Analysis of the air pollution policies and measures reported under the National Emissions reduction Commitments Directive (NECD)

December 2020

Authors:
Katrina Young, Lucy Garland, Luke Jones (Aether Limited)

ETC/ATNI consortium partners:
NILU – Norwegian Institute for Air Research, Aether Limited, Czech Hydrometeorological Institute (CHMI), EMISIA SA, Institut National de l'Environnement Industriel et des risques (INERIS), Universitat Autònoma de Barcelona (UAB), Umweltbundesamt GmbH (UBA-V), 4sfera Innova, Transport & Mobility Leuven NV (TML)

European Environment Agency
European Topic Centre on Air pollution, transport, noise and industrial pollution

Cover design: Large group of cyclists and cycling commuters in Parliament Square, Westminster, London
Cover photo © 2017 Imageplotter / Alamy Stock Photo JBD7D4

The withdrawal of the United Kingdom from the European Union did not affect the production of the report.
Data reported by the United Kingdom are included in all analyses and assessments contained herein, unless otherwise indicated.

Author(s)
Katrina Young, Lucy Garland, Luke Jones (Aether Limited)

ETC/ATNI c/o NILU
ISBN 978-82-93752-17-2

European Topic Centre on Air pollution,
transport, noise and industrial pollution
c/o NILU – Norwegian Institute for Air Research
P.O. Box 100, NO-2027 Kjeller, Norway
Tel.: +47 63 89 80 00
Email: etc.atni@nilu.no
Web : https://www.eionet.europa.eu/etcs/etc-atni

Contents

List of figures and tables

Abbreviations and units

AFID	Alternative Fuels Infrastructure Directive
AQ	Air quality
BAT-AEL	Best Available Technique associated emissions levels
BC	Black carbon
CH_4	Methane
CNG	Compressed natural gas
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
EEA	European Environment Agency
ETC/ATNI	European Topic Centre on Air pollution, Transport, Noise and Industry
EU	European Union
GHG	Greenhouse gas
IED	Industrial Emissions Directive
Kt	Kilotonnes
LNG	Liquified natural gas
LPG	Liquified petroleum gas
MMR	Monitoring Mechanism Regulation
MS	Member State
NAPCP	National Air Pollution Control Programme
NECD	Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emission of certain atmospheric pollutants
NECP	National Energy and Climate Plan
NH_3	Ammonia
NMVOC	Non-methane volatile organic compounds
NO_X	Nitrogen oxides
NPFs	National Policy Frameworks
NRMM	Non-road mobile machinery
PAHs	Polycyclic aromatic hydrocarbons
PaMs	Policies and measures
$PM_{2.5}$	Fine particulate matter
POPs	Persistent organic pollutants
SO_2	Sulphur dioxide
SO_x	Sulphur oxides
SQL	Structured Query Language
TWh	Terawatt hours
UNECE	United Nations Economic Commission for Europe

Summary

Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emission of certain atmospheric pollutants (the 'NECD') requires Member States to report National Air Pollution Control Programmes (NAPCPs). These include policies and measures (PaMs) that the Member States considered and selected in view of fulfilling their emissions reduction commitments. Commission Implementing Decision (EU) 2018/1522 requires these air pollution PaMs to be reported by Member States via an online webtool. The PaMs to be reported are restricted to 'additional PaMs', i.e. PaMs which are being considered (but not yet selected for adoption) and those which have been selected for adoption (but not yet adopted) in order to meet national emission reduction commitments. It should be noted that if a Member State considers that they will meet their emission reduction commitments with existing PaMs then information is not required to be reported under the NECD. Information on these additional air pollution PaMs was reported for the first time under the NECD in 2019.

This report describes the main characteristics of air pollutant PaMs reported through the EEA PaM tool and also explores the potential synergies between air pollution and climate PaMs that Member States report under the Monitoring Mechanism Regulation (MMR, EU 525/2013). It should be noted that this report does not consider information provided by Member States in their NAPCP but not included in the EEA PaM tool. This report focuses on the quantitative analysis of the information provided in the EEA PaM tool.

By the end of May 2020, the cut-off date for inclusion in this report, 22 Member States (including the United Kingdom[1]) had reported information on their PaMs in the EEA PaM tool. Austria is not included in the analysis as they reported PaMs in an Excel file instead of via the online PaM tool.

Emissions reductions

Member States were required to report quantified future emissions reductions of their additional air pollution policies and measures, for the years 2020, 2025 and 2030. It was however possible to report a '#' where emissions reductions could not be quantified or had not yet been quantified. Of the 379 single PaMs selected for adoption, 269 were reported with emission reduction values, either for the individual PaM or for the package overall. Given that some policies and measures would not have a direct emissions reduction associated with them, such as information or education-based policies, this level of emissions reduction reporting is quite encouraging. NO_X emission reductions were reported most frequently for PaMs selected for adoption. The completeness of reported emission reductions varied widely across Member States and years. There are several data quality issues that prevent detailed analysis on the size of emissions reductions from reported PaMs (detailed in Box 1-1 in section 1). However, some higher level analysis was possible and the reported PaMs are expected to have the highest impact on NO_X with a maximum[2] of 747 kt NO_X reductions in 2030 across the Member States who reported. The amount of detail provided in the mandatory data field on methodology details varied significantly between Member States as did the descriptions of uncertainties provided.

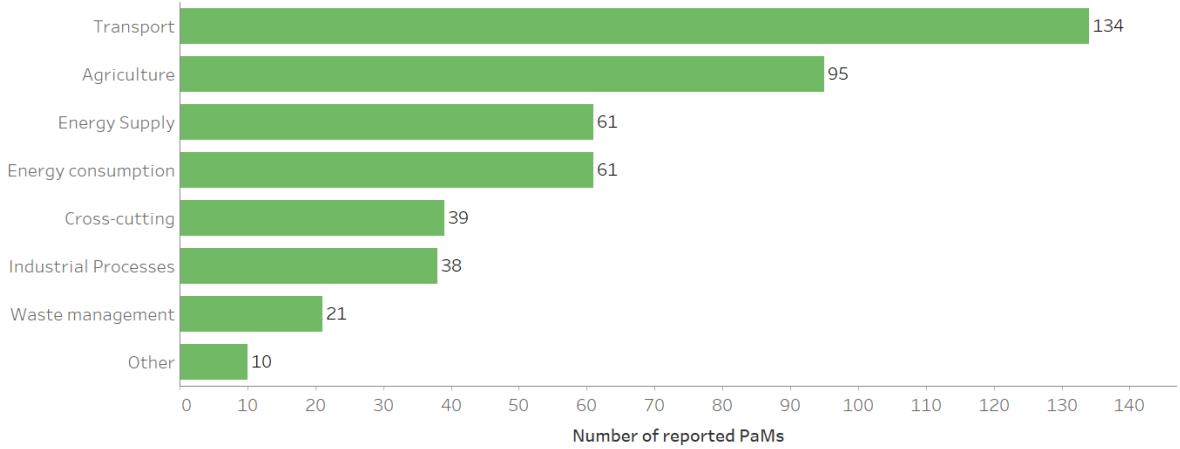
[1] The United Kingdom was a Member State of the European Union at the time of reporting and will be referred to as an EU Member State for analysis up to 2020.

[2] Member States could report a range of emissions reduction estimates.

Sectoral analysis

The PaMs reported by Member States most commonly targeted emissions reductions from the transport, agriculture, and energy sectors (see Figure 1-1). This trend is consistent amongst most Member States.

Figure 1.1 Number of individual policies and measures reported by sector selected for adoption



PaMs targeting emissions from the transport and agriculture sectors were the most frequently reported by Member States, with a considerable proportion also reporting PaMs that would either reduce emissions from the supply of energy, or through the consumption of energy within a residential setting.

PaMs targeting emissions from the agriculture sector largely focussed on reducing ammonia emissions. Within the agriculture PaMs, most Member States reported PaMs relating to the establishment of an advisory code of good agricultural practice, policies relating to the use of fertilisers, measures to reduce emissions from livestock manure, and additional controls to reduce emissions of $PM_{2.5}$ and black carbon. Across all reporting Member States there appeared no dominant policy or measure that would reduce emissions of ammonia. Instead, the content of the PaMs varied considerably, with many Member States opting for a multi-faceted approach to reducing its ammonia emissions in light of the ambitious NECD targets for 2020-2029.

A large proportion of the total PaMs also targeted emissions from the transport sector, particularly road transport. There is regional variation in the focus on transport amongst the PaMs. Portugal and Malta particularly prioritise transport action, with 71% and 63% of the PaMs reported by these Member States targeting transport respectively. By contrast the Estonia submissions had no transport policies selected for adoption, and in Spain just 10% of total policies targeted transport. Policies to encourage the uptake of alternative fuel technologies, reduce energy demand, improve behaviour and shift demand to different modes are the most frequently reported.

The proportion of total PaMs that targeted energy supply or energy consumption emissions varied significantly by Member States. For example, these energy PaMs constituted 65% and 45% of the total number of PaMs in Cyprus and Slovakia respectively, whilst in Hungary only 8% of PaMs targetted emissions from either energy supply or consumption. The content of the PaMs were striking in their similarity however, with many focussing on emissions from the residential sector, in particular, the energy efficiency of wood burners and stoves. The staggered implementation of the Ecodesign Directive (EU 66/2014) for different household appliances will act to reduce emissions from this sector. It is clear that the Member States are actively trying to encourage the uptake of new, more energy efficient household appliances through public awareness campaigns and/or financial incentives or support for households. In addition, numerous Member States reported PaMs

which would increase the market share of non-thermal renewables. Whilst an increase in the use of non-thermal renewables would reduce emissions of air pollutants and greenhouse gases, the combustion of biomass can increase emissions of air pollutants.

Links with climate policies and measures

In 2019, a new set of climate PaMs were also reported under the MMR[3]. This provided an opportunity to explore whether there is coherence and synergy between air pollution PaMs and climate change mitigation PaMs. However, the scope of PaMs reporting under the MMR is significantly larger than under the NECD; under the MMR Member States are required to report on all planned, adopted, implemented and expired PaMs (if they continue to have effects). This means that there is likely to be a limited common dataset for the analysis of air pollution and climate PaMs.

However, when focussing on PaMs selected for adoption, some differences and similarities between MMR and NECD PaMs can be observed. Agriculture is a much more represented sector in the NECD PaMs than in the MMR PaMs. Regulatory and economic PaMs are the most common across both MMR and NECD PaMs. National government is the dominating type of implementing entity for both MMR and NECD PaMs, but there is a more even distribution of implementing entity types under the NECD.

It would be useful to understand how synergistic GHG and air pollution PaMs are. Some analysis is possible on the data available, however, many of the fields that could be used were optional meaning any analysis undertaken is likely incomplete. Additionally, many of the relevant fields are free text fields which make quantitative and automated analysis difficult. However, one such optional field allowed for countries to report if a PaM had also been reported under the MMR. One third (116) of the PaMs reported as selected for adoption were submitted under both NECD and MMR, showing that a significant number of PaMs that will reduce air pollutant emissions will also reduce GHG emissions. It was possible to match 93 (80 %) with actual PaMs reported under the MMR. While many of these PaMs overlap fully between the NECD and MMR, some PaMs are reported at different levels of aggregation.

PaMs which were reported as linked to the MMR were more likely to have quantified air pollution emissions reductions reported under the NECD. In addition, a few NECD PaMs reported quantified GHG savings which were not found in the PaMs reported through the MMR, suggesting that air pollution PaMs can contribute to climate mitigation action.

However, there is a potential lack of synergy in policies around the use of solid biomass. Of the few PaMs reported through the NECD that address solid biomass, they aim to decrease its usage due to the negative impacts on air pollution. Of the PaMs reported through the MMR that focus on solid biomass, they aim to increase its usage due to the reduction in GHG emissions compared to fossil fuels.

The coherence fields were also used to assess the overlap between air pollution and GHG PaMs, although these fields were only mandatory when a PaM was listed as selected for adoption. Twelve out of the fifteen Member States whom reported PaMs selected for adoption included information in these fields. Of the 274 single PaMs selected for adoption and with completed coherence fields, 61 % reported overlap with climate plans and policies to reduce GHG emissions and 58 % with plans and

[3] Additionally, in 2020 five Member States updated their information on PaMs: Cyprus, Germany, Greece, Latvia and Slovenia.

policies relating to energy and energy efficiency. Detailed analysis of these fields was limited due to the free text nature of the data fields.

While not within scope of the NECD and not according to the provisions of the Commission Implementing Decision (EU) 2018/1522, it was possible to report existing or already adopted PaMs through the webtool. 12 Member States did so and 151 of the PaMs selected for adoption were reported with implementation start dates between 2004 and 2019. It is however important to note that the reporting deadline was within the first half of 2019 and therefore a start date of 2019 could have been within the scope of the NECD. 66 of those 151 PaMs were reported to be adopted in 2019. A potential improvement in future reporting of PaMs under the NECD would be make accommodations for all Member States to report all PaMs, past, present and future, with the appropriate distinction between existing and additional PaMs and those considered or selected for adoption. This would give a more complete picture of PaMs for reducing air pollution and allow for better understanding of the synergy between the air pollution and climate mitigation PaMs.

Acknowledgements

The EEA task manager was Federico Antognazza.
Further, the project team wishes to acknowledge the helpful review and feedback from EEA manager Magdalena Jóźwicka-Olsen, and from Viviane Andre and Nicola Ostertag from DG Env.

1 Introduction

This report contains a synthesis of the information on national air pollution policies and measures (PaMs) reported[4] by European Union (EU) Member States under Directive (EU) 2016/2284[5] of the European Parliament and of the Council on the reduction of national emission of certain atmospheric pollutants (the 'NECD'). Article 6 of the Directive sets out the obligation for Member States to draw up, adopt and implement their respective National Air Pollution Control Programmes (NAPCP) to limit their anthropogenic air pollution emissions.

The NECD requires Member States to report on their additional national air pollution PaMs considered and selected for adoption in order to meet emission reduction commitments. Information on these additional air pollution PaMs was reported for the first time under the NECD in the NAPCP that had to be submitted in 2019. Reporting of the PaMs had to be done through an online EEA tool (the PaM tool). As the NECD does not require reporting of existing air pollution PaMs currently in place, the information covered in this report pertains only to the additional air pollution PaMs Member States considered for adoption. Commission Implementing Decision (EU) 2018/1522[6], which lays down a common format for the NAPCP, specifies that Member States shall use the EEA's online reporting tool to report their additional air pollution PaMs[7].

The objectives of this report are to:

- Perform a first assessment of the additional policies and measures that Member States are considering in order to meet their emissions reduction commitments under the NECD.
- Explore the potential synergies between air pollution and climate PaMs that Member States report under the GHG Monitoring Mechanism Regulation (MMR, EU 525/2013[8]).
- Consider lessons learned from the first reporting submissions.

Beyond the overview of the PaMs reported found in chapter 2, deeper analysis in this report covers a subset of these PaMs – those that have been selected for adoption. See Box 1-1 for further explanation about the different information included in this report.

This report is structured as follows:

- Chapter 2 describes the main characteristics of the air pollution PaMs reported by Member States under the EEA PaM tool under the NECD.
- Chapter 3 explores the PaMs selected for adoption by sector.
- Chapter 4 presents the reported expected emissions reductions from the air pollution PaMs selected for adoption.
- Chapter 5 explores the synergies between air pollution PaMs reported under the NECD selected for adoption and climate PaMs reported under the MMR.
- Annex 1 presents the reporting requirements related to the NECD.

[4] This analysis considers reported information by Member States including those submissions not made public.
[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.344.01.0001.01.ENG.
[6] https://eur-lex.europa.eu/eli/dec_impl/2018/1522/oj.
[7] https://webforms.eionet.europa.eu/ (NECD questionnaire).
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R0525.

Box 1-1

Understanding the data

The underlying data set used in this report is the information submitted by Member States under the "NECD PaMs questionnaire" through the online EEA PaM tool. The questionnaire contains the data fields relating to 2.6 and 2.7 of the Annex to the Commission Implementing Decision (EU) 2018/1522.

Additional vs existing PaMs

The intention of this reporting stream is to capture information on the additional PaMs that Member States are considering and selecting in order to comply with their emission reduction commitments. However, some Member States also reported some existing policies that are already implemented or already adopted. These have not been excluded from the analysis in this report as the projections scenario that identifies the status of the PaM was optional and interpreted differently by different Member States. The implementation start date gives some insight into the number of PaMs already implemented, but this data field was not always completed. However, we can be confident that fewer than 10 % of the PaMs reported through the EEA PaM tool are not additional.

Packages vs individual PaMs

Member States could report individual PaMs as well as packages of PaMs. Packages can be used to group together individual measures into a wider strategy, or where analysis of the expected emission reduction may only be available for the package of PaMs rather than at the individual PaM level. Except where explicitly stated, the PaMs analysed in this report include just the individual PaMs.

Selected for adoption

A key distinction made in this report is between those PaMs that have been selected for adoption, and those PaMs which have not. This distinction is made based on one data field in the questionnaire: "Is the PaM selected for adoption?". If a PaM was not reported as selected for adoption, this does not necessarily mean that the PaM has been considered for adoption and discarded, just that the decision to adopt the PaM has not yet been made. Chapter 2 of this report assesses both categories (i.e. all individual PaMs), whereas chapters 3-5 cover just the PaMs selected for adoption.

Quality of data

Neither the EEA nor the ETC/ATNI authors of this report have made any substantial quality control adjustments to the data reported by Member States through the EEA PaM tool.

Limits to analysis

The data set is not a complete picture of the EU-28* Member States' additional air pollution policies. 18 months after the deadline for reporting, 21 Member States had reported through the EEA PaM tool. Two Member States confirmed that they do not have additional PaMs to report in the context of the NECD, which leaves the information from five Member States missing. There is limited quantitative data asked for by the questionnaire. As such, analysis in this report is often limited to the number of PaMs that have certain characteristics e.g. the number of PaMs reported that target the transport sector. **No conclusions can be drawn on the quality of a Member State's policies based on the number of policies they report**.

* The United Kingdom was a Member State of the European Union at the time of reporting and will be referred to as an EU Member State (EU-28) for analysis up to 2020.

2 Policies and measures (PaMs) reported by Member States under the NECD

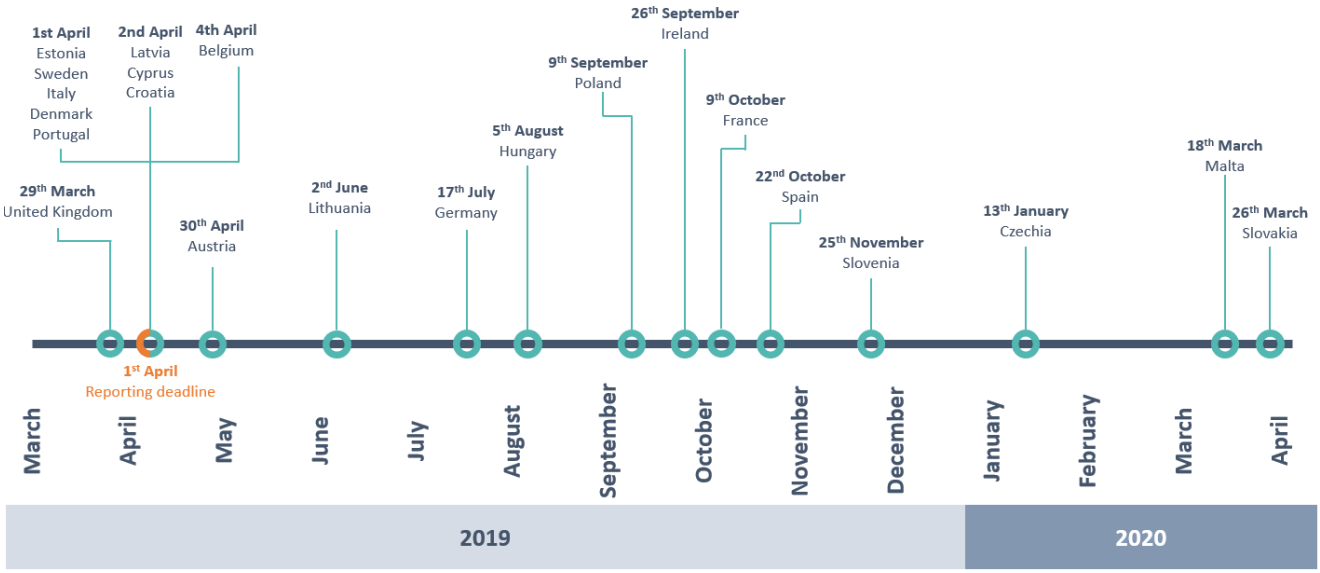
This chapter describes the characteristics of all of the Member States' reported individual PaMs as reported through the EEA PaM tool, whether they were reported as selected for adoption or not. These include the sectors targeted, the pollutants affected and the types of instrument.

The air pollution PaMs reported by Member States under the NECD should only be those which have been considered (but not yet selected for adoption) or those which have been selected for adoption (but not yet adopted) in order to meet emission reduction commitments. The EEA PaM tool is focused on the reporting of these additional PaMs. Once a PaM enters the implementation phase (the definition of which is not precise) Member States should not report them via the EEA PaM tool and do not need to provide explicit information within the NAPCP. It should be noted that if a Member State considers that they will meet their emission reduction commitments with existing PaMs then information on additional PaMs is not required to be reported under the NECD.

The data analysed in this report is from the EEA's PaM database as of 31 May 2020[9]. Austria reported on 30 April 2019 but submitted an Excel file rather than the required reporting through the EEA PaM tool, meaning that their data is not included in the database and is not included in this analysis.

By the reporting deadline of 1 April 2019, six Member States[10] had reported their NECD PaMs. As of 31 May 2020, 21 Member States had reported (not including Austria) as shown in Figure 2.1. Finland and the Netherlands confirmed that they do not have additional PaMs to report in the context of the NECD.

Figure 2.1 Timeline of Member State submissions



These 21 Member States reported a total of 602 individual PaMs and 65 packages of PaMs. The following sub chapters focus only on the individual PaMs.

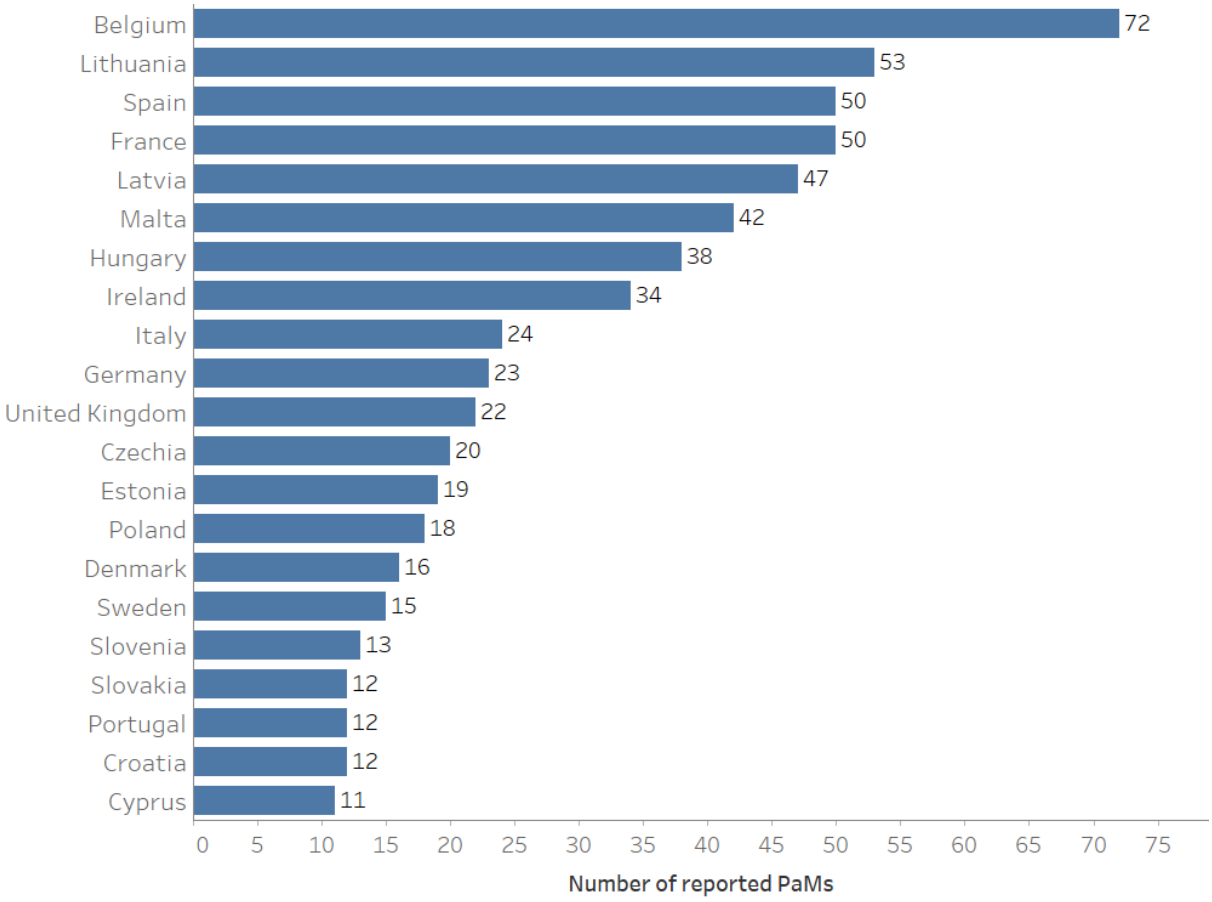
[9] At the time of publication (December 2020) no further submissions had been received by the EEA.
[10] The United Kingdom was a Member State of the European Union at the time of reporting and will be referred to as an EU Member State (EU-28) for analysis up to 2020.

2.1 Distribution by Member State

The total number of individual PaMs reported per country ranges from 11 (Cyprus) to 72 (Belgium), as shown in Figure 2.2. 14 Member States also reported at least one package of PaMs. Packages can be used to group together individual measures into a wider strategy, or where analysis of the expected emission reduction may only be available for the package of PaMs rather than at the individual PaM level.

In the absence of a strict definition of what constitutes a single PaM, Member States may differ in their approach. Some may split out actions into separate PaMs where some may consider one PaM to have multiple components. No assumptions can be made related to the number of PaMs and the quality of action being taken or the magnitude of impact on emissions by Member States. Additionally, whilst Member States were required to report only on the additional PaMs being considered and selected in order to meet their emission reduction commitments, some Member States have also reported on existing PaMs.

Figure 2.2 Number of individual policies and measures reported by Member State



2.2 Sectors of the PaMs

Member States were required to report which sector(s) each PaM affected:

- Energy supply (extraction, transmission, distribution, and storage of fuels as well as energy and electricity production);
- Energy consumption (consumption of fuels and electricity by end users such as households, services, industry and agriculture);
- Transport;

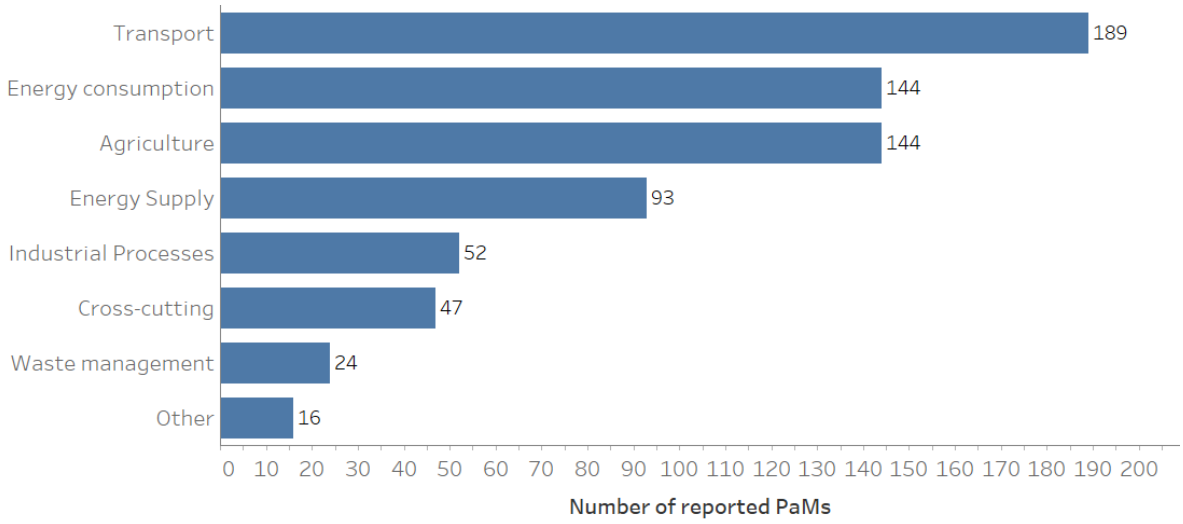
- Industrial processes (industrial activities that chemically or physically transform materials leading to greenhouse gas emissions, use of greenhouse gases in products and non-energy uses of fossil fuel carbon);
- Waste management/waste;
- Agriculture;
- Cross-cutting (multi-sectoral or framework policies);
- Other.

Most individual PaMs targeted single sectors (532 PaMs). 59 PaMs targeted two sectors, and 11 PaMs targeted three or more sectors.

As shown in Figure 2.3 the sector most frequently reported as affected by the additional air pollution PaMs was transport (189 PaMs), followed by agriculture and energy consumption (144 PaMs). Waste management was the least frequently reported specified sector (24 PaMs).

"Other" was reported as the target sector for 16 PaMs. These other sectors included PaMs to address solvents in households, improvements to air quality monitoring networks, improvements of the estimation methods in the national emissions inventory, and planting shrubbery adjacent to pollution hotspots.

Figure 2.3 Number of individual PaMs by sector



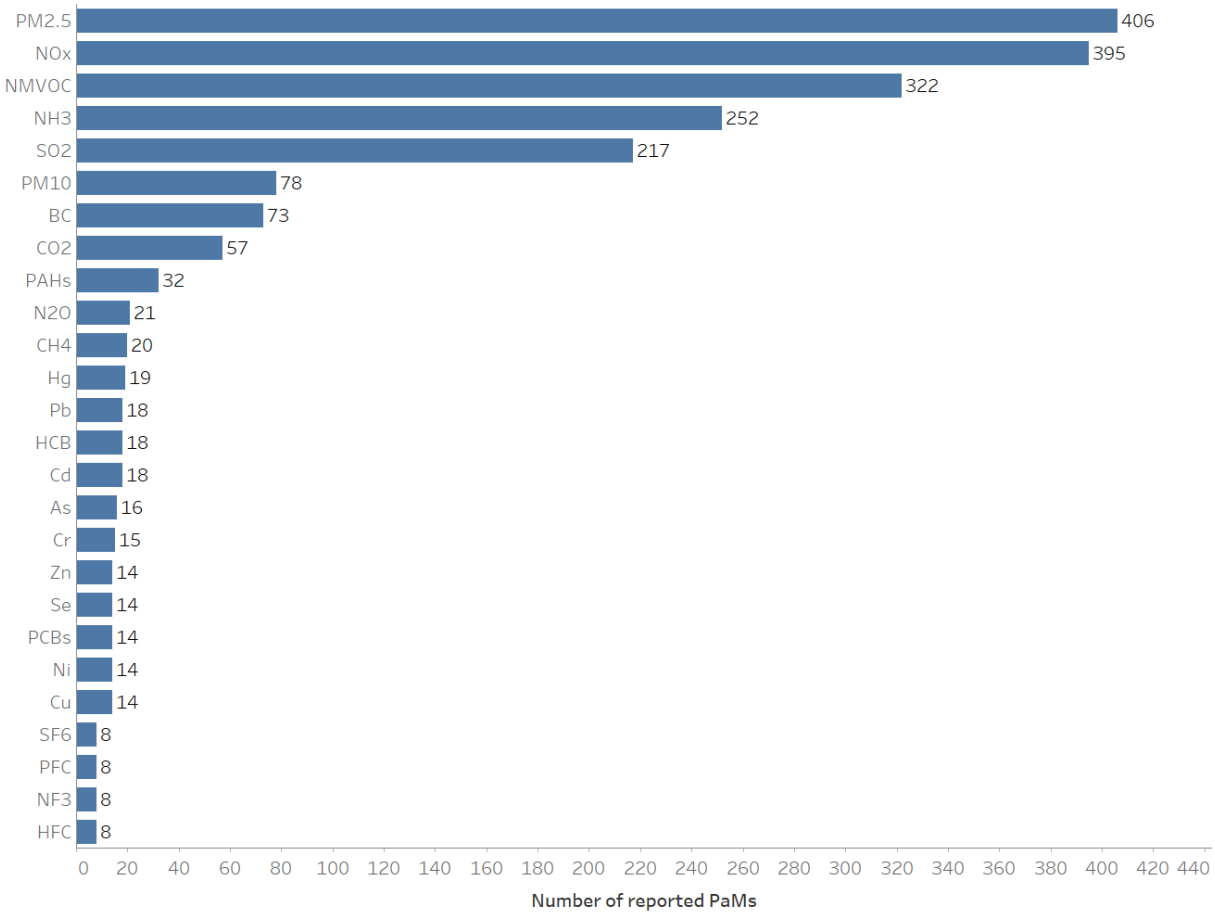
Chapter 3 of this report explores the PaMs selected for adoption by sector in more detail.

2.3 Air pollutants targeted by the PaMs

Member States were required to select at least one pollutant that each PaM would target. The main NECD pollutants were reported as the primary targets. These include nitrogen oxides (NO_X), fine particulate matter ($PM_{2.5}$), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO_2) and ammonia (NH_3). In addition, black carbon (BC) was also included in the list in the PaM-tool. Member States could also select other air pollutants that the PaMs would affect such as heavy metals and persistent organic pollutants (POPs). It was also possible to report any affected greenhouse gases.

Figure 2.4 shows that the reported PaMs most frequently targeted $PM_{2.5}$ emissions, closely followed by NO_X. It is possible that most Member States selected from only the main NECD pollutants in the reporting tool, and that there is underreporting of impacts on the wider range of pollutants.

Figure 2.4 Number of individual PaMs targeting each pollutant



All Member States need to reduce NO_x emissions from their current levels to meet their 2030 emissions reduction commitment, with 13 Member States requiring reductions of at least 30% from 2018 emission levels[11]. While Figure 2-4 shows the majority of PaMs are listed as targeting $PM_{2.5}$ and NO_X emissions, NH_3 is the pollutant most Member States project they will not meet the emission reduction commitments for. 16 out of the 21 Member States included in this report indicate, through their projections submitted under the NECD, that they are expecting to fall short of their 2030 NH_3

[11] https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive.

reduction commitments in the "With Measures" scenario[12], highlighting the need for further policies and measures. 11 out of the 21 Member States project they will not meet their 2030 emission reduction commitments for $PM_{2.5}$ or NO_X. **The difference in number of PaMs targeting these pollutants may be due to the nature of the policies**. Some of those focused on reducing NH_3 emissions are quite broad policies on fertiliser use and livestock management, whereas some of the PaMs focused on $PM_{2.5}$ and NO_X are more specific, such as different technical standards for boilers or measures for different vehicle types. In other words, **the fewer PaMs reported as targeting NH_3 emissions does not necessarily indicate a lesser focus on NH_3 emissions in Member States**.

2.4 Types of instruments

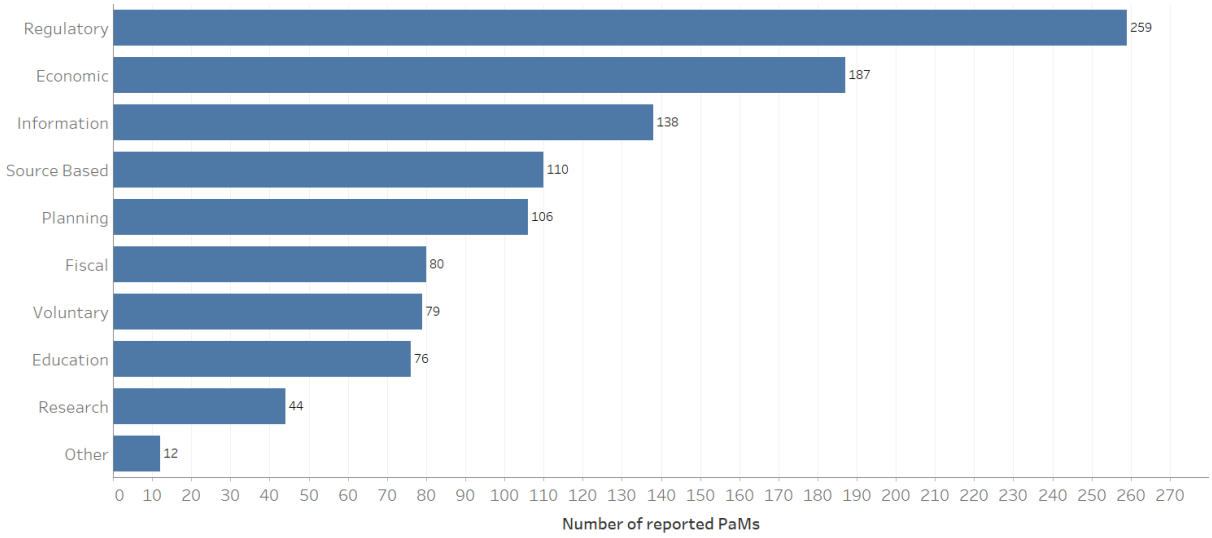
Member States had to select the type of instrument(s) that each PaM would utilise. Instrument types could be chosen from:

- **Economic:** a PaM that provides an economic incentive to reduce air pollutant emissions. This includes measures such subsidies, investment programmes, loans/grants, charges and fees for non-beneficial actions (e.g. waste fees or congestion charges).
- **Fiscal:** a PaM that provides a financial incentive via taxes. This includes both increases and decreases in taxes.
- **Voluntary/negotiated agreements:** a binding or voluntary standard/regulation as in regulatory and information measures but agreed between regulators and the sector targeted.
- **Regulatory:** measures that set binding standards and regulations or permitting system. This includes for instance building regulations, eco-design standards, establishment of permit and inspection procedures.
- **Information:** measures such as labelling, awareness rising, voluntary standards. The objective is to disseminate information to the general public or specific target groups.
- **Education:** measures such as training programmes, capacity building.
- **Research**: research programmes and demonstration projects.
- **Planning:** measures such as waste management plan, transport plan, urban planning.
- **Source-based pollution control:** measures to control pollution directly at the source, such as on exhausts of vehicles or stacks of industrial plant.
- **Other**: measures that do not fit in any of the above categories, such as public procurement.

Regulatory PaMs were the most frequently reported instrument type (see Figure 2.5), and the only type that all Member States reported (see Table 2.1). This could be because the implementation of regulatory PaMs such as improved agricultural practices, closure of fossil fuel plants, higher energy efficiency standards in buildings, and plans to stop the sale of petrol/diesel cars have the potential to deliver the largest emissions reductions that Member States need in order to meet their reduction commitments.

[12] https://www.eea.europa.eu/themes/air/air-pollution-sources-1/national-emission-ceilings/nec-directive-reporting-status-2019.

Figure 2.5 Number of individual PaMs by instrument type



Reporting of research PaMs was low. It is possible that this is due to the less direct and immediate effect that research PaMs have on emissions. Of the research PaMs reported, many were aimed at improving measurement, reporting and inventory accuracy. Other measures include investigating new technologies and fuels for transport.

Table 2.1 Share of instrument types per Member State (% of each Member State)

	Economic	Education	Fiscal	Information	Other	Planning	Regulatory	Research	Source-based pollution control	Voluntary/ negotiated agreements
Belgium	21%	24%	17%	32%		7%	69%	4%		6%
Croatia	58%	17%	17%	33%		67%	17%	8%		
Cyprus			27%	9%			82%		9%	18%
Czech Republic	20%	15%	25%	25%	15%	10%	40%	5%		5%
Denmark	19%	6%	13%	6%		6%	56%	19%	6%	25%
Estonia	74%	11%	11%	84%		37%	26%			
France	24%	14%	10%	22%		16%	40%	18%	10%	30%
Germany	65%			4%	9%	13%	65%		4%	4%
Hungary	13%	10%	20%	30%	3%	5%	38%		23%	
Ireland	41%	41%	9%	44%		3%	29%	3%	26%	35%
Italy			17%			63%	33%			
Latvia	33%	4%	11%	9%		15%	36%	5%	22%	2%
Lithuania	17%	8%	11%	8%	8%	6%	9%	15%	36%	
Malta	29%		2%	2%		14%	12%		43%	17%
Poland	28%	6%	6%	6%			39%	11%	56%	
Portugal	25%	8%	8%	25%		33%	58%		8%	
Slovakia	33%	8%	17%				42%		8%	8%
Slovenia	46%	38%	8%	62%	15%	15%	46%			
Spain	58%	22%	14%	32%		56%	72%	24%	30%	42%
Sweden	47%		40%	27%		27%	7%		33%	40%
United Kingdom	32%	9%	9%	36%		14%	86%	9%	23%	23%

Note: one PaM could have one or more instrument types so the rows may not add up to 100%.

Some Member States seem to favour particular policy instrument types. For example, 84 % of Estonia's PaMs included an information instrument, and 82 % of Cyprus' PaMs included a regulatory instrument.

The regulatory instrument was the most frequently reported instrument for the majority of countries. Sweden, Lithuania and Malta are exceptions to this. Instead, the majority of PaMs reported by Sweden are either source-based/voluntary agreements or economic/fiscal instruments and there is a roughly 50/50 split between these instruments. The source-based instrument PaMs outline the aim to strictly implement the Best Available Techniques associated emission levels (BAT-AELs) set out in the IED. 43 % of PaMs reported by Malta are sourced-based instruments. The majority of the economic/fiscal instrument PaMs relate to transport and involve phasing out old vehicles, fuel switching and the promotion of sustainable transport methods. These cover reductions of emissions from buildings, transport and industrial point sources.

Table 2.2 shows that some sectors were reported to have a greater share of some instrument types than others. For example, half of the PaMs targeting the agriculture sector are regulatory and 47 % of PaMs targeting the industrial processes sector included a source-based pollution control instrument. In industry this is mostly related to the installation of abatement techniques at refineries and industrial plants. In agriculture, the regulatory PaMs were frequently regarding restrictions on fertiliser use and practices for spreading manure on fields.

Table 2.2 Share of instrument types linked to each sector (% of each sector PaMs)

	Economic	Education	Fiscal	Information	Other	Planning	Regulatory	Research	Source-based pollution control	Voluntary/ negotiated agreements
Agriculture	31%	17%	3%	28%	2%	17%	50%	9%	22%	18%
Cross-cutting	27%	8%	17%	27%	4%	42%	29%	31%		23%
Energy consumption	34%	15%	13%	25%	1%	15%	37%	5%	16%	10%
Energy Supply	35%	5%	11%	11%	1%	24%	44%	11%	19%	13%
Industrial Processes	17%		6%	11%		8%	45%	15%	47%	8%
Other	6%	17%	11%	28%	22%		28%	11%	6%	6%
Transport	32%	10%	21%	21%	1%	25%	40%	11%	16%	13%
Waste management	21%	8%		42%		42%	42%	29%	21%	17%

Note: one PaM could have one or more instrument types so the rows may not add up to 100%.

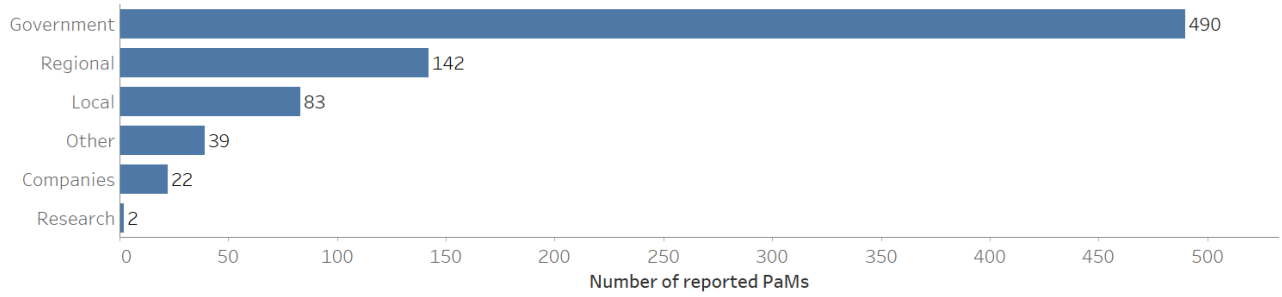
The waste management sector was the sector with the highest share of PaMs with an information instrument (42 % of waste management PaMs). This mostly related to campaigns and dissemination of information on emissions from waste to drive behaviour change from both citizens and local authorities: reducing waste production and improving participation in recycling.

2.5 Entities implementing the PaMs

Member States had to report at least one implementing entity, and the type of the entity, for each PaM. Implementing entities are the organisation(s) responsible for the implementation of the PaM,

which may cover activities such as setting required regulations, providing funding, mobilising resources, planning, monitoring and/or evaluating the PaM. These are shown in Figure 2.6.

Figure 2.6 Number of individual PaMs by implementing entity type



The majority of PaMs reported included a national government entity as an implementing entity (490 out of 602 individual PaMs). With a few exceptions, all PaMs that were reported as being implemented by others, such as a regional entity, were in addition to national government implementing entities. This is possibly because implementation of measures will be overseen by the national government entity, even if also implemented by another entity. In addition, many of the PaMs are intended to be implemented on a national scale. The majority of PaMs reported as not implemented by a government entity will be implemented by local or regional entities. The notable exception is for Belgium which reported most PaMs to be implemented by regional and/or local entities. Implementing entities reported under the "Other" category were mostly non-governmental organisations.

2.6 Implementing dates

The implementation period of the PaMs, the start date and the end date, were required fields for reporting. Member States could also provide a comment on the implementation period. If the finish date for a PaM was not yet known, Member States could indicate this by entering '9999'.

The most common start date was 2020, followed by 2019 and 2021, with these three years covering 391 of the 602 single PaMs. With the first reporting of these policies in 2019, Member States reported many policies that could be implemented in the short-term. 152 PaMs selected for adoption had a start date of 2020, indicating a potentially active year for new air pollution policies.

The most common end date was 2030, followed by '9999'. Of those with a '9999' end date, Member States frequently commented that either there was no end date foreseen (i.e. it would not run out, such as a policy to phase out diesel cars where there is no date that diesel cars would be reinstated), or that it had not yet been determined as the PaM was still under consideration and development.

3 Sectors addressed by PaMs

Box 3-1

Scope of analysis

The underlying dataset used in this analysis should not be considered complete: not all Member States reported PaMs in time for this analysis, whilst some reported PaMs but did not highlight which, if any, had been selected for adoption (Croatia, Ireland, Italy, Latvia, Poland, Slovenia). Unlike chapter 2, **all analysis in chapter 3, and in all subsequent chapters, is restricted to PaMs which were reported as selected for adoption unless otherwise stated**. It remains unclear to what extent PaMs reported as "considered for adoption" (i.e. not reported as selected for adoption) will be later implemented to bring further emission reductions.

In addition, Member States were able to quantify emission reductions from the PaMs that they did report. **Any quantitative analysis of these reductions should be considered highly uncertain and liable to underestimation**: not all Member States reported emissions reductions alongside their individual or packaged policies. In addition, Member States were not required to report PaMs that have already been implemented which may also produce additional savings in future years.

This chapter provides an analysis of the PaMs reported by Member States on a sectoral basis, looking in detail at PaMs reported to reduce emissions from the agriculture, transport, and residential sectors. A brief analysis of PaMs reported to reduce emissions from other sectors is also included. Note that for this chapter and for all following chapters, analysis is restricted as described in Box 3-1. **A total of 379 individual PaMs were reported as selected for adoption**. Overall, the transport sector had the highest number of individual PaMs reported, followed by agriculture, and energy consumption and supply (see Figure 3.1). This is not all that surprising given the persisting air pollution issues in these sectors, although conclusions on the relative level of detail and effectiveness of these PaMs cannot be drawn solely from their quantity.

Figure 3.1 Number of individual policies and measures reported by sector

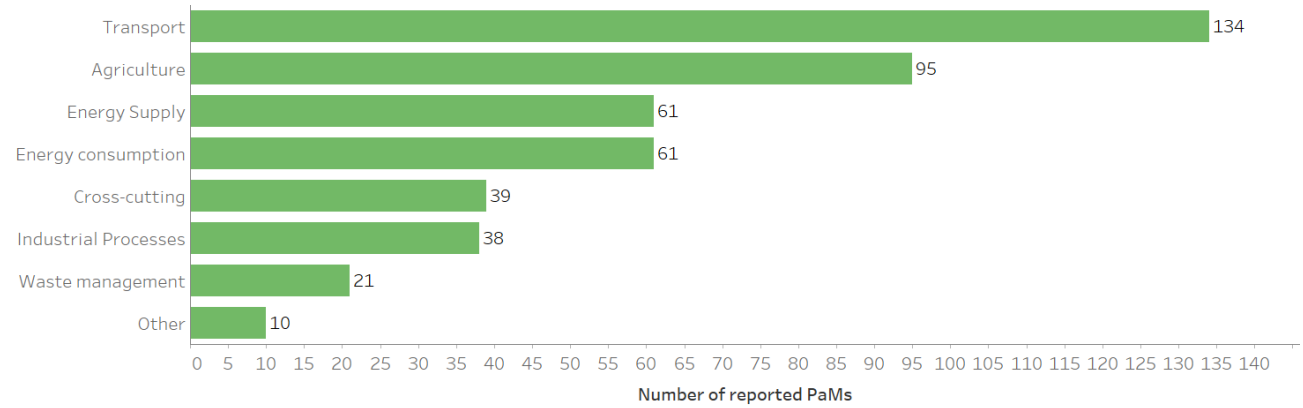


Table 3.1 shows the distribution of PaMs by sector and by Member States. This demonstrates that PaMs targeting air pollutant emissions from the transport and agriculture sectors are numerous across most Member States, albeit with some regional variability. For example, in Portugal 71 % of the reported PaMs target the transport sector but there are no PaMs reported which would reduce emissions from agriculture. There is a much more diverse spread of PaMs across the other sectors. For example, most Member States have no waste management PaMs which have been selected for

adoption, however in Spain these make up 17 % of the total number of PaMs (constituting 52 % of all waste management PaMs across reporting Member States).

Table 3.1 Share of individual policies and measures selected for adoption targeting each sector per Member State (% of total of Member State)

	Agriculture	Cross-cutting	Energy consumption	Energy Supply	Industrial Processes	Other	Transport	Waste management
Belgium	13%	11%	20%	4%	11%	9%	37%	2%
Cyprus	9%		36%	45%	9%		18%	
Czechia	25%	20%	5%	25%		5%	25%	
Denmark	33%			20%			47%	
Estonia	25%		25%	50%				
France	14%	22%	12%	2%	12%		36%	6%
Germany	57%	5%	5%	19%			19%	
Hungary	47%		3%	6%	9%	3%	31%	
Lithuania	31%	14%	25%	25%	36%	8%	42%	17%
Malta	7%		17%	12%	2%		69%	2%
Portugal				14%		14%	71%	
Slovakia	9%	18%	64%	64%			18%	
Spain	38%	14%	26%	22%	2%		12%	20%
Sweden	20%		13%	7%	27%		40%	
United Kingdom	30%	20%		15%	20%		40%	

Note: one PaM could have one or more sectors so the rows may not add up to 100 %.

3.1 Agriculture

The agriculture sector, in an air pollution context, is the most important source of ammonia (NH_3) across the EU. In fact, in the latest air pollution inventories submitted by the 28 Member States, the agriculture sector alone accounted for 93 % of EU-wide ammonia emissions in 2018. The collective efforts of Member States have resulted in EU-wide ammonia emissions remaining below the ceiling set by the NECD every year since 2012. However, to meet the much more ambitious commitments set for the period 2020-2029, further progress will be required. **12 Member States plus the United Kingdom will need to reduce ammonia emissions by a further 10 % against 2018 levels to attain their emissions reduction commitments for the 2020-2029 period**. Therefore, it is not surprising that PaMs focussing on agriculture are amongst the most numerous, as depicted in Figure 3.1.

Overall, the proportion of reported PaMs that relate to agriculture is fairly high across all Member States (see Table 3.1). Such policies account for over 25 % of all policies selected for adoption in Czechia, Denmark, Estonia, Germany, Hungary, Lithuania, Spain and the United Kingdom, and at least 15 % in many of the remaining Member States. As expected, the vast majority of agriculture PaMs would reduce emissions of ammonia in particular. Of the 95 PaMs across all Member States, 91 target NH_3 emissions to some extent (of which, 67 target NH_3 exclusively).

Member States were also asked to quantify the expected emissions reductions from PaMs they reported. **In total, the expected emissions reductions from the PaMs for the agriculture sector are between 282 and 346 kt per year in 2030. This equates to between 7 % and 9 % of EU-wide ammonia emissions in 2018**. Note that this should be treated only as a lower bound to the overall projected decline as outlined in Box 3-1. The greatest savings are expected from the group of policies implemented in Germany, which is expected to reduce emissions of NH_3 by 133 kt per year by 2030. These policies all relate to the management of manure and livestock through the use of regulatory and economic measures. In particular, these focus on implementing more effective housing and manure spreading techniques, and reducing the nitrogen content of feed with nutrition management programmes for pigs, poultry, and cattle. On their own, these sources currently account for 75 % of all NH_3 emissions in the country in 2018 and this would constitute a 21 % saving in comparison to the 2005 baseline.

A number of mechanisms to reduce emissions of ammonia are considered across the EU, which largely follows the themes outlined in the Annex III Part 2 to the NECD. These include the establishment of National Advisory Codes of Good Agricultural Practice, policies relating to the use of fertilisers, measures to reduce emissions from livestock manure, and additional controls, such as banning open field burning of harvest residue, which would reduce emissions of $PM_{2.5}$ and black carbon.

National Advisory Codes of Good Agricultural Practice

Under the original Gothenburg Protocol which came into force in 2005, Parties committed to establishing, publishing, and disseminating an advisory code of good agricultural practice to control ammonia emissions. The NECD reaffirmed this requirement, stating that all Member States shall establish such an advisory code. These codes would contain information and provisions on:

- Nitrogen management, taking into account the whole nitrogen cycle;
- Livestock feeding strategies;
- Low-emission manure spreading techniques;
- Low-emission manure storage systems;
- Low-emission animal housing systems; and
- Possibilities for limiting ammonia emissions from the use of mineral fertilisers.

Given this commitment, it is unsurprising that the majority of Member States included PaMs relating to the establishment and dissemination of an advisory code. The only Member States not to do so were Belgium, Denmark, France, Portugal and Sweden. As discussed above, Portugal submitted no PaMs relating to agriculture. For Belgium, Denmark, France, and Sweden, the absence of a national advisory code from the latest reported PaMs does not necessarily mean that such a code has not already been established. Belgium, for example, first implemented a national advisory code in 2000, before publishing a new code in 2014 and so the lack of PaMs reported in this case may be indicative of no further measures being required to supplement current ammonia control practices. Of the Member States not included in this more detailed analysis (i.e. those that only submitted draft PaMs, submitting in different formats, or not with any submission), it is unclear to what extent a National Advisory Code has already been implemented as per the NECD. A survey undertaken by UNECE in 2017[13] found that Bulgaria, Croatia, Cyprus, Finland, Ireland, and Portugal had not established a National Advisory Code at that point, although many of these had alternative codes available for farmers, within which some content would be expected to overlap. There is also evidence of some

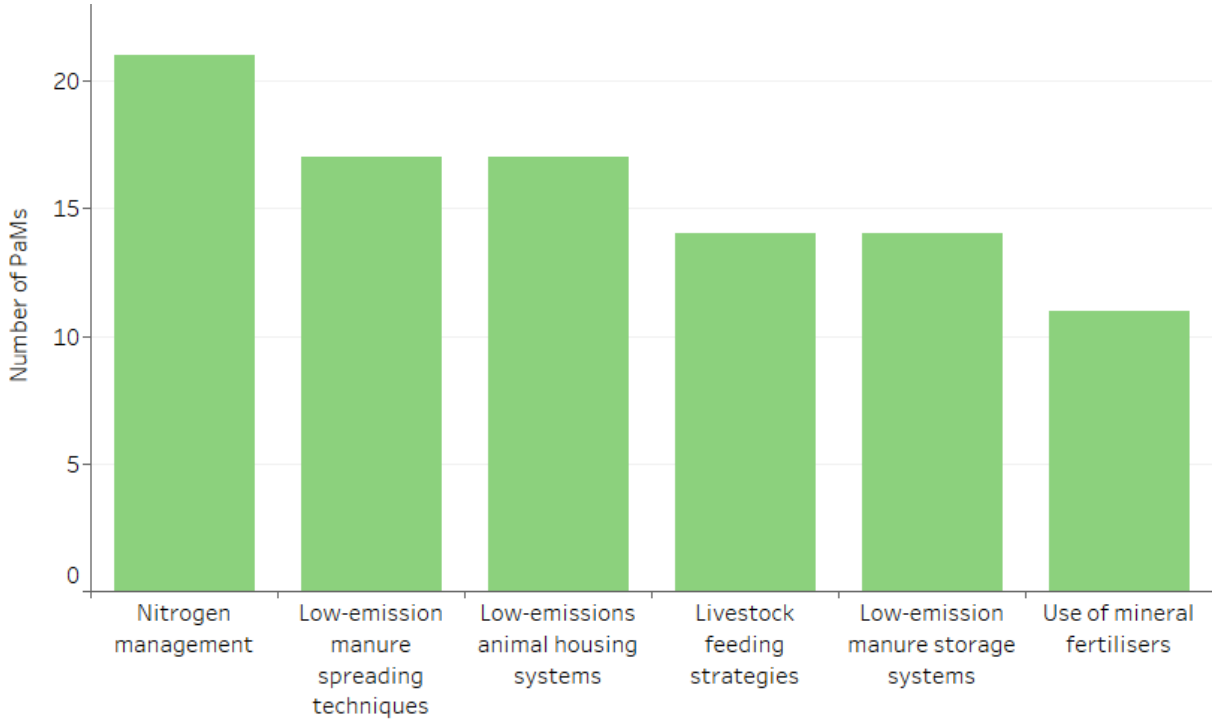
13 https://www.unece.org/fileadmin/DAM/env/documents/2017/AIR/WGSR/01062017Responses_questionnaire_NAC_v4_final_final.pdf.

codes being developed in these Member States since then. For example, Ireland published a National Advisory Code in 2019[14] whilst in Finland an alternative "Action Plan to reduce ammonia emissions from agriculture in Finland" was prepared in 2018[15].

In all, 51 % of all agriculture PaMs include the establishment or further development of a national advisory code. Figure 3.2 illustrates the relative number of PaMs targeting each of the provisions by Member State, and shows a largely even distribution across all. The highest number of PaMs focus on nitrogen management. These should account for the whole nitrogen cycle but on further inspection it was found that many of these PaMs did not do this. Only Hungary included a PaM regarding the establishment of a national nitrogen budget. Instead, the reported PaMs often focussed on smaller, isolated aspects of the cycle. When this provision is excluded from the analysis, the most numerous aspects are manure spreading techniques and the use of low-emission animal housing systems. The content of these PaMs largely follows the recommendations made in the UNECE Framework for Good Agricultural Practice, namely;

- In manure spreading, use of trailing hoses, shallow or deep injection methods of spreading;
- Optimising the timing of application to account for external conditions such as temperature, humidity, and wind speed;
- Dilution of slurry prior to spreading;
- Good practice of husbandry and keeping livestock housing areas dry, clean, and clear of manure and urine.

Figure 3.2 – Bar chart showing the number of occasions that each provision was highlighted by PaMs relating to the establishment, development, or update of a National Advisory Code



14 https://www.agriculture.gov.ie/media/migration/ruralenvironment/climatechange/bioenergy/codeofgoodagpracticeammoniaemissions/1CodeofGoodAgriculturalPracticeforreducingAmmoniaEmissions081119.pdf.

15 http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160629/MMM_1b_2018.pdf.

As a large proportion of the agriculture PaMs have been aggregated to the group level, rather than presented as individual PaMs, it is not possible to confidently compare expected emissions reductions by category.

Fertiliser use

Emissions of ammonia from the use of fertiliser on crops is an important contributer to the EU-wide ammonia inventory. In the most recent air pollutant inventories, the use of inorganic fertilisers (3Da1) accounts for 17 % of all EU ammonia emissions in 2018. Of particular importance to ammonia emissions from this category is the use of urea-based fertilisers. Rapid hydrolysis of urea in the presence of urease enzymes can lead to a significant proportion of the nitrogen contained within these fertilisers being volatised and released as ammonia gas. As a result, alternative fertilisers or mechanisms to mitigate the release of ammonia are being considered globally. The reported PaMs by Member State indicate that the EU is no different in this regard. In total, 21 PaMs (22 % of all agriculture PaMs selected for adoption) were reported as targeting ammonia emissions from fertilisers, although no such policies were reported by five of the Member States that responded (Estonia, France, Portugal, Sweden, and Slovakia).

The target of these fertiliser use-based policies was mixed and there appeared no consensus on the mechanism by which these reductions could be achieved (see
Figure 3.3). The most popular mechanism selected is through the replacement of urea-based fertilisers with ammonium nitrate-based fertilisers. Of the 10 Member States to have reported PaMs selected for adoption on fertiliser use, 6 had at least one policy relating to the use of ammonium nitrate-based fertilisers. These PaMs were typically a combination of regulatory and educational measures. Such a switch can cause a reduction of ammonia emission by up to 90 %[16] and has also been shown to increase crop yields[17]. The main barrier to the uptake of ammonium nitrate-based alternatives is the additional upfront cost to farmers. However, because the amount of nitrogen volatised is lower when using ammonium nitrate-based fertiliser, less needs to be applied to provide sufficient nitrogen for growth. As a result, overall costs to farmers can be similar over the lifetime of the product. UNECE cost-benefit analysis[18], for example, suggests that the costs from the use of ammonium nitrate-based alternative will range from between +1.0€/kg to -0.5€/kg (meaning that it can be cheaper overall).

To overcome the initial upfront cost barrier, some Member States have suggested measures such as requiring the use of urease inhibitors when using urea-based fertilisers. Rather than reducing the cost of purchasing ammonium nitrate-based fertilisers, this increases the upfront cost of the more-polluting urea-based fertiliser so that the uptake of ammonium nitrate-based fertiliser is economically preferable. Urease inhibitors provide ammonia emissions reductions of up to 70 % if solid urea is used, or 40 % if liquid urea ammonium nitrate is used. Therefore, even if urea-based fertilisers are used under such a policy, significant emissions reductions would be expected.

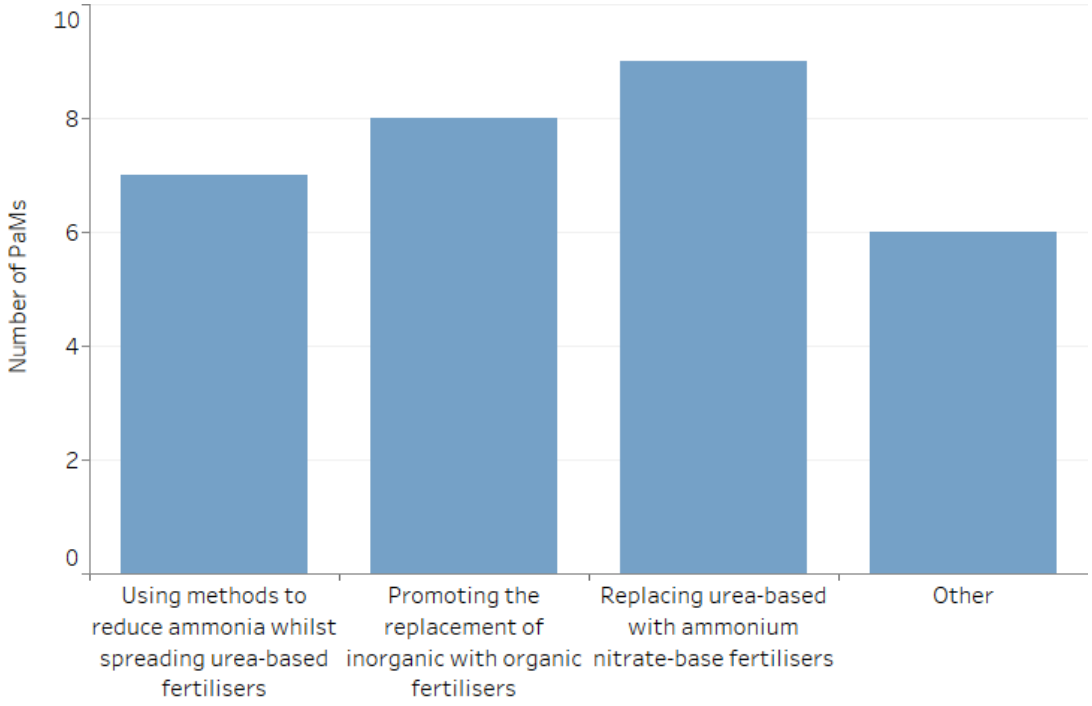
It should be noted, however, that the use of ammonium nitrate-based fertilisers can increase emissions of nitrous oxide (N_2O), a potent greenhouse gas. As a result, a wholesale switch to ammonium nitrate may not be consistent with wider EU and national targets to reduce greenhouse gas emissions. Some individual PaMs suggest that Member States are aware of these competing interests and as such are not prioritising the use of ammonium-nitrate as a final solution. For

[16] https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf.
[17] https://bg.copernicus.org/articles/16/4731/2019/bg-16-4731-2019.pdf.
[18] https://www.unece.org/fileadmin/DAM/env/documents/2019/AIR/EMEP_WGE_Joint_Session/Assessment_Report_on_Ammonia_20190827.pdf.

example, in Hungary the PaM to replace urea-based fertilisers will be implemented only if a 2025 review shows that the ammonia emissions reduction commitments cannot be met without additional action.

In addition to ammonium-nitrate, the replacement of inorganic fertilisers with organic alternatives such as the use of animal manure, can reduce emissions of ammonia. Such measures were reported by half of the Member States that reported at least one PaM on fertiliser use. As per the previous section, Member States need to ensure that the application of manure to land follow good practice guidelines on spreading, ensuring that there is no surplus nitrogen added in the process, that timing of application is idealised, and utilising alternative spreading techniques.

Figure 3.3 – Bar chart illustrating the relative number of PaMs for fertiliser use by category across all Member States



Ammonia emissions from livestock manure

Emissions from livestock manure make up much of the remaining contribution to the total emissions of NH_3 in agriculture, and as such PaMs utilised to reduce their contribution will significantly influence progress towards NECD emission reduction commitments. To that end, Annex III Part 2 of the NECD states that ammonia emissions from livestock manure can be reduced by following one of a number of approaches including:

- Reducing emissions from slurry and solid manure application to arable land and grassland by following guidance on meeting and not exceeding nutrient requirements, spreading only when conditions are favourable, and applying slurries to grassland in controlled ways that can demonstrably reduce emissions.
- Reducing emissions from manure storage outside of animal houses by using low emission storage systems or techniques, covering stores for solid manure, and ensuring farms have sufficient capacity to spread manure only during suitable periods.
- Reducing emissions from animal housing, by using systems which have been demonstrated to reduce ammonia emissions such as the use of low-protein feeding strategies.

Of the responding Member States, 9 reported no PaMs selected for adoption which addressed emissions from livestock manure. It is unclear what policies, if any, have been implemented in these Member States to mitigate emissions from livestock manure. Of the three approaches outlined in the NECD, the most popular mechanism to reduce emissions of ammonia is through improvements to the techniques used in slurry and solid manure application.

Specific details of most individual PaMs are not readily available. However, most propose that these PaMs would be regulatory in nature and would likely mirror the Ammonia Guidance Document in requiring farmers to use the methods which can bring at least 30 % emissions savings compared to the reference approach. This could include measures such as constraining the amount of manure and slurry spread on cropland and grassland so that soil nutrient requirements are just met, thereby minimising the amount of excess nitrogen which would otherwise be emitted as ammonia.

All of the three approaches from Annex III Part 2 above garnered support through PaMs from a number of Member States indicating that all three approaches have roles to play in reducing ammonia emissions from agriculture. The United Kingdom is also proposing to develop an estimate of emissions from the Best Available Technique (BAT) from which emissions limits could be developed and implemented nationally in a policy that draws similarities from the regulations of emissions from industrial units under the Industrial Emissions Directive (IED).

Emissions of $PM_{2.5}$ and black carbon

Emissions of particulate matter and black carbon from agriculture largely stem from the practice of open field burning. Farmers do this as a fast and economical way to remove straw stubble, weeds, and wastes from cultivated fields before sowing new crops. This combustion, however, produces significant amounts of particulate matter as well as being a significant source of benzo[a]pyrene, amongst other polycyclic aromatic hydrocarbons (PAHs). As such, the NECD states that Member States may ban the practice. Member States are responsible for the monitoring and enforcement of any ban, although exemptions are made in circumstances where field burning is used to avoid uncontrolled forest fires, pest control, or to protect biodiversity.

Of all of the respondents, only Hungary indicated that any ban on field burning would be appropriate to reduce $PM_{2.5}$ emissions from the sector. Belgium and France opted for an approach which would provide information to farmers on the detrimental affects of the practice, whilst Cyprus, Spain, and France again will seek instead to promote the use of such wastes and straw stubble for energy through anaerobic digestion or co-generation burning. No other Member States put forward any PaMs relating to field burning. Bans or restrictions on field burning are in place already in several Member States. In fact, in the latest air pollutant inventories submitted by each Member State, emissions of $PM_{2.5}$ from field burning were non-zero in only half of Member States: Austria, Bulgaria, Croatia, Cyprus, Denmark, Finland, France, Greece, Hungary, Italy, Poland, Portugal, Romania, Spain all reported emissions.

3.2 Transport

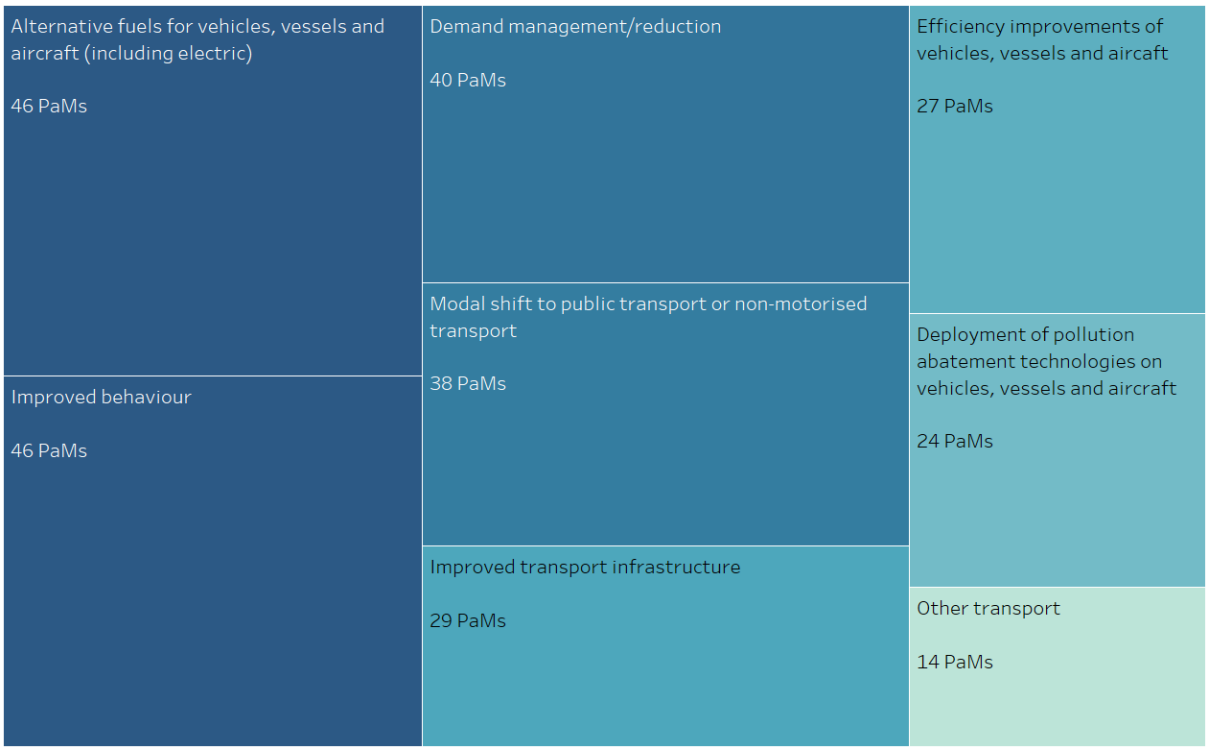
The transport sector is of particular importance to air pollutant emissions in Member States. In the most recent inventory (1990-2018), at least one transport mode was identified as a key category in most EU Member States. **In 2018 transport accounted for around 46% of total NO_x emissions in the EU-28**. It is no surprise, therefore, that a relatively high proportion of the submitted PaMs seek to address transport emissions either directly or indirectly. **Of the 380 individual PaMs selected for adoption, 134 sought to address emissions from transport in some form (35 %)**.

The road transport sector is a key emissions source across the EU. Measures to reduce emissions have historically taken the form of either encouraging modal shift to reduce energy demand from road traffic, the implementation of more stringent exhaust cleaning technologies such as through the introduction of EURO engine standards, and the uptake of alternative, low-emission fuel technologies. Despite this, emissions of air pollutants from road transport remains a problem across many Member States especially in urban areas where public exposure is highest.

There is regional variation in the focus on transport amongst the PaMs. Portugal and Malta particularly prioritise transport action, with 71 % and 69 % of the PaMs reported by these Member States targeting transport respectively. By contrast the Estonia submissions had no transport policies selected for adoption, and the proportion of total policies in Spain was 12 % (see Table 3.1). It should be noted, however, that Member States were not expected to report PaMs that have already been introduced and so the lower proportion, or absence, of policies may reflect the fact that policies and measures have already been implemented.

Figure 3.4 illustrates the relative prominence of PaMs for transport categorised by objective. **It is apparent from this diagram that there is no dominant policy objective in the transport sector: rather the distribution is more even, suggesting a mixed and varied approach to reducing emissions of air pollutants.** Policies to encourage the uptake of alternative fuel technologies, reduce energy demand, improve behaviour and to shift demand to different modes are all popular.

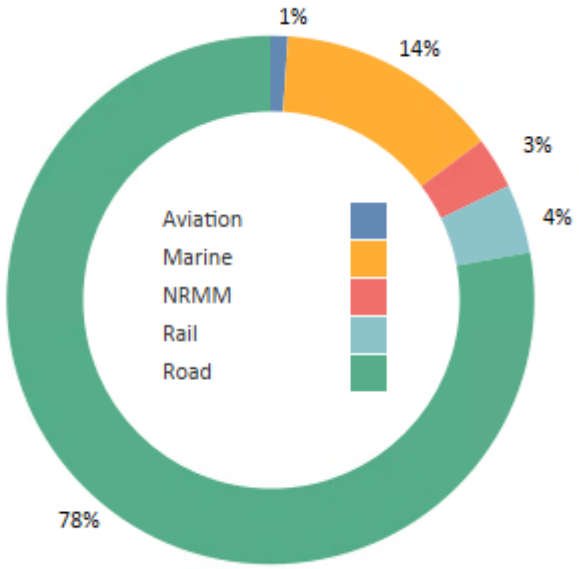
Figure 3.4 – Heatmap showing the relative importance of different objectives from PaMs selected for adoption for the transport sector



Given the relative size of the road transport sector in emissions inventories across the EU, it is unsurprising that the vast majority of transport PaMs target on-road emissions.
Figure 3.5 illustrates the distribution of PaMs against transport mode. Non-road transport policy accounts for around 17 % of all PaMs selected for adoption, with only Belgium, Denmark, France, Latvia, Malta, Spain, and the United Kingdom reporting PaMs to reduce emissions from these

sectors. For shipping, the focus is largely on ensuring that there is sufficient infrastructure for LNG vessels to operate and refuel in European waters, or for the installation of shore-side electricity supply for docked vessels to allow them to switch to all auxiliary engines whilst in-port.

Figure 3.5 – Proportion of transport PaMs selected for adoption by transport mode (aviation, marine, non-road mobile machinery (NRMM), rail, and road)



Overall, **the reported PaMs are expected to bring savings of between 309 and 375 kt NO_x per year in 2030. This is approximately 4-5 % of EU-wide NOx emissions across all sectors in 2018**. PaMs that reduce transport activity would also be expected to brings emissions reductions for other priority pollutants, such as SO_x, NMVOCs, NH_3, PM_{10}, and $PM_{2.5}$. Looking more closely at the PaMs which are set to offer the greatest benefits, it is somewhat surprising to note that of the five PaMs with the largest emission reductions reported, two relate to emissions reductions from non-road transport modes. In France, it is expected that the application of EU Regulation 2016/1628, which sets emissions limits for combustion of non-road mobile machinery, will bring about 80 kt NO_x per year savings on its own. Meanwhile in the United Kingdom the implementation of Maritime 2050[19], which will include the development of port air quality strategies and the potential expansion of the current NO_x and SO_x Emissions Control Area, will reduce emissions by up to 50 kt NO_x per year.

Of the policy types, it is clear that regulatory policies are expected to be the dominant mechanism for producing meaningful emissions reductions. While Member States do indicate that other measures, such as fiscal or economic policies, or information, voluntary, or education campaigns, have a part to play in the coming decade, regulatory measures would be most effective at reducing emissions from the transport sector.

Accelerating the uptake of alternative fuel technologies

The benefits to air pollution of shifting the energy demand of road transport away from conventional fuels and towards alternative fuels and other propulsion technologies are well documented. In particular, the uptake of electric and fuel cell technologies remain desirable options with significant reduction of emissions of both air pollutants and greenhouse gases at the point of use. As such, a key aim for policy makers across the EU is to continue to encourage the uptake of these vehicles. In the

[19] https://www.gov.uk/government/publications/maritime-2050-navigating-the-future.

past, the main barriers that have prevented a faster transition include the upfront costs to consumers for purchasing these vehicles, a lack of infrastructure to refuel / recharge vehicles safely and quickly, and consumer behaviour. Numerous policies have previously sought to overcome these barriers and this is a pattern that continues in the latest submission of PaMs by Member States under the NECD. Policies which target either infrastructure development or schemes to encourage the adoption of these vehicles, such as subsidies, were identified in nearly all Member States.

Electric vehicle adoption

In the past, Member States have introduced numerous policies to trigger the uptake of electric and low-emissions vehicles. In 2020, the United Kingdom and all but one Member State offer financial incentives to assist consumers in overcoming the cost barriers, with only Lithuania offering no support schemes[20]. These policies come in a number of forms and combinations which varies by Member States, but typically fall into one of four main categories;

- Purchase incentives and bonuses given to the consumer / business;
- Reduced costs or tax when purchasing an applicable vehicle;
- Tax benefits during the ownership of the vehicle, such as reduced road tax;
- Additional benefits for company cars.

It is noticeable that these policy stimuli will be reduced at the end of 2020 in eight Member States and the United Kingdom[20]. Largely, PaMs selected for adoption reported under NECD obligations are not extensions of current and historic PaMs. This may demonstrate the belief that the electric vehicle market is now at a stage where it can grow independently and without as much financial support as before. Indeed, the market share of electric vehicles is believed to be in the order of one percentile across the majority of Member States[21]. Recent analysis, however, has illustrated that relying on current policies alone will not steer the EU towards its climate ambitions of carbon neutrality by 2050[22]. Only eight Member States explicity indicated additional PaMs that would offer financial incentives for electric vehicles to consumers and businesses beyond 2020 (Belgium, Czechia, Denmark, Germany, Latvia, Malta, Slovakia and Sweden), and so it appears likely that additional PaMs will need to be considered by Member States in order to meet the EU-wide ambitions, but also their own national ambitions for removing petrol and diesel vehicles from the roads.

Infrastructure

The Alternative Fuels Infrastructure Directive (AFID) (2014/94/EU) was adopted in 2014 by the European Parliament, which set out the regulatory framework for the roll out of public recharging and refuelling infrastructure for electricity, hydrogen, compressed natural gas (CNG), and liquified natual gas (LNG) propulsion technologies. The AFID required all Member States to notify the European Commission on their National Policy Frameworks (NPFs) by November 2016, setting out clear targets and objectives for 2020 and 2025 as well as outlining the support measures and actions. An overall target was to ensure that there is one public charging point available per 10 electric vehicles in every Member State. The NPFs submitted to the European Commission varied in their ambition with regards to developing the infrastructure for electric vehicles[23]. Some Member States highlighted that the target of one public charging point per 10 electric vehicles may evolve to

[20] https://www.acea.be/uploads/publications/Electric_vehicles-Tax_benefits_purchase_incentives_European_Union_2020.pdf.
[21] https://www.transportenvironment.org/publications/recharge-eu-how-many-charge-points-will-eu-countries-need-2030.
[22] https://www.eea.europa.eu/themes/air/air-pollution-sources-1/national-emission-ceilings/nec-directive-reporting-status-2019.
[23] https://ec.europa.eu/transport/sites/transport/files/2017-11-08-mobility-package-two/summary_of_national_policy_frameworks_on_alternative_fuels.pdf.

become a barrier for further market deployment and could lead to market fragmentation beyond 2020, especially if electric vehicle uptake grew more quickly than the original projections had suggested. The EU at present has one charger per seven electric vehicles and so is exceeding its target. However, recent analysis has demonstrated the imbalance in European-wide charging infrastructure (see footnote [21]), especially in terms of the installation of ultra-fast charge points, the lack of which may become a further barrier to electric vehicle uptake in coming years. It is likely therefore that the ambition of European-wide targets to 2025 will need to be raised in order to ensure that there is sufficient network across all Member States, particularly in light of the stimuli either in place, proposed, or needed across the EU to increase the rate of uptake of electric vehicles as a result of its own carbon ambitions. It is with this background that eight Member States (Belgium, Czechia, Denmark, Spain, Hungary, Latvia, Portugal, and the United Kingdom) opted to select further policies for adoption to ensure the network is sufficient for electric vehicles.

Other PaMs which seek to improve infrastructure for transport include various developments of local and public transport infrastructure and availability, and other mechanisms which would encourage a modal shift away from passenger vehicles, such as the development of infrastructure for walking / cycling or "park and ride" systems for urban areas. Reducing the role of passenger vehicles, even if they are electric vehicles, particularly in the urban areas where congestion may be expected to be greater, will reduce the emissions of all pollutants as long as alternative public transport is of sufficient quality.

PaMs encouraging the implementation of green infrastructure are typically large-scale and expensive schemes and as such have been entirely assigned to government entities. Any Member State that reported PaMs focussed on the implementation of green infrastructure indicated that the PaM would be fiscal in nature. Unfortunately, there is little documentation of the expected costs of these additional PaMs and so the development of a cost-analysis against the benefits to air pollution (and greenhouse gases) is not possible at this stage.

Uptake of CNG and LNG

CNG and LNG use in road transport is expected to increase over the next decade. For example, some projections anticipate a 16-fold increase in the gas demand, principally among buses and heavy-duty vehicles between 2018 and 2030. As these fuels are considered valid alternative fuels in the AFID, a number of Memebr States reported PaMs relating to the uptake of these fuels for road transport (and the use of LNG in shipping). Such policies were selected for adoption in Belgium, Cyprus, Czechia, Hungary and Latvia, for example, principally as a propulsion alternative for buses or other passenger transport.

Modal shift away from passenger vehicles

Another common theme across several Member States is encouraging the modal shift away from individual private vehicle movements to the use of more sustainable transport options, such as public transport, car sharing, cycle, or walking. Such policies might be expected to be of particular importance to urban areas, where congestion and traffic levels are highest, and the switch to electric vehicles will not improve this. PaMs to promote a move away from individual private transport options were selected for adoption in 10 Member States. These policies are typically either voluntary or based on improved network planning or developing the infrastructure needed to ensure the use of public transport is a viable option. This policy action coupled with the introduction of low-emission buses is an attractive option for reducing emissions in urban regions, with a small number of Member States opting to integrate both of these in tandem.

Somewhat related to this stream is the development of Clean Air Zones in urban areas, or providing local or regional authorities with sufficient powers to apply rules on a more localised scale. A number

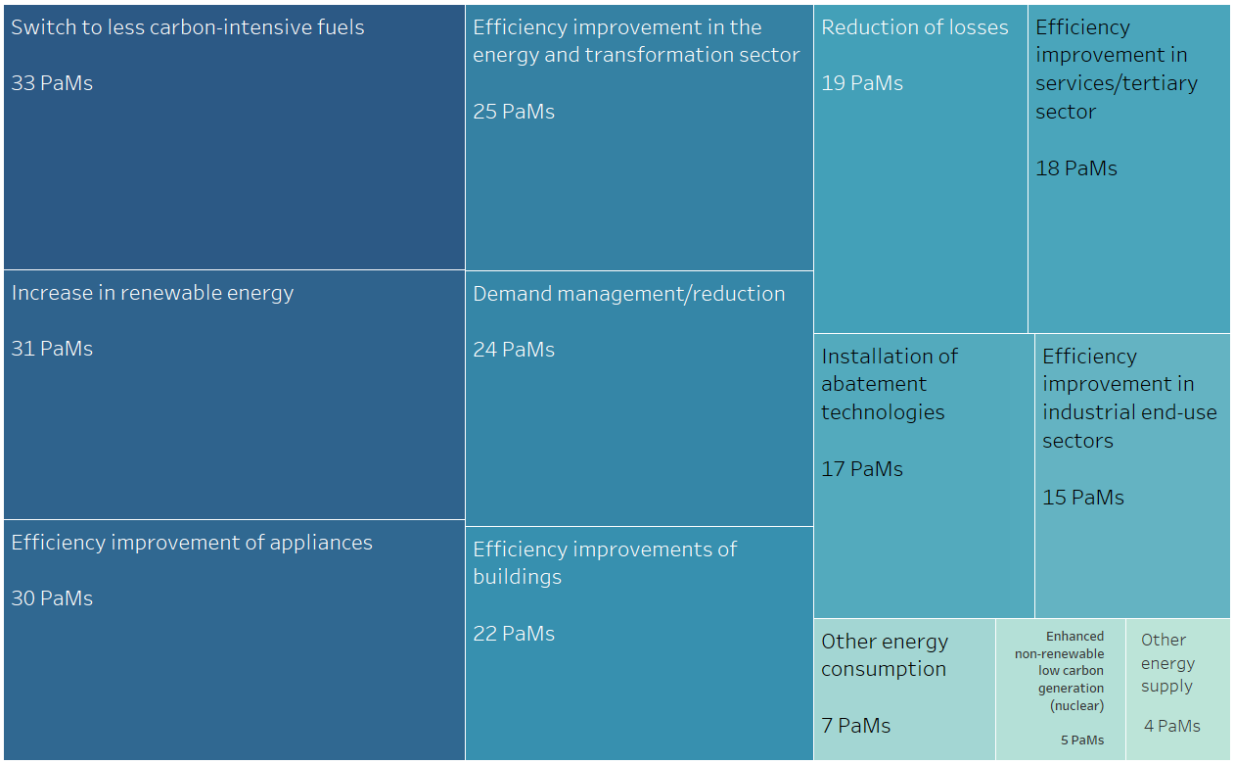
of Clean Air Zones and Low Emission Zones have been implemented across Europe already to date. Further measures that will lead to the expansion of the number of these zones were reported by seven Member States (Belgium, Czechia, Denmark, Hungary, Latvia, Portugal and the United Kingdom).

3.3 Energy

The proportion of energy supply or energy consumption PaMs varied significantly by Member States. For example, over 60 % of the total number of PaMs selected for adoption in Slovakia targeted these energy sectors, whilst in Hungary fewer than 10 % of PaMs targetted emissions from either energy supply or consumption (see Table 3.1).

The content of the PaMs were striking in their similarity however, with many focussing on emissions from the residential sector, in particular the energy efficiency of burners and stoves. The focus on residential combustion is not surprising: in the latest EU air pollutant inventories, residential combustion accounted for 51 % of total $PM_{2.5}$ emissions across the EU in 2018. Figure 3.6 illustrates the prominence of different policy objectives reported. Once again, the distribution of the number of policies between different objective types is relatively even, with switching to less carbon-intensive fuels, increasing the share of renewable energy, efficiency improvements in appliances and reducing or managing energy demand the most populous.

Figure 3.6 – Heatmap of objectives of PaMs selected for adoption by Member States within the energy supply and energy consumption sectors.



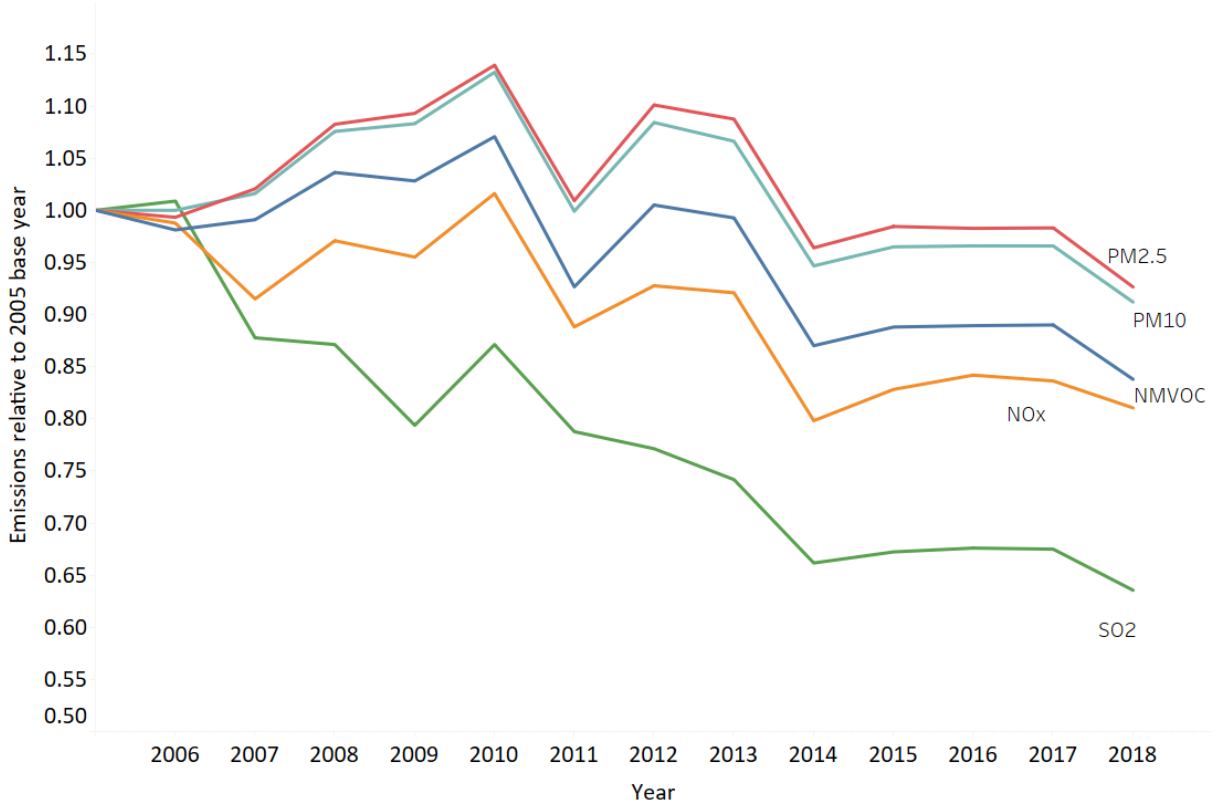
Residential combustion

Most of the PaMs proposed for the residential sector refer to the use of domestic burning stoves and solid fuel boilers. As discussed above, combustion from the residential sector now accounts for the majority of $PM_{2.5}$ emissions across the EU. It is likely that a large proportion of these emissions will be

situated in urban and semi-urban regions where most people live, and therefore can have a disproportionate impact on public exposure.

European regulations on various domestic heating mechanisms have been introduced in recent years through the Ecodesign Directive (Directive 2009/125/EC and supplementing Directive 2010/30/EU). The Ecodesign Directive provides consistent rules for improving the environmental performance of products, including some household appliances. Since 2015, these regulations have included the design of space heaters, combination heaters, and water heaters that are more energy efficient and limit air pollution. In September 2020, regulations for solid fuel boilers will introduce Ecodesign Tier 1 requirements for units with a rated heat output of 500kW or less, which covers standards on energy efficiency, energy performance, and maximum emissions in mg/kWh of fuel input. There is some evidence to suggest that these measures on domestic combustion have had an impact on emissions levels already. Since 2015, emissions of PM_{10}, $PM_{2.5}$, NO_x, NMVOC, and SO_x from residential combustion have all shown declines at the EU-wide level (Figure 3-7). In addition, emissons of benzo[a]pyrene, a pollutant for which the residential combustion of wood is a dominant source, have also declined by 4 %. This is despite increases in population numbers across Europe, suggestive of at least some contribution of energy efficiency measures or an increasing extent of electrification domestically.

Figure 3.7 – Time-series of emissions from residential combustion with respect to the 2005 baseline value of the NECD for PM_{10}, $PM_{2.5}$, NMVOC, NO_x, and SO_x



The original scenario analysis[24] undertaken as part of the Ecodesign Directive for household appliances suggests that the energy savings against a scenario without measures would be 299 TWh per year for heating and 4 TWh per year for cooling in 2015, whilst in 2030 savings are projected to be 1,035 TWh per year and 51 TWh per year respectively.

[24] https://ec.europa.eu/energy/sites/ener/files/documents/eia_overview_report_2017_-_v20171222.pdf.

It is clear that the Member States are actively trying to encourage the uptake of these new, more energy efficient household heating appliances. Public awareness campaigns and/or financial incentives or support for households looking to upgrade to an Ecodesign replacement are explicitly reported as PaMs in Czechia, Denmark, Estonia, Hungary, Latvia, Malta, and Slovakia. Many other Member States target the sector without identifying the mechanisms through which this will be achieved and it appears likely that public awareness campaigns and offering financial support will be the key mechanisms across more Member States to ensure emissions reductions from the residential sector.

In addition to the use of energy efficiency boilers, a number of other similar policies to reduce emissions from residential combustion have been reported. These include:

- Increasing public awareness of the influence that wood moisture content can have on air pollutant emissions, and encouraging or mandating the use of dry wood in solid fuel boilers when possible.
- Promotion of district heating and offering financial incentives to those who join district heating communities.
- Improving overall building efficiency and insulation of public housing.

In all, the PaMs selected for adoption to improve the energy efficiency discussed above are estimated to mitigate approximately 53 kt of $PM_{2.5}$ by 2030, and 95-98 kt per year of NMVOCs and 134-137 kt per year of NO_x. This is approximately 4 % of the EU-wide total in 2018 for $PM_{2.5}$, and 1-2 % of the EU-wide totals in 2018 for NMVOCs and NO_x. Note that not all PaMs reported quantified emissions reductions and so this should be considered a lower bound of the projected estimate. However, this early evidence suggests that further work and improved ambition will be needed to meet NECD targets for 2020-2029. Further actions to accelerate the turnover of the aged and more polluting household heating systems will promote yet greater emissions reductions.

Increasing the share of renewables in energy generation

Increasing the market share of renewables will be key to ensuring that energy generation decarbonises at the rate required to meet the EU's overarching climate ambitions. To date, support schemes have established adequate levels of investment into the renewable electricity sector. Feed-in tariffs and feed-in-premiums in the forms of grants, bonuses, or premiums were applied in 24 EU countries in 2015, for example[25]. These schemes were put in place at a time when renewable energy technologies were not as competitive as fossil-fuel fired power generators. However, declines in costs in more recent years have changed this outlook. In 2016, the capacity of installed wind-power surpassed the capacity of both coal and lignite to become the second largest energy source in the EU. The uptake of renewable technologies surpassed original assumptions, primarily as a result of the rapid decline in costs per kWh of electricity seen in recent years. Because of this, more ambitious targets were set and in 2018, the recast Renewable Energy Directive 2018/2001/EU came into force setting a binding new renewable energy target for the EU of at least 32 % of total energy supply by 2030. This goes further than the previous target of 20 % by 2020. Whilst primarily focussed on reducing carbon emissions, the uptake of non-thermal renewables, such as wind and solar power, would also bring considerable reductions in air pollutant emissions. It should be noted, however, that the combustion of biomass material, such as wood or biogas, can increase the emissions of air pollutants and PaMs which encourage the uptake of these energy sources will somewhat offset emissions reductions made in other sectors.

[25] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/renewable-technologies-eu-electricity-sector-trends-and-projections-analysis-framework-eu#:~:text=To%20reach%20the%2030%20%25%20overall,generation%20needs%20using%20renewable%20technologies.&text=Its%20share%20in%20final%20renewable,to%20reach%20at%20least%2036%25.

31 PaMs were reported across 9 Member States relating to increasing the uptake of renewables in the energy supply. The scale of these projects varied, with some outlining the need to continue to increase the market share of large-scale wind and solar farms to the overall electricity mix, whilst others outlined the support or incentives for small-scale projects such as renewable district heating and private household installation of renewable technologies. There was also some degree of crossover between the policies included here and those seeking to reduce the emissions from household heating/cooling units, with some Member States (Cyprus, Czechia, Malta, and Slovakia) intending to use renewable technology in their overhaul of the current stock of residential heating/cooling units. Despite the possible increase in emissions of air pollutants, a number of PaMs were reported which would see the uptake of biomass combustion in the residential sector. These PaMs, however, were focussed principally on either reducing the use of coal or other solid fuels, which also have high air pollutant emissions associated with them, or on improvements in energy efficiency of units and the implementation of the Ecodesign Directive, as discussed above.

Overall the content of these policies does not deviate significantly from those that have been in place over the past decade. This, coupled with various policies to decarbonise the electricity supply through reduced coal and fuel oil use, will also have a first order impact on the emissions of air pollutants across the EU.

EU Member States were required to draft national energy and climate plans (NECPs) for 2021-2030 to outline how they will meet the recast 2030 targets for renewable energy and energy efficiency. The European Commission's recent assessment[26] of the submitted NECPs shows that the full implementation of these plans would lead to Europe surpassing its present 2030 greenhouse gas emissions reduction target. They also show that the share of renewable energy in 2030 could reach, under existing plans and measures, between 33.1 % and 33.7 %, meeting the 2030 target of 32 %.

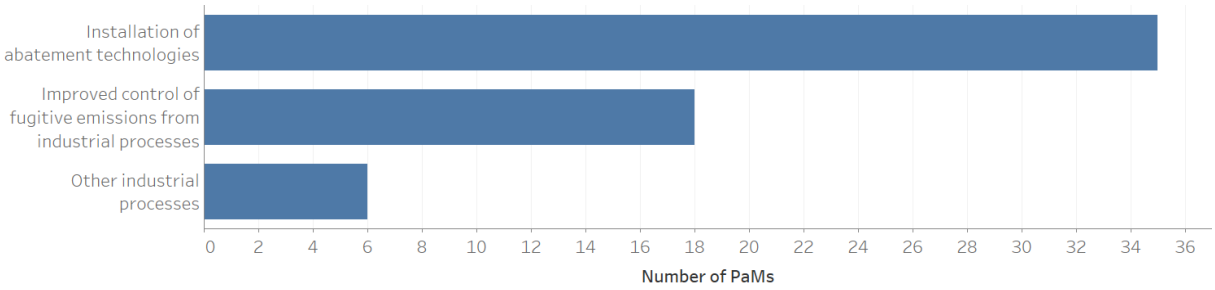
The European Commission estimates that to achieve the current greenhouse gas targets in 2030, annual investment into energy production would need to increase by around €260 billion per year[26], a large proportion of which would be directed to the residential sector. It was found, however, that the NECPs lacked sufficient information which could quantify the potential carbon/air pollution trade-off from the combustion of biomass highlighted above.

3.4 Other sectors

Regulation of emissions from industrial processes is well established, for example emission limits and standards are outlined by the Industrial Emissions Directive (IED). It is therefore not surprising that the number of policies targeting this sector is less than those for the agriculture, transport, and residential sectors. Of the PaMs that were reported, the most frequent objective, as illustrated in Figure 3.8, was the installation of abatement technologies, in particular to reduce emissions from power stations. Many of these PaMs also referred to existing regulations such as the IED, however, rather than individual Member State action.

[26] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600339518571&uri=COM%3A2020%3A564%3AFIN.

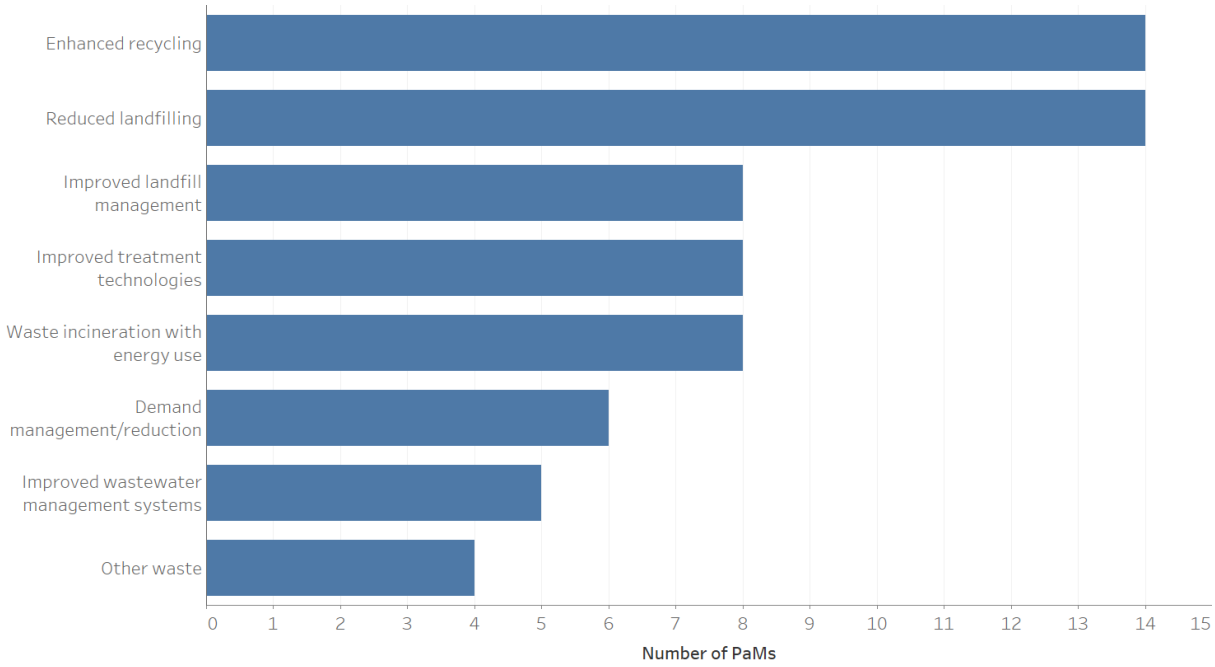
Figure 3.8 - Number of single policies and measures reported per objective for industrial processes



Nearly half of the policies targeting air pollutant emissions from industrial process are regulatory in nature, although trends on the actual content of these PaMs is bespoke to each country. This perhaps reflects the varying industrial processes and hence priorities that occur in each country.

In the waste management sector, the most reported objectives are enhanced recycling and reduced landfill, which were almost always reported together, as illustrated in Figure 3.9. Most of these measures involve awareness campaigns and implementing separate collection of waste streams. **Several of these PaMs look to improve the efficiency of the circular economy with regards to biofuels**, including PaMs to use biowaste in composters or anaerobic digestors with gas capture to provide a potential energy source in future.

Figure 3.9 - Number of reported single policies and measures selected for adoption per objective for waste management



4 Reported effects of policies and measures under the NECD

The analysis and all figures in this chapter only cover the PaMs reported in the EEA PaM tool that were selected for adoption.

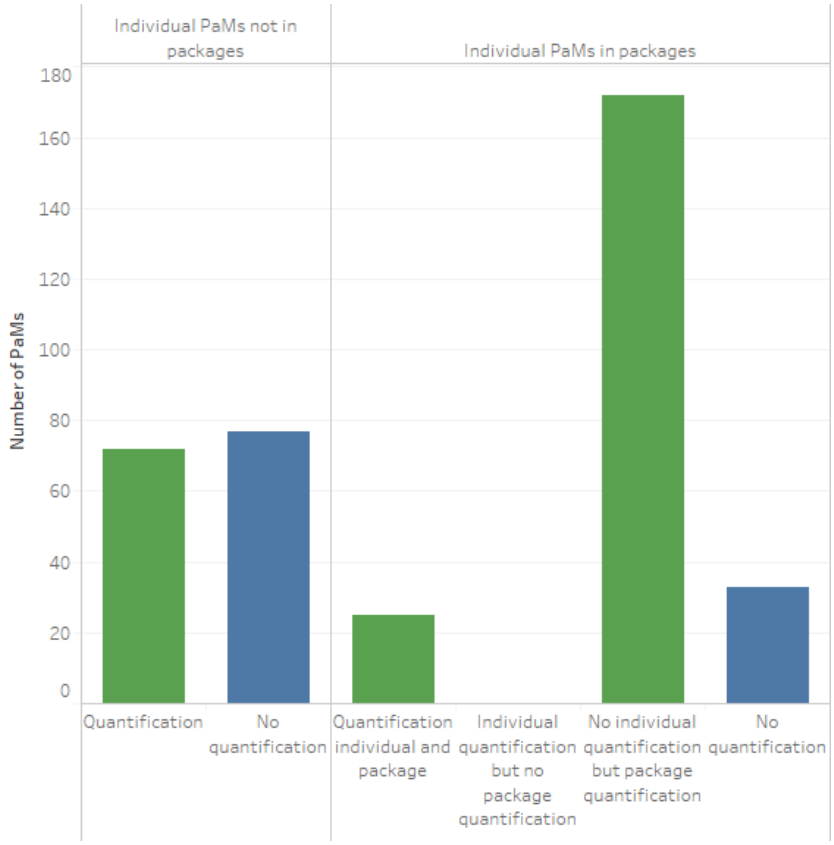
This chapter covers the data reported by Member States on the quantified future emissions reductions of their additional air pollution policies and measures. This data was mandatory reporting for each pollutant that the PaM targeted, for the years 2020, 2025 and 2030. Annex IV of the NECD outlines the requirements and specific recommended guidelines on the methodologies that Member States should use to estimate the emissions reductions.

Member States could report an absolute value for the emissions reductions, a range of values, or a '#' sign where no quantification was available or where it was being reported for a package of PaMs. Units of emissions reductions are all in kilotonnes (kt) of pollutant saved per year.

Member States could report multiple sectors that the PaM is related to so it is not always possible to directly allocate emission reductions to sectors of the air pollutant emissions inventories and projections under the NECD.

Of the 379 single PaMs reported as selected for adoption, 269 were reported with emissions reductions values (see green bars in Figure 4-1). These PaMs had emissions reductions reported for at least one year for at least one pollutant, either as an individual PaM or as part of a package. 110 individual PaMs did not have associated emissions reductions reported either individually or through a package (blue bars in Figure 4-1).

Figure 4.1 Reported quantification overview of PaMs selected for adoption



Quantified data about NO_X emissions reductions were reported the most often across all three required years of 2020, 2025 and 2030. Some Member States reported reductions for more than just the NECD main pollutants, such as CO_2, Cd, Pb, Hg and PAHs. However very few PaMs reported quantified reductions for these pollutants. For example, three PaMs were reported with quantified reductions for Cd and nine for CO_2. This could indicate some coherence and integration across air pollutant and climate action. Firm conclusions are problematic however, as these data fields were optional so a Member State may have this analysis but chose not to report the data through the NECD reporting requirements.

The completeness of reported emissions reductions from policies and measures varied widely across Member States and years. For example, 11 out of the 15 PaMs reported as affecting NO_X in Croatia had quantified data on emissions reductions for 2030. In contrast, Italy reported emission reductions for three of their 20 PaMs that affect NO_X as they reported emission reductions at the package level of PaMs. All Member States reported emission reductions for at least one PaM selected for adoption except for Portugal who reported '#' for all PaMs and Slovenia who reported 0 for all PaMs.

No conclusions can be drawn on the quality of emission reduction estimations or their impact based on numbers of PaMs alone. Member States have reported PaMs at different levels of aggregation; a single PaM can be a specific action such as prohibition of solid fuel burning in district heating areas, or a national plan such as industrial roadmaps. In addition, even looking only at PaMs covering specific actions there could be a huge variance in the impact on emissions the PaMs could have. However, it does suggest a level of organisation at the institutional level if there are systems in place to quantify more/all of their PaMs. Some Member States reported emission reductions for fewer PaMs than others, but with larger savings. Estonia, Italy and the United Kingdom reported emission reductions only for packages, whilst others such as Cyprus, Ireland and Lithuania reported emission reductions for almost all of their individual PaMs.

There are several data quality issues that prevent detailed analysis on the size of emission reductions from reported PaMs. However, **analysis on emissions reductions at the country level has been undertaken. This analysis was only undertaken on PaMs selected for adoption and for NO_X, NMVOC, NH_3, $PM_{2.5}$ and SO_2. Very few PaMs reported impacts on the other pollutants included in the webtool. Both "High" and "Low" scenarios are presented as some Member States reported emission reduction ranges**. It is likely that some emission reductions were reported using incorrect units and it is important to note that not all PaMs were reported with quantification so the emission reductions could be higher than the analysis suggests. Double counting was avoided by not including the emission reductions of single PaMs that were quantified at both the single PaM level and the group level. Figure 4-2 shows the total reported emission reductions. The highest emission reductions were reported for NO_X which is expected as a high number of PaMs are targeting NO_X emissions. Despite the highest number of PaMs targeting $PM_{2.5}$ the reported emission reductions from $PM_{2.5}$ were the lowest out of the five pollutants analysed. This however may be from lack of reporting as opposed to a reflection of the impact of the PaMs on $PM_{2.5}$ emissions.

Figure 4.2 Reported emissions reductions (kt)

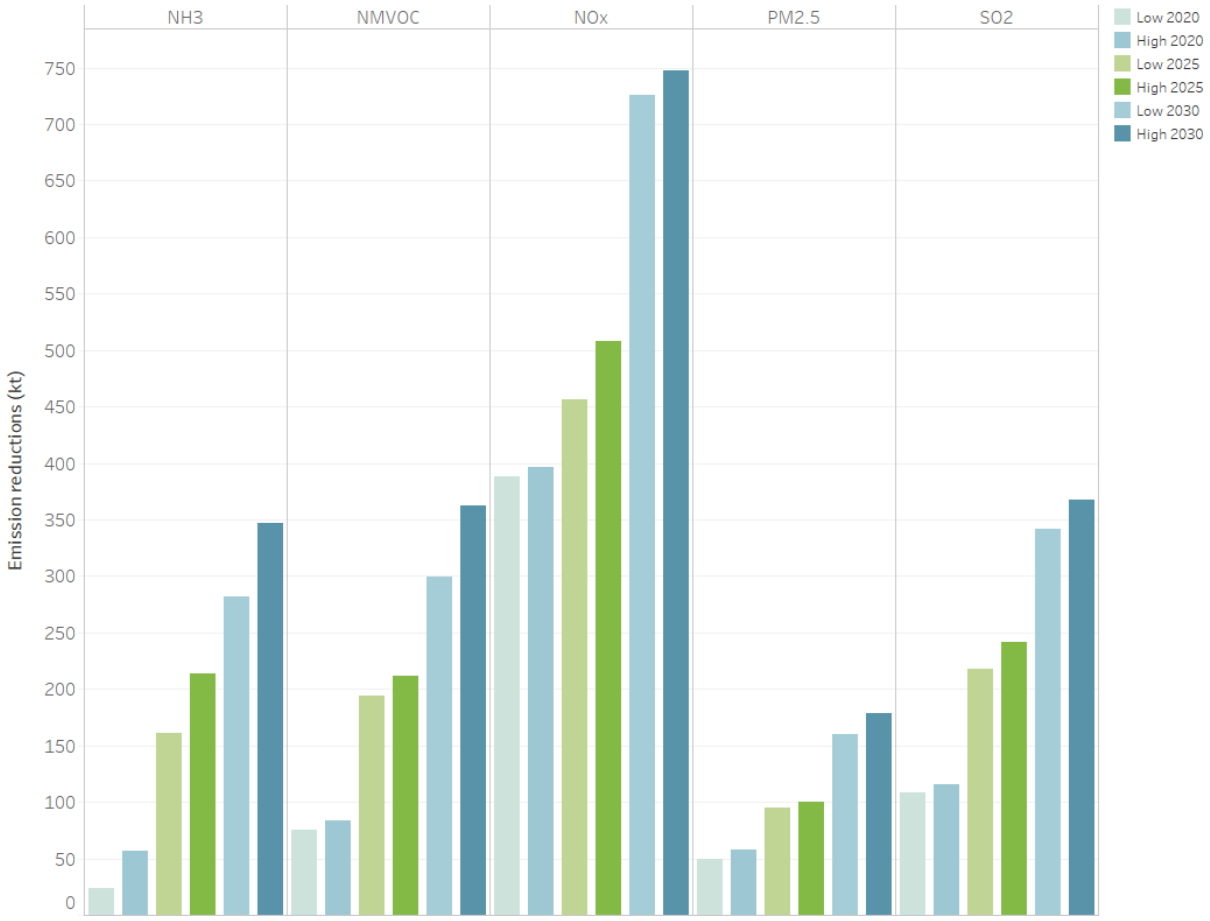


Figure 4.3 Reported NO_X reductions by Member State (kt)

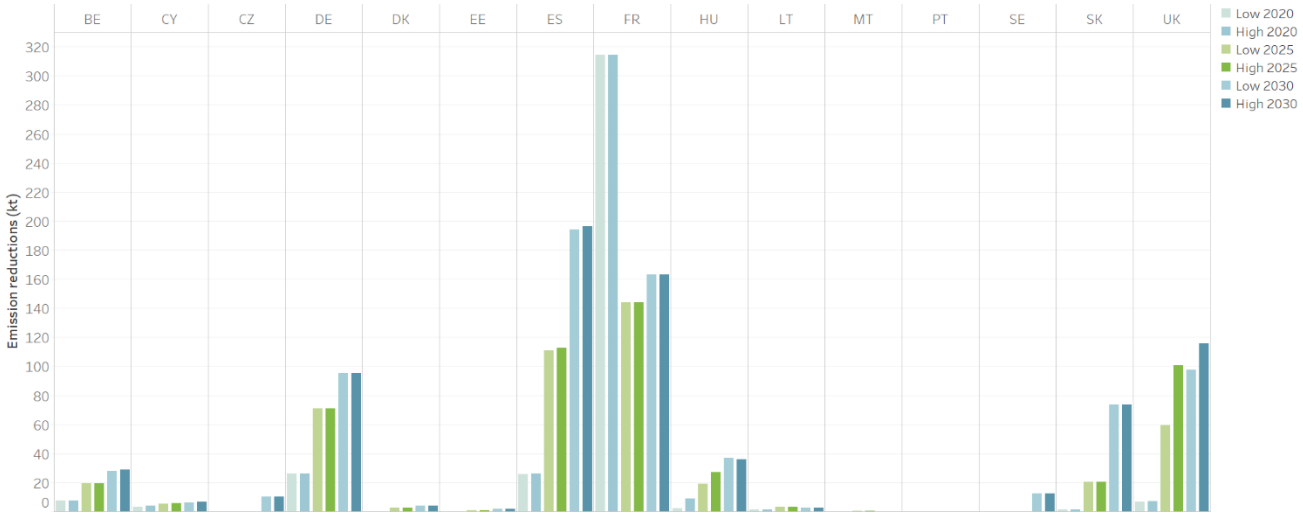


Figure 4.4 Reported $PM_{2.5}$ reductions by Member State (kt)

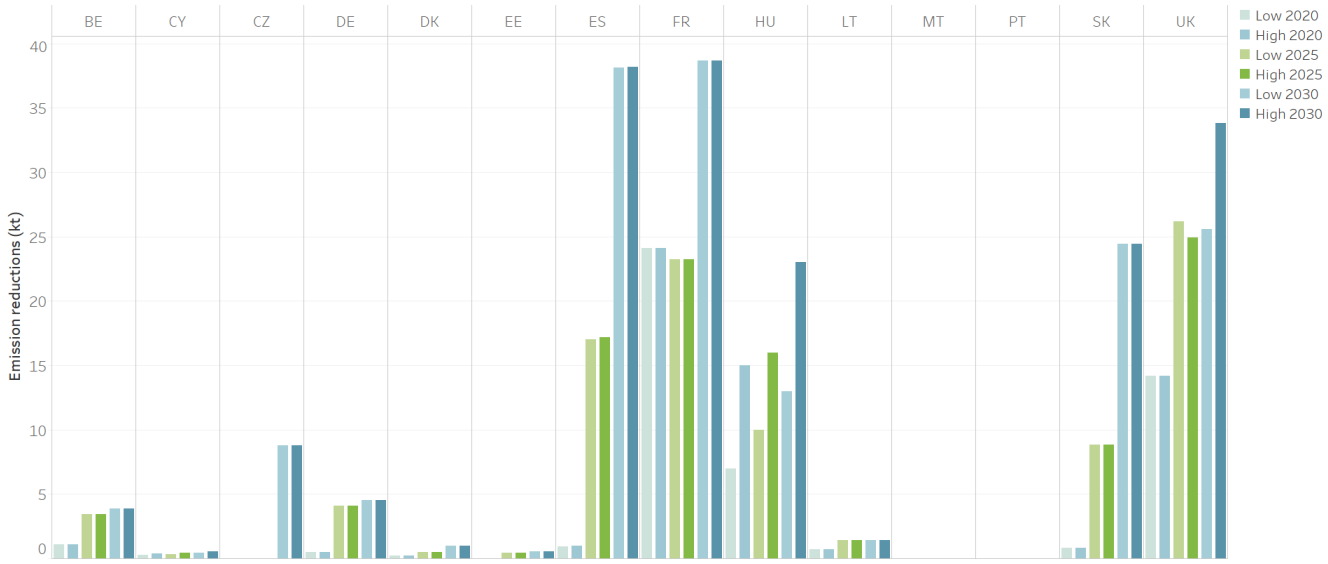


Figure 4.5 Reported NMVOC reductions by Member State (kt)

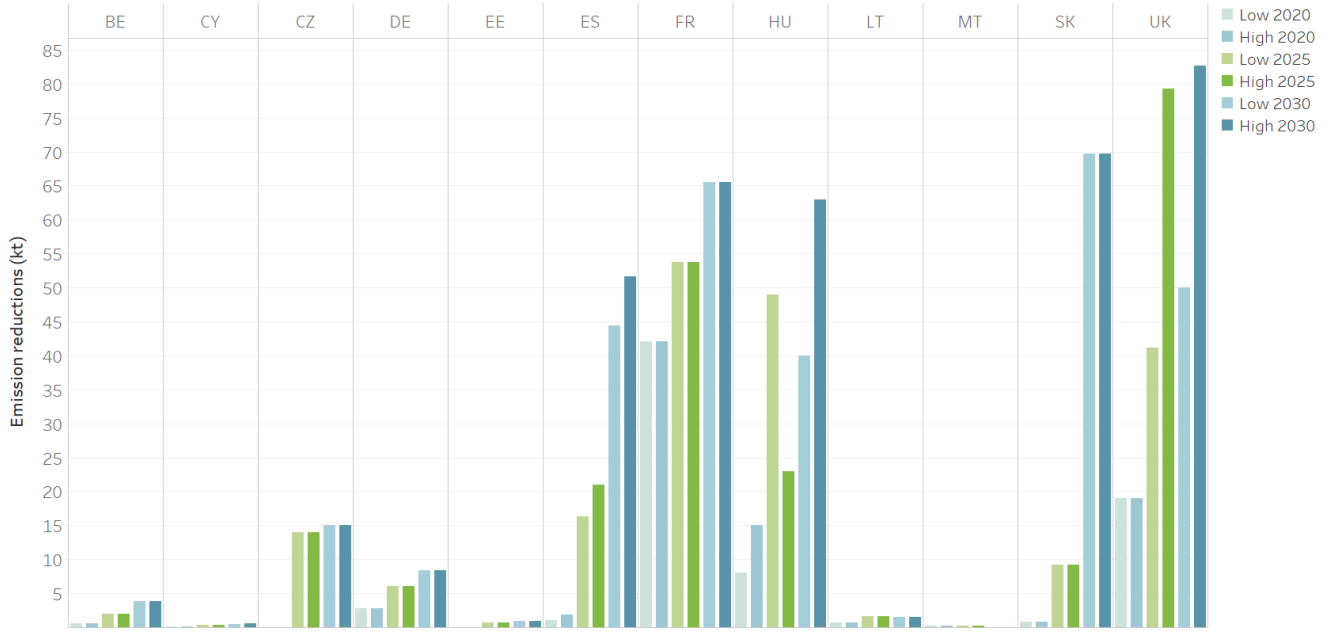


Figure 4.6 Reported NH_3 reductions by Member State (kt)

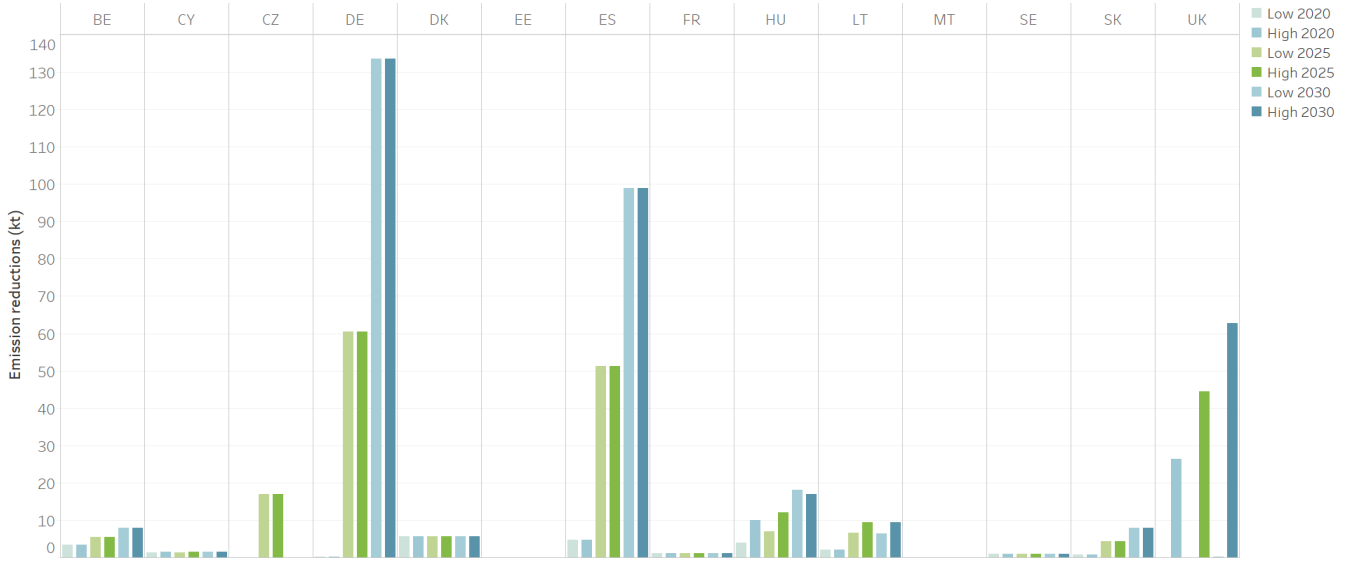
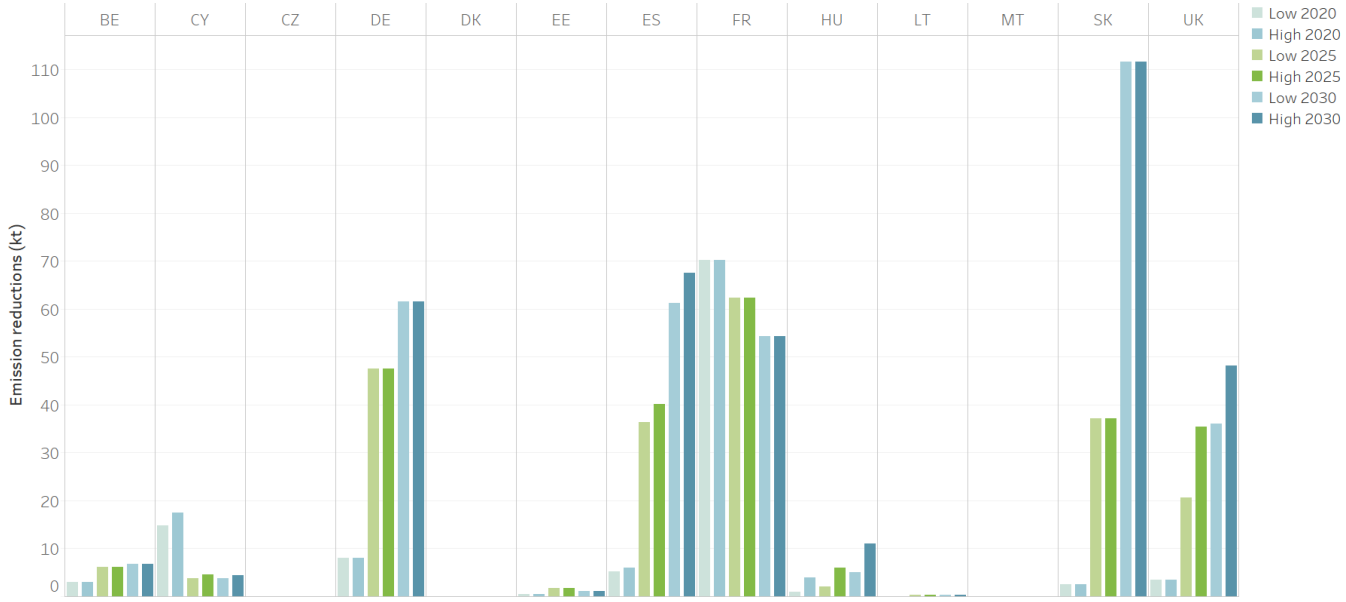


Figure 4.7 Reported SO_2 reductions by Member State (kt)



Figures 4-3 to 4-7 show the emissions reductions for NO_X, $PM_{2.5}$, NMVOC, NH_3 and SO_2 by Member State for the "Low" and "High" scenarios for the years 2020, 2025 and 2030. France reported the highest emission reductions for NO_X in 2020 whereas in 2030 Spain expects to have the highest NO_X emission reductions from their PaMs. Both Member States report a high number of single PaMs that are expected to impact NO_X emissions.

Germany reports the highest emission reductions from NH_3, except for 2020 where the United Kingdom expects to have the highest emission reductions in the "High" scenario. Fewer countries reported emission reductions for NMVOC. In 2020 France reported the highest emission reductions. In the "High" scenario in 2025 and 2030 the United Kingdom reports the highest NMVOC reductions. For $PM_{2.5}$ Spain and France again report the highest emissions reductions in 2025 and 2030. Fewer countries reported emission reductions for SO_2; Slovakia reports the highest reductions in 2030 with France reporting the highest reductions in 2020 and 2025.

The amount of detail provided in the mandatory data field on methodology details varied significantly between Member States. Most indicated some level of alignment with the historic emissions inventory and the use of the EMEP/EEA 2016 Guidebook. Some referenced specific models that were used, such as GAINS, LEAP and MARKAL, or explained expert judgment and referenced the NAPCP for further details.

Descriptions of uncertainties provided by Member States on the emission reductions ranged, including: commenting on the upper and lower values provided in the range being based on different uptake scenarios of PaM; high uncertainties due to insufficient data availability concerning the emissions methodology for specific fuels/technology; uncertainty related to lack of detail in what the potential measures may be; uncertainty of activity data and economic growth projections.

5 Comparing reported climate and air pollution policies and measures

The analysis and all figures in this chapter only cover the PaMs reported in the EEA PaM tool that were selected for adoption.

The reporting, for the first time, considers both Member State's additional air pollution policies and measures considered for meeting emission reduction commitments under the new NEC Directive and, in 2019[27], a new set of climate PaMs. This provided an opportunity to find and analyse issues which cut across the climate and air pollution policy areas, such as sectors, types of instrument, objectives, governance and knowledge base. General practices among Member States could also be explored, for example the reporting of more aggregated measures and the level of detail reported. It is also an opportunity to explore whether there is coherence and synergy between air pollution measures and climate change mitigation policies.

It should be noted that there are some fundamental differences in the reporting requirements for climate and air pollution PaMs. Under the MMR, EU Member States are required to report on all planned, adopted, implemented and expired PaMs, if they continue to have effects, using a standard webtool, developed and managed by the EEA. Elements of this approach have been adopted for the NEC Directive. However, its application has been restricted to PaMs which have been considered (but not selected for adoption) and those which have been selected for adoption (but not yet adopted). PaMs that have been adopted or have entered the implementation phase (the definition of which is not precise) were not supposed to be reported by Member States via the online webtool. Information on those PaMs should however be reflected in the "With Existing Measures" scenario of the projections. The difference in scope between the two reporting streams means that there is likely to be a limited common dataset for the analysis and evaluation of air pollution and climate PaMs, as shown in Table 5.1.

Table 5.1 PaMs reporting requirements under the MMR and NECD

Type of PaM	Reporting requirement	
	MMR	NECD
Historic (expired)	Detailed information through the webtool	Not to be submitted through the webtool
Active (implemented)	Detailed information through the webtool	Within the NAPCP (usually PDF file), but not to be reported through the webtool
Considered but not yet adopted	Not required	Detailed information through the webtool
Adopted or selected/ planned for adoption/ implementation	Detailed information through the webtool	Detailed information through webtool for PaMs selected for adoption

5.1 Comparison methodology

The methodology applied proceeds as a series of steps, although these are not necessarily wholly sequential.

Step 1: Analysis of additional air pollution PaMs reported by Member States through the air pollution PaM webtool. This draws on work to produce a data viewer being undertaken for the 2020 ETC/ATNI

[27] Additionally, in 2020 five Member States updated their information on PaMs: CY, DE, GR, LV and SI.

project 1.1.4.1. The data is extracted through the EEA's SQL database and is the data source for all analysis in chapters 2 to 5.

Step 2: Map the mandatory data fields between the air pollution PaMs webtool and the MMR PaMs webtool to identify common mandatory fields. Additionally, there is the option in the air pollution PaMs webtool to show that the PaM is also reported under the MMR. Where a PaM is specified to also be reported under the MMR, we can undertake the direct comparison of PaMs. Using just the name of the PaM is unreliable as this can change between reporting cycles.

Step 3: Analyse common data fields and present this analysis using graphical outputs.

Step 4: Map optional data fields to assess the extent of analysis which could be undertaken if they were used. Provide numerical analysis of the use of optional fields.

Step 5: Review NAPCP reports to see what other data could be used in a comparison, if reported.

Step 6: Identify examples of NAPCPs which have produced useful data in terms of air pollution-GHG PaMs evaluation and suggest ways in which this could be analysed in future projects (given that such data will generally only be available through PDF files).

The data fields which characterise a PaM under both the MMR and the NECD have been mapped in Table 5.2 below, indicating whether the fields are mandatory or not. It is important to note that submissions are not blocked by not completing mandatory fields.

Table 5.2 Common data fields of MMR and NECD

MMR	NECD	MMR mandatory?	NECD mandatory?
Name of PAM	**PaM Name**	Yes	Yes
PaM ID	**PaM ID**	Yes	Yes
	Related to AQ/MMR?		No
Short description	**Short description**	Yes	Yes
Sector affected	**Sector**	Yes	Yes
GHG(s) affected	**NECD pollutant**	Yes	Yes
Objective	**Objective**	Yes	Yes
Quantified objective		No	
Type of policy instrument	**Type of policy instrument**	Yes	Yes
Implementation Start	**Implementation Start**	Yes	Yes
Implementation Finish	**Implementation Finish**	No	Yes
Implementation Status		Yes	
Beyond ESD?		Yes	
Union policy related	**Union policy related**	Yes	No
Which Union policies	**Which Union policies**	Yes	No
Projections Scenario	**Projections Scenario**	Yes	No
	Uncertainties		No
Implementing entity type	**Implementing entity type**	Yes	Yes
Implementing entity names	**Implementing entity names**	Yes	Yes

Despite the large mismatch in scope and required data fields between the MMR and the NECD, there are some additional questions through the NECD which may be useful. For PaMs which are reported under the NECD as selected for adoption there is a mandatory question concerning the coherence of the PaM with other relevant plans and programmes, such as national energy and climate plans (NECPs) under the Energy Union. This has potentially useful information for assessing the synergy of air pollution PaMs with other environmental areas and information on consistency and reliability of the measures. Member States could also tick a box confirming whether the air pollution PaM they are reporting is linked to air quality measures or the MMR.

5.2 Summary of results

Figures 5-1 to 5-3 below show a comparison of the percentages of NECD and MMR PaMs reported by sector, policy instrument type and implementing entity type. PaMs can have one or more of each element so the percentages will not sum to 100 %. Only NECD PaMs reported as selected for adoption were included in this analysis.

Figure 5.1 Reported MMR and NECD PaMs by sector

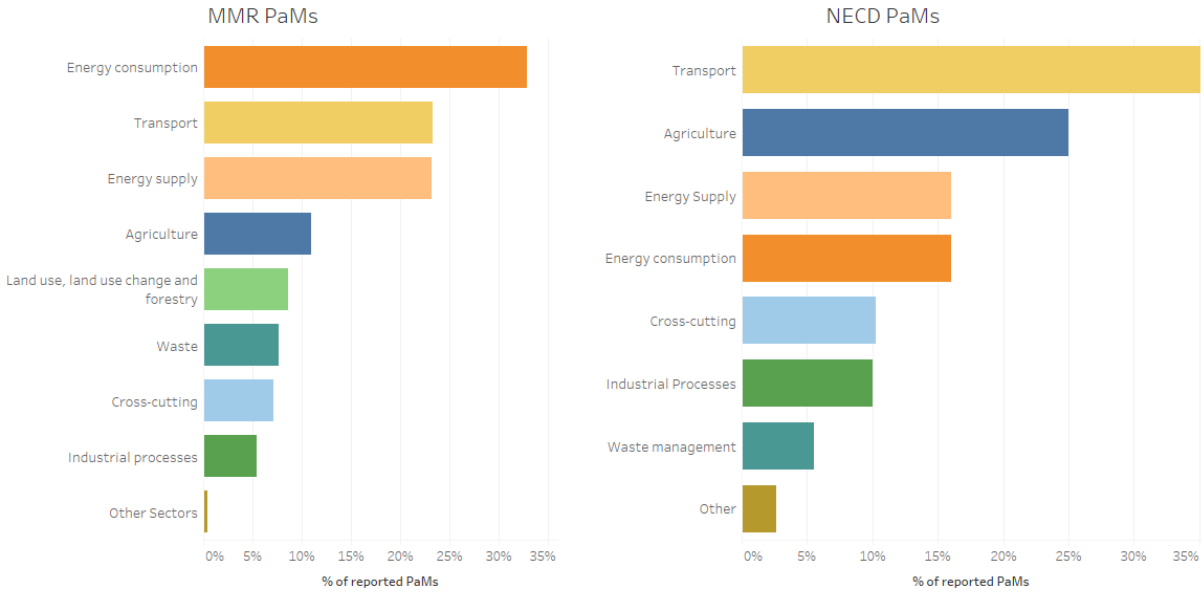


Figure 5.2 Reported MMR and NECD PaMs by instrument type

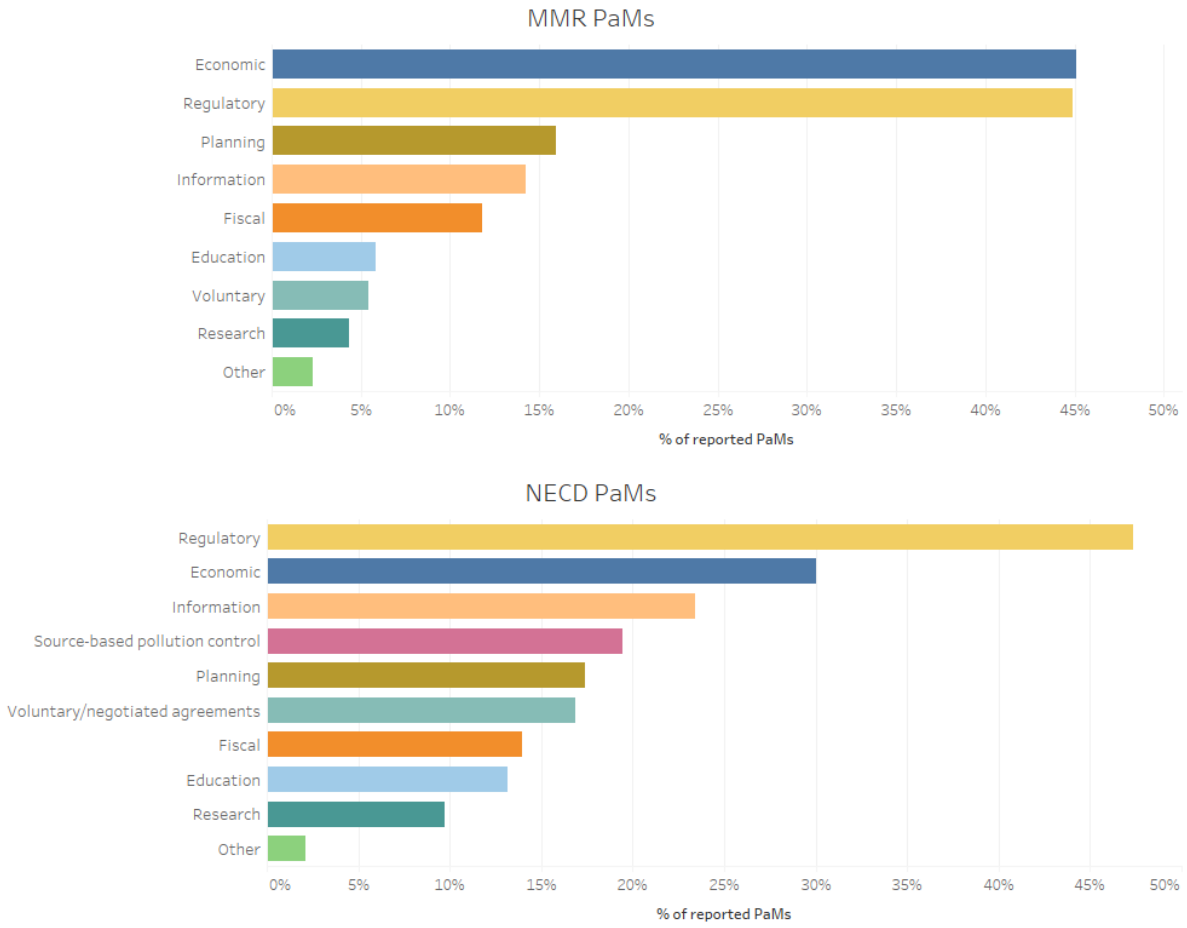
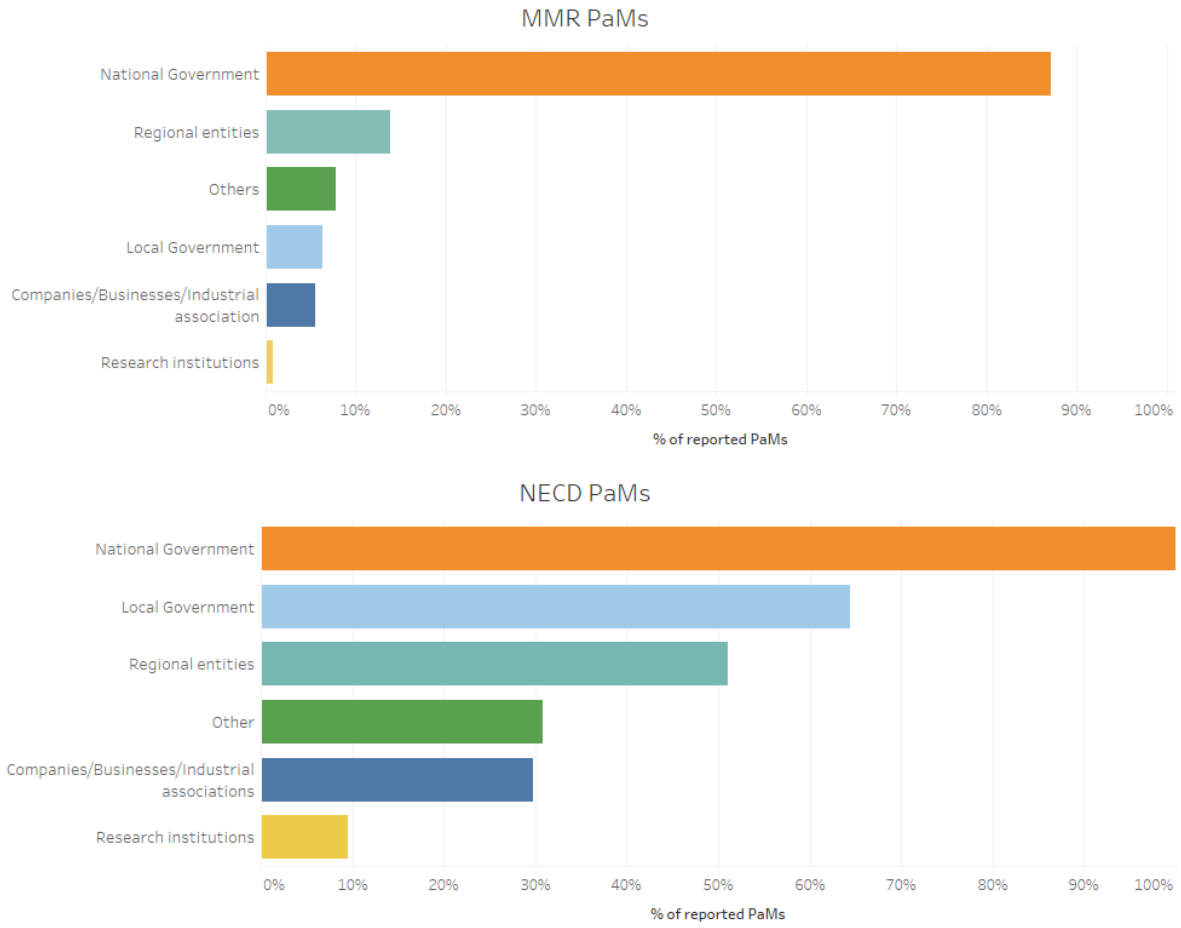


Figure 5.3 Reported MMR and NECD PaMs by implementing entity type



Some differences and similarities between MMR and NECD PaMs can be observed from these figures. **Agriculture is a much more represented sector in NECD PaMs than under the MMR**. This is likely due to many Member States needing to take further action to meet their emission reduction commitments for ammonia under the NECD, of which agriculture is the key source.

Regulatory and economic PaMs are the most common across both MMR and NECD PaMs. For MMR PaMs, national government is the dominating type of implementing entity. It is the most common for NECD PaMs too, but there is a more even distribution of implementing entity types.

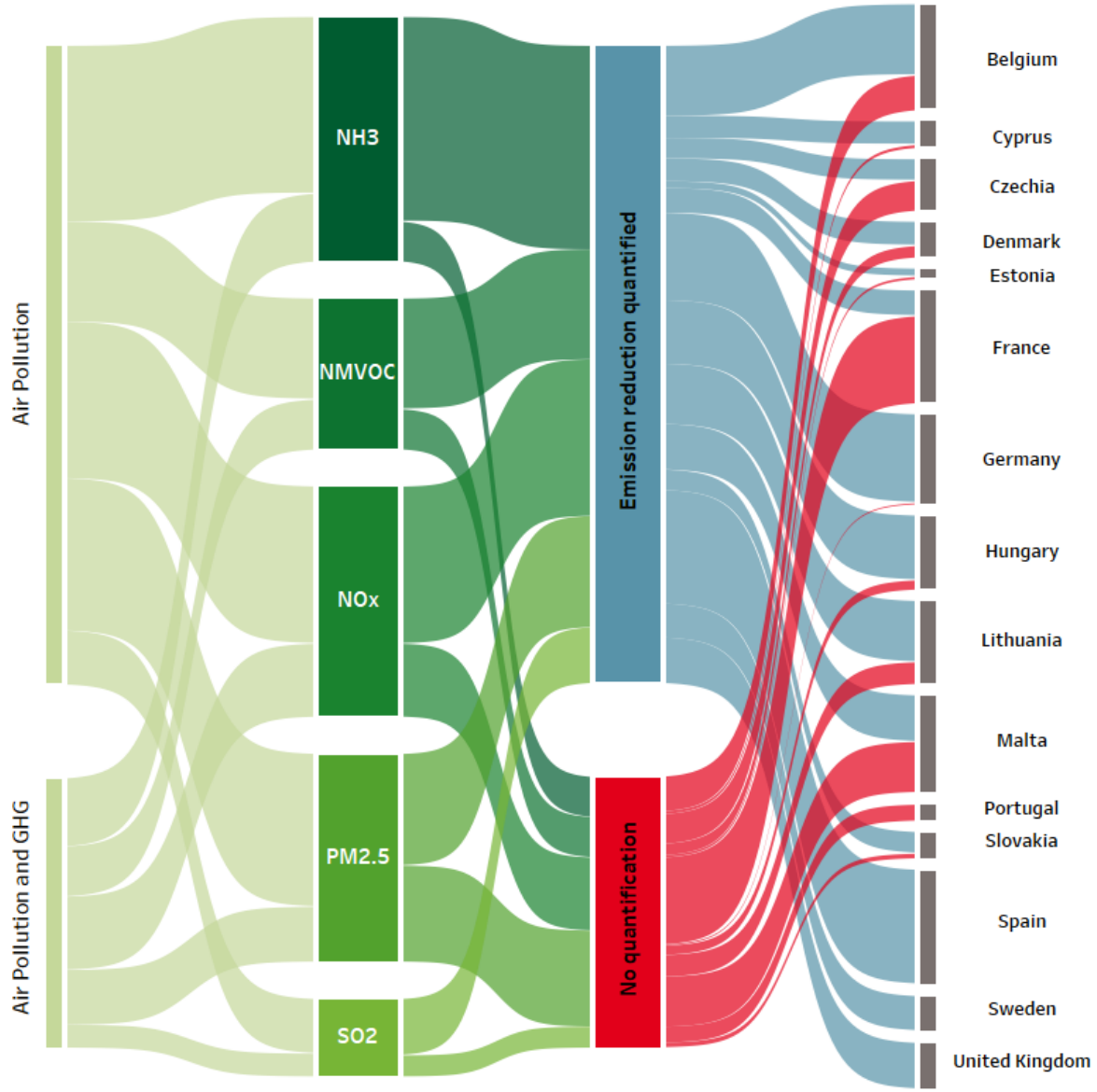
In addition, as outlined in Table 5.2, there is some overlap between optional fields of the NECD PaMs and fields reported under the MMR. The majority of PaMs reported under the NECD included a reference to the projection scenario in which the PaM features. 67 % of PaMs reported under the NECD used a “with additional measures” projection scenario whereas under the MMR only 10 % of PaMs used the same projection scenario. It should be noted that the default projection scenario was “with additional measures” therefore if a reporting country did not actively provide a projection scenario under the NECD then “with additional measures” was assumed. This may be falsely inflating the number of PaMs reporting this projection scenario. However, given the scope of NECD PaMs is focused on additional future PaMs, it would be expected that most PaMs would be in the “with additional measures” scenario or “not in projections” scenario if the PaM was in the early stages of drafting.

It would be useful to understand how harmonious air pollution and GHG PaMs are. Some analysis is possible on the data available, however, many of the fields that could be used were optional which

means that any analysis undertaken is likely incomplete. Two fields in particular of the webtool could be used to analyse the overlap between the MMR and NECD PaMs: “Related to AQ/MMR?” and the question regarding coherence with other plans.

The most quantitative analysis on assessing how joined-up air pollution and GHG PaMs were could be done using the field indicating if the PaM has already been reported under the MMR or the ambient air quality (AQ) directive, “Related to AQ/MMR?”. This field was a tick-box field with two options, however it was not mandatory. 16 out of the 21 countries reported in this field and 50 % of the PaMs selected for adoption that reported in this field had been reported under the MMR. As this is optional it may not show the full picture of overlap between air pollution and GHG PaMs however it does suggest that a significant number of PaMs that will decrease air pollutant emissions will also reduce GHG emissions. Figure 5-4 illustrates the number of PaMs, reporting links to the MMR and analysis on their quantification. It is important to note this includes all PaMs selected for adoption and not just those who reported in the “Related to AQ/MMR?” field.

Figure 5.4 Analysis of air pollution PaMs selected for adoption



Of the PaMs that indicated that they were linked to the MMR, ticking the box "related to MMR", the majority were related to the transport sector. These PaMs focused on switching to low carbon fuels and encouraging cycling. These measures would be expected to reduce fossil fuel consumption and therefore, as well as reducing GHG emissions, there would also be expected reductions in air pollution. The overlap of these PaMs reporting under MMR and NECD is therefore expected. Many of the PaMs with reported overlap also focused on the energy sector, with 28 % for energy consumption and 22 % for energy supply. The majority of these PaMs related to measures to reduce energy consumption, mostly in buildings, and to increase the prevalence of renewable energy. As with the energy sector measures, these policies would be expected to reduce GHGs as well as air pollutants through the reduction of fossil fuel consumption. Some of these measures included encouraging the use of natural gas, which, while still a fossil fuel, would be expected to reduce air pollution.

Burning solid biomass has been shown to have higher particulate matter emissions than some fossil fuels, and while switching from fossil fuels to biomass for heat or electricity production can decrease GHG emissions, there can be negative impacts on air pollution. This is seen in comparisons between the PaMs reported under NECD and MMR. There are very few NECD PaMs related to solid biomass and of those reported, many are PaMs aiming to reduce the use of solid biomass or reduce emissions from the burning of biomass, through the replacement of old technology, at a large scale or for household boilers. There are more PaMs relating to biomass reported under the MMR and the majority are aimed at increasing the use of solid biomass for electricity or heat generation. In addition, there is no reported overlap of PaMs relating to solid biomass between the MMR and NECD. **These conflicting aims for biomass point to a lack of coherence in MMR and NECD PaMs.**

Of the 30 % of PaMs selected for adoption with reported overlap with the MMR it was possible to match 93 (80 %) with actual PaMs reported under the MMR. This was done based on the PaM name and description reported under both streams. Many of these PaMs overlap fully, for example a PaM which is named "Waste to Energy Facility" in both the air pollutant and GHG PaMs, with sometimes slightly different wording in the different reporting streams. However, some PaMs are reported at different aggregations within the MMR and NECD. A PaM reported to the NECD could relate to multiple PaMs under the MMR and the opposite was also true in some cases. For example, a PaM reported under the NECD was to increase the use of renewable energy in the internal market for electricity heating and cooling in the residential and tertiary sector. In the MMR reporting there were four PaMs that were thought to overlap with this air pollution PaM: a grant scheme encouraging the use of renewable energy (end use) in the residential sector, a grant scheme encouraging the use of renewable energy sources (end use) in the tertiary sector, a grant scheme for the installation of photovoltaic systems using the net metering method and solar water heater replacement scheme. The latter two PaMs were specified to being related to the residential sector in the more detailed description field.

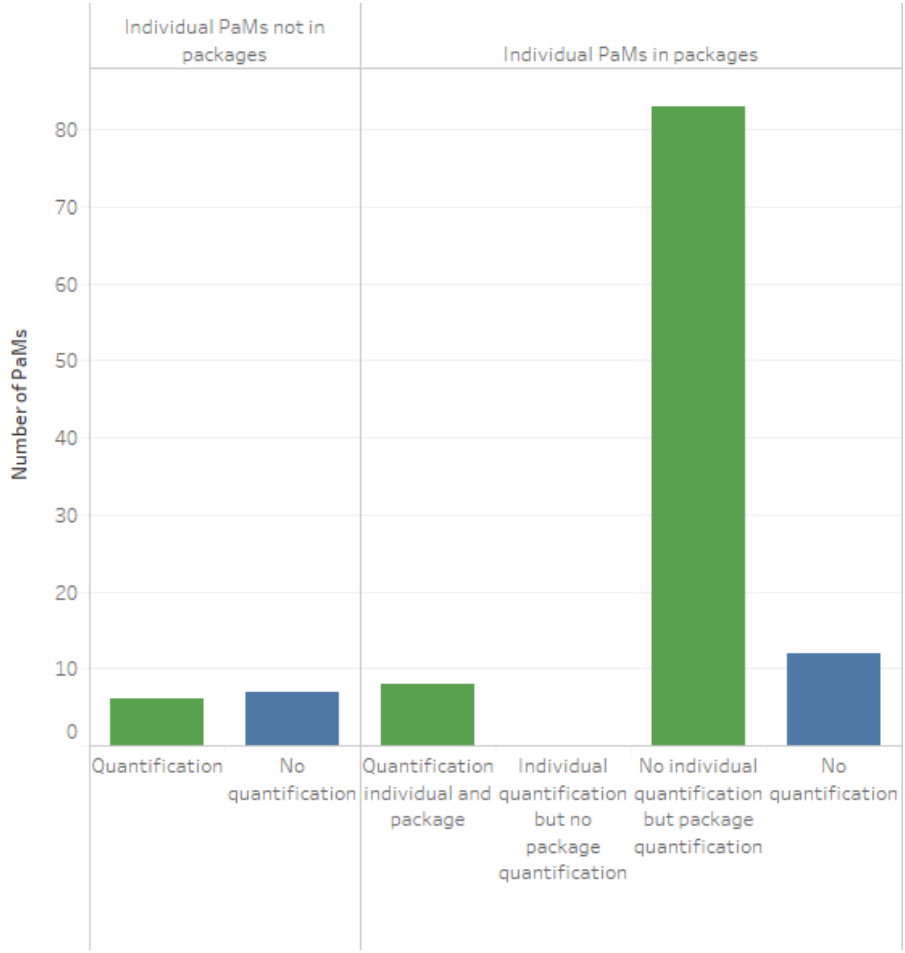
The coherence data fields were only mandatory when a PaM was listed as selected for adoption. They were intended to be used to detail how the PaMs fit into national and international air quality objectives and linked with other national plans, especially those relating to energy and GHG emissions. 12 out of the 15 countries included information in these fields for their PaMs selected for adoption (six countries did not report that any of their PaMs had been selected for adoption). These coherence data fields could be used to ascertain how joined-up air pollutant and GHG PaMs are, as they detail the national plans the PaMs are aligned with. This field significantly overlaps with table 2.7.2 of the NAPCP, and both Lithuania and the United Kingdom refer to this table in their NECD PaMs reporting. Countries reported overlap with national plans and policies relating to: climate and reducing GHGs, energy and energy efficiency, transport, agriculture and nitrate, industry and permitting, health, waste, water, housing and National Environment Plans. **Of the 274 single PaMs**

selected for adoption that also reported information in the coherence fields, 61 % reported overlap with climate plans and policies to reduce GHG emissions. 58 % were identified as overlapping with plans and policies relating to energy and energy efficiency. Overlap with other sectors was much lower, 19 % of PaMs reported overlap with national agriculture and nitrate policies and only 7 % reported overlap with national transport and housing plans.

The analysis of the overlap between PaMs reported under the NECD and MMR was limited by the scope of reporting under the NECD. As previously outlined, existing or already adopted PaMs did not have to be reported under the NECD, whereas they did need to be reported under the MMR. 12 countries however reported existing or adopted NECD PaMs in the EEA PaM tool and 151 of the PaMs selected for adoption were reported with an implementation start date between 2004 and 2019, although 44 % of these were in 2019. It is therefore possible that some of those PaMs reported with implementation start dates in 2019 were also PaMs that were, at the time of reporting, not yet adopted as the reporting deadline was April 2019. Further to this, of the PaMs that were selected for adoption and reported overlap with the MMR, 81 % had a planned year of adoption of 2019 or earlier, with 47 % having 2019 as the planned year of adoption. 36 % of PaMs reporting overlap with the MMR reported as not selected for adoption. These PaMs however are not required to be reported to the MMR. A possible improvement in reporting PaMs under the NECD would be to encourage all countries to report all PaMs, past, present and future. This would give a full picture and allow for better matching between the NECD and MMR PaMs.

Of the 116 single PaMs selected for adoption and reported as linked to the MMR, 97 (84 %) were reported with emission reduction values (see Figure 5.5). These PaMs had emission reductions reported for at least one year for at least one pollutant, either as an individual PaM or as part of a package. 19 individual PaMs did not have an associated emission reductions reported either individually or through a package. The PaMs reported as linked to the MMR had a higher proportion of quantification than the total set of PaMs reported under the NECD, 84 % rather than 71 %. Quantification of emission reductions is required where available for PaMs reported under the MMR. This may explain the higher proportion of PaMs with quantification if they are already reported under the MMR.

Figure 5.5 Reported quantification of PaMs selected for adoption and related to the MMR



It was possible for Member States reporting PaMs under the NECD to also report affected GHGs. This was an optional field so it is assumed that there is underreporting. A small reverse analysis is possible however i.e. identifying which air pollutants Member States reported when they did report GHGs:

- 57 NECD PaMs reported CO_2 as an affected GHG, 54 of which also reported NO_x as an affected pollutant. These PaMs typically targeted the transport sector.
- Of the 21 NECD PaMs which reported N_2O as an affected GHG, 15 also reported NH_3 as an affected pollutant. These PaMs mostly focused on the agriculture sector.
- 20 NECD PaMs reported CH_4 as an affected GHG, 14 of which also reported NH_3 as an affected pollutant. These PaMs mostly targeted the agriculture sector.

Only four Member States reported emission reductions for CO_2 and very few of these Member States' PaMs included this quantification. No quantification was reported for the other GHGs. Almost all PaMs selected for adoption and reporting emission reductions for CO_2 were reported as overlapping with the MMR. Malta reported 18 single PaMs selected for adoption with CO_2 emission reductions, at the group level. All were reported with overlap to the MMR and all but one could be matched to actual PaMs included in the MMR. The total annual GHG emission reductions in 2030 for these air pollution PaMs was 25 % of the total GHG emissions reductions, in CO_2e, reported for Malta's MMR PaMs. However, all but one of the air pollution PaMs reported were not quantified within the MMR reporting. This possibly indicates that the 283.5 kt CO_2 reductions will be in addition to the 1 122 kt CO_2e reported under the MMR. Denmark reported four single PaMs selected for adoption with quantified reductions, also at the group level. For Denmark in 2030 the annual CO_2 reduction reported is 5 415 kt while under the MMR the reported GHG reductions were 58 007 kt CO_2e. While all but one of these PaMs were reported with overlap with the MMR none could be

matched to actual PaMs within the MMR. Belgium also reported four single PaMs selected for adoption with CO_2 quantification at the group level. Belgium reported an annual reduction of 4 111 kt CO_2 from their air pollution PaMs in 2030, while 40 918 kt CO_2e reductions are anticipated from their climate PaMs. All of these PaMs reported overlap with the MMR but only two could be matched with actual MMR PaMs.

For the PaMs reported through the NECD as targeting the energy and transport sectors it might be expected that they would also be reported under the MMR due to the dominance of these sectors in both reporting streams. However, the majority of NECD PaMs were not tagged as being reported under the MMR – this is likely due to a combination of the questions being an optional response, and the different scopes in required reporting of PaMs (see Table 5.1).

The analysis undertaken for this report has mostly been on number of PaMs reporting in fields or particular values within fields if possible. Analysis beyond simple counts would be difficult and involve significant effort. For example, it would be interesting to analyse emission reductions expected of PaMs in conjunction, where relevant, with reductions in GHG emissions. However, it would be difficult to undertake this analysis partially due to underreporting and fields such as uncertainties being optional.

Reporting under other parts of the NAPCP could also be used for this analysis. Table 2.7.2 of the NAPCP can be used to show how PaMs are linked to energy and climate plans, although this was not completed by all countries. Where this information is provided, most Member States discuss the national energy and climate plans of relevance. However, the United Kingdom report provides an indication of the impact of the selected air pollution PaMs on GHG emissions which are expected to reduce GHG emissions by between 2.2 and 2.9 Mt CO_2e per annum by 2030. This was the only NAPCP found to include this level of detail. The report from Belgium refers to a national report where the emissions reductions calculations can be found, for Flanders only. Member States reporting this level of detail greatly facilitates further analysis.

There are clear links between climate change mitigation and air pollution reduction actions, and further integration of reporting is important. The implementation of the Governance Regulation (EU 2018/1999) and Commission Implementing Regulation (EU 2020/1208) will aim to increase synergies between climate and energy policy reporting and has the potential to include air pollution. **There are many interactions between climate, energy and air pollution PaMs, and the integration of national systems and reporting of these can increase policy coherence and effectiveness**.

6 Conclusions

This report contains information on national air pollution policies and measures (PaMs) reported by European Union (EU) Member States under Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emission of certain atmospheric pollutants (the 'NECD') and Commission Implementing Decision (EU) 2018/1522. The NECD requires Member States to report on their additional national air pollution PaMs considered and selected for adoption to meet emission reduction commitments.

Information on these additional air pollution PaMs had to be reported for the first time under the NECD in 2019. By the reporting deadline of 1 April 2019, six Member States had reported in the EEA PaM tool. The data analysed in this report contains Member State submissions through the EEA PaM tool as of 31 May 2020, which covers 21 Member States. In addition to the mandatory fields in the webtool there are a number of optional fields which improve transparency and cohesion of reporting: if the PaM has been reported to the MMR or under the ambient air quality directive, if the PaM is related to an EU policy and which, the projection scenario used for emission reduction calculations and the uncertainties within the emission reduction values. The reporting within these fields varied significantly. The majority of countries reported if the PaM had been previously reported under another EU directive and the projection scenario used. The other fields however were more sparsely populated limiting the transparency and cohesion analysis.

6.1 Sectoral analysis

The transport sector had the highest number of individual PaMs selected for adoption reported, followed by agriculture, and energy consumption and supply. This is not all that surprising given the persisting air pollution issues in these sectors, although conclusions on the quality of the PaMs cannot be drawn from the actual quantity of PaMs. For the agriculture sector, the focus of the PaMs reported varied. Across all reporting Member States there appeared no single dominant policy or measure that would reduce emissions of ammonia to an extent that would meet NECD targets for 2020-2029. Member States instead opted for a multi-faceted approach to reducing its ammonia emissions.

For the transport sector, PaMs primarily targeted emissions from the road transport sector. PaMs aiming to encourage the uptake of electric vehicles and other alternative fuels, improve driver behaviour, reduce demand and encourage a modal shift were the most numerous within this subsector. However, considerable emissions reductions are anticipated across non-road transport sectors as well. For the energy supply and consumption sectors, PaMs largely focus on improvements in energy efficiency, particularly in a domestic setting, whilst also increasing the uptake of renewable energy sources.

6.2 Links with GHG PaMs

Nearly a third (116) of the individual NECD PaMs reported as selected for adoption were submitted under both the NECD and MMR, suggesting that a significant number of PaMs that will reduce air pollution emissions will also reduce GHG emissions. Of the NECD PaMs selected for adoption that were reported as linked to the MMR, most targeted the transport or energy sectors. PaMs which were reported as linked to the MMR were more likely to have quantified air pollution emissions reductions reported under the NECD. In addition, a few NECD PaMs reported quantified GHG savings which were not found in the PaMs reported through the MMR, suggesting that air pollution PaMs can contribute to climate mitigation action.

However, there is a potential lack of synergy in policies around the use of solid biomass. Of the few PaMs reported through the NECD that address solid biomass, they aim to decrease its usage due to the negative impacts on air pollution. Of the PaMs reported through the MMR that focus on solid biomass, they aim to increase its usage due to the reduction in GHG emissions compared to fossil fuels.

6.3 Lessons from the first reporting

This initial analysis shows that Member States do see links between air pollution and climate change action. Further integration of the reporting system could foster coherence across the two policy domains and support the identification of synergies. Such policy coherence can support efforts to achieve the objectives of the European Climate Law[28], proposed by the European Commission, and the forthcoming Zero Pollution Action Plan[29].

The implementation of the Regulation on the Governance of the Energy Union and Climate Action (EU 2018/1999) aims to increase synergies between climate and energy policy reporting and establishes links to air pollution. The recent implementing regulation (EU, 2020/1208) represents the first step towards greater consistency in the reporting of PaMs under the MMR and the NEC Directive. Successful implementation of these provisions will enhance the integration of national systems and foster policy coherence and effectiveness across multiple environmental domains

Inconsistency between the PaMs reporting of Member States through the NECD limits the effectiveness of analysis. **Encouraging Member States to report more of the optional data fields would increase the analysis that could be performed**. Reporting of existing or already adopted air pollution PaMs is not the intended scope of the current NECD but it would be beneficial to make accommodations in the reporting schema for these PaMs to be reported in the future to provide a more complete picture of the PaMs aiming to reduce air pollution in EU Member States.

[28] https://ec.europa.eu/clima/policies/eu-climate-action/law_en.
[29] https://ec.europa.eu/environment/strategy/zero-pollution-action-plan_en.

Annex 1
Reporting requirements related to the NECD

Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emission of certain atmospheric pollutants (the 'NECD') and Commission Implementing Decision (EU) 2018/1522 specify the reporting requirements for Member States related to PaMs. Section 2.6 of 2018/1522 states that "The information required under this section shall be reported using the 'Policies and Measures Tool' ('PaM tool') provided for that purpose by the EEA." The online tool is available through https://webforms.eionet.europa.eu/.

European Topic Centre on Air pollution,
transport, noise and industrial pollution
c/o NILU – Norwegian Institute for Air Research
P.O. Box 100, NO-2027 Kjeller, Norway
Tel.: +47 63 89 80 00
Email: etc.atni@nilu.no
Web : https://www.eionet.europa.eu/etcs/etc-atni

The European Topic Centre on Air pollution, transport, noise and industrial pollution (ETC/ATNI) is a consortium of European institutes under a framework partnership contract to the European Environment Agency.

European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution