Guide on EU Climate and Sectoral Decarbonisation policies

European Climate Foundation

LIFE PlanUp
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Legal notice

Executive Summary

Climate change - or global warming - refers to the average warming of the earth's surface temperature. There is overwhelming consensus among scientists that climate change is due primarily to the human use of fossil fuels, which releases carbon dioxide and other greenhouse gases into the air. Today, climate change presents the single biggest threat to society as a whole, however, the effects of climate change are likely to be disproportionately felt by the poorest and most vulnerable across the world. In response to this, global negotiations have taken place each year since 1992 when the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 was established with the aim of limiting global warming.

This document aims to help civil society organisations (CSOs) and local regional authorities (LRAs) to better understand the European legislation and policy in place to reduce greenhouse gas emissions across the bloc and ultimately mitigate the most dangerous consequences of climate change. It will present an overview of these international climate negotiations as context to EU legislation; it will detail the EU's 2020 and 2030 climate and energy frameworks and explains how these link to the overarching international climate goals and the EU's commitments within these.

While providing an overview of the European Union Emissions Trading System (EU ETS), this document focuses primarily on legislation covering non-ETS sectors - transport, agriculture and buildings. Together (along with non-ETS industry and waste), these sectors account for almost 60% of the EU's greenhouse gas emissions. This guide looks at what European legislation is in place to reduce emissions in these sectors and what national measures can also be implemented. In addition, it evaluates how current member states are getting on in achieving their emission reduction targets.

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List of acronyms

CAP	Common Agricultural Policy
CAR	Climate Action Regulation
CC	Congestion charging
COP	Conference of the Parties
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CSO	Civil Society Organisation
ECA	European Court of Auditors
EEA	European Environment Agency
EED	Energy Efficiency Directive
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
EU	European Union
EU ETS	EU Emissions Trading System
EUA	European Union Allowance
GHG	Greenhouse gas
GST	Global Stocktake
ICCT	International Council on Clean Transport
ICE	Internal Combustion Engine
IED	Industrial Emission Directive
IMO	International Maritime Organisation
LEZ	Low Emission Zone
LRA	Local Regional Authority
LRF	Linear reduction factor
LTRS	Long-term renovation strategies
LULUCF	Land Use, Land Use-Change, and Forestry
MS	Member State
MTOE	Million tonnes of oil equivalent
NDC	Nationally Determined Contribution
NEC	National Emissions Ceiling
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plans
Non-ETS	Non Emissions Trading System
NREAP	National Renewable Energy Action Plans
PPM	Parts per million
RDP	Rural Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VECTO	Vehicle Energy Consumption Calculation Tool
ZEV	Zero Emission Vehicle
ZLEZ	Zero and Low Emission Zone
ZLEV	Zero and Low Emission Vehicle

Introduction and Context

Climate Change

Before the 1950's, the level of carbon dioxide (CO_2 concentration in the earth's atmosphere hadn't risen above 280 parts per million (ppm in the last 800 000 years[1,2]. However, on 2 May 2013, the global concentration of CO_2 in the atmosphere reached 400 ppm for the first time over the course of one day[3]. This 400 ppm is significant because it is the central point of the uncertainty zone of the planet for the so-called safe operating space for humanity. According to a group of Earth system and environmental scientists (led by Johan Rockström from the Stockholm Resilience Centre and Will Steffen from the Australian National University), the highest concentration for humanity to thrive is 350 ppm, a level surpassed in the mid-1980s[4]. As of June 2018, the seasonally adjusted average concentration stands at approximately 407 ppm[5], and this is rising. The increase in CO_2 is the most important of anthropogenic emissions that increases the amount of heat retained in the Earth's atmosphere and results in climate change[6]. But other greenhouse gases (GHG also have an impact, these include methane, nitrous oxide, and a range of smaller concentration trace gases[7].

Climate change pertains to increases in the frequency and severity of natural disasters and droughts, to ocean acidification, temperature change, and sea-level rise, to name a few. It is a global problem caused by human activities that has and will have increasing environmental, social, and economic costs.

Transport & Environment and the LIFE PlanUp project

This document was written by Transport & Environment under the coordination of Carbon Market Watch (CMW), and with contribution from the European Environmental Bureau (EEB) and Energy Cities. It fulfils the deliverable for activity C5.2 of the Life+ PlanUp project which aims to support the shift to a low-carbon and resilient economy through development and implementation of effective and ambitious national 2030 climate and energy plans. The Life+ PlanUp project will focus on three sectors - transport, building and agriculture - and initially concentrate on the climate and energy policies of five European Member States - Hungary, Poland, Romania, Spain and Italy – where there is need to strengthen climate and energy action at national, regional and local level.

This document serves as a guide to the European climate and energy policies, particularly focusing on those sectors not covered by the European Union Emissions Trading System (EU ETS), though a brief outline of what this is and what emissions it covers will also be provided. It is aimed at civil society organisations (CSOs) and local regional authorities (LRAs) wishing to better understand the context within which National Energy and Climate Plans (NECPs) are being developed. It aims to help these organisations better understand what role different sectors have in contributing to the European Union's overall GHG emissions, how emission reduction targets are split between these different sectors, and what mechanisms there are to help countries monitor and achieve them. In addition, it will provide details on the framework climate regulations, describe how they are monitored and how member states are getting on in achieving their individual targets.

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[1] https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/
[2] scripps.ucsd.edu/programs/keelingcurve/wp-content/plugins/sio-bluemoon/graphs/co2_800k.png
[3] https://climate.nasa.gov/news/916/for-first-time-earths-single-day-co2-tops-400-ppm/
[4] https://www.climatestewards.org/resources/atmospheric-co2/
[5] https://www.esrl.noaa.gov/gmd/ccgg/trends/global.html
[6] https://unfccc.int/sites/default/files/6_lequere13sed2.pdf
[7] https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

The international climate negotiations: from UNFCCC to Paris

The United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change - better known as the UNFCCC - was the first global treaty on climate change. Entering into force in 1994, it sets out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse gases to *"avoid dangerous anthropogenic interference with the climate system"*[8]; in other words, it tries to reduce GHG emissions in a bid to limit human influence on the climate system.

The UNFCCC acknowledged a series of points that have come to underpin the negotiations. It states that change in the Earth's atmosphere and its adverse effects are a "common concern of humankind". Significantly, it notes that the *"largest historical and current share of emissions" originate from industrialised countries*, and, while per capita emissions from developing countries are "relatively low", their share of global emissions "will grow to meet their social and development needs"[9]. The Convention therefore acknowledges the need for all countries to participate in an "effective and appropriate international response", but highlights that this should be done in accordance with "their common but differentiated responsibilities and respective capabilities".

Negotiations have continued each year through successive Conference of the Parties (COP).

The Kyoto Protocol

The next climate agreement to come into force was the Kyoto Protocol (in 2005) which set the *first legally binding emission reduction targets for developed countries*. However, because many major emitters are not part of Kyoto - notably the US - it only covers about 12% of global emissions[10].

Two commitment periods have been agreed to date (as well as a test period):

- 1st period (2008-12) – industrialised countries committed to reduce emissions by an average of 5% below 1990 levels
- 2nd period (2013-20) – Parties committed to reduce emissions by at least 18% below 1990 levels

What is the European Union's target?
The Kyoto Protocol allowed the EU and its member countries - 15 at the time the legislation was adopted - to jointly reduce their emissions[11]. The EU therefore *committed to a joint 8% cut for the bloc as a whole between 2008-2012* (higher than the overall Kyoto 5% reduction target), and further committed to an average *20% emission reduction below 1990 levels by 2020*.

[8] https://unfccc.int/resource/docs/convkp/conveng.pdf
[9] https://unfccc.int/resource/docs/convkp/conveng.pdf
[10] https://ec.europa.eu/clima/policies/strategies/progress/kyoto_1_en;
Canada also withdrew from the Protocol in 2012: https://unfccc.int/process/the-kyoto-protocol
[11] New Member States to the EU have committed to reduce emissions in line with the Protocol and EU targets.

The Paris Agreement

Flash forward a decade and we reach the single most significant climate treaty to date - the 2015 Paris Agreement. This sets out the ***first internationally binding emission reduction targets for all countries*** (whereas the Kyoto Protocol included binding targets for developed countries only).

Governments agreed to a long-term goal of keeping the increase in global average temperature to ***well below 2°C*** above pre-industrial levels, with the aim of limiting this increase to 1.5°C. In a bottom-up approach, the Paris Agreement sees individual nations set their own emission reduction targets through Nationally Determined Contributions (NDCs) - it is for this reason (self-determined targets), that the Agreement has been called a binding non-binding agreement. Starting in 2023, and then every five years, countries will assess whether they are collectively on track to meet the long-term goals of the Paris Agreement through a global stocktake (GST). These stocktakes will inform the assessment of subsequent NDCs which are required to see a progression in ambition[12].

What is the European Union's target?
The EU submitted its own Intended NDC in 2014, ahead of the Paris meeting, and ***committed to a binding target of an at least 40% domestic reduction*** in greenhouse gas emissions ***by 2030*** compared to 1990, to be fulfilled jointly by its Member States.

What does this all mean for the European Union?

In order to achieve the above emission reduction targets a number of regulations and mechanisms have been put in place.
An EU ETS - covering the power and industry sectors - was introduced to help Member States achieve their Kyoto targets and to achieve cost-efficient emission reductions. Each national Kyoto target was split into an emission budget for the ETS sectors and another emission budget for the sectors not covered by the ETS (mainly transport, buildings, agriculture and waste), and allowances for emissions were allocated to Member States. The Effort Sharing Decision, which was later replaced by the Climate Action Regulation (also known as the Effort Sharing Regulation), was established to govern these non-ETS emissions.

On top of this, in order to ensure EU level achievement of a 40% reduction in emissions by 2030, the EU requires Member States to submit National Climate and Energy Plans (NECPs) that outline how they intend to meet their national climate and energy commitments.

Remember: the international climate change negotiations aim to stabilise global GHG emissions so as to avoid the dangerous consequences of human interference in the climate system. A recent report by the IPCC[13] outlines the added danger of allowing global warming to reach 2 degrees above pre-industrial levels, compared to limiting this to 1.5 degrees. The half a degree difference significantly worsens the risks of drought, floods, extreme heat and poverty for hundreds of millions of people. According to the report, any long-term strategy to limit global warming to 1.5 °C requires us to reach net global zero emissions by 2050, with significant removal of CO_2 from the atmosphere thereafter[14]. However, it is widely recognised that EU targets and wider global NDCs fall far short of the emission reductions needed to achieve this. The 2018 United Nations Environment Programme report (Emissions Gap report 2018) states that pathways following ***current NDCs will lead to a global warming of around 3 degrees by 2100***,

[12] https://unfccc.int/sites/default/files/english_paris_agreement.pdf
[13] https://unfccc.int/topics/science/workstreams/cooperation-with-the-ipcc/ipcc-special-report-on-global-warming-of-15-degc
[14] http://www.ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

with additional warming thereafter[15]. It suggests that a tripling of action is required if we are to limit global warming to 2 degrees (and we should be aiming for 1.5 degrees!).

Consequently, increased emission reduction targets are required at both the EU and national levels. A shift in policies (and financing) focused on propping up the fossil fuel industry to investment in cleaner technologies is urgent. Bearing all this in mind, this report looks at the mechanisms put in place to help Europe meet these emission reductions.

2020 Climate and Energy Package

What is the 2020 Climate and Energy Package?

The EU's 2020 Climate and Energy Package sets out the targets, rules and governance of *GHG emission reductions, renewables and energy efficiency*[16]. Remember, under the Kyoto Protocol, the EU and its Member States committed to jointly reduce emissions by 20% below 1990 levels by 2020 (in the second commitment period). In line with this, the EU developed a package of measures to increase energy security and competitiveness, and help it achieve its obligations under the Protocol. Decided upon in 2007 and adopted in 2009, the resulting EU 2020 package sets binding targets to ensure the EU achieves its climate and energy targets for 2020:

- 20% cut in GHG emissions (from 1990 levels)
- 20% of energy from renewables
- 20% improvement in energy efficiency

This overarching framework sets Europe onto a path for a cleaner economy, however, national policies that will determine actual emission reductions.

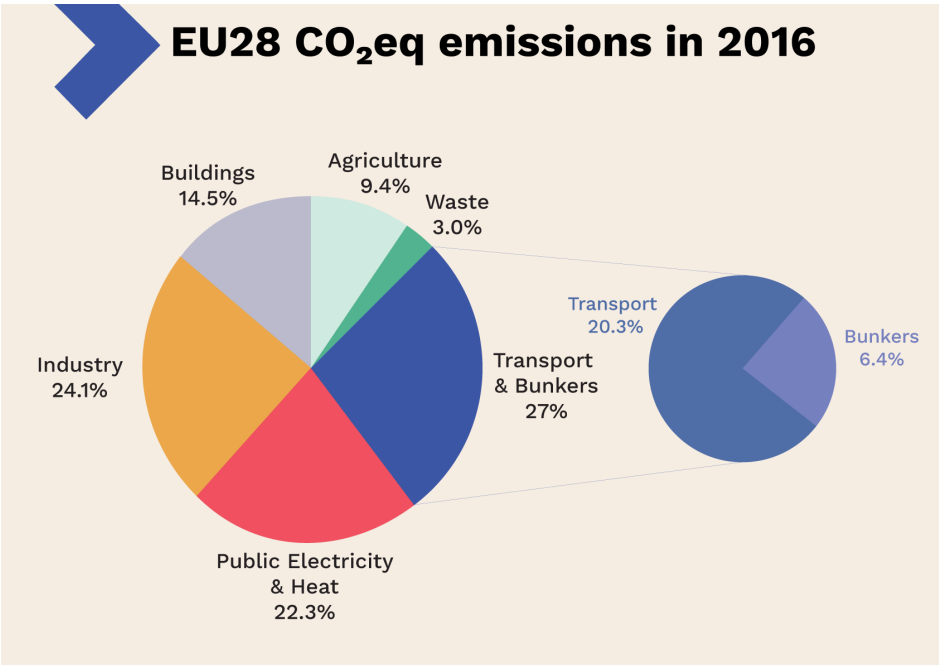

***Figure 1**: EU28 emissions from ETS and non-ETS sectors. EEA 2018 GHG inventory report. T&E's analysis including the memo items (see page 14)*

[15] https://www.unenvironment.org/resources/emissions-gap-report-2018?utm_source=POLITICO.EU&utm_campaign=204ff6b7e1-EMAIL_CAMPAIGN_2018_11_28_08_28&utm_medium=email&utm_term=0_10959edeb5-204ff6b7e1-189774485

[16] This collective target was translated into differentiated, legally-binding national targets for each EU-15 Member State, ranging from a reduction of 28% by Luxembourg to an increase of 27% for Portugal: http://europa.eu/rapid/press-release_MEMO-07-58_en.htm

2020 GHG emission reduction targets - how will they be achieved?

Two main mechanisms have been developed to ensure that the EU as a whole achieves its target of reducing emissions by 20% compared to 1990 by 2020:

- **EU ETS**. Emissions need to be *cut by 21% compared to 2005*.
- Effort Sharing Decision (**ESD**) for non-ETS sectors. These emissions need to add up to a *total cut of 10% compared to 1990*. Each EU country has an individual binding emission reduction target depending on their wealth.

The EU Emissions Trading System (EU ETS)

The EU ETS is a cap-and-trade system, meaning it puts a limit (a 'cap') on the amount of GHG emissions regulated installations are allowed to emit and allows installations to trade these emission allowances between each other[17]. *Around 11,000 power stations and manufacturing plants are subject to the ETS* throughout the 28 EU Member States plus Iceland, Liechtenstein and Norway, as well as some aviation. In total, the EU *ETS covers around 45% of the EU's GHG*.

What exactly are the allowances and how are they allocated?

Each installation, or power station, can buy and trade allowances known as a European Union Allowance (EUA). *One allowance gives the holder the right to emit one tonne of CO_2* (or the equivalent amount of two other powerful greenhouse gases, nitrous oxide (N_2O) and perfluorocarbons (PFCs)[18]. Over the years, the number of allowances is reduced meaning less emissions are allowed to be produced - this is called the linear reduction factor (LRF).

There are two ways allowances are allocated: auctioning and free allocation. Auctioning is the default method of allowance allocation, creating a clear incentive for clean investment. *Power stations must bid for allowances at auctions*, or buy them from other installations. *Industrial sectors such as cement, steel and chemicals, however, are allocated allowances for free*. This is because governments were concerned that these installations might move their production to other countries with lower production costs; this would increase emissions at the global level and cause so-called 'carbon leakage'.

From 2013-2020, a list was developed of *sectors supposedly at significant risk of carbon leakage* and *allocated 100% free allowances*. Other sectors at risk of carbon leakage that didn't make the list gradually had their free allocations reduced (from 80% in 2013 to reach 30% in 2020).

Problems with free allocation
- No incentive for industry to decarbonise.
- Uneven playing field for clean technology.
- EU governments lose out on money.
- No compelling evidence carbon leakage is a significant risk to industry.

What is the EU target for emission reduction in the ETS sectors?

Since the establishment of the EU ETS in 2005, there have been four trading periods, three of which are accounted for under the 2020 Climate and Energy Package.

2005-2007: 1st trading period

This was primarily a test period, to learn how best to operate the system. An *oversupply of allowances* meant companies could emit more and led to a surplus of allowances on the market. Eventually, this *led the price of an allowance to fall to 0* in 2007.

[17] https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf
[18] https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf

2008-2012: 2nd trading period

- *Iceland, Norway and Liechtenstein joined the ETS at the start of 2008*.

Following the overestimations of the first trading period, the ***number of allowances was reduced by 6.5%***, however, the economic crisis meant fewer emissions were emitted and so demand for allowances decreased. Once again, a ***surplus of unused allowances drove down the price of carbon***, thus reducing the incentive to reduce emissions.

2013-2020: 3rd trading period

- *Croatia joined the ETS at the start of 2013*.

Having suffered from an oversupply of allowances in both previous trading periods, the system was reformed dramatically. There was a progressive shift from giving out a number of free allowances to auctioning (though numerous free allocations continue). The ***cap on emissions*** from installations is set to be ***reduced by 1.74% every year***, meaning that in 2020, greenhouse gas emissions from these sectors will be 21% lower than in 2005. Additionally, as a short-term measure ***to address the surplus of emission allowances*** on the market, the ***Commission postponed the auctioning of 900 million allowances*** between 2014-2016 until 2019-2020 (known as back-loading of auctions)[19].

Aviation and the EU ETS

As of the 1 January 2012, ***airlines operating within the European Economic Area (EEA)*** were required to monitor and report on their emissions, and then exchange allowances for corresponding amounts[20]. Each year, airlines are given a number of tradable allowances to cover some of their emissions. If their emissions exceed this amount, they must purchase allowances from other sectors which have a surplus. For the whole 2013-2020 period, ***a cap on emissions was set at 5% below the average annual level of emissions in the years 2004-2006***.

Following a Resolution by the 2016 International Civil Aviation Organisation (ICAO) Assembly, the EU decided to continue the rule that only emissions within the EEA are regulated by the EU ETS (as opposed to the proposal to widen regulation to those emissions by flights to, from and within the EEA). This is set to be reviewed by 2023.

In October 2016, ICAO agreed to a Resolution to establish a ***global market-based measure to address the net emissions from aviation by 2021***[21]. The resulting Carbon Offsetting and Reduction Scheme for International Aviation (Corsia) aims to stabilise CO_2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020. This means that airlines will be required to monitor their emissions from *all international flights* (not just those within the EEA) and will be required to offset emissions from those routes covered by Corsia by buying offsets from initiatives that reduce emissions (such as renewable energy). However the rules for this mechanism are yet to be finalised, and it is highly likely that the scheme will recognise the use of both poor quality offsets and alternative fuels. Meanwhile industry and some states are pushing for Corsia to be the sole and exclusive measure to address emissions from the sector, something which would severely limit our ability to cut emissions from this sector.

Problems with Corsia proposal

- Some airlines and governments want Corsia to be the only tool for regulating aviation, which would be a regression in comparison to the current ETS.
- Emission reductions would be voluntary until 2027.
- The starting point for measuring emission reductions would be 2020 level, at which point emissions are expected to be even higher.

[19] https://ec.europa.eu/clima/policies/ets/reform_en

[20] https://ec.europa.eu/clima/policies/transport/aviation_en

[21] https://ec.europa.eu/clima/policies/transport/aviation_en

Shipping and the EU ETS

International shipping[22] is not currently covered by the EU ETS. However, the EU Parliament and the Council agreed in 2017 they will move to include shipping within the emissions trading system by 2023 if no sufficient progress is made by the International Maritime Organisation (IMO) on a clear CO_2 strategy[23].

What has been the impact of the EU ETS on carbon emissions and industry?

Some have argued that introducing an emissions trading system - and as such restricting the amount of carbon European companies are allowed to emit - would weaken the competitiveness of European industry. However, a new report by the OECD (2018)[24] has found that between 2005-2012, while emissions reduced by 10% over this period, revenues and "fixed assets" were found to have increased.

Memo items in Member State GHG Inventories

This report looks at the shares of GHG emissions in the European economy, based on Member State reporting to UNFCCC. While domestic aviation and maritime activities are reported under the transport sector for each Member State (IPCC code 1.A.3), *international* aviation and *international* maritime emissions (referred to as international bunkers) are counted as memo items that are reported but not counted in the emission totals. In the case of aviation, this means there is a non-congruous overlap of aviation emissions accounting and thus climate mitigation regulation, whereby the international intra EU flights are not included in a Member State's emissions totals. In all cases, the GHG emission inventories are based on fuel sales. For aviation this corresponds to all departing flights (whereby fuel uplifting is small), and thus a reasonable approximation of emissions associated with European aviation activity. For maritime however, this is generally not the case, as large ships can bunker fuels and do not necessarily need to refuel while in Europe. Nomenclature aside, the emissions associated with international aviation and shipping are linked to European transport activity, and should be accounted as such. Therefore, in this report international bunkers are counted in the European totals unless noted otherwise, effecting the shares of each sector.

Effort Sharing Decision - non-ETS sectors

Covering the period 2013-2020, the ESD is key to ensuring non-ETS sectors meet their emission reduction targets under the 2020 Climate and Energy Package (see above). These ***sectors include transport, buildings, agriculture, non-ETS industry and waste***, together accounting for almost 60% of total domestic EU emissions.

This makes the ESD the biggest climate tool for reducing emissions. However, it's important to note that the ESD only creates a framework for emission reductions in member states, it doesn't prescribe *how* member states should reduce emissions.

What is the EU target for non-ETS sectors?

A overall target of 10% below 2005 levels by 2020 was set for these sectors. This ***overall target is translated into national binding commitments for member states based on their relative wealth*** (measured as gross domestic product (GDP) per capita); targets range from 20% reduction for the wealthiest to a 20% increase for the least wealthy.

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[22] Inland shipping is covered by the Climate Action Regulation, discussed below.

[23] https://www.maritime-executive.com/article/eu-emissions-trading-system-excludes-shipping-for-now

[24] https://www.oecd-ilibrary.org/docserver/4819b016-en.pdf?expires=1544173487&id=id&accname=guest&checksum=C97B6B5832F986F53E9BC07D62333A89

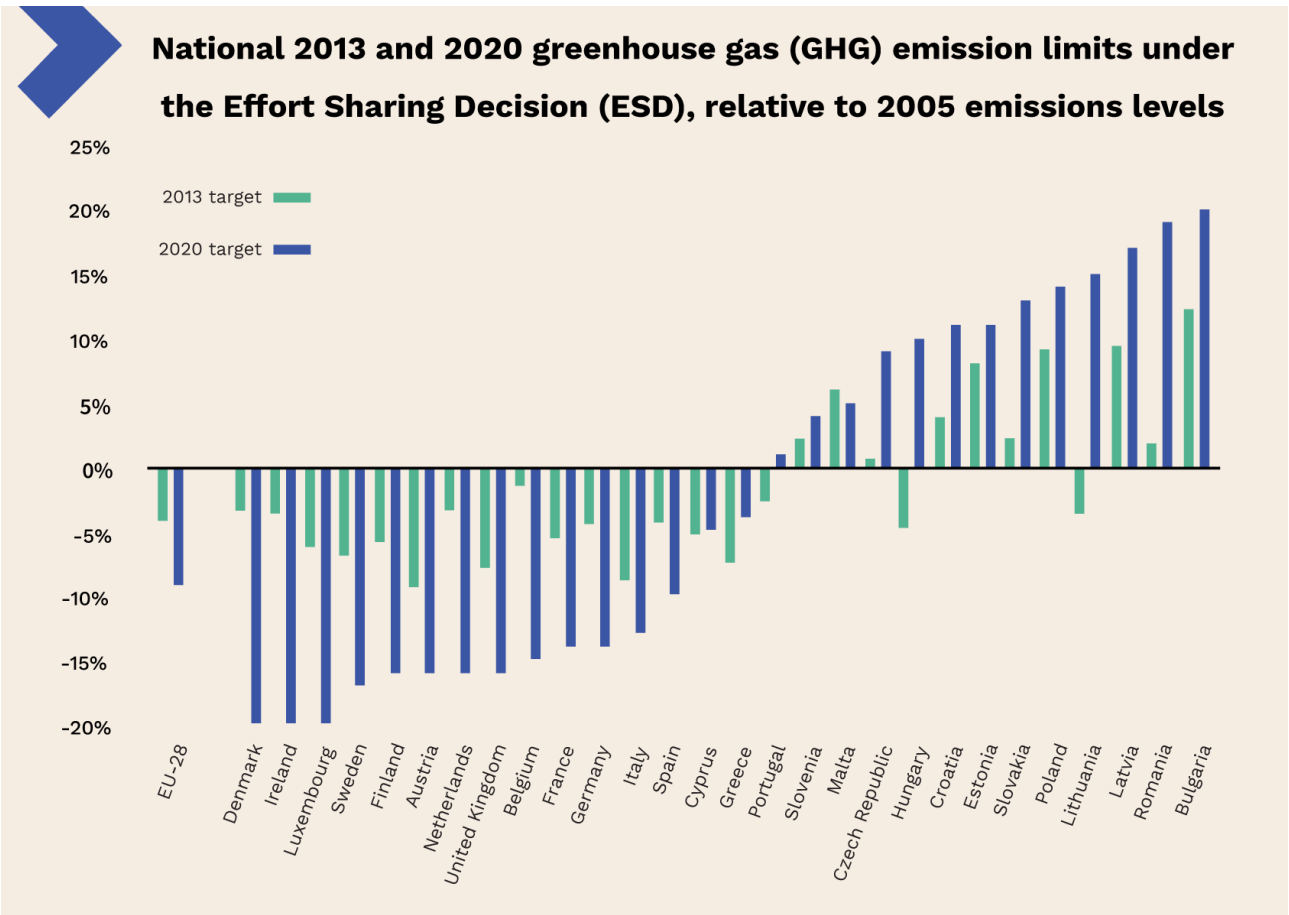

***Figure 2**: National 2013 and 2020 GHG limits under the ESD; EEA.*

The Regulation covers the GHG emissions controlled by the Kyoto Protocol during its first commitment period 2008-2012: carbon dioxide (CO_2), methane (CH_4), Nitrous Oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs), and sulphur hexafluoride (SF_6).
By 2014, total emissions in sectors covered by the ESD were already 13% lower than in 2005[25]. This effectively means that between 2014-2020, most countries are able to reduce their emission reduction efforts, and in some cases, could even reverse earlier efforts to reduce emissions.

Where is the EU on achieving its GHG emission reductions?

In 2016, the EU's total GHG emissions were 4 441 megatonnes (Mt) carbon dioxide equivalent (CO_2eq.), which means emissions were 22% less than 1990 levels[26]. But, estimates suggest that emissions increased by 0.6 % from 2016 to 2017. Despite this, the EU remains on track to achieve its GHG emission reduction target of a 20% decrease by 2020, compared with 1990 levels.

2020 Renewable Energy Targets

EU countries have also adopted binding EU and national targets for increasing the share of renewables in their energy consumption under the Renewable Energy Directive. Similar to the ESD, these binding targets reflect the countries' starting share of renewable energy and their ability to increase it, combined with a clear pathway for the national roll-out in the so called National Renewable Energy Action Plans (NREAPs).

[25] https://ec.europa.eu/clima/policies/effort/implementation_en

[26] This figure, however, excludes emissions from land use, land-use change and forestry (LULUCF); it does include all emissions from aviation (including international flights), covered under the EU target.

What is the EU target for energy from renewable sources?

The EU agreed on achieving a target a share of 20% energy from renewable sources in gross final consumption of energy. This target is split up among the EU Member states into individual national targets, generally giving the Member States the choice how to achieve their own targets. For the transport sector the Renewable Energy Directive defined that EU countries must ensure that at least 10% of their transport fuels come from renewable sources by 2020.

Where is the EU on achieving this?

According to a recent report by EEA, renewables made up 17.4% of the EU's final energy consumption last year (2017), but that is only marginally up from 17% in 2016. While the EU is still on track to meet its bloc-wide 20% renewable energy target by 2020, the pathway needed to meet the national targets are becoming steeper and less cost-effective. The EEA found that 20 EU countries are on track to reach their national renewable energy targets for 2020, but that's five less than in 2016. In many countries, the slowing of progress is due to increases in total energy consumption, which caused the share of renewables in energy consumption to fall.

2020 Energy Efficiency Targets

Measures for increasing energy efficiency are set out in the Energy Efficiency Plan, the Energy Efficiency Directive and the Energy Performance Buildings Directive.

What is the EU target for energy efficiency?

The Energy Efficiency Directive (EED) set the policy roadmap for the period 2012 to 2020. Under the EED, an EU-wide target was set to be 20% more energy efficient by 2020; the Union's 2020 primary energy consumption is to be no more than 1 474 Mtoe (million tonnes of oil equivalent) or no more than 1 078 Mtoe of final energy consumption. By 30 April 2014 (and every three years after), all Member States were required to submit to the Commission their National Energy Efficiency Action Plans (NEEAP). Every year, Member States must report to the Commission on progress in achieving their targets.

Primary energy consumption = total energy demand of a country (energy sector consumption + loss in transformation + loss in distribution + final energy use by users).
Final energy consumption = total energy consumption by end users (households, industry, agriculture... excludes use by energy sector).

What must the National Energy Efficiency Action Plans (NEEAPs) include?

NEEAPs must include analysis of energy consumption in the Member State, information on national energy efficiency targets and progress made on them. These can based on either primary or final energy consumption, or primary or final energy savings, but together must result in an achievement of the EU's overall energy efficiency target of 20%. Countries have to take into consideration the following:

- remaining cost-effective energy-saving potential
- GDP evolution and forecast
- changes of energy imports and exports
- development of all sources of renewable energies, nuclear energy, carbon capture and storage

Where is the EU on achieving this?

The EU will have to accelerate its efforts in order to achieve its 2020 targets for energy efficiency following a recent increase in energy consumption in 2016. According to preliminary projections, by the EEA, of primary and final energy consumption in 2017, it will be challenging to

remain below the indicative trajectory levels. In particular this is due to widespread economic recovery and the fact that the energy efficiency targets of Member States, when taken together at EU level, result in a less ambitious improvement in energy efficiency than the target set for the EU as a whole.

2030 Climate and Energy Framework

What is the 2030 Climate and Energy Package?

Building on the 2020 Climate and Energy Package, the EU's 2030 Package sets out renewed targets, rules and governance for *GHG emission reductions, renewables and energy efficiency*[27]. In 2014, the EU submitted its NDC to the UNFCCC committing itself and its Member States to a joint reduction of GHG emissions by 40% by 2030 (compared to 1990). Agreed in October 2014, the 2030 Package provides a stepping stone towards the long-term goal of the Paris Agreement - a carbon neutral economy - and builds on previous mechanisms to ensure the EU is on track to meet its obligations under the Paris Agreement. It sets three key binding targets for 2030:

- At least 40% cuts in GHG emissions (compared to 1990 levels)
- At least 32% share for renewable energy
- At least 32.5% improvement in energy efficiency (indicative target)

As with the 2020 Package, this framework is important, but ultimately it is up to the national Member States to translate this ambition into policies that will reduce emissions. These policies will be detailed in National Climate and Energy Plans (NECPs) to be submitted to the EU for approval (see more on pages 21-23)

2030 GHG emission reduction targets - how will they be achieved?

In addition to the two main mechanisms seen in the 2020 Package, another two strategies have been developed to ensure that the 40% GHG emission reduction target is met at EU level:

- EU (**ETS**. These emissions need to be cut by 43% compared to 2005.
- Land Use, Land-Use Change and Forestry Regulation (**LULUCF**). Emissions from this sector must be offset.
- Climate Action Regulation (**CAR**) for non-ETS sectors. These emissions need to add up to a total cut of 30% compared to 2005. Each EU country has an individual binding emission reduction target depending on their wealth.

In addition to these three mechanisms, the EU has developed an Energy Union Strategy and alongside it a governance system that requires each Member State to submit evidence on how they plan to meet their climate and energy targets. These NECPs will also be discussed in this section, along with information on how citizens and civil society can get involved their drafting and implementation.

[27] This collective target was translated into differentiated, legally-binding national targets for each EU-15 Member State, ranging from a reduction of 28% by Luxembourg to an increase of 27% for Portugal: http://europa.eu/rapid/press-release_MEMO-07-58_en.htm

The EU Emissions Trading System

The EU ETS is a cap-and-trade system that accounts for the emissions from ***around 11,000 power stations and manufacturing plants***. For a more detailed explanation, see pages 12-15 above.

2021-2030: 4th trading period

For the ETS sectors (power, industry and some aviation), emissions need to be reduced by 43% by 2030 compared to 2005. Between 2015-2018, the EU ETS was revised in attempt to tackle the continuing challenge of surplus emission allowances. As part of this revision, ***the rate at which the cap on emission allowances are reduced each year (LRF) was increased from 1.74% (between 2013-2020) to 2.2%***[28]. In addition to the back-loading of auctions in the 3rd trading period, the Commission set up a Market Stability Reserve (MSR), a long-term measure to address the surplus of allowances on the market. Those 900 million allowances that were back-loaded between 2014-2016 will be transferred to the MSR in 2019-2020, along with any unallocated allowances[29]. Each year, the Commission will assess how many unallocated allowances are on the market and determine whether they should be moved to the MSR, or if allowances should be moved from the MSR and placed back on the market. Excess emission allowances will be cancelled annually from 2023 onwards - Member States will be allowed to cancel emission allowances related to the closure of power plants.

Despite this ramping up of restriction of allowances, the ***ETS is still not consistent with the Paris climate goals***. In fact, with a 2.2% LRF, emissions from power and industry sectors would only reach net-zero by 2058 - far later than the 2040 zero-emission Paris-compliant pathway[30].

As we saw above, from 2013-2020, ***sectors supposedly at significant risk of carbon leakage were allocated 100% free allowances***. Other sectors at risk of carbon leakage (but not 'significant' risk) have gradually had their free allocations reduced (from 80% in 2013 to reach 30% in 2020). Post-2020, those industries not included on the 'significant risk' list will have their free allowances further reduced from 30% to zero by 2030.

The Innovation and Modernisation funds

In order to help energy-intensive industries and the power sector meet the innovation and investment challenges of the transition to a low-carbon economy, the revised EU ETS Directive set up two new funds:

- The **Innovation Fund** will support the demonstration of innovative technologies and breakthrough innovation in industry. It will extend existing support under the NER300 programme. The amount of funding available will correspond to the market value of at least 450 million emission allowances.
- The **Modernisation Fund** will support investments in modernising the power sector and wider energy systems, boosting energy efficiency, and facilitating a just transition in carbon-dependent regions in 10 lower-income Member States. It will be financed through auctioning approximately 310 million allowances with a total estimated value of €6.2 billion.

[28] https://ec.europa.eu/clima/policies/ets/revision_en

[29] https://ec.europa.eu/clima/policies/ets/reform_en

[30] https://carbonmarketwatch.org/wp/wp-content/uploads/2018/09/NATIONAL-ENERGY-AND-CLIMATE-PLANS-AND-THE-TRANSITION-TO-CARBON-FREE-SOCIETIES-_-WEB_final.pdf

Land Use, Land Use Change, and Forestry (LULUCF) Regulation

What is the Land Use, Land-Use Change, and Forestry Regulation?

The LULUCF Regulation includes GHG emissions and removals into the 2030 Climate and Energy Framework in line with acknowledgement within the Paris Agreement of the critical role the land use sector has in reaching long-term climate mitigation objectives. This means that ***emissions and removals from this sector are included in the calculation of Member State's GHG emissions***, which wasn't previously the case (under the 2020 Climate and Energy Package, for example).

What is the EU target under LULUCF?

Adopted in May 2018 following agreement in October 2014 by EU leaders that all sectors should contribute to reducing emissions, it ensures that GHG emissions from land use, ***land use change or forestry are offset by at least an equivalent removal of CO_2 from the atmosphere in the period 2021-2030***. This is known as the "no debit" rule.

However, there are some loopholes that weaken this regulation - that is to say some rules that make it easier for member states to meet their targets. For one, between 2021-2030 Member States can use up to 280 million credits from the LULUCF sector to count towards emission reductions in the CAR (non-ETS) sectors[31]. Moreover, relying on credits from planting trees is problematic as these carbon sinks can be reversed at anytime when trees are cut down and burned.

Climate Action Regulation (CAR) - non-ETS sectors

The Climate Action Regulation (CAR) - also known as the Effort Sharing Regulation (ESR) - is the regulation following on from the ESD governing emissions not covered by the EU ETS. The CAR runs from 2021-2030. It ***establishes annual carbon budgets for each EU country, covering sectors like surface transport, buildings, agriculture, small industry and waste***, in total covering around 60% of the EU's GHG emissions. Of these, transport is by far the largest emitting (see figure 2).

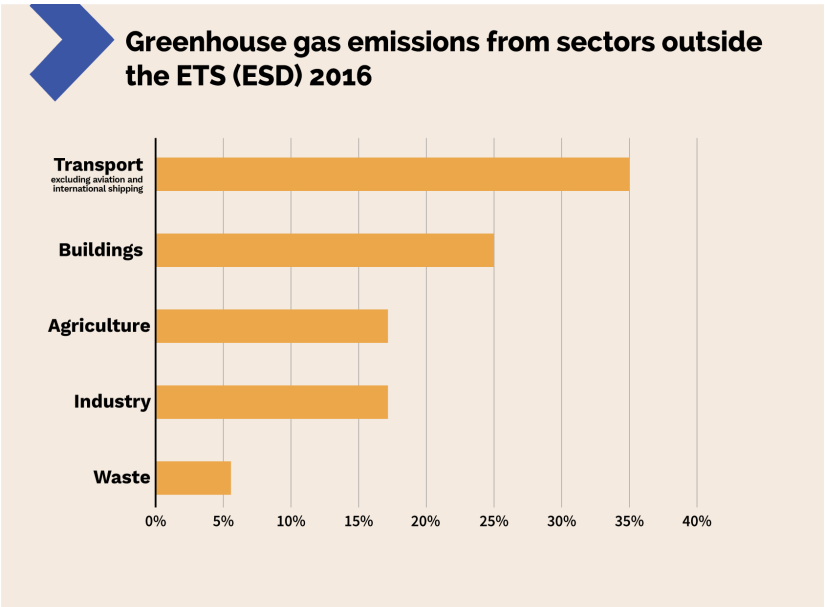

Figure 3: *share of GHG emissions by sector regulated under non-ETS; EEA*

What is the EU CAR target?

These non-ETS sectors were given an ***overall emission reduction target of 30% by 2030*** compared to 2005 levels. The ***CAR translates this target into binding commitments for individual member states based on their wealth*** (measured by GDP per capita); targets range from 0% for the least wealthy to a 40% reduction for the wealthiest. In addition to the emissions covered by

[31] http://ec.europa.eu/transparency/regdoc/?fuseaction=feedbackattachment&fb_id=3B1E3760-CF45-9A9B-6F06B6E39AF3DA9B

the ESD (noted above), the CAR also covers nitrogen Trifluoride (NF_3, included in the Kyoto Protocol second commitment period 2013-2020).

The CAR sets an overall GHG emission reduction target, but it doesn't specify where or how these emission reductions should take place. Instead, it is up to individual Member States to develop national policies and measures to ensure they meet their targets. Of course, there are a number of EU policies for specific non-ETS sectors - such as vehicle standards - which will help EU Member States in achieving their targets (see more on specific sectoral policies on pages 24-49).

Are there any problems with the CAR?

There are a ***number of loopholes in the regulation***. Firstly, the average emissions produced between 2016-2018 is taken as the starting point from which emission reductions will be measured. Each year, member states will have an allocation for the amount of emissions it can emit - its carbon budget. If a member state emits more than it is allowed, it can buy emission permits from other member states, in a similar system to the EU ETS (see above). A good starting point is essential to the effectiveness of the regulation - the higher the baseline, the less cumulative emissions reduced throughout the period. ***The 2016-2018 baseline is problematic as some member states***, even before considering other loopholes, ***will be able to emit more throughout the period than their projected emissions***; the list includes but is not limited to BG, CZ, EE, EL, HR, LV, LT, PT, RO and SK. Within this group, some will even be able to increase their emissions compared to 2021.

Secondly, countries are allowed to bank credits from one year to the next. This means that future emission reduction targets are based on past performance, so if a country overachieves one year, they can use this to count towards the following year's target, effectively achieving less. ***While a limit was set on banking at 30% of annual allocations, it is set too high***. This limit, along with other flexibilities, is estimated to reduce the overall impact of the regulation from an effective emission reduction of 30% by 2030 to just 25-26% by 2030 compared to 2005 levels[32].

Climate Action Regulation loopholes:

- The baseline - set at 2016-2018 - is too high, allowing some countries to emit more.
- Countries are allowed to bank emissions, and despite a limit on this, flexibilities will result in an actual emission reduction of just 25% - 26% as opposed to the 30% target.
- Credits can be gained from the land-use sector to count towards effort under the CAR weakening emission reduction efforts in the non-ETS sectors.

Third, the ***CAR includes the option to use the LULUCF sector as a way to compensate emissions from CAR sectors***. Credits can be generated from planting trees (afforestation) or from managing cropland and grassland. But relying on credits from planting trees is troublesome as the ***carbon removals can be reversed at any time when trees are cleared and burned***. Emissions from fossil fuels, on the other hand, stay in the atmosphere for centuries. Moreover, emissions from all sectors need to be achieved; countries should not be allowed to choose to reduce emissions in the land sector instead of reducing emissions in the transport sector, for example.

What does this mean for the EU's Paris commitments?

The CAR is a fundamental tool for the EU to meet its commitment under the Paris Agreement, and as such, in order to meet its emissions reduction target of 40% below 1990 levels by 2030, either (or ideally both) of the following needs to happen:

[32] https://www.transportenvironment.org/sites/te/files/publications/2018_03_ESR_CAR_final_report.pdf

- Both the EU and national governments implement measures that go beyond their CAR targets either through higher targets in renewables and/or energy efficiency, or through more ambitious national measures
- The ETS goes beyond its 2030 target of 43% compared to 2005, this would mean a less ambitious CAR is compensated with a higher achieving ETS

On top of this, increased efforts are needed to ensure the EU is in line to fully decarbonise non-ETS sectors by 2050. Below, we look at a new tool the EU is developing to help ensure that Member States achieve their emission reduction targets - NECPS - and later we'll see the measures taken in the individual sectors - transport, agriculture and buildings - to reduce emissions.

National Climate and Energy Plans (NECPs)

NECPs are required under a new governance system - the Regulation for the Governance of the Energy Union - which sets out ***the main planning and reporting duties on energy and climate targets for all Member States.*** Revised in 2018, the Governance Regulation has been designed to check whether the EU is on track to meeting its commitments under the Energy Union Strategy and Paris Agreement. Whereas previously responsibilities for climate and energy policies were accounted for under different laws such as the Renewables Directive and the Energy Efficiency Directive, this Regulation aims to bring all of these actions together under one roof.

What are the NECPs?

NECPs are designed to help Member States plan and report on how they will achieve their climate and energy targets[33]. Bringing all energy and climate targets into one strategy, the NECPs cover targets for GHG emissions, renewable energy and energy efficiency. They will first cover the period 2021-2030 and then every 10 year period after that.

Aims of the Governance Regulation:

- To ensure the objectives of the Energy Union are achieved.
- To promote long-term certainty for investors.
- To reduce administrative burdens, in line with the better regulation.
- To incorporate the provisions of the existing Climate Monitoring Mechanism Regulation (MMR) and harmonise them with the Paris Climate Agreement.

How will the NECPs be structured?

The Governance Regulation sets out a clear framework for the NECPs and provides a mandatory template. The NECPs should include the following 5 main sections:

Overview of the process
This section will include a summary of the main targets and details of process. It should include a description of the consultation and involvement of stakeholders and their results.

National objectives and targets
This must include a description of national objectives, targets and contributions

National policies and measures
This section should outline the policies and measures expected to help meet the country's targets.

Current situation and future projections
This section should present an overview of the current situation regarding the 5 Energy Union dimensions - including in relation to energy system and GHG emissions - and present projections relating to the national objectives.

[33] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union

Assessment of impact of planned policies

An assessment of the impacts of policies and measures implemented to meet national targets should be provided here.

What will the NECPs need to include?

Within the targets, policies and data sections (in particular), Member States should focus on information related to the 5 'pillar' dimensions of the Energy Union Strategy. The Energy Union Strategy, launched in 2015, builds on the 2030 Climate and Energy Framework with the aim of making energy in Europe more secure, affordable and sustainable.

The five so-called 'dimensions' are integrated into one strategy which will form the basis for NECPs.

1. Decarbonisation of the Economy
   - National targets for GHG emission and targets under the CAR.
   - National commitments according to LULUCF
   - Other national commitments for long-term decarbonisation strategies (when relevant)
   - National expected contribution to achieving the EU's target of 32% share of renewable energy by 2030
   - Trajectories for sectorial share of renewable energy in final energy consumption from 2021 to 2030 in heating, cooling, electricity and transport sectors

2. Energy Efficiency
   - Indicative national contribution to achieving EU's energy efficiency target of 30% in 2030
   - Cumulative energy savings expected between 2021-2030
   - Objectives for long-term renovation of residential and commercial buildings
   - Other national energy efficiency objectives (long-term and sectoral)

3. Energy Security
   - National objectives for increasing diversification of energy sources and supply from third countries
   - National objectives to reduce dependency on energy imports from third countries
   - National objectives relating to readiness in case of supply disruption
   - National objectives to deploy domestic energy sources (with a focus on renewable energy)

4. The Internal Energy Market
   - Level of electricity interconnectivity that Member States is aiming for by 2030 (in consideration of electricity interconnection of at least 15% by 2030)
   - Key national objectives for electricity and gas transmission infrastructure
   - National objectives for market integration and other aspects of the internal market

5. Research, Innovation and Competitiveness
   - National objectives and funding targets for public and private research and innovation related to the Energy Union (including time frame)
   - National 2050 objectives for the deployment of low carbon technologies
   - National objectives relating to competitiveness

These dimensions will form the basis of the NECPs in terms of targets, policies and analysis.

What role for civil society and individuals?

Under the Governance Regulation (Articles 10 and 11), Member States are required to hold a public consultation and ensure stakeholders can contribute to the drafting of the NECPs.

Public consultation

Under Article 10, Member States must ensure that the public is informed and "*given early and effective opportunities to participate in the preparation of the draft integrated national energy and climate plan",* both for the 2021-2030 NECP and the national long-term strategy (required under Article 15), and must submit these public views with their NECPs to the Commission.
Member States have to ***set reasonable time frames allowing sufficient time for the public to be informed, to participate and to express its views***.

Multilevel climate and energy dialogue

A second mechanism enables stakeholders to contribute to the NECPs. Under Article 11, each Member State has set up so-called "Multilevel climate and energy dialogues":

> *Multilevel climate and energy dialogue*
> *Each Member State shall* ***establish a multilevel climate and energy dialogue pursuant to national rules, in which local authorities, civil society organisations, business community, investors and other relevant stakeholders and the general public are able actively to engage and discuss the different scenarios*** *envisaged for energy and climate policies, including for the long term, and review progress, unless it already has a structure which serves the same purpose. Integrated national energy and climate plans may be discussed within the framework of such a dialogue.*

So civil society organisations (CSOs) can essentially participate at two stages before the submission of the final NECP:

Preparation phase

This is the period before draft NECPs are submitted when CSOs can consider what should be their main 'asks' from the NECPs. They could create an alternative NECP including pathways and key figures. Another option could be to organise consultations with government officials.

Evaluation phase

This is the period after the submission of the draft NECP in which CSOs can evaluate these draft versions and check for inconsistencies. CSOs could then develop recommendations based on their findings (and in relation to their own demands).

How will the NECPs be assessed?

Draft NECPs are expected to be submitted to the European Commission by the end of 2018, after which, the ***Commission will assess plans individually and collectively*** to see if together, they result in an achievement of the overall EU climate and energy targets.

In assessment of the draft NECPs, the Commission "may issue recommendations [and in particular set out] the level of ambition of objectives, targets and contributions in view of collectively achieving the Energy Union objectives". Importantly under Article 9.3, Member States are required to "take utmost account" of any recommendations from the Commission when finalising their plans.

Transport

An overview of transport emissions today

Transport (including shipping) is the biggest climate problem facing the EU today, accounting for 27% of the bloc's GHG emissions in 2016. While emissions decreased slightly each year between 2007-2013, since then they have only increased. In fact, transportation is the only sector in which emissions have *grown* since 1990[34]. If the EU is to achieve the global Paris climate agreement goals of pursuing efforts ***to limit the global temperature rise to 1.5ºC, transport emissions must be reduced to zero by 2050 at the very latest***.

> Non-ETS transport mostly includes surface transport (ie. passenger cars, trucks and rail).

What is the overall EU transport emission reduction target?

There is no overarching reduction target for transport at EU level. Under the CAR, the EU must reduce emissions from non-ETS sectors (transport, buildings and agriculture) by 30% by 2030. As we saw above, each Member State is assigned an individual emission reduction target for these sectors depending on their wealth. Targets across the EU range from 0% for the least wealthy to 40% for the most wealthy (for more on the CAR, see pages 14-15 above).

What policies are in place to help reduce transport emissions?

Vehicle standards are the main means by which the EU aims to reduce emissions from the transport sector. Since 2009, the EU has set legally binding CO_2 standards for cars (updating this legislation in 2014 and 2018) and new standards for heavy duty vehicles will apply as of 2020.

CO_2 standards for Light Duty Vehicles (LDV)

Light duty vehicles ***(cars and vans) account for 70% of all EU road transport emissions, and around 15% of the EU's total emissions***. In November 2017, the EU Commission launched its proposal to reduce cars and vans emissions. This is the third time the EU has set legally binding CO_2 standards for cars and vans, following the 2009 and 2014 regulations with goals for 2015 and 2021 respectively.

The proposal by the Commission was negotiated and agreed by the EU co-legislators (EU Council and EU Parliament) in late 2018. It contains a 15% and a 37.5% emission reduction by 2025 and 2030 respectively, compared to a 2021 baseline. The way it works is that each vehicle manufacturer gets a specific annual fleet-wide target that will eventually lead to the 2025 and 2030 targets. If they emit more, the carmakers must pay a fine. Additionally, the regulation aims to increase the share of Zero and Low Emissions Vehicles (ZLEVs) in the market by setting a 'soft' mandate for them, although in reality this is mostly an indicative target.

In the decision-making process, the European Parliament took a more ambitious stance opting for higher emission reduction targets for both 2025 and 2030, while the EU Council kept a more conservative position. The final agreement found a middle way for the 2030 target:

EU institution	**2025 CO_2 target**	**2030 CO_2 target**
Commission	15%	30%
Parliament	20%	40%

[34] https://www.transportenvironment.org/publications/roadmap-decarbonising-european-cars

Council	15%	35% (30% for vans)
Final agreement	15%	37.5% (31% for vans)

***Table 1**: positions of the EU institutions during the light duty vehicles CO_2 standards co-decision process*

While tough standards are important, they must also be technically feasible. A report by the International Council on Clean Transportation (ICCT) clearly demonstrates, however, that ***CO2 emissions of new cars can feasibly be reduced by over 50% by 2030***[35].

In addition, Members of the European Parliament (MEPs) voted for a strong sales target ("benchmark") for zero and ultra-low emission cars (ZLEVs) of 20% in 2025 and 35% in 2030. The benchmark was finally agreed by the institutions at 15% in 2025 and 35% in 2030.

CO2 standards Heavy Duty Vehicles (HDV)

While HDVs account for just 5% of vehicles on the road in the EU, they represent more than 25% of road transport emissions. This figure is expected to increase over the coming years as more goods are transported by road. Therefore, reducing emissions in this sector is crucial to achieving the emissions reductions necessary to meet the 2030 greenhouse gas emissions reduction target under the CAR (30% for the EU as a whole).

In May 2018, the Commission launched a proposal for Europe's first ever truck CO_2 emission standards, for the first time regulating the CO_2 efficiency of HDVs (China, the US and Japan all already have legislation that regulates truck CO_2 emissions)[36]. The Commission's proposal aims to reduce emissions in the HDVs sector using two approaches: 1) improving efficiency in the vehicles and 2) boosting market access for ZLEVs - similar to the regulation for light duty vehicles.

EU institution	**2025 CO_2 target**	**2030 CO_2 target**
Commission	15%	30%
Parliament	20%	35%
Council	15%	30%

***Table 2**: positions of the EU institutions during the heavy duty vehicles CO_2 standards co-decision process*

At the time of writing, the Regulation is still under negotiation among the EU institutions. The Commission proposes a reduction of 15% CO_2 by 2025 and 30% in 2030 compared to 2019 levels and works similarly to the cars CO_2 explained above - each manufacturer is given a fleet-wide target. Truck CO_2 emissions will be measured using the Vehicle Energy Consumption Calculation Tool (VECTO) simulation tool (as for cars, truck emissions are measured at tailpipe level). Again, ***the ICCT shows that (based on a 2015 fleet average truck) a 24% reduction (tractor unit only) is economically viable and technically feasible by 2025***, increasing to a 45% reduction (with trailers included) in 2030[37]; this 2025 reduction translates to 21% using estimations from the VECTO simulation tool.

[35] https://www.theicct.org/sites/default/files/publications/ICCT_Post-2020-CO2-stds-EU_briefing_20171026_rev20171129.pdf

[36] Only certain truck categories will be regulated by this, but together they account for around 80% of truck emissions.

[37] www.theicct.org/sites/default/files/publications/EU-HDV-Tech-Potential_ICCT-white-paper_14072017_vF.pdf

However, some 'flexibilities' are included that could undermine these targets and could lead to the achievement of targets *on paper* but not *in practice.* One of these flexibilities is the so called "supercredits", which double-counts the ZLEVs sales (meaning every one ZLEV truck sold counts twice towards the sales target, so it is easier to reach) and rewards the truckmaker by reducing the CO_2 target the more ZLEV trucks are sold, reducing from 15% to 12% in 2025.

How will these vehicles standards contribute to the CAR target?

Vehicle standards, if robust and well implemented by the EU Member States, can deliver a big part of the emission reductions that are needed to meet the EU climate targets for 2030. But even with ambitious targets, significant other policies are needed to reduce vehicle emissions, like raising fuel duty. Having said that, the level of cuts required if vehicle standards are not ambitious will likely make it impossible to achieve surface transport emission reductions of 30% by 2030, meaning bigger cuts in agriculture and buildings would be required, and Member States would likely have to buy allowances and/or pay fines. National measures would still be needed to 'close the gap', but the more robust the EU standards are, the closer countries will be to achieving their targets.

More ambitious standards, if implemented for both cars and trucks, would deliver 53% of the necessary emission reductions in the surface transport sector. The less ambitious Commission proposal, however, would only deliver 29% of the cuts required[38].

So vehicle standards are an essential first step to achieving the EU's 2030 emission reduction target of 40%, and in the long-term, to achieving the EU's zero-emission vision for 2050.

However, to achieve full decarbonisation Europe needs a fleet of entirely ZEVs by 2050. This means ***all vehicles sold by early 2030s (and by 2035 at the latest) need to be 100% zero emission***. Yet this would still not be enough to achieve zero emissions in 2050, rather achieving a limited 89% emission reduction. The ***remaining 55 Mt emission gap will be due to continued use of polluting diesel and petrol cars*** (internal combustion engine vehicles, ICEs) sold before 2035 which ***should therefore be restricted and ultimately banned***; there is, after all, a limit to the efficiency improvements possible in ICEs.

> Even if Europe sold 100% emission free cars by 2035, this would not be enough to reach zero transport emissions by 2050.

What national measures can reduce emissions from transport?

At national level, a number of measures can be taken to reduce emissions from transport:

Zero and Low Emissions Zones

Zero and Low Emission Zones can help the uptake of cleaner, more fuel efficient vehicles and ZEVs. Cars spend a lot of time in cities, but a disproportionate amount of that time is spent parked. A ***duration based charging system, whereby users pay per hour of city access, can reduce the amount of cars*** in city centres. Such a system encourages collective mobility (i.e. train, bus, or carpooling) and allows for more space to become available for better cycling, walking infrastructure, bus lanes, or parks. This charge could be further differentiated to promote the use of cleaner vehicles, through higher charges for more polluting vehicles.

Increases in fuel taxes

Fuel taxation is not only a means to earn money for the state, it ***helps internalise the externalities of transport (societal costs of infrastructure, congestion, health problems related***

[38] https://www.transportenvironment.org/sites/te/files/publications/Council%20briefing%20-%20Impact%20of%20vehicle%20standards%20on%20national%20transport%20emissions-output.pdf

to pollution, injuries and loss of life due to accidents) and more significantly, it influences the long term behaviour and choices of passengers. An increase on petrol, diesel and natural gas fuel taxes resulting in a 10% final increase of the fuel would decrease demand (passenger activity) by 3-5%[39]. But increases in price may also have other effects, such as increasing carpooling or modal shift to bus or train.

Lower speed limits

Reducing speed limits and having them properly enforced, particularly on *highways*, can reduce fuel consumption of passenger cars. One report found that *modern cars could reduce their CO_2 emissions per kilometer by up to 12% however more realistic estimates put that figure at around 3%*[40]. Reducing speed limits in *cities* would improve pedestrian and cyclist safety with less severe injuries and smaller probability of fatalities (but CO_2 savings would not be so significant).

Investment in public transport and walking and cycling infrastructure

At typical occupancy rates, cars are the least efficient form of land transport, so shifting passengers to rapid transit or active modes enables lower carbon intensive transport.

In cities, *in order to shift car passengers to public transport, an essential component is appropriate infrastructure for walking and cycling*. While a journey by car is typically characterised by door to door transport, a public transport journey is often part of a multimodal trip, and typically involve walking or cycling to mass transit stations. Although walking in itself will not be able to offer the same transport activity as cars in terms of sheer numbers, it is an integral element of facilitating the journey. Cycling enables short distance trips to be completely replaced, especially with the current uptake of electric bikes, making cycling a transport solution for more people.

Shift freight from road to rail

To shift freight from trucks to (electric) trains, the regulator must ensure that the railway infrastructure manager is treating all trains equally regarding track access, explore the idea of obliging the state-owned company to rent unused electric locomotives to new entrants that do not have the access to capital to buy such rolling stock, improve the flexibility and speed of freight services by investing in rail infrastructure that's not as complex or time-consuming as large cranes, and increase competition in the rail freight market.

Are there other policies at the EU level to reduce emissions in transport?

While vehicle standards are the main tool for reducing emissions in the transport sector, other policies certainly have an impact.

The EU Renewable Energy Directive

The EU Renewable Energy Directive (RED) has the aim of decarbonising the energy sector in the EU and setting targets for the use of energy from renewable sources, such as solar and wind. It also covers energy used in the transport sector.

In the 2009 RED ("REDI"), the EU set a target for the use of renewables in transport - 10% of the total energy used in the transport sector must be renewable by 2020. However, this target only triggered the use of food and crop-based biofuels such as palm oil, rapeseed or wheat. The use

[39] https://www.transportenvironment.org/sites/te/files/publications/2050_strategy_cars_FINAL.pdf
[40] https://www.eea.europa.eu/themes/transport/speed-limits

of these *materials for biofuels quickly displace their original use - food - causing an expansion of agricultural land into virgin areas such as tropical forests and peatlands, leading to large amounts of greenhouse gas emissions*. This phenomena is known as Indirect Land Use Change (ILUC) and because of it, *biofuels used in the EU emit (in some cases) more than fossil diesel*[41]. The Directive was reformed in 2015 setting a limit for the use of these biofuels to meet the 2020 target (max. 7%).

In 2018, the *REDII (for the period 2020-2030) was adopted and sets a clear market signal as it freezes the use of crop-based biofuels to current levels and sets specific targets for advanced fuels such as renewable electricity*. There are however concerns about the availability of materials for advanced biofuels (wastes and residues), as scaling them up to unsustainable levels can lead to indirect emissions - similar to crop biofuels. Nevertheless, a proper implementation can deliver greenhouse gas savings in the transport sector.

Clean Vehicles Directive

The Clean Vehicles Directive (CDV) was proposed also in November 2017, together with the CO_2 standards for LDVs regulation. The main goal of this legislation is to increase the market uptake of clean/ZLE vehicles in public procurement. This directive, therefore, aims to decarbonise transport by working on the demand side, especially on the HDVs sector (i.e. city buses, waste collection vehicles) but also, at a smaller scale, light vehicles such as mail delivery vehicles or vehicles used in public services. The responsibility is thus on the public entities in charge or operating these services - i.e. STIB in Brussels (Belgium) or Transport for London in London (UK).

Energy Efficiency Directive

The Energy Efficiency Directive was agreed in 2018 and it sets an EU-wide indicative target to improve energy efficiency by 32.5% by 2030, compared to 2013. To account for these improvements on energy efficiency, *each Member State can decide if it wishes or not to include the energy consumed in transport in its energy consumption baseline* - it's left at each country's discretion. This is a big loophole: not accounting for the energy used in transport wouldn't reflect the real total energy consumption in the country, and therefore any achievements in energy savings, while welcome, would be 'fake'. On the contrary, if energy in transport would be accounted for in the baseline, transport would play a key role in achieving the energy efficiency goals, which would trigger strong(er) measures to decarbonise transport.

Eurovignette Directive (road charging)

As with fuel taxes, road charging can contribute to increasing car costs, promoting smarter passenger demand and modal shift to cleaner transport modes. On 31 May 2017, the European Commission published its proposal to review the Eurovignette Directive which determines how Member States can charge vehicles for their use of road infrastructure. Road charges are either applied as distance-based tolls, whereby a vehicle is charged per kilometer it travels, or by a time-based vignette, which allows a vehicle to travel as much as possible within a given time-period. The proposal seeks to phase out time-based charging systems, so-called 'vignettes', in favour of *distance-based tolls, which are widely considered to encourage more efficient driving behaviour*. In addition, the proposal looks to make the toll charge applicable to all trucks and buses over 3.5 tonnes, and require differentiation of charges based on the CO_2 emissions of the vehicle (with an additional discount for zero-emission technologies), which would provide an incentive to logistics companies to invest in cleaner vehicles.

The European Parliament met in October 2018 to agree on a revision to the Directive. They voted in favour of the above amendments and called for a 50% discount to zero-emission vehicles,

41 https://www.transportenvironment.org/sites/te/files/publications/2016_04_TE_Globiom_paper_FINAL_0.pdf

and decided that from 1 January 2022 toll differentiation according to a vehicle's emission standards must apply to cars, as well as trucks/buses. At the time of drafting, this proposal for a revision to the Eurovignette Directive awaits a decision by Council before it can move to trilogues.

Where are EU MS on achieving these targets?

As mentioned above, transport is the only sector where emissions have actually increased since 1990. In figure 3, you can see how emissions from transport have increased in all EU member states, with the exception of just four (Lichtenstein, Lithuania, Estonia, and Sweden).

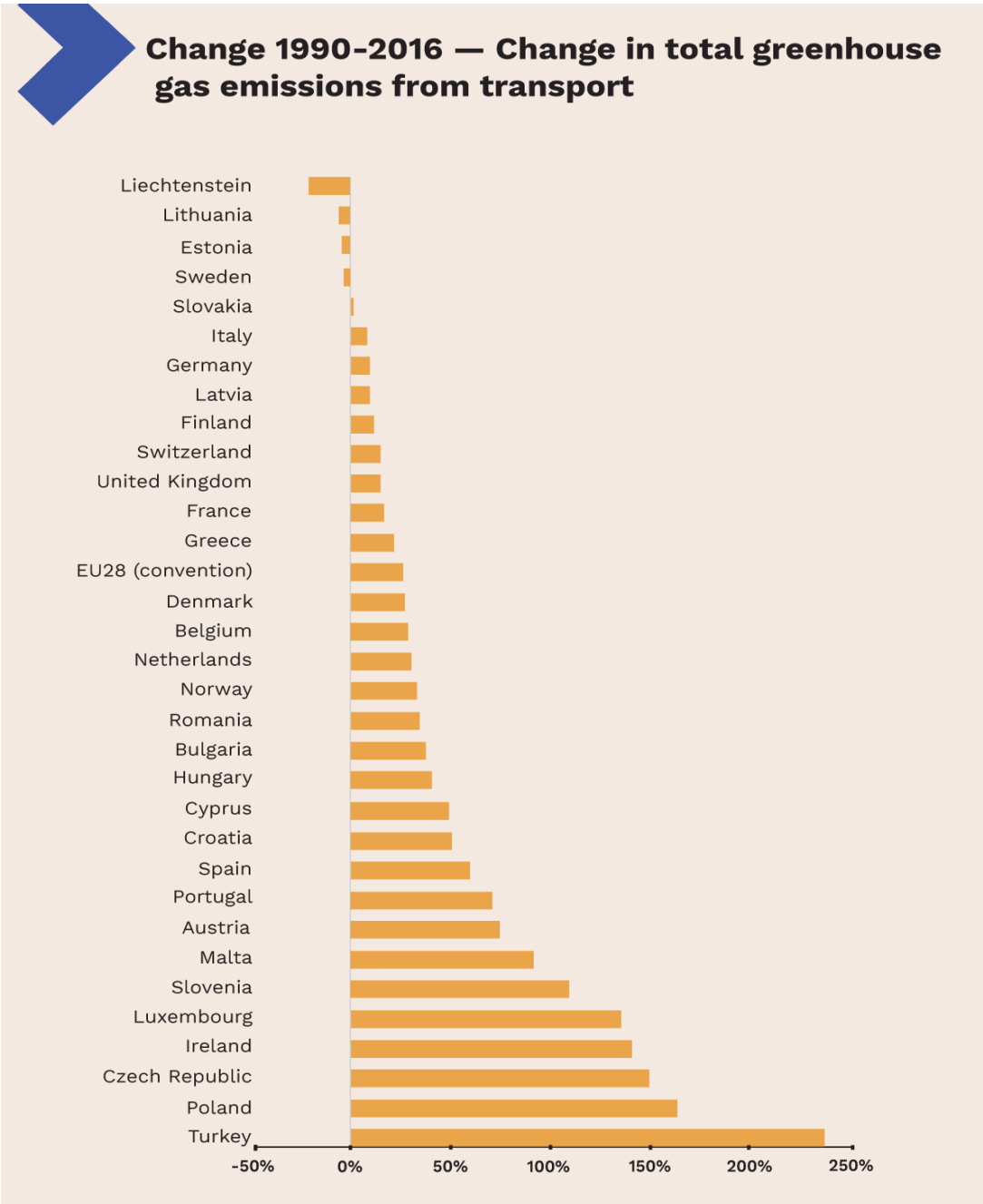

***Figure 4**: Change in GHG emissions from transport from 1990-2016; EEA*

Despite this some positive measures have been taken in recent years, with a growing trend towards ZEZ and pledges to phase out the sale of diesel and petrol cars over the next decade. London has announced a toxicity charge while Oslo, Paris, Madrid, Athens and Rome have pledged to ban diesel cars altogether in the years to come.

City	Measure	Minimum standard allowed	Entry into force
Amsterdam	LEZ (taxis)	Euro 5	Jan 2018
Athens	odd-even rationing + LEZ aspect	Euro 5	May 2012
Berlin	LEZ	Euro 3 + DPF / Euro 4	Jan 2010
Brussels	LEZ	Euro 2	Jan 2018
Lisbon	LEZ (two sub-zones)	Euro 3 / Euro 2	Jan 2015
London	CC, T-charge / ULEZ	All vehicles*/Euro 6	Feb 2003 / April 2019
Madrid	parking LEZ	All vehicles	Mar 2012
Milan	CC, LEZ	Euro 4 + DPF	Oct 2017
Oslo	CC, LEZ	Electric vehicles	Oct 2017
Paris	LEZ	Euro 3	July 2017
Stockholm	CC	All vehicles	Aug 2007

Table 3: *European cities with LEZ for cars; T&E report (2018) 'City bans are spreading in Europe'*[42]

On top of this, in Germany - the center of the car industry - the highest civil court has confirmed that German city councils have the right to ban dirty diesel cars from city centres to bring air pollution down to legally required limits. The Federal Administrative Court (BVG) said on 27 February 2018 that cities are entitled to ban the most polluting engines if there are no other effective measures to reduce pollution; in fact they must do so if that is the most effective measure to reduce pollutants, particularly nitrogen dioxide (NO_2).

Note: there are large differences in the environmental zones implemented so far. Some policies permanently exclude polluting vehicles and are intended to drive modal shift to cleaner transportation options. Others are of temporary nature in response to hazardous air pollution episodes. Overall, one of the key weaknesses of measures introduced to date is the blanket exemption for Euro 6 vehicles. Less than 10% of new Euro 6 diesels on sale today meet the EU emission limits; the remaining 90% still exceed the nitrogen oxides limit by 4 to 5 times and some models up to 10 times. This is having a huge impact on air quality. Any serious attempt to improve air quality must consider the real-world emissions of vehicles and ultimately move to remove polluting ICE vehicles from our roads.

This is all to say that there is still a lot of progress to be made to reduce emissions in the transport sector. At the EU level, strong passenger car and truck emissions standards are

[42] https://www.transportenvironment.org/publications/city-bans-are-spreading-europe

needed for both 2025 and 2030, with a view to bringing transport emissions down to zero by 2050.

Checklist for proper implementation of policies

Broadly speaking policies should reduce overall emissions. That means that they should not work against other policies to reduce emissions, and they shouldn't create a rebound effect by pushing the problem further afield. This passes as well by improving city planning to incorporate/ease the use and promotion of alternative ways of travelling within cities and commuting, including walking.

Checklist:

- Low and Zero Emission Zones - these need to be based on real-world driving emissions; for example, research shows that Euro 6 diesels still break legal limits for air pollution, which means allowing them into ZLEV zones severely restricts the ability of the zone to improve air quality
- Road charging - vehicles should be charged according to distance not time as this is proven to encourage more efficient transport behaviour
- Energy Efficiency Directive - each Member State should ensure that they include how much energy is consumed in the transport sector within the calculation of their energy consumption baseline, this will provide a more realistic overview of how much energy they actually consume
- Fuel tax parity - diesel should be taxed at the same rate as petrol, and both should include a charge to help better 'internalise' the external costs of burning fuel (ie. air pollution, noise pollution and health costs).
- Countries and cities should work on the improvement (or development) of infrastructure for alternative modes of transport, such as cycling, shared mobility (car, bike, motorbike sharing), efficient public transport, etc. This includes making cities and areas easier and more appropriate to use these modes of transport, for instance by improving safety.
- Countries should not rely on the use of crop-based biofuels as "renewable" energy for transport. Instead, the focus should be on cleaner and truly renewable energy sources such as renewable electricity and advanced biofuels made of wastes and residues.

Agriculture

An overview of agriculture emissions today

2018 once again demonstrated how much farmers are already being affected by the increasing frequency and magnitude of extreme weather events caused by climate change. At the same time, the farming sector is also a major source of different greenhouse gases (GHG), namely methane (CH_4), nitrous oxide (NO_2) and carbon dioxide (CO_2). These gases are formed during different biological and chemical processes.

The different sources within livestock and arable farming will be explained below. Since the emissions from agriculture are reported internationally within two different reporting categories, the different sources are grouped accordingly.

Reporting category "Agriculture"[43]

Nitrous oxide is mainly emitted from soil as a result of biological and chemical processes involving inorganic nitrogen compounds from fertilizers. A smaller percentage (13%) of agricultural nitrous oxide emissions is linked to animal manure. Nitrous oxide from soil and manure accounted for 4.6 % of the total EU-28 GHG emissions in 2016[44]. Methane emissions originate from livestock farming. The digestive processes of ruminants (called "enteric digestion"; mainly from cattle) account for 81% of the methane emissions from agriculture. The remaining methane emissions come from animal manure. Methane emissions from enteric digestion and manure account for 5.8 % of the total EU-28 GHG emissions[43]. In the EU's GHG inventory, the sources mentioned above are recorded within the reporting category "Agriculture", along with the much smaller amounts of emissions from field burning of agricultural residues, liming, urea application and rice cultivation.

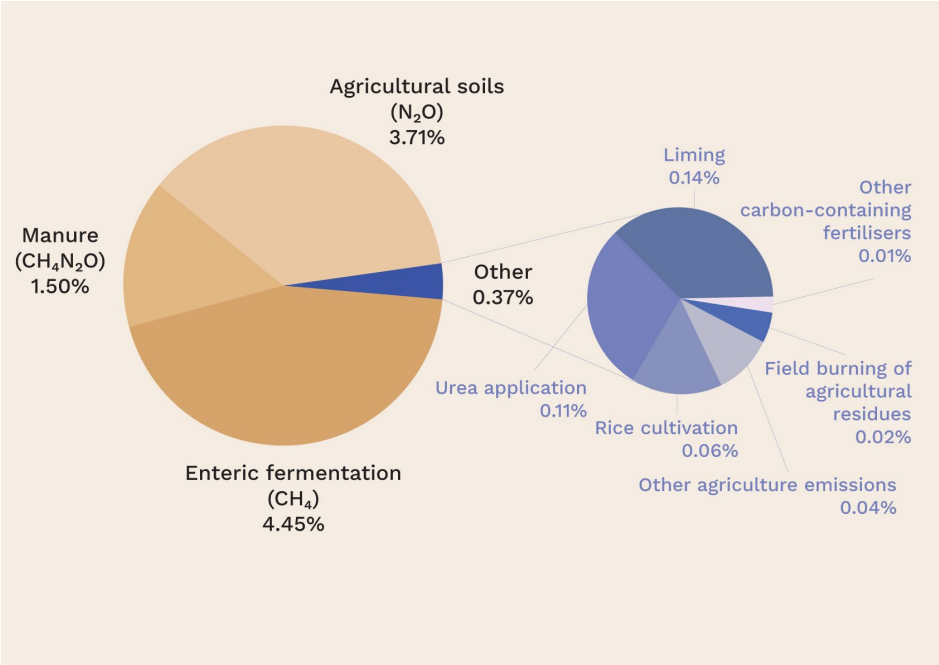

Figure 5: *Composition of GHG emissions from agriculture in the EU in 2016*

Within member states, GHG emissions from agriculture play different roles. While France has the highest GHG emission from agriculture in absolute terms (followed by Germany and the UK), Ireland is the country where GHG emissions from agriculture hold the highest relative share of the national GHG inventory (followed by Latvia and Lithuania). Likewise, the contributions from

[43] Since agriculture is responsible for 10% of total emissions, dividing the percentages by ten gives the respective share of total EU-28 GHG emissions. Based on EEA GHG inventory report 2018

[44] https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2018

livestock and arable soils differ significantly between countries, with emissions from the livestock sector ranging from more than 70% to less than 50%. (see Figure 6 below).

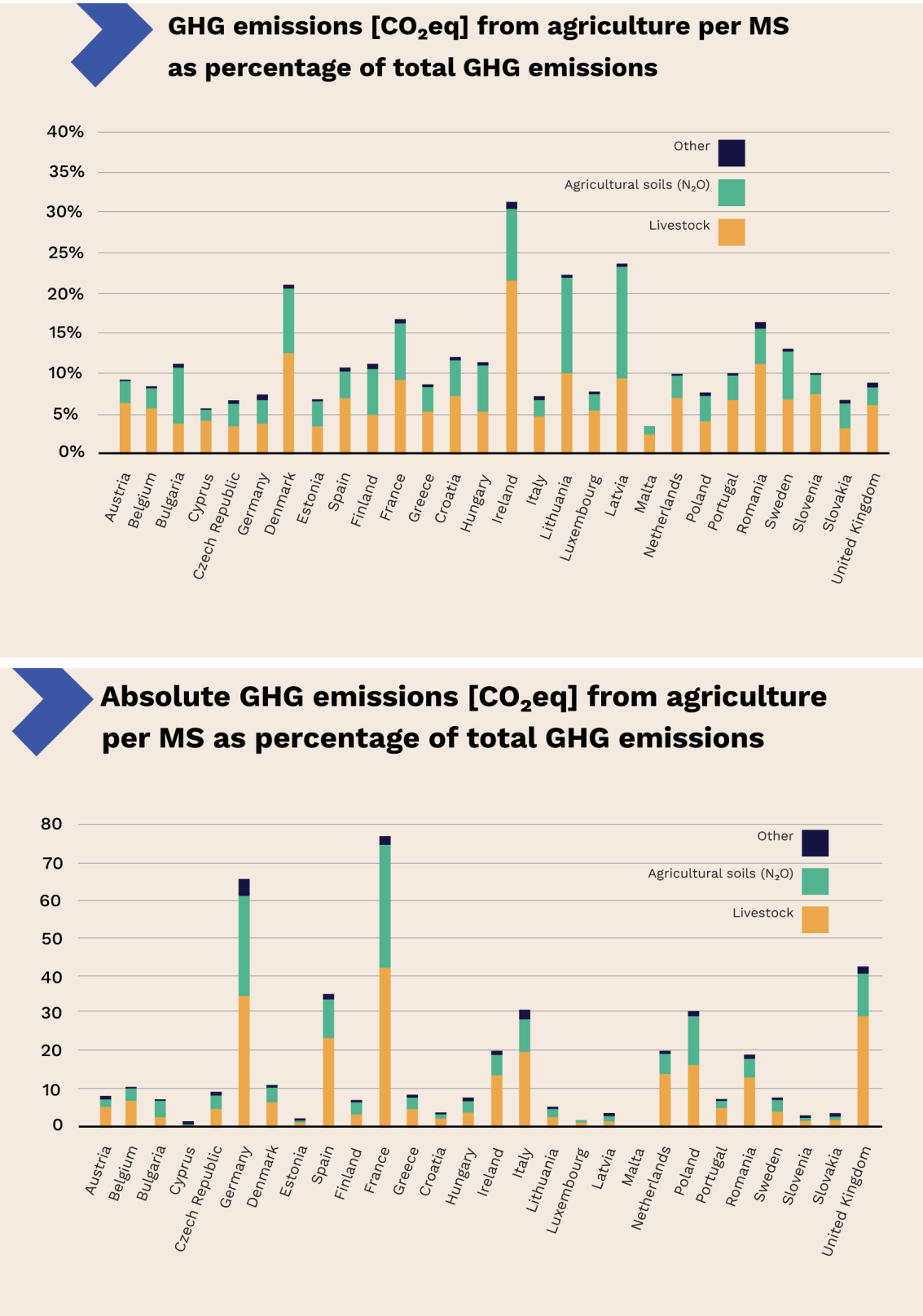

Figure 6: *Absolute and relative 2016 GHG emissions from agriculture per Member State.*

Reporting category "Land Use, Land Use Change and Forestry" (LULUCF)

When plants grow, they extract CO_2 from the atmosphere and convert it into organic molecules, locking it down in a process known as carbon sequestration. These molecules can be stored in the stems and roots of trees and other woody perennials, but also as organic matter in soils.

Naturally, the type of land use influences the amount of carbon stored in trees and soil organic matter. The two land use categories relating to agriculture are grassland and cropland. While the amount of soil organic matter in grassland is usually higher compared to cropland, both store much less carbon compared to forests or wetlands (peatland).

On the other hand, the way land is managed also influences the rate at which soil organic matter forms or breaks down, leading to the release of CO_2 into the atmosphere. For instance, soil disturbance by plowing as well as drainage result in the loss of organic matter and thereby higher carbon emissions.
The emissions from these types of land use and changes in land use are reported under the category LULUCF. These emissions can be negative as well as positive, since CO_2 can be sequestered in trees and soils, but can also be released again. Therefore, all these emissions were summarized in a separate category.
For the whole EU, the overall emissions from LULUCF (i.e. including forests etc.) are negative, meaning that the sector is a net carbon sink. However, currently only the forest sub-sector stores more carbon than it emits. Crop- and grassland are a net source of 73 Mt CO_2eq (compared to 430 Mt CO_2eq from the reporting category "Agriculture" detailed above)[45]

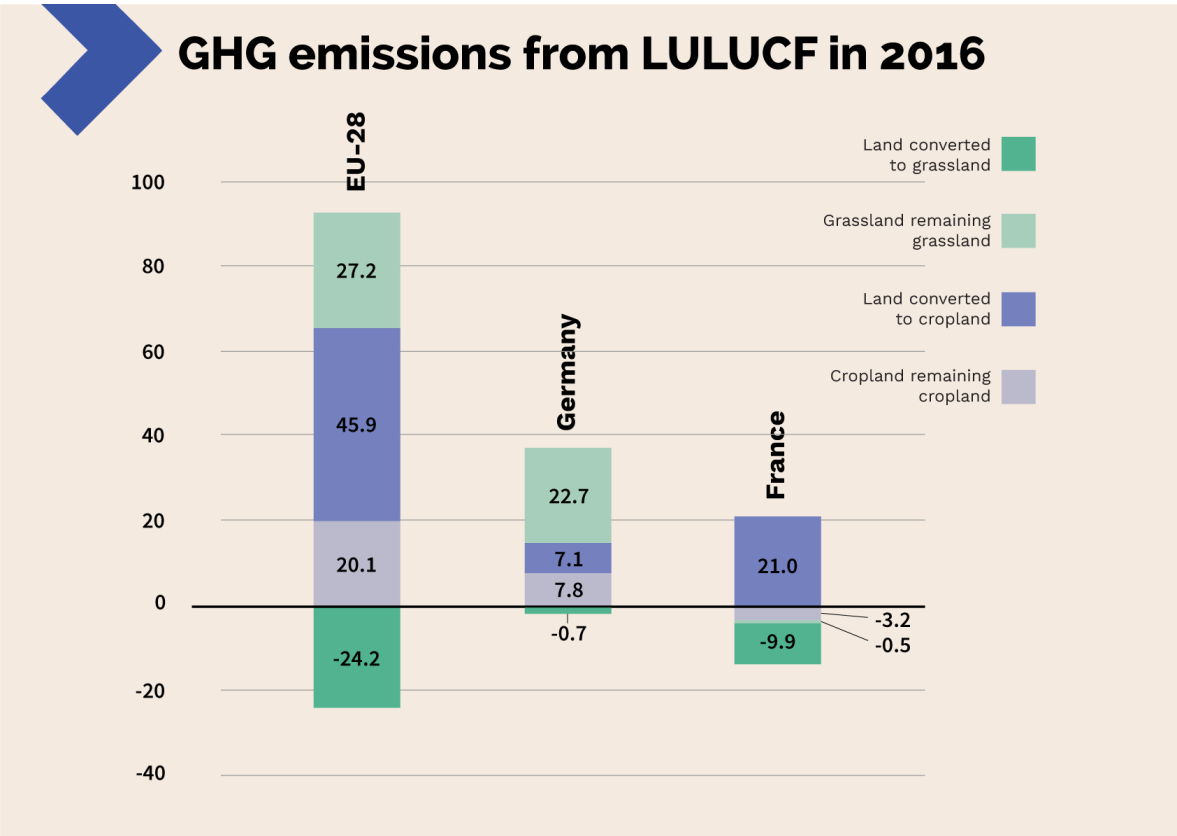

Figure 7: GHG emissions [in CO2eq] from farming in LULUCF in 2016. Based on EEA GHG inventory report 2018

[45] https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2018

Figure 7 shows the different net emissions (in Mt CO_2eq) and removals from the LULUCF sub-categories from cropland and grassland. These sinks and sources differ considerably between countries as indicated by the examples for Germany and France. France for instance overall has more mineral soils compared to Germany which has more organic soils. While the carbon stock in mineral soils can often still be improved (especially compared to intensive management in the past), organic soils often still lose carbon. This explains why German grassland is a large source of emissions while in France overall grasslands even present a small net-sink.
Other aspects influencing these statistics in different countries are crop rotations that include grassland (i.e. non-permanent grassland) and the abundance of woody crops (i.e. orchards, vineyards, Christmas trees, bushes, and olive trees), which provide a net carbon sink. Similarly, the number of trees and hedgerows on grassland and cropland can influence net emissions from this category (see footnote 45).

It should also be noted that even the overall emissions from LULUCF differ immensely between countries. While in countries like France, Spain and Sweden, the LULUCF sector represents an overall sink of emissions, it is a net source in countries like Denmark, the Netherlands and Ireland. It is no coincidence that the latter have a large agricultural sector and comparably small forestry sector (see footnote 45).

Emissions from farming in other categories

In addition to the two categories detailed above, there are also emissions upstream and downstream of farming activity. For instance, the production of mineral nitrogen fertilizers is very energy intensive and accounts for about 1.7% of total EU-28 GHG emissions[46], but these emissions are assigned to the chemical industry in the category "Industrial Processes and Product Use".
Likewise, emissions from energy and fuel consumption for agricultural machinery or greenhouses are reported in the category "Energy", subcategory "Transport - Agriculture/Forestry/Fishing".
However, policies aiming to reduce emissions from farming activity usually include all these sources as well and thereby don't limit themselves to the reporting categories. For instance, investing in more energy-efficient irrigation pumps would still be considered a climate mitigation measure under the Common Agricultural Policy.
Moreover, it should always be kept in mind that Europe's agricultural supply chains also cause emissions in other countries. For instance, soy imported as animal feed from Brazil would be associated with emissions from soil and often also deforestation in that country. It could be argued that the EU imports these emissions, in addition to the emissions that are reported on a national level.
This needs to be kept in mind when climate policy measures are designed, in order to ensure that emissions do not just move around or even increase elsewhere in the system.
Last but not least, a lot of food is currently wasted – by consumers as well as retailers, producers and farmers themselves. Along the entire value chain, the emissions from food waste account for about 10% of GHG emissions[47].

What is the overall EU agriculture emission reduction target?

As we've seen with the transport section above, there is no overarching reduction target for agriculture at the EU level. Under the CAR, the EU must reduce emissions from non-ETS sectors (transport, buildings and agriculture) by 30% by 2030. In order to achieve this, each Member State is assigned an individual emission reduction target for these sectors depending on their

[46] https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2018
[47] https://www.ifoam-eu.org/sites/default/files/ifoameu_advocacy_climate_change_report_2016.pdf

wealth. Targets across the EU range from 0% for the least wealthy to 40% for the wealthiest (for more on the CAR, see section pages 19-20 above).

Nevertheless, it is possible to draw some conclusions from the current and future relative share of agricultural emissions in each Member State.

Ireland for instance has a 30% GHG emission reduction target under CAR. At the same time, Ireland's agriculture sector is responsible for more than 30% of its total national GHG inventory and even 44% of just the CAR sectors[48]. At the same time, Ireland's LULUCF sector is a net source, because the small forestry sector cannot compensate for CO_2 emissions from grasslands and peat extraction from wetlands. Accordingly, Ireland will hardly be able to reach its climate reduction targets without reducing emissions from agriculture.

Economically speaking, the cheapest emission reduction measures would usually be implemented first, regardless of the sector. However, in addition to the financial abatement cost of climate measures, there is often also a political price attached to designing and implementing them. Therefore, national sectoral targets are usually based on a number of factors. In the case of Ireland, where agriculture and dairy exports is a major pillar of the economy, emission reduction might therefore be focused on other sectors.

On the other hand, the German agriculture sector contributes only about 7% to the total national GHG inventory. Nevertheless, Germany is also planning to implement measures to reduce emissions from farming. The rationale here is to create some manoeuvring space for other sectors such as Energy and Industry.

Most importantly however, it should be kept in mind that emission reductions in agriculture are often much harder to achieve compared to sectors where purely technical solutions are already available. In other words, there are no short and steep mitigation pathways for emissions from farming. With respect to the objective of reaching net-zero emission in 2050, it is therefore important for each Member State to identify sustainable long-term mitigation pathways[49] helping their farmers in the transition towards a climate neutral agricultural sector.

These sets of measures, practices and policies need to be implemented immediately to avoid disruptions and stranded assets that would only harm the farming sector.

What policies are in place to help reduce agriculture emissions?

On an EU level, it is only the Common Agricultural Policy that addresses emission reductions directly, but in absence of binding EU targets, any investment in GHG mitigation remains voluntary. However, since agriculture so heavily interacts with our landscapes, nature, and environment, the policies and measures protecting biodiversity, water quality, and air quality often also lead to GHG emission reduction.

Common Agricultural Policy (CAP)

Making up almost 40% of the EU's budget during the programming period 2013-2020, the Common Agricultural Policy (programming period 2014-2020) is potentially the most relevant tool to influence and steer the EU's farming sector. It is currently being reformed for the period 2021-2027.

The (current) CAP has three main environmental instruments, namely:

[48] http://www.caneurope.org/docman/climate-energy-targets/3138-submission-how-the-state-can-make-ireland-a-leader-in-tackling-climate-change/file
[49] https://link.springer.com/article/10.1007/s10584-013-0909-y

1. Cross-compliance, consisting of mandatory Statutory Management Requirements (SMR) and Good Agricultural and Environmental Conditions (GAEC), without financial support
2. Greening, consisting of mandatory environmental and climate-friendly practices, with financial support
3. Environmental measures under the Rural Development Program (RDP)

All these instruments have brought some climate benefits, although with limited impact.
The inclusion of the nitrates directive for instance was the main driver for the reduction of nitrous oxide emissions from soil[50]. Likewise, many GAEC measures delivered co-benefits with respect to climate change mitigation (see Table 1 below).
Likewise, the RDPs of many countries include schemes on climate friendly farming practices or support measures aiming to reduce water pollution, improve air quality or increase biodiversity, which also have co-benefits for our climate.

However, overall it is questionable at best whether the current CAP is actually helping to reduce emissions from agriculture, as becomes obvious when one compares the vast amount of money available to the actual emission reductions achieved.

In their Fitness check of the CAP, Pe'er et al. (2017) for instance state that "*there is no visible effect of climate action under the CAP on the EU's agricultural GHG emissions*" and the "*slight overall reduction since 2001 and also a recent increase since 2012 can mainly be explained by changes of the bovine herd size and fertilizer use*".

Main issue	**No**	**Requirements and standards**	**Link to Climate Mitigation**
Water	GAEC 1	establishment of buffer strips	protection of carbon stores in permanent grassland and soils
Soil and carbon stock	GAEC 4	minimum soil cover	protection of soil carbon and reduced risk of erosion
	GAEC 5	minimal land management reflecting site specific conditions to limit erosion	protection of soil carbon and reduced risk of erosion
	GAEC 6	maintenance of soil organic matter level through appropriate practices including a ban on burning arable stubble, except for plant health reasons	reduced GHG emissions from fires and potential to use residue in order to promote soil carbon
Landscape minimum level of maintenance	GAEC 7	retention of landscape features, including, where appropriate, hedges, ponds, ditches, trees in line, in group or isolated, field margins and terraces, and including a ban on cutting hedges and trees during the bird breeding and rearing season and, as an option, measures for avoiding invasive plant species	protection of carbon stores and sequestration potential in woody vegetation, wetlands and soils

***Table 4**: Selected GAEC measures which can bring climate co-benefits*[51]

[50] https://www.idiv.de/web/cap_fitness_check.html
[51] https://ieep.eu/uploads/articles/attachments/50d55380-e29d-4e41-9a96-f1d011328828/Art%2010%20study%20final%200108%20clean.pdf?v=63687224233

With respect to Greening, the European Court of Auditors comes to similar conclusions regarding the effectiveness of the CAP in contributing to its own climate objectives. In their "Special report: Greening: a more complex income support scheme, not yet environmentally effective"[52], the ECA states that while 77% of EU farmland in 2016 was subject to Greening, it only lead to a change in farming practices on around 5% of EU farmland, with the reasons being the overlap with cross-compliance and the general modesty of Greening requirements that often merely reflect normal farming practices. Furthermore, the report describes that "*among green payment recipients, a total of 65 %, farming around 16 % of the EU farmland declared for direct payments, were fully exempt from all greening obligations*".

With respect to Greening measures protecting grassland and thereby bringing climate benefits through soil carbon conservation, the report notes that, while the relative share of grassland increased by 1.5%, there was an actual loss of 3 mio ha of permanent grassland.
The findings of the ECA's special report on Greening are also reflected in their previous "Special report: Spending at least one euro in every five from the EU budget on climate action: ambitious work underway, but at serious risk of falling short"[53]. The report found that "*assumptions concerning the contribution from agricultural direct payments to the climate action target lack sound justification*" and that the contribution of the first pillar to climate action is overestimated by at least 9 billion Euro, simply because of an over-optimistic methodology and false assumptions used by the European Commission.

How will these policies contribute to the CAR target?

The next CAP covering the period 2021-27 is currently being negotiated.
While the Commission's proposal claims higher climate ambition and expects that 40% of the expenditure under the future CAP will be related to climate actions, it is even more questionable if the future CAP will deliver actual GHG emissions reduction[54] [55]. This is because rebound effects or flawed spatial targeting (e.g. afforestation or bioenergy crops on peatland soils) could result in net positive emissions due to a specific measure.
More importantly, "*the contribution these funds would make to preventing climate change is unknown, as it would depend on the measures selected by the Member States*", as the European Court of Auditors (ECA) notes in their 2018 "Opinion concerning Commission proposals for regulations relating to the Common Agricultural Policy for the post-2020 period"[56].

In the current programming period, the Commission directs 20% of non-greening payments as contribution towards climate action, largely because of cross-compliance, while the ECA only saw a justification for 10%. It is therefore no surprise that it also deems the 40% weighting of basic income support in the CAP post-2020 as "unrealistic".

Most importantly, the ECA rightfully concludes that "*overestimating the CAP contribution could lead to lower financial contributions for other policy areas, thus reducing the overall contribution of EU spending to climate change mitigation and adaptation*".

[52] https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=44179
[53] https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=39853
[54] https://ieep.eu/publications/cap-2021-27-proposals-for-increasing-its-environmental-and-climate-ambition
[55] http://www.europarl.europa.eu/thinktank/en/document.html?reference=IPOL_BRI(2018)617494
[56] https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=39853

What national measures can reduce emissions from agriculture?

There are significant differences between the agricultural sectors of different Member States. This is because of different soil types, climate, farm structure and different agricultural outputs produced.

Accordingly, there is no "one size fits all" approach. The section below describes possible technical options that bring climate benefits if implemented well and under the right conditions. In any case, an equally crucial factor to the effectiveness of these measures and practices is which policies are put in place to reduce the barriers that prevent their full implementation. Whether taxes, subsidies, credit guarantees, fines, permits, labelling or awareness raising programs are most appropriate depends on the national context as well as the desired mitigation measure and practice.

Reducing CO_2 emission from soil and increasing carbon stocks

Minimal soil disturbance[57] (e.g. reducing the depth and/or frequency of tillage) can conserve soil organic matter and at the same time reduce fuel usage. However, this measure should not come at the expense of increased pesticides use.
Crop residue left on the field during fallow periods[58] can be turned into soil organic matter by soil organisms. At the same time, this measure also increases soil fertility, thereby reducing fertilizer requirements and subsequent GHG emissions.
Similarly, the use of **cover crops[59]** alters the biogeochemical processes in the soil and conserves/increases solid organic matter and reduces nitrous oxide emissions.
Northern countries with large amounts of peatland soils (histosols), such as Germany or the Baltic States, can reduce emissions significantly by raising water levels on these soils.
Measures such as **wet agriculture or paludiculture[60]** may also often bring additional benefits e.g. for climate change adaptation. These solutions usually require the agreement of many farmers, since the water level would be raised in an entire area. Therefore, intensive awareness raising can be necessary. In Germany, this measure is subsidized within the RDP of the federal state Brandenburg[61].
Agroforestry[62] presents another way to sequester carbon in agricultural systems by "*the integration of trees and shrubs [e.g. hedgerows] with livestock and/or crops*". In Ireland for instance, more carbon is stored in hedgerows than in trees, which illustrates the potential of this measure.

Reducing nitrous oxide emissions from soil

There can also be climate benefits from **reduced fertilizer use**. Ways to reduce fertilizer use are to match it more precisely with plant needs or to apply **variable rate fertilization** (precision agriculture). These measures are usually best supported by education programs or loans for necessary investments in new machinery. Since fertilizer reduction also lowers costs, this measure should only be subsidized in exceptional cases.
Using **organic instead of synthetic fertilizers** can reduce upstream emissions from fertilizer production if emissions from manure handling and storage are managed well.

[57] http://solmacc.eu/climate-friendly-practices/optimised-tillage-system/
[58] https://www.cedelft.eu/en/publications/2196/cutting-emissions-from-farming
[59] https://link.springer.com/article/10.1007/s13593-016-0410-x#Sec12
[60] https://www.moorwissen.de/en/paludikultur/paludikultur.php
[61] https://lfu.brandenburg.de/cms/detail.php/bb1.c.427130.de
[62] http://solmacc.eu/climate-friendly-practices/agroforestry/

Reducing emissions from livestock

When it comes to methane and nitrous oxide emissions from livestock, reduction becomes more difficult. Many approaches try to increase emission efficiency. Ireland for instance maintains a national breeding program funded through its RDP among other aspects aiming to reduce methane emissions from cows.

These approaches bear the danger that the agricultural sector is locked in an intensive system which still reaches the end of its mitigation pathway. At the same time, it will be much more difficult and costly to switch from such a system to an alternative long-term sustainable mitigation pathway.

With respect to manure, the storage and handling can be improved, e.g. by shortening storage times or using air-tight covers. Anaerobic digestion of manure (creation of methane for biogas) is also mentioned as a climate mitigation measure. However, the climate benefits of this measure heavily depend on the design of the policy supporting it. This is because making manure profitable can also set incentives to intensify and increase production. Furthermore, the digestion process requires additional non-manure feedstock such as maize.

Other policies

On a national level, different policies might impact GHG emission reduction positively or negatively.

Policies encouraging citizens to reduce their consumption of animal products will provide climate benefits; however, as the EU is also exporting vast amounts of dairy products, policies targeting consumer choices can only be an accompanying measure to changing the production side.
Having such export-oriented agricultural activity can have large impacts on the agricultural sector.
In Ireland for instance, agricultural emissions are projected to grow by 9% for the period 2013-2020 or 3% above 2005 levels, despite the focus on climate mitigation in the Irish RDP.
This increase can be explained by Ireland's national "Food Harvest 2020" strategy[63], which among other things sets the 2020 target of increasing milk production by 50% - following the expiration of milk quotas in 2015. (DAFM, 2015). Similarly, Ireland's Foodwise 2025 program[64] continues this trend, stating that "*The abolition of the EU Milk Quota regime presents the Irish dairy sector with the freedom to realize its full potential in terms of output, export earnings, rural employment and investment* [...]".
With 40% of the EU's food being wasted, policies aiming to reduce food waste on both the producer and consumer side can also bring significant benefits.

Are there other policies at the EU level to reduce emissions in agriculture?

As mentioned earlier, many agriculture-related policies that provide climate benefits are actually aiming to solve different policy objectives in the first place. In other words, activities that harm our climate often also pollute water and air or are harmful for biodiversity. Several policies regulating such activities that lead to GHG emission reduction as an incidental co-benefit are detailed below.

[63] https://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodharvest2020/2020FoodHarvestEng240810.pdf
[64] https://www.agriculture.gov.ie/foodwise2025/

Fertilizer Directive

The Nitrates Directive (91/676/EEC) aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. It includes measures to reduce fertilizer run-off and leeching, but also the reduction of overall fertilizer use, for instance by setting regional limits or incentivizing more efficient fertilizer use. Through this reduction of overall fertilizer use, the nitrates directive is seen as one of the main drivers reducing nitrous oxide emissions from agriculture in the 1990s[65].
The significance of the Nitrates Directive for the reduction of nitrous oxide emissions is also illustrated by the fact that, for instance, Germany listed the "amendment to the fertilizer application ordinance" as one of three mitigation measures for the agricultural sector in its "Climate Action Programme 2020" [66].

Other EU policies

Even though methane is currently excluded from the National Emissions Ceiling (NEC) Directive (2016/2284/EU) on air quality, measures taken to reduce ammonia emissions from agriculture often also affect the levels of nitrous oxide and methane emissions. This is because the sources and mitigation options for air pollutants and GHG often overlap.
Likewise, the Industrial Emission Directive (IED) (2010/75/EU) can also have positive side effects with respect to GHG mitigation, for instance by making adequate manure storage mandatory for larger pork and poultry farms[67]. This is especially relevant, because such facilities are not within the scope of the CAP since production is too industrialized to fall under national definitions of "farming".

Animal welfare policies can indirectly help to reduce emissions if they lead to a net reduction of the number of livestock. However, the relation between climate mitigation in the livestock sector and animal welfare is ambiguous and full of potential pitfalls[68].

While management options or technical options exist, we also need to address food consumption if climate targets are to be taken seriously.

Where are EU Member States on achieving these targets?

While, as mentioned earlier, there are no sectoral targets under CAR, it is possible to draw some conclusions from the relative share of agriculture in a member state, its overall target under CAR and the latest projections of the 2018 EEA report on GHG "Trends and projections in Europe 2018".
In 2016, the Effort Sharing emissions of six member states (Belgium, Finland, Germany, Ireland, Malta and Poland) exceeded their respective Effort Sharing emission targets[69]. Since Ireland had by far the highest percentage of emissions from agriculture, it has no other chance than to address these emissions if it wants to reach its GHG

For the whole EU, emissions from agriculture have been rising again since 2012 and in 2016 reached the same level they were at in 2006 (see Figure 8 above). Within the same time frame, emissions in all other sectors together have steadily declined by 18%.

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[65] https://www.idiv.de/web/cap_fitness_check.html
[66] https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/aktionsprogramm_klimaschutz_2020_broschuere_en_bf.pdf
[67] http://eippcb.jrc.ec.europa.eu/reference/BREF/IRPP/JRC107189_IRPP_Bref_2017_published.pdf
[68] https://www.mdpi.com/2076-2615/5/2/361
[69] https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2018

While emissions from all other sectors are projected to decrease further, albeit slower than necessary, emissions from agriculture are projected to increase in absolute terms. That means that the relative share of GHG emissions is going to increase as well.
Naturally, this illustrates the urgency with which these emissions need to be addressed already now in light of our common objective of achieving net-zero emissions in 2050.

Member States need to realize that minor changes within the system or sparing the agricultural sector in the first place will not be sufficient. Instead they should initiate a transition towards sustainable livestock production and healthy and sustainable diets that are higher in plant-based foods and include considerably less and better produced meat, dairy and eggs.
A more holistic solutions would not just benefit our climate, but also protect biodiversity, improve water & air quality as well as animal welfare.

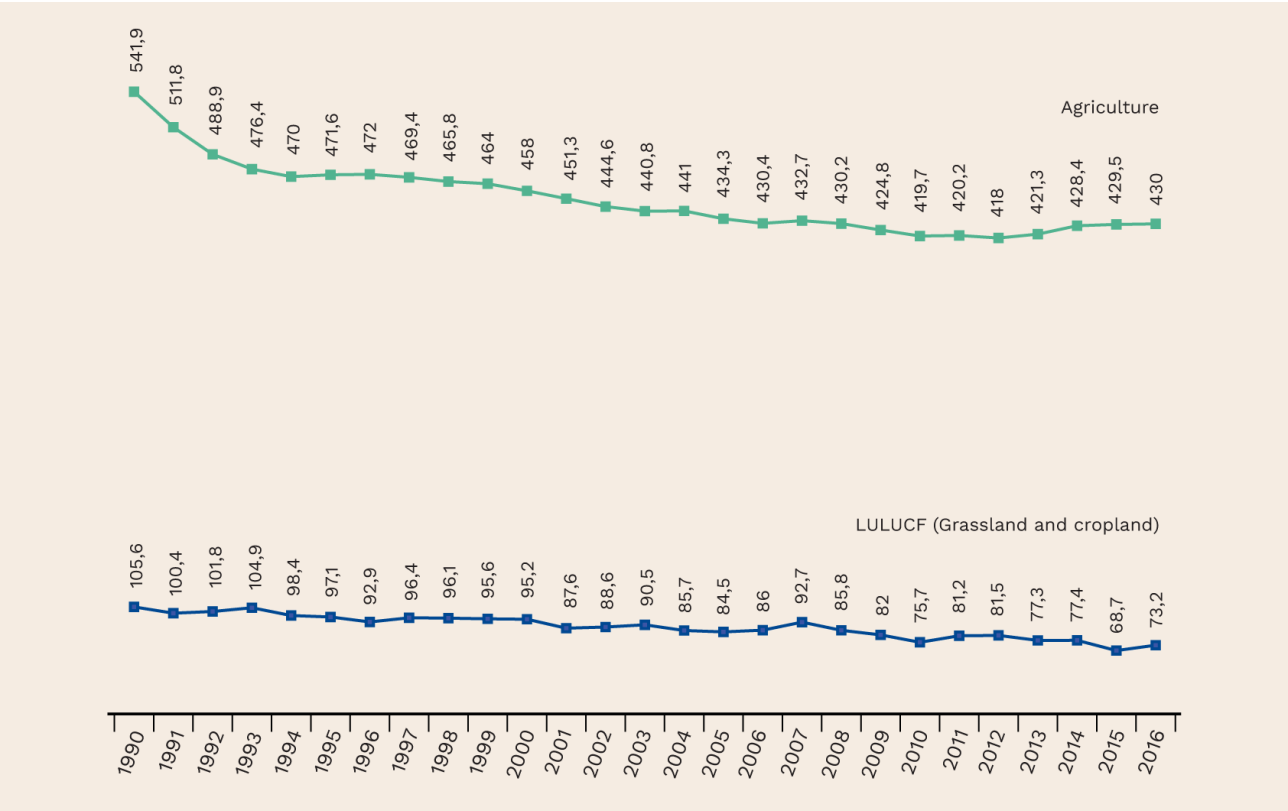

Figure 8: *Evolution of EU-28 GHG emissions from agriculture (Mt CO2eq). EEA GHG inventory report 2018*

However, this requires not just finding suitable long-term mitigation pathways, but also making them fair and safe economic routes. Redirecting public money from supporting activities harmful to our climate and environment should be the first step to save our climate and ensure future generation's ability to farm.

Checklist for proper implementation of policies

The success of any climate mitigation measure should be evaluated against its ability to bring an absolute reduction of GHG emissions, regardless of accounting categories and even national boundaries. In other words, a measure causing rebound effects or increasing emissions elsewhere in the system should not be considered as climate mitigation. Afforestation or bioenergy production on peatland soils would for instance produce more emissions from the loss of soil carbon that they sequester or save.

Moreover, climate mitigation should be in harmony with other sustainability policy objectives, such as on air and water quality, biodiversity and animal welfare. At the very least this requires

a set of safeguards which avoids these trade-offs. However, ideally the measures are aiming to maximize synergy between these policy objectives.

Check list:

- No absolute increase of emissions outside of the EU (e.g. deforestation for feed production)
- Adequate spatial planning (e.g. no afforestation on peat land)
- Avoidance of rebound effects (e.g. overall increase of production and emissions as a result of efficiency increases)
- No increase in pesticides use (e.g. to remove cover crops or manage no-tillage systems)
- No loss of biodiversity (e.g. through intensification of land use)
- Compliance with the NEC-Directive (no increase of ammonia emissions)
- No negative effects on animal welfare (through intensification)
- No negative effects with other environmental objectives
- Avoidance of lockins by taking a long-term perspective

Buildings

An overview of building emissions today

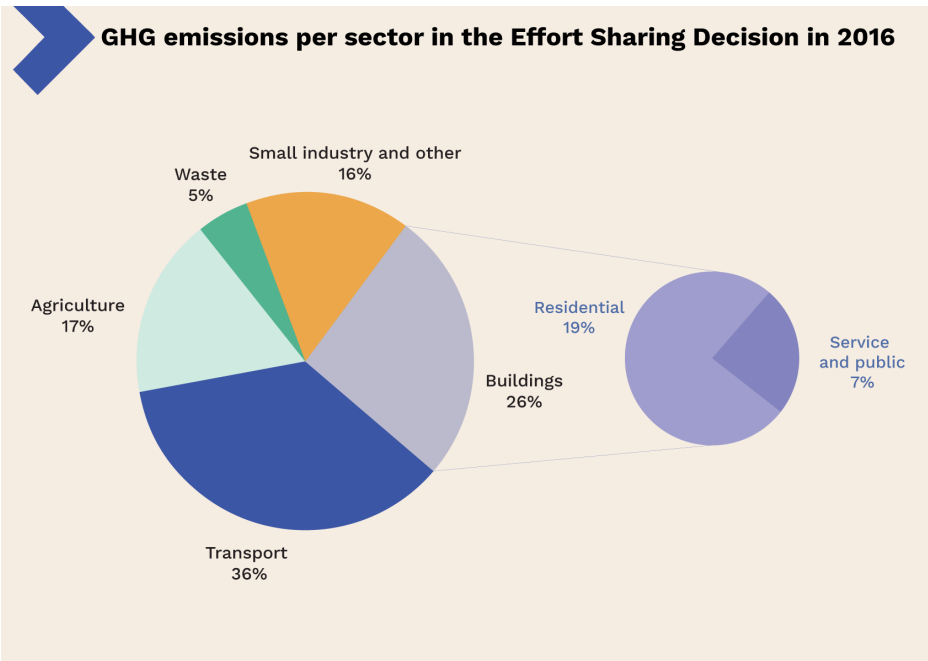

Figure 9: *GHG emissions per sector, breakdown buildings sector. EEA inventory report 2018*

In 2016 26% of the emission in the Effort Sharing Regulation sectors are attributed to the building sector.

Due to investments in the energy efficiency of existing and new buildings and a switch to fuels that are renewable or less carbon intensive, the direct emissions have been significantly reduced in the last year.

It is important to note that there are interlinkages to the power sector which accounts for emissions to produce fuels, provide electricity, but also generate district heating and cooling for the building sector. As long as the power sector continues to use carbon emitting fuels, the building sector is responsible for a share of those emissions. Currently, if those emissions are also accounted for the building sector can be made responsible for 36% of the CO_2 emissions.

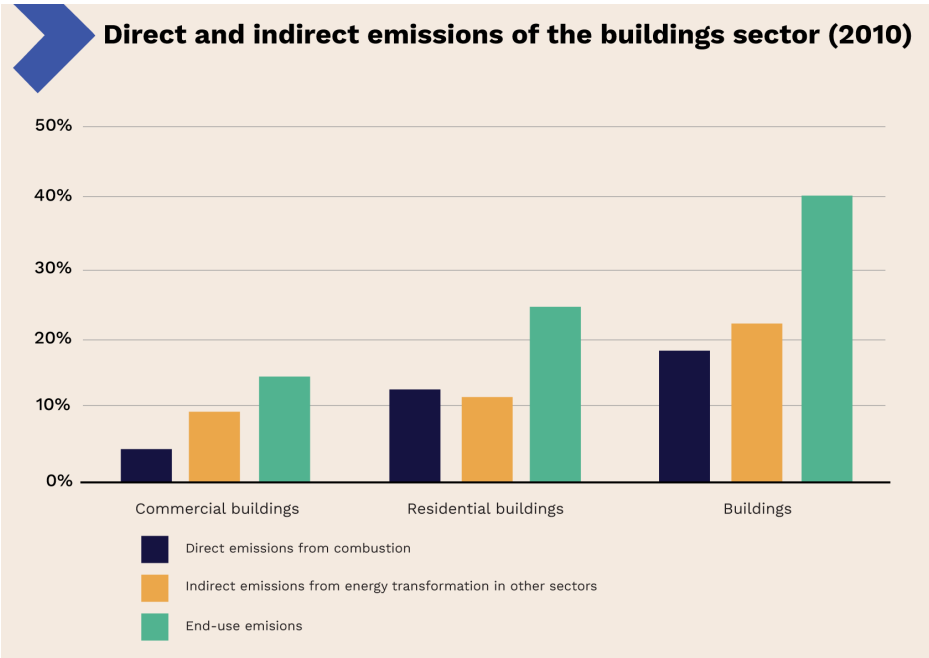

Figure 10: *Direct and Indirect emissions by end user by direct energy sector emissions. EEA Technical report no 18/2012*

The European Environmental Agency (EEA) carried out a detailed analysis for the year of 2010 showing that adding indirect emissions roughly doubles the total emissions in the residential sector, for commercial sector the total emissions are tripled, if indirect emissions are taken into account. Reducing energy waste is, therefore, not only relevant for the residential buildings but especially important for commercial buildings.

The amount and composition of these emissions differ largely between countries with Nordic countries with increased heating and lightning demand having significant higher energy use.

As discussed, direct emissions from the building sector have been slowly declining by 9% from 2005 to 2014, mostly due to energy retrofits in existing buildings but with a concerning trend of slightly increased in emissions 2015 and in 2016 and a stabilisation in 2017.

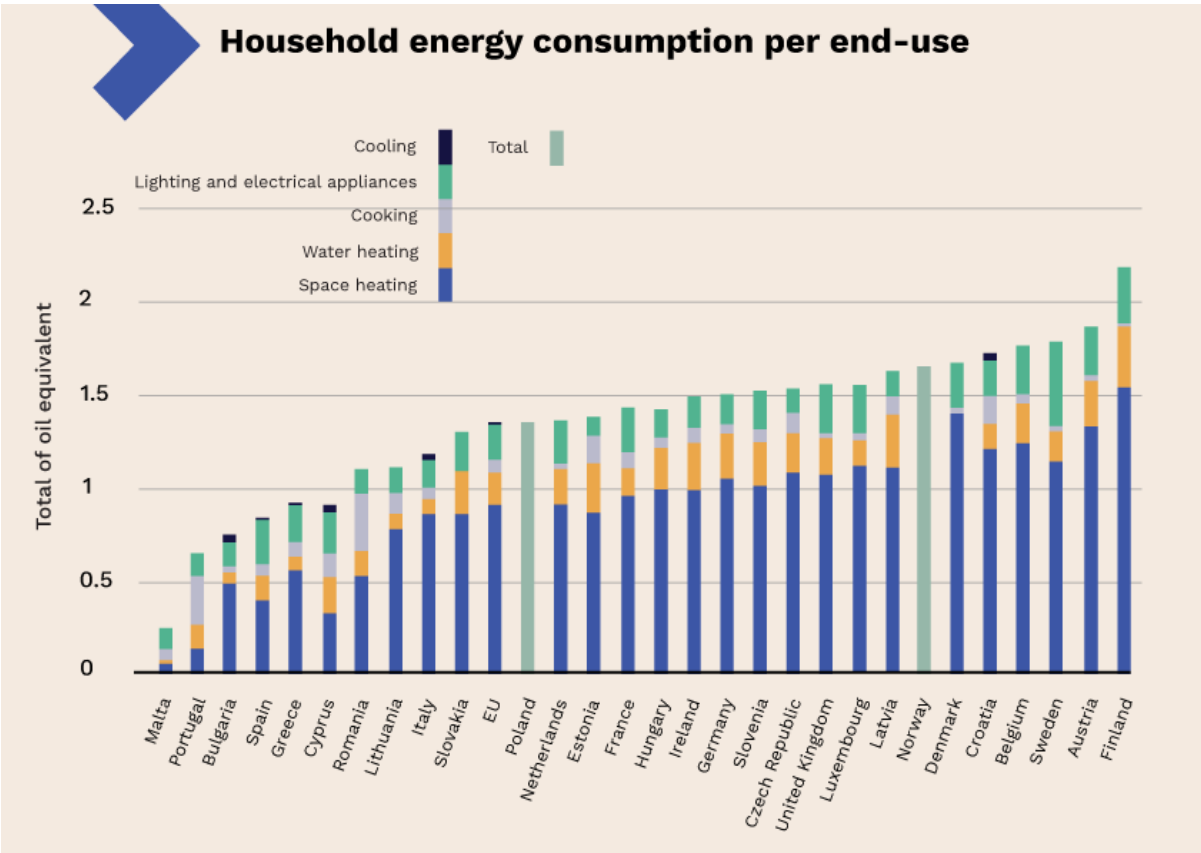

Figure 11: *Household energy consumption per end-use. EEA*

According to the data of the European Environmental Agency (EEA) the building sectors have contributed most to absolute emission reductions in the sectors covered by the ESD since 1990. While Member States have projected only limited decreases in ESD emissions between 2015 and 2030, the largest decreases of more than 100 Mt CO2-equiv are expected to take place in the building sector (-16 %)[70]. Around 75% of the projected reductions under the Effort Sharing Decision are expected to come from energy efficiency measures in the building sector but the sector could deliver much higher cost-effective reductions, doubling of even tripling the GHG reductions in the sector when moving from the current business as usual to ambitious cost-effective energy efficiency policies.
With the current business as usual and existing policy framework residential and tertiary building emissions are projected to decrease between 2015 and 2030 and continue to decrease or stagnate until 2050 but fail to achieve the necessary decarbonisation by 2050.

[70] https://www.eea.europa.eu/themes/climate/trends-and-projections-in-europe/trends-and-projections-in-europe-2016/action-download-pdf

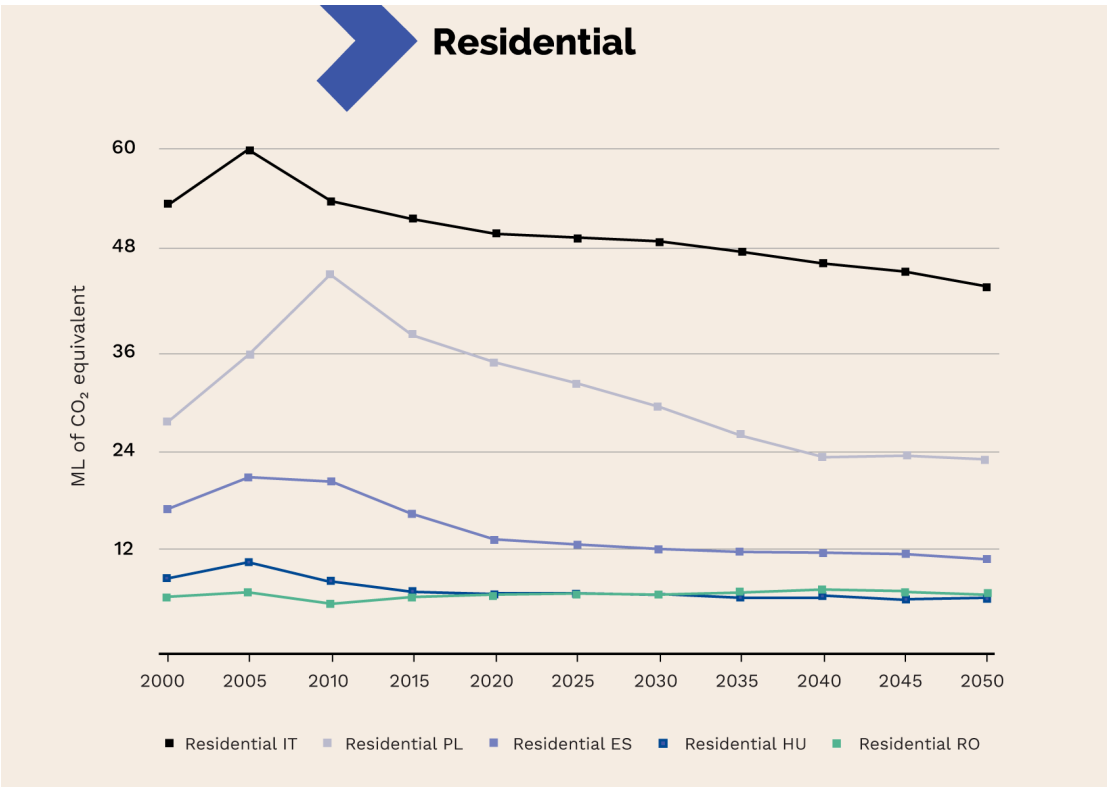

***Figure 12**: GHG emission projections of the business-as-usual scenario in the residential sector; PRIMES 2016.*

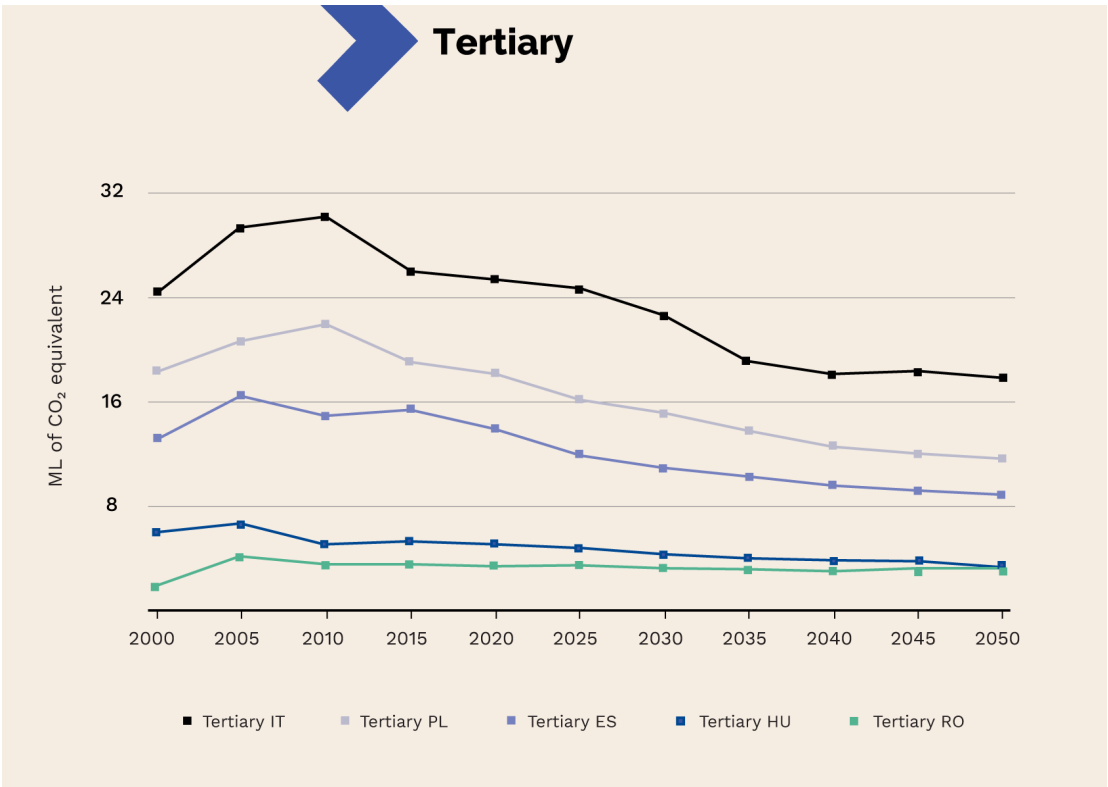

***Figure 13:** GHG emission projections of the business-as-usual scenario in the tertiary sector; PRIMES 2016.*

While there is a significant variation in the characteristic of the buildings stock in the countries in the scope of PlanUp with a high share of ownership of single houses in Italy and Spain and a high share of multi-apartment buildings in Romania, Poland and Hungary from the pre 1990 era,

one joint fact for the limited reduction of GHG in the sector is the limited access to financing and innovative business models driving the thermal modernisation in these countries.

What policies are in place to help reduce building emissions?

The Energy Performance of Buildings Directive

The measures related to minimum energy performance standards and mandatory energy certification as well as on billing and energy management in bigger buildings have their foundation in the European Energy Performance of Buildings Directive. The first version in 2002 required member states to establish Energy Performance Certificates, regulate the inspection of boilers and of air conditioning systems. Later in 2010 the recast of the Energy Performance of Buildings Directive was instrumental to set and gradually improve minimum energy performance requirements for new buildings and establish requirements for existing buildings if they undergo major renovations or if a replacement or retrofit of building elements (windows, roofs, walls) are carried out. From 1. Jan 2019 onwards new public buildings are required to be nearly zero-energy buildings (nZEB). Other new buildings need to achieve this from 1 January 2021 onwards. The definition what is nearly zero is defined on national level. Also the minimum energy performance levels for buildings after renovations are defined at national level. The EU Directive aims at having a harmonised way of deriving these standards. For existing buildings that do not undergo a renovation EU law does not set energy performance requirements.

In 2018 selective rules of the Energy Performance of Buildings Directive were revised. The changes especially aimed at directing the focus more on the energy renovation of their building stock in order to transform it into a highly energy efficient and decarbonised stock by 2050. The effort is to transformation the whole building stock towards nearly zero-energy buildings (nZEB). Furthermore, the Directive itself needed modernisation to reflect key advances in several building technologies ranging from self-regulating devices to building automation and control, digitalisation and facilitating the roll-out of e-mobility[71]

In order to deliver on the transformation of the whole building stock the Directive requires Member States to prepare long-term renovation strategies (LTRS). The rules for these strategies has been moved from the Energy Efficiency Directive (EED) to the amended EPBD. The rules have been strengthened and expanded and require that Member States lay down plans that will steadily lead to the transformation of the building stock in the EU to reach nearly zero-energy performance levels by 2050.

The preparation and implementation of the LTRs needs to be done in a participatory manner and is linked to the planning in the Integrated National Energy and Climate plans.

Energy labelling and Ecodesign

Energy labelling and Ecodesign rules are measures targeted at products. All of these rules are applicable in the same way to every EU member state ensuring consumers have access to the same information and same quality in every country. Rules for products including Air conditioners, air heating and cooling products, lighting, local space heaters, tumble driers, dishwashers, ventilation units, solid fuel boilers, washing machines, space and water heaters and fridges and freezers are all tools to lower energy consumption in and from buildings.

While EU energy labels tell consumers about the efficiency of products in a scale from A+++ (most efficient) to G (least efficient) as a tool of consumer information, the Ecodesign rules

[71] https://euroace.org/wp-content/uploads/2018/11/EuroACE-Guide-to-EPBD-Implementation-web-version.pdf

define which kind of products can be sold in Europe and eliminates the least performing products from the market.

Energy Efficiency Directive

The first Energy Efficiency Directive (EED) entered into force on 4 December 2012. In addition to setting an EU-wide target of improving energy efficiency, the Energy Efficiency Directive also establishes binding measures for Member States that drive public and private investments in energy efficiency.

The adoption of the EED has reinforced the European legislative framework, helping create a level playing field among Member States. For the first time, Member States had to set national energy efficiency targets and report on them in a comparable and transparent way. Time and resources are being invested into energy efficiency measures, especially related to the implementation of the Article 7 of the EED ("Energy efficiency obligation schemes"), which requires Member States to save at least 1.5% savings every year from 2014 to 2020. While the Directive does not prescribe in which sectors the savings shall be achieved, the majority of measures are targeting the buildings sector expected to contribute to around 250 Mtoe of cumulative savings by 2020.

In 2018 the EED was revised, setting a new target of 32.5% energy efficiency improvement until 2030 and continuing the annual energy savings measure to 2030 and beyond. The Directive is now also more targeted at households and requires that efficiency measures need to be included in the integrated national energy and climate plans, existing provisions on individual metering and billing based on real consumption are strengthened and remote reading established. With its final conclusion in late 2018, the revised EED needs to be transposed into national legislation within 18 months of its entry into force, ensuring the new provisions take effect before 2021[72]

What national measures can reduce emissions from buildings?

The full implementation of the relevant EU law is the very backbone of an effective reduction of GHG emissions from the building sector.
In addition to the full implementation, a number of facilitative measures can be taken. This especially concerns economic incentives and instruments like taxes, tax-rebates and subsidies to accelerate investments in the building stock. While all of these measures are not obligatory as part of EU law, they can be used to comply with EU law.

Measures of awareness raising, education, re-skilling and training are also very important tools to speed up emission reductions in the building sector.
Measures related to fuel switch and mandatory requirements going beyond the EU law can also be considered.

While fuels switch can be done with simple measures, it is preferential to follow the energy efficiency first principle and consider the full range of demand- and supply-side improvements together. A fuel switch to solid fuel boilers based on bioenergy must take into account that badly installed, badly maintained or low-quality fuels can cause significant emissions of air pollutants. A fuel switch from coal or oil to natural gas might bring an short-term gain but does not ensure the full decarbonisation of the building. The greenhouse gas reduction effect of a fuel switch to district heating and cooling or electric heat pumps does depend on the fuel mix used to generate the energy in first place.

[72] http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/595923/EPRS_BRI(2017)595923_EN.pdf

While EU rules do not oblige owners of buildings to renovate their homes, national measures to make a renovation obligation have been put in place in some countries under specific situations eg. for renting out or as requirement of buying property as foreseen in the German energy efficiency law.

Where are EU Member States on achieving these targets?

Depending on their starting points and national specificities countries have chosen different paths to reduce greenhouse gas emission in the building sector.

In Hungary total fuel consumption in the residential sector decreased by about 17% (including a 33% drop in solid fuel and a 18% decrease in natural gas use) - due to mild winters in 2007 as well as growing energy prices and the support for modernization of buildings which might have played a role as well.
In Italy the introduction of minimum energy performance standards for new and modernised buildings and mandatory energy performance certificates are seen to have improved the energy efficiency. In 2013, tax incentives for energy efficiency measures were introduced so that certain energy refurbishment measures can now count on a tax deduction of up to 65 % of expenses related to the refurbishment of existing buildings, renovations aimed at increasing energy efficiency and installation of renewable technologies.
For the Polish building sector more stringent rules for minimum energy performance standards for new buildings and those undergoing major renovation and a new law on energy building performance introducing the obligation to receive Energy Performance Certificates for new buildings sold or rented were introduced. Financial support is mainly provided through grants and low-interest loans for investments in energy efficiency.
Spain also implemented minimum energy performance standards for new and modernised buildings and owners of buildings are required to present an energy efficiency certificate to buyers or renters of flats. Financial support for efficiency improvements in existing buildings is provided through grants covering between 22 and 35 % of investment costs.
The building sector in Romania has minimum energy performance standards and mandatory energy certification for a real estate that is sold or rented. The Programme for Refurbishment of Multi-Storey Family Buildings supports building refurbishment measures like thermal insulation of exterior walls, roof or ground floor, and replacement of windows and doors.

Checklist for proper implementation of policies

In order to achieve climate efficiency in the building sector, some considerations and measures beyond the EU obligations should be taken into account. EU countries, when implementing the EU regulations on buildings explained above, must ensure that the policies act in synergy and should include a long-term perspective.

Checklist:

- EU buildings stock needs to be transform it into a highly energy efficient and fully decarbonised stock by 2050.
- From 1. Jan 2021 onward all new buildings must be nearly-zero energy (nZEB), new public buildings must be already nZEB since 1 January 2019.
- Almost all buildings (97%) will require full or partial renovation to be fully in line with the Paris Agreement, this means a doubling or tripling of the current renovation rate.
- When the heating and cooling demand has been reduced to the optimal level, remaining energy demand including energy for warm water, lighting, ventilation etc. should be supplied from sustainable renewable sources.
- While renewable solid biomass is a solution for some cases, impacts on air pollution and the availability of sustainable biomass is a key issue.

- Integrating a highly efficient building stock with flexible electricity, district heating & cooling and transport system can improve the overall system efficiency.
- Increased energy performance of buildings can create rebound effects that need to be considered.
- Investments in the energy performance of the building stock saves energy bills and creates local jobs. Further benefits from clean air, better indoor-air quality and lightning are crucial to take into account when assessing the cost and benefits of building stock investments.
- A full decarbonisation of the building stock requires a phase-out of fossil fuel based individual heating systems like coal, oil or gas boilers. While the switch to a more efficient boiler can deliver short term savings policies must avoid of lock-ins by taking a long-term perspective.
- To ensure a proper implementation of the existing building sector policies appropriate financial and human resources must be allocated in the relevant administrative bodies. Dedicated departments or agencies staffed with qualified personnel to oversee the implementation efforts as well as dedicated resources for stakeholder interaction and management of consultation processes is key.
- While the latest provision of the 2018 Energy Performance of Buildings Directive are yet to be transposed in national law, the implementation of the 2010 Energy Performance of Buildings Directive must continue with full effort.
- A key element of transforming Europe's building stock are the long-term renovation strategies (LTRS). A combination of clear milestones for 2030 and 2040, to benchmarking of progress with measurable progress indicators that reflect national conditions is necessary.
- Energy Performance Certificates have empowered consumers to become informed decision makers. Building renovation passports are the next step to inform, motivate and incite building owners to undertake energy renovations and bring tangible benefits to their communities.
- Recording and sharing information and anonymised key statistics on our efforts to decarbonise our buildings by all involved parties including national or regional authorities, researchers, building owners lay the foundation for further innovation.
- To facilitate the roll-out of the relevant investments different tools like aggregation of projects, de-risking of investments, public-private partnerships or using public funds to leverage private funding need to be considered.
- Enforcement of building code regulation and retaining relevant inspection regimes for heating, cooling and ventilation systems are crucial to tap the full potential of building systems and building automation and control systems.