy buildings with low energy requirements. National policies on new buildings have therefore been tuned to reach this goal by the end of 2020. Some countries also provide investment subsidies for small-scale renewables like heat pumps and solar water heaters. A list of the key reduction policies for the built environment in the nine countries is presented in Table 5.

[9] DKK 172.5/tonne at an exchange rate of DKK 7.46 per €.
[10] Part of the TICPE: domestic consumption charges on energy products.
[11] Response to Carbon Tax Guide: A Handbook for Policy Makers – Questionnaire.
[12] 96 Swiss francs per tonne of CO_2 at an exchange rate of 1.17 Swiss franc per €.

Table 5 - Key GHG reduction measures in the selected countries in the built environment

Built Environment	NL	AT	DK	DE	UK	FR	CH	BE	LU
Energy or CO_2 tax	X	X	X	X	X	X	X	X	X
Obligated heat transition plan per municipality	X*								
Loans/grants/fiscal incentives for energy efficiency in existing buildings	X	X	X	X	X	X	X	X	X
Investment subsidies small-scale renewables	X	X		X	X	X		X	
Energy efficiency standards/labels existing and new buildings	X	X	X	X	X	X	X	X	X
Mandatory energy efficiency refurbishments existing buildings	X				X*	X			

* Proposed policy.

The Dutch Climate agreement for the built environment includes an obligation to draw up a heat transition plan for municipalities, which will determine the neighbourhoods which will transition away from natural gas by 2030, and includes implementation plans to make the transition plans concrete. With respect to mandatory energy efficiency refurbishments of existing buildings the Netherlands has an obligation to include insulation renovations when more than 25% of the surface of the building is renewed, modified or enlarged (although it is not clear how this cut-off is practically enforced[13]). In France compulsory energy efficiency renovations are not only applicable to renovations to the living quarters, but also to renovations of the building's façade, its roof or garage.

France: Requirement thermal insulation refurbishments all major building renovations
This regulation was implemented in 2017 as part of the Energy Transition for Green Growth Act of 2015, without a minimum surface area cut-off: thermal insulation refurbishments are compulsory when there are any major renovations taking place to a building's façade, its roof, or any conversion of garages or the living quarters. This applies to residences, offices, commercial spaces, educational centres and hotels.
To finance these insulation measures, operations may benefit from financial aid packages such as energy transition tax credits, zero-interest eco-loans and energy savings certificates. The measure is likely to affect 171,000 buildings per year, and it is expected to lead to an emissions reduction of 333 ktonnes in 2018 (Ministère de l''Environnement, de l'Energie et de la Mer, 2017).

Germany's energy-efficient construction and modernisation programme, which is run by its development bank KfW, is quite different from how energy renovations to existing buildings are financed in the Netherlands. Subsidised loans and grants for residents are provided at their local retail bank.

Germany: Energy-Efficient Refurbishment Programme
Retail banks can provide subsidised loans and repayment bonuses for energy saving renovations in existing residential and non-residential buildings. These loans are provided by savings and cooperative banks, which in turn loan from Germany's development bank KfW. The KfW's AAA rating means it can cheaply acquire funds via capital markets and has the guarantee of the Federal Government. Furthermore the government, via the Federal Ministry of Building, Transport and Urban Development, provides an interest subsidy to KfW, enabling it to lower its interest rates at which it lends to commercial banks. This allows these banks to offer loans to homeowners below market rates. The programme provides funding depending on the level of efficiency that is achieved with the renovation. This measure, including the funding provided for the construction of new energy-efficient buildings, is expected to realise a CO_2 reduction of 2.9 Mtonnes in 2020 (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), 2017).

[13] Most adaptations to the existing buildings are permit-free, such as insulating roofs or placing a small extension the building. As a result, there are practically no enforcement options.

2.4 Transport

National climate policies within the transport sector mostly centre on fiscal exemptions for fuel-efficient cars (private and company owned) and fuel excise duties and/or CO_2 taxes. Company-specific incentives for cars are usually additional to other instruments (purchase subsidies, registration tax differentiation, etc.), providing a further incentive to fleet managers to lower emissions of their fleet (EEA, 2018). Aviation taxes and a kilometre charge for heavy vehicles are also implemented in some countries, and further described in Section 3.4.4. In Table 6 the main GHG reduction policies taken in the set of countries are shown.

Table 6 - Key GHG reduction measures in the selected countries in the transport sector

Transport	NL	AT	DK	DE	UK	FR	CH	BE	LU
Fuel excise duty and/or CO_2 tax	X	X	X	X	X	X	X	X	X
CO_2 differentiated company car incentives	X	X	X		X	X		X	
CO_2 differentiated fiscal policy passenger cars	X	X	X	X	X	X	X	X	X
Kilometre charge heavy vehicles**	X*			X			X	X	
Aviation ticket tax	X*	X		X	X	X			
Tyre pressure campaign	X								
50% of car replacements for public authorities must be low emission vehicles						X			

* Proposed policy.

** The Eurovignet, also a form of road toll for heavy-duty vehicles in the Netherlands, Luxemburg, Denmark and Sweden is not included here as it is typically not considered to be a climate policy.

The Netherlands is the only country to propose a tyre pressure campaign as a climate policy to improve transport efficiency. In France, the state's vehicle replacements must include at least 50% low-emissions vehicles. For local authorities this must be at least 20%, while rental companies and taxi operators' vehicle fleets must have a share of 10% low-emissions vehicles by 2020 (Ministère de la Transition Écologique et Solidaire, 2017).

2.5 Agriculture and Land Use, Land use Change and Forestry (LULUCF)

In the UK, the Netherlands and Switzerland voluntary agreements have been signed for emission reductions in the agricultural sector. For instance in the Netherlands the Agro Covenant was signed in 2008 in the agriculture and horticulture sectors to reduce emissions in 2020 by 3.5-4.5 Mtonnes relative to 1990 levels. In Table 7 some of the important GHG reduction policies implemented in the set of countries are included.

Table 7 - Key GHG reduction measures in the selected countries in the agriculture sector

Agriculture/land use	NL	AT	DK	DE	UK	FR	CH	BE	LU
Voluntary emissions reduction agreements	X		X		X		X		
Manure management	X	X	X	X	X	X	X	X	X
Land use measures (afforestation, reduction CH_4 leakage from peatlands)	X			X	X				

In these nine countries most agricultural policies leading to greenhouse gas reductions are set at the EU level, such as the Common Agricultural Policy, the National Emissions Ceiling Directive and the Nitrates Directive. Manure management is tailored to adhere to this last Directive. With regards to land use, the UK has a plan to plant 11 million trees in order to absorb CO_2 from the atmosphere, while the Netherlands wants to add an additional 40,000 ha to its nature network by 2027, which will include afforestation. It is not yet known how many trees will be planted.

2.6 Conclusions

The countries included in this analysis employ a range of climate policies which are either not implemented in the Netherlands, or are implemented differently, which Dutch policymakers could learn from. Also, many policy measures are implemented in more than one country, although the details of the implementation vary. These measures warrant further investigation to assess if the Netherlands could learn from experiences in other countries, and to determine if more cooperation and alignment of these similar-but-different measures could be beneficial.

For the energy and industry sector, the Dutch government aims to introduce a carbon price floor, following the lead of the United Kingdom which has one in place since 2013, as well as phasing out the remaining five coal plants between 2024 and 2030. All nine countries have some form of renewable energy support.

Some countries such as France, the United Kingdom, Denmark and Switzerland levy CO_2 taxes on energy products, which is a more focussed policy measure to reduce greenhouse gas emissions than the Netherlands' energy tax. With a CO_2 tax, energy from fossil sources that emit more CO_2 per GJ such as coal will have a higher levy than energy from sources with lower emissions such as natural gas, and renewable energy is exempt. An energy tax is typically levied on all energy consumed, irrespective of the source. Other interesting industry measures include Germany and Switzerland's tender procedure to allocate subsidies to the most cost-effective electricity (or energy) saving measures in industry.

In the built environment, new buildings in the EU have to adhere to the European Energy Performance of Buildings Directive. However, with respect to existing buildings there are innovative policies being implemented to save energy: in France it is compulsory to improve the energy efficiency of existing buildings in case there are major renovations, while in Germany financing for energy saving measures can be acquired from retail banks.

In the transport sector, all studied countries have fiscal policies in place for new car sales based on their efficiency and excise duties on fuel consumptions. France's obligation to replace a part of the state's vehicle fleet with low-emission vehicles is not currently implemented in the Netherlands.

With regards to agriculture and land use the Netherlands and the UK have both set ambitions for afforestation and voluntary emission reduction agreements.

3 Synergy through cooperation

3.1 Introduction

Based on the policy overview of the previous chapter, we can assess which current and proposed Dutch policies measures would have the most potential synergy benefits when coordinated with other countries. Before discussing these measures individually, we first describe the potential benefits of policy harmonisation and select those measures which could potentially have the largest synergy impacts from an international approach.

3.2 Different types of benefits

International cooperation to harmonize policy measures in neighbouring countries can improve the cost-effectiveness of policies. Four major benefits can be distinguished:

1. A first benefit is a potential **reduction in carbon leakage effects**. Climate measures, such as taxes or regulations, can result in cost increases for the industry and thereby a loss of market share to foreign competitors that are not faced with these cost increases. If companies shift their activities to other countries, or foreign based companies increase market shares at the expense of companies located in the Netherlands, the climate measure will result in lower CO_2 emissions in the Netherlands but an increase of activities and emissions in other countries.[14] Harmonising and coordinating measures can reduce the risk of leakage.
2. A second potential benefit, related to the first one, is reducing negative economic impacts of policy: the harmonisation of measures **reduces the competitive disadvantages** for the Dutch industry. The level playing field can be maintained with less distortions in international markets and less competitive disadvantages for Dutch companies.
3. A third benefit is an **improvement of markets and economics of scale**. By harmonising measures, it will be easier for companies (including SMEs) to comply with foreign regulations, reducing administrative cost and the need for technical differentiation of their products. A larger market can lead to more competition and cost reductions because of economies of scale. It will also stimulate innovations and investments. Harmonising policies is in line with the EU's Single Market Act, which aims to create an internal market and remove obstacles to the free cross-border trade in goods, services, capital and labour. Economic theory suggests mutual national welfare gains by removing barriers to cross-border trade.[15]
4. A fourth benefit is that the issue of achieving cross-border CO_2 reductions in a system with national goals and targets can be resolved. Some measures, such as CCU, product policies or recycling, can lead to reduction of greenhouse gases in other countries. Although these measures could be very (cost)effective from an environmental perspective, emissions that are administratively attributed to other countries do not contribute to meeting national targets. Cooperation (for instance making agreements on costs) can ensure that costs and benefits are attributed to the same country, making it more attractive for policymakers to implement these measures.

[14] Carbon leakage can also occur when a reduction in energy prices in the North-West European market (due to reduced energy demand in the Netherlands) triggers higher energy demand and CO_2 emissions elsewhere.

[15] Economic welfare can increase because of specialisation benefits.

The first two types of benefits (carbon leakage and competitive disadvantages) will mainly occur when climate policies increase the costs for companies operating in international markets. Typical measures that could increase cost are taxes (such as energy taxes, a carbon price floor) or standards and regulations (including coal phase-out). For such measures the benefits of international harmonisation are potentially the most significant.

Measures lowering the cost of technologies (such as subsidies or tax exemptions) will have little or no leakage risks, as these measures will not increase cost prices for companies. For these measures the third and fourth categories of benefits (economies of scale and/or solving issues with reductions over the border) are potentially more relevant.

The exact benefits of cross-border cooperation will depend strongly on the details of the policy measures that are implemented jointly, for example the scope and level of a tax or levy implemented jointly, on the countries that are cooperating, etc. In this report we can therefore only identify the type of benefits that can be achieved for the policy measures that are discussed. A quantitative assessment of the effects requires a more detailed design of the policies, and typically also a detailed impact assessment (including modelling of effects).

3.3 Selection of measures with potential synergy impacts

Table 8 shows measures that are currently in place in the Netherlands or have been proposed recently (see Chapter 2). For each measure we have assessed if national implementation could potentially result in costs increases, and if the measure affects sectors exposed to international competition. Measures meeting both criteria, indicated by the red highlighting, have the most risk of causing leakage effects and could benefit from international cooperation.

Table 8 - Cost increasing policy measures for sectors exposed to international competition (a, b, c: see notes below)

		Cost increasing measure	Sector exposed to international competition
Energy and Industry	Renewable energy subsidies		X
	Phasing out coal-fired power stations*	X	X
	Carbon Price Floor*	X	X
	Energy tax	X	X
	Voluntary agreements and/or in combination with fiscal measures		X
	Taxes on incineration and landfilling	X	X
	Green funding/grants for industry		X
	Subsidies for CCS/CCU		X
Built environment	Energy and/or CO_2 tax	X	(a)
	Loans/grants/fiscal incentives energy efficiency existing buildings		(a)
	Investment subsidies small-scale renewables		(a)
	Energy efficiency standards/labels existing and new buildings	X	(a)
Transport	Excise duties, energy and/or CO_2 tax	X	X (c)
	CO_2 differentiated fiscal policy passenger cars		(a)
	Kilometre charge heavy vehicles	X	(b)

		Cost increasing measure	Sector exposed to international competition
	Aviation ticket tax	X	X
	Tyre pressure campaign		(a)
Agriculture and land use	Voluntary agreements emissions reduction		X

a Consumers are not exposed to international competition.

b The commercial transport sector is exposed to competition, but it is assumed here that international competitors are affected by the kilometre charging as well.

c Gas stations near the border are exposed to international competition.

In the industry and energy generation sectors, measures meeting both criteria are the proposed phase-out of coal-fired power plants, the carbon price floor, and incineration and landfill taxes. In addition, energy taxes for the industry could potentially result in leakage impacts although levels in the Netherlands are currently limited for the energy-intensive industry.[16]

Consumers in the built environment and the transport sector are hardly exposed to international competition. Most cost increasing measures in these sectors are therefore unlikely to have significant leakage impacts. However, there are some exceptions: aviation ticket taxes may harm the competitive position of the aviation industry (passengers moving, for example, from Amsterdam to the Brussels Airport) while excise duties may harm the competitive position of gas stations near the border.
Other measures in the transport sector (such as stimulating energy-efficient transport) do not increase cost prices nor harm competitiveness significantly. Kilometre charging for heavy-duty vehicles will also apply for international competitors and will therefore have little leakage impacts (also note that Germany and Belgium have this system in place already).

In the agricultural sector, the voluntary agreement (covenant) for the horticultural sector has probably not resulted in major cost increases according to the most recent evaluation (CE Delft, 2016a).

Other measures with potential synergy impacts when coordinated

In addition to the measures indicated in red in Table 8, measures with little leakage risk could still have synergy advantages when coordinated, if this results in economies of scale benefits and/or increased market demand for new technologies. Cooperation could also be used to overcome the issue of CO_2 reduction over the border, encouraging and enabling governments to opt for cost-effective climate measures that reduce GHG emissions in one of the other European countries.

[16] In the industry and electricity sector, most current measures in the Netherlands are voluntary (MJA/MEE convenant) or decrease costs of measures (SDE+, EIA, MIA\VAMIL, Green Funding). For companies under the 'Wet milieubeheer' only cost-effective measures with a payback period lower than five years are compulsory. Such measures are unlikely to harm the competitiveness of the Dutch industry.

We foresee that in particular measures with large reduction potentials that require large-scale roll out of new technologies and companies operating in international markets could benefit from these effects of cooperation. Such measures are renewables support schemes (achieving economies of scale in the renewable energy industry), harmonisation of building standards (construction industry, technology providers), fiscal exemptions for energy-efficient cars (car industry) and kilometre charging (transport industry, heavy-duty vehicle industry).

Potential measures with emission reductions over the border that could benefit from international cooperation are stimulation of CCU/CCS and product and recycling policies. The potential benefits of international coordination of CCU/CCS policies will be discussed in Section 3.4 while cooperation on recycling policies is discussed further in Section 4.3.

3.4 Key measures with synergy benefits from international cooperation

The result of this assessment, an overview of the implemented (or proposed) policies in the Netherlands with most potential for synergy effects are presented in Table 9. Below we discuss the cooperation benefits per measure in more detail.

Table 9 - Policies and potential benefits when coordinated with other countries

Policy	Potential benefits		
	Reduction of leakage	Less competitive disadvantages	Trade benefits and economies of scale
Energy			
Carbon price floor	X	X	X
Coal phase-out	X	X	X
Renewables support (FIP, FIT, Quota, Tendering, etc.)			X
Industry			
Incineration and landfill taxes	X	X	X
CCS/CCU			X
Energy taxes	X	X	X
Built environment			
Building standards			X
Transport			
Fiscal exemptions energy-efficient cars			X
Excise duties fuel	X	X	
Kilometer charge			X
Aviation ticket tax	X	X	X

3.4.1 Energy

Renewables subsidies (FIP, FIT, Quota, Tendering procedures, etc.)

Different support schemes are in place in the North-West European countries to support renewables. Examples are feed-in premiums, feed-in tariffs and quota systems. Coordination of these schemes can result in cost reductions through more market integration, increased competition and economies of scale.

Coordination could take place in the form of opening support schemes (tendering procedures[17]) for cross-border projects. A recent report from the Council of European Energy Regulators (CEER, 2018) showed that is not common practice yet in Europe. So far only Germany and Denmark have opened auctions for ground mounted PV installations in neighbouring countries (signed in July 2016).[18] The German and Danish authorities foresee an extension of cross-border support to onshore wind. Such cooperation could be potentially interesting for cross-border projects for the Netherlands as well. Germany announced that it will open 5% of yearly installed renewable capacity to installations in other Member States from 2017 onwards (ca. 300 MW per year). This could support a joint learning curve and more competition in auctions.

Another form of coordination could also take place by fully aligning support schemes. However, such a process is complicated and should be approached in a holistic manner. Spijker et al. (2015) showed that policy harmonisation of renewables support schemes is multifaceted and does not only require the implementation of renewables support.[19] There are multiple auxiliary policy instruments that impact cost prices of renewables and should be aligned as well. Examples are differences in regulations for the biomethane market (e.g. which biomass resources are allowed) or requirements of balancing periods.[20] If not properly addressed, the costs (or inefficiencies) resulting from such differences could partially or completely offset the benefits from the coordinated effort. Full alignment of the policies therefore requires an integrated approach and an intensive political process.

There may be less drastic forms of coordination that could reduce administrative efforts, for example by coordinating the administrative requirements for the support. This could be explored further.

[17] Under the EU Guidelines on State Aid for Environmental Protection and Energy (EEAG), EU Member States are required to introduce competitive tendering procedures for determining the level of operational support granted to RES installations from 2017 onwards (CEER, 2018).

[18] In the fourth quarter of 2017, a 50 MW auction in Germany was opened for installations in Denmark. The volume of the bids was 297 MW, and 5 bids of 10 MW were awarded with a reference value of 5.38 €ct per kWh.

[19] In this study the practical implications of harmonising the Dutch and German schemes for biogas were assessed.

[20] Because of the longer balancing period in Germany, gas can be stored for a longer period of time and be sold at moments that prices are higher. This is a competitive advantage of German regulations which should be taken into account as well when harmonising policies. Furthermore, in the Netherlands the yearly subsidy budget is capped while in Germany this is not the case. The absence of a cap reduces the project risk for investors in Germany (risk of not receiving the subsidies) decreasing the costs of capital. These examples show that feed-in premiums could not be simply harmonised between Germany and the Netherlands.

Coal phase-out

Phasing out coal-fired power plants is a measure with potentially significant leakage effects that can be reduced significantly with international cooperation and harmonisation of measures. For this reason, international cooperation on this issue is already taking place at the moment. To align policies, the Powering Past Coal Alliance has been signed by (among others) fifteen European countries: Austria, Belgium, Denmark, Finland, France, United Kingdom, Ireland, Italy, Latvia, Liechtenstein, Luxembourg, Netherlands, Portugal, Sweden, and Switzerland. By joining the alliance, the countries have committed to phasing out coal power.

Of the North-West European countries considered in this report, the most recent developments are:

- In May 2018, the Dutch government announced a legal ban of electricity production with coal from 1 January 2030 onwards (Volkskrant, 2018).
- The Danish Ministry of Energy, Utilities and Climate also unveiled proposals to phase-out coal for electricity production by 2030 (IEEFA, 2018).
- The French president has promised to shut down coal power plants by the end of 2021 (Reuters, 2018).
- The German government agreed in its coalition treaty to put in place an end date for coal power (Clean Energy Wire, 2018a). In 2018, a commission has been installed to make agreements on the coal phase-out (Clean Energy Wire, 2018b).
- The UK government has unveiled a phase-out plan in January 2018 to close all plants by 2025 (The Guardian, 2018).
- Austria will phase-out coal by 2025 (Erneubare Energien, 2015).
- Luxembourg, Belgium and Switzerland do not have coal-fired power plants. In Belgium the last coal plant closed in March 2016.

We can conclude that in all countries with coal generation the phase-out is on the political agenda. More coordination and cooperation could accelerate the phase-out, whilst reducing carbon leakage effects of this policy. Other measures (such as a carbon price floor, see below) could be implemented jointly to stimulate the process.

Carbon price floor/Carbon pricing

A North-West European carbon price floor could have a significant climate impact, as it can provide an incentive for companies to invest in GHG reduction measures irrespective of the ETS price. This policy allows frontrunner countries to speed up decarbonisation efforts in industry, and it enables governments to provide a more stable and predictable incentive for investors than the EU ETS. So far this measure has only been implemented in the United Kingdom for electricity generation. A recent study concluded that a North-West European carbon price floor and a coal ban (Netherlands, Belgium, Germany, France, Austria, Switzerland) could reduce emissions by 40 Mtonnes. When a price floor and coal ban are implemented in the Netherlands only, the reduction is 4 Mtonnes (Frontier Economics, 2018)[21].

France has proposed a carbon floor price on several occasions, while in Germany this discussion has been taken up by a commission that has been formed to investigate a coal phase-out. In September 2018, the French and German government planned a high-level bilateral climate working group to develop joint policies for carbon pricing with a view to the next Franco-German Council of Ministers scheduled for early 2019.

[21] Frontier Economics (2018) does not mention the carbon prices they used in their report.

However, at this stage no concrete measures have been discussed yet. According to French policymakers we interviewed during this project, different options for implementation will be discussed, both within and outside the EU ETS. The Dutch government (and other countries) could join these discussions, further expanding the scope of the measure and thereby of the level playing field that this policy can create. If agreements will be made in a broader North-West European context, the cost-effectiveness of carbon pricing could be increased significantly.

3.4.2 Industry

Incineration and landfill taxes

Several countries have introduced landfill and/or incineration taxes. Table 4 shows that in all the considered European countries except Germany this is the case. A study of the Confederation of European Waste to Energy Plants (CEWEP) confirms that only four countries in Europe do not have a landfill tax (Germany, Croatia, Malta and Cyprus).

In the Netherlands, the tax was introduced in 1995, repealed in 2012 and reintroduced in 2015. The tax rate was 13 €/tonne waste (both for landfilling and incineration). In addition, there is a landfill ban on over 60 waste streams (including combustible and biodegradable waste). The waste streams that have ended up in landfills have decreased significantly in the Netherlands, mainly as a result of these bans. The 2017 Dutch Coalition Agreement presented that the revenue of this tax will increase by € 100 million from 2019 onwards. The bill for fiscal greening proposes to increase the tax rate to 31.19 €/tonne. This will increase costs for waste incineration and stimulate recycling.

However, the tax rates of landfilling and incineration differ substantially between North-West European countries, while Germany (with a large market) has no taxes at all. To prevent carbon leakage effects (and cross-border transport of waste), the level of taxes could be more aligned to create a level playing field. The absence of taxes in Germany is considered to be one of the arguments not to increase the level of the incineration and landfill taxes further in the Netherlands.[22] Cooperation could pave the way to more ambitious policies.

CCU and CCS

Carbon capture and use (CCU) can occur through mineralisation when CO_2 is stored in sand-lime bricks and becomes permanently stored (CE Delft, 2018a). If these bricks would usually be manufactured in another country, say Germany, and the mineralisation occurred in the Netherlands, the CO_2 savings would not officially be attributable to this mineralisation process nor counted towards the national GHG target of the Dutch government. This reduces the incentive to implement this type of technology. This administrative issue could be solved through cooperation between a group of countries, for example by agreeing that these emission reductions count towards the national target of the country supporting this technology (in this example the Netherlands), and not towards the national target of the other country (in this example Germany). Note that this would only be relevant for national targets, as it is not allowed for GHG reduction targets in the EU Effort Sharing Agreement (i.e. the non-ETS target) or in IPCC accounting.

[22] From 2019 a tax will be introduced for incineration or landfilling of Dutch waste abroad. This measure will increase the level playing field for the treatment of Dutch waste.

With respect to carbon capture and storage (CCS) the studied countries differ in their potential for CO_2 storage. According to Höller and Viebahn (2011) the UK has a storage potential of 15 Gtonne, Germany 5 Gtonne, the Netherlands 3 Gtonne and France and Denmark 1 Gtonne each. This means that some of these countries (like Germany and France) will probably need more storage capacity than is available to them in their own territories (Höller & Viebahn, 2011). Cooperation is therefore needed in order to ensure the matching of supply and demand for CO_2 storage, the building of infrastructure and coordination of state support. See also Section 4.3.1 for more discussion on international cooperation on this technology.

Energy taxes for industry

Minimum energy tax rates in the EU are laid out in the Energy Tax Directive (EC, 2003). Member States are however free to apply energy tax rates above these minimum rates. In the Netherlands the energy tax rate on for instance electricity is inversely proportional to the quantity consumed. Businesses pay a tax rate of € 117.8/MWh when consuming 0-10 MWh of electricity, while this rate falls to € 0.8/MWh for companies when consuming more than 10,000 MWh (EC Taxation and Costums Union, 2018). All other Member States levy a flat rate, which varies from € 0.5/MWh in Denmark to € 22.5/MWh in France. It should however be noted that some countries provide exemptions to certain consumers — these were not investigated in this study.

For taxes on natural gas the flat rates for business use vary more than those for electricity. In the Netherlands the tax rate on natural gas use is also inversely proportional to the quantity consumed: for businesses using less than 170,000 m^3 the rate is more than € 8/GJ, while that for large-scale consumers the rate is € 0.4/GJ. With respect to flat rates on natural gas for business use Denmark has the highest rate (€ 7.5/GJ) of the selected Member States, followed by Germany (€ 4/GJ). Exemptions were not included in this comparison.

International alignment of these rates and exemptions would ensure a level playing field, and it would also make implementation of energy tax increases easier in sectors that operate on an international market. See also the discussion on carbon taxes in the next section.

3.4.3 Built environment

Cooperation on the implementation of building standards

Building standards can be a key measure to reduce greenhouse gas emissions in the built environment. Since 2002, the Energy Performance of Buildings Directive (EPBD) has been the main EU legislation on the reduction of the energy consumption of buildings. The EPBD requires all new buildings to be nearly zero-energy by the end of 2020, and new public buildings must be nearly zero-energy by 2018. This will decrease emissions from the new building stock substantially.

However, the calculation methods for determining the energy efficiency of buildings differs between countries. According to DG Energy, in 2017 there were 35 different performance calculation methodologies across Europe (EC, 2017a).[23] This may increase the barriers and transaction costs for companies to operate abroad, as they are less familiar with national guidelines and methodologies. Standardisation may therefore facilitate trade, increase economies of scale and stimulate implementation of cost-effective measures and innovations.

Internationally standardised rules and guidelines have been developed to harmonize the assessment of the energy performance of buildings (the EPB), which were approved in January 2017 (EC, 2017b). Member States are obligated to translate those (general) rules into national legislation. In the Netherlands, the new rules will be introduced in 2020 replacing the current method for determining the energy efficiency performance (the so-called Energieprestatiecoëfficiënt, EPC). Other Member States are in similar processes for implementing new rules on the assessment of the energy efficiency in buildings. Further coordination and alignment of these rules can lead to more cost-effective policies in the built environment.

The translation of the technical rules and guidelines into national guidelines is carried out by the Dutch Ministry of the Interior and Kingdom Relations, in dialogue with the NEN standardisation organisation. Coordination with other Northwest European countries could take place in for instance the concerted action EPBD (organized by the European Commission, see box below) or by organising study courses or workshops with representatives of the nine countries to share best practices.

The "Concerted Action" (CA) EPBD is a European network that supports the dialogue among the Member States in implementing the Energy Performance of Buildings Directive (EPBD). It involves workshops, lectures and discussion with representatives of national ministries or their affiliated institutions who are in charge of preparing the technical, legal and administrative framework for the Energy Performance of Buildings Directive (2002/91/EC) and the Recast (2010/31/EC) in each EU Member State, plus Norway. The objective is to enhance the sharing of information and experiences from national adoption and implementation of this important European legislation (CA EPBD, 2018).

3.4.4 Transport

Fiscal exemptions energy-efficient cars

Most countries exempt electric vehicles from ownership taxes and company taxes are deductible. In addition, all the countries have introduced fiscal stimulations or grants for the purchase of electric and energy-efficient cars (ACEA, 2018):

- In the Netherlands, electric cars are exempt from registration tax and motor vehicle tax.
- In Denmark, owners of electric vehicles (BEVs) are partially exempted from the registration tax (40% of the registration tax in 2017). This percentage will gradually increase to 65% in 2018, 90% in 2019 and 100% in 2020. In addition, hydrogen and fuel cell-powered vehicles will be exempted from registration tax until the end of 2020.

[23] These methods are often not in line with international EN/ISO standards.

- In Belgium (Flanders), electric and plug-in hybrid vehicles are exempt from registration tax (until 31 December 2020). Electric vehicles have the lowest rate of annual circulation tax in all three regions. In addition, grants are available for the purchase of battery electric and hydrogen-powered cars.
- In Luxembourg electric and fuel-cell vehicles receive a tax allowance of € 5,000 (in the registration tax). In addition, owners of electric vehicles pay the minimum rate of the annual circulation tax.
- In Germany, purchasers of electric and fuel-cell vehicles receive a grant of € 4,000. For plug-in hybrid and range-extended electric vehicles a grant of € 3,000 is available. In addition, electric vehicles are exempt from the annual circulation tax for a period of ten years.
- In France, purchasers of electric and hybrid electric vehicles emitting 20 g CO_2/km or less are eligible for a premium of € 6,000 (under a bonus/malus scheme). In addition, a grant of € 4,000 is available for replacing an eleven-year or older diesel vehicle for a new battery electric vehicle (or € 2,500 for a plug-in hybrid vehicle).
- In Austria, electric vehicles are exempt from the fuel consumption tax, ownership tax and company car tax (Linszbauer, 2017). (ACEA, 2018).
- In the United Kingdom, zero-emission vehicles are exempt from vehicle excise duty, while cars that emit less than 50 g/km qualify for 100% first year writing down allowances from April 2018 until March 2021.

This overview illustrates the differences in fiscal stimulations for electric and energy-efficient vehicles. Aligning tax exemptions and grants therefore has the potential to integrate markets and to reduce administrative cost to car manufacturers. If vehicles, having received a tax exemption (or purchase grant) in one country, are sold in the second hand market in another North-West European country, the emission reductions achieved during the remainder of the lifetime of the vehicle are attributed to the country after the sale. Although the net (global) CO_2 reduction is not affected by the sale, it will lower the CO_2 reduction effect of the purchase grants for the country in which the new car has been purchased. This could prevent policymakers from implementing more ambitious policies and raise purchase grants significantly. Aligning policies (one-off purchase grants and annual tax benefits) could thus allow for more ambitious policies for stimulating electric cars.

Kilometre charge freight transport

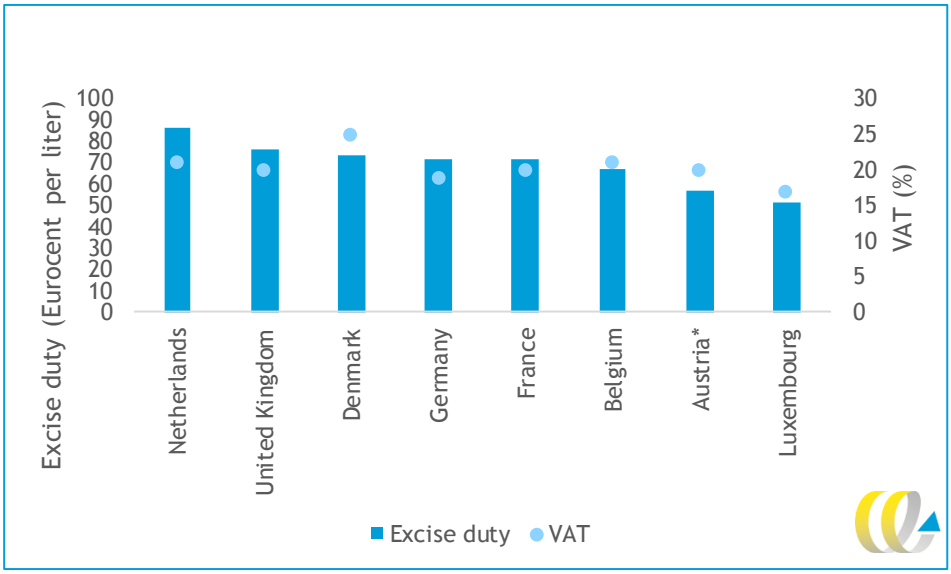
In the Netherlands, the 2017 Coalition Agreement (Rijksoverheid, 2017) states that a kilometre charge for freight will be introduced. In the surrounding countries such a charge is already in place (Germany, Belgium). In Austria an electronic network-wide toll exists as well, while in the other North-West European countries (UK, France, Denmark) a vignette is in place or tolls exist with physical barriers (France) (EC, 2015). In Switzerland drivers of vehicles weighing over 3.5 tonnes are required to pay tax on the use of road sections instead of vignettes.

Coordinating the electronic network-wide toll (kilometre charge) with Belgium and Germany can have multiple synergy effects. It enhances the level playing field and prevents additional costs for the required technical equipment in trucks.

Excise duties fuel

As stated in Section 3.4.1, transport energy taxes like fuel excise duties differ between Member States. These differences in fuel tax rate provide an incentive for cross-border tanking and hamper the competitive position of gas stations near the border in the country with the highest taxes. The rate of the excise duties (and VAT) in the nine countries included in this study are presented in Figure 1.

Figure 1 - Excise duties and VAT petrol[24] in 2018



* Austria imposes a different excise duties depending on the biofuel content. In this figure the average rate has been presented.

Source: (EC Taxation and Costums Union, 2018).

Figure 1 shows that Dutch tax rates are currently the highest within the group of North-West European countries. Coordination of these tax rates could improve the level playing field, reduce leakage effects and allow for more ambitious policies.

Aviation ticket taxes

Direct emissions from aviation account for about 3% of the EU's total greenhouse gas emissions (CE Delft, 2016b). Currently a number of countries levy ticket taxes, such as Austria, Germany, the UK and France. Even though these taxes make up a relatively small portion of the average ticket price (CE Delft; SEO, 2018 (ongoing)), higher tax rates could have significant effects on aviation-related CO_2 emissions.

[24] No data have been presented for Switzerland in EC (2018).

The Government of the Netherlands has announced that it will work to achieve agreement at European level concerning aviation taxes in the context of the negotiations on the Paris climate objectives due to take place in 2019. The aim is to contribute to a more sustainable aviation sector and to better reflect environmental and social costs in the ticket prices.
Although the Government of the Netherlands will also explore options for a national aviation tax, it has a strong preference for a European approach with respect to aviation tax. Divergent national approaches towards aviation tax within Europe can fragmentize the EU Single Market, increase tax uncertainty and destabilize the level playing field. For this reason, the Netherlands has initiated several actions at European level to explore the possibilities of a European aviation tax or coordination between European countries' national aviation taxes.

CE Delft (2018b) determined the effect on CO_2 emissions when applying different types of aviation taxes in the Netherlands: in 2021 a ticket tax modelled on for instance the German ticket tax[25] could reduce aviation-related CO_2 emissions by 2.5%. This relatively low emission reduction is due to the fact that the main airport, Schiphol, is expected to be operating at full capacity in 2021 and due to the exemption of cargo and transfer passenger in this system. Both assumptions reduce the expected impact of this policy.

If a much higher ticket tax were to be levied in the Netherlands, the CO_2 reduction could potentially be much more significant. However, to avoid adversely affecting the level playing field and leakage effects, whereby passengers evade the Dutch tax by flying to or from a Belgian or German airport, alignment of this policy among a group of North-West European countries would be beneficial. Aviation ticket taxes could then lead to significant climate benefits whilst limiting negative competitive impacts on airline companies.

3.5 Conclusion

In this chapter a wide range of climate measures have been presented that could contribute significantly to carbon reduction and could lead to significant synergy advantages when harmonised between North-West European countries. The main benefits could be a reduction of leakage impacts, less competitive disadvantages and economies of scale benefits. Furthermore, international cooperation could be used to overcome the issue whether CO_2 reductions over the border can be counted toward the national GHG reduction target.

We conclude from this quick scan that there are various measures which would be more effective when coordinated with other North-West European countries. In the industry and energy sector, measures with significant advantages of international cooperation are the proposed phase-out of coal-fired power plants, the carbon price floor, incineration and landfill taxes, CCU/CCS policies and coordination of renewables subsidies. In addition, international harmonisation of energy taxes for the industry could allow for more ambitious policies in that sector.

In the built environment, alignment of building standards (for the construction industry and technology providers) can lead to economy of scale advantages and more cost-effective policies. Coordination, already taking place in the current international policy discussion, could be further strengthened.

[25] Tax rate for EU flight departures is € 7.47, for middle range flights € 23.32 and for long range € 41.99.

In the transport sector, cooperation and alignment of (tax) rates could prevent leakage effects and allow for more ambitious policies. Regarding kilometre charging, harmonising the electronic network-wide road toll with surrounding countries (Belgium and Germany) will prevent additional costs for the required technical equipment in trucks. Aligning tax exemptions and grants for energy-efficient cars will integrate markets and create economy of scale advantages.

4 Additional policy opportunities

4.1 Introduction

In addition to the current climate policy measures identified in the previous chapters, it is useful to also look at what (sub)sectors and potential GHG mitigation opportunities are not yet addressed in the current climate policies of the various countries. In some sectors, current policy efforts are still relatively limited compared to the emissions reductions required in the coming decades. Also, a range of new technologies is expected to enter the market in the coming decades which might be crucial to meeting the longer-term GHG targets, but are not yet covered in the mainstream climate policy framework. These may require new policies, to support their development and remove barriers to their market introduction and growth.

In both cases, policy development could benefit from close cooperation of the North-West European countries, for the same reasons identified in the previous chapter (Section 3.2) but also for reasons of knowledge transfer, and speeding up of research and development efforts.

The chapter will start with a brief assessment of which sectors might need additional efforts the most. This is followed by a description of potential climate policy measures not yet implemented that could have significant impact or may be otherwise necessary to achieve the future climate goals (e.g. facilitating the growth of wind and solar energy) and could benefit from international cooperation. The main sources for this analysis are recent reports and studies, supported by input from experts in the various topic areas.

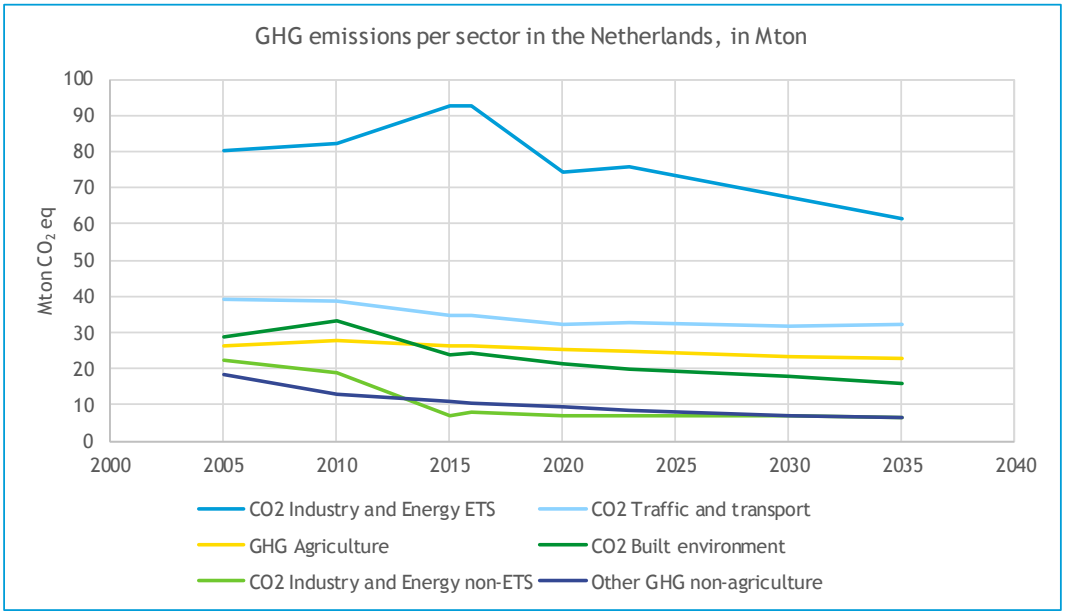
4.2 Which sectors are the most challenging?

First of all, additional policy efforts may be focussed on sectors where current policy efforts are still relatively limited, compared to the GHG emission reduction efforts needed in the long term. These can be identified by assessing which sectors are the main emitters in 2030 given the current policy framework, an analysis that was carried out for the Netherlands in 2017 by ECN, PBL and CBS, in the National Energy Outlook (NEO) 2017 (ECN, et al., 2017).

The GHG emission forecast in NEO for the scenario that includes current and proposed policy measure is shown in Figure 2. In 2030, the CO_2 emissions of the Dutch EU ETS industry and energy production are expected to be responsible for by far the largest share of the Dutch GHG emissions (44%), followed by CO_2 emissions of traffic and transport (21%), GHG emissions of agriculture (15%), and CO_2 emissions of the built environment (12%)[26].

[26] The NEO only specifies the non-CO_2 GHG emissions in agriculture, which account for about 80% of the GHG emissions in that sector. Non-CO_2 emissions in the other sectors are combined into one category, other GHG non-agriculture. 95% of these emissions are in the non-ETS sectors.

Figure 2 - GHG emissions per sector in the Netherlands, in Mton



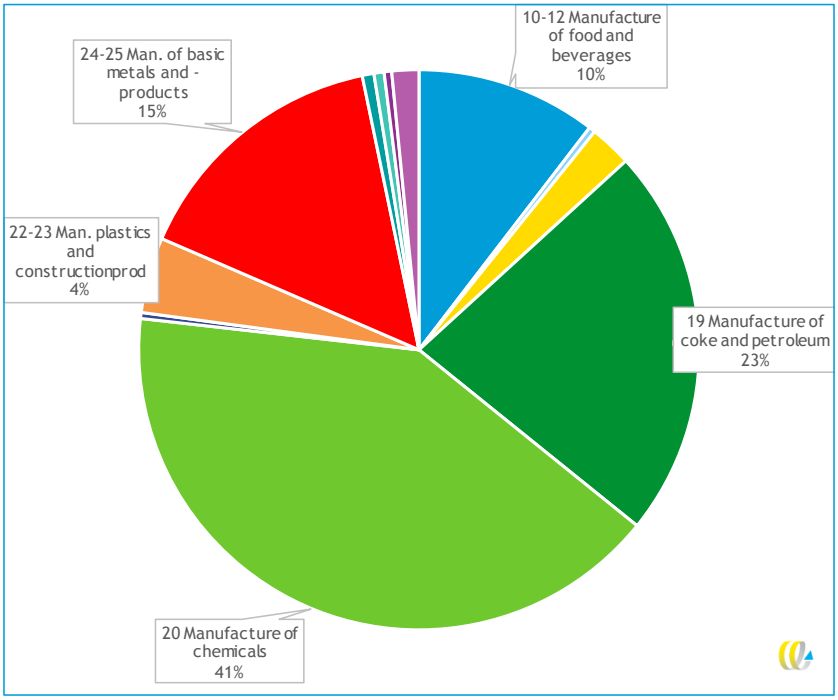
Source: NEO, 2017, Table 8b. (ECN, et al., 2017).

When looking at the trends in this scenario, CO_2 emissions are expected to reduce between 2020 and 2030 in industry and energy production included in the ETS by 10% and in the built environment by 16%. Greenhouse gas emissions in agriculture are expected to reduce by 8%, almost entirely due to reductions in CO_2 emissions. CO_2 emissions in traffic and transport and non-CO_2 emissions in agriculture are expected to remain constant during this period, with the current and proposed policy framework in place.

Zooming in on the CO_2 emissions in the ETS-companies, the expected emission reduction between 2020 and 2030 is mainly due to an increase of renewable electricity production (replacing production from fossil fuels), together with reduced electricity demand and somewhat less export of electricity. By 2030, about two-thirds of the Dutch electricity production is expected to be from renewable energy sources. However, emissions from industry are expected to increase somewhat over this time period in this scenario.

The NEO does not publish detailed emission data per industrial (sub)sector, but the 2016 emission data can provide insight into the largest emitters in the Dutch industry (ETS and non-ETS combined), see Figure 3: the petroleum industry, the chemical industry and the basic metals and metal products industry.

Figure 3 - GHG emissions of industry in the Netherlands in 2016, share per (sub)sector



NB. To improve readability, only the subsectors with emissions >4% are labelled. The numbers refer to the categorisation used by CBS. Total industry emissions in 2016: 47 Mton CO_2 eq.

Source: CBS data.

The expected GHG emission reductions between 2020 and 2030 in the traffic and transport sector are mainly due to electrification of passenger cars and busses, driven by EU policies for cars and the ambition of zero-emission transport in public transport (planned policy). Nevertheless, in 2030 passenger cars still account for about half of the GHG emissions in this sector. The remainder is mostly due to heavy-duty road transport (about 25%), vans (about 15%), followed by inland shipping and mobile machinery.

These data provide an indication of where additional policy efforts are needed, and where these could achieve significant emission reductions. In industry, further strengthening of the EU ETS could be the preferred option. This could also be true for transport and traffic, where the current EU level policies could provide significant emission reductions over time, if strengthened further. The range of options for international cooperation on existing policy measures described in the previous chapter could help speed up these developments.

In the following, we look beyond the current climate policies in these sectors and explore possible additional policy measures that could speed up these developments, for which it would be beneficial to be implemented and aligned in the frontrunner countries in North-West Europe.

4.3 Additional policy opportunities per sector

4.3.1 Industry and the energy sector

For the industry and energy sectors, a number of policy measures currently implemented or planned in the Netherlands where cooperation could have potential benefits were identified in the previous chapters: a carbon price floor, coal phase-out agreements, increased efforts in CCS and CCU and cooperation in the field of renewable energy support can all speed up decarbonisation in these sectors, and contribute to meeting ambitious future climate targets in the Netherlands.

A number of suggestions for additional policy measures that could benefit from a North-West European approach are listed below. The first is a tender system aimed to support industry to implement carbon mitigation measures at high levels of technology readiness with significant impact. The other measures are aimed at facilitation and support for new technologies such as power-to-gas, which are likely to be key to achieving further decarbonisation of the energy system throughout the economy, and throughout the EU.

Tenders for climate measures in industry

Investments in climate measures in industry may be cost-effective compared to climate measures implemented in other sectors, but can still have too long payback times for the companies themselves, due to relatively low energy taxes and CO_2 prices, often in combination with high return on investment (ROI) requirements at corporate level.
A policy support measure comparable to the tender systems for renewable energy (which is currently planned for by the Dutch government) could then provide the fit-for-purpose financial support to increase the ROI to levels needed by the companies to encourage them to implement the measure.

This type of tender system could be set up on national level, however the innovative technologies supported through such a policy are likely to benefit from international coordination of the approach. Alignment of tender procedures, definition of scope of the system, etc. on North-West European level could significantly increase the potential market demand and speed up the learning curve for the relevant technologies. This can result in increased R&D efforts in industry, and faster cost reductions over time.

Another benefit for a cross-border, coordinated approach is that this would make it more attractive to develop a tender system that can be revenue neutral for the government: the tender budget could be filled with revenues from a levy on the energy tax for the companies. This type of funding would not require government budget or increase energy cost of households. International coordination of the level of this levy would reduce competitive impacts of this supplement, compared to a solely national approach.

Of course, there are many design parameters and details to consider when setting up such a tender system to achieve the desired GHG reduction effect (whilst ensuring that state aid regulations are adhered to). For example, the tender system could be designed as an open tender, open for all companies (large and small), assigning grants to the most cost-effective proposals (in terms of Euro per ton CO_2 reduced). Alternatively, it could target the most carbon-intensive industries only, such as the petro-chemical, chemical and cement industries, requiring minimum levels of CO_2 reduction, to specifically speed up investments in decarbonisation in these sectors.

Since this type of policy measure is already in place in Switzerland and Germany (see Section 2.2), a first step could be to assess their systems in more detail and learn from their experiences. The next step would then be to assess the potential impacts of different design options, assessing their cost-effectiveness and potential effects on innovation and longer-term contribution to CO_2 reduction in industry. This assessment can look at both the tender programme itself and its funding. When the Netherlands has insight in the preferred objectives and design of this policy instrument for the Dutch situation, cooperation can be sought with our neighbouring countries to seek alignment of the policies on the key issues of the tender programme.

Policies for new technologies: Hydrogen, energy storage, etc.

The development of new decarbonised energy carriers, energy storage systems and demand flexibility has only just started but will be a key part of the energy transition of the coming decades. The energy policies and market regulations need to be adapted accordingly to enable and support their market introduction and ensure that the energy transition is achieved cost-effectively. Some of the North-West European countries, including the Netherlands, are currently leading the research into these developments, ranging from desktop studies to large scale pilot and demonstration projects. Cooperation between countries on these topics and developments is likely to speed them up and lead to cost reductions due to scale benefits and increased efficiency of R&D efforts.

As fossil fuels are gradually replaced by renewable energy sources, the share of variable power production with wind turbines and solar PV will increase significantly over time. These technologies are typically considered to be the renewable energy sources with the highest growth potential, and have shown strong cost reductions over the past years. They do, however, create a number of new challenges for the energy system, such as the need for storage of this energy to ensure energy supply in times of low wind and solar production, and a significant increase of peak loads on the power infrastructure in times of high wind and/or solar production.

These developments are the driver for increasing research and development efforts into various technologies that can convert this power into a gaseous or liquid energy carrier. These technologies are often known as Power to X, where the X can stand for heat, hydrogen, ammonia, methane or other energy carriers. Conversion of the renewable power to hydrogen or other gaseous or liquid fuels could benefit a wide range of end-use sectors, since they can be stored and transported over long distances at relatively low cost (compared to electricity). This makes them attractive for a wide range of applications:

- Power to X fuels from renewable sources can be used to produce electricity and/or heat in times of low renewable energy production and high demand. They are suitable for large-scale storage, including seasonal storage, and can therefore be attractive energy carriers for both the power sector and industry.
- Renewable hydrogen can also be used as feedstock for the chemical industry, where it can replace hydrogen produced from natural gas (the current production route).
- These fuels can be used as a renewable fuel for the transport sector, especially in transport modes that require an energy carrier with high energy density such as heavy duty, long distance transport, shipping and perhaps also aviation.
- They can also be used as a decarbonised source of energy for heating in the built environment, potentially replacing the current role of natural gas in part of that sector.

Hydrogen and Power to X is therefore included in many if not all of the recent future outlooks and scenarios that explore a decarbonisation of the future energy system.

Following from the previous point, the energy transition is also likely to require significant investments in energy infrastructure:

- Electricity: both demand and supply will change over time, leading to different requirements for the power infrastructure (e.g. higher peak loads, changing locations of production and demand, etc.)
- Gases: The demand for natural gas will reduce, whereas other, decarbonised gases will emerge, such as hydrogen, synthetic methane, biomethane. Especially the non-methane options will require infrastructure investments, as they have different characteristics than national gas.
- CO_2: Many decarbonisation scenarios include increasing implementation of carbon capture and storage (CCS) or usage (CCU). This requires development of CO_2 infrastructure and of CO_2 storage locations.
- Heat: The same holds for heat, as the energy transition is also likely to lead to increased use of residual heat, and increased roll-out of district heating systems.

Eventually, these type of investments will be needed throughout Europe (perhaps with the exception of CCS), but the efforts to develop these new technologies are currently still limited to the North-West European region – driven by ambitious plans and investments in off-shore wind in the North Sea, a large concentration of carbon-intensive industry that are likely to require technologies such as CCS and power-to-X to achieve long term climate goals. These countries therefore already play a key role in driving the research and development in these new technologies, and in developing the necessary policies and regulations for the future energy system. Further strengthening these efforts in a coordinated and joint approach can lead to cost reductions and speed up R&D.

Furthermore, an international and coordinated approach can drive the necessary regulatory developments. As the energy system and industry decarbonise further, the current legal and regulatory framework will need to be adapted to the new technologies and energy carriers, on national and EU level. This includes regulations for issues such as cross-border transport of CO_2 (for CCS and CCU) and renewable hydrogen, and for the market introduction and growth of decarbonised gases (e.g. power-to-hydrogen, biomethane). For a recent overview of the regulatory implications and barriers for the latter developments, see (CEER, 2018).

Potential areas for cooperation are therefore,

- Joint development of a roadmap for the new technologies, for example starting with a roadmap for decarbonised gases and for CCS. This can build on the specific characteristics and strengths of each country's industry. A key outcome of this roadmap should be a strategic mapping of infrastructure needs that follows from an industrial low-carbon transition (VEB and IES, 2018).
- Knowledge transfer, e.g. through regular workshops or conferences, on the various topics mentioned above. These could focus on identifying the key learning points from pilot projects currently carried out in the various countries, and discussing the potential implications for the North-West European region. Regulatory barriers and gaps can be identified and, if possible, resolved.
- Support of cross-border pilot projects, in regions where a cross-border approach could lead to cost benefits. For example, the large-scale developments of off-shore wind in the North Sea basin could benefit from a regional rather than a national approach (e.g. by developing wind parks that cross borders, by optimising infrastructure developments to result in a cost-effective regional energy system, etc.).

Some of these topics are developed further in the following sections.

Energy markets and regulations

Enhanced market integration through adjustments and alignments in energy market design and regulation can improve efficient flexibility provisioning in support of renewable electricity production like solar and wind. A recent assessment of the short-term market design indicates several pathways for enhanced market design and regulation in the North-West European region (CE Delft and Microeconomix, 2016).

With regard to fundamental aspects of balancing market design, it is noted that marginal pricing does not typically apply in the Pentalateral Energy Forum countries balancing markets, neither in the case of balancing energy nor in the case of imbalance settlement pricing. This undermines efficient allocation of balancing energy, as is shown in the underlying empirical analysis of several balancing markets in the region.

In CE Delft and Microeconomix (2016) a range of existing design elements is identified that compromise frictionless trading of flexibility. Increased contracting frequency, shortened contracting periods, and shortened gate closure times would all allow for enhanced valuation of a given (flexibility) product as well as account for the foregone value of capacity in other market segments. These measures would enable more accurate pricing by flexibility providers, enhance flexibility price discovery, and reduce the risks involved for flexibility providers.

In the analysis, the day-ahead and intraday markets revealed themselves as more closely aligned with principles of efficient pricing. However, improvements remain to be made in the linkage between cross-border trading and cross-border capacity allocation in the intraday time frame. This time frame becomes increasingly relevant as variable renewable energy (vRES) contributions increase, since the intraday market facilitates corrective program adjustment in response to (typically significant) shifts in vRES production forecasts after day-ahead.

The findings relating to the required intraday market adjustments are largely targeted by the joint XBID project creating a joint integrated intraday cross-border market that went live earlier this year[27].

Common infrastructure development and coordination

Regarding the development of offshore wind in the North Sea basin, a coordinated effort for maritime spatial planning, infrastructure development, technical specification and market design/integration is generally acknowledged to promote cost reductions and support large scale offshore wind development. In 2016, commitment to such efforts was embodied in the Political Declaration on Energy Cooperation between the North Seas Countries, to facilitate international cooperation on energy. The associated work program for the period 2016-2019 covered:

1. Spatial planning: optimising use of limited space on the North Sea, by sharing information, finding common approaches to minimizing environmental impacts and coordinating licensing.

[27] https://www.entsoe.eu/news/2018/06/14/european-cross-border-intraday-xbid-solution-and-10-local-implementation-projects-successful-go-live/

2. Development and regulation of an electricity grid: to enable transport and market integration of large quantities of wind energy a coordinated approach may offer up to 5.1 billion euros of savings (Ecofys, PWC & Tractebel Engineering, 2014). Participating countries will share information about the infrastructure they need to streamline investments and subsidy programs.
3. Technical regulations and standards: identify best practices for harmonisation of technical regulations and standards.

Differences in costs for offshore wind development among the North Seas Countries, as apparent by the divergences between winning bids, seems to have fuelled differences in appetite for offshore wind development. Notably, the recent offshore wind cost declines in the Netherlands have sparked enthusiasm for large-scale offshore wind development, while even inducing renegotiation regarding committed subsidies for two offshore wind concessions in Belgium (see for example also PWC (2018)). This course of events suggests limited alignment of the sense of opportunity in the North Seas Countries.

Recycling, reuse and circular economy

Another climate policy area that is still in development and could benefit from international cooperation is the circular economy, and especially the goal to increase energy-efficient recycling throughout the economy. Enhanced circularity of materials is also identified by VEB and IES (2018) as a topic that will become more important as a strategy to reduce emissions in the energy-intensive industry over the next decades, at the same time reducing energy use, maintain security of supply (in some cases) and reducing cost of production.

EU policies and regulations are still relatively limited in this area, resulting in different standards, definitions and monitoring protocols in various countries. VEB and IES (2018) mentions in particular waste policies, which should, for example, award benefits of co-processing (when recycling of materials is combined with recovery of energy) and recognise this in the waste management hierarchy. They also suggest to enhance R&D policy efforts in this area.

Cooperation in North-West Europe on these developing policies and regulations could lead to larger markets of the relevant recycling technologies, which would increase investment volumes for R&D and lower cost of recycling due to economies of scale. In the longer-term, this may also speed up EU level policies and regulations.

A specific area that could be focussed on in this regard is chemical recycling of plastics (CE Delft, 2018c), a range of technologies that yield relatively high-value resources whilst achieving significant CO_2 emission savings, compared to conventional, mechanical recycling.

Circular economy is not only recycling of materials but preferably reuse of products, parts of products and expanding the lifetime of products. This could be stimulated with lower VAT on repair services, including reuse statistics in the recycling statistics, rules for the rights of consumers for affordable spare parts fifteen years after purchase of the product. In the Netherlands the transition team for consumer products Nederland Circulair! (2018) have proposed a number of measures to stimulate a real circular economy. This could mean a substantial reduction of production/import of new products and materials and therefore worldwide of a substantial reduction of GHG emissions.

4.3.2 Transport

Strengthening efforts in aviation and maritime shipping

These two international transport modes are not included in the national or EU climate targets, and are not included in national climate and energy policies. However, they contribute significantly to global GHG emissions, and their share in overall emissions is likely to increase further in the future as other sectors decarbonize.

Climate policies for both transport modes are discussed at global level, in the ICAO (2018) and IMO (2018) respectively. Strengthening the efforts on these levels can be key to speed up decarbonisation in these sectors. This can be achieved through coordination of the ICAO and IMO positions between frontrunner European countries, as well as through coordinated efforts in R&D (including the realisation of pilot or demonstration projects). Additional national policy measures can furthermore support and drive the global efforts, for example by driving innovation in these sectors and demonstrating the feasibility and impact of new policy measures.

In aviation, there is already cooperation on the European level through the European Civil Aviation Conference (ECAC), with 44 Member States. The national climate action plans submitted by the ECAC countries to ICAO in recent years contain a range of actions undertaken within the framework of ECAC, most of them led by the EU. However, additional national actions are also included in the action plans. Looking at these national actions, two areas can be identified that could be key to achieve the necessary future GHG emission reduction in this sector and which could benefit from enhanced coordination between the frontrunner countries:

- driving the efforts in ICAO to develop a global market based measure (i.e. a cap on international aviation's total carbon emissions);
- driving R&D into sustainable, low-carbon aviation fuels.

A third area, aviation ticket taxes, was already discussed in Section 3.4.4.

One issue that is lacking from most national action plans is a way to create more demand for sustainable aviation fuels. Currently, investments in R&D into sustainable fuels and their large-scale production are hampered by the low demand. As a result, economies of scale and learning effects are limited and the price difference between sustainable and fossil fuels stays high. Frontrunner countries could collectively develop policies such as a fuel mandate (starting perhaps for flights between the participating countries) or bilaterally removing exemptions from energy taxation of on fossil aviation fuels (as allowed under the Energy Taxation Directive).

Global efforts to reduce GHG emission climate in maritime shipping are also the preferred route, key to making significant steps towards decarbonisation in this global transport mode. Nevertheless, increased coordination of efforts and joint implementation of national policy measures could speed up global developments, similar to what was discussed above for the aviation sector.

Enhancing international railway transport

Another policy area with potentially large climate benefits is international rail transport. According to the European Environment Agency, CO_2 emissions from rail transport are 3.5 times lower per tonne kilometre than those from the road transport (ECA, 2016).

However, there are still multiple obstacles hindering railway transport across borders in Europe. For example, most international train services require specially adapted (and authorised) rolling stock or locomotive changes to cross the border. In addition, regulation and licensing of locomotives is still arranged on a national level, there are not many drivers licensed to drive locomotives in more than one country as they have to qualify in each country independently. Furthermore, there are many different electrical supply systems and different safety regulations between countries increase costs significantly as it requires multiple headlights on locomotives (Zunder, 2011).

This lack of cooperation creates service disruptions and decreases the competitiveness of rail cargo transport. For instance, for a transport from Rotterdam to Spain four different national infrastructure companies (Netherlands, Belgium, France, and Spain) have to give a time slot within different legal and administrative rules. International rail freight not travelling on one of the rail corridors in Europe achieve an average speed of 18 to 30 kilometres per hour due to administrative constraints, waiting times, lack of central management. In comparison, the average speed of road freight transport by truck on European roads is 60 kilometres per hour (Liguori, 2018).

Harmonisation of technical measures and administrative procedures is being discussed for many years, but is currently not expected to be resolved before 2030. A joint effort to move this dossier forward with our neighbouring countries could therefore increase the cost-effectiveness of international cargo transport by trains significantly. This is particularly important for decarbonizing freight transport, as rail transport can be realized in a climate neutral manner (when the electricity is from renewable sources), while commercially viable zero-emission transport alternatives for freight transport are hardly available yet.

Coordinating policies on fuel-efficient and zero-emission vehicles

EU level policies, notably the CO_2 regulations for cars, vans and trucks, are a key element of climate polities in transport. A joint effort of frontrunner countries, to support ambitious CO_2 targets and supporting regulations, can enhance the effectiveness of these EU policies. This is especially relevant for trucks, where CO_2 regulations are still very much in development (the European Commission presented a legislative proposal setting the first CO_2 emission standards for heavy-duty vehicles in the EU in May 2018).

Furthermore, a number of related national and local policies can also benefit from international cooperation, and some were mentioned earlier in the previous chapters (e.g. aligning fiscal exemptions and kilometre charge systems, see Section 3.4.4). Other opportunities are coordination of support policies for zero-emission trucks, for example for goods distribution in cities (the most likely application of these trucks in the short to medium term). Synergy effects would include an increase of the market demand for zero-emission trucks, which is likely to increase R&D efforts and speed up cost reductions of new technologies.

Coordinating policies on advanced biofuels

The revised Renewable Energy Directive distinguishes different types of biofuels, with specific support for biofuels with low indirect land use change (ILUC) impacts, and even more support for 'advanced biofuels', for which technology is more innovative and less mature. It includes an obligation for Member States to require fuel suppliers to supply a minimum share of these advanced biofuels, increasing over time. In addition, advanced fuels and other biofuels with low ILUC impacts can be counted double towards the renewable fuels in transport target. Advanced biofuels are defined by a list of feedstocks provided in Annex IX, Part A of the revised RED, feedstocks for other low-ILUC biofuels are defined in Annex IX, Part B.

The revised RED provides minimum levels for the share of biofuels and biogas produced from feedstock listed in part A of Annex IX, Member States can set higher levels. This provides an opportunity for the North-West European frontrunner countries to set a higher level, thus providing a stronger incentive for industry to invest in these technologies and start developing production capacity and set up the value chain for these fuels (most notably, developing the supply of the relevant feedstock). This coordinated approach could then include both the level of the target and its increase over time, as well as the exact definitions of what is considered 'advanced biofuels'.

4.3.3 The built environment

In the built environment, the main challenges shared by all nine countries are in the area of decarbonisation of heat in existing buildings. This requires increasing the energy efficiency of buildings, and a transition to a range of technologies including heat pumps, geothermal energy, district heating with other decarbonised energy sources or residual heat (from industry and/or power production), and a switch from natural gas to hydrogen or synthetic methane from renewable energy sources.

Knowledge sharing

Some countries, most notably Denmark, have already achieved significant progress in this area in recent decades, whereas other countries, including the Netherlands, only just started this development.

An example of an area where some countries can learn from others is district heating. In Denmark, 60% of all households is connected to a district heating network (in Copenhagen even 98%). Important drivers for this high contribution have been (among others) competitive prices (because of energy taxes and investment subsidies) and the possibility for municipalities to dedicate certain areas for district heating and oblige households to be connected to the network (Odgaard, 2016). Such obligations remove consumer choice but decrease the costs of the network and reduce the investment risks for large-scale projects.

These developments have resulted in extensive expertise with policy measures and stakeholder involvement that could be of use for countries such as the Netherlands, where district heating currently has a small share in the total, but is one of the key solutions to achieving the climate goals in the built environment. Knowledge sharing could therefore speed up developments. To illustrate this: in October 2018, the Dutch Stichting Warmtenetwerk went on a three-day study tour to Denmark with 50 organisations. The sector concluded that Danish practice showed that large-scale expansion of heat networks in the Netherlands is possible as well. According to the sector, it would require 'cooperation, knowledge sharing and some courage' (Warmtenetwerk, 2018). In order to

realise large-scale developments, successful elements of the Danish approach could be copied in the Netherlands.

A similar potentially effective measure could be the German KFW system for low interest loans for renovations (see Chapter 2.3). This system has been particularly successful because it is a recognised brand in Germany, very well-known and promoted by TV commercials (ICF ; Hinicio ; CE Delft, 2014). Such best practice elements are important to take into account if similar measures are considered in the Dutch context.

4.3.4 Agriculture

Sustainable agriculture and food policies

A number of countries are discussing GHG policy measures for food and agriculture. These options include:

- transition goals form animal proteins to vegetable proteins;
- higher value added tax (or other levies) on meat;
- a carbon trading system for Farmers (RLI Advice);
- subsidies for efficient and sustainable farming (UK);
- green public procurement rules with meat restrictions and other goals.

In the Netherlands both governmental advisory institutes WRR (WRR-rapport nr. 93: Naar een voedeslbeleid, 2014) and RLI (Advise Duurzaam en Gezond, 2018) advised to include both production and consumption policies. The protein transition is the most important in the consumption policies but an important argument against policies for a shift from animal to vegetable proteins is that the substantial GHG reduction of this shift will take place for a substantial part in other (European) countries. A more coordinated approach with a common policy for the protein transition in Europe could solve this problem.

Zooming in on a policy area that could have significant potential for GHG reduction in this sector, but is not yet developed in any of the nine countries are measures aimed at impacting consumer behaviour, encouraging them to buy food with lower climate impact. Potential policies could be a tax on meat[28] or a climate impact labelling system on packages. An international approach in this area cannot only increase the impact, but also the cost-effectiveness of the policy.

Alignment of definitions and regulations

There are some areas of agricultural policy that impact GHG emissions of the sector and are included in EU level policies, but that could still benefit from more international cooperation to ensure the same definitions and regulations are implemented in the various countries. Relevant examples are the regulations covering use of residual streams of food production and agriculture in fodder, and regulations allowing certain products from waste treatment to be used as fertilizer/soil enhancers.

[28] This has not yet been implemented in other countries but some have carried out assessment, see for example Limits to green? Greening tax system in the Netherlands and Meat tax 'inevitable' to beat climate and health crises, says report.

Ensuring a harmonised implementation of the EU sustainability criteria for bioenergy can also increase the efficiency of these policies and lower the overall cost, as this can increase market demand (which benefits investments) and limit cross-border transport due to different incentives in different countries. This includes regulations for biogas, liquid biofuels and solid biomass.

4.4 Conclusions

A range of new policy opportunities can be identified that could contribute to a significant reduction of carbon emissions, and that could benefit from cooperation within the North-West European countries. To achieve the highest impact— additional to the current climate policy framework — these policy efforts should focus on the sectors that are not yet expected to achieve the GHG reductions needed to meet the longer-term climate goals: industry and the transport sector, followed by the built environment and agriculture.

Furthermore, significant benefits can be expected when countries coordinate their efforts to develop the new technologies needed in the future energy system.

The key policy measures that could significantly strengthen the current policy framework and benefit from international coordination are the following.

In the industry and energy sectors:
- tenders for climate measures in industry;
- policies for new technologies: Hydrogen, storage, etc.;
- adaptation of energy markets and regulations;
- alignment of energy taxes;
- recycling and circular economy.

In transport:
- strengthening efforts in aviation and maritime shipping;
- enhancing international railway transport;
- coordinating policies on advanced biofuels.

In the built environment:
- knowledge sharing.

Agriculture:
- alignment of definitions and regulations;
- consumer policies.

5 Conclusions and recommendations

5.1 Conclusions

This study resulted in a broad inventory of potentially successful policy measures which can be more effective when implemented in cooperation with neighbouring countries. For these measures, the potential synergy effects were assessed — qualitatively, since the actual benefits will depend on the details of the policy design and cooperation agreement. Furthermore, new policy opportunities were identified that are not yet implemented but could contribute to significant emission reductions. This inventory can provide a sound basis for discussions with other countries that aim to speed up their climate mitigation efforts.

By aligning policies and implementing instruments and measures in close cooperation with other North-West European countries, climate policies can be more effective as carbon leakage effects can be reduced. Furthermore, competitive disadvantages for the Dutch economy can be reduced, and economies of scale can increase, which will spur investments, speed up innovations and reduce cost of technologies.
The group of countries investigated in this study are the Netherlands, Belgium, Luxembourg, the United Kingdom, France, Germany, Austria, Switzerland and Denmark.

First, an inventory was carried out of the main climate policies in these nine countries, serving two purposes: to identify similar policies implemented in different countries, and to ascertain which important reduction policies in the other countries are not implemented in the Netherlands.

Some of the latter policies include:
- CO_2 taxes on energy products (France, UK, Denmark and Switzerland);
- a tender procedure for subsidies for electricity and heat-saving measures in industry (Germany and Switzerland);
- France's state car fleet replacement obligation.

Second, overlapping policies were further assessed to highlight possible synergy effects in the case that these policies would be aligned between this group of countries.
Possible synergies in industry and energy include:
- the proposed phase-out of coal-fired power plants;
- a carbon price floor;
- incineration and landfill taxes;
- CCU/CCS policies;
- coordination and alignment of renewables subsidy schemes.

In addition, international alignment of energy taxes for industry could allow for more ambitious policies in that sector.

In the built environment, cooperation on the national implementation of the energy performance of buildings (EPB) may lead to economies of scale advantages and more cost-effective policies, while in the transport sector cooperation and alignment of fuel tax rates could prevent leakage effects and allow for more ambitious policies. Regarding kilometre charging, a coordinated approach on the electronic network-wide road toll with surrounding

countries (Belgium and Germany) will prevent additional costs for the required technical equipment in trucks in the Netherlands.

And finally, new policy opportunities not yet implemented were identified that could contribute to a significant reduction of carbon emissions and benefit from cooperation within the European countries. We focussed this part of the study on sectors that are not yet expected to achieve the GHG reductions needed to meet the longer-term climate goals: the industry and transport sectors, followed by the built environment and agriculture.

- In industry and energy, policies for new technologies like hydrogen and storage are needed, as well as for adaptation of energy markets and regulations and the circular economy.
- In transport, efforts in aviation and maritime shipping need to be strengthened through coordination of the ICAO and IMO positions with frontrunner European countries, while international railway transport can be coordinated via both technical measures and administrative procedures to increase the cost-effectiveness of international cargo transport. In the field of biofuels, European frontrunner countries could set a higher biofuel share than is required according to the Renewable Energy Directive, providing a stronger incentive for industry to invest in these technologies and start developing production capacity and set up the value chain for these fuels.
- In the built environment knowledge sharing can speed up developments, as there are many common issues the various countries are faced with. For example, the Netherlands can learn from Denmark, where 60% of all households is already connected to a district heating network.
- In agriculture, GHG reduction can benefit from joint implementation of policies aimed at sustainable agriculture and consumer behaviour. Examples of potential policy measures in this area are a carbon trading system for farmers, a tax on meat or a climate impact labelling system on packages. Also, alignment of definitions and regulations, such as the regulations covering use of residual streams of food production and agriculture in fodder can increase the effectiveness of the climate policies in this sector.

5.2 Recommendations

This report can be used as a basis for discussions with countries that share the Dutch ambition to speed up CO_2 mitigation in the coming decade, and aim for a higher CO_2 reduction target than the current EU target. These discussions can be initiated in the various international platforms and meetings that the Netherlands is already part of, to assess which countries are interested in pursuing this route of cooperative climate policies. The areas where cooperation would have the most benefits (given the national circumstances) and political support can then be identified.

The next step could then be to further develop and assess the policy measures of interest, in close cooperation with this group of countries.

As a preparation for these discussions, this report can also be used for in-depth discussions within the Dutch government, to identify the policy measures that would be best suited to the Dutch situation. This should take into account (or be included in) the current ongoing discussions of the Dutch Climate Agreement, since many of the measures identified here are also included in these discussions.

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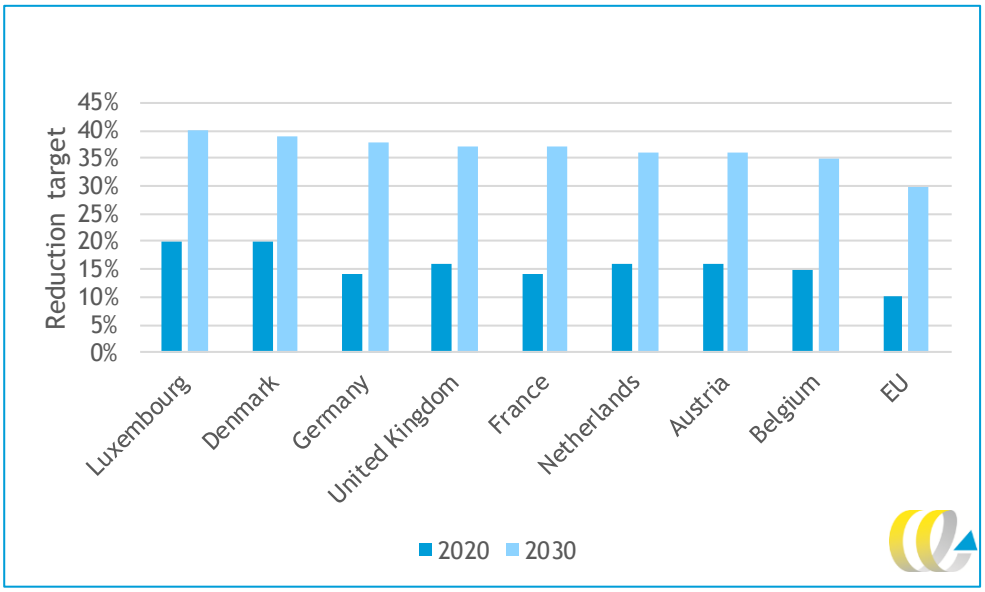
A Overview climate targets

Different climate targets exist. For instance, climate targets can be economy-wide (EU ETS and non-EU ETS), focus on non-EU ETS sectors or individual sectors. In addition, climate targets can be binding or voluntary, the base year can differ (1990 or 2005), can be agreed upon in international context or set individually by Member States[29], etc.

On EU level, there is a binding reduction target to reduce economy-wide emissions. The EU 2030 Climate and Energy Framework has set a target to cut EU emissions by at least 40% in 2030 compared to 1990 levels. In 2050, emissions have to be reduced by 80-95% according to the 2050 Energy Strategy.[30] The 2050 roadmap however does not yet impose legally binding objectives on EU Member States (Euractive, 2017).

To achieve the required economy-wide 30% reduction target of 2030, an emission cut of 43% has been set for the EU ETS sector, while non-EU ETS emissions have to be reduced by 30%.[31] This 30% reduction has been translated in binding annual greenhouse gas reductions for the Member States in the Effort Sharing Directive (ESD). The required reductions for the North-West European countries range from 35% (Belgium) to 40% (Luxembourg) in 2030.

Figure 4 - Emission reduction targets in 2020 and 2030 according to the Effort Sharing Directive (compared to 2005)



[29] For instance, the 2020 target for the Netherlands was based on a national court ruling.

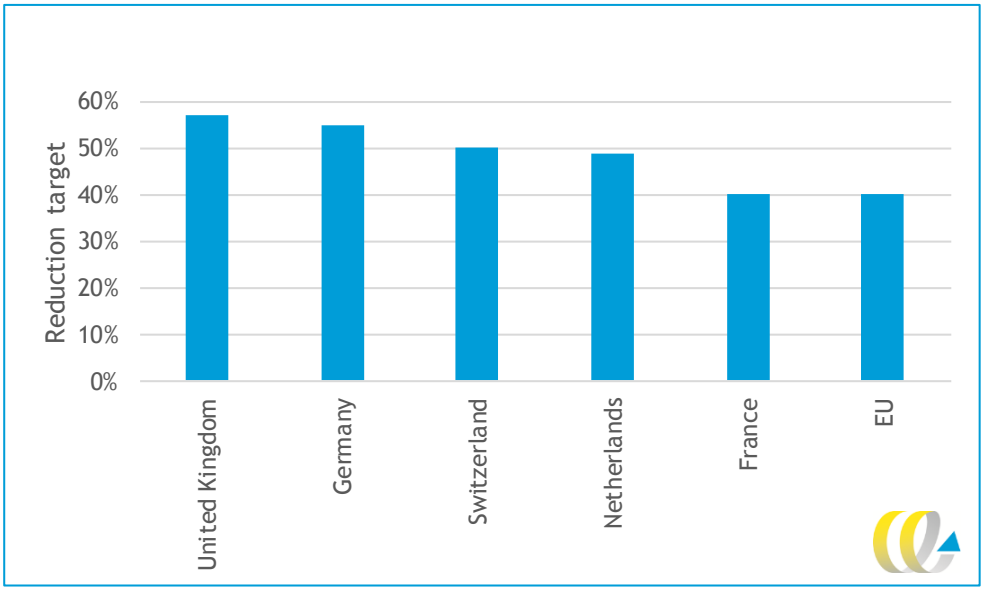
[30] Compared to 1990 levels.

[31] Compared to 2005 levels.

Beside these binding national targets for non-EU ETS emissions, some Member States have set economy-wide (EU ETS and non-EU ETS) targets for their countries. For instance, in the recent coalition agreement in the Netherlands, a reduction of 49% in 2030 compared to 1990 levels is proposed.[32] Switzerland, not being an EU Member State, ratified the Paris Agreement on 6 October 2017 and its Nationally Determined Contributions (NDC) commits Switzerland to an economy-wide emission reduction of 50% by 2030.

The economy-wide ambitions of the countries (if available) are presented in Figure 5.

Figure 5 - Economy-wide emission reduction targets for 2030 (compared to 1990 levels)



The figure shows that the United Kingdom has set the most ambitious economy-wide emissions target for the year 2030, followed by Germany. The aspired emission reduction of the French government for 2030 is lower than the other countries and equivalent with the EU-wide average (40%). For the other countries (Belgium, Luxembourg, Austria and Denmark), no economy-wide targets have been reported.

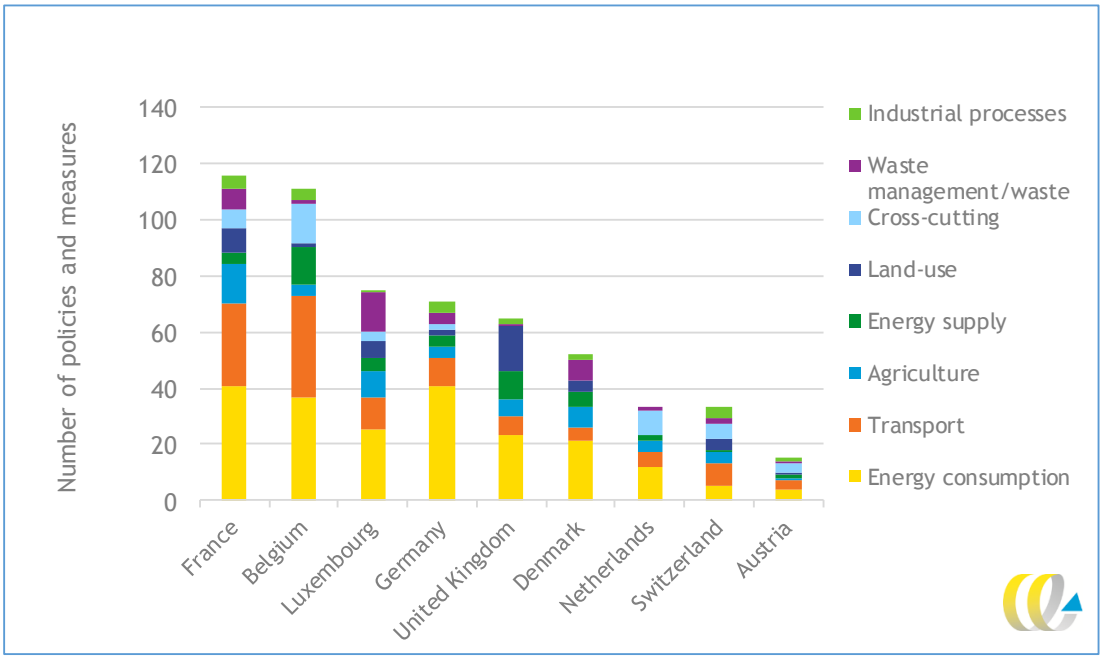
[32] This target could be altered resulting from international negotiations in 2019.

B Policies and measures in EEA database

Many different policies and measures have been implemented in the group of North-West European countries. Policy measures can differ in the type of instrument (economic, voluntary, regulatory, informational, educational or fiscal) and sector of the economy (industry, waste management, agriculture, land use, transport, energy supply and production).

In Figure 6, the existing and planned policies and measures (PaM) are illustrated per sector and per country. This overview is based on the European Environment Agency's database on climate change mitigation policies (EU Member States) and the UNFCCC monitoring reports (Switzerland).[33] Member States report these policies and measures under the European Union Monitoring Mechanism Regulation (MMR).

Figure 6 - Number of policies and measures per sector, per country[34]



[33] The EEA database differentiates between a number of sectors, and sometimes groups a policy into multiple sectors. For instance, the Covenant Clean and Efficient Agro-sectors in the Netherlands spans the agriculture and energy consumption sectors. In these cases, we chose one sector as the main sector by which to differentiate the policies and measures (e.g. the mentioned policy was only grouped in with the agriculture sector). We excluded the expired PaMs.

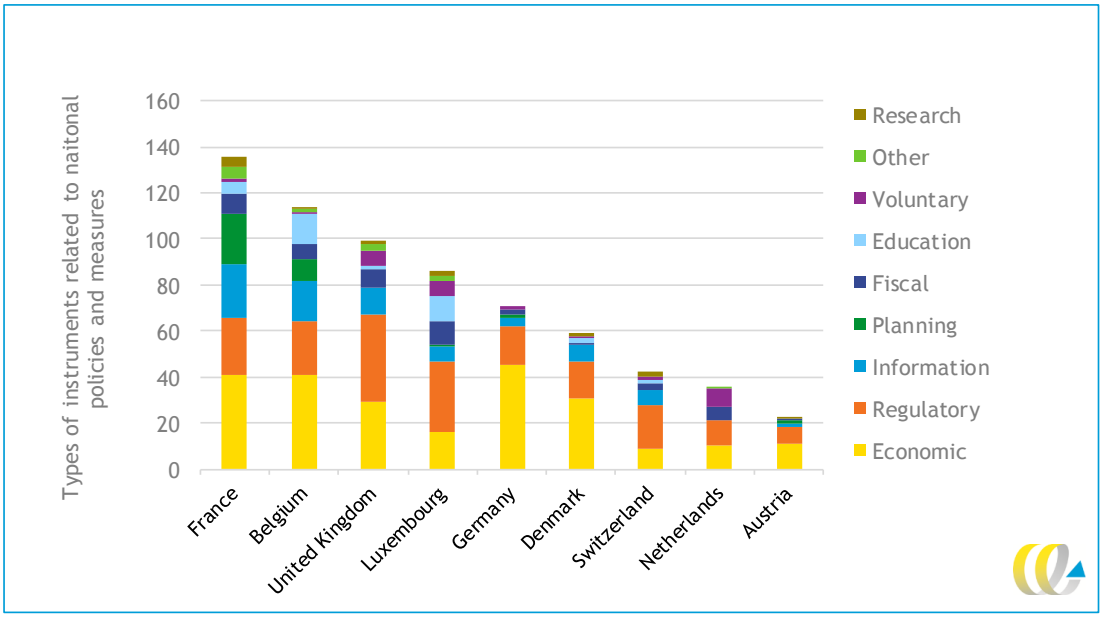
[34] The EEA database on climate change mitigation policies and measures in Europe contains an overview of policies and measures (PaMs) implemented, adopted or planned by Member States to reduce greenhouse gasses. The most recent update is 2017. The database includes EU policies such as EU ETS, as well as expired PaMs. The database however does not include Switzerland's PaMs, which were instead obtained from Switzerland's Seventh National Communication and Third Biennial Report under the UNFCCC.

Figure 6 shows 571 PaMs in total. France reported most measures (over 110), while Austria reported less than 20 policies and measures. The number of measures reported by the Netherlands is relatively low compared to most other countries (less than 40). The figure shows that energy consumption and transport measures are relatively widespread, while few industrial policies are implemented or planned.

The total number of PaMs per country however does not necessarily give an indication of the degree of climate ambition. For instance, Belgium has the lowest emission reduction target for 2030 under the effort sharing directive (see Annex A for an overview of the targets per country), while it reported the second most planned or implemented policies and measures of the considered countries.

Economic and regulatory instruments are most common in the selected countries (see Figure 7).[35] In Germany these instruments make up around 88% of the types of instruments related to national policies and measures, while in the Netherlands, Belgium and France this share is between 50 and 60%. Some countries like France and Belgium use a range of different instruments, while others like the Netherlands and Austria use fewer types. The Netherlands also utilises voluntary agreements relatively more than the other countries, with 22% of the instruments being classified as voluntary, while Luxembourg follows with 8% and the rest with even less.

Figure 7 - Types of instruments related to national policies and measures



The EEA database also makes a distinction between the type of instrument used to achieve the policy or measure. Table 10 describes the different instruments according to the European Environment Agency (2018).

[35] See Table 10 in Annex B for a description of the categories. Note that the EEA database classifies some PaMs as multiple types of instruments, hence the number of types of instruments does not correspond with the number of policies and measures per country (there are more types of PaMs than there are PaMs).

Table 10 - Types of instruments and descriptions

Instrument	Description of instrument
Economic	Policy that provides an economic incentive to reduce GHG emissions, e.g. infrastructure programmes, subsidies, investment programmes, feed-in tariffs, loans/grants and trading schemes (e.g. EU ETS).
Fiscal	Policy that provides a financial incentive via taxes.
Voluntary	Regulatory and information measures agreed between regulators and the targeted sector which are either binding or voluntary standards or regulations.
Regulatory	Setting binding standards and regulations such as building regulations.
Information	Labelling, awareness raising, voluntary standards to disseminate information to the general public or to specific target groups.
Education	Training programmes and capacity building.
Research	Research programmes and demonstration projects.
Planning	Measures like waste management and transport plans.
Other	Measures which do not correspond with above categories such as public procurement.

Source: (European Environment Agency, 2018).