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COMMISSION STAFF WORKING DOCUMENT

Cohesion in Europe towards 2050

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

on the 8th Cohesion Report: Cohesion in Europe towards 2050

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CHAPTER 3 A Greener, low-carbon Europe – PART 1

- The EU has adopted the European Green Deal with the goal to make the EU economy climate-neutral by 2050. This will require a rapid reduction of greenhouse gas (GHG) emissions, more investments in green technologies and protecting the natural environment.
- GHG emissions dropped by 24% between 1990 and 2019. This suggests the EU will meet its 2020 target of reducing GHG emissions by 20%. The new 2030 target as part of the 'Fit for 55' is a reduction of 55%. This will imply large reductions in emissions both within and outside the emissions trading scheme.
- Energy consumption has decreased significantly in the EU over the past decades. Nevertheless, the latest figures indicate that the 2020 energy efficiency target will be missed. The 2030 target is more ambitious and will require additional efforts.
- Renewable energy consumption in the EU rose steadily from 11% in 2006 to 19% in 2018, close to its 2020 target of 20%, but some Member States are lagging behind their 2020 national targets. The target of 40% by 2030 will require combined efforts for boosting production of renewable energy and reducing total energy consumption.
- Climate change affects a growing number of EU regions but the impact differs depending on their geography and the structure of their economy. Sectors such as tourism and agriculture are likely to be particularly affected.
- Only 40% of EU water bodies are in a good ecological state. Despite significant progress, several rural areas and less developed regions still need important investment in waste water treatment.
- The share of waste recovered increased from 46% in 2004 to 54% in 2018 in the EU. This helps to protect environment, recycle raw materials and recover energy. Nevertheless, recycling and incineration with energy recovery remain low in several Member States.
- The emissions of most major air pollutants have significantly shrunk in the EU. Exposure to air pollutants, however, is still high in many cities. One out of three city residents lives in a city where at least one of the air pollution thresholds is exceeded.
- Biodiversity loss and the degradation of ecosystem services continue in the EU across terrestrial, freshwater and marine ecosystems. Protecting and restoring biodiversity can help to improve the flow of ecosystem services and to mitigate climate change and its impacts. For example, investing in urban vegetation or wetlands can reduce the impact of heat waves and floods, provide more habitat for endangered species, reduce air and noise pollution and provide spaces for leisure, thus improving urban quality of life. In rural areas, fostering high-diversity landscapes can increase ecological connectivity and help species to adapt to climate change, while at the same time

enhancing ecosystem services such as pollination, climate and water regulation, and erosion protection.

Contents

3.1 Introduction

Recent extreme events such as deadly flooding in Germany and Belgium or uncontrollable forest fires in Greece illustrate the challenges faced by the EU in tackling the consequences of climate change. According to the last report from the Intergovernmental Panel on Climate Change (IPCC), almost the entire 1.1 degrees C of warming since the pre-industrial era is due to human activity[1]. The IPCC gives a 50% chance that a 1.5 degrees C warming could be reached before 2040. As a result, the negative impacts of climate change will become more frequent and more severe and all regions in the EU will be affected.

At the same time, the world is facing a massive extinction episode. This translates into a rapid fall in biodiversity which affects all parts of the world. At present, one million of the eight million species known on the planet are at risk of being lost due to the impact of human activities, including land and sea use changes, over-harvesting, climate change, pollution and invasive alien species. Biodiversity loss due to human pressures continues also in the EU, undermining the capacity of ecosystems to deliver benefits to humans. Yet, the quality of our environment is essential to human wellbeing and to maintain the provision of key ecosystem services such as climate regulation, flood protection, air and water quality, soil fertility, pollination and the production of food, fuel, fibre and medicines.

This chapter looks at the main trends related to climate change and environment. It assesses the extent to which the EU has or has not reached some of its key policy targets in the area. It also analyses how and to what extent EU regions are affected by the consequences of climate change and how they perform in preserving the quality of their environment.

3.2 EU climate action and the European Green Deal

Climate change and environmental degradation are the most challenging threats to living conditions in Europe and, indeed, in the world as a whole. In response, the EU has adopted the European Green Deal, a new growth strategy, with ambitious targets for resource-efficiency, competitiveness, greenhouse gas (GHG) emissions and inclusiveness. The goal is to make the EU economy and society climate-neutral by 2050 by cutting emissions, investing in green technologies and protecting the natural environment. A European Climate Law has been proposed by the Commission to make the goal legally binding[2].

Over the past decades, the EU has adopted a series of targets for GHG emissions, energy efficiency and the share of renewables in energy consumption with the aim of

[1] IPCC (2021), "Climate Change 2021 – The Physical Science Basis", Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press.

[2] COM/2020/80 final - Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law).

achieving the transformation to a low carbon economy. The EU key targets were set in following frameworks:

- The 2020 climate and energy package adopted in 2007 and which aimed at a 20% cut in GHG emissions (from 1990 levels), a 20% share of renewables in energy consumption and a 20% improvement in energy efficiency by 2020;
- the 2030 climate and energy framework adopted in 2014 which upgraded the 2020 targets to respectively 40%, 32% and 32.5%;
- the European Green Deal, in which the Commission proposed an update of the 2030 target for reducing GHG emissions by 55% and raise the targets relative to renewables and energy efficiency to 40% and 36% respectively;
- the 2050 long-term strategy aiming at making the EU climate-neutral by 2050.

Table 3-1 summarises the most recent steps taken by the EU in setting climate and energy targets.

Table 3-1 Key EU climate and energy targets

Target time timeline	2020	2030	2030	2050
Policy framework	2020 Climate and Energy Package	2030 Climate and Energy Framework	EU Climate Law and Fit for 55	EU Climate Law and Fit for 55
Year of adoption	2007	2014	2021	2021
Targets				
GHG emissions reduction	20%	40%	55%	Net zero GHG emissions
Share of renewables in energy consumption	20%	32%	40%	NA
Increase in energy efficiency	20%	32.5%	36-39%%	NA

In July 2021, the European Commission adopted a series of legislative proposals setting out how it intends to achieve climate neutrality in the EU by 2050, including the intermediate target of an at least 55% net reduction in greenhouse gas emissions by 2030. The so-called ‘Fit for 55’ package combines the application of emissions trading to new sectors and a tightening of the existing EU Emissions Trading System, accelerating the use of renewable energy and greater energy efficiency, a faster roll-out of low emission transport modes, an alignment of taxation policies with the European Green Deal objectives, measures to prevent carbon leakage and tools to preserve and grow the EU’s natural carbon sinks. At the same time, a more transparent and dynamic governance process has been set up to help meet the 2030 targets and the EU’s international commitments under the Paris Agreement, involving an integrated monitoring system and reporting rules.

For these plans to succeed, action in all parts of the EU economy is needed, notably investment in environmentally-friendly technologies, targeted R&D and innovation, cleaner, cheaper and healthier forms of private and public transport, decarbonisation of the energy sector and improvements in the energy efficiency of buildings.

3.2.1 Reducing greenhouse gas emissions

Under the 2020 climate and energy package [3], the EU committed to reducing GHG emissions by 20% by 2020 relative to 1990. The pursuit of this objective was supported by two instruments, the EU Emissions Trading System (ETS) and the Effort Sharing Decision (ESD).

The ETS is a market based tool for cutting emissions from large-scale power and industrial plants and aviation. It covers around 45% of EU total emissions and the target at the time was to reduce these emissions by 21% below the 2005 level by 2020. The ESD covers sectors not included in the EU ETS, such as transport, buildings, agriculture (non-CO2 emissions) and waste, which account for around 55% of EU emissions. Member States have committed to national 2020 targets, set according to their levels of development – from a 20% cut for the most developed countries to a maximum increase of 20% for the least developed relative to 2005. The ESD objective is to reduce emissions in the sectors it covers by 10%.

According to the latest figures available, the EU is likely to have met its 2020 target. Between 1990 and 2019, GHG emissions were reduced by 24%, while EU GDP grew by around 60%. Accordingly, the GHG emission intensity of the economy, defined as emissions relative to GDP, fell to less than half of the 1990 level[4]. EU-27 emissions covered by the ESD were 10% lower in 2019 than in 2005, so the 2020 target is likely to have been achieved.

In 2014, the EU has enacted legislation to reduce emissions by at least 40% by 2030. National emission targets for ESD sectors have been revised to achieve a reduction of 30% by 2030 relative to 2005. These targets, enshrined in the Effort Sharing Regulation[5], range from a reduction of 0 to 40%. Although all Member States have committed to not increasing emissions from their ESD sectors, they have risen in Malta, Latvia, Lithuania and Poland (Figure 3-1)[6].

In 2018, levels of ESD emissions were lower than the 2030 target only in Greece, Hungary and Croatia and were well above it in a number of countries, either because the target was set at a high level (as in Luxembourg, Finland, Germany, and Belgium - a cut of 35% or more in all cases) or because emissions have been reduced only

[3] The 2020 climate and energy package is a set of binding legislation to ensure the EU meets its climate and energy targets for 2020. The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also the headline targets of the Europe 2020 strategy for smart, sustainable and inclusive growth.

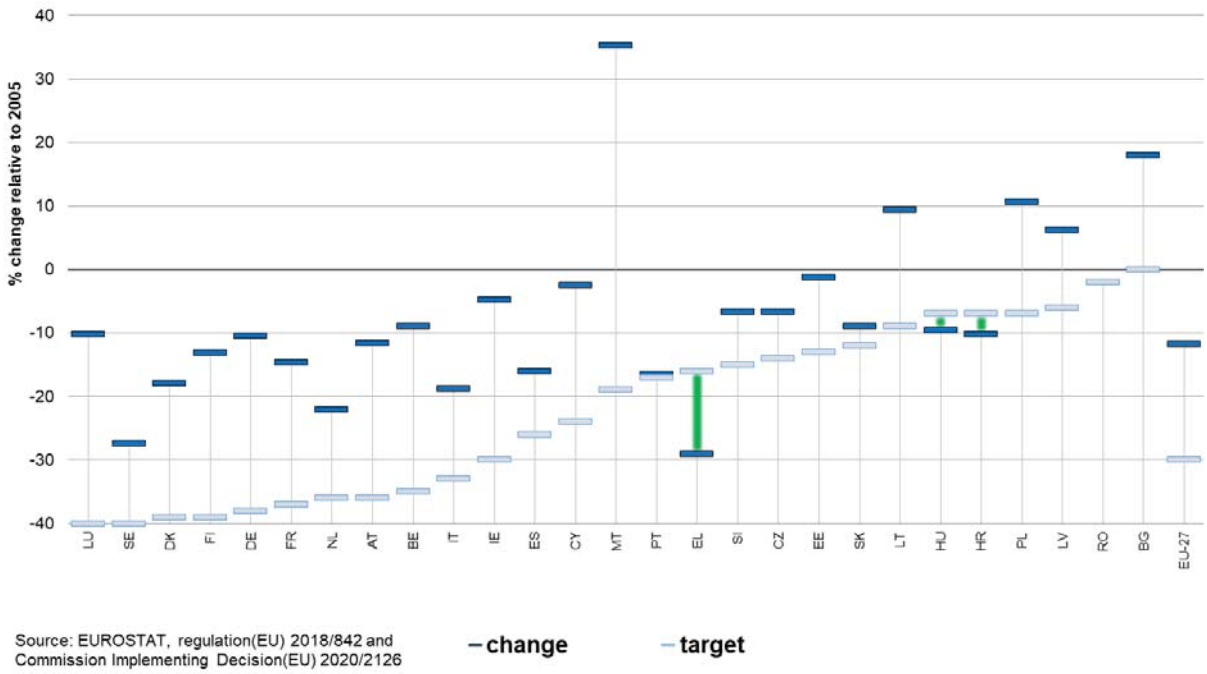
[4] European Commission (2020), EU Climate Action Progress Report 2020.

[5] REGULATION (EU) 2018/842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018; https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0842&from=EN.

[6] The national targets under the ESD should be revised in the context of the 'Fit for 55' package but they have not been set yet.

slightly (as in Ireland) or have increased (as in Bulgaria, Latvia, Lithuania , Malta and Poland).

Figure 3-1 Change in greenhouse gas emissions outside the Emissions Trading Scheme, 2005-2018 and Europe 2030 targets



Source: Source: EUROSTAT, regulation(EU) 2018/842 and Commission Implementing Decision (EU) 2020/2126. Member States with actual changes above their target are highlighted.

Under the European Green Deal, as noted above, the EU launched the 2030 Climate Target Plan under which it set a more ambitious target of cutting emissions by at least 55% below 1990 levels by 2030, instead of 40%, on the way to becoming climate neutral by 2050.

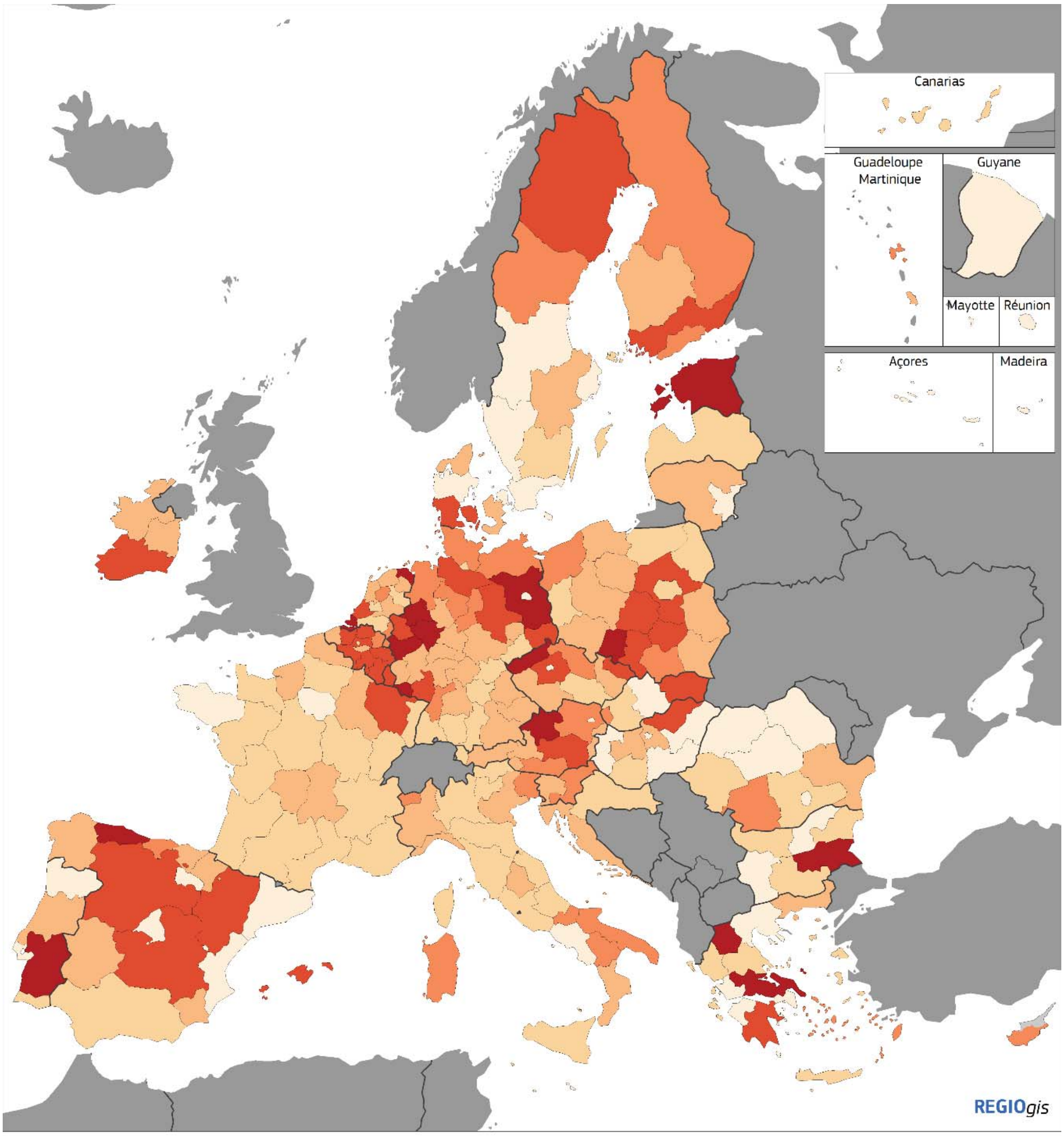
GHG emissions per head vary substantially within countries. This is notably the case in Spain, Portugal, Germany, Greece, Bulgaria and Poland, where some regions are emission hotspots (Map 3-1)[7]. Many factors can explain differences in high emission levels, including, in particular, the level and composition of economic activity, the

[7] The figures are based on the EDGAR (Emissions Database for Global Atmospheric Research) database, which provides emission data and grid maps for all countries from 1970 to 2015 (2018 for CO_2), for both air pollutants and greenhouse gases, calculated in a consistent way to be comparable between countries. In order to estimate CO2 emissions, EDGAR uses international activity data (mainly energy balance statistics from IEA (2017), IEA CO2 emissions by main fuel type and BP statistics), emission factors from various technological databases and proxies to estimate the regional location of emissions . Because of differences in methodology, the figures do not always match official estimates provided by Member States at national level.

energy efficiency of production plants and buildings and the use of renewable energy as well as land use, climate and geography[8].

Map 3-1 CO2 emissions from fossil fuels per head, NUTS2, 2018

8 Crippa, M., Oreggioni, G., Guizzardi, D., Muntean, M., Schaaf, E., Lo Vullo, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J. and Vignati, E. (2019), "Fossil CO2 and GHG emissions of all world countries - 2019 Report", EUR 29849 EN, Publications Office of the European Union, Luxembourg, doi:10.2760/687800, JRC117610 - https://edgar.jrc.ec.europa.eu/overview.php?v=50_GHG.



CO_2 emissions from fossil fuels per head, 2018

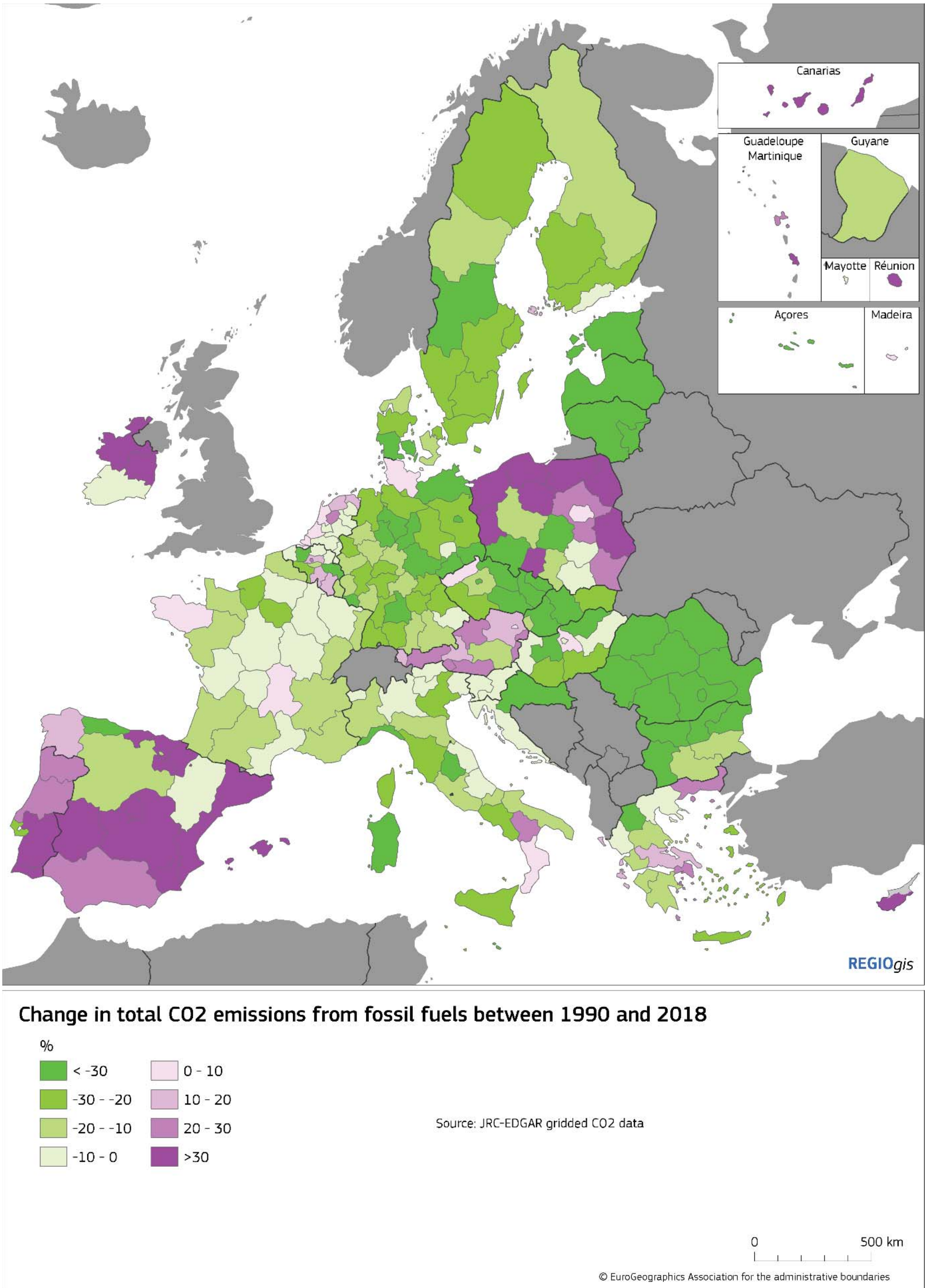
tCO_2 per head

- <= 4.5
- 4.5 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- 10.0 - 15.0
- > 15.0

EU-27 = 7.2
Source: Crippa e.a. (2019)

0 500 km

Map 3-2 Change in total CO2 emissions from fossil fuels between 1990 and 2018



Between 1990 and 2018, GHG emissions were reduced in most EU regions but they significantly increased in some of them, notably in Cyprus, Ireland, Spain and Poland where they soared by more than 30% (Map 3-2).

Box 3-1 Employment in EU ETS installations

The EU Emissions Trading Scheme (ETS) was launched in 2005 and it is the world's biggest greenhouse gas trading programme, covering around 14,000 factories in the EU-27, power stations and other companies in the EU, most of them being highly energy-intensive installations. The key principle of the ETS is to set a total annual quantity of GHG (measured in CO2 equivalent) and sell it by auction to the installations involved.

The geographical distribution of the ETS installations among EU NUTS 2 regions is very heterogeneous. A recent study on employment in ETS installations[9] estimates that employment in ETS installations corresponds to around 1% of the EU-27 total employment but with some regional variations (Map 3-3). In 2018, persons employed in the EU ETS installations constituted more than 3% of total employment in seven NUTS 2 regions, peaking at 4.1% in Közép-Dunántúl (Hungary). At NUTS 3 level, the share of employment in ETS installations exceeds 10% in three regions, with a maximum at 14% in Gotlands län (Sweden). Five out of the top 10 regions are located in Germany.

There has been a concern that the ETS adds costs to companies, implies loss in competitiveness and encourages relocation of activities in places where environmental regulations are less stringent. However, an increase in the price of carbon can lead to a variety of different responses from industry apart from reducing activities and/or employment, such as improving energy efficiency, changing the type of energy used, adapting technology, or innovate.

This is confirmed by a number of studies on the impact of the EU ETS on firms performance and on employment which generally conclude (i) that the EU ETS offers competitive advantages compared to alternative regulatory scenarios and (ii) the EU ETS has so far not had any statistically significant impact on regulated firms' number of employees and profit. Instead, the EU ETS induced regulated companies to increase investment, notably in carbon-saving technologies (see for instance Abrell et al., 2011 or Dechezleprêtre et al., 2018[10]).

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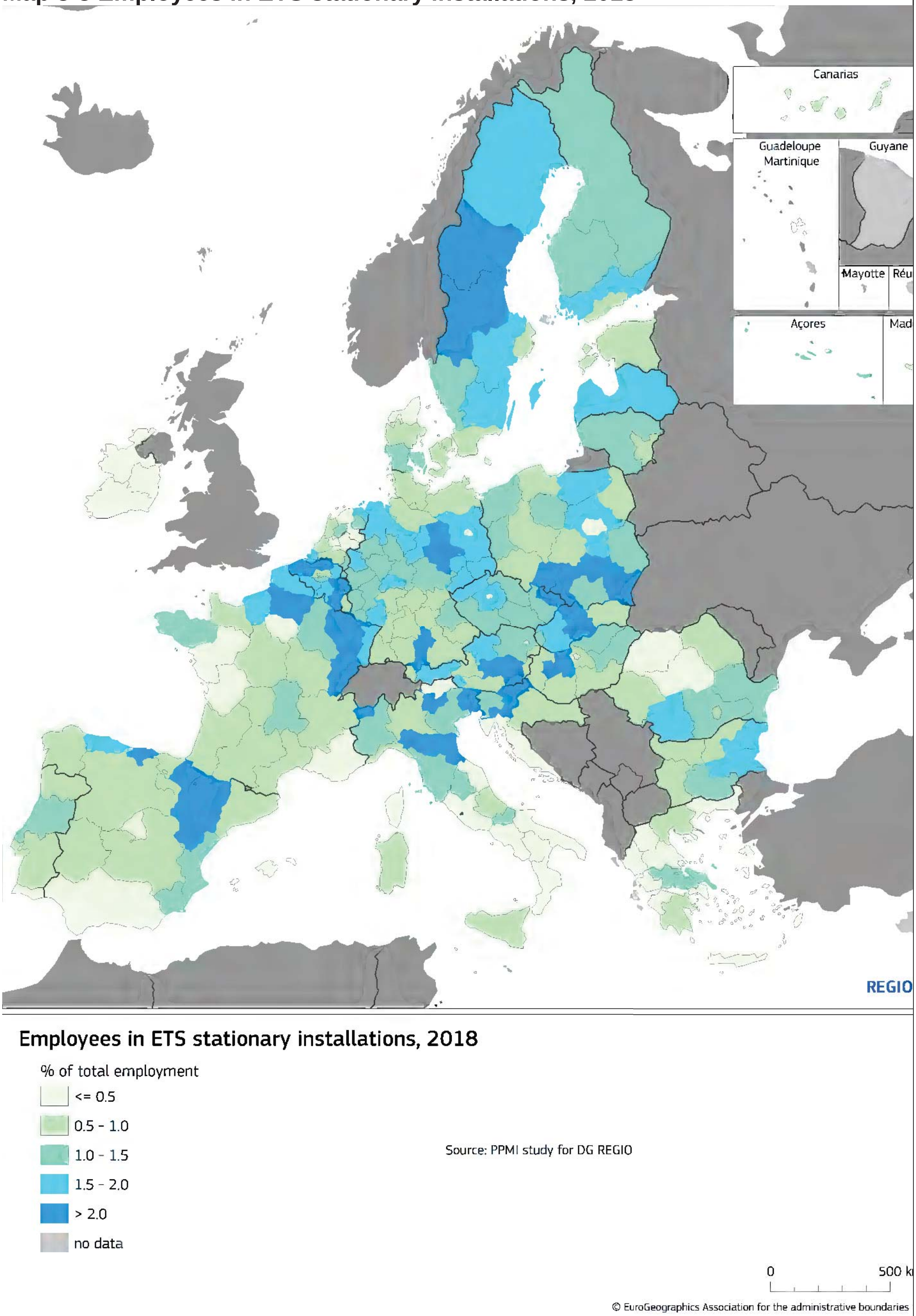
9 European Commission (2021), "European Emissions Trading System (ETS) – Calculations on the regional employment impact of ETS installations, Analytical and methodological report", Luxembourg: Publications Office of the European Union.

10 Abrell, J., Ndoye Faye, A. and Zachmann, G. (2011), "Assessing the impact of the EU EST using firm level data", Bruegel Working Paper 2011/08; Dechezleprêtre, A., Nachtigall, D. and Venmans, F. (2018), "The joint impact of the European Union emissions trading system on carbon emissions and economic performance", OECD Economics Department Working Papers No. 1515.

Map 3-3 Employees in ETS stationary installations, 2018



3.2.2 Increasing energy efficiency

Increasing energy efficiency is key to protecting the environment, reducing GHG emissions and improving the quality of life. The EU has set ambitious targets for 2020 and 2030, focusing on the sectors where the potential for savings is the greatest, such as buildings.

As part of the 2020 climate and energy package, the objective set in 2007 was to improve energy efficiency by 20% by 2020[11] compared to the projections made at that time. To achieve this objective, Member States were asked to set their own indicative national energy efficiency targets[12].

In 2018, the Energy Efficiency Directive[13] was amended to establish a target for 2030 of reducing EU energy consumption by at least 32.5%[14]. A reduction in energy consumption, however, does not necessarily signify an improvement in energy efficiency. The main determinants of energy use are GDP growth and the share of manufacturing in the economy. Changes in energy consumption, therefore, reflect not only changes in energy efficiency but also fluctuations in economic activity as well as changes in the structure of the economy.

In 2019, primary and final energy consumption[15] had decreased by 9.7% and 5.5% respectively compared to their 2005 levels. However, primary and final energy consumption levels were respectively 3.0% and 2.6% above the 2020 targets and 19.9% and 16.3% above the 2030 targets. It is therefore likely that the EU will miss its 2020 targets while it is still far from the 2030 targets, implying a need for additional efforts to make the EU economy more energy efficient.

Progress in reducing energy use varies markedly between Member States. In 2018, only 11 of the 27 Member States had lowered primary energy consumption below their 2020 target and only 9 had reduced final consumption below the target. In a

[11] The 20% energy efficiency target was enacted in legislation with the adoption of the Energy Efficiency Directive 2012/27/EU in 2012.

[12] DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2012 on energy efficiency. Member States targets are included in their National Action Plan and Annual Progress Report (https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/national-energy-efficiency-action-plans_en?redir=1). With the withdrawal of the United Kingdom, the Union's energy consumption figures for 2020 and 2030 were adjusted to the situation of 27 Member States.

[13] Energy Efficiency Directive 2018/2002.

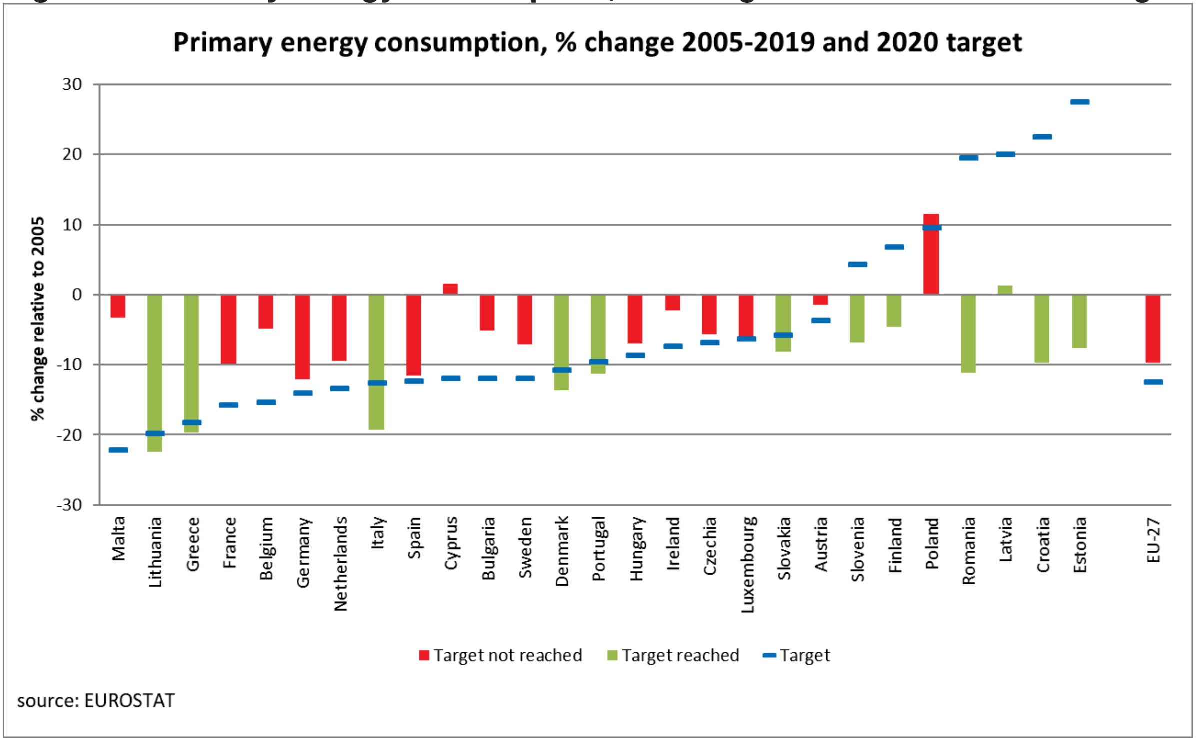
[14] The ‘Fit for 55’ package has set the EU target at 36% but as for the ESD, national targets have not been set yet.

[15] Primary energy consumption measures total domestic energy demand, while final energy consumption refers to what end users actually consume. The difference relates mainly to what the energy sector needs itself and to transformation and distribution losses.

number of Member States, the reduction required to meet the targets was still considerable (Cyprus, Malta, Bulgaria and France in respect of primary energy consumption and Lithuania, Hungary, Malta and Slovakia in respect of final consumption) (

Figure 3-2).

Figure 3-2 Primary energy consumption, % change 2005-2019 and 2020 target



Source: EUROSTAT.

3.2.3 Boosting renewable energy

Renewable sources play an increasing role in the production of energy in the EU. The share of renewables in gross final consumption of energy in the EU rose steadily from 11% in 2006 to 19% in 2018. In the 2020 climate and energy package of 2007, the objective was to raise this share to at least 20% by 2020, with a 10% share of renewables in transport. EU Member States have committed to meeting binding national targets for the share of renewables in energy consumption under the Renewable Energy Directive[16] of 2009. These range from 10% in Malta to 49% in Sweden.

The 2030 climate and energy framework of 2014 set the target of reaching a share of 32% of renewables in energy consumption by 2030 but, as part of the 'Fit for 55'

[16] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

package, the Commission has proposed to increase this target to 40%[17]. For this target to be reached, the share of renewables would have to double compared to levels of 2018.

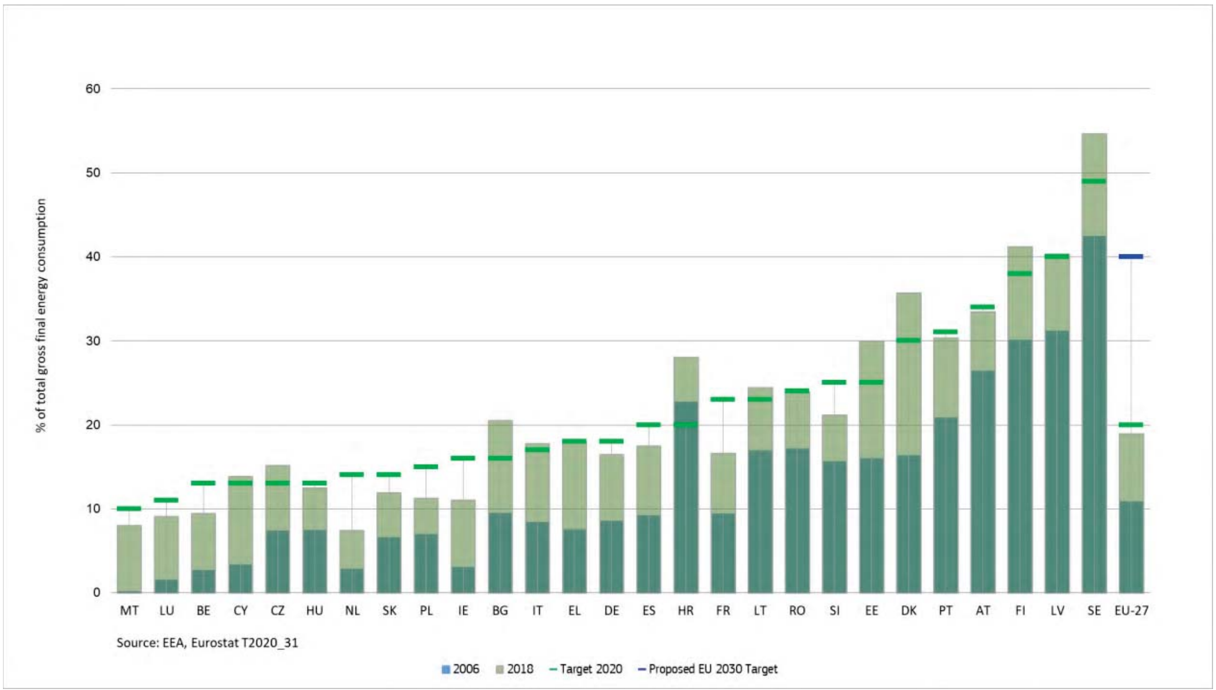
The share of renewables in energy consumption varies substantially across the EU. In 2018, it was over 40% in Finland and Latvia and close to 55% in Sweden (Figure 3-3). It is much smaller in other countries – below 10% in Malta, Luxemburg, Belgium and the Netherlands – though it has increased significantly in recent years. In 2018, 13 Member States had reached their national target set for 2020, Sweden, Estonia and Denmark exceeding it by over 5 percentage points. At the same time , some countries are still far from their target, like Belgium, France and Ireland where the share of renewables in 2018 was still less than 75% of the national 2020 target. For the Netherlands to meet their target, the share of renewables would need to have almost doubled between 2018 and 2020.

The capacity to produce renewable energy is closely linked to the geography of countries and regions. The production of wind energy is easier in coastal regions, like those of north-western Europe and Baltic Seas, the Atlantic and some Mediterranean coasts. The production of hydroelectricity requires suitable geo-physical features, while the potential for solar energy production is higher in southern European regions where there are many more days of sunshine. For instance, in 2018, the photovoltaic (solar panel) capacity per head in the EU was largest in Germany (590 watts per inhabitant), followed by the Netherlands (401) and Belgium (394)[18]. In Spain (197 watts per inhabitant) and Portugal (88), it was much less despite the potential production of electricity by this means being among the highest in the EU.

Figure 3-3 Share of renewables in gross final energy consumption, 2006, 2018 and 2020 target

[17] To reach the 2030 target, the overall binding target of 40% of renewables in the EU energy mix will be complemented by indicative national contributions, showing what each Member State should contribute to reach the collective target (COM(2021) 550 final).

[18] EUOBSERV'ER, Photovoltaic barometer, April 2020.



Source: EEA, EUROSTAT T2020_31.

Box 3-2 Coal regions in transition

The deployment of renewable energy sources can be an opportunity for many regions. This is notably the case for Coal Regions in Transition[19] (CRiT), which could facilitate energy transition and support post-mining communities through the jobs induced by the installation of renewable energy production capacities. According to recent research by the Joint Research Centre (JRC), up to 315 000 jobs could be created in the coal regions by 2030 by deploying renewable energy technologies as projected in the EUCO3232.5 energy scenario[20]. Around 200 000 additional full time equivalent jobs a year could be created if the potential for energy efficiency in residential buildings were realised[21].

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19 The JRC has identified the European CRiTs that will be affected by the reduction in coal mining and coal powered-plant activities, estimating that more than 200 000 jobs may be at risk. See P. Alves Dias et al. (2018), “EU coal regions: opportunities and challenges ahead”, JRC Science for Policy Report, Publications Office of the European Union, Luxembourg. doi: 10.2760/064809.

20 In order to estimate the potential impact of the EU’s climate and energy targets for 2030, the Commission has developed a set of scenarios, the EUCO scenarios. The most recent scenario. EUCO3232.5, models the impact of achieving the target for improving energy efficiency by 32.5% and the target for the share of renewables in energy consumption of 32%, as agreed in the ”Clean energy for all Europeans package”. This scenario was used to support the Commission’s June 2019 assessment of the draft national energy and climate plans (NECPs), submitted by Member States.

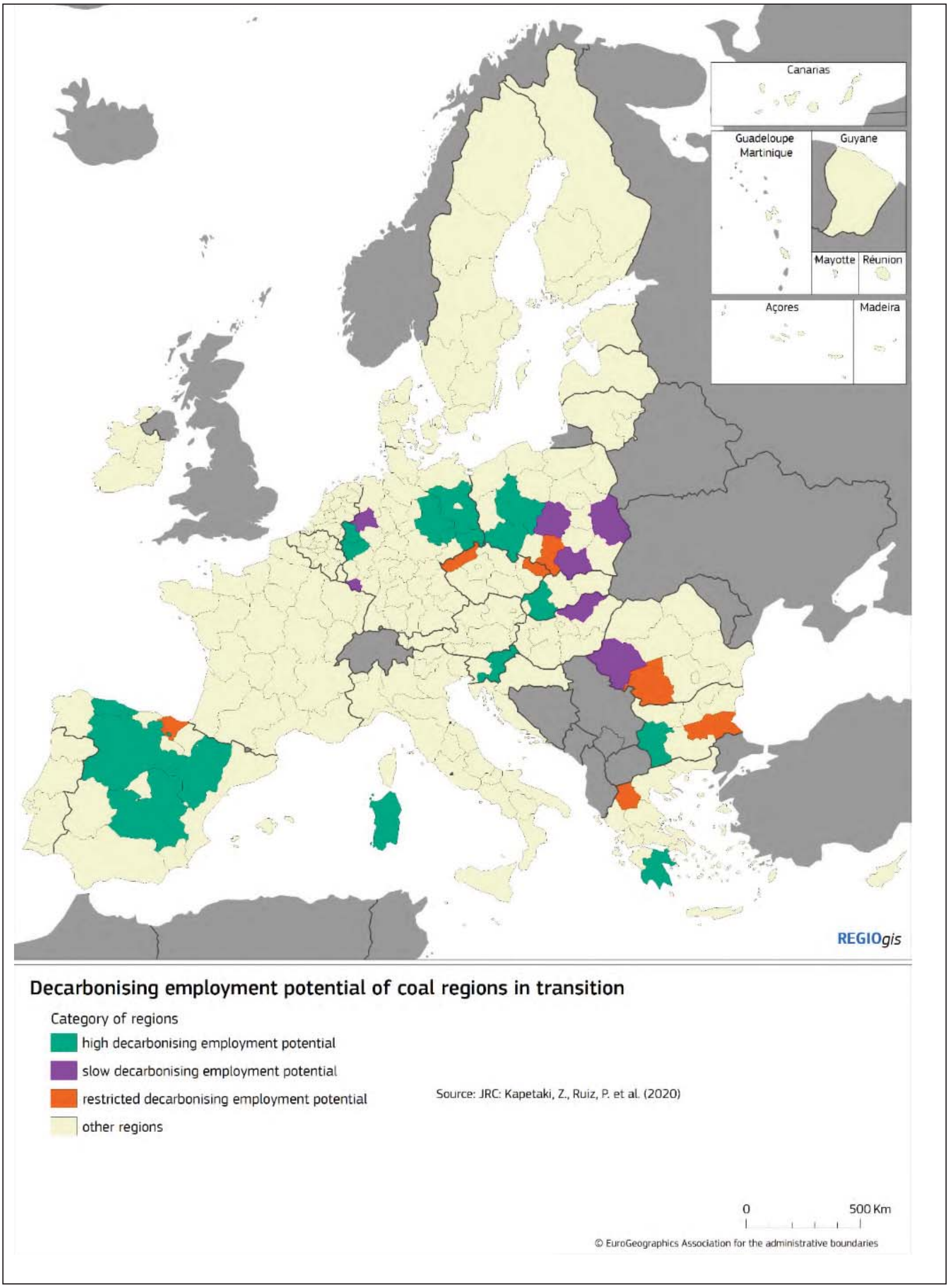
21 The analysis considers various types of job created in terms of their nature and duration. The jobs relating to operations and maintenance are assumed to last 15 years from the installation date, those relating to the manufacturing of the equipment one year (that before the installation) and those associated with installation also one year (that of the installation).

Transition opportunities vary between regions (Map 3-4). In the majority of CRiTs in the EU, clean energy and energy efficiency technologies could trigger significantly higher employment than in their coal industry at present, while in a number of others, potential employment with such technologies is similar to that in their coal industry.

In Map 3-4, regions are grouped as follows:

- 17 regions with High Decarbonising Employment Potential (HDEP): where potential employment in RES- sectors is currently comparable to coal-related jobs. Future decarbonisation will result in the latter being exceeded, though support may be needed to realise the potential identified fully.
- 7 regions with Slow Decarbonising Employment Potential (SDEP) which can potentially develop decarbonising sectors to compensate for the loss of coal-related jobs. The pace of change estimated in the EUCO3232.5 scenario could generate transitionary imbalances., so that support might be needed to accelerate the development of these sectors.
- 7 regions with restricted decarbonising employment potential (RDEP):which under the EUCO3232.5 scenario do not develop employment in decarbonising sectors to a level similar to existing coal-related jobs. Support might be needed to mobilise untapped potential or to promote alternative employment options.

Map 3-4 Decarbonizing employment potential in coal regions under the EUCO3232.5 energy scenario

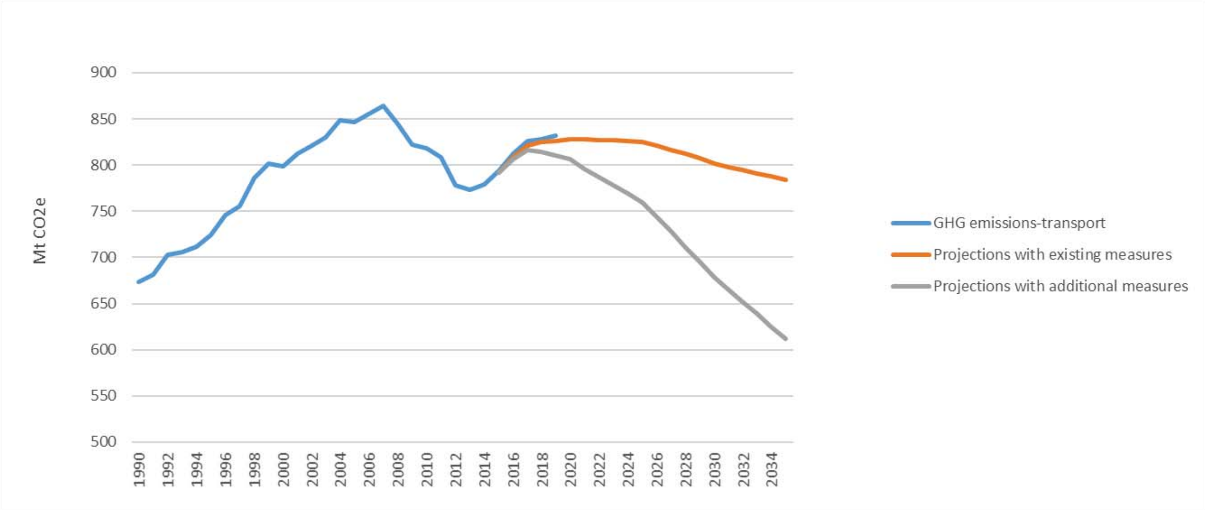


3.2.4 Achieving low-carbon transport

After a sharp drop between 2008 and 2014 as a consequence of the 2008 economic crisis, GHG emissions from transport in the EU increased from 2014 to 2019 at rates similar to those in the period 1990-2008, just under 2% a year[22] (Figure 3-4). This implies that transport has not followed the general tendency for GHG emissions to decline in recent years. Its contribution to overall GHG emissions in the EU has therefore become more significant.

Projections suggest that GHG emissions from transport will decline relatively little over the next few years and will remain higher than in 1990, even with measures currently planned in Member States. Further action is therefore needed, particularly in road transport but also in aviation and shipping where demand is pushing emissions up in both absolute and relative terms. Emission reduction in all transport sub-sectors will need to be much more ambitious if the sector as a whole is to contribute its fair share to the goals set out in the European Green Deal.

Figure 3-4 GHG emissions in transport 1990 to 2019 and projections to 2035[23], Metric tons of carbon dioxide equivalent (MtCO2e), EU-27



Source: EEA.

The new EU Strategy on Sustainable and Smart Mobility[24] includes measures aimed at significantly reducing CO2 and polluting emissions in all modes of transport with the objective of reducing emissions by 90% by 2050. As part of the strategy, the Commission will foster the use of more sustainable transport modes such as rail and inland waterways.

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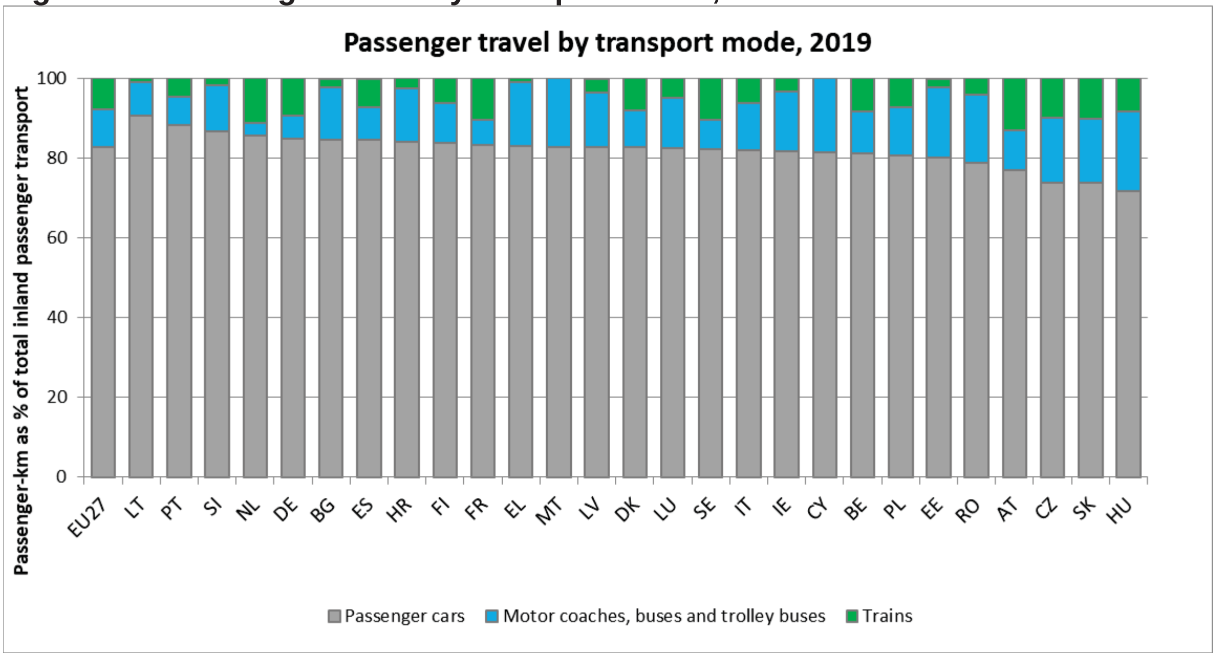
22 See EEA, Indicator Assessment, Greenhouse gas emissions from transport in Europe, https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases-7/assessment.

23 The values shown include all domestic transport emissions as well as international aviation and international maritime transport. The 'with existing measures' scenario reflects existing policies and measures and the 'with additional measures' scenario also includes further planned policies and measures reported by Member States until March 2020.

24 The EU Strategy for Sustainable and Smart Mobility (EUSSSM) was announced by the European Commission as part of its Communication on the European Green Deal. The EUSSSM aims to contribute to the achievement of the EU Green Deal target of reducing transport-related GHG emissions by 90% by 2050.

The use of cars remains predominant for passenger travel and has even expanded slightly in recent years (Figure 3-5). In 2014, cars were used for 82.2% of inland travel and in 2019 for 82.8%. The share of passenger travel by train increased slightly from 7.7% to 8.0%, meaning that the share by buses, trams and trolleybuses fell from 10.1% to 9.2%. Cars account for less than 80% of passenger travel in only 5 Member States (Romania, Austria, Slovakia, Czechia and Hungary), while in Lithuania the share is over 90%.

Figure 3-5 Passenger travel by transport mode, 2019



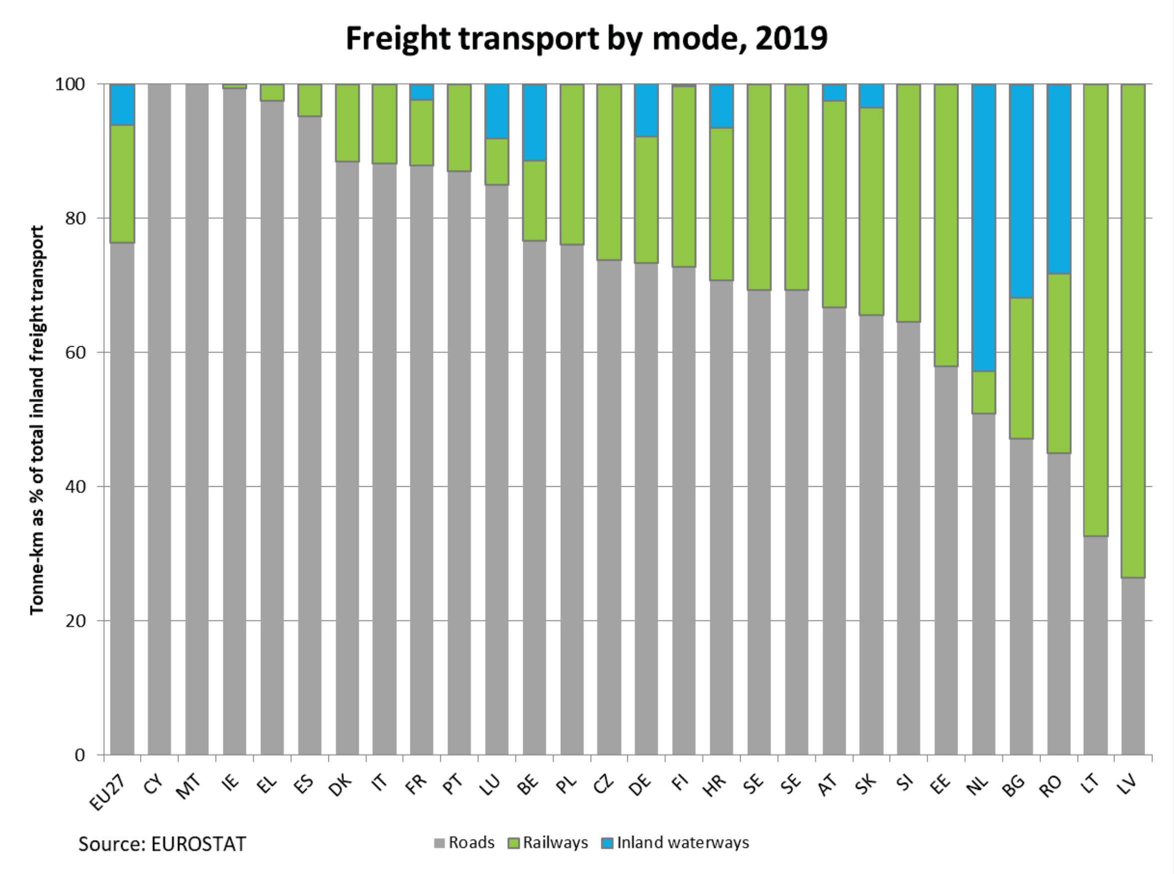
Source: EUROSTAT

These trends are a matter of concern as transport is responsible for almost a quarter of EU GHG emissions and is the main cause of air pollution in cities. Roads are by far the biggest emitter accounting for over 70% of all GHG emissions from transport in 2019. Emissions from road transport, however, are expected to diminish as it decarbonises faster than other modes. The largest increases are expected in aviation and international maritime transport, which are likely to account for a bigger share of transport emissions in coming years.

As in the case of passenger travel, most goods in the EU are transported by road (

Figure 3-6). In 2019, 76.6% of freight was carried by road, up from 73.9% in 2014. In 8 countries, the share is over 80%, peaking at 98 and 99 in Greece and Ireland, respectively (Malta and Cyprus have no inland waterways and railways transport, therefore the share freight carried by road is 100%). At the other end of the scale, over half of freight is transported by rail or inland waterways in Bulgaria, Romania, Latvia and Lithuania.

Figure 3-6 Freight transport by mode, 2019



Source: EUROSTAT.

3.3 Reducing the impact of climate change

Climate change is recognised as the most serious threat to human societies around the world. Scientists see an increase in global temperature of 2°C relative to pre-industrial times as the threshold beyond which there is a very real risk that dangerous and possibly catastrophic changes in the global environment will occur. The past three decades have been warmer than any previous decade since records began in 1850. All parts of the world are potentially affected by the consequences of a rapid rise in temperature and the various climatic changes that are associated with it. Southern and part of Eastern Europe will experience more frequent and severe heat waves, forest fires and droughts. Already Northern Europe is becoming much wetter, with increasing risk of floods and extreme weather events, while coastal areas face the devastating consequences of rising sea levels from the melting of polar ice sheets and glaciers. The marine environment is also heavily affected by climate change and these impacts are projected to increase dramatically with severe implications for marine currents, vulnerable ecosystems such as coral reefs, biological resources and food chains.

The effects of climate change pose a major challenge for a growing number of EU regions. Around 7% of EU population live in areas at high risk of floods and over 9% live in areas where there are already over 120 days a year without rain. The exposure of EU regions to the damaging effects of climate change, however, differ widely between them, depending on their location but also the structure of their economies, given that sectors such as tourism or agriculture are likely to be particularly affected.

3.3.1 The threat of floods from climate change

Flooding is a major cause of economic damage and loss of life in Europe and other parts of the world[25]. Despite considerable efforts to reduce the risk, the damage from floods appears to have increased over recent decades[26]. Ongoing climate change coupled with growing land take, especially in flood plains, is likely to further increase the social and economic damage in the EU.

The greater risk of floods for future societies makes it important to identify adaptation strategies that are effective and sustainable in economic, social and environmental terms. In particular, such strategies need to be assessed in terms not only of their effectiveness in reducing the potential damage, but also of the economic costs involved (e.g. for building and maintaining defences). According to recent estimates of the consequences of river flooding[27], if no mitigation and adaptation measures are taken and the global temperature rises by 3°C by the end of the century, economic losses from river flooding will grow to nearly €50 billion a year, or over 6 times more than at present, and nearly three times as many people would be exposed to flooding[28]. The damaging effects are projected to increase with higher temperatures and economic growth in almost all EU regions, although countries in Eastern Europe would suffer larger losses relative to their GDP (

[25] See for instance Alfieri, L., Feyen, L., Dottori, F., Bianchi, A. (2015), “Ensemble flood risk assessment in Europe under high end climate scenarios”, Global Environmental Change 35, 199–212, https://doi.org/10.1016/j.gloenvcha.2015.09.004.

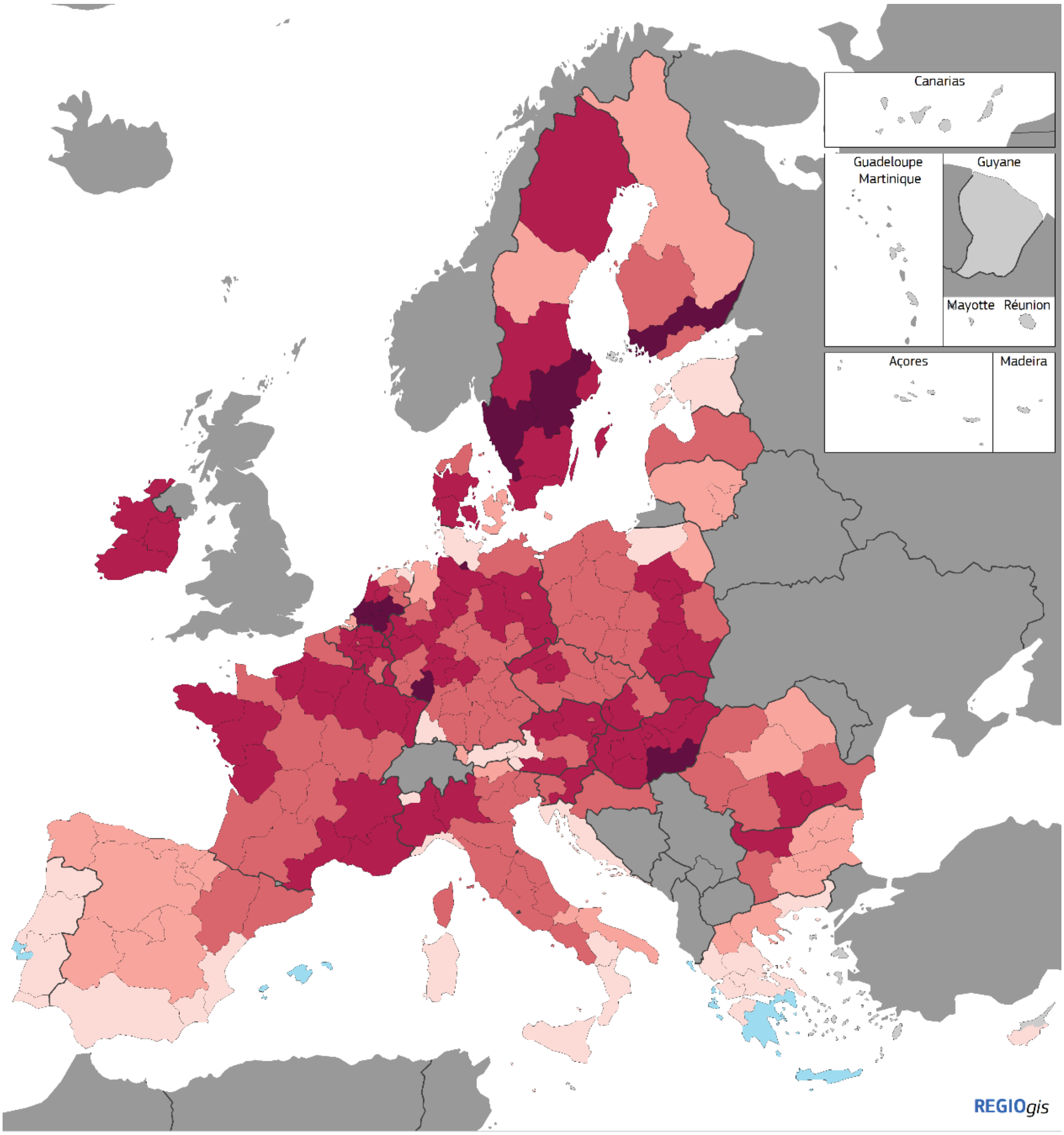
[26] Paprotny, D., Sebastian, A., Morales-Napoles, O., Jonkman, S. (2018) Trends in flood losses in Europe over the past 150 years. Nature Communications 9(1), 1985, https://doi.org/10.1038/s41467-018-04253-1.

[27] Dottori F, Mentaschi L, Bianchi A, Alfieri L and Feyen L (2020), “Adapting to rising river flood risk in the EU under climate change”, Publications Office of the European Union, Luxembourg, doi:10.2760/14505, JRC118425.

[28] Dottori F, Mentaschi L, Bianchi A, Alfieri L and Feyen L (2020), “Adapting to rising river flood risk in the EU under climate change”, Publications Office of the European Union, Luxembourg, doi:10.2760/14505, JRC118425.

Map 3-5). Limiting global warming to 1.5°C would halve economic losses and the population exposed to river flooding in the EU.

Map 3-5 Economic damage due to floods in 2100 under the 3°C warming scenario relative to the baseline



Economic damage due to flooding under the 3°C warming scenario, 2100

% change relative to baseline

- < 0
- 0 - 100
- 100 - 250
- 250 - 500
- 500 - 1000
- > 1000
- no data

EU-27 = 498
JRC

0 500 Km

© EuroGeographics Association for the administrative boundaries

Flood risk reduction strategies can substantially reduce the projected losses due to climate change. However, these strategies have different costs as well as benefits, as illustrated by a recent study which assessed four different approaches to limit the damages from coastal flooding[29]:

- Strengthening existing dyke systems, which is likely to have larger benefits than costs but tend to transfer risks downstream by stimulating further the development of human settlements and activities in risk zones behind flood barriers, which can result in catastrophic effects in case of failure;
- Retention areas and dykes require large investment but can reduce the economic and human losses substantially;
- Flood proofing buildings can markedly reduce losses with limited investment, but they do not prevent floods from happening and so can only partly prevent flood damage.
- Relocation can produce the largest benefits but tends to be the least cost-effective, though the costs involved vary substantially; it also tends to have low social acceptance.

Results suggest that reducing flood peaks using retention areas has strong potential for lowering the effects in a cost-efficient way in most EU countries (see section 3.3.2). Implementing such a strategy at EU level could reduce the economic damage and population exposed to flooding by over 70% by 2100. Moreover, retention areas have many additional benefits, such as restoring the natural functioning of flood plains and improving the ecosystem by improving nutrient removal, water filtration and the replenishment of groundwater reservoirs, providing fish-spawning habitat as well as opportunities for recreation and nature-based activities. Depending on local circumstances, other strategies than creating retention areas may be more suitable.

3.3.2 Protecting Europe's coasts against rising seas

Coastal zones are areas of high interest. Over 200 million people in the EU live within 50 km of the coast, stretching from the north-east Atlantic and the Baltic to the Mediterranean and Black Sea and in the EU outermost regions, and the evidence is that migration to coastal zones is continuing. Such areas in many cases are locations for major commercial activities and support diverse ecosystems with important habitats and sources of food.

Coastal zones are particularly vulnerable to climate change due to the combined effects of rising sea levels and the increasing frequency and intensity of storms, adding to already significant pressures from human activities. The mean global sea level has increased by 13-20 cm since pre-industrial times[30] and at an accelerating

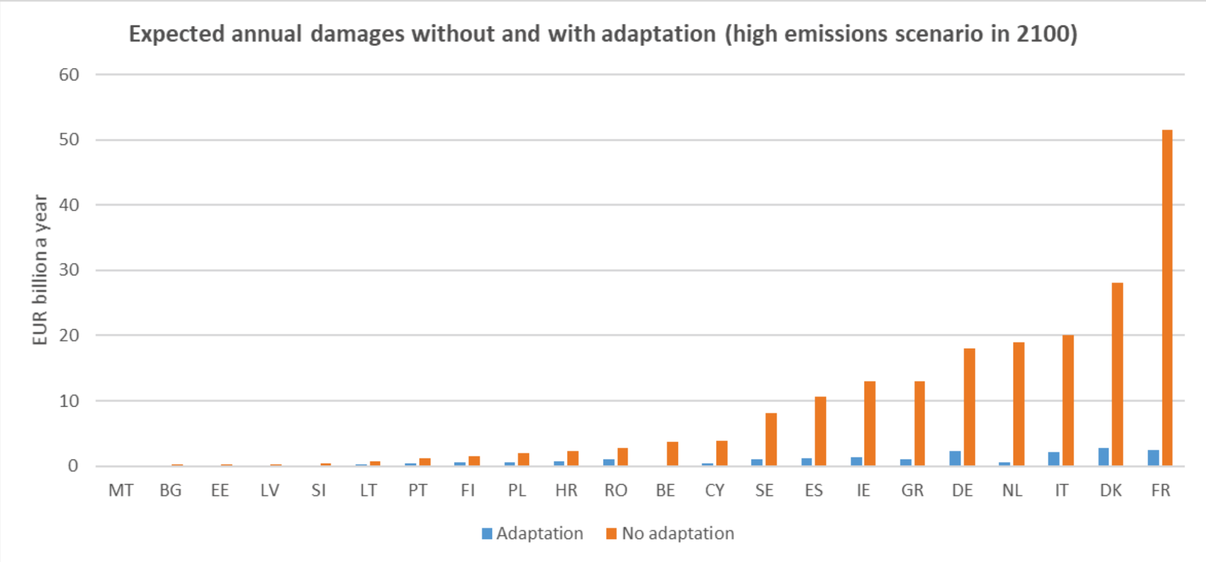
[29] Vousdoukas, M. I. et al (2020), « Economic motivation for raising coastal flood defences in Europe", Nature Communications 11, 2119, doi:10.1038/s41467-020-15665-3.

[30] See for instance Dangendorf, S. et al (2019),, "Persistent acceleration in global sea-level rise since the 1960s", Nature Climate Change 9, 705-710, doi:10.1038/s41558-019-0531-8.

rate since the 1990s, the rise since 1950 being explicable by global warming[31]. This has already contributed to coastal erosion and made Europe's coasts more susceptible to hazards. The continued rise in sea levels from global warming could result in unprecedented coastal flood losses in the EU unless additional coastal protection and measures to reduce risks are implemented.

This is affirmed by a recent study[32], which assesses the costs and benefits of applying additional protection through dyke improvements. The largest amounts of damage are projected for France, Denmark, Italy, the Netherlands and Germany (Figure 3-7), though for some countries the potential damage is larger in relation to GDP, such as for Cyprus (5%), Greece (3%) and Denmark (2%). Appropriate adaptation measures are therefore needed to lessen these damaging effects.

Figure 3-7 Estimated damage to coastlines in 2100 without and with adaptation measures (high emissions scenario) [33]



Source: Vousdoukas et al. (2020).

As argued by the authors, raising dyke levels along the EU coast could significantly reduce damages from flooding. The costs and benefits involved, however, vary markedly along coastal sections. The presence of human settlements makes investing in dykes economically beneficial, typically when population density exceeds 500 people per square km. In urbanised and major economic areas, the benefits of

31 Fasullo, J. T. and Nerem, R. S. (2018), "Altimeter-era emergence of the patterns of forced sea-level rise in climate models and implications for the future", Proceedings of the National Academy of Sciences 115, 12944-12949, doi:10.1073/pnas.1813233115

32 Vousdoukas, M., Mentaschi, L., Hinkel, J., Ward, Ph., Mongelli, I., Ciscar,J-C, and L. Feyen (2020), "Economic motivation for raising coastal flood defenses in Europe", Nature Communications 11, 2119, doi:10.1038/s41467-020-15665-3.

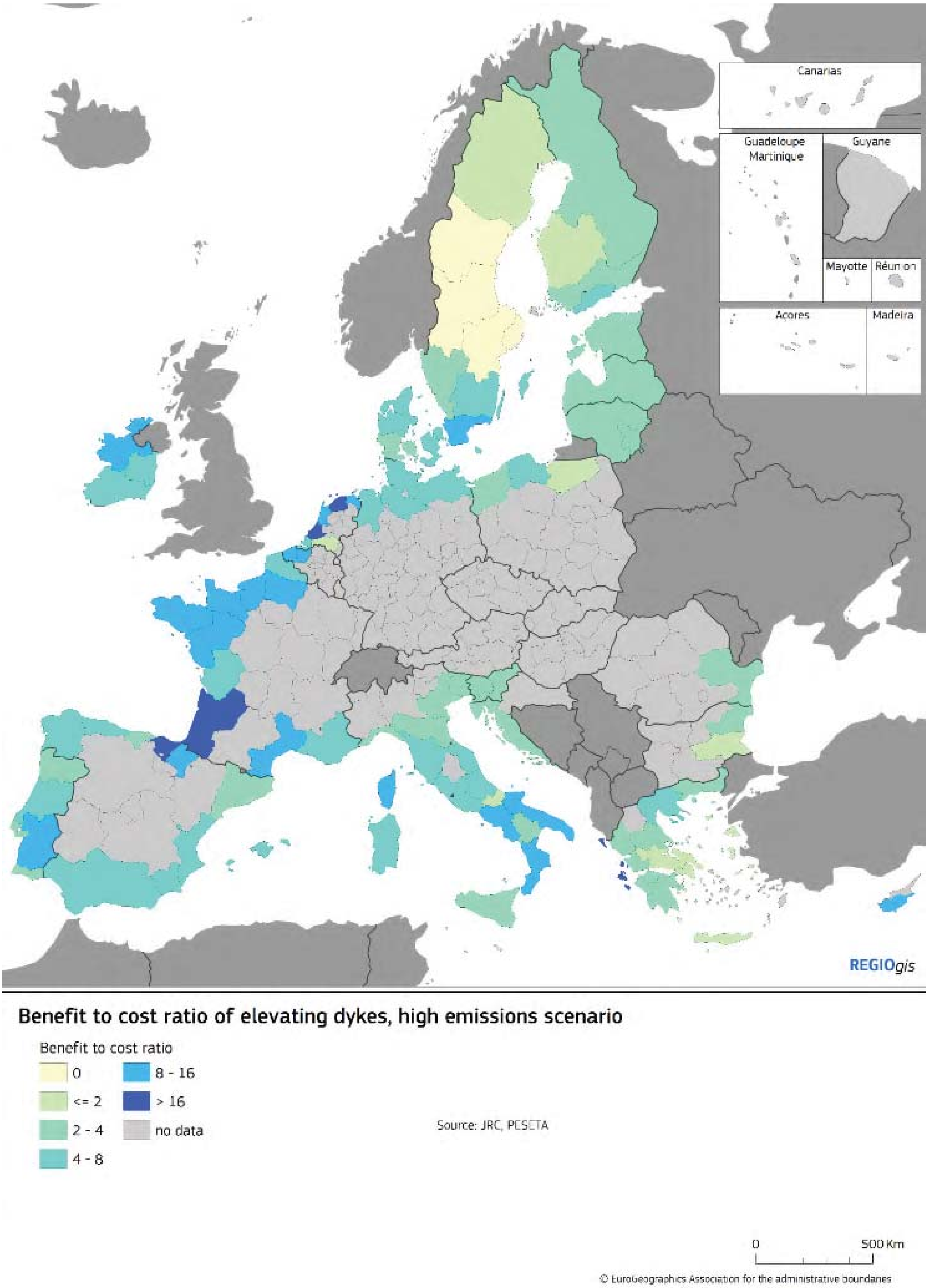
33 Projections to 2100 under a high emissions scenario corresponding to a global warming scenario called "RCP8.5" frequently referred to as "business as usual", suggesting it is a likely outcome if concerted efforts are not made to cut GHG emissions.

raising dykes tend to be several times the costs. Under a high emissions scenario, this would be the case for around 23% of the EU coastline. For the remainder, additional protection against coastal flooding is not needed or is not economically beneficial. This is either because natural barriers will provide sufficient protection against the rise in sea levels or because the costs of increasing dyke levels outweigh the benefits, such as in almost inhabited areas or along winding coastlines.

The analysis suggests that the average increase in the height of coastal defences needed where further protection is required is one meter under a high emissions scenario. In Slovenia, Latvia, Poland, Germany and the Netherlands it is well above this, and in Belgium it is over 2 meters. This implies that along many such areas, the shoreline might well become disconnected from hinterland areas.

When benefits and costs are aggregated across coastal sections of NUTS2 regions, the benefits to cost ratio (BCR) is highest in urban centres (Map 3-6). Adaptation brings large net economic benefits in the Ionian Islands (a BCR of 30 under a high emissions scenario), País Vasco (27), Aquitaine (16), Calabria (11.3), Basse-Normandie (14), Pays de la Loire (13), Puglia (11) and Alentejo (11).

Map 3-6 Benefit to cost ratios of elevating dykes in NUTS2 regions under a moderate mitigation and high emissions scenario



Aggregating the results for coastal sections to the country level shows the Netherlands to have the highest BCR under a high emissions scenario (18), followed by Greece (12), France and Belgium (11 for each). By contrast, the BCR is low – though still over 1 – in Bulgaria, Finland, Romania, Croatia and Malta (3 or less in each case).

Investments in green infrastructure can also provide an efficient mean to enhance EU coastal defences against sea level rise. In particular, protecting and restoring costal ecosystems such as seagrass meadows and coral reefs can buffer the impacts of storms and help to reduce coastal erosion while bringing simultaneous benefits for biodiversity and natural resources.

3.3.3 Infrastructure is also at risk

The EU has an extensive transport network, with around 5 million km of paved roads, 0.5 million km of railways, over 2 400 airports, and almost 2 000 seaports, with a combined estimated value of around EUR 9 trillion. This is particularly susceptible to climate hazards and so is generally built to withstand the variations in temperature as indicated by historical observations, or according to regional standards of construction. However, rises in average temperatures or greater frequency of extreme weather events as a result of increased GHG emissions are likely to lead to increased economic losses.

A recent study[34] estimates the direct effects of flooding and heatwaves (two of the most damaging climate-related hazards according to a 20 year review by the UN Office for Disaster Risk Reduction[35]) on the transport network in the EU, covering the modes of roads, railways, airports, and seaports. For each hazard, the effect is estimated as the change in expected annual damage for global warming levels of 1.5, 2, and 3°C relative to 1981–2010.

As would be expected, flood risk is concentrated in areas prone to flooding with high-value infrastructure, such as motorways and electrified railways. Some 95% of potential flood damage comes from roads and railways, with airports and seaports accounting for only 4%. The estimated cost of potential damage to railways is particularly high, at almost twice that of roads, reflecting the much higher costs of reconstruction and their location in lower lying terrain.

Nearly all regions in the EU are expected to experience increasing flood damage to their infrastructure as a results of climate change, particularly those prone to flooding in north-western and Eastern Europe, where the damage could in some case be over 6 times the present damage with global warming of 3°C. For most southern regions,

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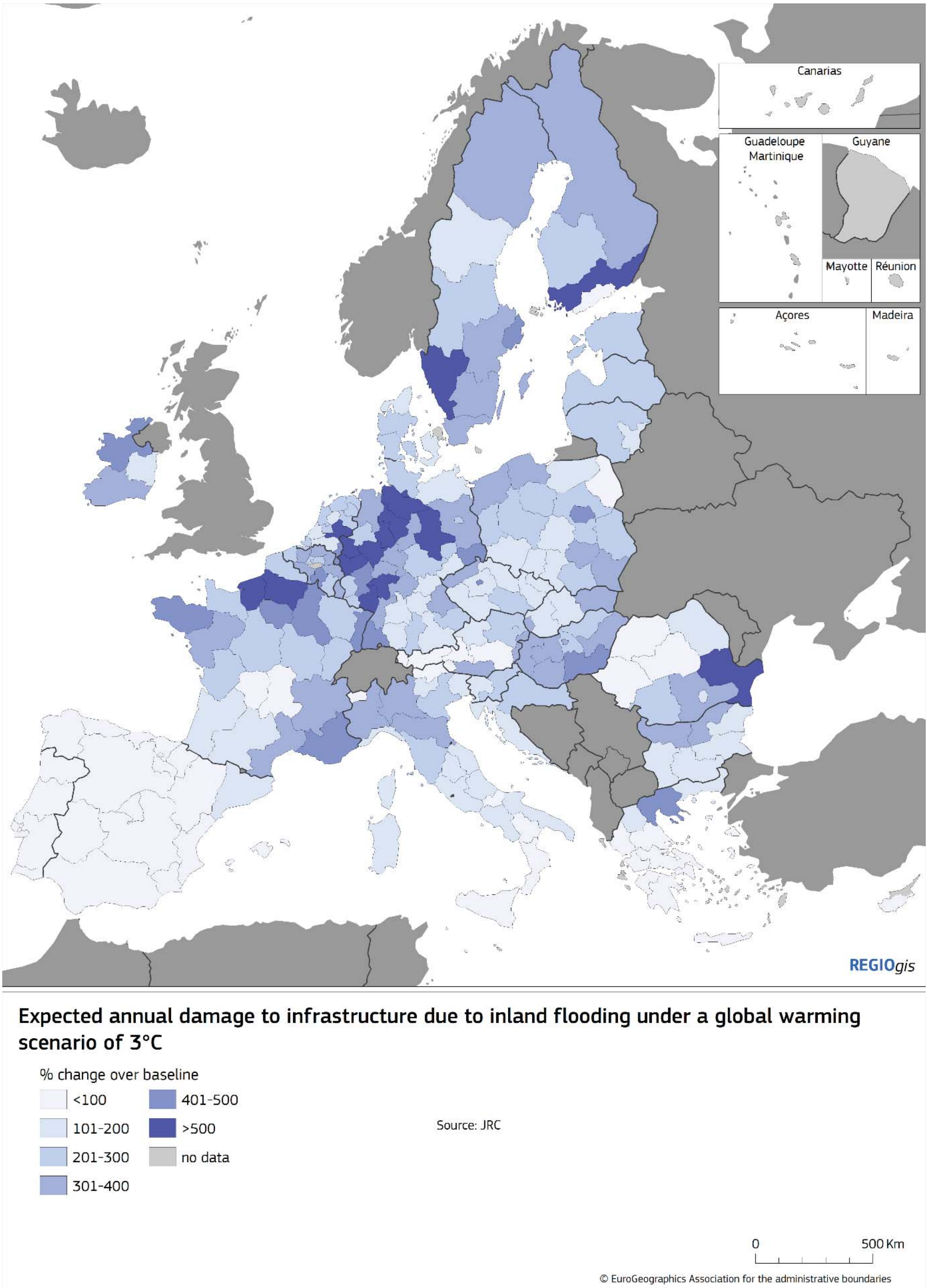
34 Feyen, L., Mulholland E., Dottori, F., Alfieri, L., Mentaschi, L., Ciscar, J-C, (2020), “Climate change impacts and adaptation in Europe” - PESETA IV. JRC.

35 Pascaline, W. and H. Rowena (2018), “Economic Losses, Poverty & Disasters: 1998-2017”. United Nations Office for Disaster Risk Reduction.

damage to transport infrastructure from floods is projected to increase less dramatically, but could still be over twice as high as today (Map 3-7).

Map 3-7 Expected annual damage to infrastructure due to inland flooding under a global warming scenario of 3°C



Road maintenance costs are also projected to rise in all EU regions as a result of more frequent spells of extreme heat. The most significantly affected countries in terms of additional cost to maintenance are Bulgaria, Poland, Greece, Ireland and Romania. Future risk can be alleviated by upgrading roads or doing more frequent maintenance.

Most of the increased maintenance costs are on tertiary and rural roads, which are generally managed by local authorities. Since their road maintenance budgets already tend to be constrained, damages from climate change could be particularly problematic for them.

The buckling of railway lines is also likely to occur more frequently with global warming so increasing maintenance costs. The biggest increases (of up to 10% with global warming by 3°C) are projected for regions in Germany and southern Spain, because of stress-free temperatures[36] being likely to be exceeded most often. Significant increases are also likely in regions in Belgium, France, Sweden, Finland, Poland and Czechia.

3.3.4 Unevenly distributed impact of extreme temperature events

Extreme heat events are projected to happen more frequently and become more intense with climate change. The number of people exposed to heatwaves in the EU is projected to grow from 10 million/year (average 1981-2010) to nearly 300 million/year in a scenario with 3°C global average warming by the end of this century[37]. As a result, the number of fatalities from extreme heat could increase up to nearly 100,000 per year if no mitigation measures are taken, which is significantly higher than the current 2,750 annual deaths.

The exposure of the population to the risk of extreme temperature considerably varies across EU Member States and regions. Risks of being exposed to extreme heat should increase in southern Europe while milder winters could reduce significantly exposure to extreme cold, nearly 10-fold with 3°C global average warming by the end of this century (Map 3-8). Heatwaves, human exposure and fatalities are projected to increase everywhere in Europe but Cyprus, Greece, Malta and Spain could see a 40-fold increase in mortality from heatwaves if no adaptation and mitigation actions are taken.

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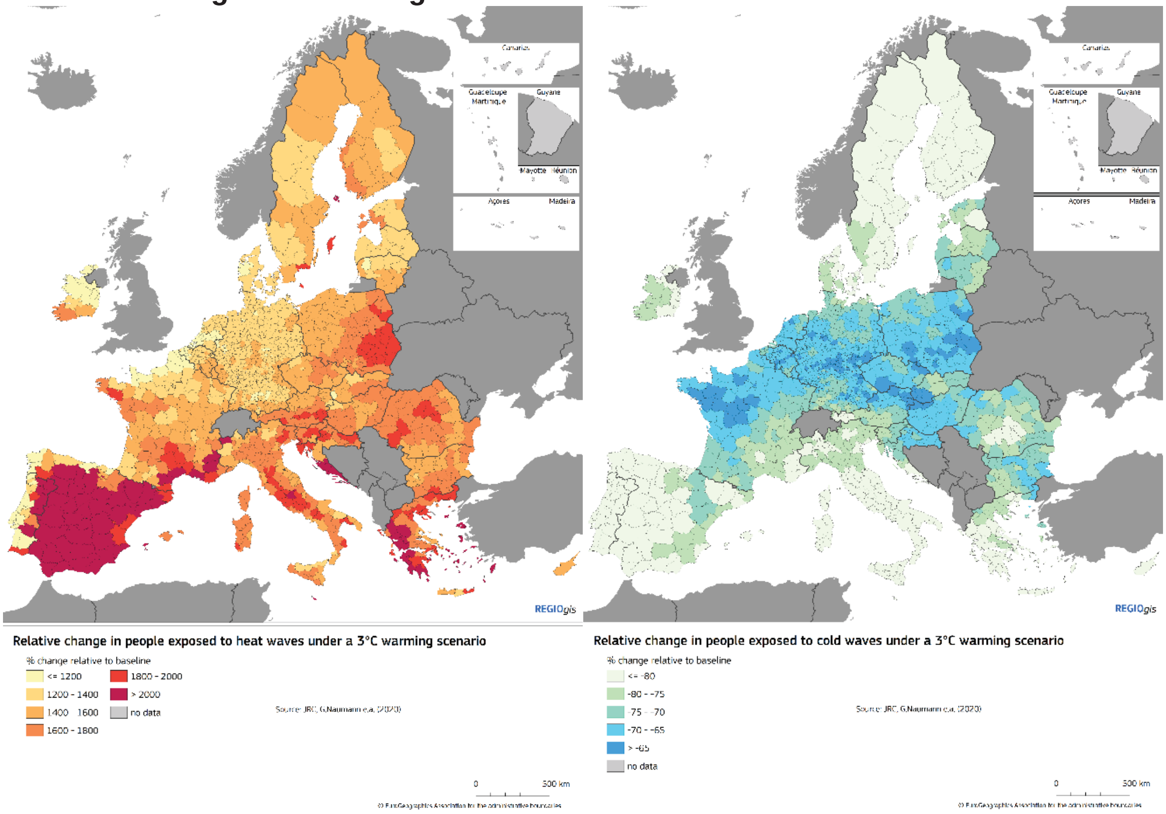
[36] Stress-free (or neutral) temperature is the point at which the rail is not in tension or compression. The stress-free temperature is usually set at 5° or so above the mid-point between the lowest and highest temperature the rail is likely to reach. Railway companies need to monitor the stress-free temperature of the rail to identify risks, plan effective maintenance and maintain safety and operating performance.

[37] The PESETA IV task on human impacts of heat and cold extremes provides a quantitative assessment of human exposure to and mortality from these extremes in Europe. The methodology integrates empirical data on human losses from disasters, past climate information, EUROSTAT demographic data and high resolution climate and socio-economic projections.

Map 3-8 Projected changes in human exposure to heat and cold waves events for a 3.0°C levels of global warming



In order to limit exposure and the increase of fatalities linked to extreme heat, a wide range of measures can be taken, including improved design and insulation of houses, schools and hospitals, education or early warning systems. This risk also needs to be taken into consideration in urban planning in order to minimise the urban heat island effect[38]. In that perspective, urban green infrastructure can play an important role, notably by increasing tree and vegetative cover, installing green or reflecting roofs, or using cool pavements (see section 3.5).

3.4 Improving our environment

The EU faces unprecedented challenges of environmental sustainability, notably from accelerating biodiversity loss, degradation of ecosystem services, depletion of scarce resources and various forms of pollution, with the associated risk to human health and well-being.

As pointed by a series of recent scientific reports from the EEA, IPCC, IPBES, IRP and UN Environment[39], current trends in production and consumption are fundamentally unsustainable.

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[38] Urban heat islands are urbanised areas that experience higher temperatures than outlying areas. This is often due to the fact that structures such as buildings, roads, and other infrastructure absorb and re-emit the sun’s heat more than natural landscapes such as forests and water bodies.

[39] Intergovernmental Panel on Climate Change (IPCC) reports on 1.5 °C Global Warming and Climate Change and Land; Intergovernmental Science-Policy Platform on Biodiversity and

The EU has launched many policy initiatives to address these challenges, putting in place a broad range of legislation to reduce air, water and soil pollution. These have produced substantial benefits over recent decades. EU citizens enjoy some of the best water quality in the world and over 18% of the EU land area has been designated as protected for nature. As part of the European Green Deal, the European Commission adopted the EU Biodiversity Strategy 2030, which acknowledges nature restoration as a key contribution to both climate change mitigation and adaptation, the Farm to Fork Strategy[40], the Zero pollution action plan[41], the EU forest strategy[42] and the EU Soil Strategy[43]. The 8th Environmental Action Plan is designed to support the objectives of the European Green Deal and the transition towards a climate-neutral, resource-efficient and regenerative economy while improving the status of ecosystems.

These EU initiatives have set targets to tackle environmental challenges via concerted action and systemic solutions. Their delivery will greatly depend on support from EU and national policy and funding instruments.

3.4.1 More investment needed to improve water quality

Essential for human health and well-being, water is also a key resource for agriculture, certain industries, energy production and transport. Water and wetland areas are also necessary for the provision of a number of ecosystem services (e.g.

Ecosystem Services (IPBES) Global Assessment Report on Biodiversity and Ecosystem Services; International Resource Panel (IRP) Global Resources Outlook report; UN Environment Global Environment Outlook 6.

40 The farm to fork strategy sets ambitious targets by 2030 on reducing the use and risk of chemical pesticides and the use of more hazardous pesticides by 50%, reducing nutrient losses by at least 50%, reducing the use of fertilisers by at least 20%, reducing the sales of antimicrobials for farmed animals and in aquaculture by 50% and reaching 25% of agricultural land under organic farming. The reform of the Common Agricultural Policy and the national CAP Strategic Plans to be in place as of 2023 will contribute to achieving those targets.

41 The zero pollution action plan for 2050 aims at reducing air, water and soil pollution to levels no longer considered harmful to health and natural ecosystems. It includes key 2030 targets: improving air quality to reduce the number of premature deaths caused by air pollution by 55%; improving water quality by reducing waste, plastic litter at sea (by 50%) and microplastics released into the environment (by 30%); improving soil quality by reducing nutrient losses and chemical pesticides' use by 50%; reducing the EU ecosystems where air pollution threatens biodiversity by 25%; reducing the share of people chronically disturbed by transport noise by 30%, and significantly reducing waste generation and residual municipal waste by 50%.

42 The new EU forest strategy for 2030 supports the EU's biodiversity objectives as well as the GHG reduction target of at least 55% by 2030 and climate neutrality by 2050.

43 EU Soil Strategy for 2030: reaping the benefits of healthy soils for people, food, nature and climate (COM(2021) 699 final). The aim of the EU Soil Strategy is to help achieve land degradation neutrality by 2030. The strategy will consider challenges such as identifying contaminated sites, restoring degraded soils, defining the conditions for their good ecological status and improving the monitoring of soil quality.

floodplains) and indispensable for preserving biodiversity as habitats for many species.

The condition of water bodies in the EU is a concern. Only 40 % of these are in good ecological state and many wetlands are in a poor condition[44]. Even though various sources of pollution have been reduced over the past decade, the pressure from nutrients[45], hazardous substances and over-abstraction of water remains high. This implies that the objective set in the Water Framework Directive (2000/60/EC) of achieving good qualitative and quantitative status of all water bodies by 2015 is still not reached.

Most EU citizens benefit from good water services (such as drinking water supply, and waste water collection and treatment) but access to those services is still lacking in a number regions, notably rural areas and less developed regions.

The Urban Waste Water Treatment Directive[46] (UWWTD) has a key role in reducing water pollution in the EU by requiring Member States to collect and treat urban wastewater. Its objective is for all wastewater to be collected and suitably treated. Implementing the Directive requires significant investment in new infrastructure but also in the maintenance and extension of existing facilities.

The considerable investment made in improving urban wastewater treatment has helped to reduce concentrations of organic matter and nutrients in surface waters. In 2018, more than 98% of urban wastewater was collected[47], though there are still a number of agglomerations where infrastructure needs to be built or improved. Only around 89% of wastewater was collected in Croatia and 85% in Cyprus, while in Romania, the figure was less than 80%, with just 57% being collected in Sud-Muntenia.

Significant effort is still required regarding treatment[48]. In the EU, around 7% of urban waste water failed to meet secondary treatment (biological) standards in 2018, while

44 European Environment Agency (2019), The European environment — state and outlook 2020, Knowledge for transition to a sustainable Europe, Luxembourg, Publications Office of the European Union. doi: 10.2800/96749.

45 Nutrient pollution is caused by excess nitrogen and phosphorus in the air and water. Nitrogen and phosphorus are nutrients that are natural parts of aquatic ecosystems.

46 Council Directive 91/271/EEC.

47 These figures do not systematically correspond to the targets set in the UWWTD as in some Member States not all agglomerations are required to comply with the provisions of the Directive because of transitional periods.

48 The level of treatment partly determines the effect of wastewater on aquatic ecosystems. Primary (mechanical) treatment removes part of the suspended solids, while secondary (biological) treatment uses aerobic or anaerobic micro-organisms to decompose most of the organic matter and retain some of the nutrients. Tertiary (advanced) treatment removes the organic matter even more completely.

over 16% did not meet more stringent standards (removal of phosphorus and nitrogen). Almost 79% of regions in EU provide at least secondary treatment to 90% of their urban wastewater, but this share falls to 57% for more stringent treatment. Less than 30% of urban wastewater receives tertiary treatment in Croatian regions, some regions in Italy, Romania and Spain and in a number of French and Portuguese outermost regions (Map 3-9).

Map 3-9 Urban wastewater receiving more stringent treatment