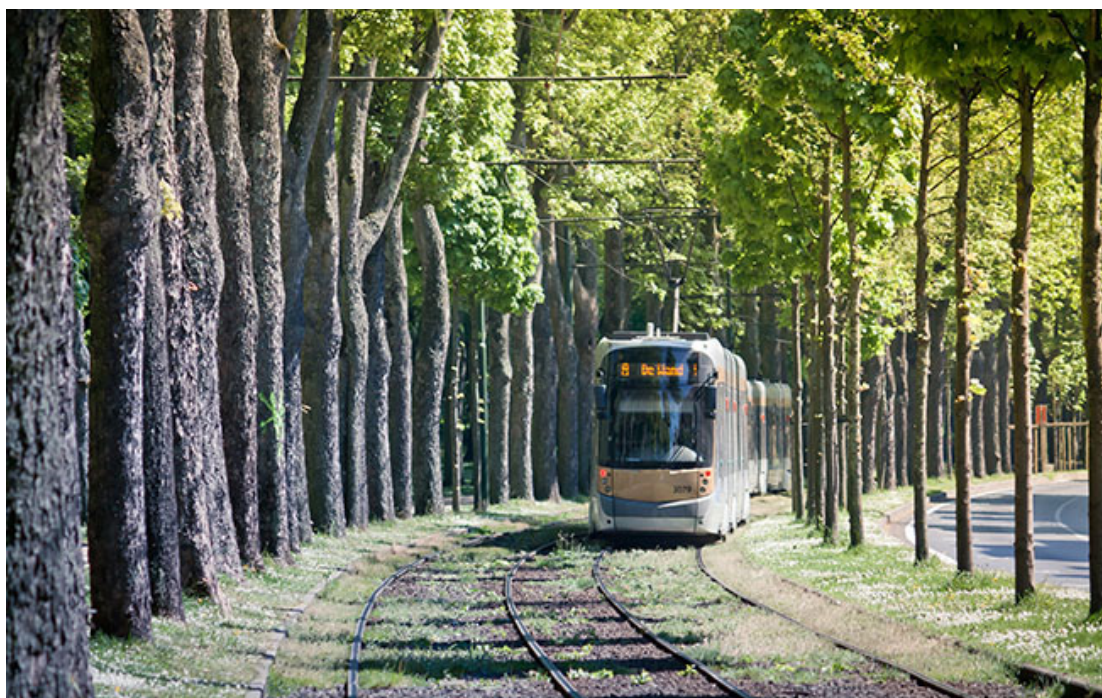


STUDY

Requested by the REGI committee



Cohesion Policy and Climate Change



Regional Development



Policy Department for Structural and Cohesion Policies
Directorate-General for Internal Policies
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RESEARCH FOR REGI COMMITTEE

Cohesion Policy and Climate Change

Abstract

This study provides an assessment of how EU Cohesion Policy currently contributes and can contribute in the future to the attainment of the goals of EU Climate Policy. It explains how much of the budget goes to climate action and to what kind of initiatives across EU regions. It also discusses the obligations from the Paris Agreement, the role of Cohesion Policy within the European Green Deal and the impact of phasing out fossil fuels. Policy recommendations for strengthening climate action financed by Cohesion Policy are set out.

This document was requested by the European Parliament's Committee on Regional Development.

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CONTENTS

LIST OF ABBREVIATIONS	4
LIST OF BOXES	6
LIST OF FIGURES	6
LIST OF TABLES	7
EXECUTIVE SUMMARY	9
1. OVERVIEW OF GLOBAL CLIMATE CRISIS	13
1.1. Climate change evidence and global projections	13
1.2. How near/far we are today from the 1.5°C target in temperature rise?	14
1.3. What are the projected effects of climate change on EU regions?	17
2. COHESION POLICY SUPPORT TO CLIMATE ACTION	23
2.1. How the design of Cohesion Policy takes climate actions into account	24
2.1.1. Incorporation of climate action in the design of 2014-2020 Cohesion Policy	24
2.1.2. How 2021-2027 Cohesion Policy design integrates climate change	28
2.2. Cohesion Policy budget dedicated to climate action	30
2.2.1. How much of Cohesion Policy went to climate action?	30
2.2.2. What kind of interventions were financed so far in 2014-2020?	34
2.2.3. Cohesion Policy budget for climate action in 2021-2027	36
2.2.4. Climate change interventions across main EU geoclimatic regions	41
2.3. Obligations resulting from the Paris Agreement towards Cohesion Policy	60
2.4. Role of Cohesion Policy in the context of the European Green Deal	68
2.5. Investment needs to meet EU 2030 and 2050 climate and energy targets	73
3. IMPACT OF PHASING OUT OF FOSSIL FUELS AND OTHER IMPLICATIONS OF CLIMATE CHANGE FOR EU REGIONS	77
3.1. Impact of phasing out of fossil fuels	78
3.1.1. Decarbonisation targets and actions to achieve them	78
3.1.2. Main effects of phasing out in EU regions	79
3.1.3. Main costs of the phasing out	88
3.2. Implications of climate change for public health and the economy in EU regions	91
4. POLICY RECOMMENDATIONS	95
REFERENCES	108

LIST OF ABBREVIATIONS

CAP	Common Agricultural Policy
CEF	Connecting Europe Facility
CF	Cohesion Fund
CFP	Common Fisheries Policy
CO₂	Carbon Dioxide
COP	Conference of the Parties
COVID-19	Coronavirus Disease 2019
EEA	European Environment Agency
EIB	European Investment Bank
ERDF	European Regional Development Fund
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
ETS	Emissions Trading System
EU	European Union
G20	Group of Twenty: the international forum that brings together the world's major economies accounting for more than 80% of world GDP, 75% of global trade and 60% of the world population.
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GtCO₂e	Gigatonnes of carbon dioxide equivalent
GW	Gigawatt
IB	Intermediate Body
INDC	Intended Nationally Determined Contributions

IPCC	United Nations Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
LIFE	EU's funding instrument for the environment and climate action
LUC	Land Use Change
LULUCF	Land Use, Land Use Change and Forestry
MA	Managing Authority
MFF	Multiannual Financial Framework
MtCO₂e	Million tonnes of carbon dioxide equivalent
MW	Megawatt
NDC	Nationally Determined Contributions
NGEU	Next Generation EU
OP	Operational Programme
PESETA	Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis
RIS3	Regional Innovation Strategy for Smart Specialisation
SIDS	Small Island Developing States
SME	Small and Medium-Sized Enterprises
tCO₂e	Tonnes of carbon dioxide equivalent
TJTP	Territorial Just Transition Plans
UN	United Nations
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change

LIST OF BOXES

Box 1:	Examples of initiatives for climate change in Atlantic regions	40
Box 2:	Examples of initiatives for climate change in Continental regions	44
Box 3:	Examples of initiatives for climate change in Mediterranean regions	48
Box 4:	Examples of initiatives for climate change in Mountain regions	52
Box 5:	Examples of initiatives for climate change in Boreal and Arctic regions	55
Box 6:	Examples of initiatives for climate change in outermost regions	59

LIST OF FIGURES

Figure 1:	Greenhouse gas emission trend projections and target	17
Figure 2:	Changes from reference (1981-2010) in annual average temperature (top panels) and precipitation (bottom) for the three global warming scenarios* used in PESETA IV	21
Figure 3:	Key observed and projected climate change and impacts for the main biogeographical regions in Europe	24
Figure 4:	EU amounts planned, decided and spent for climate action	31
Figure 5:	Cohesion Policy decided and spent as % of planned over time	31
Figure 6:	Total planned amounts for climate action across the EU27 + UK	32
Figure 7:	Share of Cohesion Policy focused on climate change	33
Figure 8:	Cohesion Policy amounts for climate action (annual average) as % of NEEP	36
Figure 9:	Cohesion Policy amount planned for climate action across types of regions	34
Figure 10:	Distribution of amounts for climate action by Thematic Objective	35
Figure 11:	Distribution of Cohesion Policy funds by macro-category of intervention	36
Figure 12:	Cohesion Policy funds across main EU regions	38
Figure 13:	Cohesion Policy contribution to climate action in Atlantic regions	39
Figure 14:	Cohesion policy funds planned by macro-category of intervention in Atlantic regions	43
Figure 15:	Cohesion Policy contribution to climate action in Continental regions	43
Figure 16:	Cohesion policy funds planned by macro-category of intervention in Continental regions	47
Figure 17:	Cohesion Policy contribution to climate action in Mediterranean regions	47
Figure 18:	Cohesion policy funds planned by macro-category of intervention in Mediterranean regions	52
Figure 19:	Cohesion Policy contribution to climate action in Mountain regions	51

Figure 20:	Cohesion policy funds planned by macro-category of intervention in Mountain regions	56
Figure 21:	Cohesion Policy contribution to climate action in Boreal and Arctic region	54
Figure 22:	Cohesion policy funds planned by macro-category of intervention in Borea and Arctic regions	59
Figure 23:	Cohesion Policy contribution to climate action in outermost regions	58
Figure 24:	Cohesion policy funds planned by macro-category of intervention in outermost regions	64
Figure 25:	Evolution of EU targets for climate mitigation	61
Figure 26:	GHG emissions by Member State	62
Figure 27:	Estimated annual decrease of GHG: overview of programme targets, decided and implemented values in 2018 (MtCO ₂ e)	72
Figure 28:	Estimated annual decrease of GHG: overview of programme targets, by year and Member State in 2018 (MtCO ₂ e)	72
Figure 29:	Additional capacity of renewable energy production: overview of programme targets, decided and implemented values, per Member State, in 2018 (MW)	73
Figure 30:	An indicator of dependency on fossil fuels: Gross Inland Consumption of energy (ktoe) in the EU27	86
Figure 31:	Primary energy production in main EU geoclimatic regions (Mtoe)	81
Figure 32:	Material flows in the EU (2019)	83
Figure 33:	Material flow accounts in main EU geoclimatic regions (EU28, thousand tonnes and percentage, 2019)	90
Figure 34:	Evolution of CO ₂ Emission in main EU geoclimatic regions (MtCO ₂)	85
Figure 35:	TOTAL GHG emission (no LULUCF) Index (1990 = 100)	86
Figure 36:	All Non-CO ₂ emissions in main EU geoclimatic macro-regions (MtCO ₂ eq)	87
Figure 37:	Overall CO ₂ emissions in the main EU geoclimatic regions (MtCO ₂ eq)	87
Figure 38:	Costs related to energy investment in in the main EU geoclimatic regions	90
Figure 39:	Energy subsidies (€2018bn) by category (EU27)	90
Figure 40:	Energy subsidies by sector (€2018bn) by category (EU27)	91

LIST OF TABLES

Table 1:	Projected impacts of climate change in Europe for warming scenarios of 1.5°C , 2°C and 3°C until 2100	20
Table 2:	Comparison between 2014-2020 and 2021-2027 Cohesion Policy: mandatory minimum spending for low-carbon economy	32
Table 3:	Expected Cohesion Policy amounts for climate action in 2021-2027 and comparison with 2014-2020	40

Table 4:	Effort to meet EU targets and objectives, compared with 1990 emissions (MtCO ₂ e)	63
Table 5:	Overview of ESIF common output indicators, relevant for climate mitigation, in 2018	71
Table 6:	Overview of ESIF common output indicators, relevant for climate adaptation, in 2018	74
Table 7:	Transformative policies and policies for mainstreaming sustainability in the context of the European Green Deal	76
Table 8:	Key areas of the European Green Deal transition and Cohesion Policy role on supporting them	78
Table 9:	Sources of climate finance under the European Green Deal Investment Plan	74
Table 10:	Key recommendations at policy design stage and actors they are mostly relevant for	105
Table 11:	Key recommendations at policy implementation stage and actors they are mostly relevant for	109
Table 12:	Key recommendations at monitoring and evaluation stage and actors they are mostly relevant for	112

EXECUTIVE SUMMARY

Global climate crisis: the role of the EU and of Cohesion Policy

Global warming, a significant increase in the average temperature of the Earth's surface since the pre-industrial period due to human activity, produces long-term changes in average weather patterns. The climate change caused by global warming has massive and mostly negative effects on economies, societies and the environment. Mitigating climate change by addressing the causes of global warming, most notably by reducing greenhouse gas (GHG) emissions, requires a broad and coordinated global response. It is also necessary to further develop the capacity to adapt to the consequences of climate change that have already occurred and whose effects are likely to persist for decades or centuries, even if immediate action is taken.

The world is still not on track to satisfactorily curb global emissions and there are wide disparities in commitments and current efforts across countries and regions. The EU can contribute to address climate change directly, by reducing emissions and with adaptation policies, as well as by continuing to take a leading role in advocating global action. In the fight against climate change, the EU can draw on lessons learned from the COVID-19 pandemic. It has demonstrated how dramatic negative side-effects of human activity can be, how quick to unfold, and how difficult or impossible to contain, while risk prevention is essential because it is unknown whether a chain of events like a pandemic or climate change, once triggered, can be stopped without significant losses. Moreover, mass awareness of the anthropogenic origin of global warming is critical to drive political action and ensure a broad public engagement.

In view of the importance of fighting climate change, EU institutions have been setting increasingly ambitious targets such as reducing GHG emissions by at least 55% by 2030, and becoming the first carbon neutral continent by 2050. In European regions, warming is greater than the global average. Therefore, the negative impacts of climate change may be more severe and, in any case, asymmetric, with southern European regions expected to be impacted the most. In this context, the role of Cohesion Policy in climate action is likely to be essential.

Cohesion Policy support to Climate Action: How much and what types of interventions

Climate action objectives were integrated into the 2014-2020 Cohesion Policy both at the design stage and during the implementation of programmes. This will also be the case in 2021-2027 to ensure that climate change is addressed from programme design to the selection of operations, and that investments are "climate proofed". Approximately EUR 56.5 billion of Cohesion Policy Funds (ERDF, CF and ESF) were assigned for climate action in 2014-2020, 15.9% of total planned Cohesion Policy funds (based on ESIF Open Data). In 2021-2027, the amount planned for climate change is expected to increase to at least EUR 77.2 billion (or 83.7 billion, if REACT-EU, a component of Next Generation EU which tops up ERDF and ESF until 2023, is considered). This is roughly 25% of total Cohesion Policy, a significantly higher share than previously, which should ensure a stronger contribution to the delivery of climate policy outcomes. For 16 countries, i.e. more than half of the Member States of the EU, most notably central and eastern European nations, the amounts planned for climate action in 2014-2020 were higher than 10% of the National Expenditure on Environmental Protection. This means that Cohesion Policy should play a vital role, and even more so in 2021-2027.

Most of the Cohesion Policy funds for climate have been allocated to energy efficiency renovation of public infrastructure (16.6% of the total in 2014-2020), followed by adaptation to climate change

and risk prevention (11.4%), clean urban transport (9.1%) and energy efficiency in existing housing stock (8.2%). In all EU regions, Cohesion Policy has made it possible to finance a wide array of initiatives for climate change mitigation and adaptation, not without obstacles, but certainly facilitating learning among managing administrations. Many of those initiatives will be continued in 2021-2027.

The share of planned funds which have actually been spent is lower for climate operations compared to total Cohesion Policy, a fact which may be due to a longer implementation cycle of investments on energy efficiency and renewable sources. This is reflected in slower delivery of concrete achievements in terms of annual GHG reduction, and additional renewable energy production capacity. The achievements of interventions to adapt to the extreme weather events and other environmental risks are more positive (e.g. 64% of the target population was protected from forest fires and 24% from floods as of end of 2019).

In the next programming period, Cohesion Policy will contribute to the implementation of the European Green Deal, the European Commission's overarching plan to achieve sustainability and to protect the environment. The Cohesion Policy contribution to the Green Deal is likely to be limited in most Member States from a financial point of view, but may have an important catalytic effect, especially in Member States where it is a major source of public investment.

Phasing out fossil fuels: benefits and costs

The EU has made increasingly strong policy commitments to decarbonisation, particularly by reducing the carbon intensity of the power sector (or emissions per unit of electricity generated), to pursue the objective of climate neutrality at the heart of the European Green Deal, and in line with the EU's commitments under the Paris Agreement, a legally binding international treaty on climate change adopted in 2015. Decarbonisation will have overall beneficial effects in the EU such as: a reduced dependency on fossil fuels, an increase in renewable energy production, a boost to innovation and a shift towards a circular economy, with positive consequences on competitiveness.

Decarbonisation and phasing out fossil fuels also have costs. These are chiefly the increased costs of energy systems and additional investments in energy efficiency necessary to achieve the GHG emission reduction targets. The transition away from fossil fuels will also produce savings on import bills which may partially compensate the costs of phasing out.

Policy recommendations for an enhanced role of Cohesion Policy in the fight against climate change

There are some weaknesses in how Cohesion Policy pursues climate objectives that could in fact reduce the effectiveness of the interventions. Such weaknesses concern policy design and formulation, implementation, monitoring and evaluation. At the policy design stage, it is recommended to: make a greater effort to ensure mainstreaming of climate change in Cohesion Policy interventions; coordinate investment in order to achieve a critical mass and avoid fragmented initiatives; raise public awareness, and boost behavioural change through education and training, as well as through effective communication. It is also important to promote capacity building amongst public administrators, on complex climate change issues to foster design of effective mitigation and adaptation measures.

Considering the slow progress of the 2014-2020 Cohesion Policy initiatives for climate, most notably support to energy efficiency and renewable energy sources, financially and in terms of achievements, it is important to reduce the administrative burden for beneficiaries and Managing Authorities. At the same time, Cohesion Policy programmes should avoid climate action being

neutralised by investments in other areas which may contribute to climate change (e.g. supporting unsustainable uses of biomass and natural gas infrastructure). Local plans, such as SECAPs (Sustainable Energy and Climate Action Plans) could be used to ensure that the most appropriate energy mix for satisfying the demand of local communities is identified. Continuity of successful 2014-2020 interventions in the next programming period is also important to ensure a durable impact.

As regards monitoring, the method currently used for tracking climate expenditure has merits (e.g. simplicity) but also shortcomings, which need to be corrected (e.g. it is based on planned amounts and does not consider whether climate change is an objective of the expenditure or not). The system of output and result indicators also needs improvement. Finally, systematic and well-planned evaluations of the contribution of supported investments towards achieving the set targets are essential.

1. OVERVIEW OF GLOBAL CLIMATE CRISIS

KEY FINDINGS

- All climate models used in scientific research predict a significant increase in the average temperature of the Earth's surface due to human activity and this has vast and widespread negative effects on human society. According to the IPCC, global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate (IPCC, 2018). The past five-year period is already likely to be the warmest on record globally, with a 1.1°C global temperature increase since the pre-industrial period.
- Tackling the causes of global warming, most notably by reducing GHG emissions, requires a wide and coordinated response. This response should be quick and relentless because even if we act immediately and effectively, the inertial impacts of the current situation are likely to persist for hundreds of years. Due to the persisting and long-term effects of global warming, a strong effort to mitigate climate change is necessary but not sufficient as we also need to adapt to its consequences.
- Unfortunately, there is a significant disproportion between the initiatives taken so far and the severity of the climate crisis. Moreover, there are wide disparities in commitments and actual efforts across countries and regions.
- Current Nationally Determined Contributions for the climate goals of the Paris Agreement, a legally binding international treaty on climate change adopted in 2015 to keep the increase in global average temperature well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C, remain inadequate and, all things being equal, they would lead to a temperature increase of at least 3°C by the end of the century. This means that the EU should not only firmly commit to pursue mitigation and adaptation objectives, through Cohesion Policy and other instruments, but also advocate global action.
- In European regions, the magnitude of warming is greater than the global average. Therefore, the negative impacts may be more severe and, in any case, asymmetric, with southern European regions expected to be impacted the most due to changes in high-end temperatures and the spatial and temporal availability of water.

1.1. Climate change evidence and global projections

The main aim of this chapter is to provide a concise overview of the state of play of the global climate crisis, especially of the aspects with implications for EU Cohesion Policy. To do so, this section provides a summary of key findings of the IPCC and their effects on the EU. In addition, the next paragraphs include an analysis on how far we are today from the 1.5°C target in temperature rise and an overview of the effects of an increase of the average temperature on EU regions.

The Fifth Assessment Report (AR5) of the United Nations Intergovernmental Panel on Climate Change (IPCC, 2014) set out the scientific evidence concerning the influence of human activity on the climate system and the unambiguous trend of global warming on the planet. The main conclusions of this report are the following:

- The human influence on the climate is clear. Greenhouse gas (GHG) emissions produced by anthropogenic action (industry, burning of fossil fuels, fertilizer use, food waste and

deforestation) have grown steadily, and are now at the highest levels ever recorded in history. The negative effects of global warming on human society and nature are vast and globally widespread.

- The warming of the climate system is unequivocal and many of the changes observed since the 1950s are unprecedented: there has been a warming of the atmosphere and oceans, a decline of snow and ice, a rise in sea levels, with more intense high tides, and the number of torrential rain events has increased in various regions of the planet.
- All theoretical models project an increase in the average temperature of the Earth's surface. The increase observed between the average temperature of the period 1850-1900 and the average of the period 2003-2012 was 0.78°C. The continued observed trend of GHG emissions may result in a temperature increase of 4.8°C by 2100. In this context, more frequent and longer-lasting extreme heat waves would occur, and torrential rains would become more frequent and intense.
- Between 1901 and 2010, the average sea level increased by about 19 cm, resulting from the thermal expansion of the waters and the melting of ice. According to the IPCC scenarios, on average, global sea level is projected to rise between 0.43 m and 0.84 m by 2100 relative to 1986–2005. Beyond 2100, sea level will continue to rise for centuries due to continuing deep ocean heat uptake and massive loss of the Greenland and Antarctic ice sheets, and will remain elevated for thousands of years.
- Global warming will amplify existing environmental risks and problems, with poor countries and coastal communities being the most penalised. Wide-ranging side effects on food production, health, social security, and biodiversity are expected, among others.
- Warming oceans and atmosphere, and rising sea levels will continue for centuries, even if GHG emissions were to cease immediately. The feedback and the slowness with which many of the effects occur on the global scale have serious consequences that are already inevitable.

1.2. How near/far we are today from the 1.5°C target in temperature rise?

According to an IPCC special report, global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate (IPCC, 2018). This is not at all a distant prospect. According to the World Meteorological Organization, the latest five-year assessment period (2015–2019) has seen a continued increase in carbon dioxide (CO₂) emissions and an accelerated increase in the atmospheric concentration of major GHGs, with growth rates nearly 20% higher in comparison with the previous five-year period (2011–2015), while the increase in the oceanic CO₂ concentration has increased the ocean's acidity. The five-year period 2015–2019 is likely to be the warmest period on record globally, with a 1.1°C global temperature increase since the pre-industrial period (1850-1900) and 0.2°C warmer than 2011-2015 (World Meteorological Organization, 2019). Addressing this situation requires a firm and coordinated action at global level. Against this background, it is necessary to reduce disparities in commitment and implementation efforts across countries and regions. Furthermore, there is still a significant disproportion between the initiatives taken and the severity of the climate change effects.

Recognizing the need to significantly reduce the risks and impacts of climate change, in 2015, 196 state parties adopted the first multilateral agreement on climate change – the Paris Agreement¹. This agreement covers almost all global GHG emissions and sets a global action plan to hold the increase in the global average temperature well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. To achieve this goal, countries agreed to present and pursue their own national goals for their climate efforts – known as Nationally Determined Contributions (NDCs) – which must be revised every 5 years with an increased degree of ambition.

Since 2011, the United Nations Environment Programme has published the Emissions Gap Reports: annual science-based assessments of the gap between countries' pledges on greenhouse gas emissions reductions and the reductions required to stay below a 2°C target by the end of this century. The main conclusion of the most recent Emissions Gap Report (UNEP, 2020) is that the world is still not on track to curb global emissions – essentially, there is a significant gap between projected emissions and the effort needed to mitigate climate change – and current NDCs remain seriously inadequate to achieve the climate goals of the Paris Agreement and would lead to a temperature increase of at least 3°C by the end of the century. More specifically, this report concludes that:

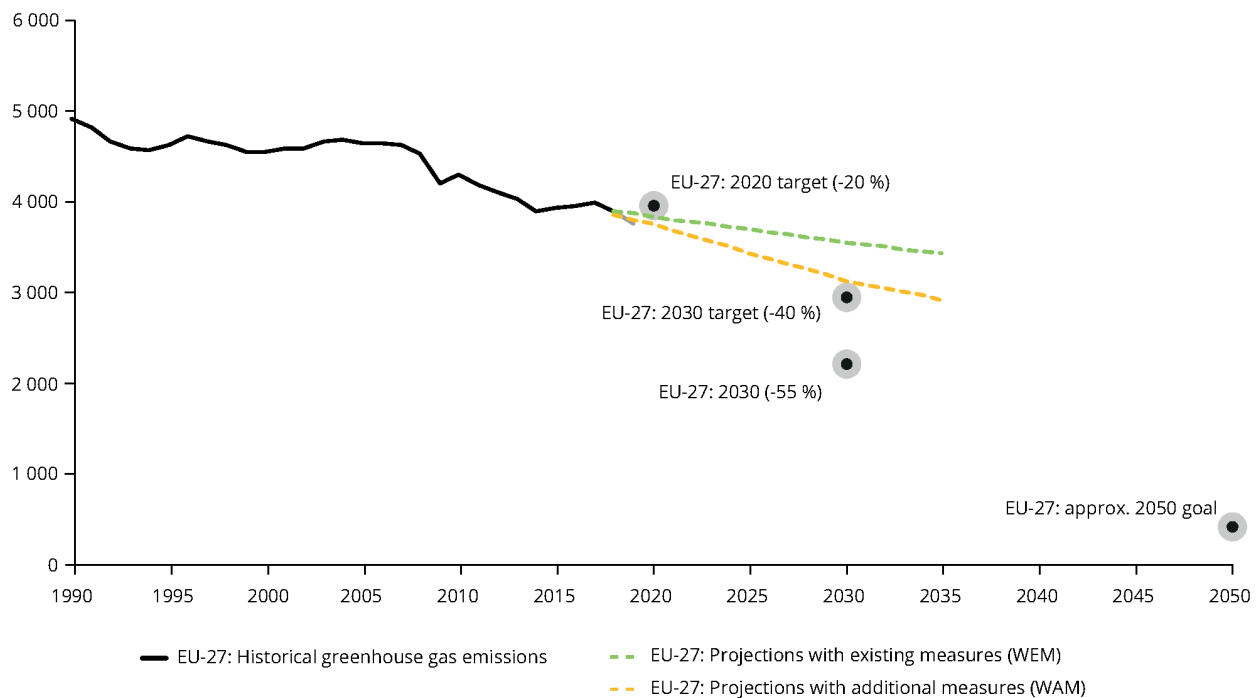
- Global GHG emissions continued to grow for the third consecutive year in 2019, reaching a record high of 52.4 GtCO₂e (range: ±5.2) without land-use change (LUC) emissions and 59.1 GtCO₂e (range: ±5.9) when including LUC.
- CO₂ emissions could decrease by about 7 per cent in 2020 (range: 2–12 per cent) compared with 2019 emission levels due to COVID-19, with a smaller drop expected in GHG emissions as non-CO₂ is likely to be less affected. However, atmospheric concentrations of GHGs continue to rise.
- The COVID-19 crisis offers only a short-term reduction in global emissions and will not contribute significantly to emissions reductions by 2030 unless countries pursue an economic recovery that incorporates strong decarbonisation.
- The growing number of countries that are committing to net-zero emissions goals by around mid-century is the most significant and encouraging climate policy development of 2020. To remain feasible and credible, it is imperative that these commitments are urgently translated into effective near-term policies and action reflected in the NDCs.
- Collectively, G20 members are projected to overachieve their modest 2020 Cancun Pledges, but they are not on track to achieve their NDC commitments. Nine G20 members (Argentina, China, EU27+UK, India, Japan, Mexico, the Russian Federation, South Africa and Turkey) are on track to achieve their 2030 NDC commitments, five members (Australia, Brazil, Canada, the Republic of Korea and the United States of America) are not on track, while for two members (Indonesia and Saudi Arabia) there is a lack of sufficient information to determine this.
- The emissions gap has not been narrowed compared to 2019 and is, as yet, unaffected by COVID-19. By 2030, annual emissions need to be 15 GtCO₂e (range: 12–19 GtCO₂e) lower than the level implied by current unconditional NDCs in order to be on track for reaching the 2°C

¹ The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse-gas-emissions mitigation, adaptation, and finance, signed in 2016. The agreement's language was negotiated by representatives of 196 state parties at the 21st Conference of the Parties (COP21) of the UNFCCC in Le Bourget, near Paris, France, and adopted by consensus on 12 December 2015. The Paris Agreement was ratified by the EU and entered into force in November 2016.

goal, and 32 GtCO₂e (range: 29–36 GtCO₂e) lower for the 1.5°C goal. Collectively, current policies fall short by 3 GtCO₂e for meeting the level associated with full implementation of the unconditional NDCs.

- Current NDCs remain seriously inadequate to achieve the climate goals set in the Paris Agreement and would lead to a temperature increase of at least 3°C by the end of the century. Recently announced net-zero emissions goals could reduce this by about 0.5°C, provided that short-term NDCs and corresponding policies are made consistent with the net-zero goals.
- COVID-19-related fiscal spending by governments is of unprecedented scale, currently amounting to roughly US\$12 trillion globally, or 12% of GDP in 2020. For G20 members, fiscal spending amounts to around 15% of GDP on average for 2020. However, so far, there has been insufficient effort to support measures which could simultaneously support recovery as well as a low-carbon transition.
- Current policy frameworks to address emissions are weak and additional policies are required to bridge the gap between the current trajectories of shipping and aviation and GHG emissions pathways consistent with the Paris Agreement temperature goals. Changes in technology, operations, fuel use and demand all need to be driven by new policies.
- Lifestyle changes are a prerequisite for sustaining reductions in GHG emissions and for bridging the emissions gap. Around two thirds of global emissions are linked to the activities of private households according to consumption-based accounting. Reducing emissions through lifestyle changes requires changing both broader systemic conditions and individual action. However, equity is central to addressing lifestyles. The emissions of the richest 1 per cent of the global population account for more than twice the combined share of the poorest 50 per cent.

In recent years, Europe has been reducing its GHG emissions at a pace that allowed it to meet its 2020 policy target of a 20% reduction below 1990 emissions levels. Still, this trajectory of reduction was clearly insufficient to reach the previous 2030 target of a 40% reduction (EEA, 2020), and implies the need for a great reinforcement of mitigation policies to achieve the new ambitious targets, set by the European Council in December 2020, of reducing GHG emissions by at least 55% by 2030, and to become the first carbon neutral continent by 2050.

Figure 1: Greenhouse gas emission trend projections and targetMillion tonnes of CO₂ equivalent (Mt CO₂e)

Source: European Environment Agency (2020a).

Note: This figure shows the greenhouse gas emission targets, trends as well as the EU Member States (EU-28 and after 2019 EU-27) Monitoring Mechanism Regulation (EU) 525/2013 projections.

1.3. What are the projected effects of climate change on EU regions?

Naturally, the effect of climate change throughout the world is not uniform, varying significantly between global regions, reflecting the diversity of climates in the planet, essentially determined by geophysical parameters. Likewise, the potential impacts of present and future climate in natural and human systems and its vulnerabilities are also truly diverse. These are determined not only by the exposure of each location to present and future climate variability, but also by characteristics that are sensitive to climate risks (environmental values, population, infrastructures, land use, economic activities, cultural assets) and – not least important – by the adaptive capacity of each system (environmental, economic, social) to climate change.

Also, the effects of climate change are interdependent with the evolution of other socioeconomic factors, e.g., the ageing of the population, increasing urbanisation across Europe, projected decreases in population size in eastern Europe, a narrowing economic gap between eastern and western parts of Europe, the interdependencies between the water sector, agriculture, forestry and biodiversity, changing land-use patterns and population change (EEA, 2017).

The implications of projected changes in temperature and precipitation patterns are also very different throughout Europe, where the magnitude of warming is also greater than the global average.

The potential impacts for Europe of a 3°C warming, which is closer to what could be expected by the end of the twenty-first century without adequate mitigation, and without adaptation policies, are very significant and mostly negative, but even a 1.5°C warming implies significant negative social, economic and environmental impacts.

The main climate impacts for Europe under three global warming scenarios used in the PESETA IV project² (1.5°C, 2°C and 3°C warmer than pre-industrial times) are presented in Table 1.

Not all regions will be affected to the same extent, with southern European regions expected to be impacted the most due to changes in high-end temperatures and the spatial and temporal availability of water.

Indeed, according to an assessment carried out by the European Environment Agency of the spatial distribution of climate change, impacts and vulnerability throughout the main biogeographical regions in Europe (EEA, 2017), climate change is affecting all regions in Europe, but “*south-eastern and southern Europe are projected to be hotspot regions, having the highest numbers of severely affected sectors and domains. Coastal areas and floodplains in the western parts of Europe are also multi-sectoral hotspots. The Alps and the Iberian Peninsula are additional hotspots for ecosystems and their services. Ecosystems and human activities in the Arctic will be strongly affected owing to the particularly fast increase in air and sea temperatures and the associated melting of land and sea ice*”. The assessment also estimates that the projected damage costs from climate change will be the highest in southern Europe.

Table 1: Projected impacts of climate change in Europe for warming scenarios of 1.5°C, 2°C and 3°C until 2100

Type of impacts	Potential impacts	Base	1.5°C	2°C	3°C
Human impacts from heat and cold extremes	People annually exposed to a 50-year heatwave (million)	9.6	103	168	288
	Annual fatalities from heatwaves (x1000)	2.7	28.8	49.4	89.0
	People annually exposed to a 50-year cold wave (million)	9.6	4.9	2.7	1.2
	Annual fatalities from cold waves	80	33	19	8
Impacts of windstorms	Wind losses (€ billion) ^(a)	4.6	4.5-11.3	4.6-11.4	4.6-11.4
	Wind losses (% of GDP) ^(a)	0.04	0.03-0.04	0.03-0.04	0.03-0.04
Impacts on water resources	People living in areas with water stress (million)	52	59	60	65
	People living in areas with severer water stress (million)	3.3	3.4	3.4	11
Impacts of droughts	Drought losses (€ billion) ^(a)	9.0	9.7-25	12.2-31	17.3-45
	Drought losses (% of GDP) ^(a)	0.07	0.06-0.08	0.07-0.10	0.10-0.14
River flood impacts	Damage (€billion/year) ^(b)	7.8	8.6-24	9.6-33	8.6-48
	People exposed (1000/year) ^(b)	172	92-252	100-338	90-482
Coastal flood impacts	Damage (€billion/year) ^(b)	1.4	12-111 ^(c)		23-239 ^(d)
	People exposed (1000/year) ^(b)	0.1	0.6-1.4 ^(c)		0.8-2.2 ^(d)

² The series of PESETA (Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis) projects of the Joint Research Centre (JRC) of the European Commission aim to reduce the knowledge gap on climate change impacts and adaptation. PESETA integrates a common set of climate scenarios and socioeconomic data with detailed biophysical process simulation and economic modelling. Impacts are estimated for the warming targets set out in the Paris Agreement (1.5°C and 2°C) as well as a higher level of warming (3°C), which is closer to what could be expected by the end of the twenty-first century without adequate mitigation. The differences between regions in terms of temperature and precipitation anomalies become more striking under 2°C and 3°C global warming scenarios, with greater changes projected for north-central-eastern Europe and the Mediterranean basin.

Type of impacts	Potential impacts	Base	1.5°C	2°C	3°C
Wildfire danger and vulnerability	Population in Wildland-Urban Interface exposed to fire danger (million)	63	68	-	78
Alpine tundra habitat loss	Alpine tundra loss in Pyrenees (%)	-	74	91	99
	Alpine tundra loss in Alps (%)	-	36	50	75
	Alpine tundra loss in Scandinavian Mountains (%)	-	50	61	87
Economic impacts	Annual welfare loss (€ billion)	-	42	83	175
	Annual welfare loss (% of GDP)	-	0.33	0.65	1.38
	Welfare loss from human mortality related with extreme heat (€ billion)	-	36	65	122
	Welfare loss from human mortality related with river and coastal floods (€ billion)	-	8.5	16	40

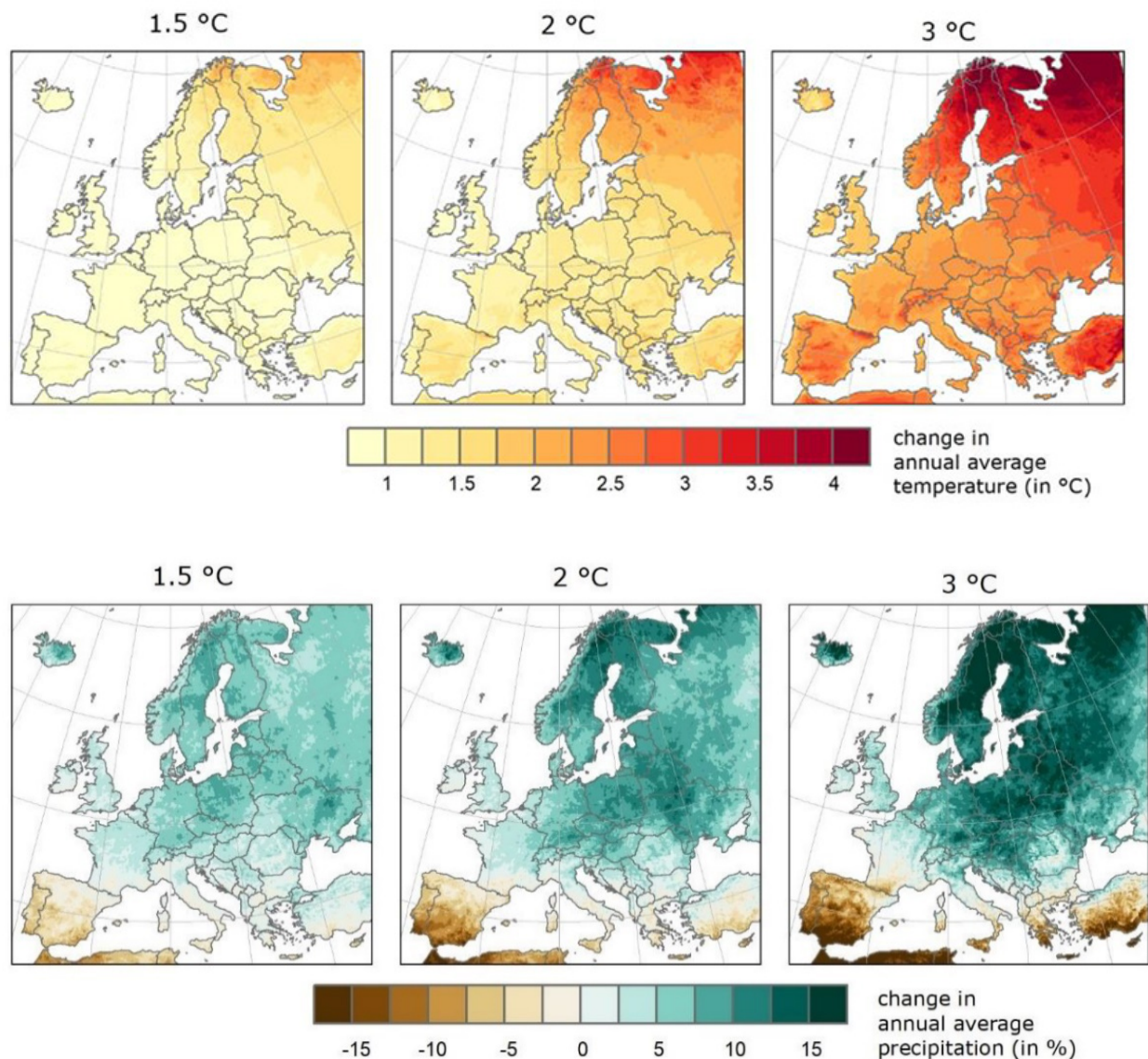
Notes: (a) Range of values variate by considering if future socioeconomic change is accounted for, compared to when the current socioeconomic conditions are assumed to continue into the future. (b) Range of values variate by considering impacts with or without adaptation. (c) Scenario with moderate mitigation. (d) Scenario with high emissions.

Source: Feyen L., Ciscar J.C., Gosling S., Ibarreta D., Soria A. (2020) (adapted).

Moreover, due to their locations, the 9 outermost regions of the EU are exposed to quite different trends of climate change, and have particular sets of climate vulnerabilities that, in many ways, are identical to the problems faced by small island developing states (SIDS), that have long been recognised as being particularly vulnerable to the impacts of climate change.

From a different perspective, it should be highlighted that Europe is also vulnerable to climate change impacts in other parts of the world, and not only in its periphery. These can be associated with trade in agricultural and other commodities, infrastructure and transport, geopolitics and security risks, human mobility related to migration and finance (EEA, 2017).

Figure 2: Changes from reference (1981-2010) in annual average temperature (top panels) and precipitation (bottom) for the three global warming scenarios* used in PESETA IV



* 1.5°C, 2°C and 3°C warmer than pre-industrial times.

Source: Feyen L., Ciscar J.C., Gosling S., Ibarreta D., Soria A. (2020).

Drawing on the EEA typology summarised in Figure 3, in the following sections of this study we carry out an analysis of Cohesion Policy contribution to climate action according to groups of EU regions which take into account common biogeographical features as well as the existence of relevant EU Cohesion Policy programmes investing on the territory. The groups used in the study are:

- **Boreal and Arctic EU regions.** This group covers northern EU regions and sparsely populated Arctic territories. The typical features of climate impacts in these regions may include the following: temperature rise much larger than global average; decrease in snow, lake and river ice cover; increase in river flows; northward movement of species; increase in crop yields; decrease in energy demand for heating; increase in hydropower potential; increasing damage risk from winter storms; increase in summer tourism.

- **Atlantic EU regions.** This cluster covers North-Western European areas facing the Atlantic Ocean. Atlantic regions are characterised by climate impacts that include: increase in winter precipitation; increase in river flow; northward movement of species; decrease in energy demand for heating; increasing risk of river and coastal flooding.
- **Mountain EU regions.** This group includes alpine and mountainous areas which have climate impacts such as: temperature rise larger than EU average; decrease in glacier extent and volume; decrease in mountain permafrost areas; upward shift of plant and animal species; high risk of species extinction in Alpine regions; increasing risk of soil erosion; decrease in ski tourism.
- **Continental EU regions.** This cluster mostly covers Central and Eastern Europe. Climate impacts in these regions may be characterised by: increase in warm temperature extremes; decrease in summer precipitation; increase in water temperature; increasing risk of forest fire; decrease in economic value of forests.
- **Mediterranean EU regions.** This group includes regions on the Mediterranean Sea and hence many coastal areas, as well as territories that extend from the coast to the adjacent hills and mountains. These regions have climate impacts including: temperature larger than EU average; decrease in annual precipitation; decrease in annual river flow; increasing risk of biodiversity loss; increasing risk of desertification; increasing water demand for agriculture; decrease in crop yields; increasing risk of forest fire; increase in mortality from heat waves; expansion of habitats for southern disease vectors; decrease in hydropower potential; decrease in summer tourism and potential increase in other seasons.
- **EU outermost regions.** These are mostly insular territories (except for French Guyana), located far from the European continent and which receive compensation in a range of EU policies due to the consequences of their remoteness. Outermost regions are diverse but may be characterised by some common climate vulnerabilities, such as: sea level rise; increase in ocean acidity; increasing risk of biodiversity loss; decrease in crop yields; increasing risk for fish stocks; decrease in tourism.

Figure 3: Key observed and projected climate change and impacts for the main biogeographical regions in Europe



Source: European Environment Agency (2017) (adapted).

2. COHESION POLICY SUPPORT TO CLIMATE ACTION

KEY FINDINGS

- Climate action objectives were integrated in 2014-2020 Cohesion Policy at the design stage and during the implementation of programmes, as well as in monitoring and evaluation, as laid down in the Common Provisions Regulation and specific fund regulations. A similar approach has been proposed for 2021-2027 to ensure that climate change is addressed from programme design to the selection of operations, and that investments are “climate proofed”.
- To achieve the new more ambitious spending target (at least 30% of the EU budget and Next Generation EU is to be climate-related expenditure), ERDF and Cohesion Fund operations are expected to contribute 30% and 37%, respectively, of their overall financial envelopes to climate objectives in 2021-2027. A weighting methodology is proposed for tracking climate change related expenditure.
- Approximately EUR 56.5 billion of Cohesion Policy (ERDF, CF and ESF) were planned for climate action in 2014-2020, 15.9% of total planned Cohesion Policy funds. In 2021-2027, while the Cohesion Policy budget is slightly lower than in the previous cycle, the amount planned for climate change is expected to increase to EUR 77.2 billion (83.7 billion, if REACT-EU, a component of Next Generation EU which tops up ERDF and ESF until 2023, is considered). This is roughly 25% of total Cohesion Policy, a significantly higher share than previously, which should ensure a stronger contribution to the delivery of climate policy outcomes.
- For more than half of the Member State of the EU, most notably central and eastern European countries, the amounts planned for climate action in 2014-2020 are higher than 10% of the National Expenditure on Environmental Protection. This means that Cohesion Policy should play a vital role.
- Most of the Cohesion Policy funds for climate have been allocated to energy efficiency renovation of public infrastructure (16.6% of the total in 2014-2020), followed by adaptation to climate change and risk prevention (11.4%), clean urban transport (9.1%) and energy efficiency of existing housing stock (8.2%).
- The share of funds planned for climate action which has been actually spent is lower compared to total Cohesion Policy rate of expenditure, which may be due to a longer implementation cycle of investments on energy efficiency and renewable sources. This is reflected in actual achievements. For example, the annual GHG reduction from selected projects is 66% of the target, while the value from fully implemented projects is only 6.3% of the target. The rate of achievement of the targets relating to additional capacity of renewable energy production is also modest while the achievements in respect to adaptation to extreme weather events look better (e.g. 64% of the target population was protected from forest fires and 24% from floods).
- The distribution of funds for climate varies across main EU geoclimatic regions. In 2014-2020, most of the funds were planned in Continental and Mediterranean EU regions, followed by Atlantic, Mountain and Boreal EU regions. In all these regions, Cohesion Policy made it possible to finance a wide array of initiatives for climate change mitigation and

adaptation, not without obstacles but certainly facilitating learning among managing administrations. Many of those initiatives will be continued in 2021-2027.

- In the next programming period, Cohesion Policy will play a key role in implementation of the Green Deal, the European Commission's over-arching plan to achieve sustainability and to protect the environment, which sets ambitious climate-related goals, in line with the Paris Agreement. Among the headline objectives: 55% reduction in GHG emissions by 2030 and climate neutrality by 2050.
- Despite a significant reduction of emissions achieved in the past decades in Europe thanks to the combined effect of EU and national policies, a much greater effort to achieve climate neutrality in the next 30 years is necessary.
- This requires also a great financial effort and the European Green Deal will have to trigger a wave of green investment, from the private sector and national governments, to fill the gap in investment needed to achieve the climate targets.
- Cohesion Policy contribution is likely to be limited from a financial point of view, but may have an important catalytic effect, especially in Member States where it is a major source of public investment.
- The implementation of the European Green Deal requires several transformations in respect of which Cohesion Policy can play an enabling role through a multi-sectoral and place-based approach, promoting innovation, technology development and diffusion, employment, education and infrastructure.
- Cohesion Policy interventions on climate and sustainability can also contribute to reduce territorial imbalances, promoting regional development by addressing the specific needs of each Member State and region with place-based actions.

2.1. How the design of Cohesion Policy takes climate actions into account

2.1.1. Incorporation of climate action in the design of 2014-2020 Cohesion Policy

Climate change is a major challenge faced by the European Union and the entire World and, as such, was taken into account in designing Cohesion Policy in 2014-2020. Specifically, climate action is considered not only at the design stage but also during the implementation of programmes as well as in monitoring and evaluation.

Before the start of the 2014-2020 programming period, the European Commission prepared for each Member State a Country Position Paper (CPP) as a contribution to the development of Partnership Agreements and programmes for the period 2014-2020.³ The Partnership Agreements, drafted by the Member States in dialogue with the Commission, outlined the strategic goals and investment priorities for each country, and linked them to the aims of the Europe 2020 strategy for smart, sustainable and inclusive growth. In other words, Partnership Agreements led to a number of

³ The CPPs informed the Member States of the views of the Commission as regards the main challenges and specific funding priorities for the particular country. The CPPs also established a framework for dialogue between the Commission and each Member State on the preparation of the Partnership Agreement (see below) and Programmes, which are the operative instruments for delivering the EU Structural and Investment (ESI) Funds. The CPPs were based on the lessons learnt in the previous programming period (2007-2013) and on the Commission's legislative proposals for 2014-2020.

investment programmes which direct the funding to different policy areas and regions. This process, from CPP to Partnership Agreements, programmes and actual investments is characterised by a multi-level governance whose rules are defined in the EU regulations which, therefore, also specify how climate action is embedded in Cohesion Policy. The Regulation which lays down Common Provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Funds (hereafter CPR) states that the objectives of the ESI Funds should be pursued in the framework of sustainable development and the Union's promotion of the aim of preserving, protecting and improving the quality of the environment⁴. In particular, the Member States and the Commission shall ensure that climate change mitigation and adaptation, together with other topics (environmental protection, resource efficiency, biodiversity, disaster resilience, and risk prevention and management) are promoted and integrated in the preparation and implementation of Partnership Agreements and programmes⁵.

The CPR identifies the Thematic Objectives (TOs) to be supported by the ESI Funds (Article 9 of the regulation). In principle all TOs can directly or indirectly contribute to mitigate and or adapt to climate change. Some TOs, though, are mainly targeted towards climate: TO4 supporting the shift towards a low-carbon economy in all sectors; and TO5 promoting climate change adaptation, risk prevention and management. The regulation also states that the ERDF shall support, within operational programmes, sustainable urban development through strategies that set out integrated actions to tackle the economic, environmental, climate, demographic and social challenges affecting urban areas, while taking into account the need to promote urban-rural linkages.

The CPR states that the Partnership Agreement shall set out the indicative allocation of support by the Union by TO at national level for each of the ESI Funds, as well as the total indicative amount of support envisaged for climate change objectives (article 15 of CPR). Furthermore, the CPR states that each operational programme shall set out the indicative amount of support to be used for climate change objectives (article 27 on the content of the Programmes). These amounts are calculated on the basis of a methodology (article 8 of the CPR) based on the categories of intervention, focus areas or measures, as appropriate, for each of the ESI Funds. The methodology consists of assigning a specific weighting⁶ to the support provided under the ESI Funds at a level which reflects the extent to which such support makes a contribution to climate change mitigation and adaptation goals⁷. The support for climate change objectives must be in line with the ambition to allocate at least 20% of the budget of the Union to such objectives in 2014-2020. The specific weighting assigned is differentiated on the basis of whether the expenditure falls into a category judged to make either a significant or a moderate contribution towards climate change objectives. A weighting of zero is

⁴ As set out in Articles 11 and 191(1) TFEU.

⁵ According to the article 8 of the CPR.

⁶ The weighting is differentiated on the basis of whether the support makes a significant or a moderate contribution towards climate change objectives. The standard weightings are used to ensure a harmonised approach to tracking of climate change related expenditure across different Union policies. In accordance with the CPR, in the case of the ERDF, the ESF and the Cohesion Fund weightings should be attached to categories of intervention established within the nomenclature adopted by the Commission. The methodology is described in the Commission Implementing Regulation (EU) No 215/2014 of 7 March 2014 laying down rules for implementing the CPR (amended by Commission Implementing Regulation (EU) No 1232/2014 of 18 November 2014). For ERDF, the ESF and the Cohesion Fund, the calculation of support to be used for climate change objectives is carried out on the basis of the coefficients set out in the CPR Implementing Regulation (Annex I), applied by intervention field code to financial data reported for those codes.

⁷ For instance, in the ERDF case, three weighting are assigned to investment categories: 100% where the support makes a significant climate contribution (e.g. sustainable energy, climate related risk prevention, climate related RTDI), 40% when there is a moderate contribution (e.g. clean urban transport, rail, intermodal and other public transport), 0% where the support does not contribute or where the contribution is insignificant (most intervention codes). See Annex I of Commission Implementing Regulation (EU) No 215/2014 of 7 March 2014.

assigned in the cases in which the expenditure falls into a category which is judged not to contribute towards those objectives, or to make only an insignificant contribution.

At the design stage, Member States were also required to carry out ex ante evaluations to improve the quality of the design of each programme⁸.

Another important feature of 2014-2020 consisted in the requirement to fulfil ex ante conditionalities (Article 19 and Annex XI of CPR) at the date of submission of the Partnership Agreement and the respective programme(s). Four specific ex ante conditionalities are relevant to climate change mitigation and adaptation interventions⁹. The failure to complete actions to fulfil an applicable ex ante conditionality leads to suspension of interim payments by the Commission to the affected priorities of the programme concerned.

As indicated above, climate action was embedded in Cohesion Policy not only at the design stage. Indeed, the 2017 annual implementation reports for each OP had to set out the progress made towards achieving the objectives of the programme, including the contribution of the ESI Funds to changes in the value of result indicators and, inter alia, to report on support used for climate change objectives (article 50 of CPR). The progress reports of August 2017 and 2019 on implementation of the Partnership Agreement (article 52) are required to provide information on the progress made towards achievement of the Union strategy for smart, sustainable and inclusive growth, and, inter alia, on the support used for climate change objectives.

According to the regulation (article 96 of CPR), each OP, apart from those specifically oriented to Technical Assistance, should include a description of the specific actions to take into account climate change mitigation and adaptation, in the selection of operations, as well as environmental protection requirements, resource efficiency, disaster resilience and risk prevention and management.

Guiding principles for using the ESI Funds and achieving an integrated development approach, in coordination with other Union policies, are provided in the Common Strategic Framework (CSF), annexed to the CPR and in the Fund-specific Regulations.

Member States are required to concentrate support in order to ensure critical mass necessary to deliver growth and jobs, and ensure the effectiveness of spending (article 18 of CPR and provisions in Fund-specific regulations). In doing so, Member States are requested to give particular attention to prioritising growth-friendly expenditure and to ensure environmental sustainability, the management of natural resources and climate action as well as to modernise public administration.

Moreover, the CSF requires Member States and the Commission to seek to exploit synergies with Union policy instruments (both funding and non-funding instruments) serving climate change mitigation and adaptation, environmental protection and resource efficiency. In this context, where appropriate (and in accordance with article 4 of CPR), complementarity and coordination with LIFE programme¹⁰ is promoted, in particular with integrated projects in the areas of nature, biodiversity, water, waste, air, climate change mitigation and adaptation. Such coordination is achieved through measures such as promoting the funding of activities through the ESI Funds that complement

⁸ Ex ante evaluations incorporate, where appropriate, the requirements for strategic environmental assessment set out in Directive 2001/42/EC of the European Parliament and of the Council taking into account climate change mitigation needs (article 55 of CPR).

⁹ Climate relevant ex ante conditionalities: 4.1. Actions have been carried out to promote cost-effective improvements of energy end use efficiency and cost-effective investment in energy efficiency when constructing or renovating buildings; 4.2. Actions have been carried out to promote high-efficiency co-generation of heat and power; 4.3. Actions have been carried out to promote the production and distribution of renewable energy sources; 5.1. Risk prevention and risk management: the existence of national or regional risk assessments for disaster management, taking into account climate change adaptation.

¹⁰ The LIFE programme is the EU's funding instrument for the environment and climate action.

integrated projects under LIFE as well as by promoting the use of solutions, methods and approaches validated under LIFE, inter alia, including investments in green infrastructure, energy efficiency, eco-innovation, ecosystem-based solutions, and the adoption of related innovative technologies.

The CSF requires Member States and Managing Authorities (MAs) to ensure the full mainstreaming of sustainable development into the ESI Funds, in all phases of programme implementation, respecting the principle of sustainable development.¹¹ MAs undertake actions throughout the programme lifecycle, to avoid or reduce environmentally harmful effects of interventions and ensure results in net social, environmental and climate benefits.¹²

The CSF also indicates that Member States should take into consideration the climate change mitigation and adaptation potential of investments made with the support of the ESI Funds, and ensure that they are resilient to the impact of climate change and natural disasters such as increased risks of flooding, droughts, heat waves, forest fires and extreme weather events. With a view to an integrated territorial approach to addressing territorial challenges, Member States are expected to ensure that programmes under the ESI Funds reflect the diversity of European regions, also in terms of climate change vulnerabilities and impacts, land use and resource constraints, potential for more sustainable use of natural resources including renewables.

As stated in the fund-specific regulation, the ERDF supports investment to promote energy efficiency and security of supply in Member States through, inter alia, the development of smart energy distribution, storage and transmission systems, including through the integration of distributed generation from renewable sources, in order to promote the achievement of the energy and climate targets set as part of the Union strategy for smart, sustainable and inclusive growth.

Within the framework of sustainable urban development, it is considered necessary to support integrated actions to tackle the economic, environmental, climate, demographic and social challenges affecting urban areas, including functional urban areas, while taking into account the need to promote urban-rural linkages.¹³

In outermost regions, the scope of ERDF support can be extended to operating aid linked to the offsetting of the additional costs resulting from the specific economic and social situation of those regions, which is compounded by the handicaps resulting from remoteness, insularity, small size, difficult topography and climate, economic dependence on a few products, the permanence and combination of which severely restrain their development (Article 349 TFEU).¹⁴

The ESF through its investment priorities contributes to the shift towards a low-carbon, climate-resilient, resource-efficient and environmentally sustainable economy, through the improvement of education and training systems necessary for the adaptation of skills and qualifications, the up-skilling of the labour force, and the creation of new jobs in sectors related to the environment and energy.

¹¹ As laid down in Article 3(3) TEU, as well as complying with the obligation to integrate environmental protection requirements pursuant to Article 11 TFEU and the polluter pays principle as set out in Article 191(2) TFEU

¹² Actions to be undertaken may include the following: (a) directing investments towards the most resource-efficient and sustainable options; (b) avoiding investments that may have a significant negative environmental or climate impact, and supporting actions to mitigate any remaining impacts; (c) taking a long-term perspective when 'life-cycle' costs of alternative options for investment are compared; (d) increasing the use of green public procurement.

¹³ A minimum of 5% of the ERDF resources had to be allocated at national level for the purpose and the principles for selecting the urban areas where integrated actions for sustainable urban development are to be implemented, and the indicative amounts are set out in the Partnership Agreement.

¹⁴ In outermost regions, operating aid granted by Member States is exempt from the notification obligation laid down in Article 108(3) TFEU, if, at the time it is granted, it fulfils the conditions laid down by a Regulation declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 TFEU, and adopted pursuant to Council Regulation (EC) No 994/98.

2.1.2. How 2021-2027 Cohesion Policy design integrates climate change

In 2021-2027, the importance of climate action will grow in the framework of Cohesion Policy. Indeed, the Commission proposal for the 2021-2027 Multiannual Financial Framework¹⁵ proposed a more ambitious goal for climate mainstreaming across all EU programmes, with an overall target of 25% of EU expenditure contributing to climate objectives, which was increased to 30% by the co-legislators¹⁶. The contribution to the achievement of this overall target will be tracked through an EU climate marker system, similar to the one used in 2014-2020, and the Commission will continue to present the information annually in terms of commitment appropriations in the context of the annual draft budget.

According to the proposal for the Regulation laying down Common Provisions for ERDF, CF, ESF+ and EMFF, Member States should take account of the contents of their draft National Energy and Climate Plan, to be developed under the Regulation on the Governance of the Energy Union and the outcome of the process resulting in Union recommendations regarding these plans, for their programmes, as well as for the financial needs allocated for low-carbon investments.

The ERDF, the ESF+, the Cohesion Fund (and the EMFF) will support five policy objectives¹⁷, one of them directly linked to climate: policy objective 2, a greener, low-carbon Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention and management. This objective is to be pursued by: (i) promoting energy efficiency measures; (ii) promoting renewable energy; (iii) developing smart energy systems, grids and storage at local level; (iv) promoting climate change adaptation, risk prevention and disaster resilience; (v) promoting sustainable water management; (vi) promoting the transition to a circular economy; (vii) enhancing biodiversity, green infrastructure in the urban environment, and reducing pollution. The focus on climate change is also explicitly mentioned in another policy objective: (policy objective 3), a more connected Europe by enhancing mobility and regional ICT connectivity by, inter alia, developing a sustainable, climate resilient, intelligent, secure and intermodal TEN-T, developing sustainable, climate resilient, intelligent and intermodal national, regional and local mobility, promoting sustainable multimodal urban mobility.

The CPR proposal for 2021-2027 requires the funds to contribute to mainstream climate action, reflecting the importance of fighting climate change in line with the Union's commitments to implement the Paris Agreement and the United Nations Sustainable Development Goals, and to achieve the above-mentioned overall target (30% of EU budget for climate). To support the full utilisation of the potential of the programme to contribute to climate objectives, the Commission will seek to identify relevant actions throughout the programme preparation, implementation, review and evaluation processes.

As in 2014-2020, Member States will provide information on the support for environment and climate objectives using a methodology based on types of intervention for each of the Funds. This consists again of assigning a specific weighting to the support provided. For Cohesion Policy (ERDF, the ESF+ and the Cohesion Fund), weightings are to be attached to dimensions and codes for the

¹⁵ Proposal adopted on 2 May 2018 (COM(2018) 322 final).

¹⁶ Interinstitutional Agreement (IIA) of 10 November 2020 between the European Parliament, the European Council and the European Commission on "budgetary discipline, on cooperation in budgetary matters and on sound financial management, as well as on new own resources, including a roadmap for the introduction of new own resources".

¹⁷ The eleven thematic objectives used in 2014-2020 have been simplified to five policy objectives:

1. A smarter Europe - innovative and smart economic transformation.
2. A greener, low-carbon Europe.
3. A more connected Europe - mobility and regional ICT connectivity.
4. A more social Europe - implementing the European Pillar of Social Rights.
5. Europe closer to citizens – sustainable and integrated development of urban, rural and coastal areas through local initiatives.

types of intervention established in the proposal regulation (Annex I). Furthermore, in the selection of operations, the Managing Authorities of Programmes will ensure the climate proofing of investments in infrastructure with an expected lifespan of at least five years.

Provisions on thematic concentration are set out in Fund-specific regulations. To ensure that there is a critical mass of investment, the 2021-2027 ERDF and the Cohesion Fund Regulation requires that 65% to 85% of resources, depending on the gross national income of the state,¹⁸ are to be concentrated on contributing to the policy objectives with the highest added value, as well as the greatest contribution to EU priorities.¹⁹

According to the ERDF and CF regulation proposal, ERDF operations are expected to contribute 30% of the overall financial envelope to climate objectives, while Cohesion Fund operations are expected to contribute 37% of the overall financial envelope to climate objectives, in order to contribute to the overall target of 30% of the EU budget expenditure supporting climate objectives. As in 2014-2020, an additional allocation is foreseen for the outermost regions to offset the additional costs incurred as a result of one or several of the permanent restraints including difficult topography and climate.

The ESF+ will contribute to mainstream climate action in the Union's policies and to the achievement of the overall target. To support the full utilisation of the potential of the ESF+, the Commission will identify relevant actions throughout the programme preparation, implementation, review and evaluation processes. Relevant actions identified during the preparation and implementation, will be reassessed in the context of the mid-term evaluation. The ESF+ will contribute not only to the policy objective directly related to this fund (policy objective 4, a more social Europe) but also to other policy objectives such as those related to: a smarter Europe (policy objective 1), and a greener, low carbon Europe (policy objective 2), through the improvement of education and training systems necessary for the adaptation of skills and qualifications, the upskilling of all, including the labour force, the creation of new jobs in sectors related to the environment, climate and energy, and the bioeconomy. Member States and beneficiaries of ESF+ support for material deprivation²⁰ will choose the food and/or the basic material assistance on the basis of objective criteria related to the needs of the most deprived persons and in the selection, where appropriate, will also take into consideration climatic and environmental aspects, in particular with a view to reduction of food waste.

In conclusion, in the 2021-2027 programming, climate change objectives remain central in Cohesion Policy. Due to the awareness that, in the previous period, MAs did not support adaptation sufficiently (see for example the distribution of 2014-2020 planned expenditure for mitigation and adaptation estimated in paragraph 2.2.4) but also to the increasing evidence on short term effects of climate change on nature, safety, wellbeing of citizens and on the economy, the proposed Regulations are

¹⁸ In order to enable flexibility, thematic concentration criteria will apply at national level:

For countries with:	minimum % "PO1"	minimum % "PO2"
GNI below 75%	35%	30%
GNI 75-100%	45%	30%
GNI above 100%	60%	not applicable PO1 and PO2 min. 85%

¹⁹ These are, according to evaluation evidence and the impact assessment: a smarter Europe by promoting innovative and smart economic transformation (Policy objective 1); a greener, low-carbon Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention and management (Policy objective 2).

²⁰ The ESF+ support for addressing material deprivation is used to support the distribution of food and goods that are in conformity with the Union law on consumer product safety.

more focused than in the past on the need for supporting adaptation, resilience and, hence, on the fact that Cohesion Policy investments must be “climate proofed”.

Table 2: Comparison between 2014-2020 and 2021-2027 Cohesion Policy: mandatory minimum spending for low-carbon economy

	2014-2020	2021-2027
Cohesion Policy	EUR 355 billion approx. (33% of MFF)	EUR 330 billion approx. (31% of MFF)
Share committed to climate action	20% of EU budget	30% of EU budget
Mandatory minimum spending by type of region	<ul style="list-style-type: none"> • Less developed: >12% • Transition: >15% • More developed: >20% 	<ul style="list-style-type: none"> • Less developed: >30% • Transition: >30% • More developed: >85%

Source: European Commission.

2.2. Cohesion Policy budget dedicated to climate action

2.2.1. How much of Cohesion Policy went to climate action?

In the 2014-2020 period, approximately EUR 56.5 billion of Cohesion Policy expenditure was planned for climate action, based on information available on the Commission’s Open Data portal (ESIF Open Data)²¹. In comparison with the total available resources, the amounts planned for climate action are 15.9% of total planned Cohesion Policy funds.²²

ERDF is the largest contributor to climate action among Cohesion Policy funds. Indeed, around 67% of the mentioned 56.5 billion, namely EUR 38 billion, consists of ERDF. EUR 17.2 billion, or 31% of the total, are from the Cohesion Fund and only a small share, 2% or EUR 1.2 billion, comes from the ESF (Figure 4).

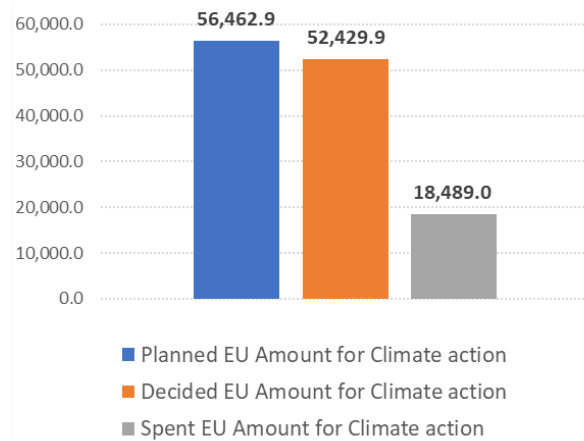
The share of total funds planned for climate is highest for the Cohesion Fund, 27.2%, and lowest in the case of ESF and YEI, 1.3%. The share of total ERDF which went to climate action is in between these two extremes as it is equal to 19.1% (Figure 2 in Annex).

²¹ EU amounts planned in the EU27 and in the UK: <https://cohesiondata.ec.europa.eu/>

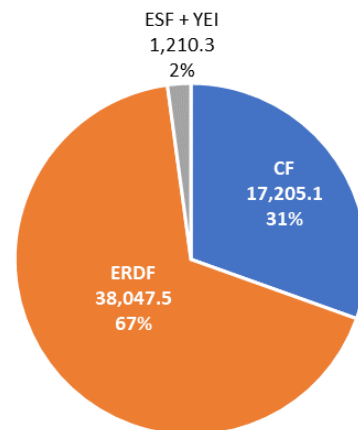
²² In the calculations of the present analysis, Cohesion Policy funds include ERDF, CF and ESF, in line with the definition of Cohesion Policy set out in the 2014-2020 official texts and commentaries: https://ec.europa.eu/regional_policy/sources/docgener/guides/blue_book/blueguide_en.pdf

Figure 4: EU amounts planned, decided and spent for climate action

EU amounts planned, decided and spent for climate (EUR million)



Planned amounts by Cohesion Policy funds (EUR million)



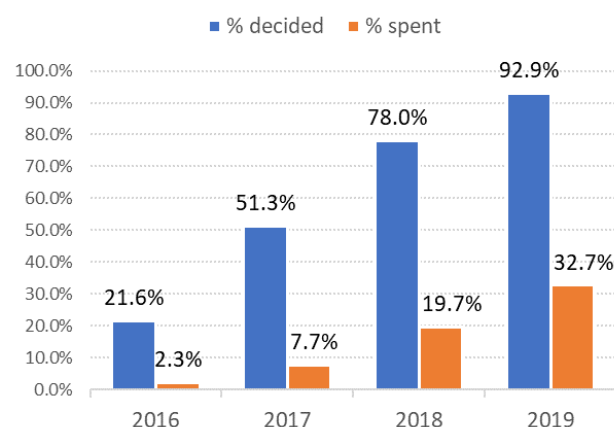
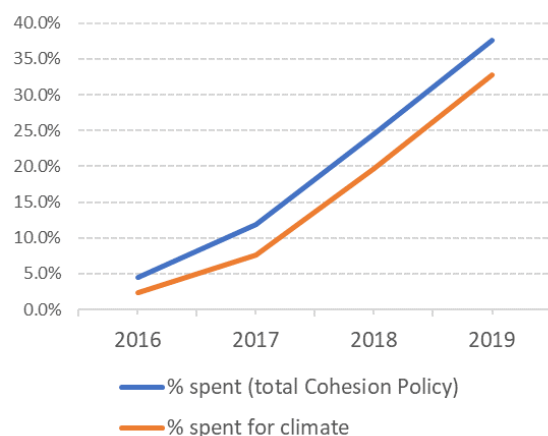
Source: ESIF Open data.

As of end of 2019, EUR 52.4 billion, or 93% of the total planned were decided (allocated to selected projects), while 18.5 billion, or 33% of planned amounts, were spent.²³ The rate of spending for climate action was nearly nil during the first two years of programming, it then increased to approximately EUR 5 billion in 2017, up to over EUR 10 billion in 2018 and almost doubled reaching EUR 18.5 billion in 2019.

The spending rate is lower compared to the overall Cohesion Policy performance (Figure 5). This may be due to the fact that these investments have a longer implementation cycle but may also signal some difficulties in the execution of measures for energy efficiency, which accounts for a significant share of the total funds for climate (see below).

Figure 5: Cohesion Policy decided and spent as % of planned over time

Expenditure as % of planned: total Cohesion Policy vs. climate action



Source: ESIF Open data.

²³ In the case of the ERDF, the decided amount is EUR 29.8 billion or 78.4% of planned funds. The spent amount is EUR 10.8 billion or 28.5% of planned resources; in the case of the Cohesion Fund, the decided amount is EUR 17.6 billion or 102.3% of planned resources, while the expenditure is equal to 5.6 billion or 32.5% of planned amounts.

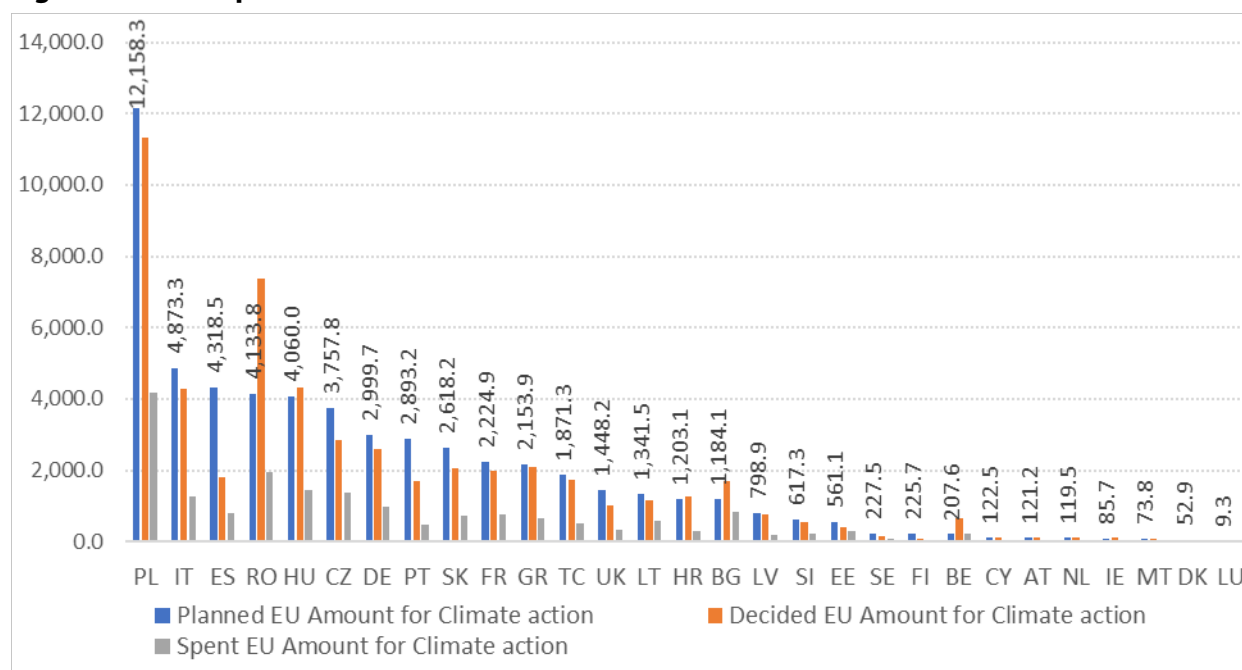
Across EU Member States, the total absolute amount planned for climate action varies from a maximum of EUR 12.2 billion in Poland to a minimum of 9.3 million in Luxembourg (Figure 6). In addition to Poland, the countries where the amounts are higher in absolute values (e.g. larger than 4 billion in 2014-2020) include: Italy, Spain, Romania and Hungary.

In respect to total Cohesion Policy planned amounts, the resources which target climate change range from over 20% in Luxembourg, Slovenia and Lithuania, to 8.4% in Ireland. This indicates that for a number of countries, mostly central and eastern EU, Cohesion Policy has a fundamental role. In addition to the Member States already mentioned, these include: Slovakia, Hungary, Latvia, Czech Republic, Cyprus, Estonia and Bulgaria, as well as Finland and Germany. For the other Member States, mostly western EU but also Mediterranean and Nordic countries (e.g. Sweden and Denmark), Cohesion Policy has a more modest role which may be due to the fact that the bulk of the investments are carried out with national resources.

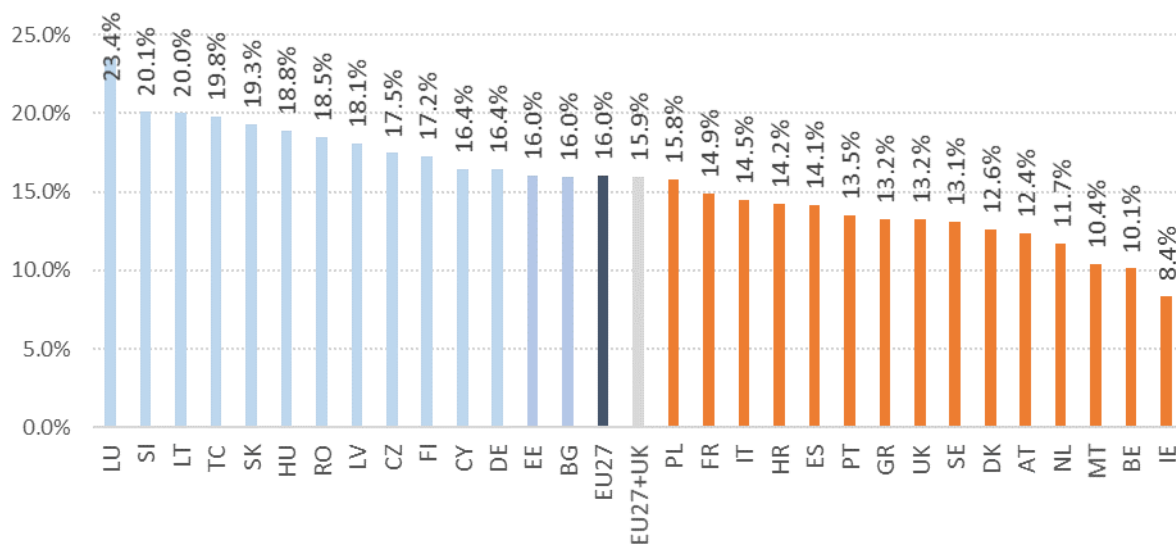
42.3% of the funds for climate action were planned in less developed regions, 13.3% in more developed regions and 10.8% in transition regions (Figure 9). A relatively large share of the total though, 33.5%, cannot be regionalised. The amounts planned for climate action in outermost regions as well as northern and sparsely populated regions is around 0.1% of the total.

Compared to the total Cohesion Policy amounts, funds planned for climate action are 11.3% of the total in less developed regions, 10.5% in more developed regions, 6.7% in outermost regions and 13.6% in transition regions. As regards the amounts that cannot be regionalised, the amount for climate action is 21.6% of the total planned funds (Figure 5 in Annex).

Figure 6: Total planned amounts for climate action across the EU27 + UK

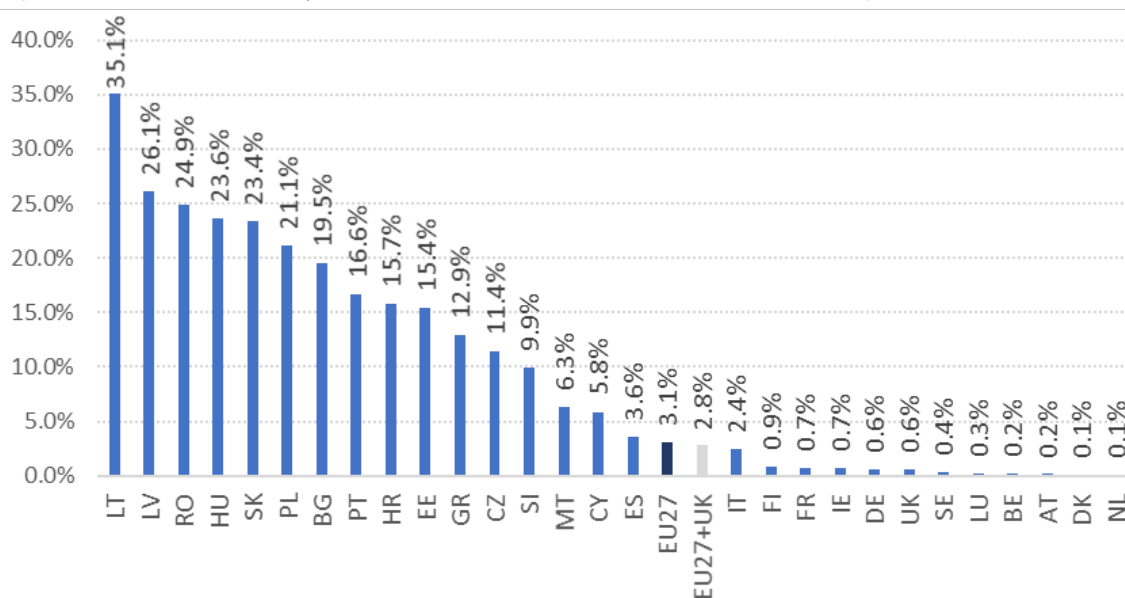


Source: ESIF Open data.

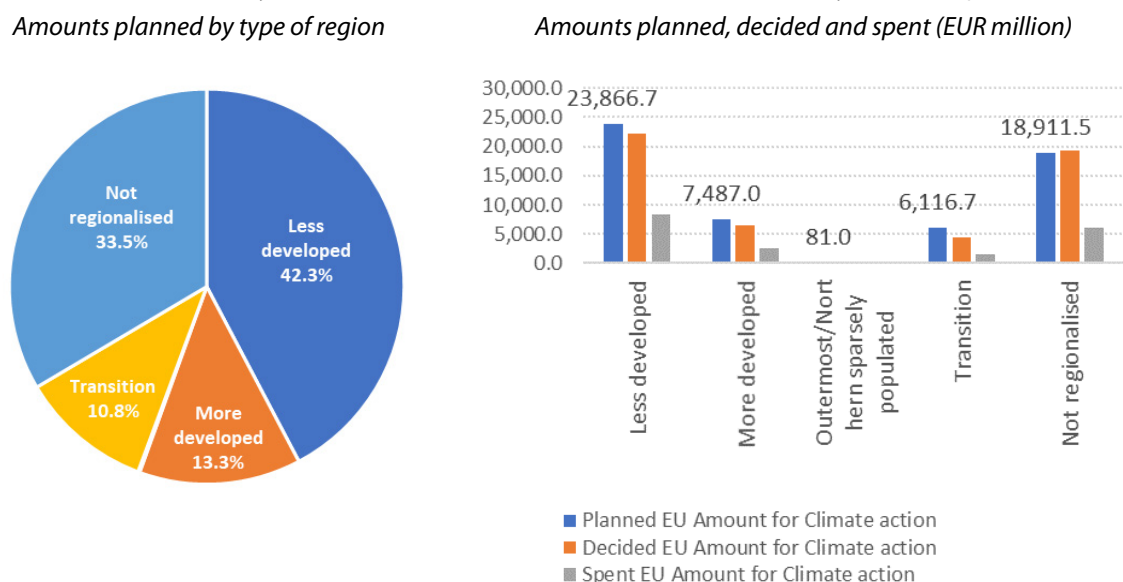
Figure 7: Share of Cohesion Policy focused on climate change

Source: ESIF Open data

If we take the national expenditure on environmental protection (NEEP) as a proxy of the national financial effort made address issues that concern the environment, we can observe that this is on average 2% of GDP in the EU27 (1.9% in the EU27 + UK), ranging from 3.2% of GDP in Belgium to 0.8% in Ireland. By comparing the Cohesion Policy amounts planned for climate action to the NEEP, we can see that on average in the EU28, the annual EU funds planned for climate are 2.8% of national expenditure on environment. This ratio varies from 35.1% in Lithuania, where the relative importance of EU funds is very high, to 0.1% in the Netherlands.

Figure 8: Cohesion Policy amounts for climate action (annual average) as % of NEEP

Source: ESIF Open data and Eurostat [TEN00135].

Figure 9: Cohesion Policy amount planned for climate action across types of regions

Source: ESIF Open data

2.2.2. What kind of interventions were financed so far in 2014-2020?

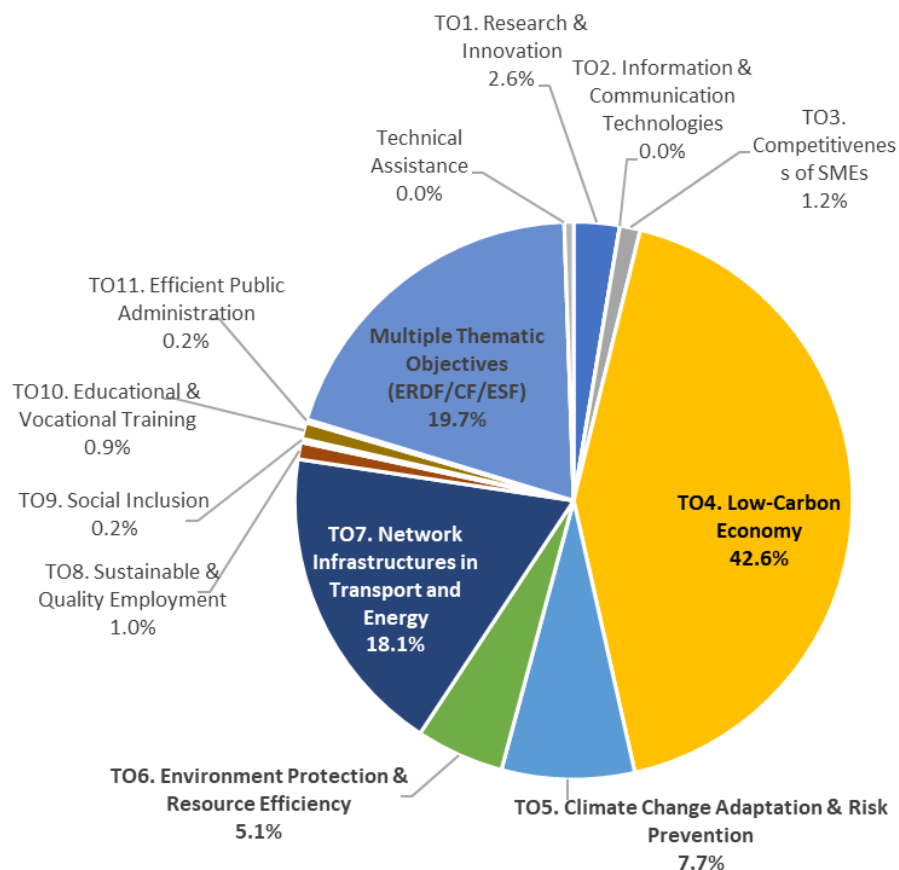
In 2014-2020, Cohesion Policy has set 11 Thematic Objectives (TOs) supporting growth and creation of jobs. Most of the Cohesion Policy resources planned for interventions which are tracked as contributing to climate change objectives have been allocated under Thematic Objective 4 ("Low-carbon economy"). Indeed EUR 24.1 billion or 42.6% of the total was planned under TO4 (Figure 10 and, for absolute values, Annex Figure 6). The amount spent, as of end of 2019, was 28% of planned for this TO, slightly below average (33%).

TO7 ("Network infrastructure in transport and energy") is the second most important thematic objective for interventions contributing to climate change, with EUR 10.2 billion or 18.1% of the total. 33% of planned amounts were spent, as of end of 2019.

TO5 ("Climate change adaptation and risk prevention") and TO6 ("Environmental protection and resource efficiency") had climate-relevant allocations of respectively EUR 4.3 billion, or 7.7% of the total, and 2.9 billion, or 5.1% of the total amount planned on climate change. The expenditure rate, as of end of 2019, is 27% for TO5 and 24% for TO6.

Smaller amounts have been planned under the other TOs. For example, approximately EUR 1.5 billion was planned under TO1 ("Research and innovation"), and over EUR 500 billion was planned under TO8 ("Sustainable and quality employment") and TO10 ("Educational and vocational training").

The spending rate is significantly lower than average in the case of TO1 while it is above average in the case of TO10 (49%). The rate of expenditure is also higher than average for the funds for climate action which cannot be attributed to a single TO but to multiple objectives. A significant amount, EUR 11.1 billion or 19.7% of the total is associated to multiple thematic objectives and multiple funds (ERDF, CF and ESF).

Figure 10: Distribution of amounts for climate action by Thematic Objective

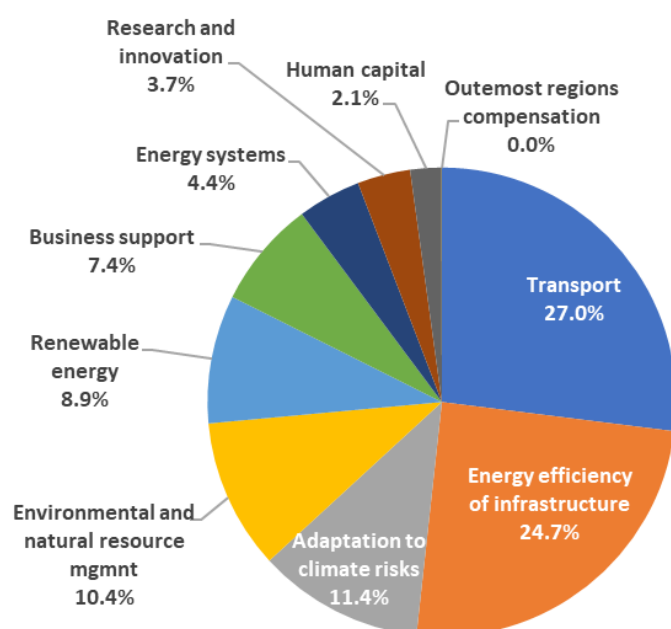
Source: ESIF Open data.

Intervention fields allow a breakdown of expenditure at a higher level of detail (Annex Figure 7). Most of the funds are allocated to energy efficiency renovation of public infrastructure (16.6% of the total). This is followed by adaptation to climate change and risk prevention (11.4%), clean urban transport infrastructures (9.1%) and energy efficiency of existing housing stock (8.2%).

All the other fields gathered an amount ranging from 5.9% of the total in relation to railways to 0.1% for productive investment in large enterprises linked to the low-carbon economy.

Intervention fields can be grouped in macro-categories of intervention as shown in Annex Table 4 which provides also a correspondence between the 2014-2020 and the 2021-2027 programming period.

Interventions on transport absorbed the largest share of Cohesion Funds for climate action in 2014-2020 (Figure 11). Energy efficiency of infrastructures have gathered 24.7% of total. Measures for adapting to climate risks and environmental management around 10% each. Nearly 9% of the total went to renewable energy, 7.4% to business support relevant for climate, 4.4% to energy systems, 3.7% to research and innovation oriented towards climate change and 2.1% to human capital development relevant to climate action.

Figure 11: Distribution of Cohesion Policy funds by macro-category of intervention

Source: ESIF Open data.

2.2.3. Cohesion Policy budget for climate action in 2021-2027

In 2021-2027, the Cohesion Policy budget is slightly lower than in 2014-2020. Indeed, without considering Next Generation EU, the temporary instrument designed to boost the recovery from the consequences of the Covid-19 pandemic, approximately EUR 330 billion are allocated to Cohesion Policy (ERDF, CF and ESF+) in the MFF 2021-2027²⁴ while, in 2014-2020, Cohesion Policy had a budget of approx. 355 billion.

Despite this reduction in total Cohesion Policy funds of roughly EUR 25 billion, the minimum amount planned for climate change is expected to increase to 77.2 billion²⁵, based on the proposed specific funds' regulations²⁶, compared to the 56.5 billion in 2014-2020 (Table 3). If we also consider REACT-EU²⁷, a component of Next Generation EU which tops up ERDF and ESF until 2023, then the total amount for climate action goes up further to EUR 83.7 billion (+27.2 billion compared to 2014-2020). This is roughly 25% of total Cohesion Policy resources, a significantly higher share than the % of total planned Cohesion Policy funds geared towards climate change in 2014-2020 (15.9%). Therefore, Cohesion Policy has the potential to contribute more than in the previous period.

²⁴ Council of the EU press release of Dec. 17 2020 "Multiannual financial framework for 2021-2027 adopted".

²⁵ This estimate was calculated considering the expected contributions of ERDF and CF to climate objectives, according to the proposed regulations. As regards ESF+, it was assumed that the share of the planned resources which will go to climate action will be the same of 2014-2020.

²⁶ Operations under the ERDF are expected to contribute 30 % of the overall financial envelope of the ERDF to climate objectives. Operations under the Cohesion Fund are expected to contribute 37% of the overall financial envelope of the Cohesion Fund to climate objectives.

²⁷ REACT-EU is a EUR 47.5 billion initiative that continues and extends the crisis response and crisis repair measures delivered through the Coronavirus Response Investment Initiative and the Coronavirus Response Investment Initiative Plus. It will contribute to a green, digital and resilient recovery of the economy. The funds will be made available to: the ERDF, the ESF, and the European Fund for Aid to the Most Deprived (FEAD). These additional funds will be provided in 2021-2022 from Next Generation EU and in 2020 through a targeted revision to the current financial framework.

Table 3: Expected Cohesion Policy amounts for climate action in 2021-2027 and comparison with 2014-2020

	2021-2027			2014-2020	2021-2027 compared to 2014-2020	
	Cohesion Policy for climate (EUR billion)	REACT-EU for climate (est. EUR billion)	Total for climate (est. EUR billion)	Cohesion Policy for climate (EUR billion)	Total variation (EUR billion)	% Change
CF	15.7		15.7	17.2	-1.5	-9%
ERDF	60.0	6.2	66.2	38.0	21.9	58%
ESF	1.5	0.3	1.8	1.2	0.3	27%
Total	77.2	6.5	83.7	56.5	20.8	37%

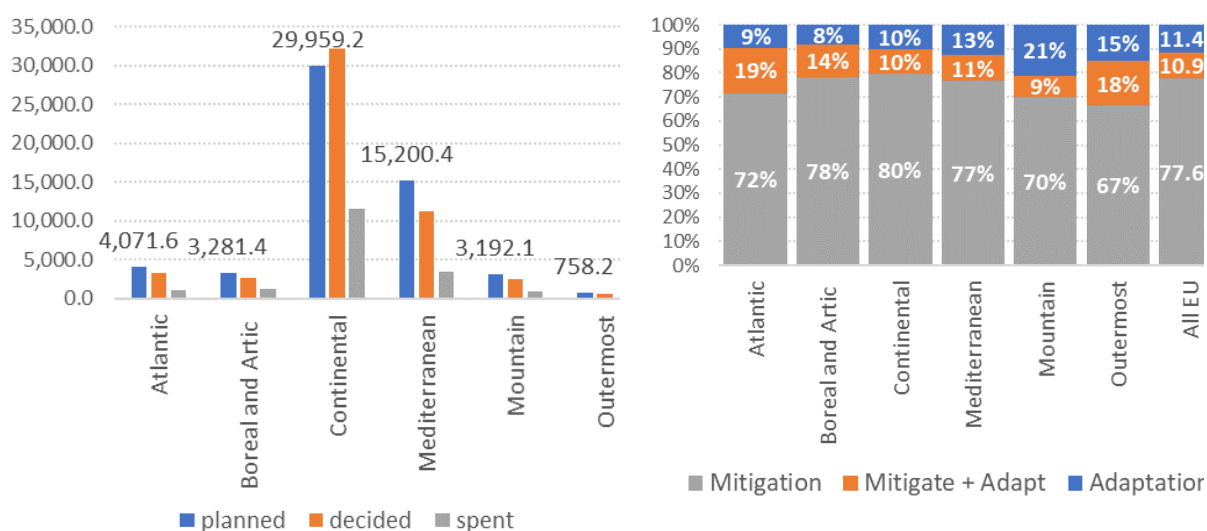
Source: Own calculations based on ESIF Open Data and Multiannual Financial Framework 2021-2027 and Next Generation EU commitments (updated December 17, 2020).

2.2.4. Climate change interventions across main EU geoclimatic regions

Cohesion Policy funds are distributed across the main EU regions, identified in the previous chapter of this report on the basis of common geoclimatic features, as shown in Figure 12.

Most of the funds planned for climate action in 2014-2020, nearly EUR 30 billion out of the total EUR 56.5 billion, are from OPs which concern mainly EU Continental regions. EUR 15.2 billion are planned to be spent in Mediterranean regions. Atlantic EU regions gathered EUR 4.1 billion. Mountain EU regions as well as Boreal and Arctic regions account for more than EUR 3 billion each. Outermost regions have planned around 782 million of Cohesion Policy funds for climate.

Overall, based on intervention fields, 77.6% of total resources for climate planned in the EU are used to finance interventions for climate change mitigation. 11.4% goes to climate change adaptation and for a share of 10.9% it is not possible to clearly distinguish between mitigation and adaptation. The share of funds which is geared towards adaptation to climate change is highest in EU Mountain areas (21%) as well as in outermost regions (15%).

Figure 12: Cohesion Policy funds across main EU regions*Planned, decided and spent amounts (EUR million)**% of funds planned for mitigation and adaptation to climate change*

Source: ESIF Open data.

The following case study factsheets provide a more detailed overview of the interventions in each group of regions as well as concrete examples of what has been financed by Cohesion Policy in 2014-2020.

a. Atlantic EU regions

i. Key relevant geoclimatic features

The EU Atlantic regions are north-western European areas facing the Atlantic Ocean. This macro-region stretches from the top of Norway down to the northern shores of France, Spain and Portugal, encompassing the United Kingdom, Ireland and the Netherlands, as well as Flanders (Belgium), north western Germany and Denmark.

The region is characterised by an oceanic climate and a long coastline with several rivers draining off into two of the most productive seas of the world in terms of fishing (North Sea and North-east Atlantic Ocean). These geographical features make the region particularly vulnerable to: an increase in winter precipitation; increase in damages from winter storms; increase in river flow; northward movement of species; increase in risk of river and coastal flooding (EEA 2017)²⁸.

Geoclimatic vulnerabilities, aggravated by climate change, may have direct consequences on infrastructures damages, sea levels rise, water restrictions for some Atlantic sub-regions and changes in fish stocks abundance and/or distribution. Nonetheless, the decrease in global temperature could possibly benefit the northern part of this region by favouring an increase of agriculture and tourism as well as a decrease in demand for heating.

²⁸ EEA (2017), Climate change, impacts and vulnerability in Europe 2016, An indicator-based report, Report No 1/2017.

Cohesion Policy addresses the climate vulnerabilities of the EU Atlantic regions. A summary of the financial contribution of Cohesion Policy and examples of interventions for climate change mitigation and adaptation are provided next.

ii. Cohesion policy contribution to climate action

How much Cohesion Policy contributed to climate action. Over the programming period 2014-2020, out of a total amount of EUR 4.1 billion of Cohesion Policy funds planned for climate action in EU Atlantic regions, EUR 4 billion were ERDF while the ESF amounted to approximately EUR 74 million. The amount decided is equal to EUR 3.3 billion, while 1.1 billion, or 27% of planned funds were spent.

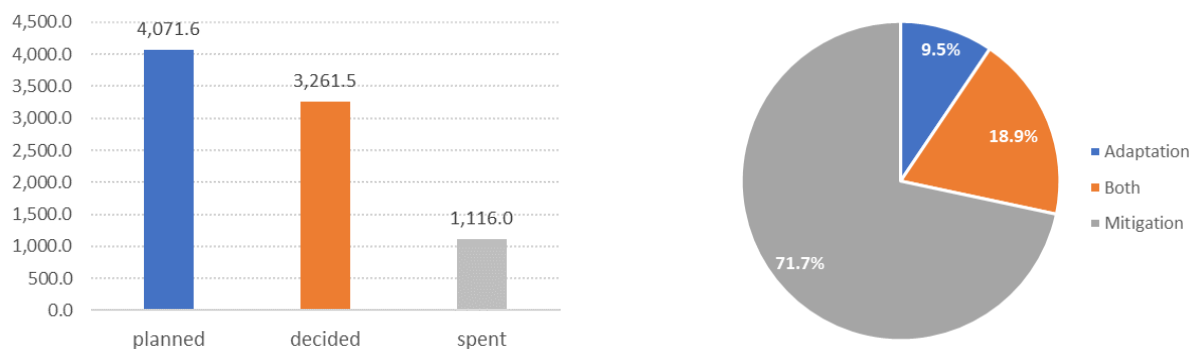
Most of the planned amount for climate action (71.7%) was allocated to climate change mitigation. Initiatives for mitigation consist mainly of interventions on renewables, energy efficiency of infrastructure and environmental and natural resource management (see below).

Approximately 18.9% of the total amount planned for climate action went to climate change adaptation while 9.5% was planned on interventions that may be relevant to both mitigation and adaptation.

Figure 13: Cohesion Policy contribution to climate action in Atlantic regions

Cohesion policy funds planned, decided and spent for climate action (EUR million)

Cohesion policy funds planned for climate change mitigation, adaptation or both

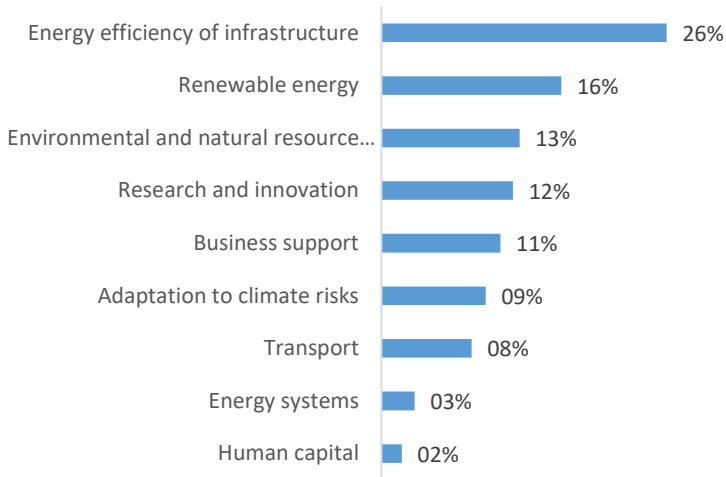


Source: ESIF Open data.

Types of interventions supported by Cohesion Policy. Based on the intervention fields, the Cohesion Policy planned resources can be broken down by main category of intervention. The highest share of total planned funds, 25.9%, went to initiatives aiming at increasing energy efficiency of infrastructure, mainly related to strengthening the energy performance of housing and public infrastructures.

The development of renewable energy sources has obtained approximately 16.3% of the total. These interventions support mainly solar, biomass and other renewable energy sources. An important part of the total planned resources (12.5%) has been devoted to environmental and natural resource management. These interventions focus mostly on cycle tracks, footpaths as well as on biodiversity, nature protection & green infrastructure. Research and innovation accounted for approximately 11.9% of total resources for climate action, while 10.8% of planned amounts was allocated to business support aiming at increasing SMEs' energy efficiency and environmental-friendly production processes.

Figure 14: Cohesion policy funds planned by macro-category of intervention in Atlantic regions



Source: ESIF Open data.

Adaptation to climate risk and investments in transport obtained respectively 9.5% and 8.2% in EU Atlantic regions, with the latter mostly focusing on support for the development of clean urban transport infrastructures and intelligent transport. Less than 5% of the total went respectively to energy systems and human capital initiatives.

Cohesion Policy financed various initiatives in the EU Atlantic regions to address climate change mitigation and adaptation. Box 1 provides examples of projects suggested by MAs of OPs selected on the basis of the relative importance of Cohesion Policy amounts allocated to climate action.

Box 1: Examples of initiatives for climate change in Atlantic regions

Examples of initiatives for climate change adaptation

The **Galicia ERDF 2014-20 OP** has financed the coordination and management of the Covenant of Mayors for Climate and Energy which is a good example of multilevel governance (Coordinación y gestión en Galicia del Pacto de los Alcaldes para el Clima y la Energía como mejor iniciativa de gobernanza multinivel de la Acción Climática)²⁹. Already 230 out of 313 municipalities joined the initiative, receiving on-line training and financial support for the preparation of the Sustainable Energy and Climate Action Plan (SECAP).

Furthermore, the Galician OP also supported the LIDAR³⁰ coverage of the Galician coastline within the framework of the adaptation of the Spanish coast to climate change (Cobertura LIDAR del ámbito del litoral de Galicia en el marco de la adaptación de la costa española al cambio climático)³¹. Thanks to the LIDAR technology it will be possible to collect high quality data on the effects of climate change caused by the rise

²⁹ For more information see: <https://pactodosalcaldes.gal/gl>
³⁰ LIDAR (Light Detection and Ranging o Laser Imaging Detection and Ranging) is a technology that allows to make high-resolution maps using laser light to image objects, with applications in fields such as geomatics, geography, geology and geomorphology.
³¹ For more information see: https://experience.arcgis.com/experience/b5625a0f102649f1a44a6d28b9fbbed3/page/page_12/

in sea level, waves, meteorological tide, sediment transport and erosion. This will help the responsible authority in the planning and adoption of adequate adaptation measures.

The **Interreg Spain-France-Andorra** (POCTEFA) financed a research project aiming at developing local operative tools to strengthen risk management practices of the Basque coastal areas (MAREA - Modelizaciones y Apoyo a la toma de decisiones ante los Riesgos costeros del Euskal Atlántico). Several sensors and video systems have been placed along the Basque coast and some predictive models for local alerts have been already developed.

The **Interreg North Sea OP** supported an initiative aimed at creating a new approach to peatland ecosystems (CANAPE). This is intended to enhance resilience of lowland peatland ecosystem against drought and flood risks. It also finances the installation of carbon capturing technologies in peat soils and wetlands. The project is under implementation in 7 pilot sites and it is expected to boost carbon capture and reduce annual CO₂ emissions by 624.7 tonnes. The OP also co-financed a project concerning flood risk and coastal erosion management (Building with Nature - BwN). Nature based solutions have been successfully tested in several coastal sites and the tools and methodologies used have been made accessible to practitioners and policy makers.

Examples of initiatives for climate change mitigation

In order to support the transition of the economy towards carbon neutrality, the **OP South Netherlands ERDF** has financed several projects focused on increasing energy efficiency of buildings and supporting research and innovation in SMEs, on a large variety of issues related to a greener and more sustainable economy.

Another example of initiative for climate change mitigation is the Better Energy Warmer Homes scheme (BEWH)³² financed by the **Southern & Eastern Regional Programme OP** in Ireland. It is aimed at increasing energy efficiency of the households at risk of energy poverty³³. It includes several measures of heat insulation and replacement of electrical appliances. The implementation of these measures resulted in an improved energy consumption classification of 12,214 households, which is estimated to yield an annual saving of 10,787 Tonnes of CO₂ equivalent. It is also expected that this scheme will increase health and well-being of households at risk of poverty, by reducing the amount of disposal income spent on energy.

The **Galician OP**, has financed the Development of the regional strategy for climate change and energy up to 2050 (Elaboración de la Estrategia Gallega de Cambio Climático y Energía 2050)³⁴. A roadmap to achieve climate neutrality by 2050 was agreed and the first 170 measures to be implemented during the period 2019-2023 through Integrated Regional Plans were approved.

The **Interreg North Sea OP** launched the 2IMPRESZ³⁵ project whose mission is to increase energy efficiency of public schools as well as promoting behavioural change toward energy consumption. The aim of the initiative is to promote energy savings of 30% in 141 schools in the North Sea Region and transforming at least 4 schools into nearly zero-energy buildings by the end of the project.

Challenges for Cohesion Policy in supporting climate action. The consulted MAs³⁶ consider climate action to be a truly transversal issue since lots of cross sectoral initiatives produce impacts on climate. Therefore, Cohesion Policy support to climate action represents a useful tool when synergies across

³² For more information see: <https://www.seai.ie/grants/home-energy-grants/free-upgrades-for-eligible-homes/>

³³ Energy poverty is defined as the lack of access to sustainable modern energy services and products.

³⁴ For more information see: <https://cambioclimatico.xunta.gal/estrategia-cambio-climatico>.

³⁵ For more information see: <https://northsearegion.eu/2impresz#>

³⁶ The MAs of 25 OPs, selected on the basis of the relative importance of resources planned for climate action, were consulted with a questionnaire and by phone, between December 2020 and January 2021. These OPs (listed in Annex) cover all the main geoclimatic regions considered in the study: Boreal and Arctic, Mountain, Atlantic, Continental, Mediterranean and outermost EU regions.

funds are sought and optimised. Nonetheless, the MAs believe that a greater effort should be made to mainstream climate change rather than treating it as a standalone problem.

The size of the financial support available is sometimes considered too modest to generate sizable effects. Additionally, the limited scale of investment may represent an obstacle to properly evaluate the impact of policy intervention.

Most of the MAs highlight that the financial instruments were not suitable in their experience to pursue the objectives of Cohesion Policy in relation to climate. Furthermore, the MAs of the selected OPs believe that more flexibility in the instruments and less burdensome administrative procedures would increase effectiveness, efficiency and make it possible to promptly adapt to the needs of a constant changing world.

The MAs also highlighted the need for clear and rigorous methodological guidelines for quantifying common performance indicators to ensure comparability across projects and interventions. Furthermore, targets for output indicators should be revised on the basis of the evidences collected over the current funding period.

In order to increase the effectiveness of the projects the MAs consider it important to devote more attention to measures aimed at overcoming fears of transition, and resistance to the necessary behavioural change.

b. Continental EU regions

i. Key relevant geoclimatic features

The group of EU Continental regions mostly covers Central and Eastern Europe. It includes territories belonging to France, Belgium, Luxembourg, Netherlands, Germany, Denmark, Poland, Czech Republic, Slovakia, Austria, Hungary, Romania, Slovenia and Croatia.

This macro-area is characterised by a relatively flat landscape and a climate of pronounced contrasts between extreme hot and cold, wet and dry, especially in the eastern part of Europe (EEA 2017). Therefore, EU Continental regions show some common vulnerabilities such as: increase in heat extremes; decrease in summer precipitation; increasing risk of forest fire; increase in risk of river floods.

Geoclimatic vulnerabilities, magnified by climate change, are likely to produce particularly severe impacts on the eastern part of region. The increase in heat extremes and the decrease in summer precipitation has direct consequences on human health, on drought risk, as well as on energy demand and crop yields' variability. Rising temperatures could also increase the risk of spreading exotic diseases. Climate change effects on northern EU Continental regions could be milder, with potentially beneficial effects on tourism and some food production.

Cohesion Policy addresses the climate vulnerabilities of the EU Continental regions in several ways. A summary of the financial contribution of Cohesion Policy and examples of interventions for climate change mitigation and adaptation are provided next.

ii. Cohesion policy contribution to climate action

How much Cohesion Policy contributed to climate action. Over the programming period 2014-2020, out of a total amount of around EUR 30 billion of Cohesion Policy funds planned for climate action in the EU Continental regions, EUR 17 billion were from the ERDF while the CF provided

approximately EUR 12 billion. The amount already committed was equal to around EUR 32.2 billion, while EUR 11.6 billion, or 39% of planned funds, were actually spent.

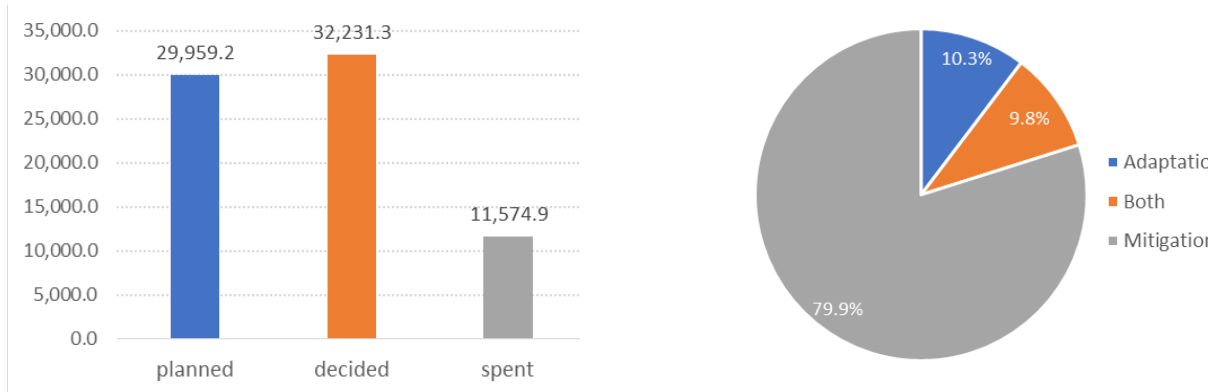
Most of the planned amount for climate action (79.9%) went to climate change mitigation. Initiatives for mitigation consist mainly of interventions on transports and energy efficiency of infrastructure (see below).

Climate change adaptation accounted for approximately 10.3% of the total amount planned for climate action while 9.8% was planned on interventions that may be relevant to both mitigation and adaptation.

Figure 15: Cohesion Policy contribution to climate action in Continental regions

Cohesion policy funds planned, decided and spent for climate action (EUR million)

Cohesion policy funds planned for climate change mitigation, adaptation or both

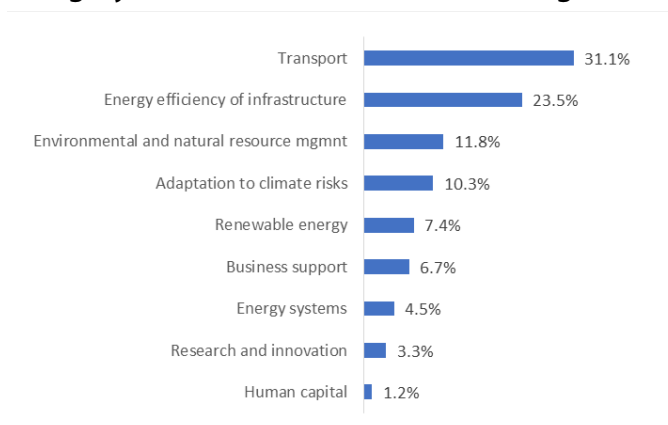


Source: ESIF Open data.

Types of interventions supported by Cohesion Policy. Based on the intervention fields, the Cohesion Policy resources planned in EU Continental regions can be broken down by main category of intervention. The highest share of total planned funds, 31.1% went to transport, more specifically clean urban transports and railways.

An important part of the total planned resources has been devoted to energy efficiency of infrastructure (23.5%), concerning both public infrastructure and housing. Environmental and natural resource management obtained approximately 11.8% of the total. These interventions focus mostly on: cycle tracks and footpaths; water management and drinking water conservation; air quality measures; biodiversity, nature protection and green infrastructure. Adaptation to climate risk gathered 10.3% of the total, while 7.4% went to investments in renewables, mostly solar, biomass and other. Initiatives aiming at supporting businesses, mainly related to the promotion of energy

Figure 16: Cohesion policy funds planned by macro-category of intervention in Continental regions



Source: ESIF Open data.

efficiency interventions, obtained 6.7% of the planned resources, while investments in the development of energy systems obtained 4.5% of the total planned amounts, focusing mostly on High efficiency co-generation and district heating projects. Research and innovation (3.3%) and human capital (1.2%) each received less than 4% of the total resources allocated.

Cohesion Policy financed various initiatives in the EU Continental regions to address climate change mitigation and adaptation. The following box provides examples of interventions suggested by Managing Authorities of OPs selected on the basis of the relative importance of amounts allocated to climate action.

Box 2: Examples of initiatives for climate change in Continental regions

Examples of initiatives for climate change adaptation

The **Interreg Central Europe OP** financed the ProteCHt2save³⁷ project aiming at an improving protection and management of cultural heritage by strengthening central Europe's resilience to flood, heavy rain and droughts. The project involved research institutions and local and regional public authorities from 7 countries (Austria, Croatia, Czech Republic, Hungary, Italy, Poland and Slovenia). It financed the development of innovative tools, such as a Web GIS tool for risk mapping and a decision support tool for identification of criticalities. Thanks to this tool, 7 local emergency plans were set up and tested in the framework of pilot actions.

Another example of initiative for climate adaptation financed by the Interreg Central Europe OP is the RAINMAN³⁸ project, whose mission is to improve integrated management capacities of public authorities for the mitigation of heavy rain risks and hazards of flash floods. The project included the development of the RAINMAN-Toolbox³⁹, an online information platform that contains guidance on emergency response practices, methods for assessment, mapping of heavy rain risks, and good practice examples. So far, 25 pilot municipalities developed hazard and risk maps. Furthermore, other public authorities improved their risk reduction measures, warning systems and emergency response strategies. The project also included trainings on heavy rain risks and tools developed under the project for 672 people in 22 pilot regions.

The **Czech ERDF/CF Environment OP** financed several interventions in the Danube area aimed at preserving biodiversity, landscapes and quality of air and soil.⁴⁰ Thanks to various interventions several watercourses have been revitalized; 1,173 localities enhanced their landscape and ecosystem; 9,194.55 ha of natural habitats were given a conservation status and several measures unblocking migration barriers for animals were implemented.

The **Hungarian ERDF/CF Environmental and Energy Efficiency OP** has financed a flood protection system in the Upper-Tisza area.⁴¹ The project consists in the realization of a flood control reservoir of almost 45 million cubic metres and the renewal of the water management system of the basin. The project is expected to have positive effects on water management and to prevent water damage, favouring repopulation of the area, tourism and economic development. Furthermore, in the middle-Tisza section, the OP financed the relocation and construction of flood defence lines and other interventions to increase resilience against floods providing a safer environment to nearly 125,000 people.⁴² The OP also supported the development of a storm water reservoir in the area of Baranya Canal to reduce flood risk and ensure proper water management during drought periods.⁴³ The Bayern ERDF OP has also financed a similar initiative in Ansbach.

³⁷ For more information see: <https://www.interreg-central.eu/ProteCHt2save>

³⁸ For more information see: <https://www.interreg-central.eu/rainman>

³⁹ For more information see: <https://rainman-toolbox.eu>

⁴⁰ For more information see: <https://www.opzp.cz/about/>

⁴¹ For more information see: <http://tiszaturtarozo.ovf.hu/>

⁴² For more information see: <http://tiszahullamter.ovf.hu/>

⁴³ For more information see: <http://www.ddvizig.hu/hu/lezarult-fejlesztések-baranya-megye-1>

Examples of initiatives for climate change mitigation

As an example of initiatives for climate change mitigation, the **Interreg Central Europe OP** financed the **ENERGY@SCHOOL**⁴⁴ project. The aim of the project is twofold: to promote behavioural change of students and school staff toward energy consumption, and to ensure energy efficiency of schools' buildings. The initiative includes educational activities as well as investments in smart meters, apps and other tools to monitor energy consumption. Over 3 years, 24 training programmes were conducted, 3 digital learning applications created and 241 energy guardians⁴⁵ were trained. These measures contributed to the reduction of energy consumption in 48 participating schools. Furthermore, behavioural change will have long lasting effects decreasing energy consumption in both the school and domestic environment.

The **Thüringen ERDF OP** financed three projects aiming at reducing CO2 emissions and increasing energy efficiency. The first one concerns the optimization of energy infrastructure and the promotion of the use of renewable sources for energy provision in the indoor swimming pool of Ilmenau⁴⁶. The second one aims at increasing energy efficiency in the urban districts of the city of Nordhausen by developing an infrastructure for the use of green waste for heat generation.⁴⁷ The third project consists in the development of the IAB Weimar gGmbH's cogeneration system in order to increase the plant's energy efficiency.⁴⁸ The OP will also finance other similar initiatives aiming at reducing CO2 emission in the next programming period.

The **Bourgogne ERDF/ESF/YEI OP** has also promoted an initiative aiming at reducing CO2 emissions. The OP supported several projects whose mission is to generate energy using local green sources such as wood or biogas, which already increased the capacity for renewable energy production by 6.77 megawatts.⁴⁹ In addition, the OP launched another initiative aiming at improving households' energy consumption classification by financing energy efficiency renovation of buildings. Already 2,451 households improved their energy consumption classification, this number is projected to increase to 5,000 by 2023.⁵⁰

The **Czech ERDF/CF Environment OP** financed several interventions aiming at increasing energy efficiency of public and private buildings and promote the use of renewables. The programme has supported 12 projects which are expected to reduce energy consumption, greenhouse gas and dust emissions, as well as to increase the use of renewable resources.

In addition, the **Bayern ERDF OP** financed the MOORuse initiative.⁵¹ The intervention promotes projects aimed at reducing CO2 emissions from peaty soils and promotes research on potential usage of wet cultivation on lowland moor soils. In order to reduce CO2, the OP also financed the development of a heating network in the city of Kaufbeuren and insulated five public buildings, enhancing public infrastructure energy efficiency.

Challenges for Cohesion Policy in supporting climate action. The consulted MAs consider Cohesion Policy as a suitable instrument to effectively finance climate action, allowing them to treat climate change as a transnational and cross-sectorial issue. According to the consulted MAs, Cohesion Policy initiatives facilitate the exchange of good practices among territories and cooperation among different political and non-political stakeholders, favouring institutional capacity building.

⁴⁴ For more information see: <https://www.interreg-central.eu/energyatschool>

⁴⁵ Energy guardians are students and teachers trained to monitor and reduce school's energy consumption.

⁴⁶ For more information see: <https://www.ilmenau.de/4091-0-EFRE+Neubau+Schwimmhalle+Ilmenau.html>

⁴⁷ For more information see: https://www.stadtwerke-nordhausen.de/detailansicht/news/uebergabe-des-efre-bescheids-fuer-das-vorhaben-energetische-nutzung-von-gruenabfaellen-fuer-die-alternat/7tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Baction%5D=detail&cHash=c7870c3227c790b665678cdae0cdf40e

⁴⁸ For more information see: <https://www.iab-weimar.de/errichtung-eines-demonstrators-zur-reduzierung-energiebedingter-co2-emissionen/>

⁴⁹ For more information see: <https://www.europe-bfc.eu/dispositif/aide-a-linvestissement-pour-la-production-energies-renouvelables/>

⁵⁰ For more information see: <https://www.europe-bfc.eu/dispositif/reduire-la-consommation-energetique-des-batiments/>

⁵¹ For more information see: [MOORuse \(hswt.de\)](https://www.mooruse.de/)

Nonetheless, Cohesion Policy shows some weakness that could potentially diminish the impact of the implemented projects.

The MAs believe that a greater effort should be made to mainstream climate change rather than treating it as a standalone problem. As for example, by working more on strategic objectives and ensuring that all interventions financed by Cohesion Policy are climate proofed.

The high administrative burden decreases the attractiveness of Cohesion Policy funding especially for small enterprises, and delays projects' implementation. Some MAs reported that a few local innovative projects with significant potential were hindered by the intricacy of regulations and the fact that the maximum state aid which is given can be, at times, too low for supporting complex and innovative projects⁵². Therefore, simplification, more flexibility and reduction of complexity and administrative burden would enhance climate actions effectiveness. MAs highlighted that some climate related projects need several years to be designed and implemented, sometimes exceeding the financial programming period. Therefore, ensuring continuity of these projects will be essential to ensure meaningful and durable impact of climate action.

Ex-post evaluation on the long-term impact of climate action projects is perceived as limited. This is also linked to the fact that data on sustainability of interventions, territorial impacts and long-term effects on climate change mitigation are limited and unreliable. A proper evaluation of the results and effects of the Cohesion Policy support would be needed in order to facilitate future programming. In the light of this, the MAs suggested the need for clear and rigorous methodological guidelines for quantifying common performance indicators to ensure comparability across projects and interventions.

Resistance to change towards more sustainable behaviours is still strong in some countries, preventing the adoption of more effective measures. Against this background, the MAs in our sample suggest that more effort should be devoted to the promotion of behavioural change in order to maximize the effectiveness of climate actions.

c. Mediterranean EU regions

i. Key relevant geoclimatic features

Mediterranean EU regions covers territories on the Mediterranean Sea and, hence, many coastal areas. It includes parts of Portugal, Spain, France, Italy, Slovenia, Croatia, as well as Malta, Greece and Cyprus.

This cluster of regions is characterised by a mainly hilly territory where summers are hot and dry, winters are humid and cool, while biodiversity is very rich (EEA 2017). EU Mediterranean regions show some common vulnerabilities such as: temperature higher than EU average; decrease in annual precipitation; decrease in annual river flow; increasing risk of biodiversity loss; increasing risk of desertification; increasing water demand for agriculture; decrease in crop yields; increasing risk of forest fire; increase in mortality from heat waves; expansion of habitats for southern disease vectors; decrease in hydropower potential. Geoclimatic vulnerabilities, magnified by climate change, have more severe impacts on southern Mediterranean areas. The increase in heat extremes and the decrease in summer precipitation is expected to have critical consequences on drought risk, demand for cooling, biodiversity and food production, negatively affecting human health and economic

⁵² EU generally prohibits state aid because of its distortionary effects on competition. Nonetheless, it is possible to resort to state aid for environmental protection actions under some restrictions concerning the financial amount and intensity of the aid. For more see https://ec.europa.eu/competition/sectors/energy/environment_en.html.

development. Rising temperatures could also increase the risk of spreading exotic diseases as well as hinder tourism during summers while favouring it during colder seasons.

Cohesion Policy addresses the climate vulnerabilities of the EU Mediterranean regions in several ways. A summary of the financial contribution of Cohesion Policy and examples of interventions for climate change mitigation and adaptation are provided next.

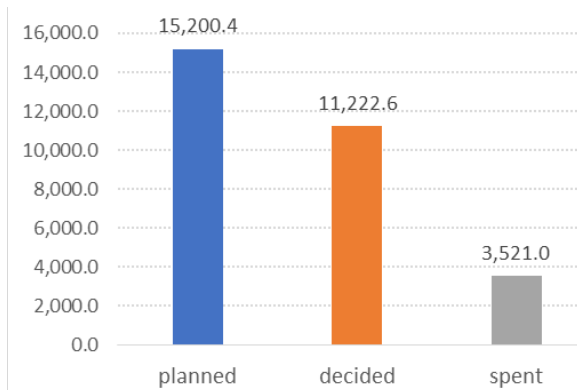
ii. Cohesion policy contribution to climate action

How much Cohesion Policy contributed to climate action. Over the programming period 2014-2020, out of a total amount of around EUR 15.2 billion of Cohesion Policy funds planned for climate action in the EU Mediterranean regions, EUR 12.4 billion were from the ERDF while the CF and the ESF provided approximately EUR 2.2 billion and 0.6 billion respectively. The amount committed was equal to around EUR 11.2 billion, while EUR 3.5 billion, or 23% of planned funds, were actually spent.

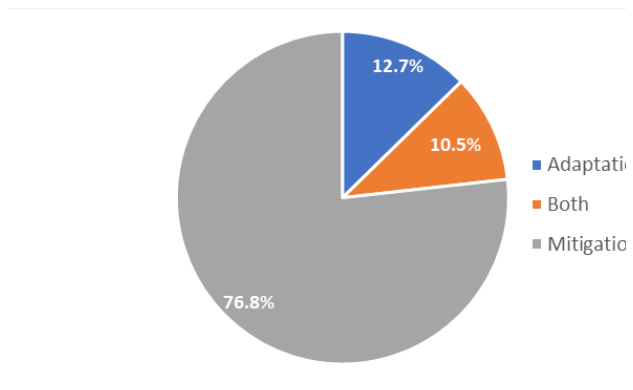
Most of the planned amount for climate action (76.8%) went to climate change mitigation. Initiatives for mitigation consist mainly of interventions on transports and energy efficiency of infrastructure (see below). Climate change adaptation accounted for approximately 12.7% of the total amount planned for climate action while 10.5% was planned on interventions that may be relevant to both mitigation and adaptation.

Figure 17: Cohesion Policy contribution to climate action in Mediterranean regions

Cohesion policy funds planned, decided and spent for climate action (EUR million)



Cohesion policy funds planned for climate change mitigation, adaptation or both

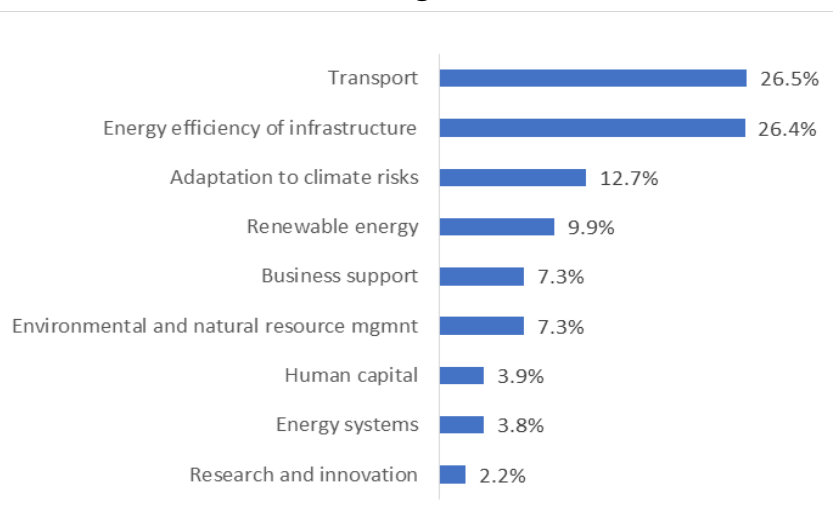


Source: ESIF Open data.

Types of interventions supported by Cohesion Policy. Based on the intervention fields, the Cohesion Policy planned resources can be broken down by main category of intervention. In EU Mediterranean regions, the highest share of total planned funds, 26.5%, went to transport, more specifically to investments in clean urban transport, railways and seaports. A similar amount was devoted to energy efficiency of infrastructure (26.4%), concerning both public infrastructure and housing.

Adaptation to climate risk obtained 12.7%, while investments on renewables, mostly focusing on solar, biomass and other, received 9.9%. The amount planned for business support and environmental and natural resource management was 7.3%.

Figure 18: Cohesion policy funds planned by macro-category of intervention in Mediterranean regions



Source: ESIF Open data.

The former mainly focuses on interventions aiming at supporting the development of environmental-friendly production processes and the increase of businesses' energy efficiency, while the latter includes investments on: cycle tracks and footpaths; biodiversity, nature protection and green infrastructure; water management and drinking water conservation; protection, restoration and sustainable use of Natura 2000 sites. Around 4% of planned resources has been allocated to human capital and a similar share to energy systems, with the latter mostly focusing on investments on intelligent energy distribution systems (included smart grids). Initiatives related to research and innovation obtained only 2.2% of the total planned resources.

Cohesion Policy financed various initiatives in the EU Mediterranean regions to address climate change mitigation and adaptation. The following box provides examples of interventions suggested by Managing Authorities of OPs selected on the basis of the relative importance of Cohesion Policy amounts allocated to climate action.

Box 3: Examples of initiatives for climate change in Mediterranean regions

Examples of initiatives for climate change adaptation

The **Portuguese OP "Sustainability and Resource Use Efficiency"** supported the elaboration and monitoring of a plan for adaptation to climate change in the metropolitan area of Lisbon (PMAAC-AML).⁵³ The plan aims at boosting a culture of adaptation, transversal to all key sectors, creating awareness toward climate change impacts and ensuring a safe environment for people and economic activities. Following the initiative, a municipality has already set up its Climate Change Adaptation Plan while other six are working on similar plans which are expected to strengthen their resilience to climate change risks. Furthermore, in order to ensure continuity of this initiative across programming cycles, 33 strategic projects aimed at

⁵³ For more information see:

[https://www.aml.pt/susProjects/susWebBackOffice/uploadFiles/wt1wwpgf_aml_sus_pt_site/componentPdf/SUS5E6B9B74C34BC/PMAAC_AML_P069_BROCHURA_INSTITUCIONAL_ENG_PMAAC-AML_30NOV2019_\(1\).PDF](https://www.aml.pt/susProjects/susWebBackOffice/uploadFiles/wt1wwpgf_aml_sus_pt_site/componentPdf/SUS5E6B9B74C34BC/PMAAC_AML_P069_BROCHURA_INSTITUCIONAL_ENG_PMAAC-AML_30NOV2019_(1).PDF)

strengthening resilience toward floods, costal erosion, droughts and heat waves have been already identified to be developed over the 2021-2027 programming period.

In addition, the OP also financed some interventions aimed at increasing resilience to cliffs' instability caused by sea level rise in the coastal area of Praia Formosa and Praia Azul (Torres Vedras).⁵⁴ Since the beginning of the project, a section of the coastal strip was requalified and several coastal containment structures were built, lowering the risk of damages for buildings and transport infrastructures. In order for these measures to have durable effects, a continuous monitoring of land erosion and cliff's solidity is expected to take place in the next years.

Examples of initiatives for climate change mitigation

The **Baleares ERDF OP** financed several projects aiming at reducing greenhouse gas emissions and increasing energy efficiency. For example, the OP financed a project whose mission is to improve energy efficiency of public lighting in Palma de Mallorca.⁵⁵ Existing lighting has been replaced and new lighting appliances have been installed in several neighbourhoods, reducing public energy expenses of around EUR 1 million per year. Furthermore, to increase energy efficiency and reduce GHG emissions of local businesses, the OP co-financed the acquisition of photovoltaic power generation facilities.⁵⁶ The investment lowered energy costs for enterprises boosting their competitiveness. Finally, the OP financed the replacement of diesel buses with buses powered by Compressed Natural Gas. Considering the significant positive results achieved in terms of CO2 emissions, the municipality of Palma is planning to add new sustainable bus lines to the already existing ones, benefitting both citizens and tourists. The **Portuguese OP "Sustainability and Resource Use Efficiency"** implemented a similar initiative. Diesel busses were replaced with 160 Compressed Natural Gas and electric busses. Furthermore, 17 clean power service stations (electric and gas) were built, successfully reducing CO2 emissions in the area.

The **Greek Transport Infrastructure Environment and Sustainable Development OP** also launched several initiatives to reduce CO2 emissions in the country. For example, it financed interventions aimed at increasing energy efficiency of a complex of 4 refugees' buildings in the municipality of Agia Varvare and of the Megaron building of the Hellenic Parliament. These projects will allow to reduce greenhouse gas emissions significantly and to lower energy costs. Furthermore, the OP supported the renovation of the largest green area of Athens (Grove of Nea Filadelfeia). The project includes the creation of cycle tracks, the implementation of sports and leisure infrastructures as well as lighting modernisation. This will have beneficial effects on both CO2 emissions and citizens' health, by promoting a more active and sustainable lifestyle. Similar initiatives will be financed also during the next programming period.

Challenges for Cohesion Policy in supporting climate action. The consulted MAs perceive Cohesion Policy as an effective tool to fight climate change, notably when climate action is integrated into other investment priorities such as business support, ICT, research and innovation. Nonetheless, the consulted MAs believe that a greater effort should be made to mainstream climate change. For example, this can be done by ensuring that all interventions are climate proofed. Moreover, they recommend making sure that complementarities and synergies are strengthened across programmes and funds to reduce duplications and enhance efficiency.

According to some of the MAs of the selected OPs, the rules and instruments are too complex and rigid for supporting climate actions. For example, private homes and communities, initially did not qualify as beneficiaries and this slowed down the implementation of energy efficiency or renewable energy sources interventions. Therefore, over the next years, the institutions and management

⁵⁴ For more information see: <http://www.cm-tvedras.pt/artigos/detalhes/protecaao-costeira-das-praias-formosa-e-azul/>

⁵⁵ For more information see: <http://www.federpalma.es/>

⁵⁶ For more information see: <http://www.caib.es/govern/sac/fitxa.do?codi=3628364&coduo=2390767&lang=es>

should promote a simplification of administrative procedures, more flexible eligibility conditions and higher co-financing rates.

MAs highlighted that some climate related projects need constant monitoring and adjustments to keep up with the constantly changing reality. Moreover, financing of successful 2014-2020 projects in the next programming period is considered essential to ensure that climate action has a durable impact.

Evaluation and monitoring should be enhanced. It is suggested that clear and rigorous methodological guidelines for quantifying common performance indicators should be provided, ensuring comparability across projects and interventions. Correct evaluation of current and past projects is essential to successfully plan future interventions.

Some MAs reported that the outbreak of COVID-19 pandemic slowed down and sometimes hindered project implementation, limiting the use of financial instruments. In this framework, the adoption of a mix of refundable financial instruments and non-refundable grants could help overcome this problem.

Last but not least, also in this case the consulted MAs highlighted that actions aimed at promoting behavioural change are essential to maximize the effectiveness of climate actions.

d. Mountain EU regions

i. Key relevant geoclimatic features

EU Mountain regions include Alpine and mountain areas of Spain, France, Italy, Austria, Slovenia, Croatia, Slovakia, Romania, Bulgaria and Sweden.

These regions show some common vulnerabilities such as: temperature rise larger than EU average; decrease in glacier extent and volume; decrease in mountain permafrost areas; upward shift of plant and animal species; high risk of species extinction in Alpine regions; increasing risk of soil erosion; decrease in snow coverage (EEA 2017).

Geoclimatic vulnerabilities, magnified by climate change, may have direct consequences on the economy of these areas by reducing ski tourism and food production. Furthermore, the increase in heavy precipitations could exacerbate the risk of infrastructure damages due to geological instability. Nonetheless, the rise in global temperature could possibly benefit some of the mountain regions, mostly the coldest, by favouring agriculture and hydropower potential. Climate change works like a double-edged sword in these regions, with net effects which are ambiguous and variable across territories. These features make the context for policy intervention complex. Cohesion Policy addresses the climate vulnerabilities of the EU Mountain regions in several ways. A summary of the financial contribution of Cohesion Policy and examples of interventions for climate change mitigation and adaptation are provided next.

ii. Cohesion policy contribution to climate action

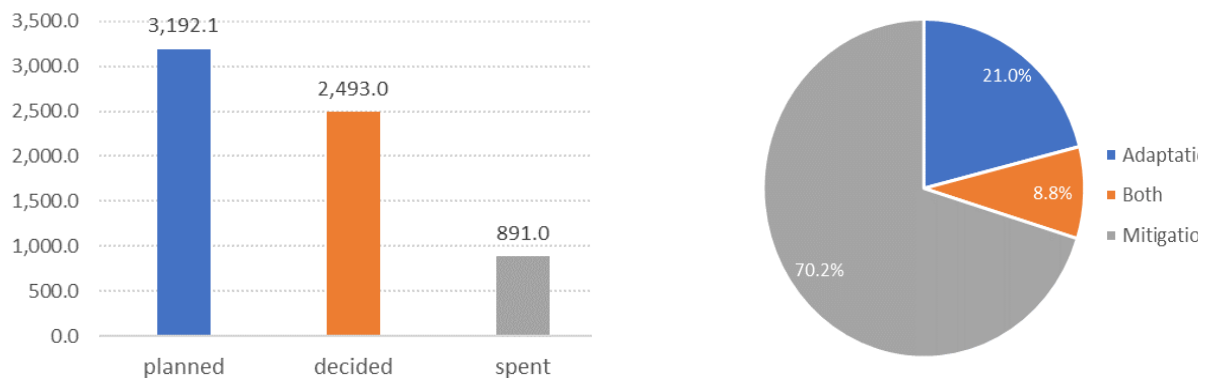
How much Cohesion Policy contributed to climate action. Over the programming period 2014-2020, out of a total amount of EUR 3.2 billion of Cohesion Policy funds planned for climate action in the EU Mountain regions, EUR 2.1 billion were from the ERDF while the CF provided approximately EUR 1 billion. The amount committed was equal to around EUR 2.5 billion, while EUR 891 million, or 27% of planned funds, were actually spent. Most of the planned amount for climate action (70.2%) went to climate change mitigation. Initiatives for mitigation consist mainly of interventions on

transports and energy efficiency of infrastructure (see below). Climate change adaptation received approximately 21% of the total amount planned for climate action while 8.8% was planned on interventions that may be relevant to both mitigation and adaptation.

Figure 19: Cohesion Policy contribution to climate action in Mountain regions

Cohesion policy funds planned, decided and spent for climate action (EUR million)

Cohesion policy funds planned for climate change mitigation, adaptation or both

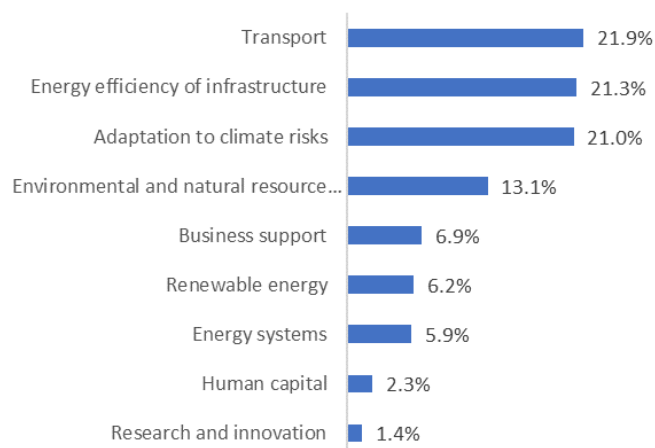


Source: ESIF Open data.

Types of interventions supported by Cohesion Policy. Based on the intervention fields, the Cohesion Policy planned resources can be broken down by main category of intervention. The highest share of total planned funds, 21.9% went to clean transport.

An important part of the total planned resources has been devoted to energy efficiency of infrastructures (21.3%) and adaptation to climate risk (21%). The environmental and natural resource management obtained approximately 13.1%

Figure 20: Cohesion policy funds planned by macro-category of intervention in Mountain regions



Source: ESIF Open data.

of the total. These interventions focus mostly on: cycle tracks and footpaths; biodiversity, nature protection & green infrastructure; air quality measures and GHG emission reduction. 6.9% of planned amounts was allocated to business support aiming at increasing SMEs energy efficiency and environmental-friendly production processes. Investments focusing on renewables, mostly related to biomass and solar, obtained 6.2% of total planned resources. A slightly lower share (5.9%) was planned for investments focusing on energy systems. About 2.3% of the total planned resources went to human capital development and 1.4% to research and innovation initiatives.

Cohesion Policy financed various initiatives in the EU Mountain regions to address climate change mitigation and adaptation. Some examples of interventions, suggested by Managing Authorities of OPs selected on the basis of the relative importance of amounts allocated to climate action, are listed in the box.

Box 4: Examples of initiatives for climate change in Mountain regions

Examples of initiatives for climate change adaptation

The **Bolzano ERDF OP** financed the renovation and expansion of the Gadera hydrometric station in Mantana⁵⁷, a district of the Municipality of San Lorenzo di Sebato. The site is part of a wider water-monitoring network in South Tyrol that facilitates the collection of data for managing hydrological and hydraulic emergencies, for the sustainable planning of water resources and for preventing hydrogeological risks. In 2021-2027, similar measuring stations will be renewed so that the experience of Mantana will be transferred elsewhere. The Trento ERDF OP has financed the reconstruction of the left bank of river Brenta after a recent sudden and unforeseen flood. The intervention aims at enhancing resilience to extreme climatic events of the nearby towns and at ensuring high standards of hydrogeological safety.

The **Interreg Alpine Space OP** has financed the GoApply⁵⁸ project, which supports climate change adaptation strategies in the Alpine Space. GoApply facilitates policy cooperation and exchanges on joint challenges faced by Alpine areas. It allows mapping, analysing and comparing relevant governance systems. Its main beneficiaries include policy makers, sectorial agencies (e.g. environment, water management, risk management), infrastructure and public service providers, international organisations (e.g. EUSALP, Alpine Convention), NGOs etc.

The Interreg Alpine Space OP also supported the development of the Alpine Drought Observatory (ADO)⁵⁹ whose mission is to improve drought risk management practices and provide recommendation for drought governance policy in the Alps. A platform was developed to collect data and produce monitoring indicators on droughts as well as case studies covering different drought issues and alpine countries.

Another example of an initiative for climate change adaptation is the Pyrenean Climate Change Observatory (OPCC-2)⁶⁰ financed by the **Interreg Spain-France-Andorra** (POCTEFA). It is a network of more than 80 organizations from Spain, France and Andorra, which aims at monitoring the effects of climate change to help the Pyrenees planning effective adaptation measures. The work of OPCC-2 will continue under the OPCC ADAPYR project, started in January 2020, that will develop the first Pyrenean Climate Change Strategy. In addition, POCTEFA financed an emergency coordination and fire prevention initiative (COOPEREM – Cooperació Operativa d’Emergències i Prevenció d’Incendis)⁶¹ which is aimed at developing a common policy in the field of emergency prevention and fire management in the Pyrénées-Orientales and Catalonia cross-border forestry and urban areas.

Examples of initiatives for climate change mitigation

As regards mitigation of climate change, the **Trento ERDF OP** has invested in the building of a high-performance cogeneration plant in the Hotel Ambassador Suite (Riva del Garda)⁶². The plant, while producing domestic hot water, generates electricity which in turn is used within the structure, increasing the energy efficiency of the building.

The **Interreg Alpine Space OP** financed the Carbon Smart Communities (CASCO)⁶³ project, which aims at reducing CO2 emissions by sourcing timber locally in public procurements. The project included a training program on skills and tools for the promotion of shorter and more sustainable timber value chains.

⁵⁷ For more information: https://appc.provincia.bz.it/downloads/Progetti_FESR_-_EFRE_Projekte_2014-2020.pdf

⁵⁸ For more information: <https://www.alpine-space.eu/projects/goapply/en/home>

⁵⁹ For more information: <https://www.alpine-space.eu/projects/ado/en/home>

⁶⁰ For more information: <https://www.opcc-ctp.org/en>

⁶¹ For more information: <http://cooperem.eu/fr/>

⁶² For more information: <https://www.ambassadorsuite.it/wp-content/uploads/2020/07/MODELLO-POSTER.pdf>

⁶³ For more information: <https://www.alpine-space.eu/projects/casco/en/home>

Challenges for Cohesion Policy in supporting climate action. The consulted MAs, of the OPs selected among the Mountain EU regions, consider Cohesion Policy to be a suitable instrument to ensure the effectiveness of climate action, allowing to treat climate change as a transnational and cross-sectorial issue. It facilitates the exchange of good practices among territories and cooperation among different political and non-political entities. Nonetheless, Cohesion Policy shows some weakness that could potentially diminish the impact of the implemented projects. Despite the efforts already made to treat climate change as a cross-sectorial issue, more action should be taken in this direction, according to the MAs. Furthermore, the MAs in our sample consider that the already available instruments and regulations do not fully take into account the fast changing and transversal nature of climate action, hampering the efficacy of the implemented measures. Therefore, the MAs believe that a simplification, more flexible instruments, more openness toward experimental action and the reduction of the administrative effort for beneficiaries and programme bodies are essential (e.g. increased use of simplified cost options - SCO).

The consulted MAs believe that the scale of investment devoted to climate action is still disproportionate compared to the high relevance of the issue. Furthermore, the MAs highlight that several projects addressing climate change need a number of years to produce meaningful and durable impact. Therefore, planning climate action projects over a relatively short horizon, as it is currently done, could hamper their effectiveness.

Monitoring and evaluation practices are considered insufficient and inadequate. More indicators reflecting real impact and durability of projects' outcomes should be developed and projects should undergo regular revision and evaluation to keep up with a constantly changing context. Furthermore, the MAs believe that a comprehensive assessment of the measures already implemented should be encouraged in order to improve the designing and planning of 2021-2027 projects.

e. Boreal and Arctic EU regions

i. Key relevant geoclimatic features

The group of EU Boreal and Arctic regions mostly covers northern Europe and sparsely populated Arctic territories. It includes Estonia, Latvia and Lithuania, as well as most of Finland and Sweden.

These regions are characterised by a relatively flat landscape, large forests, wetlands and a ragged coastline with thousands of islands (EEA 2017). The EU Boreal and Arctic regions show some common vulnerabilities such as: temperature rise much larger than global average; increase in heavy precipitation events; decrease in snow, lake and river ice cover; increase in river flows; northward movement of species; increasing potential for forest growth and increasing risk of forest pests.

Geoclimatic vulnerabilities, magnified by climate change, will have mixed consequences on Boreal and Arctic regions. On a one hand, damage risks due to storms will negatively impact infrastructures and human health. On the other hand, the rising temperature could help economic activities by decreasing energy demand, increasing summer tourism, favouring agriculture, boosting hydropower potential, creating new opportunities for the exploitation of natural resources and for sea transportation.

Cohesion Policy addresses the climate vulnerabilities of the EU Boreal and Arctic regions in several ways. A summary of the financial contribution of Cohesion Policy and examples of interventions for climate change mitigation and adaptation are provided next.

ii. Cohesion policy contribution to climate action

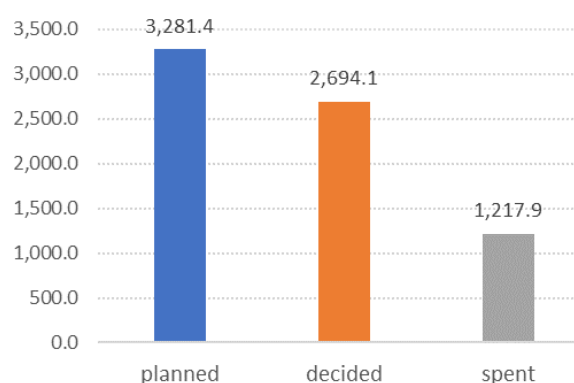
How much did Cohesion Policy contribute to climate action? Over the programming period 2014-2020, out of a total amount of around EUR 3.3 billion of Cohesion Policy funds planned for climate action in the EU Boreal and Arctic regions, EUR 1.7 billion were from the ERDF while the CF provided approximately EUR 1.5 billion. The amount committed was around EUR 2.7 billion, while EUR 1.2 billion, or 37% of planned funds, were actually spent.

Most of the planned amount for climate action (78.2%) was allocated to climate change mitigation. Initiatives for mitigation consist mainly of interventions on energy efficiency of infrastructure and transports (see below).

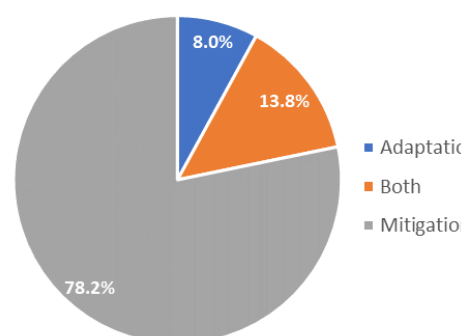
Climate change adaptation accounted for approximately 8% of the total amount planned for climate action while 13.8% was planned on interventions that may be relevant to both mitigation and adaptation.

Figure 21: Cohesion Policy contribution to climate action in Boreal and Arctic regions

Cohesion policy funds planned, decided and spent for climate action (EUR million)



Cohesion policy funds planned for climate change mitigation, adaptation or both

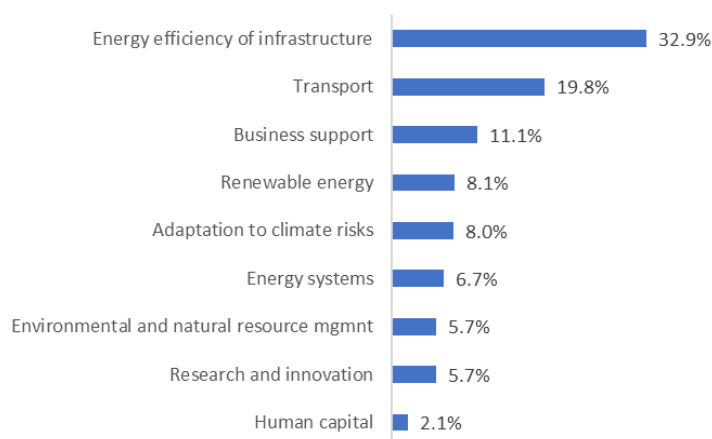


Source: ESIF Open data.

Types of interventions supported by Cohesion Policy. Based on the intervention fields, the Cohesion Policy resources planned in EU Boreal and Arctic regions can be broken down by main category of intervention. The highest share of total planned funds, 32.9% went to energy efficiency of infrastructure, concerning both public infrastructure and housing.

An important part of the total planned resources has been devoted to transport (19.8%) mostly focusing on railways, clean urban transport, seaports, multimodal transports and intelligent transport systems. Initiatives aiming at supporting businesses, mainly related to the

Figure 22: Cohesion policy funds planned by macro-category of intervention in Boreal and Arctic regions



Source: ESIF Open data.

promotion of environment-friendly production processes and energy efficiency interventions, represented 11.1% of the planned resources. Renewables, mostly biomass, accounted for 8.1%, while adaptation to climate risks obtained 8% of the planned amount. Investments in energy systems, mostly related to the development of high efficiency co-generation and district heating as well as intelligent energy distribution systems, represented 6.7% of the planned resources. Both research and innovation as well as environmental and natural resource management obtained 5.7% of the total planned amount, with the latter mainly focusing on water management, drinking water conservation, biodiversity, nature protection and green infrastructure. Only 2.1% went to human capital development.

Cohesion Policy financed various initiatives in the EU Boreal and Arctic regions to address climate change mitigation and adaptation. The following box provides examples of interventions suggested by Managing Authorities of OPs selected on the basis of the relative importance of Cohesion Policy amounts allocated to climate action.

Box 5: Examples of initiatives for climate change in Boreal and Arctic regions

Examples of initiatives for climate change adaptation

The **Interreg Northern Periphery and Arctic OP** financed several initiatives for climate change adaptation. An example is the “Collaborative Learning Initiative Managing and Adapting to the Environment” (C.L.I.M.A.T.E.)⁶⁴, which aims at promoting awareness of climate change in the European peripheral rural communities, sharing best practices and providing the necessary tools to help local authorities adapting to climate change. Thanks to this project a climate adaptation plan, an assessment of risk and opportunities related to climate change and guidelines for preparedness against severe weather events have been already developed. The OP also financed “ADAPTING NORTHERN cultural HERITAGE”, a project whose mission is to reduce the impact of climate change on historical sites in the region.⁶⁵ An online tool assessing risks and vulnerabilities of historical sites has already been tested in 9 pilot locations across the region. In addition, the OP financed the development of the “Arctic Preparedness Platform for oil Spill and other Environmental Accidents” (APP4SEA)⁶⁶ aiming at promoting the sharing of best practises and tools among environmental authorities. An interactive platform, giving information on rescue centres and accident zones has been already developed. This will help the authorities to respond quickly and effectively to crises and therefore, minimizing environmental and social impacts of accidents.

The **Latvian Growth and Employment OP** financed a set of measures aiming at reducing the effects of costal erosion and increasing resilience to floods. These initiatives have already made it possible to increase safety for already nearly 70 thousand people. Another set of measures aiming at mitigating the effect of climate change on coastal areas has been financed by the **Lithuanian multi-fund OP for EU Structural Funds Investments**(ERDF/ESF/CF/YEI)⁶⁷. The implemented interventions have already enhanced the resilience of 14.47 km of shore against the effects of sea level rise. The Lithuanian OP also supported an initiative whose mission is to reduce river flood risk and update a flood risk management plan⁶⁸. This should increase safety and favour economic activities in the areas of intervention.

Examples of initiatives for climate change mitigation

As an example of initiative for climate change adaptation, the **Latvian Growth and Employment OP** financed an initiative aiming at increasing energy efficiency and reduction of expenditure for heating in municipal buildings in the country. After the completion of 92 projects, energy consumption of public buildings was reduced significantly generating an estimated annual decrease of 5,675 tons of CO₂

⁶⁴ For more information: <http://climate.interreg-npa.eu/>

⁶⁵ For more information: <http://adaptnorthernheritage.interreg-npa.eu/>

⁶⁶ For more information: <http://app4sea.interreg-npa.eu/>

⁶⁷ For more information: https://www.esinvesticijos.lt/lt/finansavimas/patvirtintos_priemones/pajurio-juostos-tvarkymas

⁶⁸ For more information: https://www.esinvesticijos.lt/lt/finansavimas/patvirtintos_priemones/potvyniu-rizikos-valdymas

equivalent. Furthermore, the OP supported an initiative whose mission is to promote the use of renewable energy resources in district heating. This should lead to an estimated reduction of 178,437 tonnes of CO₂ equivalent per year and a reduction in thermal energy losses.

The mentioned **Lithuanian OP** supported an initiative aiming at increasing energy efficiency of apartment buildings⁶⁹. More than 38 thousand households have benefited from an upgrade in the energy efficiency of their buildings, reducing CO₂ emissions by nearly 80 thousand tonnes in 2020. The project will continue until 2023 and it is expected to improve energy efficiency classification for a total of 52,000 households with a consequent reduction of 110,000 tonnes of CO₂ equivalent.

The **Swedish national OP for investments in growth and jobs** launched the Climate Sync platform which aims at enhancing communication as well as sharing best practises on climate action.⁷⁰ The platform provides data on several projects financed under the TO4 and on their results. Furthermore, the OP financed a project whose mission is to support SMEs towards the adoption of measures aiming at increasing energy efficiency.⁷¹ Already EUR 2.6 million in grants have been made to several businesses to evaluate their current situation and plan investments to increase their energy efficiency. In addition, thematic websites and nine educational programs concerning energy efficiency in SMEs were developed.

Challenges for Cohesion Policy in supporting climate action. The consulted MAs of the OPs selected in Boreal and Arctic EU regions consider Cohesion Policy support to climate action as an essential tool to fight climate change in one of Europe's most effected regions. According to them, Cohesion Policy initiatives facilitate the exchange of good practices among territories and boost cooperation among different political and non-political stakeholders, supporting institutional capacity building. Nonetheless, Cohesion Policy shows some weakness that could potentially hamper the impact of the implemented projects.

In the view of the MAs in our sample, Cohesion Policy does not ensure the integration of climate issues into all areas of support, hindering the design and implementation of complex transversal projects. Furthermore, the scale of investment devoted to climate action is still perceived as disproportionately low compared to the importance of the problem. Against this background, ensuring complementarity and synergies among different EU funds and programmes could avoid double funding and allow to maximise projects efficiency.

Some MAs reported that necessary qualifications and technical skills regarding climate action are lacking, both at the government and business level. This hinders the ability of MAs to design effective projects as well as to correctly evaluate them. In addition, green transition initiatives are still facing some resistance from the private sector due to the still scarce economic convenience of investing in them. Against this background, initiatives aimed at increasing technical knowledge and behavioural change could help the MAs to successfully implement the right set of measures to ensure a positive and durable impact on society, the environment and the economy.

Higher attention should be paid to monitoring and evaluation both at local and EU level. In order to ensure the designing of highly effective projects over the next programming periods, examples of best practices and successful projects should be shared across the EU. Furthermore, since the high heterogeneity of performance and climate indicators across the EU make data hardly comparable, clear guidelines and methodologies for the calculation of performance indicators should be provided.

⁶⁹ For more information: https://www.esinvesticijos.lt/lt/finansavimas/patvirtintos_priemones/daugiabuciu-namu-atnaujinimas

⁷⁰ For more information: <https://klimatsynk.se/>

⁷¹ For more information: <http://www.energimyndigheten.se/smf>

Finally, the MAs of some of the selected OPs recommend a simpler and more effective communication of climate objectives to possible beneficiaries and the wider public, in order to increase the attractiveness of Cohesion Policy funding for climate action.

f. EU Outermost Regions

i. Key relevant geoclimatic features

Outermost regions are the most distant territories of the European Union. The EU supports their development through specific measures aimed at compensating for the constraints caused by their geographical remoteness. The group of outermost regions includes French, Portuguese and Spanish regions:

- Guadeloupe, French Guiana, Réunion, Martinique, Mayotte and Saint-Martin (France)
- the Azores and Madeira (Portugal), and
- the Canary Islands (Spain).

EU outermost regions are very diverse in terms of location. Some of them are placed in the Atlantic Ocean, others are located in the Caribbean Sea or in the Indian Ocean. They also differ due to their economic structure and level of development. The majority of EU outermost regions are islands, except for French Guyana. Despite such differences they share some vulnerabilities caused by climate change, as highlighted in chapter 1 of this study.

These vulnerabilities include: change in annual precipitation patterns; sea level rise; increase in sea temperature and ocean acidity; coral bleaching; increasing frequency of inland and coastal floods; saltwater intrusion into freshwater aquifers; increasing risk of soil degradation, droughts, wildfires and biodiversity loss (EEA 2017). Obviously not all these challenges are relevant to the same extent to all outermost regions.

Geoclimatic vulnerabilities, aggravated by climate change, may have direct socio-economic consequences: negative impacts on agriculture and food production due to a decrease in crop yields and increasing risks for fish stocks; negative impacts on the health sectors; decrease in tourism and, in general, increasing negative impacts on the few relevant economic sectors.

EU Cohesion Policy addresses the geographical features of outermost regions as well as their Climate Vulnerabilities. A summary of the financial contribution of Cohesion Policy and examples of interventions for climate change mitigation and adaptation are provided next.

ii. Cohesion policy contribution to climate action

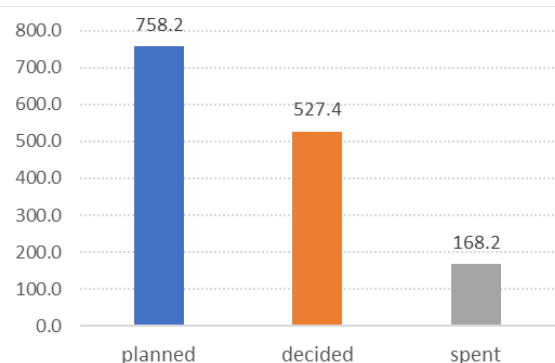
How much Cohesion Policy contributes to climate action. A total amount of EUR 758.2 million of Cohesion Policy funds was planned for climate action in 2014-2020. Most of these, about 724.9 million are ERDF while the ESF amounts to approximately 33.3 million. The amount decided is equal to EUR 527.4 million while 168.2 million or 22% of planned funds were spent.

Most of the support planned for climate action (66.7%) was planned for climate change mitigation. This consists mainly of interventions on transport, renewables and the energy efficiency of public infrastructure (see below).

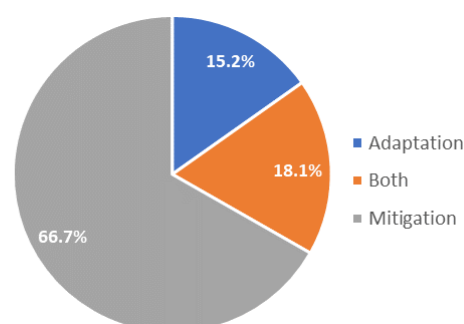
Only approximately one sixth of the total (15.2%) went to climate change adaptation while a similar amount (18.2%) was planned on interventions that may be relevant to both mitigation and adaptation.

Figure 23: Cohesion Policy contribution to climate action in outermost regions

Cohesion policy funds planned, decided and spent for climate action (EUR million)



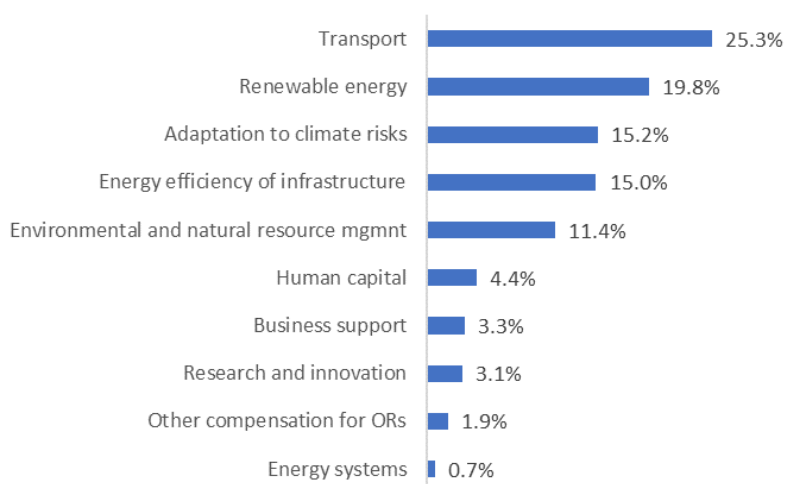
Cohesion policy funds planned for climate change mitigation, adaptation or both



Source: ESIF Open data.

Types of interventions supported by Cohesion Policy. Based on the intervention fields, the Cohesion Policy planned resources can be broken down by main category of intervention. The highest share of total planned funds, 25.3%, goes to transport initiatives in outermost regions. These include interventions for multimodal transport, seaports and clean urban transport infrastructure & promotion.

The development of renewable energy sources accounted for approximately 19.2% of the total. These are mainly solar, biomass and other renewables. Adaptation to climate risks received approximately 15%. Energy efficiency of infrastructure also obtained 15%. The latter includes energy efficiency renovation of public infrastructure and of housing stock. Environmental and

Figure 24: Cohesion policy funds planned by macro-category of intervention in outermost regions

Source: ESIF Open data.

and natural resource management was allocated 11.4% of the total. These interventions consist mostly of biodiversity, nature protection & green infrastructure, as well as water management & drinking water conservation.

Less than 5% of the total went respectively to human capital initiatives financed by the ESF, business support (e.g. energy efficiency & demonstration projects in SMEs), research and innovation processes, technology-transfer & cooperation in firms on low carbon economy etc.

Various different types of initiatives were financed by Cohesion Policy in outermost regions to address both climate change mitigation and adaptation. The following examples (Box 1) were suggested by Managing Authorities of OPs selected on the basis of the relative importance of Cohesion Policy amounts allocated to climate action.

Box 6: Examples of initiatives for climate change in outermost regions

Examples of initiatives for climate change adaptation

The **Azores ERDF OP** has financed the development of a Regional Plan for Climate Change (Plano Regional para as Alterações Climáticas)⁷². The Plan sets out the Regional Climate Change Strategy and contributes to increasing the training of public officials in preventing, detecting and combating the effects of climate change, through the effective use of up-to-date knowledge and data on climate change impact, especially in terms of land planning and management. This is an important instrument to identify vulnerabilities and risks in the entire regional territory. The OP also financed an Emergency Telecommunications Network management of climate related risks (Rede de Telecomunicações de Emergência da RAA)⁷³. This is aimed at increasing resilience in exceptional situations involving a collective threat. It makes it possible to coordinate, in real time, the means and resources to assure that the Azores Fire Brigades, Municipal Councils, Health Units and Government Organizations, have an integrated and effective performance, either in routine situations, in emergency situations or in natural catastrophes of all kinds. The network covers the entire archipelago. Furthermore, the OP supported the development of a coastal slide protection of 200 metres to safeguard people and infrastructures. The main purpose of this operation is to protect from maritime agitation the structures located on the shore of Fajã dos Vimes, namely the marginal road, as well as the adjacent housing, other constructions and land.

In Guadeloupe, a Flood Prevention Action Program (PAPI) was financed by the **Guadeloupe and St Martin ESF/ERDF OP**⁷⁴. The program covers an area of approximately 350 km² which is concerned by two types floods: "land" floods linked to intense rainfall, and so-called "marine" floods linked to cyclonic sea conditions. These two phenomena can be concomitant. Six adjacent municipalities are participating as partners: Cities of Abymes, Pointe-à-Pitre, Morne-à-l'Eau, Gosier, Sainte-Anne and Moule. The expected results include a Flood Risk Prevention Plan (SPRI) with a proposal of actions targeting all the population living in vulnerable areas, and a diagnosis of all coastal structures.

Examples of initiatives for climate change mitigation

The **Madeira OP** financed several important initiatives for reducing greenhouse gas emissions and global warming. For example, the sustainable and affordable urban mobility project MUSA (Mobilidade Urbana Sustentável e Acessível) is aimed at the partial renewal of the fleet of public transport in Funchal (5 electric minibuses and 25 E6 buses)⁷⁵. This is meant to contribute to phasing out from fossil fuels, reduce GHG emissions and pollution, reduce noise, promote regional public transport and its sustainability, for which a fleet renewal is essential. In addition to reduce emission, the new buses facilitate access to public transport for the population with reduced mobility and incorporate technologies which promote an upgraded monitoring and management of mobility. The Madeira OP also financed the set-up of a charging network for 100% electric vehicles. 11 charging points were deployed in the municipal public areas to promote electric mobility and decarbonisation⁷⁶. As regards energy efficiency in housing, the Romeiras Social Housing Project was financed⁷⁷. This operation promotes an improved energy performance in housing and common areas of buildings (5 buildings in a total of 88 fractions are covered). The project aims to reduce

⁷² For more information: https://docs-agric.azores.gov.pt/Portal/file_04-12-2019_10-29-27.0940535.pdf

⁷³ For more information: <http://poacores2020.azores.gov.pt/candidaturas/rede-de-telecomunicacoes-de-emergencia-da-regiao-autonoma-dos-azores/>

⁷⁴ For more information see: <https://www.ville-sainte-anne.fr/citoyennete/prevention-des-risques/article/connaissez-vous-le-papi-des-grands-fonds> and <https://papidesgrandsfonds.fr/>.

⁷⁵ For more information see: http://www.horariosdofunchal.pt/index.php?option=com_content&task=view&id=2342&Itemid=465
<http://cm-funchal.pt/pt/projetos-financiados-2/6315.html>

⁷⁷ <http://www.ihm.pt/index.php/publicacoes/projetos-cofinanciados#efici%C3%A4ncia-energ%C3%A9tica-nos-edif%C3%ADcios-de-habita%C3%A7%C3%A3o-social-do-conjunto-habitacional-romeiras-i>

primary energy consumption from fossil sources and CO₂ emissions and, consequently, reduce regional energy dependence from abroad, through energy efficiency measures and the use of renewable energy for self-consumption in social housing buildings. The savings benefit especially low-income families.

In Guadeloupe, several initiatives were taken, thanks to the **Guadeloupe and St Martin ESF/ERDF OP**, to improve seismic resilience of school infrastructures⁷⁸. In the context of these interventions, the financed measures also aimed at reducing vulnerability to extreme climatic events.

Challenges for Cohesion Policy in supporting climate action. In the view of consulted MAs of the OPs of the outermost regions, selected on the basis of their relative share of funds allocated to climate action, Cohesion Policy support was essential both financially and strategically because it allowed the embedding of the objective of sustainable development, including climate change mitigation and adaptation, in the regional development strategy. The ex-ante conditionality on climate change, applied at the design stage, ensured coherence between the OPs and climate action. The existence of binding planning instruments is essential for introducing concrete measures that more easily achieve the intended climate objectives.

The MAs of the selected OPs also highlight that the specific features of their regions should be taken into account in the approval of Cohesion Policy programmes while the promotion of one-size-fits-all measures is unlikely to work and should be avoided.

Considering the specificities of the outermost regions, the most relevant themes for intervention are and will be prevention, management of risk, of water cycle, of waste and the circular economy. Energy issues continue to be vital, in order to make the islands self-sufficient, and to promote energy efficiency, transport sustainability and protection of nature. Technical knowledge of climate change and energy related issues is not necessarily very sound and diffused in the public administration and this deserves strengthening. Monitoring of Cohesion policy interventions suffers from lack of official data on energy efficiency which is needed for quantifying indicators.

2.3. Obligations resulting from the Paris Agreement towards Cohesion Policy

In line with its progressive commitments with GHG mitigation targets in the context of the UNFCCC and the Kyoto Protocol, in 2009 the EU and its Member States adopted the 2020 Climate and Energy Framework. This is essentially a package of laws passed to ensure the EU meets its climate and energy targets for the end of the decade. It established three targets for 2020:

- 20% cut in GHG emissions (from 1990 levels) (binding target);
- 20% of EU energy from renewables (binding target);
- 20% improvement in energy efficiency (indicative target).

Afterwards, at the European Council of October 2014, the 2030 climate and energy policy framework and the European Commission's blueprint for tackling global climate change beyond 2020 were set, paving the way for the EU's participation in negotiations on the Paris Agreement.

The Paris Agreement is a legally binding international treaty on climate change, which was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016.

⁷⁸ For example: Construction of the Calvaire School Group (Baie-Mahault) and Seismic strengthening of the BAIMBRIDGE City School (<https://www.europe-en-france.gouv.fr/en/projets/renovation-de-la-cite-scolaire-de-baimbridge-en-guadeloupe>).

It is aimed at limiting global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible in order to have a climate neutral world by mid-century.

During the negotiations on the Paris Agreement, the EU became the first major economy to present its Intended Nationally Determined Contributions (INDC), on 6 March 2015.

At the end of 2016 the Commission put forward a successor package of legislative proposals in energy and climate (the Clean Energy for All Europeans package) with a 2030 horizon. Based on global projections that are in line with the medium-term ambition of the Paris Agreement, the EU has set a more ambitious economy-wide domestic target of at least 40% greenhouse gas emission reduction for 2030.

On 12 December 2019 the European Council, taking note of the Communication of the European Commission on the European Green Deal, endorsed the objective of achieving a climate-neutral EU by 2050, in line with the objectives of the Paris Agreement and in the light of the latest available science and of the need to step up global climate action. More recently, also as part of the European Green Deal (see paragraph 2.4), on 4 March 2020 the Commission proposed the first European Climate Law to enshrine the 2050 climate-neutrality target in law.

As part of the European Green Deal, the Commission also proposed in September 2020 to raise the 2030 GHG emissions reduction target, including emissions and removals, to at least 55% compared to 1990. The achievement of these targets is implemented by the combination of the EU Emissions Trading System, the Effort Sharing Regulation with Member States' emissions reduction targets and the Land use, land use change and forestry Regulation. To implement the proposed greenhouse gas emissions reduction target of at least 55% net, these three pieces of climate legislation will be updated, with proposals from the Commission expected to be presented by June 2021.

Currently, the key targets for 2030 are the following:

- At least 55% cuts in GHG emissions (from 1990 levels).
- At least 32% share for renewable energy.
- At least 32.5% improvement in energy efficiency.

Figure 25: Evolution of EU targets for climate mitigation

Target year	2020	2030		2050
Established in	2020 Climate and Energy Framework (2009)	Clean energy for all Europeans package (2016-2019)	European Green Deal (2020)	
Cuts in GHG emissions (from 1990 levels)	20%	40%	55%	Net zero GHG emissions
Share for renewable energy	20%	32%		
Improvement in energy efficiency	20%	32.5%		

Source: European Commission.

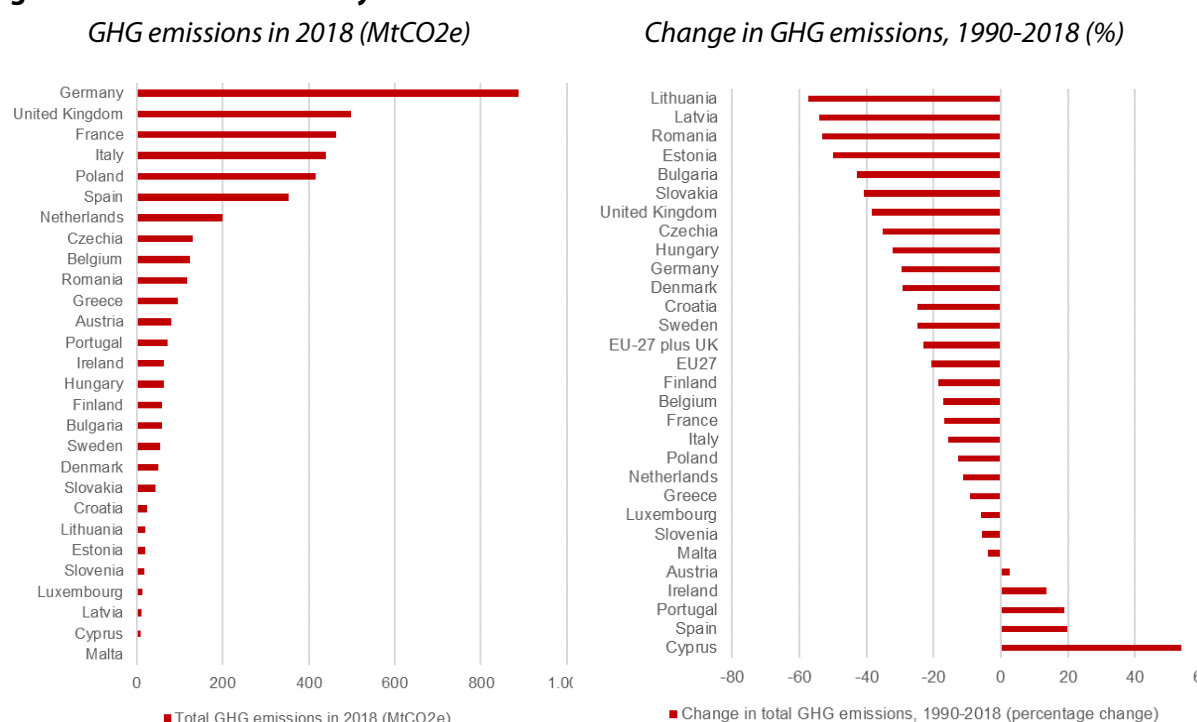
EU achievements and challenges towards decarbonising the European economy

Over the past three decades, the EU plus the United Kingdom have already reduced significantly their GHG emissions by 23.2%, corresponding to -1,329.5 MtCO₂e⁷⁹. The EU share of global GHG emissions went down from 15% of the total in 1990 to 8% in 2018. In the same period, the total GHG intensity of the economy halved in real terms between, reaching an average of 277 gCO₂e per Euro (EEA, 2020b).

This accomplishment is due to a combination of factors such as the effects of EU and national policies and measures for reducing GHG emissions, a significant increase in the use of renewables, a decrease in the use of coal for power generation, and improvements in energy efficiency and structural changes in the EU economies, amongst others. Combined, these factors have led to overall improvements in the carbon intensity of energy production and consumption and a lower energy intensity of the economy (EEA 2020b).

There are significant differences between Member States in terms of total emissions, emissions *per capita*, and the carbon and energy intensity of the national economies. The relative reduction of GHG emissions has also not been consistent throughout the EU in this period. Germany and the United Kingdom are the largest emitters of GHG but have also been responsible for nearly 50% of the EU net decrease in emissions. On the other hand, the overall net GHG emission reductions by most Member States were partly offset by increased GHG emissions in Spain, Portugal, Ireland, Cyprus, and Austria (EEA, 2020b) that were recorded essentially from the mid-90s until the 2008 crisis, associated with an increase in energy consumption during a period of more significant economic growth.

Figure 26: GHG emissions by Member State



Source: European Environment Agency (2020b).

⁷⁹ Source: European Environment Agency (2020b). These values still include the United Kingdom. In the same 1990-2018 period, the EU member states without the United Kingdom have reduced their emissions in -20.7% (-1,018.5 MtCO₂e).

A comparison between the progress in the reduction of GHG emissions and decarbonising the EU economy, and the targets with which the EU committed to 2030 and 2050, suggests that there needs to be a much greater effort to achieve climate neutrality in the next 30 years, possibly almost tripling the reduction attained in the past 30 years (EEA, 2020b).

These targets, although very challenging, are still considered within reach, if accompanied by long-term green investments. According to the EEA, *“Improved energy efficiency and carbon intensity, with an increasing role for renewables in the energy mix, will help reduce the CO₂ footprint of the energy sector. But all sectors of the economy, including industrial processes and product use, agriculture, forestry and land use as well as waste management, would have to contribute to the objective of climate neutrality by 2050”* (EEA, 2020b).

Table 4: Effort to meet EU targets and objectives, compared with 1990 emissions (MtCO₂e)

	GHG level (MtCO₂e)	Total reduction (MtCO₂e)	Number of years	Annual reduction (MtCO₂e)
Year 1990	5 721	-	-	-
Year 2018	4 392	-1 330	28	-47
2020, 20% reduction target compared to 1990	4 577	-1 144	30	-38
2030, 1st NDC 40% reduction target compared to 1990	3 433	-2 289	40	-57
<i>Meeting the 2030 target taking into account already-achieved (by 2018) reductions</i>	3 433	-959	12	-80
2050 EU objective, 80% reduction compared to 1990	1 144	-4 577	60	-76
and 95% reduction compared to 1990	286	-5 435	60	-91
<i>Meeting the 95 % objective taking into account already-achieved reductions</i>	286	-4 106	32	-128
Meeting the objective of climate neutrality by 2050	Net zero GHG emissions	Net GHG emission reduction also depends on emissions removals	32	-

Notes: The main purpose of this table is to show that emission reduction efforts will have to increase substantially in the next three decades at a rate that is likely to triple the emission reductions achieved since 1990. The GHG emission numbers in this table represent the available information (as of 8 May 2020) on the geographical scope, targets and objectives regarding climate change mitigation in the European Union. The numbers also include the United Kingdom, as part of the EU's 2020 GHG inventory submission under the UNFCCC and the Kyoto Protocol. The European Union and its Member States are currently discussing more ambitious goals which would be part of the EU's revised National Determined Contribution by 2030 and that would also be consistent with the objective of climate neutrality by 2050. Given that this discussion is ongoing and that its outcomes are uncertain, the information in this table should not be considered final. In addition, the role of the LULUCF sector has not been included in these calculations. The LULUCF sector is included in the 2030 target under the 'no-debit' accounting rules, which requires each Member State to ensure that accounted CO₂ emissions from LULUCF are fully compensated by an equivalent removal of CO₂. However, Member States can use up to 280 million CO₂ credits over the period 2021-2030 to comply with their national effort sharing targets. The European Council of October 2009 supported the EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, to reduce emissions by 80-95 % by 2050 compared to 1990 levels. Climate neutrality, or net-zero GHG emissions by 2050, can also be achieved by increasing carbon sinks and not by reducing GHG emissions alone.

Source: European Environment Agency (2020b).

Potential impact of Cohesion Policy on climate change mitigation

The 2017 study 'Research for REGI Committee - Cohesion Policy and Paris Agreement Targets'⁸⁰ presented a preliminary analysis of the contribution to climate change mitigation and adaptation under the Cohesion Policy 2014-2020, based on the common indicators on achievements from ESIF operational programmes (OPs) made available by the European Commission on its Open Data website⁸¹. With respect to climate change mitigation, this study focused on the following relevant common indicators: additional capacity of renewable energy production (MW); number of households with improved energy consumption classification (households); decrease of annual primary energy consumption of public buildings (kWh/year); number of additional energy users connected to smart grids (users); estimated annual decrease of GHG (tonnes of CO₂e).

The analysis was based on the targets set in the 2014-2020 Cohesion Policy OPs, given that, in 2017, there was still very little information available on the contribution to climate action. Although the consistency and integrity of reporting of emissions reductions under the Cohesion Policy monitoring system was considered not clear enough as regards the contribution to overall climate objectives (M Nesbit, K Paquel, A Illes, 2017), and despite significant improvements in comparison to the previous programming period (2007-2013), in 2020 there is already some information available regarding the implementation, in addition to the targets set. This allows an update of the previous study's results, and a clearer picture of the potential and effective impact of Cohesion Policy on climate change mitigation.

Table 5: Overview of ESIF common output indicators, relevant for climate mitigation, in 2018

Common Indicator	Target (2023)	Decided (values from selected projects - project pipeline)		Implemented (values from fully implemented projects)	
		Value	% of target	Value	% of target
Estimated annual decrease of GHG (MtCO ₂ e)	20.6	13.6	66.0%	1.3	6.3%
Additional capacity of renewable energy production (MW)	7 293	5 230	71.7%	1 148	15.7%
Number of households with improved energy consumption classification (households)	707 947	502 205	70.9%	174 102	24.6%
Decrease of annual primary energy consumption of public buildings (GWh/year)	5 461.6	4 681.1	85.7%	548.3	10.0%
Number of additional energy users connected to smart grids (users)	1 359 897	3 995 585	293.8%	78 657	5.8%

Source: European Commission, ESIF Open Data.

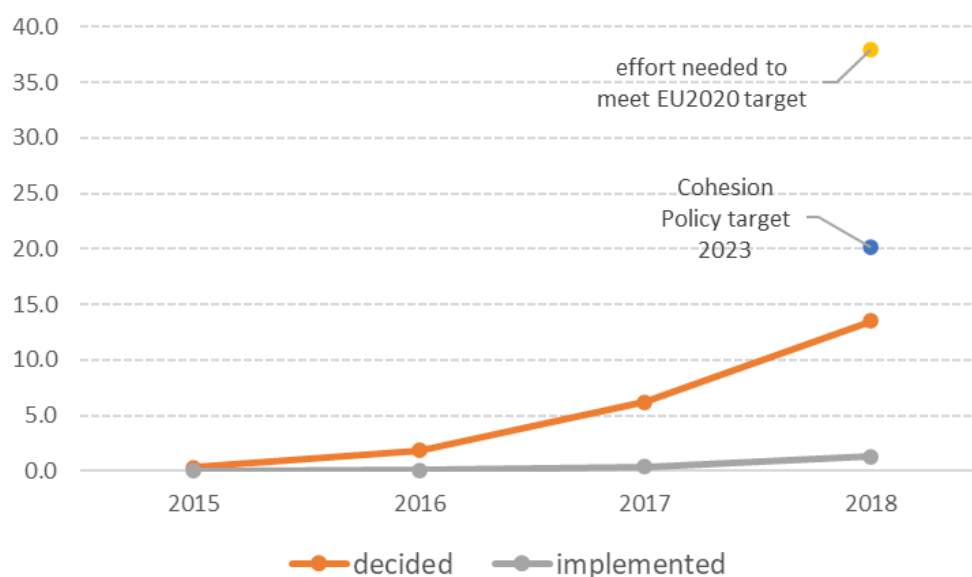
⁸⁰ Source: M Nesbit, K Paquel, A Illes, (2017).

⁸¹ <https://cohesiondata.ec.europa.eu/themes/4>

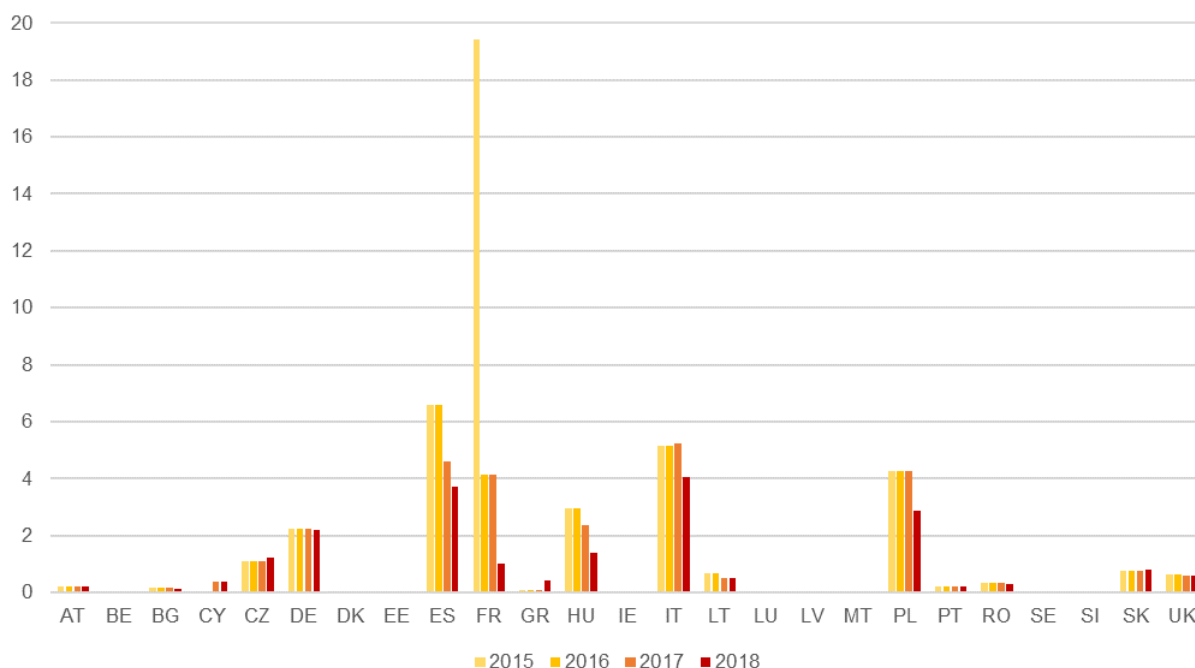
According to the latest European Commission data on the achievements of Cohesion Policy, despite a target of 20.6 MtCO₂e of estimated annual decrease of GHG emissions, that represents more than half of the annual reduction necessary to achieve, in 2020, a 20% reduction in GHG emissions from 1990 levels (i.e. -38 MtCO₂e, as presented in Table 1), the “decided” and “implemented” values are, so far, still distant from desired levels. Indeed, the GHG reduction, projected from selected projects (i.e. “decided” value) is equal to 13.6 MtCO₂e of annual reduction in GHG emissions (as of end of 2018 which is the latest available year). More significantly, the implemented value (from fully implemented projects) is even further from the targets as it is equal to only 1.3 MtCO₂e of annual GHG reduction (Table 2).

This means that, while Cohesion Policy has the potential to provide a very significant contribution to achieve the EU GHG reduction targets at the end of the programming period, the actual outcomes are still way below the objectives which have been set, as of the end of 2018.

Figure 27: Estimated annual decrease of GHG: overview of programme targets, decided and implemented values in 2018 (MtCO₂e)



Source: European Commission, ESIF Open Data; European Environment Agency (2020b).

Figure 28: Estimated annual decrease of GHG: overview of programme targets, by year and Member State in 2018 (MtCO₂e)

Source: European Commission, ESIF Open Data.

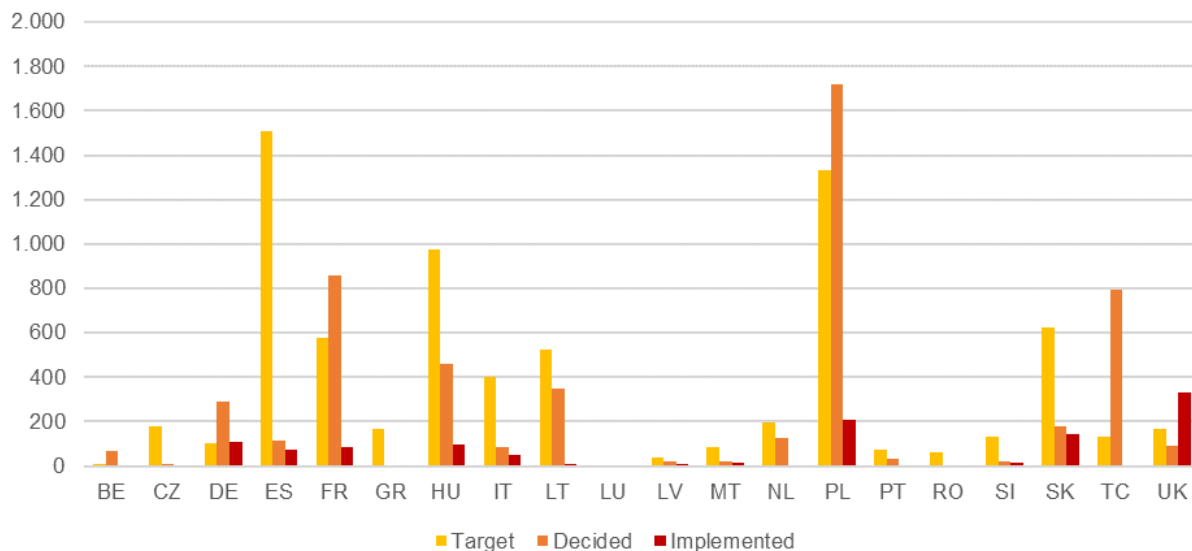
Regarding the additional capacity of renewable energy production, in 2018 the target was 7.29 GW. This is again lower than the target set in 2015 (7.76 GW). The value of additional capacity of renewable energy production, projects from selected projects, is 5.23 GW, of which 1.15 GW was already implemented. Considering the decided values, the greatest contributions to this achievement comes from OPs in Poland, France, Hungary, Lithuania and Germany, but also from Territorial Cooperation OPs⁸² (Figure 32).

The potential contribution of the Cohesion Policy to achieve the 2020 target of 20% of EU energy originating from renewable energy sources (RES) is modest, because it represents approximately 1.5% of the additional installed RES capacity required to ensure a 20% RES share in total energy production between 2012 and 2020 (505,159 MW⁸³).

⁸² More specifically, from Interreg V-B - Atlantic Area (749 MW decided) and Interreg V-B - North West Europe (43,9 MW decided).

⁸³ Source: M Nesbit, K Paquel, A Illes, (2017), based on data from: European Court of Auditors (2014). *Cohesion policy funds support to renewable energy generation — has it achieved good results?*. Special report No. 6.

Figure 29: Additional capacity of renewable energy production: overview of programme targets, decided and implemented values, per Member State, in 2018 (MW)



Note: TC – Territorial Cooperation.

Source: European Commission, ESIF Open Data.

The potential contribution of Cohesion Policy towards the achievement of the 2020 EU targets in energy efficiency is difficult to measure, since there is not a direct relation between the relevant ESIF common output indicators and the energy efficiency targets set by the EU, which are expressed in both primary energy consumption (total energy demand, including that for transformation into electricity) and final energy consumption (consumption by end users). According to the EEA, the achievement of EU's 2020 energy efficiency targets remains uncertain: despite recent reductions, primary energy consumption levels still remain above the indicative linear trajectory to the 2020 target, for both EU-27 and EU-28. On the other hand, final energy consumption actually grew between 2017 and 2018, while a reduction would be needed to reach the 2020 target (EEA, 2020a).

Potential impact of Cohesion Policy on climate change adaptation

The indicators relevant for climate change adaptation suffer from similar limitations and, moreover, they are also constrained by the narrow scope of climate risks and types of adaptive actions they cover – essentially, only measures for floods and forest fires protection. Important climate risks such as heat waves, landslides, coastal floods, droughts, or reduced snowfall are hardly covered, or not covered at all. There are in fact other indicators potentially relevant for monitoring climate adaptation, such as: surface area of rehabilitated land; surface area of habitats supported in order to attain a better conservation status; public or commercial buildings built or renovated in urban areas; rehabilitated housing in urban areas, and; population living in areas with integrated urban development strategies. However, given the broader scope of these indicators, it is harder to trace a clear connection between its results and climate action.

Based on the targets which have been set, Cohesion Policy can be expected to have a relevant impact on adaptation to extreme weather events causing floods and forest fires. The target population benefitting from flood protection measures is approximately 16.5 million EU citizens, mostly from Bulgaria, France, Portugal, Poland, Hungary and Greece. It is worth highlighting that this climate vulnerability frequently affects neighbouring countries, e.g. those sharing river basins, and indeed Territorial Cooperation OPs account for most of this indicator's value, as it benefits

approximately 5.9 million people⁸⁴. Cohesion Policy is also pursuing a target of benefiting 16.5 million EU citizens, mostly located in Portugal, Italy, Poland and Greece, with forest fire protection measures. A third of this target is also associated with Territorial Cooperation OPs⁸⁵.

The performance of the 2014-2020 Cohesion Policy in the domain of climate adaptation until 2018 is more satisfactory than what was observed with mitigation indicators, as values from decided projects generally exceed targets, and more satisfactory implementation rates have also been achieved.

Table 6: Overview of ESIF common output indicators, relevant for climate adaptation, in 2018

Common Indicator	Target (2023)	Decided (values from selected projects - project pipeline)		Implemented (values from fully implemented projects)	
		Value	% of target	Value	% of target
Population benefiting from flood protection measures (persons)	16 544 827	32 812 819	198.3%	4 006 528	24.2%
Population benefiting from forest fire protection measures (persons)	16 509 730	21 440 523	129.9%	10 558 808	64%
Total surface area of rehabilitated land (hectares)	13 969	4 351	31.1%	575	4.1%
Surface area of habitats supported in order to attain a better conservation status (hectares)	8 504 131	8 964 477	105.4%	2 939 181	34.6%

Source: European Commission, ESIF Open Data.

2.4. Role of Cohesion Policy in the context of the European Green Deal

The European Green Deal and its objectives

The adverse effects of climate change expose societies to risks, such as, inter alia, sea level rise or increase in frequency of extreme meteorological events, which demand a strong answer by all stakeholders in terms of both climate change adaptation and mitigation.

Aware of this challenge, the European Commission launched a new growth strategy, known as the European Green Deal⁸⁶, which defines an ambitious set of climate-related goals to be met by 2050. This strategy acknowledges the urgency and relevance of climate change and sustainability, which requires a broad compromise between the Member States to act in a concerted way, putting Europe on a path of increased responsibility towards climate issues as well as conservation of species and habitats.

⁸⁴ Namely, the following INTERREG V-A OPs: Italy-Croatia; Italy-Slovenia; Italy-France (Maritime); Slovenia-Croatia; Spain-Portugal (POCTEP); Atlantic Area; Greece-Bulgaria; Romania-Bulgaria.

⁸⁵ Namely, the following INTERREG V-A OPs: Romania-Bulgaria; Italy-Croatia; Italy-France (Maritime); Spain-Portugal (POCTEP); Atlantic Area.

⁸⁶ COM/2019/640 final.

Cohesion Policy can play an important role in promoting the transition to a greener Europe, consistent with the significant socio-economic and territorial disparities that exist and the different needs they originate across EU Member States and regions.

Overall, the Green Deal's main objective is to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy, where there are no net emissions of GHG by 2050 and where economic growth is decoupled from resource use (COM(2019) 640 final).

To achieve these outcomes, the Green Deal provides a roadmap for the elimination of net GHG emissions, to promote resource use effectiveness and the circular economy, and to protect biodiversity.

The proposed policies can be divided into 2 categories: transformative policies, which aim at transforming the EU in a resource-efficient and competitive economy; and policies aimed at mainstreaming sustainability goals. These types of policies are presented in more detail in the table below.

Table 7: Transformative policies and policies for mainstreaming sustainability in the context of the European Green Deal

	Policy	Objective
Transformative policies	Climate action	Increasing the EU's climate ambition for 2030 and 2050, towards climate neutrality
	Clean energy	Supplying clean, affordable, and secure energy
	Sustainable industry	Mobilising industry for a clean and circular economy ensuring more environmentally-respectful production cycles
	Building and renovating	Building and renovating in a cleaner and energy and resource-efficient way
	Sustainable mobility	Shifting to sustainable and smart mobility, promoting more sustainable means of transport
	From farm to fork	Designing a fair, healthy, environmentally-friendly and more sustainable food system
	Biodiversity	Measures to Preserve and restore ecosystems and biodiversity
	Eliminating pollution	Measures to achieve a zero-pollution ambition for a toxic-free environment
Policies for mainstreaming sustainability	Pursuing green finance and investment and ensuring a just transition	Assure the availability of resources to support the investments needed.
	Greening national budgets and sending the right price signals	Redirect public investment, consumption, and taxation to green priorities
	Mobilising research and fostering innovation	Support and promote green technologies to create new value chains
	Activating education and training	Promote sustainability awareness and behaviours
	A green oath: "do no harm"	Remove legislation inconsistencies and promote better regulation

Source: European Green Deal (2019).

The role of Cohesion Policy

Cohesion Policy main function is to support the socio-economic development of the European countries in several key areas, promoting convergence while reducing inequalities between and within Member States.

Given the broad scope of the policies and actions envisaged in the context of the Green Deal, there are several opportunities for synergies with Cohesion Policy. In general, Cohesion Policy is expected to help countries dealing with the short-term negative socio-economic impacts that may arise from the adoption of new and more ambitious ecological targets, as set in the context of the Green Deal. Indeed, the need for pursuing Green Deal objectives may aggravate existing inequalities (e.g. Claeys et al. 2018; Cameron et. al 2020). Furthermore, Cohesion Policy is expected to leverage green investments in key areas for decarbonising the economy. This is particularly relevant in Member States where the ESI Funds are a significant source of public investment. Achieving the European Green Deal objectives will require a variable effort from the Member States, with territories more vulnerable to climate changes and less developed regions bearing most of the burden. Against this background, Cohesion Policy can play an essential role to facilitate a smoother transition to a greener economy as it is mainly focused on less developed regions and can be adjusted to target specific territorial needs.

Cohesion Policy can provide a direct support to transition or channel usual investments towards areas that can contribute to mitigation and adaptation, while still promoting regional development.

This is also in line with the priority of the Cohesion Policy to support less developed countries and regions, allowing them a higher share of the total funding, with the aim of making progress across Europe as a whole, instead of in a fractured way. As previously highlighted, climate action and sustainability goals were already pursued in the 2014-2020 programming period. Although these predate the European Green Deal, they represented important contributions towards meeting its objectives. The new Cohesion Policy can benefit from this experience but, given the new ambitious and challenging targets, there is the need for a set of renewed place-based solutions and for an active mobilisation of energy transition actors.

Climate objectives cannot be met through environmental policies alone. The transition to a new paradigm characterised by sustainability and climate mainstreaming implies moving away from the status quo to allow for a new sustainable society and economy to emerge, which requires an adaptative capacity that varies across territories and sectors. Cohesion Policy can assist the Member States in this transition, providing the right tools to mitigate the drawbacks of the green transformation and to ease the adaptation processes.

In the report on *“Supporting sustainability transitions under the European Green Deal with Cohesion Policy”* (European Commission, 2020c), the Commission provides national and regional decision-makers with a toolkit to boost the sustainability transition and to help prioritise Cohesion Policy resources. The report provides relevant background on the ways a transition can be facilitated in several key areas, also identifying examples of good practice. According to the Commission, the sustainability transition is characterised by three types of processes, with associated risks and opportunities. These processes include: 1) Innovation (emergence), in which regions are the locations from which new technological and social solutions emerge; 2) Large-scale deployment of sustainable solutions (diffusion), where regions need to contribute to the achievement of European and national environmental, climate and energy targets by adopting, in ways suited to their local context, existing technological, economic, and societal solutions. They also need to contribute to the phasing out of unsustainable solutions; 3) System reconfiguration (just transition), that is phasing

into sustainable solutions and phasing out of unsustainable results in a reconfiguration of socio-economic and technological systems, where there is the need to ensure that scaling down and phasing out unsustainable technologies and practices does not negatively impact regional development, employment, and welfare in a too severe way. These processes should be considered when designing the 2021-2027 Cohesion Policy, to support the implementation of the Green Deal in several key areas.

These key areas should not be seen as isolated or merely chronological chapters. The different conditions each Member State and European region faces means that the transition process is complex and to be carried out at different speeds. Therefore, the actions that lead to the transition cannot be performed in all of Europe at the same time.

This differentiated timing will allow for lessons to be learned and experiences to be passed between stakeholders making the revisitation of each key area a natural process to optimize the societal changes needed, contributing to a more successful transition. Some stages of the transition may also be more challenging for certain territories. For example, a region that is advanced in terms of innovation and energy efficiency will face different challenges than one that is lagging behind in terms of innovation or technology diffusion. Another example would be a region that is greatly exposed to certain climate change risks (e.g. sea level rise), and hence would need a specific territorial approach, compared to others that are not vulnerable to that threat.

Table 8: Key areas of the European Green Deal transition and Cohesion Policy role on supporting them

Key Area	Cohesion Policy	
	Role	Actions to be supported
<i>Vision of a Sustainable Future</i>	Contribute to create a shared vision and broad strategy towards sustainability transition	<ul style="list-style-type: none"> National, regional and/or thematic strategies and action plans with associated targets and timeframes; Mapping and identification of systems and processes that are to be subjected to change;
<i>Governing Transitions</i>	Contribute to phasing out of unsustainable systems and promote the adoption of increasingly sustainable ones through a policy mix	<ul style="list-style-type: none"> Action plans to identify and support change (innovation and technology); Strengthen governance and stakeholders to lead the processes; Support innovation and technology on strategic areas (unsustainable systems); Address negative impacts that prevent and resist to change.
<i>Supporting Innovation</i>	Increase confidence in the transition process with effective innovation application	<ul style="list-style-type: none"> Increase reliability of sustainable systems; Promote the transition from old and inefficient technologies to modern and more efficient ones on essential systems; Support RIS3 and associated processes.
<i>Deployment and Phasing Out</i>	Promote a gradual and effective shift from old to newer sustainable systems	<ul style="list-style-type: none"> Mainstream achieved innovations and sustainable technologies; Address non-financial barriers to investment in sustainable solutions; Increase the reception capacity of sustainable systems; Fill funding gaps on mature sustainable technological systems.

Key Area	Cohesion Policy	
	Role	Actions to be supported
<i>Supporting a Just Transition</i>	Promote a fair transition, taking into account European internal differences and asymmetries	<ul style="list-style-type: none"> • Address unavoidable effects of the transition process; • Reskilling of human resources; • Diversification of local economies; • Investment in low-carbon growing sectors and technologies; • Implement and support Territorial Just Transition Plans (TJTPs).
<i>Territorial Approach</i>	Support local territorial negative impacts resulting from the sustainability transition	<ul style="list-style-type: none"> • Specific support to highly specialized areas on unsustainable activities (coal areas); • Funding for differentiated impacts and needs in different socioeconomic contexts (urban, rural); • Mobilize different tools to support regional transitions (European Urban Initiative)
<i>Mainstreaming sustainability into programme and projects</i>	Integrate the sustainability transition in all Cohesion Policy investments – “Do no harm” principle	<ul style="list-style-type: none"> • Set climate and biodiversity baselines (red lines); • Prevent new negative climate or biodiversity impacts; • Account for climatic and biodiversity impacts in all investments and actions supported; • Promote climate-proof criteria for investments.

Source: European Commission, 2020c (adapted).

A transition to a greener economy can be successful only if there is a wider and active engagement of management authorities, citizens and all relevant authorities. Cohesion Policy should be able to address their needs and expectations without losing focus on the greater picture to ensure an effective transition. As previously mentioned, Cohesion Policy can be used as a tool to induce the transformations needed, addressing territorial differentiation, through place-based actions, providing a multi-sectoral approach, from innovation and technology to labour market, from infrastructures to education and capacity building.

Capacity building is a relevant component of the whole transitioning process to sustainability. Social skills and capital are also variable throughout European countries and regions. Again, these differences are the result of different backgrounds, emerging from various territorial constraints and opportunities. To reduce these asymmetries, differentiated amounts of effort and funding are needed so that active stakeholders and all society members can be effective promoters of change.

Territorial challenges require a place-based approach, tailored to each reality, which stresses the need for a sensitive Cohesion Policy, with regional and local solutions suited to a broad scope of necessities. No country or region can be left behind on the transitions that are to happen in the medium to long term and hence differentiated territorial approaches as well as broad active involvement from all stakeholders are necessary. Otherwise, the collective effort to a paradigm transition could be undermined, putting the Green Deal at risk, and further increasing Europe vulnerability to climate change and the loss of biodiversity and habitats.

The thematic concentration of the new funding period on fewer policy objectives (see paragraph 2.1.2), and the fact that operations under the ERDF and Cohesion Fund are expected to contribute 30% and 37%, respectively, of their overall financial envelopes to climate objectives in 2021-2027, mean that these funds will focus on relevant climate areas by addressing regional imbalances, integrating climate mainstreaming and climate-proofing on supported investments. This allows for investments to be directed to polluting or GHG emitting sectors, like housing, transport and waste (European Climate Initiative, 2019).

Greater concentration also helps the Cohesion Policy financial package to be applied where is needed the most, catalysing changes and leveraging investments on climate and sustainability-related areas and systems. This is stressed by the “do no harm” principle, a key aspect of the Green Deal, as well as the transformative policies. The synergy between Cohesion Policy and the Green Deal is enhanced by the Just Transition Fund⁸⁷ (JTF) one of the pillars of the Just Transition Mechanism. The JTF supports: the economic diversification and reconversion of the territories concerned, backing productive investments in SMEs, creation of new firms, research and innovation, clean energy, environmental rehabilitation, up-skilling and reskilling of workers, job-search assistance and active inclusion of jobseekers, transformation of existing carbon-intensive installations, when these investments lead to emission cuts.

To unlock the JTF, EU Member States are required to match the funds received for a just transition with Cohesion Policy resources. Moreover, national co-financing is foreseen according to Cohesion Policy.

Finally, it is worth mentioning that a common classification system, the EU taxonomy, was set out establishing a list of environmentally sustainable economic activities.⁸⁸ The taxonomy is meant to further connect finance with sustainability and contribute to direct EU Green Deal investments towards sustainable projects and activities by providing appropriate definitions to companies, investors and policymakers on which economic activities can be considered environmentally sustainable. This can be used to direct Cohesion Policy investments towards climate and sustainability, and also for strengthening the climate expenditure tracking system (see policy recommendations).

2.5. Investment needs to meet EU 2030 and 2050 climate and energy targets

The 2020 EU Climate Action Progress Report published in November 2020 (European Commission, 2020a) acknowledged that the European Green Deal objectives require a significant increase in investments, relying heavily on private sector engagement that must be supported and reassured by new policy instruments and financial mechanisms, disruptive business models and services, and societal innovation.

More specifically the commission estimates that to achieve the target of a 55% reduction in GHG emissions by 2030, an additional EUR 350 billion per year should be invested during 2021-2030 (or 3.5 trillion over the decade), with around one third of this figure devoted to interventions concerning transport and residential sectors (European Commission, 2020a).

In order to reach the objectives of a just transition to a climate-friendly economy and to finance the EU 2030 GHG reduction commitments, the Green Deal provides an investment plan to mobilise public and private funding, organised along three dimensions: funding, enabling framework and, advisory and technical support.

Regarding funding, the Commission aims to mobilise more than EUR 1 trillion⁸⁹ of sustainable investment over the 2021-2030 period, by increasing the resources devoted to climate action under the EU budget and leveraging additional public and private financing, while allocating part of the

⁸⁷ COM(2020) 460 final.

⁸⁸ Regulation (EU) 2020/852.

⁸⁹ This figure is net of any possible overlaps, taking into account the fact that different sources of finance and/or instruments may interact and contribute to a given project or operation jointly (D’Alfonso, 2020).

overall resources to support the regions most exposed to the challenges of the transition (D'Alfonso, 2020). There are five categories of sources of climate finance that would support a broad range of projects and contribute to the European Green Deal Investment Plan (see the following table).

Table 9: Sources of climate finance under the European Green Deal Investment Plan

Source	Contribution	Implementation notes
EU budget	€503 billion	Instruments that should make significant contributions to this objective include: the funds under the Common Agriculture Policy (CAP); the European Regional Development Fund (ERDF); the Cohesion Fund; the Horizon Europe framework programme for research and innovation; the LIFE programme; and the Connecting Europe Facility (CEF).
EIB Group and other investment partners in the context of InvestEU	€279 billion	Includes the creation of the InvestEU programme that would streamline in a single investment scheme the operations currently carried out under the European Fund for Strategic Investments (EFSI) and various financial instruments supported by the EU budget.
Just Transition Mechanism	€143 billion	Structured along three pillars: a Just Transition Fund; a specialised just transition scheme under InvestEU to crowd in private resources; and a new public-sector loan facility with the EIB to leverage additional public funding.
Member States	€114 billion	Climate-related measures supported by the EU budget under the ESIFs receive additional co-funding from Member States
Emission Trading System - ETS	€25 billion	Part of the revenue stemming from auctioning carbon allowances under the ETS is allocated to two funds that finance climate-related projects outside the MFF: the Innovation Fund focuses on demonstration projects of promising low-carbon technologies; and the Modernisation Fund supports modernisation of energy systems, improvements in energy efficiency and just transition in ten lower-income Member States in central and eastern Europe
TOTAL	€1.064 billion	-

Source: D'Alfonso, 2020 (adapted).

Therefore, the European Green Deal Investment Plan will provide around 30% of the €3.5 trillion that the Commission estimates will be needed over the next decade to fill the investment gap in climate action and achieve the current EU 2030 climate and energy targets. It is also worth noting that only a part of the EUR 1 trillion from the Green Deal is additional funding, considering it includes reshuffled funds from different existing programmes (Claeys G., Tagliapietra S., Bruegel, 2020).

The EU Budget (including Cohesion Policy but also the CAP, Horizon Europe, the LIFE programme and the Connecting Europe Facility) is expected to contribute EUR 503 billion to the Green Deal, representing approximately 47% of its budget (see above table). This contribution makes up for about 14% of the total investment gap.

On the basis of the estimates presented in paragraph 2.2.3, the Cohesion Policy contribution to climate action is projected to be equal to EUR 77.2 billion (83.7 billion when REACT-EU is considered) in the 2021-2027 programming period. This is around 2% of the investment gap (i.e. 3.5 trillion needed to reach the 2030 EU climate and energy targets).

In conclusion, a significant wave of green investments, from the private sector and national governments, is needed to fill the gap and achieve the desired 55% reduction in GHG emissions by 2030. The contribution of Cohesion Policy is likely to be modest in financial terms but its role can still be decisive as a catalyst for green investment in some Member States where the share of cohesion policy funding in public investment is most significant (Claeys G., Tagliapietra S., Zachmann G., 2019). Cohesion Policy can also have a multiplier effect insofar as it is capable of promoting policy experimentation and innovation, exchange of good practices in climate action, and awareness raising.

3. IMPACT OF PHASING OUT OF FOSSIL FUELS AND OTHER IMPLICATIONS OF CLIMATE CHANGE FOR EU REGIONS

KEY FINDINGS

- The EU has taken increasingly strong commitments towards decarbonisation, significantly raising its ambitions in terms of GHG cuts, share for renewable energy and improvement in energy efficiency to be achieved by 2030. The final goal is to become climate-neutral, namely an economy with net-zero GHG emissions by 2050. As highlighted before, this objective is at the heart of the European Green Deal and in line with the EU's commitment to global climate action under the Paris Agreement.
- Decarbonisation is mainly pursued by two types of actions: improvements in energy efficiency and reductions in the consumption of energy, primarily from fossil fuels, in all sectors; an increase of production of energy from renewable sources.
- Considering the existing policy context, decarbonisation will have overall beneficial effects in the EU, according to the available scenarios produced by the EC. Such effects include: reduced dependency on fossil fuels, increase in RES production, boosting innovation and the shift towards a circular economy with positive consequences on competitiveness and, obviously, a reduction in GHG emissions, with a positive contribution to mitigating global warming.
- The central role of a circular economy paradigm for the success of decarbonisation deserves to be highlighted. Indeed, the abatement of fossil fuel consumption and the overall reduction of energy consumption may not be sufficient to contain global warming and the problems related to the consumption of all finite, and renewable resources. Therefore, there is a need for increasingly decoupling growth and consumption of resources to achieve a new and more sustainable social and environmental equilibrium and guarantee a more resilient energy and material supply chain.
- Decarbonisation and phasing out of fossil fuels have also costs. These are essentially of two types: increased costs of energy systems and additional investments necessary for achieving the GHG emission reduction targets.
- The increases in energy system costs are expected to be limited (10.6% of GDP in 2015 and around 11% in 2030), while annual average investments, including transport investments, would need to be increased in the period 2021-2030 compared to the period 2011-2020 up to EUR 312 billion to achieve a 50% GHG emission reduction and up to 350 billion to achieve a 55% GHG emission reduction.
- The transition away from fossil fuels will also produce savings. A recent impact evaluation of the European Commission demonstrates that the decrease of dependency on fossil fuel imports will produce savings on import bills in the range of EUR 325-375 billion over the period 2021-2030. This may compensate some of the extra costs mentioned earlier.
- Looking at welfare losses, such as those related to increased human mortality from extreme heat, the consequences of climate change are mostly negative for Europe even though also in this case effects are asymmetric from a geographical point of view.

- The JRC Projections of Economic impacts of climate change in Sectors of the EU based on bottom-up Analysis (PESETA IV) highlight, inter alia, that there is a clear north-south divide in the regional distribution of additional welfare losses. While northern Europe (e.g. Boreal and Arctic, Atlantic, northern parts of Continental EU regions) may experience gains from climate change (e.g. more productive agriculture, greater electricity production). In southern Europe (e.g. Mediterranean EU and outermost regions), the impacts are mostly negative and welfare losses are several times larger.
- All in all, total welfare losses are expected to be very significant in the EU and their scale depends on the capacity to keep global warming under control. Therefore, policies for mitigation of climate change are essential because “limiting global warming to 2°C would reduce additional welfare losses by 50% compared to 3°C, while achieving the Paris goal of 1.5°C would lower additional welfare losses by 75%”.

3.1. Impact of phasing out of fossil fuels

3.1.1. Decarbonisation targets and actions to achieve them

The EU has taken increasingly stringent initiatives, over time, for decarbonising the economy and society. In 2007, the EU leaders approved a package of laws (enacted in legislation in 2009), aimed at ensuring that the EU met climate and energy targets by 2020. The package set three key targets: 20% cut in GHG emissions (from 1990 levels); 20% of EU energy from renewables; 20% improvement in energy efficiency. The EU took actions in several areas to meet such targets, among which: the Emissions trading system (ETS); the Effort Sharing legislation, that establishes binding annual GHG emission targets for Member States for the periods 2013–2020, concerning emissions from most sectors not included in the EU Emissions Trading System (EU ETS), such as transport, buildings, agriculture and waste; the Renewable Energy Directive (2009/28/EC), that establishes an overall policy for the production and promotion of energy from renewable sources in the EU; the Energy Efficiency Directive (2012/27/EU), that establishes the targets for the EU’s final energy consumption. Subsequently, the EU set more ambitious objectives within the 2030 climate and energy framework: cutting GHG emissions of at least 40% from 1990 levels; increasing the share of renewables of at least 32%; improving in energy efficiency of at least 32.5%. The 40% GHG target will be implemented by a set of laws, the Emission Trading Systems (ETS), the Effort Sharing Regulation (ESR) and the Land use, land use change and forestry (LULUCF) Regulation, involving all sectors.

All the energy and climate legislation is expected to be revised by June 2021, to implement the proposed increase of the 2030 GHG emission reduction target, including emissions and removals, to at least 55% compared to 1990. This proposed amendment of the emission reduction target was made in September 2020 as part of the European Green Deal. This will enable the EU to move towards a climate-neutral economy by 2050 (long-term strategy) and implement its commitments under the Paris Agreement by updating its Nationally Determined Contribution.

The objective of decarbonisation of the EU economy can mainly be pursued by two macro-categories of actions, both aiming at reducing GHG emissions: 1) improvements in energy efficiency and reductions in the consumption of energy, primarily from fossil fuels, in all sectors, with a particular attention to energy efficient and low carbon energy technologies⁹⁰ which were identified

⁹⁰ JRC, 2017, Cost development of low carbon energy technologies.

as key instruments to boost Europe's efforts in decarbonisation⁹¹; 2) an increase of production of energy from renewable sources. According to the scenarios produced by the EC on the main effects of energy policy⁹², the overall impacts of decarbonisation will be positive for the Union even though there are costs associated to this process.

Overall, the combined beneficial effects of decarbonisation are expected to translate into an increased quality of life in the EU in terms of: a more secure energy system and a decreased dependency on fossil fuel imports; more energy efficiency and deployment of renewables, that would help to shield the consumers from negative impacts of rising energy prices; a significant reduction in air pollution, with relevant impacts on the healthcare system costs⁹³; and more sustainable land use management, powered by an increase in the incentives for afforestation and restoration of degraded lands, which will reverse the decrease of the EU natural carbon sinks.

3.1.2. Main effects of phasing out in EU regions

a. Decrease of dependency on fossil fuels

According to the EC scenarios mentioned above, the most important expected impact of European energy policy, based on diffusion of low carbon and green technologies, is a decrease of dependency on fossil fuels and on their imports⁹⁴.

Energy consumption will remain substantially stable in all the main EU geoclimatic regions, after the decline registered between 2010 and 2020⁹⁵, unless new consumption patterns emerge or specific policies tailored to optimise the efficiency of products, the production processes and services are introduced.

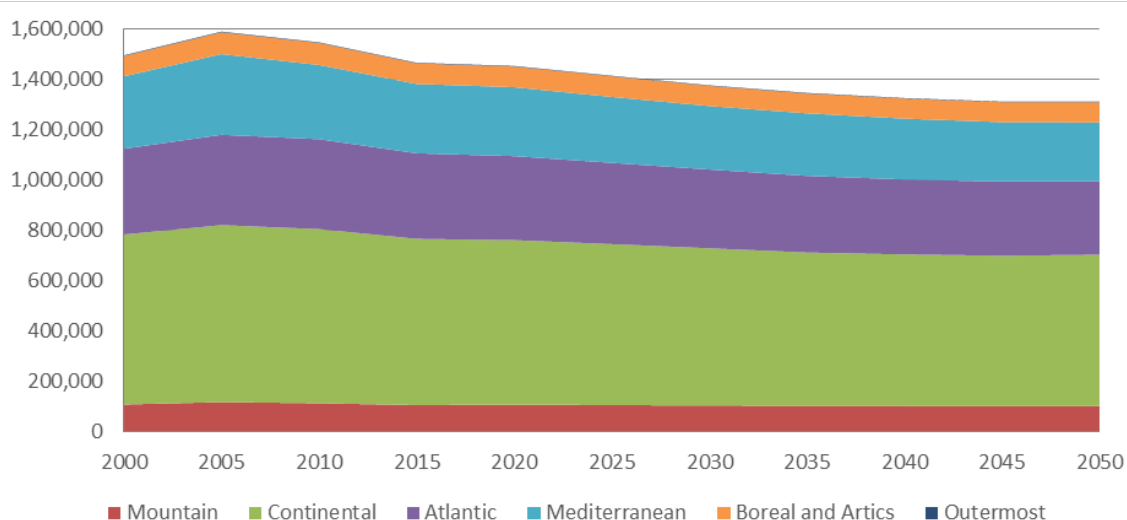
⁹¹ European Commission, 2015, C(2015) 6317 final, Communication from the Commission. Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformations.

⁹² The main effects of the existing energy policies have been positively evaluated by the European Commission (2016), EU Reference Scenario 2016. Energy, transport and GHG emissions - Trends to 2050. The new energy policy framework for 2030 and 2050 was evaluated in a more recent European Commission Staff Working Document which also assesses the socio-economic effects of decarbonisation. The document highlights the main benefits of an accelerated clean energy transition which could play a major role in a green recovery from the COVID-19 crisis; European Commission, 2020, Commission Staff Working Document, SWD(2020) 176 final. Impact Assessment 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: Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people".

⁹³ As of 2010, the annual economic cost of premature deaths from air pollution across the countries of the WHO European Region stood at US\$ 1.431 trillion World Health Organization (WHO) Regional Office for Europe, 2015, Economic Cost of the Health Impact of Air Pollution in Europe; <https://www.eea.europa.eu/data-and-maps/indicators/heat-and-health/heat-and-health-assessment-published>.

⁹⁴ Intelligent Energy Agency – IEA, European Union 2020. Energy Policy Review, 2020 (<https://www.iea.org/reports/european-union-2020>).

⁹⁵ The trends estimated by the REF scenario (2016) have been reviewed in the most recent scenario elaborated by EC (2020) for the EU-27. According to the updated estimates (not available in terms of geo climatic regions) the introduction of general and sectorial energy policies should impact significantly industries and residential sectors: "final energy demand for coal drops by 88% over the entire period 2015-2050 (-62% by 2030 and another -67% thereafter by 2050). Also demand for oil sees a significant decrease of 55% over the entire period – the most important in absolute terms. Electricity as an energy carrier grows by 30% by 2050 on the energy consumption". European Commission, 2020, Commission Staff Working Document, SWD(2020) 176 final. Impact Assessment 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: Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people".

Figure 30: An indicator of dependency on fossil fuels: Gross Inland Consumption of energy (ktoe) in the EU27⁹⁶

Source: European Commission, EU Reference Scenario, 2016.

Therefore, to facilitate the transition, the promotion of new consumption models oriented towards the circular economy and a substantial reduction in the use of raw materials, not just fossil fuels, are considered important.

Looking at the consumption by energy end user, transport is the sector with the highest energy demand in all regions, followed by the industrial and residential sectors.

b. Increase in renewable energy production

The EU is a leader in RES and related technologies. Cleaner electricity was the main driver behind the reduction of GHG emissions in Europe over the decades: in 2019 they were 23% lower than in 1990, already exceeding the 2020 target⁹⁷.

An increase in the diffusion of RES is projected to take place in all regions, however, in Continental and Atlantic regions⁹⁸, which concentrate the bulk of energy consumption, as well as in Mountain areas, it may not be sufficient to satisfy a stable trend in energy demand and this calls for more effort in these areas. The situation may be partially different in Mediterranean and outermost regions where energy consumption will decrease and it is expected that oil can be progressively replaced by renewables.

The increase in renewable energy production is expected to bring benefits not only to the environment, but also to the security and quality of the energy system⁹⁹, primarily in terms of balance between the internal production and imports.

Primary energy production, an indicator which provides useful information on the impact of decarbonisation, is expected to go down by 10% in 2030, compared to 2015. The share of fossil fuels

⁹⁶ See Annex for information, broken down by geoclimatic region, on: Gross Inland Consumption in the EU-27 geoclimatic-regions (ktoe); Final Energy Consumption by fuel in the EU-27 geoclimatic regions (ktoe); Final Energy Consumption by sector in the EU-27 geoclimatic regions (Mtoe).

⁹⁷ Intelligent Energy Agency – IEA, 2020, *European Union 2020. Energy Policy Review*

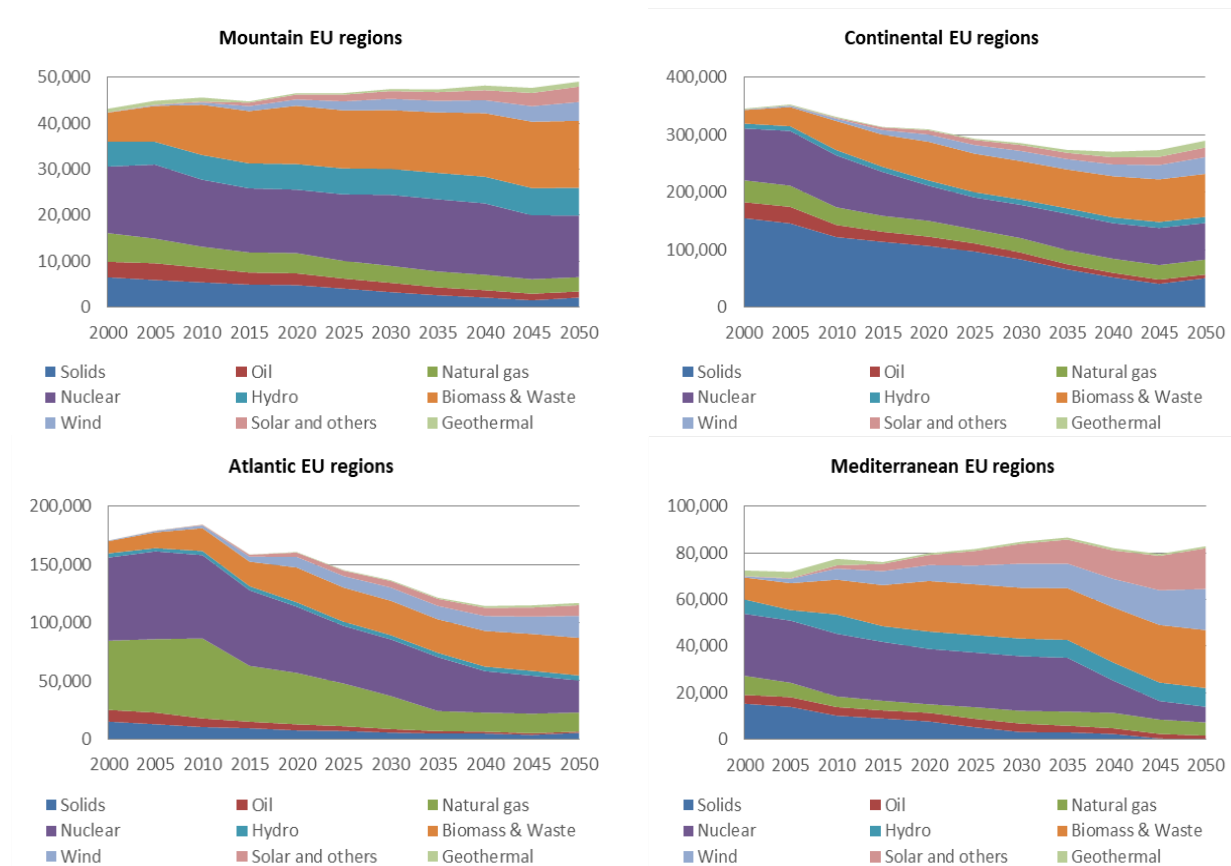
⁹⁸ These are the largest and most populated territories (about 60% of the EU population), also as a consequence of the concentration of production activities and to specific climatic conditions.

⁹⁹ <https://ses.jrc.ec.europa.eu/electricity-security>

in energy production is expected to go down “from 38% in 2015 to 23% in 2030 (further declining towards 2050), mainly driven by the reduction of solid fossil fuels replaced by renewable energy sources, chiefly wind and solar. [...] Net imports will decrease by 18% until 2030 and another 14% thereafter until 2050. Over time, natural gas increases its share in imports at the expense of coal and oil”¹⁰⁰.

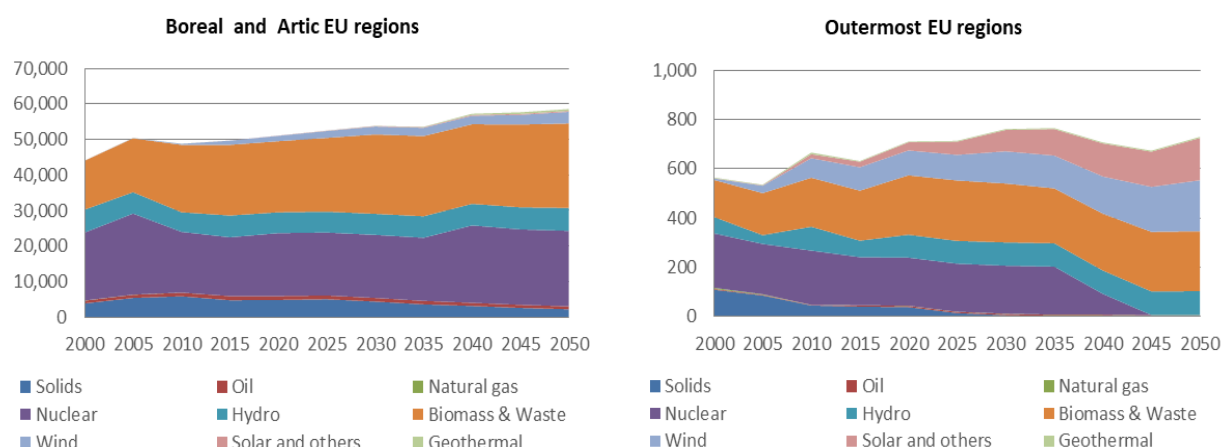
Overall, according to the EC scenario mentioned above, energy production by solid fuel and oil will experience an important reduction in most EU regions but, in any case, there are significant regional differences, due to the variability of energy production mix and current availability of fossil fuels. The reduction will be particularly significant in Continental (-27% and -32% in 2030 with respect to 2015) and Atlantic EU regions (-40% and -45% in 2030 with respect to 2015), due to the depletion of inland solid fuels and the progressive substitution of large fuel-oil based power plants, supported by both the existing energy policies and the increase of oil price. In Atlantic regions an important reduction of natural gas is expected (-41% in 2030 with respect to 2015).

Figure 31: Primary energy production in main EU geoclimatic regions (Mtoe)¹⁰¹



¹⁰⁰ European Commission, 2020, *Commission Staff Working Document, SWD(2020) 176 final. Impact Assessment 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: Stepping up Europe’s 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people”*

¹⁰¹ See Annex for information, broken down by geoclimatic region, on: Gross Electricity Generation in the main EU geoclimatic regions (GWh); Net installed capacity in the Baseline in the main EU geoclimatic regions (MW).



Source: European Commission, EU Reference Scenario, 2016.

Even though the increase of primary energy production from RES will be significant in all regions, the mixes of renewables are likely to vary in relation to the availability of specific sources:

- a balanced mix of biomass & waste, wind and solar is expected to prevail in Mediterranean region, that will ensure also an important increase of primary production, with a peak in 2035;
- an increase of the share of biomass & waste and wind in energy production in Boreal and Arctic regions;
- a large use of biomass in Mountain, Continental, and Atlantic regions;
- a nearly 100% (73% in 2030 and 99% in 2050) renewable production in the outermost regions (+41% in 2030 and +85% in 2050 with respect to 2015). These regions, characterised by geographical isolation, can be important experimentation outposts as regards energy autonomy and reduction of dependency from imports.¹⁰²

According to the EC scenarios, all the geo-climatic regions will also witness an increase in Gross Electricity generation (total amount of electrical energy produced by transforming other forms of energy).¹⁰³

c. Boosting innovation and a shift towards a circular economy

The EU supports a transition to a circular economy, a paradigm shift which, as previously mentioned, is essential for tackling climate change.

¹⁰² For more information see: Clean energy for EU islands forums and technical fairs (https://ec.europa.eu/energy/topics/markets-and-consumers/clean-energy-eu-islands/forums-and-technical-fairs_en?redir=1).

¹⁰³ Mountain EU Region are expected to experience a significant reduction of the carbon-based electricity (-30% in 2030 with respect to 2015), while keeping an almost steady production (+4% in 2030 with respect to 2015) from hydro sources and a significant increase (+130% in 2030 with respect to 2015) of wind derived electricity; Continental Regions are expected to reduce the production from solids (-15% in 2030 with respect to 2015) but to increase (+16% in 2030 with respect to 2015) the production from oil with a net difference close to zero. In Continental Europe decarbonisation could play a major role only if the oil contribution is lowered and replaced by additional RES (Wind and Solar generated electrical power will be in any case significant increase by 120% and 90% in 2030 with respect to 2015); in Atlantic areas, Nuclear and fossil fuel generated power will tend to decrease (-25% and -30% in 2030 with respect to 2015), while Wind and Solar generated electrical power will be in any case significant increase by 165% and 185% in 2030 with respect to 2015; in Mediterranean regions, the situation will be similar to the Atlantic ones, but the decrease in fossil fuels will be more significant (-60% in 2030 with respect to 2015) and the increase in Wind and Solar derived power will increase (+70% and +180% in 2030 with respect to 2015); in the Boreal and Arctic regions the generation of electricity produced by oil is expected to experience a reduction (-72% in 2030 with respect to 2015), while the power produced from natural gas will see an increase of almost 100% in 2030 with respect to 2015. A rapid transition to decarbonisation is expected to impact the electricity market in this region. Wind derived power will increase (+90% in 2030 with respect to 2015); outermost regions will see a decrease in fossil fuel derived electricity (-83% for solids, -30% for oil, -18% for gas in 2030 with respect to 2015, while electricity from renewables will see an increase (Solar is expected to grow by more than 300% in 2030 with respect to 2015).

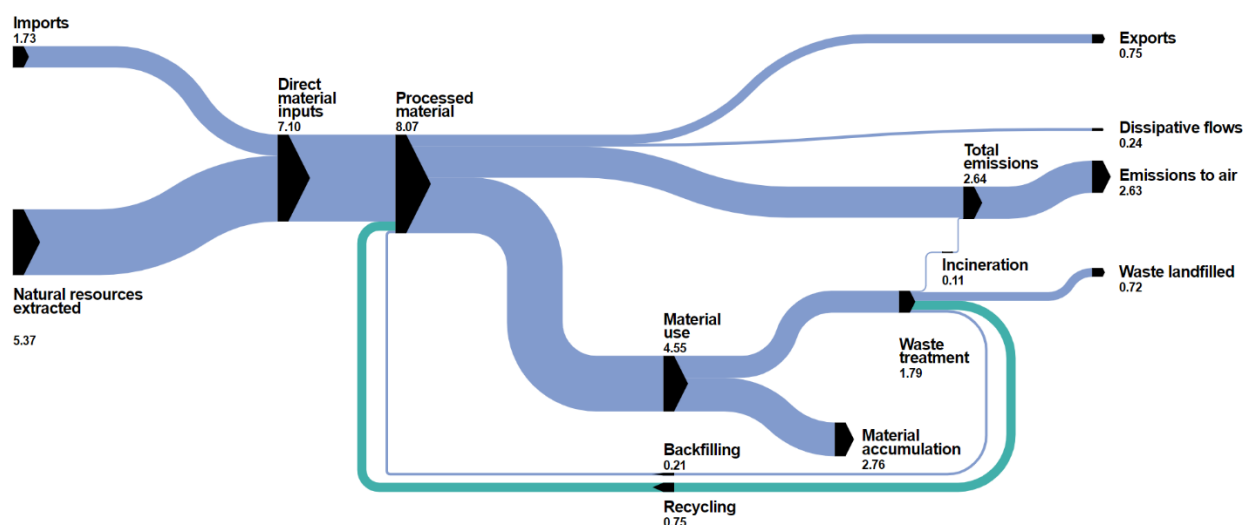
In the EU, for example, about 33.5% of domestic and imported material inputs turn into atmospheric emissions and only a minimal fraction (about 9,6%) is recycled. Decarbonisation, if not based on circular economy, might actually lead to negative impacts on global warming, as it might cause higher demand of natural resources and it might produce an overall increase in entropy (increase of heat at a given temperature) with respect to the current situation. Therefore, shifting to a circular economy is a necessary condition for being successful in decarbonising the EU.

The scarcity of raw materials in the EU, is a growing problem, and highlights the importance of its natural resources, of the bioeconomy, and of the correct evaluation, use and maintenance of all ecosystem services, avoiding biodiversity loss, deforestation and land and soil degradation.

Materials consumption in EU Continental regions play a significant role in EU material flow accounts as it represents 47% of the total EU27 + UK amount. Among Continental regions, German, French and Polish territories account for the largest share of consumption in the EU. Atlantic regions contribute to the total EU27 + UK Material Flow for about 24%. All the remaining regions combined account for about 29% of the total share. Therefore, a 10% decrease in material consumption in Continental and Atlantic regions, obtained by embracing circularity would lead to a 7% decrease in EU27 + UK material flow, while a 10% decrease in the other regions would produce a 3% decrease in the EU27 + UK.

Progressive innovations in EU industries have steadily reduced the use of raw materials, with several and positive environmental impact (air pollutant emissions, firstly GHG; water use; solid waste). New technologies could ensure climate sustainability and, at the same time, maintaining production levels in sectors depending on raw materials affected by rapid depletion and/or high costs of extraction (both monetary and environmental), including certain materials used for applications in the green economy and renewable energies (for example: minerals and rare earths). The following figure shows the flows of materials as they pass through the EU economy and are discharged back into the environment or re-fed into the economic processing.

Figure 32: Material flows in the EU (2019)

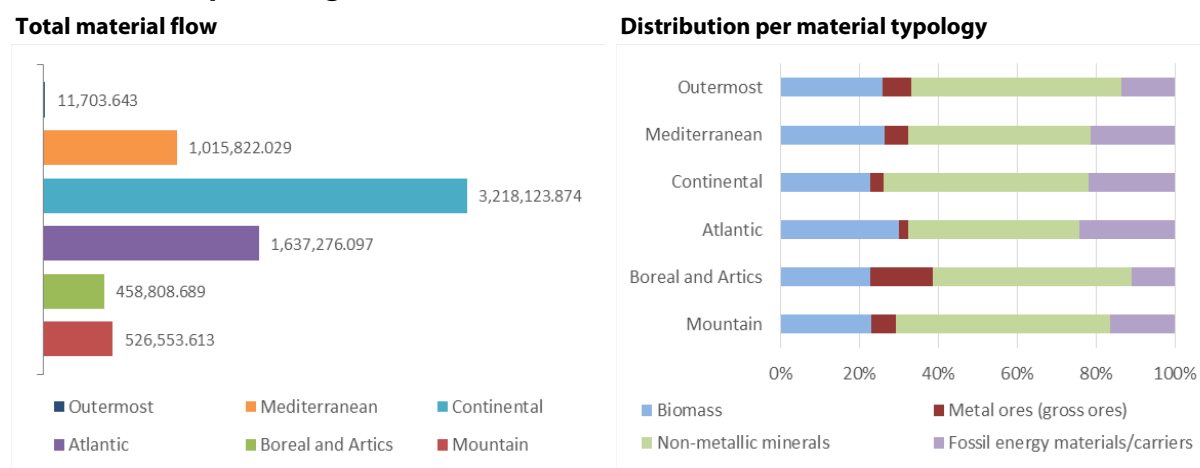


Note: The width of the bands is proportional to the flow quantity; materials are extracted from the environment to make products and assets or as a source of energy; they accumulate in societal stocks and they are eventually discharged to the environment as residuals; imports and exports, which are flows of products with other economies, are also shown; the closed loop represents residuals which are not discharged into the environment but reused in the economy or used to produce secondary raw materials or for other purposes preventing further extraction of natural resources.

Source: EUROSTAT, 2018 (<https://ec.europa.eu/eurostat/web/circular-economy/material-flow-diagram>).

Digitalisation and the bio-economy, two expressions of true circularity of the economy, are likely to play an important role in decarbonisation. Digitalisation can enable and accelerate the tracking, tracing and mapping of information on products, components, materials and value chains. The combination of digitalisation and the bioeconomy can boost sustainable innovation processes in industries depending on raw material import and awareness raising among consumers.

Figure 33: Material flow accounts in main EU geoclimatic regions (EU28, thousand tonnes and percentage, 2019)



Source: Eurostat, 2020.

d. GHG emission reduction

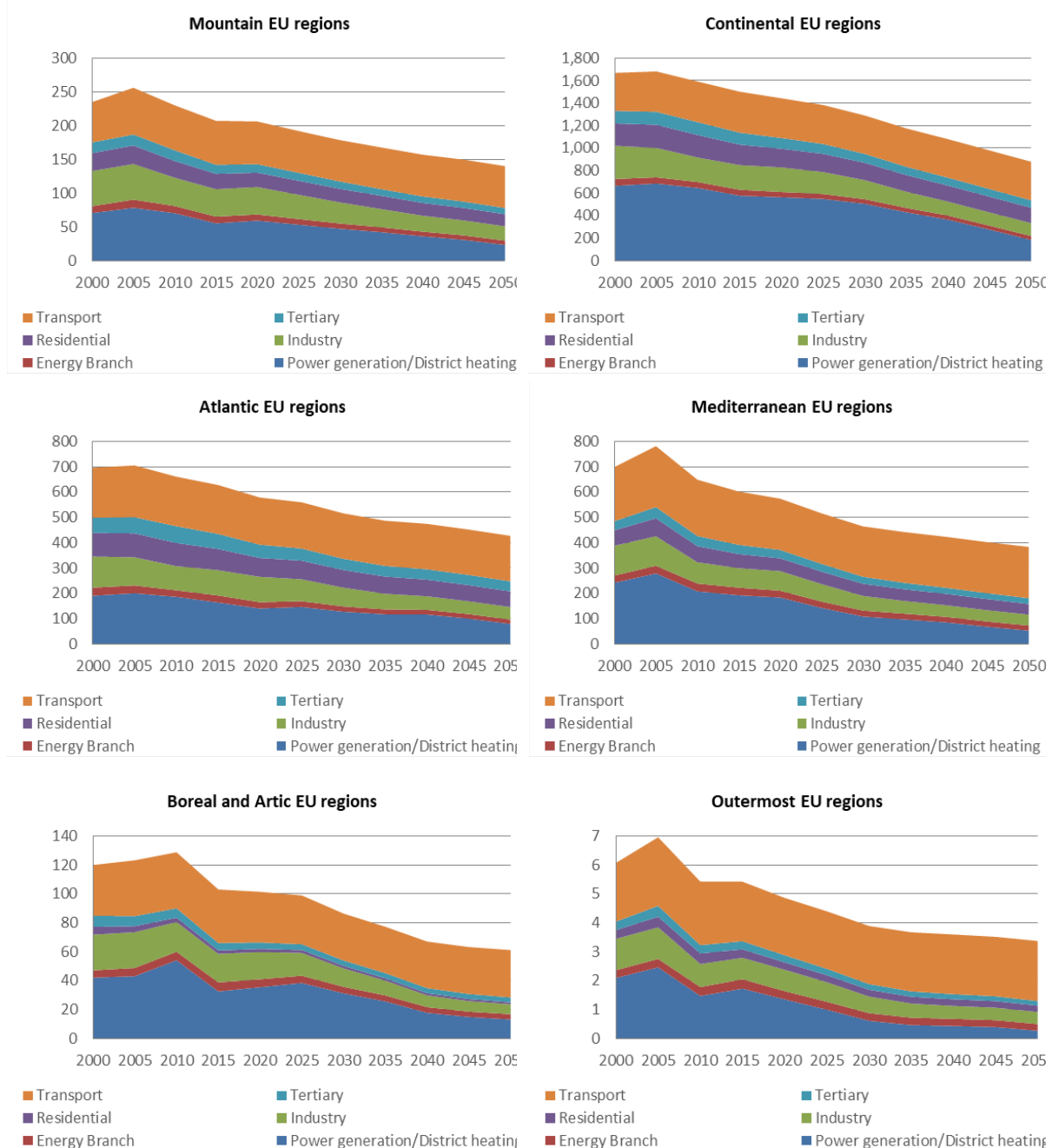
According to the EC scenarios, on the basis of global and EU market trends and the energy and climate policies already adopted by the EU and its Member States¹⁰⁴, the total amount of GHG emissions is expected to decrease.

An overall GHG emission reduction is expected, well beyond the target of -40% by 2030 compared to 1990 (GHG emissions that include intra and extra EU aviation and maritime navigation but exclude net LULUCF emissions are foreseen to be reduced by 44.5% compared to 1990 by 2030; if net LULUCF is included, this estimated reduction is 46.3%).

In the absence of additional energy and climate policy initiatives though, the strong GHG emissions reduction trend is not likely to continue after 2030. According to the EC scenarios, emissions will tend to be almost stable from 2040 onwards.

The reduction in GHG emission concerns all European regions but differences persist. In Continental regions, which as of 2016 were responsible for more than 45% of the Total EU27 + UK GHG Emissions, the expected reduction will be 10% in 2020-2030, and 26% by 2050. Mountain and Atlantic EU regions will also experience a GHG reduction of about 10% in the decade 2020-2030, and of an additional 15% by 2050. Mediterranean regions are likely to experience a 17% reduction in 2020-2030, and a 14% drop by 2050.

¹⁰⁴ European Commission - Directorate-General for Energy, Directorate-General for Climate Action and Directorate-General for Mobility and Transport, *EU Reference Scenario 2016. Energy, transport and GHG emissions - Trends to 2050*, 2016.

Figure 34: Evolution of CO2 Emission in main EU geoclimatic regions (MtCO2)

Source: European Commission, EU Reference Scenario, 2016.

The previously summarised energy projections will lead to reduced consumption and to lower carbon emissions. This in turn will translate into a steady decrease of energy related CO2 emissions across the economy. CO2 emission reduction compared to 1990 is expected to reach 46% in 2030 and 59% in 2050. Emissions of Power Generation will likely experience the largest reductions by 2030 compared to 2015 (52%), followed by the residential (49%) and the service (47%) sectors. Industrial energy emissions will be reduced by 18%. By contrast the transport sector is expected to achieve only a 12.5% emission reduction by 2030.

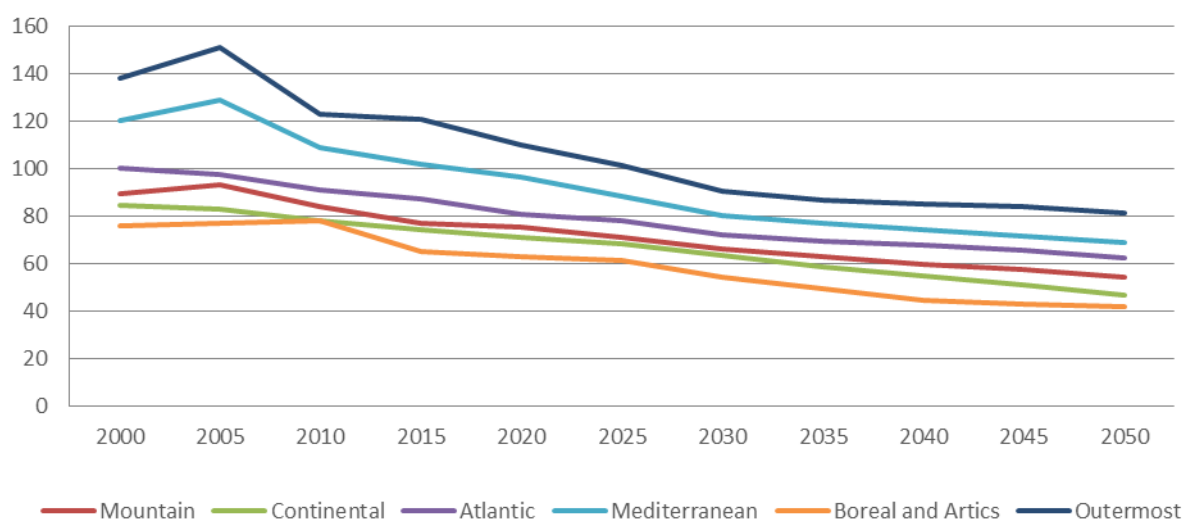
The reduction of non-CO2 emissions is expected to be more limited than for CO2. Total reductions in 2030 are likely to reach 32% compared to 2005 and 26% compared to 2015. Methane emissions

(CH₄), which are close to two thirds of total non-CO₂ emissions, are only expected to be reduced by 26% between 2015 and 2030, while nitrous oxide emissions (N₂O) will be reduced by 5%. Only F-gases will experience a drastic 65% reduction.

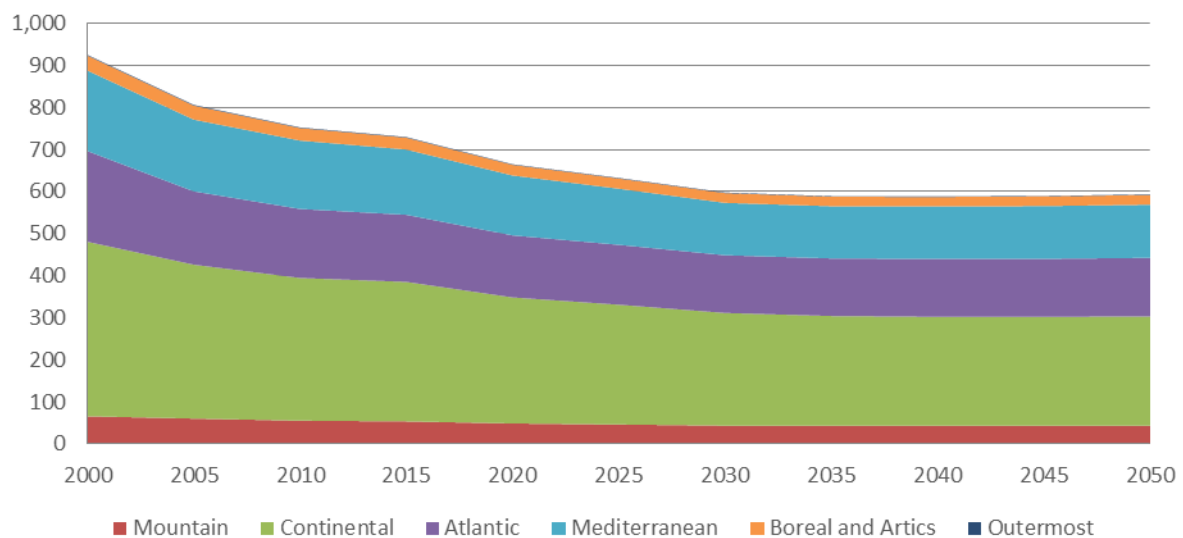
From a sectoral perspective, agriculture is not only predicted to remain the biggest emitter, but as its emissions will reduce very slightly over time, its share in total non-CO₂ emissions will gradually increase from 54% in 2015 to 68% in 2030 and 73% in 2050. The sectors showing the largest emissions reductions are air conditioning & refrigeration, waste and energy, with reductions by 2030 compared to 2015 being 68%, 53% and 36% respectively. Non-CO₂ emissions in agriculture are expected to be reduced by only 7%, in industry by 6%, while in wastewater they are likely to remain stable.

The LULUCF sector has seen an increase in sinks in the period up to 2013 but since then, with increasing harvesting rates and natural disturbances like forest fires, this was reduced and this negative trend is projected to continue. The EC scenario assumes a deterioration of the EU emissions and removals from forest management and harvested wood products in line with increasing harvesting foreseen as under the Forest Reference Levels.

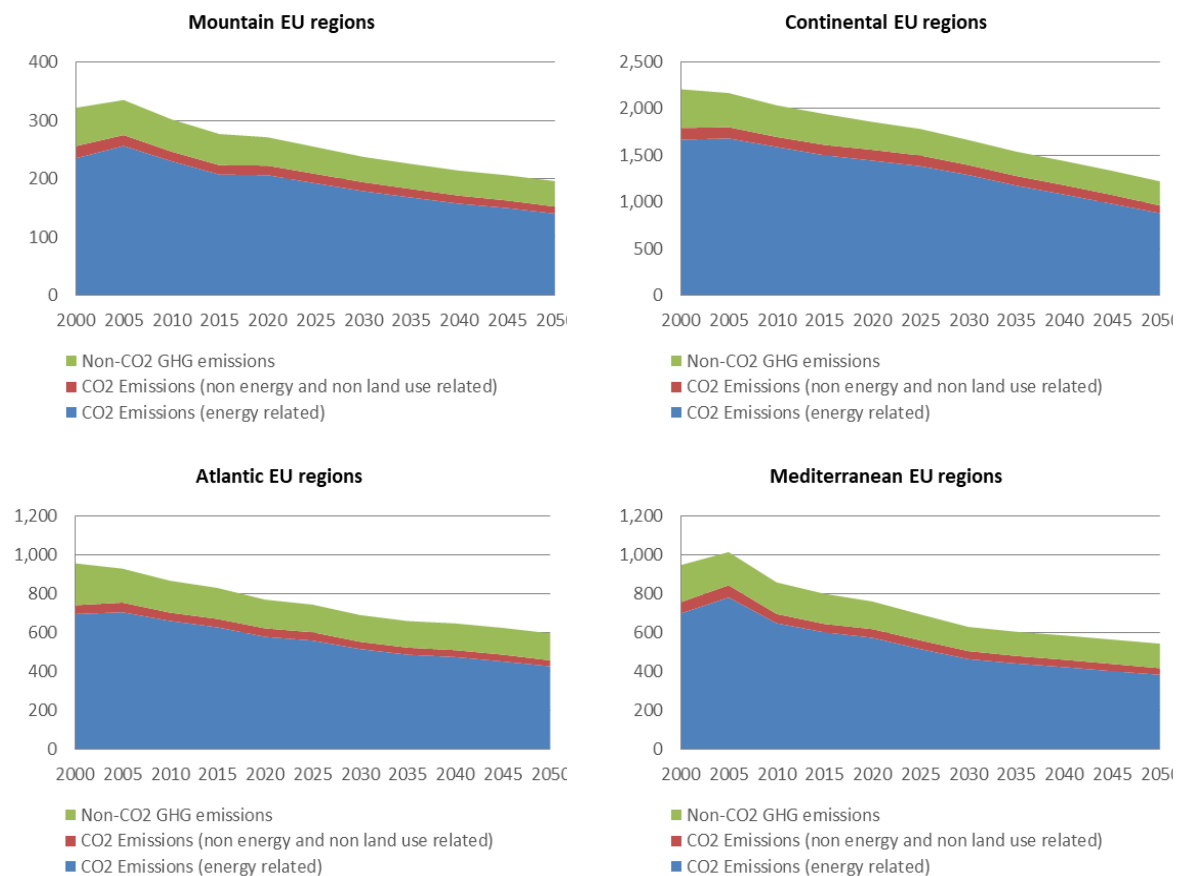
Figure 35: TOTAL GHG emission (no LULUCF) Index (1990 = 100)

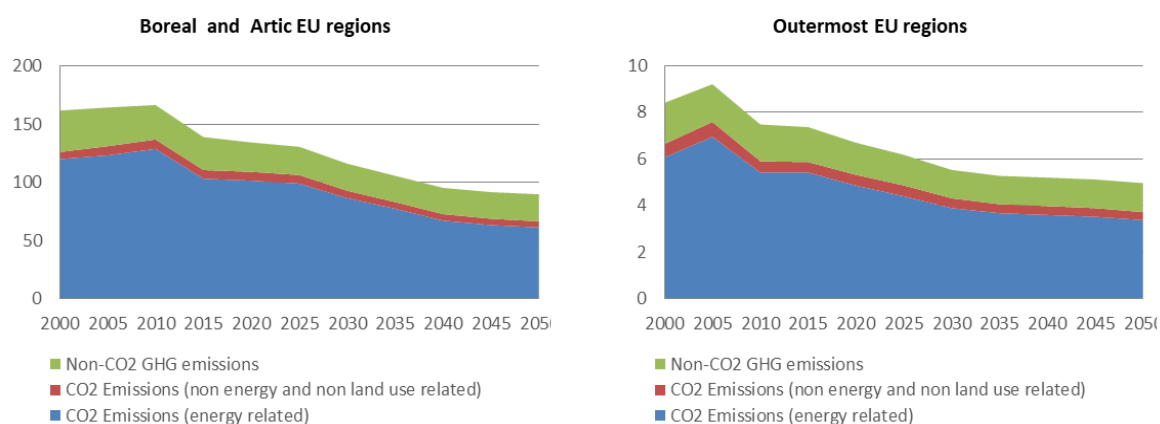


Source: European Commission, EU Reference Scenario, 2016.

Figure 36: All Non-CO2 emissions in main EU geoclimatic macro-regions (MtCO2eq)

Source: EU Reference Scenario 2016.

Figure 37: Overall CO2 emissions in the main EU geoclimatic regions (MtCO2eq)



Source: European Commission, EU Reference Scenario, 2016.

3.1.3. Main costs of the phasing out

The transition of moving away from fossil fuels implies several costs. Their magnitude depends on socio-economic contexts, on geoclimatic features as well as on policy. Costs of transition are not likely to be evenly distributed across regions and, within them, among social groups.

The expected costs are essentially of two types: increased costs of energy systems and additional investments necessary for achieving the target GHG emission reduction.

The increased costs of energy systems include all costs for the production of renewable or low-carbon energy and for energy transmission. Energy production will become increasingly distributed while currently is centralised around the large distribution backbones of gas and electricity, whereas oil pipelines are few and oil is still mainly shipped by sea and road transport. Increased costs of energy systems, therefore, may be related, inter alia, to costs for energy distribution grids, cost for renewable and low carbon energy power plants, refurbishment of existing thermal and nuclear power plants.

The additional investments necessary for achieving the GHG emission reduction targets include all costs for energy efficiency across all sectors, apart from energy production. All energy-related investments in manufacturing, agriculture, transport, services, housing etc. belong to this category. For example, energy efficiency of transport system (investments in electrically chargeable vehicles), energy efficiency of SMEs and of buildings (Nearly Zero-Energy Buildings - NZEB), are all additional investments for reducing GHG emissions.

The increases in energy system costs are expected to be very limited, from 10.6% of GDP in 2015 to around 11% in 2030, while annual average investments in the energy systems, including transport, would need to be increased in the period 2021- 2030 compared to the period 2011-2020 up to EUR 312 billion to achieve 50% Green House Gas (GHG) emission reductions and up to 350 billion to achieve 55% GHG emission reductions.

Clearly both system costs and investment needs will depend on the implemented policies. Mobilising the required scale of finance by 2030 will be a significant challenge. All in all, phasing out costs are high insofar as they require setting up renewable energy power plants, or increasing the efficiency of traditional plants. This is still true even though some renewable energy sources are becoming cheaper and cheaper (e.g. photovoltaic and wind) because RES technologies are produced at increasingly large scales and capital expenditures (CAPEX) continued to decrease, also driven by important European RES support schemes. Phasing out is costly also because of the need

for upgrading energy networks. Although overall electricity consumption in the EU has remained stable over the last 10 years, distribution network investment increased considerably, due to market integration and actions to improve security of energy supply. Finally, boosting energy efficiency requires interventions in all sectors, from industrial machinery to vehicles and buildings.

All these costs, in some sectors, are compensated by energy and other savings (e.g. those linked to higher fossil fuel prices and emission limits), while the existing taxes and incentive structures are often inadequate, not well matched and still favour fossil fuels.¹⁰⁵

In the EU27, consumption taxes for electricity are equivalent to around 50-60% of the external costs of electricity. Taxes on energy consumption in 2018 totalled €263 billion, whilst taxes on energy production and infrastructure totalled only about €5 billion¹⁰⁶.

Total energy subsidies in the EU27 have increased by 65% from €95bn in 2008 to €159bn in 2018 in real terms (€2018) driven by subsidies for energy production (+€48bn) that have risen by 130%. On the side of renewable energy sources, the financial support increased from €22bn in 2008 to €73bn in 2018. Solar PV received €28bn in 2018 (+€24bn since 2008), followed by wind onshore (€16bn, +9.5bn), biomass (€15bn, +€9bn) and lately by wind offshore (€5bn, +4.5bn). Subsidies for energy efficiency represented 10% of the total subsidy amount in 2018 at €15bn, and have increased by more than 114% since 2008, from €7bn. On the side of fossil fuels, the subsidies have slightly shrunk over the full 2008-2018 timeframe, to reach approx. €50bn in 2018, in the most part for the energy sector (€18bn), transport and industry (€11bn each). Tax expenditures for fossil fuels are extensively used by the MS and reached €27bn in 2018. Indirect subsidies or total tax revenues forgone by the EU27 reached €57bn. €35bn were revenue waivers from taxes on fossil fuels, including carbon taxes, and €9bn from taxes on electricity¹⁰⁷.

Despite a mismatch between the system of incentives and costs, according to extant analysis investments are to a large extent expected to be repaid over time through reduced fuel payments. A recent impact evaluation¹⁰⁸ of the European Commission demonstrates that the decrease of dependency on fossil fuel imports will produce savings on fossil fuel import bills in the range of EUR 325-375 billion over the period 2021-2030 which may compensate the extra costs.

Nonetheless attention should be paid to asymmetrical impacts. A JCR analysis shows that the share of energy-related expenses in households budgets increases only slightly with GHG reduction target increasing but, for low-income households, energy costs represent a larger share of income and they will be more significantly impacted by the transition¹⁰⁹. Also, geographically, the costs related to energy investment and other mitigation costs will not increase evenly. For example, costs will go up in particular in some EU Continental and Atlantic regions, due to major availability of indigenous

¹⁰⁵ For example, a large part of the actors in the fossil fuel value chain, from the producers to the users, do not pay a price that is adequate to the generated climate change damages. See for example: OECD, 2019, Taxing Energy Use 2019, Using Taxes for Climate Action.

¹⁰⁶ The energy taxes analysed in the study of European Commission are excise taxes on fuels, non-tax levies on fuel purchases, such as on natural gas and electricity bills and all other taxes, levies and fiscal measures that end consumers pay when they consume energy.

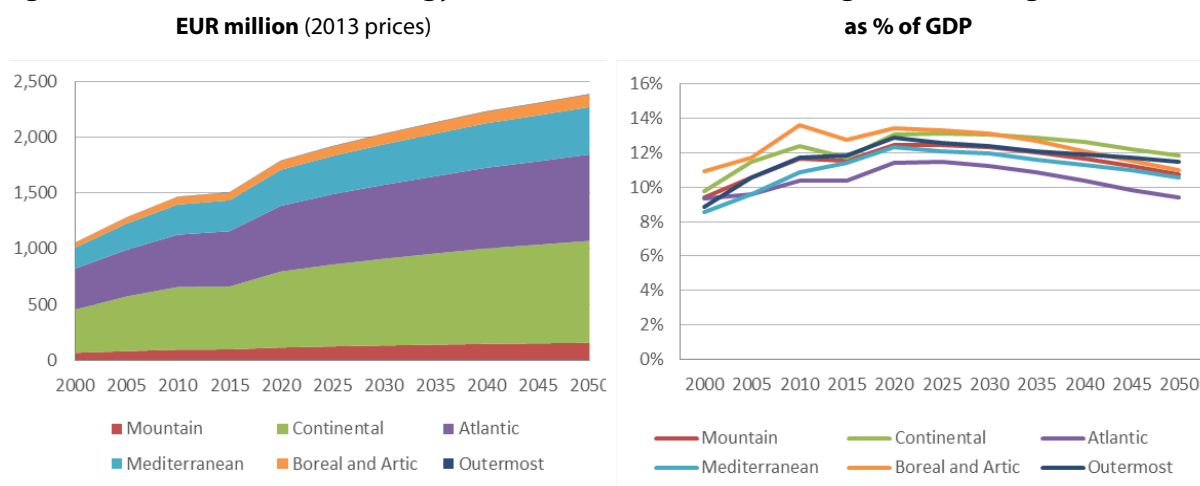
¹⁰⁷ The energy subsidies analysed in the study of European Commission are all forms of monetary transfers from public entities to private (direct transfers, tax expenditures) as well as regulatory economic mechanisms and schemes that results in cross-subsidies.

¹⁰⁸ European Commission, 2020, *Commission Staff Working Document, SWD(2020) 176 final. Impact Assessment 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: Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people"*.

¹⁰⁹ Joint Research Centre, Cost development of low carbon energy technologies, 2018 (<https://data.europa.eu/euodp/en/data/dataset/jrc-etri-10003>). The study assesses the main impacts of decarbonisation, projecting capital investment costs of 9 low carbon energy technologies (40 sub-technologies) from 2015 to 2050, under different scenarios. The technology portfolio does not assess the conversion options in specific sectors (namely transport and industry).

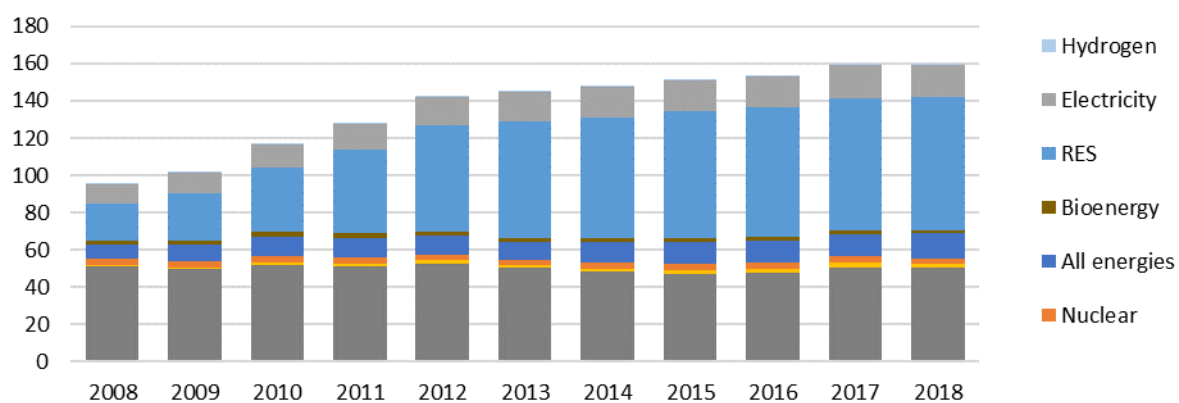
fossil fuels, that have to be progressively replaced by massive installation of renewable and low carbon energy technologies.

Figure 38: Costs related to energy investment in in the main EU geoclimatic regions

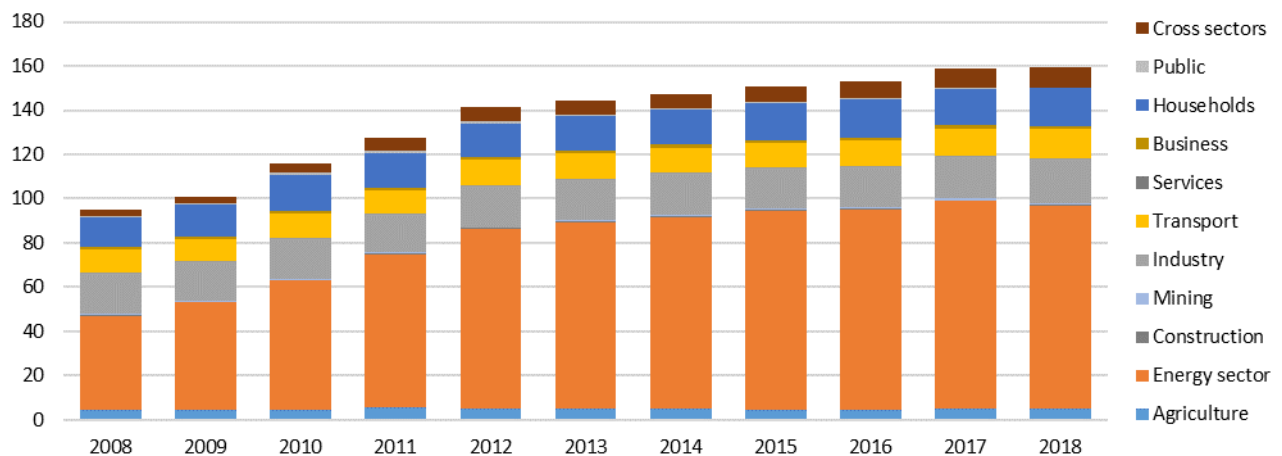


Source: European Commission, EU Reference Scenario, 2016.

Figure 39: Energy subsidies (€2018bn) by category (EU27)



Source: Directorate-General for Energy (European Commission), Trinomics, 2020, *Study on energy costs, taxes and the impact of government interventions on investments. Country subsidy factsheets*.

Figure 40: Energy subsidies by sector (€2018bn) by category (EU27)

Source: Directorate-General for Energy (European Commission), Trinomics, 2020, Study on energy costs, taxes and the impact of government interventions on investments. Country subsidy factsheets.

3.2. Implications of climate change for public health and the economy in EU regions

The most comprehensive and up-to-date review of sectoral impacts of climate change in EU regions which takes into account the relevant state of the art literature is provided by the JRC PESETA¹¹⁰ project which started in 2009. According the most recent JRC study (PESETA IV), global warming has biophysical and economic implications which concern multiple domains, from public health to the environment, from agriculture to energy production and so forth.¹¹¹

The analysis carried out in the context of PESETA is aimed at better understanding the effects of climate change on European regions and how these effects could be avoided with mitigation and adaptation policies. Projections of climate change from several climate models as well as a set of climate change impact models are used to estimate welfare losses.

In summary, welfare losses due to climate change are expected to be very significant in the EU. The scale of such losses depends on the capacity to keep global warming under control. Exposing the present economy to a global warming of 3°C would result in an additional annual welfare loss of at least 175 €billion (1.38% of GDP). Under a 2°C scenario the additional welfare loss would be lower, 83 €billion/year (0.65% of GDP), while restricting warming to 1.5°C, in line with the Paris Agreement, would reduce the additional welfare loss to 42 €billion/year (0.33% of GDP).

Therefore, policies for mitigation of climate change are essential because “limiting global warming to 2°C would reduce additional welfare losses by 50% compared to 3°C, while achieving the Paris goal of 1.5°C would lower additional welfare losses by 75%”.

Among the impacts of global warming highlighted by PESETA, human mortality from extreme heat dominates the scene. The additional welfare loss related to mortality has been quantified and

¹¹⁰ Projections of Economic impacts of climate change in Sectors of the EU based on bottom-up Analysis (<https://ec.europa.eu/jrc/en/peseta-iv>). The PESETA project also monitors the progress of the EU Adaptation Strategy. See also: European Commission (2018), Report from the Commission to the European Parliament and the Council on the implementation of the EU Strategy on adaptation to climate change.

¹¹¹ The PESETA project covers several sectors that are relevant to society and the natural environment, such as freshwater, agriculture, and coasts. See: JRC, 2020, PESETA IV final report. *Climate change impacts and adaptation in Europe*.

reaches EUR 36 billion with a 1.5°C temperature increase, 65 billion and 122 billion with a 2°C and 3°C global warming respectively.

The projections also highlight, inter alia, that there is a clear north-south divide in the regional distribution of additional welfare losses. The sum of impacts in northern regions are relatively small or even positive (e.g. northern Europe with 1.5°C and 2°C temperature increase) as “these regions experience gains from climate change for some of the categories considered (more productive agriculture, greater electricity production). In southern EU regions, the impacts are mostly negative. As a result, aggregated welfare losses in southern regions are several times larger compared to those in the north of Europe”. The main sectoral implications of climate change highlighted in the PESETA assessment include the following:

- **Human impacts from heat and cold extremes:** during intense heatwaves, in the summer, many locations in Europe have recently recorded all-time temperature records (for example, June and July 2019). If temperatures are stabilised (i.e. a 1.5°C increase above pre-industrial temperature), each year more than 100 million Europeans would be exposed to an intense heatwave, compared to around 10 million/year in the period. With a 2°C increase, the number of people exposed goes up to 176 million people per year and with unmitigated climate change (3°C in 2100) to nearly 300 million/year, or more than half of the European population. Without climate mitigation and adaptation, the death-toll from extreme heat in the EU could be 30 times higher than at present by the end of this century. Similar conclusions can be drawn from higher frequency of cold extremes.
- **Impacts on water resources:** the number of people in the EU27+UK who live in areas under water stress, for at least one month per year, could rise from 52 million nowadays to 65 million in a 3°C warming scenario (about 15% of the EU population). Climate projections highlight the large geographical diffusion of the decrease of water availability that, obviously, will be more accentuated in southern European countries, which already suffer most from water scarcity (in particularly Spain, Portugal, Greece, and Italy).
- **Droughts:** droughts induce a complex web of impacts that span many sectors of the economy (for example: extensive crop failure, reduced power supply, shipping interruptions, etc.). With 3°C global warming in 2100, drought losses could be 5 times higher compared to today, with the strongest increase in drought losses projected in the Mediterranean and Atlantic regions of Europe. The EU drought damage slightly increases with a global warming of 1.5°C (9.7 €billion/year) but then increases much more with a further warming to reach 17.3 €billion/year at 3°C. The economic damages are projected to be relatively low because agriculture is the most drought-sensitive sector and its economic weight is not relevant in Europe, in terms of GDP, but the consequences on rural populations and on ecosystems will be considerable, although they are typically not monetised and, hence, not estimated.
- **River floods:** at present river flooding causes damage of 7.8 €billion/year in the EU27+UK, which is equivalent to around 0.06% of current GDP. Moreover, more than 170,000 people every year are exposed to river flooding. Direct damage from flooding could increase 6-fold from present losses by the end of the century in the case of no climate mitigation and adaptation. Keeping global warming well below 2°C would halve these impacts.
- **Coastal floods:** around one third of the EU population lives within 50 km of the coast. Extreme sea levels in Europe could rise by as much as one metre or more by the end of this century. Without mitigation and adaptation measures, annual damage from coastal flooding in the EU and UK could increase sharply from 1.4 €billion nowadays to almost 240 €billion by

2100. Damage from coastal flooding in the EU and UK currently amounts to 1.4 €billion annually, which is equivalent to around 0.01% of current GDP. Almost half of this damage is shared by two countries: the UK (0.4 €billion annually) and France (0.2 €billion annually). Annual damage grows to 239 €billion (0.52% of the EU+UK GDP projected for 2100) and 111 €billion (0.24% GDP) by 2100 under a high emissions scenario and a moderate mitigation scenario respectively. The largest absolute damage levels are projected for Germany, Denmark, France, Italy, Netherlands, and UK. For some countries the damage represents a considerable proportion of future national GDP, e.g. 4.9% (Cyprus), 3.2% (Greece) and 2.5% (Denmark) by 2100 (high emissions).

- **Wildfire:** Mediterranean countries (Portugal, Spain, Italy, Greece and France), are currently most prone to fires and account for around 85% of the total burnt area in Europe. In these countries, fires destroyed nearly half a million hectares per year on average between 1999 and 2016. In 2017, the worst year over the last two decades, the total burnt area in Portugal, Spain, and Italy alone exceeded 0.8 million hectares. According to the PESETA IV final report, *"in 2018, vulnerable ecosystems of the Natura 2000 network, home to several endangered plant and animal species, lost 50,000 hectares to fires, accounting for approximately one third of the total burnt area"* (JRC 2020). The number of European citizens living near wildland and exposed to at least 10 days of high-to-extreme fire danger per year is projected to increase from 63 million in the present to 78 million with 3°C global warming, an increase of 15 million people (24%).
- **Alpine tundra habitat loss:** about 98% of Europe's alpine tundra domain is in the Pyrenees, the Alps and the Scandinavian mountains. In a 3°C warming scenario, the natural climatic treeline is projected to move vertically upwards by up to 8 metres per year and over Europe the domain could shrink by 84% of its present size. In the Pyrenees high warming could lead to a near total loss of the alpine tundra. As highlighted in the PESETA IV final report *"limiting warming to 1.5°C could reduce the loss of alpine tundra to 48%. The projected changes have implications for vital ecosystem services, habitat for biodiversity, and recreational services such as skiing"* (JRC 2020).
- **Forest ecosystems:** At present around 26 billion tonnes of forest biomass in Europe is potentially vulnerable to natural disturbances. Nearly half of that amount (46%) is threatened by windthrows, followed by forest fires (29%) and insect outbreaks (25%). There is substantial spatial variation across Europe in the vulnerability of forests to the different natural disturbances. Vulnerability to windthrows is higher in northern Europe, the British Isles, and in southern Europe. In these regions, up to 60% of the stand biomass is potentially vulnerable in areas affected by windthrows. A prominent south-north gradient of increasing vulnerability to fires and insect outbreaks emerges, with peak values in northern Europe, particularly in the Scandinavian Peninsula, and European Russia where areas affected by these disturbances may lose up to 30% of stand biomass.
- **Impacts on agriculture:** change will substantially lower yields of irrigated crops (for example, grain maize) in most producing EU countries, due to the reduction of water available for irrigation. The most severe impacts are projected for southern Europe. In contrast to irrigated crops, for non-irrigated, rain-fed crop (for example, wheat) in Europe increases in yields are projected for northern Europe, due to changes in precipitation regime combined with an anticipated growing cycle and enhanced growth from increasing atmospheric CO₂ concentrations. The negative economic effects of climate change on crop yields in the EU may be reduced considerably as a result of market adjustments due to more

severe climate change impacts on agriculture outside Europe and, consequently, the price increases will induce changes in EU farmers' management practices (e.g. input use per unit of land).

- **Impacts on electricity production:** Global warming results in an overall increase in hydropower production in the EU27 + UK, especially in northern regions that rely heavily on hydropower. On the contrary, nuclear power reduces significantly, while other energy sources are only moderately impacted. The evolution of the mix is in itself an adaptation of the energy system to climate change. The overall increase in hydropower is dominated by increasing water availability in northern European countries where there is a high installed capacity for hydropower. Since hydro has a lower marginal cost, it undercuts the demand in these regions for power from other energy sources. Depending on the local electricity production mix, the substitution effect is different. For example, in a "static scenario", hydro mainly replaces biomass in Sweden, coal in Finland, oil in Lithuania and gas in Latvia.

4. POLICY RECOMMENDATIONS

KEY FINDINGS

- The analysis carried out in the study highlights that, overall, there was a fairly satisfactory integration of climate change objectives in Cohesion Policy in 2014-2020 and this is likely to be the case also in 2021-2027. However, the study has also pointed out some weaknesses in how Cohesion Policy pursues climate objectives, that could reduce the effectiveness of the actions taken and increase the risk of not achieving the ambitious targets set. Such weaknesses concern policy design and formulation, implementation, and monitoring and evaluation.
- At the design stage, it is recommended to make a greater effort to mainstream climate change and sustainability in Cohesion Policy interventions, to avoid financing fragmented initiatives and achieve a critical mass. Moreover, it is essential to raise awareness in order to boost behavioural change and commitment. It is also important to promote capacity building, amongst administrators, on complex climate change issues. This is necessary for designing effective mitigation and adaptation measures and for successfully addressing territorial differences.
- Regarding policy implementation, considering the delay and scarcer performance of Cohesion Policy for climate in comparison to overall Cohesion Policy, most notably energy efficiency and RES support, it is important to reduce the administrative burden for beneficiaries and managing authorities but, at the same time, policy makers must make sure that climate action is not neutralised by investments in other areas. For example, supporting fossil fuels and promoting unsustainable uses of biomass is incompatible with the objective of carbon neutrality.
- To ensure a durable impact of climate action, it would be advisable that financing of successful 2014-2020 interventions is continued in 2021-2027 and that best practices are shared. This requires that Managing Authorities possess a solid evaluation evidence on the outcomes of their policies. In any case, strengthening evaluation of climate actions financed by Cohesion Policy is essential in 2021-2027, to track progress in achieving the ambitious EU targets.
- As regards monitoring of Cohesion Policy expenditure for climate, the method currently used for tracking climate expenditure has shown strengths (e.g. simplicity) but also weaknesses which deserve corrections (e.g. expenditure is estimated on the basis of planned amounts and by assuming that a certain initiative contributes to climate action only on the basis of the selected intervention field, rather than considering whether climate change is an explicit objective of the initiative). The system of output and result indicators is also weak and needs to be improved (e.g. making sure that indicators are more comprehensive and quantified coherently across programmes).

The global climate crisis has already reached a point where many negative consequences of global warming and related extreme events are inevitable for EU regions, even if immediate and tenacious action is taken. However, postponing action or acting with insufficient effort may further aggravate the situation in the long term or make the negative consequences of climate change unbearable for a considerable share of the European population.

The fact that the climate crisis has reached a point that makes some negative impacts inevitable calls for a stronger effort to pursue adaptation policies, while the need for avoiding a situation where we eventually go beyond a point of no return calls for resolute mitigation policies, capable of shifting the EU to a sustainable economic model. Clearly, the success of mitigation policy also depends on the commitment and action taken at global level to reduce GHG emissions and hence is to a certain degree out of EU control, even though the EU could have an increasingly leading role in advocating global climate action.

As highlighted in the analysis, there is a significant disproportion between the initiatives taken so far and the severity of climate crisis. Moreover, there are wide disparities in commitments and current efforts across countries and regions. For example, the current Nationally Determined Contributions for the climate goals of the Paris Agreement are inadequate and, all things staying equal, we are going towards a temperature increase which is likely to be unsustainable for humanity in the medium-long term.

Therefore, in such a gloomy global scenario, the EU needs to make a greater effort, directly and in terms of advocacy and leadership. EU climate action can learn greatly from a pandemic such as the COVID-19. Indeed, both climate change and COVID-19 have anthropogenic origins, they require a change in individual behaviour as well as collective effort, and the worst scenario they may lead to is a significant increase in mortality. The pandemic is a divide in contemporary history which demonstrated that the negative effect of human activity can be dramatic, quick to unfold, difficult or impossible to contain, while prevention is essential because it is unknown whether a reaction, once started, can be stopped. Moreover, mass awareness is critical to push for political action, which cannot be postponed.

If EU climate action is essential for the success of the fight against global warming, the analysis carried out in the previous chapters of this study highlighted that the EU Cohesion Policy certainly contributes to the Union's climate objectives, even though the financial contribution is modest in absolute value. In any case, this contribution is growing in overall monetary terms and, assuming that the new regulations achieve the expected changes, it will grow also in terms of scope of action as more emphasis should go to climate change adaptation and to the incorporation of climate objectives in all types of investments (climate proofing).

Notwithstanding a significant linkage between EU Cohesion Policy and climate action, there are strengths and weaknesses in this relationship which emerged from the previous analysis and that this section is aimed at highlighting, in order to provide recommendations for tackling them, with a view to integrate Cohesion Policy objectives in 2021-2027. Since Cohesion Policy is a multi-phase process, we organise the following recommendations according to the main stages of the policy decision making processes: 1) Policy design and formulation; 2) Policy implementation; 3) Monitoring and evaluation. Furthermore, we distinguish amongst the main actors addressed (EU level policy makers; national/regional policy makers or programme authorities).

Policy design and formulation

Climate action objectives were incorporated in 2014-2020 Cohesion Policy at the design stage and during the implementation of programmes, as well as in monitoring and evaluation, following the Common Provisions Regulation and the specific fund regulations. A similar approach is taken in 2021-2027 to ensure that climate change is addressed from programme design to the selection of operations, and that investments are "climate proofed".

To achieve a more ambitious spending target, namely at least 30% of the EU budget and Next Generation EU contributing to climate objectives, ERDF and Cohesion Fund operations are expected

to contribute 30% and 37%, respectively, of their overall financial envelopes to climate objectives in 2021-2027.

The analysis highlighted that, according to our estimate, approximately EUR 56.5 billion of Cohesion Policy was planned for climate action in 2014-2020, 15.9% of total planned Cohesion Policy funds and that, in 2021-2027, the amount planned for climate change is expected to increase to EUR 83.7 billion (including REACT-EU, a component of Next Generation EU which tops up ERDF and ESF until 2023). This is roughly 25% of total Cohesion Policy, a significantly higher share than previously, which should ensure a stronger contribution to the delivery of climate change outcomes.

The analysis also pointed out that for more than half (16) of the Member States of the EU, most notably central and eastern European countries, the amounts planned for climate action in 2014-2020 are higher than 10% of National Expenditure on Environmental Protection. This means that Cohesion Policy may have a potentially important role, assuming higher or at least similar share are devoted to climate in 2021-2027. However, it is also worth recalling that the analysis highlighted that Cohesion Policy is likely to provide around 2% of the investment gap needed to reach the 2030 EU climate and energy targets.

Therefore, considering the importance of Cohesion Policy for pursuing climate objectives but also its limited budget in comparison to the financing needs for climate investment, programme authorities should be encouraged to pool together resources from multiple sources, public, including Cohesion Policy, and private, to **achieve a critical mass** in investments on climate change mitigation and adaptation. Complementarity and synergies among different EU funds and programmes should be strengthened to avoid double funding and allow to maximise projects efficiency.

Based on the analysis, it is suggested that despite the existing alignment between Cohesion Policy and climate change policy, **a greater effort should be made to mainstream climate change** rather than treating it as a standalone problem (e.g. more focus on strategic objectives and climate proofing), ensuring that projects have a long term impact.

For example, during the 2014-2020 programming cycle, the actions aiming at enhancing the competitiveness of SMEs (Thematic Objective 3) often did not systematically require that energy and material savings were an integral part of enterprises business plans. Moreover, circular economy and energy production and saving were conceived as separate chapters of OP actions (often, there were specific objectives for each of these themes). Instead, there is a strict – and often underestimated – interrelation between energy system and circular economy: circularity could generate a substantial reduction of the energy consumption in all the phases of sectoral productivity processes, including the final uses if a product can be made with a smaller quantity of a specific material, probably also the energy required for its production will be smaller, and certainly the energy required in all its lifecycle - extraction, transportation, and removal of material - will be lesser. Therefore, a greater integration between energy saving and production (with particular attention to energy production from the wastes internal to the production process) and the circular economy should be promoted, also considering that material saving always generate energy saving, whereas energy savings do not necessarily generate material savings.

Sustainability mainstreaming and the “do no harm” principle should be adopted as necessary criteria for financing all Cohesion Policy investments whenever they relate to physical investments or to GHG relevant areas. Even though this is foreseen in the current regulations, supported investments that do not directly relate to climate and sustainability should provide a quantitative estimate of their impact on the European Green Deal Targets, or the (qualitative)

indirect way in which they can contribute to meet them. This aims to effectively broaden the mainstreaming of climate and sustainability matters within all actions to be supported by EU funding.

Applying the EU Taxonomy for sustainable activities¹¹² to the selection of Cohesion Policy operations is an option which is worth exploring (Sweatman and Hessenius 2020). This implies that interventions must substantially contribute to at least one of the six environmental objectives¹¹³ defined in the "Taxonomy Regulation"¹¹⁴, do no significant harm (DNSH) to the other five, and meet some minimum safeguards (e.g., alignment to OECD Guidelines on Multinational Enterprises and the UN Guiding Principles on Business and Human Rights). The EU Taxonomy can be also used to strengthen the current approach to tracking climate related expenditure (see below). The analysis of impacts and costs of phasing out of fossil fuels carried out in this study suggests that **particular attention must be paid to the evolution of sectoral demand, the role of consumer behaviour and how awareness can be raised on the need for caring about climate** (e.g. supporting preferences towards long term lease as opposed to purchases, being informed on the external costs of products, etc.). In this area, R&D investments (TO1 in 2014-2020; PO1 in 2021-2027), in synergy with Horizon 2020/Europe, and with education and training, should stimulate the commercial uptake of "climate friendly" ideas (e.g. energy saving technologies, resource-efficient production, bioenergy; bio-based materials; sustainable construction materials; etc.) and of climate proofed solutions (e.g. resilient critical infrastructures and green infrastructures).

Awareness and engagement are essential to effective mobilisation of relevant stakeholders. Hence a greater effort should be made in establishing and communicating clear targets and objectives to be reached, in the context of the OPs but also, ideally, at a broader level (e.g. regional and sectoral). Sectoral and regional targets should be defined in cooperation with the main actors, allowing for synergies and common efforts to be made in all relevant areas.

To design effective projects, the Managing Authorities of OPs selected on the basis of the relative share of their finance allocated to climate action, who were consulted during the analysis, highlighted that it is necessary to **acquire deeper technical knowledge on climate change**. More attention to administrative capacity building of MAs and Intermediate Bodies (IB)¹¹⁵ is hence essential. This would make them more active actors on the sustainability transitions. Greater technical knowledge on climate and sustainability can be used to better evaluate project proposals and allocate resources more effectively.

This is also essential to ensure that climate adaptation operations are aligned with adaptation strategies determined at European, national, and regional or local level, thus assuring a coherent link between the interventions promoted and the specific climate vulnerabilities and adaptation pathways and priorities of each territory, while also supporting the development of adaptation strategies for territories still not covered by these planning instruments. The use of planning instruments that provide a diagnostic of present and future climate vulnerabilities and propose an

¹¹² The Taxonomy for sustainable activities is a tool to help planning and reporting the transition to an economy that is consistent with the EU's environmental objectives. See: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

¹¹³ The six environmental objectives covered in the Taxonomy Regulation are: climate change mitigation; climate change adaptation; the sustainable use and protection of water and marine resources; the transition to a circular economy; pollution prevention and control; and the protection and restoration of biodiversity and ecosystems.

¹¹⁴ Regulation (EE) 2020/852 of The European Parliament and of The Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088

¹¹⁵ Member States can delegate tasks of the MA to an Intermediate Body (IB). The IB, which can be a public or private body (e.g. local authorities, regional development bodies or non-governmental organisations), performs these tasks under the responsibility of the relevant authority. The MA or the Member State may also designate an intermediate body to manage part of an OP.

adaptation strategy for a specific territory may contribute to reinforce the connection between Cohesion Policy investments and climate action. This would make it possible to distinguish operations that are likely to have a positive impact from those which, in theory, could be considered as climate adaptation (e.g. some infrastructure or urban renewal projects) but in practice are not aligned, do not contribute, or even contradict adaptation strategies.

The analysis of impacts and costs of phasing out of fossil fuels has highlighted that the severity of some of the projected changes in natural resource availability (such as fresh water, clean air) suggests that various adaptation mechanisms will be needed to lessen the effects on population and economic activities exposed to scarcity. Therefore, it is recommended to **follow adaptation strategies aimed at lowering dependency** in the resource-intensive sectors, rather than increasing supply, as this may further increase dependency from the specific resource. For example, more efficient cooling technologies and a more rapid shifts from conventional energy production (fossil fuel or nuclear) to renewable energy production (wind and solar) could reduce cooling water demand and net water consumption with diminished impacts on climate change, especially in southern parts of Europe.

A related issue is energy self-sufficiency as opposed to energy dependency which may expose EU regions and local communities to the unpredictable negative consequences of extreme weather events caused by climate change. Extreme events may simultaneously hamper the supply of power and fuel and drive-up demand. The recent United States energy crisis illustrates well this point. The exceptionally cold weather, which hit large areas of the US in February 2021, caused an electricity shortage in Texas that affected over 4 million households. Such crises could become more frequent as electrification of heating grows as part of clean energy transitions. It is hence important to promote self-sufficient energy production systems instead of relying on large network systems that may become increasingly vulnerable.

It is important to **strengthen place-based approaches** within European diversity, addressing territorial differences with greater horizontality through governance structures and institutions, including those who design policies and the ones implementing specific actions. Greater **synergies between Cohesion Policy and other policies** and instruments should be pursued, facilitating integration and cooperation. For instance, this can be done within the specific support given to the outermost regions, which, in several cases, face relevant challenges resulting from climate change, allowing for a greater fit between instruments and the local characteristics of specific regions.

Mechanisms of support to **cross-border approaches to common climate vulnerabilities can be further facilitated**, in cooperation with national programmes. In this sense, it is essential to assure coherence and additionality between climate action operations over the same territory promoted under national, regional and cross-border OPs, and to explore the potential of cross-border solutions for common climate vulnerabilities. This can be achieved by means of compliance with climate adaptation strategies and through the implementation of concertation mechanisms between OPs and Member States.

Table 10: Key recommendations at policy design stage and actors they are mostly relevant for

	EU level policy makers	National/regional policy makers (Programme Authorities)
Pool together resources from multiple sources to achieve a critical mass in investments on climate change mitigation and adaptation		✓
Make a greater effort to mainstream climate change and promote integration between energy saving and production, and the circular economy	✓	✓
Adopt the “do no harm” principle as necessary financing criterion for all Cohesion Policy investments; apply the EU Taxonomy for sustainable activities to the selection of Cohesion Policy operations	✓	✓
Invest more on awareness raising and behavioural change; make a greater effort in establishing and communicating clear targets and objectives	✓	✓
Acquire deeper technical knowledge on climate change (e.g. more attention to capacity building of Managing Authorities and Intermediate Bodies)		✓
Promote the use of planning instruments that propose an adaptation strategy for a specific territory, and are aligned to EU and national adaptation strategies		✓
Follow adaptation strategies aimed at reducing dependency from natural resources		✓
Reduce energy dependency and promote self-sufficiency	✓	✓
Strengthen place-based approaches and promote synergies between Cohesion Policy and other policies		✓
Further facilitate support mechanisms for cross-border approaches to common climate vulnerabilities	✓	✓

Policy implementation

The EU has already reduced emissions significantly in the last three decades mostly due to the combined effect of Union and national policies for curbing GHG emissions, increased use of renewables, decrease in the use of coal, and improvements in energy efficiency as well as structural changes in the EU economies. Nonetheless, a much greater effort to achieve climate neutrality in the next 30 years is needed, tripling the reduction attained in the past three decades.

As shown in the analysis, most of the Cohesion Policy funds for climate have been allocated to energy efficiency renovation of public infrastructure (16.6% of the total in 2014-2020), followed by adaptation to climate change and risk prevention (11.4%), clean urban transport (9.1%) and energy efficiency of existing housing stock (8.2%).

The spending rate of operations for climate is so far lower compared to the overall Cohesion Policy performance. This may be due to the fact that investments on energy efficiency and renewable sources have a longer implementation cycle.

Cohesion Policy has a potential for making a contribution to GHG emission reduction but achievements in practice are still far from the targets set. For example, the value from selected projects is 66% of the target of annual GHG reduction, while the implemented value (from fully implemented projects) is only 6.3% of the target. The contribution of Cohesion Policy to additional capacity for renewable energy production is modest while the contribution to energy efficiency is uncertain. More positive is the impact of Cohesion Policy in relation to adaptation to extreme weather events. For example, 64% of the target population (16.5 million) was protected from forest fires and 24% from floods.

The fact that there are significant achievements in protection against environmental risk while targets are at risk of being missed in energy efficiency, RES and GHG was also highlighted by a European Court of Auditors report¹¹⁶. It must be noted, though, that there is a significant time gap between selection of energy projects and reporting of achievements and that the bulk of achievements tend to materialise near the end of the programming cycle.

In addition to this, recent European Commission analyses highlight that financial progress is slow due to various well-known reasons: the late start of 2014-2020 programmes, the N+3 rule, and a long implementation cycle¹¹⁷. The European Court of Auditors report mentioned also stresses that the increased flexibility introduced with the COVID-19 crisis may affect Cohesion Policy's capacity to reach the climate objectives set in the OPs.

In this context, it is therefore of utmost importance to **reduce the administrative burden for beneficiaries and managing authorities**. The Managing Authorities consulted agree on this, emphasising that deregulation, flexible instruments, more openness toward experimental action, if coherent with sustainability principles, are needed to ensure smooth and effective implementation. At the same time, it is worth noting that there is a trade-off between increasing simplification and ensuring that funds are focused on delivering EU priorities. This necessarily requires to find an optimal balance between flexibility and restrictions aimed at directing investments on EU objectives.

Continuity of successful 2014-2020 projects in the next programming period is essential to ensure durable impact of climate action. This requires a systematic evaluation of interventions and the possibility to share the best experiences, encouraging the transfer of good practices (see also below, monitoring and evaluation). The adoption of a mix of refundable financial instruments and non-refundable grants could speed up the implementation of projects that experienced delays due to COVID-19.

Simpler and more effective communication of climate objectives to possible beneficiaries and the wider public could increase the attractiveness of Cohesion Policy funding for climate action. Actions aimed at promoting behavioural change are essential to maximize climate actions' effectiveness.

A relevant problem of 2014-2020 Cohesion Policy is that it provides support to fossil fuels (e.g. natural gas infrastructure) and may also support unsustainable uses of biomass, while there is low spending on clean energy infrastructure, efficiency and RES.¹¹⁸ The European Parliament has been a

¹¹⁶ Report of the European Court of Auditors on the performance of the EU budget – Status at the end of 2019.

¹¹⁷ See BRIEFING prepared for the REGI Committee, Climate Spending in EU Cohesion Policy: State of Play and Prospects, December 2020.

¹¹⁸ Climate Action Network (2020), Funding climate and energy transition in the EU: The untapped potential of regional funds. Assessment of the European Regional Development and Cohesion Fund's investments in energy infrastructure 2014-2020.

strong advocate of ‘climate proofing’ of investments, and of promoting the removal of sensible areas (like fossil fuels production, processing, transport, distribution or storage) from the scope of ERDF and CF, as mentioned on its resolution of 27 March 2019.

As regards biomass, it is worth noting that the process of oxidation of these energy sources is natural and unavoidable, unlike combustion of fossil fuels. However, the use of biomass that is a waste material of existing production processes should be distinguished from unsustainable uses of biomass. The latter may consist, for example, of biomass produced on purpose to power conventional combustion engines, or of acceleration of the natural oxidation process. Promoting an unsustainable use of biomass should be avoided, as it not only clashes with the objective of carbon neutrality but also increases air pollutants that are dangerous for human health (e.g. particulate matter, nitrogen oxides and sulphur dioxide) and, moreover, may subtract arable soil to food and feed production.

Therefore, it is essential to **make sure that the potential positive impacts of climate action are not neutralised by the investments in other policy areas** which are eligible under Cohesion Policy. The best way to ensure a balance is to promote the development of local plans aimed at identifying the most appropriate energy mix for satisfying the demand of the local community, that takes into account availability of energy sources, including waste.

For example, **Sustainable Energy and Climate Action Plans (SECAP)**, or similar tools could be a prerequisite for using funds, an option which is not explicitly considered in the proposed Regulations. SECAP are important for identifying eligible territories, to ensure choosing the right renewable/low carbon energy mix and the integration of mitigation and adaptation measures.

Energy Flow Analysis (EFA) and Material Flow Analysis (MFA) can be also useful to correctly identify the most favourable energy mix and material mix at regional/local area investment planning, and Life Cycle Assessment (LCA) at SMEs planning level. The evaluation of impacts of raw materials and water are of great importance also for adaption measures. These analyses, which can enhance the effectiveness of energy planning, are not explicitly considered in the proposed Regulations but some Operational Programmes in 2014-2020 adopted them as selection criteria of specific actions for sustainable development of SMEs. It is also important to **prioritise innovation and technological development in key strategic areas for climate** (GHG emissions and adaptation) and sustainability (biodiversity protection). This may allow innovation deficits to be overcome and help to focus investment on areas that face greater challenges in the sustainability transition. As regards specifically the implementation of adaptation measures, it is recommended to invest in innovation and technology to improve the accuracy of forecasts and warning time, readiness, emergency communications and responses to all the extreme events and their consequences (flood, windstorm, forest fire, etc.). This is in line with the principles of the new EU Adaptation Strategy.¹¹⁹

A greater concentration of investments in specific areas or districts in which energy demand is high is desirable. However, in 2014-2020, isolated projects aimed at energy production and saving in enterprises, buildings, etc. have often been financed. This is relevant for selection and also for monitoring of operations.

Scalable or transferable actions with a high possibility of replication throughout Europe should also be prioritised. This aims to stimulate the adoption and spreading of good practices as

¹¹⁹ COM(2021) 82 final.

well as to share experience on existing approaches, increasing the chances of success when applied in other regions with similar conditions.

Complementary measures such as those promoting energy managers, Energy Service Companies (ESCOs) etc. are important to ensure a better performance of energy operations financed under 2021-2027 OPs (e.g. in terms of the choice of the right energy mix, equilibrium between local energy production and demand, integration of energy production with smart grid, involvement of diversified stakeholders, both from public and private sectors, including micro-enterprises).

Often, in 2014-2020 calls for tender, the possibility of achieving multiple climate-related goals simultaneously was not explicitly pursued, while there was a focus on individual intervention fields.

A more integrated approach to climate action should be pursued. For maximising the effectiveness of climate change investments, it would be important to address all the aspects that can enhance resilience (e.g.: for an enterprise it is important to plan energy and material saving simultaneously and to treat them both as economic savings; building efficiency often requires deep renovation intervention that can be optimised by integrating them with interventions for water or seismic efficiency).

It is also recommended to **exploit the joint mitigation and adaptation potential of industrial investments** by means of a wide use of the intervention fields on circularity, that can ensure broad benefits in a resilient - and not just carbon neutral - energy transition (relevant intervention fields are: 017, 018, 019, 023, 065, 068, 069, 070, 071 in 2014-2020; 022, 027, 045, 047 in 2021-2027).

A value chain approach to climate action could be also pursued. This requires focusing on industrial districts and, where feasible, on the integration between them and rural districts, in relation to demand and supply of raw and secondary materials and energy. For example, the waste of rural districts – biomass, manure – could be used as a renewable source in the neighbouring industrial or urban districts and Cohesion Policy could support this.

Several Digital Agenda instruments (e.g. ITS - Intelligent Transport Systems, material recycling tracking, resource mapping and other in the context of smart cities) can be promoted to ensure the shortening of the chain between generation and consumption of energy, materials and products, with particular attention to the integration of reduction in the use of water in the energy and materials flow accounts.

Table 11: Key recommendations at policy implementation stage and actors they are mostly relevant for

	EU level policy makers	National/regional policy makers (Programme Authorities)
Reduce the administrative burden for beneficiaries and managing authorities	✓	
Consider keep on financing successful 2014-2020 projects in 2021-2027 to ensure durable impact of climate action.		✓
More effective communication of climate objectives to potential beneficiaries and the wider public to increase the attractiveness of Cohesion Policy funding for climate action.	✓	✓

	EU level policy makers	National/regional policy makers (Programme Authorities)
Finance actions aimed at promoting behavioural change that are essential to maximize climate actions' effectiveness.		✓
Make sure that the potential positive impacts of climate action are not neutralised by the investments in other policy areas which are eligible under Cohesion Policy	✓	✓
Make Sustainable Energy and Climate Action Plans (SECAP) a prerequisite for using Cohesion Policy funds.	✓	✓
Use Energy Flow Analysis (EFA) and Material Flow Analysis (MFA) to identify the most favourable energy mix in regional/local planning.		✓
Invest in research and innovation concerning climate change. As regards adaptation measures, invest in technology development aimed at improving the forecast accuracy and responses to extreme events.		✓
Promote a greater concentration of investments in areas or districts in which energy demand is high rather than isolated projects		✓
Prioritise scalable or transferable actions with a high possibility of replication throughout Europe.	✓	
Promote a more integrated approach to climate action; all the aspects that can enhance resilience should be addressed simultaneously		✓
Exploit the joint mitigation and adaptation potential of industrial investments by means of a broader use of the intervention fields on circularity.		✓
Pursue a value chain approach to climate action. For example, the waste of rural urban districts could be used as a renewable source in the neighbouring industrial or urban areas.		✓

Monitoring and evaluation

The current approach to tracking climate related expenditure, which was used also in this study to estimate the amounts of Cohesion Policy planned for climate action, has strengths and weaknesses. The main advantages of this method are simplicity and applicability. On the other hand, it may overestimate the actual climate related expenditure because it is based on planned amounts. Moreover, the tracking methodology assumes that a certain intervention contributes towards climate objectives, regardless of whether climate change is a stated objective of the expenditure or

not¹²⁰. The European Commission draws upon the Rio Markers¹²¹ approach to measure its climate-relevant spending and provide statistical reports to the OECD-DAC, however, in practice, the Cohesion Policy method for tracking climate related expenditure differs from the OECD recommendations which require that, in order to qualify for a certain scoring, the objective (climate change mitigation, climate change adaptation etc.) must be explicitly stated as fundamental in the design of, or the motivation for, the assessed action. The mentioned European Court of Auditors work, as well as Nesbit et al. (2020), underline that the labelling of expenditure as climate relevant is likely to have been over-generous in several areas. To overcome this problem, some suggest netting off the EU funding by compensating for any investments with a negative climate impact with additional climate-related spending (European Court of Auditors 2020). However, mechanisms to reflect the net impact of expenditure, by deducting expenditure shown to have negative climate or biodiversity impacts, would be difficult to implement (Nesbit et al. 2020). On the contrary, there is a stronger case for further legislative and other measures to avoid such expenditure being made.

Consequently, it is recommended to further explore viable options to **improve the tracking system, for example, by including only amounts allocated to programmes/interventions that have clear, verifiable, and quantified targets for the achievement of climate objectives**. A clear differentiation between climate change mitigation and adaptation objectives should be also made.

Applying the EU Taxonomy of sustainable activities to strengthen Cohesion Policy tracking of climate related expenditure can be an option. According to the Taxonomy Regulation, an investment can be considered climate relevant if: it is eligible under the Regulation or, in other words, fits a NACE macro-sector category; it makes a significant contribution to climate objectives because it exceeds the recommended thresholds¹²²; it does not do significant harm (i.e. it does not harm the environmental objectives defined in the Regulation); and complies with minimum social and governance safeguards set out in Taxonomy Regulation.

The system of Cohesion Policy indicators also has shortcomings with respect to effectively monitoring climate action. According to MAs, indicators reflecting real impact and durability of projects' outcomes should be used, while clear and **rigorous methodological guidelines for quantifying common performance indicators** should be provided to ensure comparability across projects and interventions. It is also of the utmost importance to provide clear guidelines on setting targets, to avoid each administration using a different approach, thereby making the outcomes incomparable, or that targets are either overestimated or underestimated, making them meaningless. Furthermore, output indicators should be revised on the basis of the evidence collected over the current funding period.

It is important to design a set of **common indicators that cover a greater variety of climate risks** – covering at least forest fires, river floods, coastal floods, landslides, droughts and heat waves – allowing a more precise monitoring of adaptation projects. Although the new set of common indicators included in the proposal for a regulation on the ERDF and the Cohesion Fund are a clear advance in qualitative terms compared to the previous programming period – in the sense that they

¹²⁰ Nesbith, Stainforth et al. (2020), Documenting climate mainstreaming in the EU budget.

¹²¹ The OECD Development Assistance Committee (DAC) set up the Rio markers system in 1998. This consists of policy markers to monitor and statistically report on the development finance flows targeting the themes of the Rio Conventions (signed at the "Earth Summit" in 1992). There are three possible scores for the Rio markers, indicating whether the Rio Convention themes are: (0) not targeted, (1) a significant objective or (2) a principal objective of the action. The values are assigned according to the extent to which the themes are explicitly addressed at the level of problem analysis, objectives and activities. The OECD-DAC guidance sets out the criteria used to define whether an action addresses any of these themes as a significant or main objective, and provides examples of typical activities. For more information see: [https://www.oecd.org/dac/stats/DCD-DAC\(2016\)3-ADD2-FINAL%20-ENG.pdf](https://www.oecd.org/dac/stats/DCD-DAC(2016)3-ADD2-FINAL%20-ENG.pdf)

¹²² Defined in the technical annex to the Technical Expert Group's (TEG) final report on EU Taxonomy 9th March 2020: https://ec.europa.eu/info/files/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en

are more comprehensive - they are still unable to differentiate outputs and results in adaptation to specific climate risks, other than floods and forest fires (e.g.: 'RCO¹²³ 25 - Coastal strip, river banks and lakeshores, and landslide protection newly built or consolidated to protect people, assets and the natural environment'; 'RCO 26 - Green infrastructure built for adaptation to climate change'; 'RCR¹²⁴ 37 - Population benefiting from protection measures against climate related natural disasters other than floods and forest fires').

It is equally essential to **improve the quality of the common indicators monitoring mitigation action and the methodology to estimate carbon content of each action**, ensuring that a baseline is established, and that the measurement of carbon savings reflects the actual impact of the Cohesion Policy funded projects, i.e., additional to savings associated with the "business-as-usual" trends. For example, result indicators such as 'RCR 26 - Annual final energy consumption', 'RCR 27 - Households with improved energy performance of their dwellings', 'RCR 28 - Buildings with improved energy classification', 'RCR 29 - Estimated greenhouse gas emissions' or 'RCR 30 - Enterprises with improved energy performance' (presented in Annex I to the proposal for a regulation on the ERDF and the Cohesion Fund) in themselves are not able to quantify how much of that result is an actual achievement of the supported operations. In these cases, the evaluation of these results will need to be primarily based on case studies, for a sample of projects, in order to estimate the value-added of Cohesion Policy.

As sustainability transitions demand action throughout all society, all actors should have the chance to access funding, regardless of their size, activity area, and formal capacity, as long as the funding is to be invested in relevant climate and sustainability areas. Effective access to funding should also be granted within suitable timeframes, and monitoring and evaluation exercises should address this matter to optimise it in the future. This suggests the importance of maintaining high standards of responsibility with a clearer and simpler approach to audit procedures, allowing for applications for funding to be more attractive and accessible for all stakeholders.

Finally, to ensure the success of climate action financed by Cohesion Policy, it is fundamental to **evaluate, within suitable timeframes, the contribution of supported investments towards reaching the 2030 and 2050 targets as well as towards regional and national climate strategies goals**. Evaluation is an essential dimension of European Structural and Investment Funds. Climate action and sustainability measures require timely and effective monitoring and assessments. There is a need to understand if the predicted impacts are really happening or if further investments or corrections are needed, assuring that no time is lost, given the time-proximity of the targets to be achieved. Projects should also undergo regular revision and evaluation to keep up with a constantly changing world. This would allow, as previously highlighted, the identification of successful initiatives and sharing of best practices across the EU. In this respect, a comprehensive assessment of the measures already implemented should be encouraged in order to improve the design and planning of 2021-2027 interventions. It is worth noting that monitoring and evaluation of climate action may suffer from: limited and unreliable data on sustainability of interventions, territorial impacts and long-term effects on climate change, that reduce the ability to create quantifying indicators; limited scale of investment, which may represent an obstacle to properly evaluate the impact of policy intervention. These issues should be properly considered in the evaluation plans of each OP.

¹²³ RCO: regional policy common output indicator.

¹²⁴ RCR: regional policy common result indicator.

Table 12: Key recommendations at monitoring and evaluation stage and actors they are mostly relevant for

	EU level policy makers	National/regional policy makers (Programme Authorities)
Improve the tracking system of the climate related expenditure by including only amounts that have clear, verifiable, and quantified climate objectives.	✓	
Apply the EU Taxonomy of sustainable activities to strengthen Cohesion Policy climate tracking	✓	
Provide clear and rigorous methodological guidelines for quantifying common performance indicators and setting targets coherently across programmes and interventions.	✓	
Strengthen the set of indicators concerning climate risks to allow a more precise monitoring of adaptation interventions.	✓	✓
Improve the quality of the common indicators concerning climate change mitigation and the methodology to estimate carbon content of each action, ensuring that a baseline is set	✓	
Carry out evaluations, at suitable timeframes, of the contribution of supported investments towards reaching the 2030 and 2050 targets as well as regional and national goals.	✓	✓

REFERENCES

- Cameron, A., Claeyes, G., Midões C., Tagliapietra, S. (2020). *A Just Transition Fund - How the EU budget can best assist in the necessary transition from fossil fuels to sustainable energy. Study Requested by the BUDG Committee of the European Parliament*. PE 651.444 - April 2020.
- Claeyes, G., Fredriksson, G., & Zachmann, G. (2018). *The Distributional Effects of Climate Policies* (No. 28; Blueprint Series, p. 110). Bruegel.
- Claeyes, G., Tagliapietra, S. and Bruegel (2020). *A trillion reasons to scrutinise the Green Deal Investment Plan*. Bruegel 15 January 2020.
- Claeyes, G., Tagliapietra, S., Zachmann, G. (2019). *How to make the European Green Deal work*. Bruegel 5 November 2019.
- Climate Action Network (2020), *Funding climate and energy transition in the EU: The untapped potential of regional funds. Assessment of the European Regional Development and Cohesion Fund's investments in energy infrastructure 2014-2020*.
- D'Alfonso A. (2020). *European Green Deal Investment Plan. Main elements and possible impact of the coronavirus pandemic*. EPRS | European Parliamentary Research Service. Members' Research Service. PE 649.371 – April 2020
- ENTSO-E, European Network of Transmission System Operators (2020), *TYNDP 2020 Scenario Report*
- European Climate Initiative EUKI (2019). *Climate Change and the EU Budget 2021-2027, A Multiannual Financial Framework (MFF) for the Climate Project*
- European Commission - Directorate-General for Energy, Directorate-General for Climate Action and Directorate-General for Mobility and Transport (2016). *EU Reference Scenario 2016. Energy, transport and GHG emissions - Trends to 2050*
- European Commission - Directorate-General for Research and Innovation (2018). *FINAL REPORT of the High-Level Panel of the European Decarbonisation Pathways Initiative*.
- European Commission (2017). *Climate mainstreaming in the EU Budget: preparing for the next MFF - Final report*. ISBN 978-92-79-73510-3. doi:10.2834/218038. ML-04-17-844-EN-N
- European Commission (2019a). *Annex to the Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the regions, the European Green Deal*, Brussels, 11.12.2019 COM(2019) 640 final
- European Commission (2019b). *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the regions, the European Green Deal*, Brussels, 11.12.2019 COM(2019) 640 final
- European Commission (2019c). *Explanatory Memo: European Urban Initiative – Post 2020, Article 104(5) CPR Proposal and Article 10 ERDF/CF Proposal*
- European Commission (2020a). *Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Kick-starting the journey towards a climate-neutral Europe by 2050 EU Climate Action Progress Report 2020*. COM/2020/777 final

- European Commission (2020b). *Report on a toolkit for national and regional decision-makers, Supporting sustainability transitions under the European Green Deal with cohesion policy.*
- European Commission (2020c). *Supporting sustainability transitions under the European Green Deal with cohesion policy, Toolkit for national and regional decision-makers.*
- European Commission - Directorate-General for Research Sustainable Energy Systems (2006). *European SmartGrids Technology Platform.*
- European Commission (2020). *Amended proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the Just Transition Fund.* (COM2020) 460 final.
- European Commission (2020), *Commission Staff Working Document SWD(2020) 176 final. Impact Assessment 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: Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people".*
- European Commission (2020), *Commission Staff Working Document, SWD(2020) 100 final. Leading the way to a global circular economy: state of play and outlook.*
- European Commission (2020), *Study on energy costs, taxes and the impact of government interventions on investments.*
- European Commission (2021), *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change, Brussels, 24.2.2021.*
- European Council (2020). *European Council conclusions on the recovery plan and multiannual financial framework for 2021-2027.* 17-21 July 2020.
- European Court of Auditors (2016), *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, Special report No 31 2016.*
- European Court of Auditors (2019), *report on the performance of the EU budget - status at the end of 2019.*
- European Court of Auditors (2020), *Tracking climate spending in the EU budget, review No1 2020.*
- European Environment Agency (2017). *Climate change, impacts and vulnerability in Europe 2016 - An indicator-based report.* 419 pp. ISBN 978-92-9213-835-6. doi:10.2800/534806ef.
- European Environment Agency (2020a). *Trends and projections in Europe 2020 - Tracking progress towards Europe's climate and energy targets.* 57 pp. ISBN 978-92-9480-287-3. doi:10.2800/830157.
- European Environment Agency (2020b). *Trends and drivers of EU greenhouse gas emissions.* 27 pp. ISBN 978-92-9480-224-8. doi:10.2800/19800.
- European Parliament (2020). *BRIEFING Prepared for the REGI Committee, Climate Spending in EU Cohesion Policy: State of Play and Prospects.*
- European Parliament (2019). *Legislative resolution of 27 March 2019 on the proposal for a regulation of the European Parliament and of the Council laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund,*

and the European Maritime and Fisheries Fund (COM(2018)0375 – C8-0230/2018 – 2018/0196(COD)).

- Feyen L., Ciscar J.C., Gosling S., Ibarreta D., Soria A. (editors) (2020). *Climate change impacts and adaptation in Europe. JRC PESETA IV final report*. EUR 30180EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-18123-1, doi:10.2760/171121, JRC119178.
- High-Level Commission on Carbon Prices (2017). *Report of the High-Level Commission on Carbon Prices*.
- Intelligent Energy Agency – IEA (2020), *European Union 2020. Energy Policy Review*.
- IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
- IPCC (2018). *Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.
- IRENA (2020), *Renewable Energy and Jobs – Annual Review 2020*.
- JRC (2018), *Cost development of low carbon energy technologies*.
- JRC (2017), *Cost development of low carbon energy technologies*.
- JRC (2017), *Assessment framework for projects of common interest in the field of smart grids*
- JRC (2017), *Energy Service Companies in the EU. Status review and recommendations for further market development with a focus on Energy Performance Contracting*.
- Nesbit M., Paquel K., Illes A., (2017). *Research for REGI Committee – Cohesion policy and Paris Agreement Targets*, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels.
- Nesbit M., Thorfinn S., Hart K., Underwood E. and Becerra G. (2020), *STUDY Requested by the BUDG committee, Documenting climate mainstreaming in the EU budget making the system more transparent, stringent and comprehensive*.
- Sweatman, P. and Hessenius, M. (2020), *Applying the EU Taxonomy: Lessons from the Front Line, Paper jointly prepared by Climate Strategy and Partners and Climate & Company*. United Nations Environment Programme (2020). *Emissions Gap Report 2020*. Nairobi. ISBN: 978-92-807-3812-4. Job number: DEW/2310/NA.
- World Health Organization (WHO) Regional Office for Europe (2015), *Economic Cost of the Health Impact of Air Pollution in Europe*.
- World Meteorological Organization (2019). *The Global Climate in 2015–2019*. https://library.wmo.int/doc_num.php?explnum_id=9936.

This study provides an assessment of how EU Cohesion Policy currently contributes and can contribute in the future to the attainment of the goals of EU Climate Policy. It explains how much of the budget goes to climate action and to what kind of initiatives across EU regions. It also discusses the obligations from the Paris Agreement, the role of Cohesion Policy within the European Green Deal and the impact of phasing out fossil fuels. Policy recommendations for strengthening climate action financed by Cohesion Policy are set out.
