

CES DOCUMENTS

Socio-economic and employment impacts of climate change



CONSEJO ECONÓMICO
Y SOCIAL ESPAÑA

NUMBER 01|2024

DOCUMENTS COLLECTION

DOCUMENT 01|2024

Socio-economic and employment impacts of climate change

In 2023, the effects of climate change were clearly and closely felt. It was the warmest year in Spain since records have been kept and also one of the driest. With an average temperature of 15.2 °C –1.3 degrees above the average of the last thirty years–, and an average rainfall of 536.6 mm in the peninsular territory, –84 % lower–, 2023 was once again a year of thermal anomalies. The incidence of this type of anomaly has been increasing in frequency and intensity since the early 2000s, making evident the advance of climate change in Spain.

The effects of climate change affect the economy at large, jobs and working people, and quality of life and well-being, highlighting the need to increase ambition and accelerate the fight against climate change and to match mitigation strategies with adaptation strategies, which must be accompanied by compensation measures with an equity perspective.

Until recently, the debate has revolved around the speed of the transition to address the climate challenge and minimise economic, employment and social risks. Today, however, there seems to be a broad consensus on the need to accelerate the transition, and the current debate focuses on how to achieve it in a rapid, orderly and just manner.

CONSEJO ECONÓMICO Y SOCIAL **ESPAÑA**
PUBLICATIONS DEPARTMENT
NICES: 871-2024

Socio-economic and employment impacts of climate change

Main theme included in the Report on the Socio-economic and Employment Situation in Spain, 2023
www.ces.es



CONSEJO ECONÓMICO
Y SOCIAL ESPAÑA

INDEX

ECONOMIC IMPACTS OF CLIMATE CHANGE	5
1. Direct impact of climate risks	8
2. Commitments, strategies and public policies	10
3. Macroeconomic impact of climate change	13
4. Impact on productive sectors in Spain	16
4.1. Sectors most vulnerable to the physical risks of climate change	17
4.2. Sectors most affected by the decarbonisation challenge	25
4.3. Key sectors in the fight against climate change	32
CLIMATE CHANGE AND EMPLOYMENT	41
1. Employment impacts of climate change	43
1.1. Direct impact	44
1.2. Impact of ecological transition	46
2. PAE and green transition, the key role of skills	56
3. The role of social dialogue and collective bargaining	60
SOCIAL IMPACT OF CLIMATE CHANGE: ADDRESSING TRANSITION WITHOUT DEEPENING INEQUALITIES	75
1. Climate change and the right to a healthy environment	77
2. Climate impact and social risks in Spain	82
3. Impacts on health and health system	85
4. Sustainable urban planning and housing: problems and emerging inequalities	89
4.1. Making cities resilient to climate change: the role of the urban agenda	92
4.2. Housing, energy poverty and climate change	97
5. Social impact in rural areas: a particularly at-risk environment	99
6. Sustainable consumption and lifestyles	100
7. Gender impact of climate change	103

ECONOMIC IMPACTS OF CLIMATE CHANGE

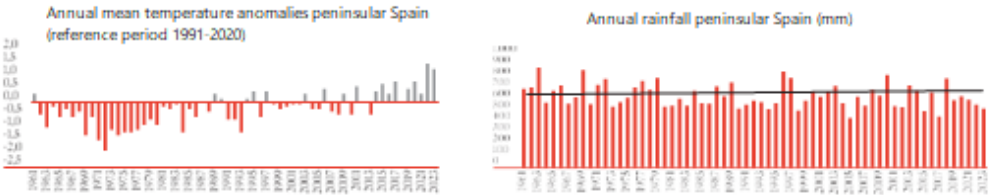
In 2023, the effects of climate change were clearly and closely felt. It was the warmest year in Spain since records have been kept and also one of the driest.

With an average temperature of 15.2 °C –1.3 degrees above the average of the last thirty years–, and an average rainfall of 536.6 mm in the peninsular territory, –84 % lower–, 2023 was once again a year of thermal anomalies (Figure 1) The incidence of this type of anomaly has been increasing in frequency and intensity since the early 2000s, making evident the advance of climate change in Spain. Heat waves are recurring, with high temperatures and worsening droughts, impacting people's health, damaging agricultural yields and increasing the likelihood of forest fires.

But the effects of climate change are spreading and spreading further, affecting the wider economy, working people and quality of life and well-being, highlighting the need to increase ambition and accelerate the fight against climate change and to match mitigation strategies with adaptation strategies.

Until recently, the debate has revolved around the speed of the transition to address the climate challenge and minimise economic, employment and social risks. Today, however, there seems to be a broad consensus on the need to accelerate the transition, and the current debate focuses on how to achieve it in a rapid, orderly and just manner.

FIGURE 1. THERMAL ANOMALIES IN SPAIN AND ANNUAL RAINFALLS



Source: AEMET, *Avance climático 2023*.

1. Direct impact of climate risks

The high temperatures reached in 2023 were widespread globally. Between February 2023 and January 2024, the global average temperature exceeded pre-industrial levels by 1.5°C¹, adding evidence to the global warming trend that has been underway since the mid-20th century and is unequivocally linked to human activity, namely greenhouse gas emissions².

Climate and environmental risks have been considered to have the greatest impact and probability in recent *World Economic Forum (WEF) Global Risks Reports*, ahead of others of a geopolitical, technological, demographic or economic nature. In its latest report³, the WEF indicates that the possibility of reaching a point of no return in the fight against climate change seems likely in the next decade and adds that economies remain unprepared, especially for the “non-linear” impacts of possible acceleration of global warming, which increases the magnitude of the effects and the need for infrastructure investment.

The European Environment Agency⁴ has recently expressed its views in this sense, stressing that the European continent is facing an accelerated warming process with very heterogeneous impacts per country, some affected by extreme precipitation and catastrophic floods and others by a considerable reduction in precipitation and more severe droughts, as is the case of the countries of southern Europe. In the latter region, climate warming is already having an impact on agricultural production, energy production, outdoor work, summer tourism and the propensity for more forest fires. Its main conclusion is that Europe is unprepared for rapidly growing climate risks, which are increasing faster than our preparedness as a society. The report makes it clear that Europe is the fastest warming continent, but Spain is among the most affected EU countries. It is therefore exposed to serious climate risks with multiplying and cascading effects.

For example, Spain is identified⁵ as the Member State most affected by water scarcity, indicating that around half of the population is exposed to this risk and estimating the losses generated by drought at around 1.5 billion euros per year; and this without taking into account other environmental impacts

1 European Environment Agency, *European climate risk assessment* (EUCRA Report 01/2024). These temperatures call into question the fulfilment of the main objective of the Paris Agreement: to keep the global average temperature increase by 2030 below 2°C, and aim to limit it to 1.5°C compared to the pre-industrial period.

2 IPCC Sixth Assessment Report.

3 WEF, *Global Risks Report 2024*, 10 January 2024.

4 European Environment Agency, *op.cit.*

5 Feyen L., Ciscar J. C., Gosling S., Ibarreta D., Soria A. (ed.) (2020). *Climate change impacts and adaptation in Europe. JRC PESETA IV final report.*

that are difficult to calculate. This drought situation affecting several areas of the national territory also has serious repercussions on the economic sectors, and it is necessary to deploy all the economic resources foreseen in the hydrological plans. Analyses of the impact of climate change in different scenarios⁶ (Box 1) reveal the cost that would have to be faced in each scenario and raise the need to reduce it through adaptation and mitigation policies. As far as the European Union is concerned, the Commission comes to four main conclusions: 1) EU ecosystems, people and economies will face major impacts caused by climate change, 2) the effect of climate change has a significant north-south divide in the EU, with southern regions being the most affected, 3) climate change mitigation can limit impacts and, 4) adaptation to climate change can reduce unavoidable impacts in a cost-efficient manner.

BOX 1. DIRECT IMPACTS OF CLIMATE CHANGE

Heat and cold waves: In the absence of mitigation measures, the intensification of these processes could increase dramatically. If a temperature increase of 1.5°C is reached, 100 million Europeans will be exposed to intense heat waves annually, while if 3°C is reached, 300 million people will potentially be affected annually.

Storms: Projected annual loss for EU and UK estimated at around 5 billion euros, may increase to 11 billion euros by 2100 due to the increasing value of affected assets.

Droughts: The impacts generated affect multiple sectors of the economy, including crop failures, reduced energy supply or transport disruptions. With climate change, these effects will increase in frequency and intensity, especially in countries in the south and west of the European Union, which already suffer from water stress.

Water resources: Demand for water in excess of availability that could be reduced by up to 40 per cent in southern European regions is leading to a growing imbalance in the resource, and may result in the deterioration of inland and coastal aquatic ecosystems, affecting 65 million people each year if a temperature rise of 3°C is reached. Adaptation strategies become important.

River flooding: Global warming, together with the increase in flood plains, will intensify future losses from river flooding, which in the absence of mitigation and adaptation measures could increase by up to 6 times. Around half a million people per year will be exposed to this impact by 2100.

Coastal flooding: Sea levels could rise up to 1 m in extreme cases by the end of the 21st century in coastal areas (up to 50 km from the coastline), where a third of

6 Feyen, L. *et al.* (2020), *op. cit.*

BOX 1. DIRECT IMPACTS OF CLIMATE CHANGE (*continued*)

Europe's population lives. Together with the retreat of the coastline, there will be changes in the sediment and erosion regime, with effects on coastal ecosystems (sandy areas, deltas, estuaries, etc.), infrastructures and buildings. In the absence of measures, these impacts could lead to an increase in damages from the current 1.4 billion euros to 240 billion euros by 2100.

Forest fires: Increased incidence in terms of intensity and frequency of forest fires. The impact will be greater in southern European countries, where the composition of vegetation formations, which are progressively more vulnerable to these phenomena, could change. Forest ecosystems cover about one third of Europe's territory and are home to some 15 million people; they are becoming increasingly fragile, especially in northern and southern Europe, where defence mechanisms have been reduced and vulnerability to pest attack has increased due to higher temperatures and reduced rainfall.

Fauna, flora and natural heritage features: climate change will cause phenological and ethological changes, including decoupling in the biological rhythms of interdependent species. Changes in external geodynamic processes, which may directly affect geological heritage features. In addition, shifts in the ranges of terrestrial and aquatic plant and animal species to better adapted habitats may occur. These dynamics induce movements along food chains, with a particular impact on marine food chains.

Expansion of invasive alien species: Colonisation of the territory by new species or extension of the distribution area of existing species. Among other effects, they cause an increase in the distribution area of disease transmission vectors and loss of stability of native species.

Source: drawn up from European Commission, Joint Research Centre. *Projection of Economic impacts of climate change in Sectors of the UE based on bottom-up Analysis (PESETA IV) – Project Summary Infographic* (2 February 2022) and Plan Nacional de Adaptación al Cambio Climático.

2. Commitments, strategies and public policies

In this context, international, European and national commitments on energy and climate are multiplying, both from institutions and the private sector. Thus, the European Union, even though it accounts for only 7.5% of global CO₂ emissions, is determined to lead global climate action. In December 2019, it presented the *Green Deal* or *Pacto Verde Europeo*⁷ which sets out the roadmap for Europe to become the world's first carbon neutral continent by 2050. In April 2021, the European Climate Act⁸, was adopted, which commits politically and legislatively to this goal, and in July 2021

⁷ *The European Green Pact, COM (2019) 640 final.*

⁸ Regulation (EU) 2021/1119 of 30 June 2021 establishing the framework for achieving climate neutrality, and amending Regulations (EC) No 401/2009 and (EU) 2018/1999.

the Fit for 55⁹, for achieving climate neutrality by 2050. The latter was modified shortly afterwards by the REPowerEU Plan in response to the change of scenario brought about by the Russian invasion of Ukraine and its effects on the energy markets, which de facto meant an acceleration in the targets for renewable energy penetration.

Taking the European framework as a reference, the current Spanish strategy has as its main reference the Strategic Energy and Climate Framework, which is made up of the National Integrated Energy and Climate Plan (PNIEC) 2021-2030, the National Plan for Adaptation to Climate Change (PNACC) 2021-2030, the Just Transition Strategy and Law 7/2021 of 20 May on climate change and energy transition, together with the Long-Term Decarbonisation Strategy, and responds to the commitment to decarbonise the economy, with the aim of achieving climate neutrality by 2050. This package of structural measures is underpinned by various initiatives of a strategic nature, aimed at identifying challenges and opportunities in different sectoral and technological fields¹⁰.

Given the need to better meet the 2030 targets in line with the aforementioned European requirements¹¹, it has been necessary to review and update the PNIEC, whose 2023-2030 draft includes more demanding targets in terms of emissions reduction, based on the promotion of renewables in the energy mix, electrification and increased renewable electricity generation, the incorporation of green hydrogen in industry, and the reduction of intensity or improvement of energy efficiency (Table 1), which is expected to reduce energy dependence to 49% in 2030.

The European Commission published in 2023 its assessment of the updated PNIECs by Member States (MS); it analyses national contributions and ambition gaps towards the EU target of at least 42.5 per cent renewable energy consumption, where Spain, together with 6 other MS, is in line or above the expected contribution, with the rest of the 20 countries below¹².

9 *“Target 55”: meeting the European Union’s 2030 climate target on the road to climate neutrality, COM (2021) 550 final.*

10 Roadmaps for Self-consumption, Renewable Hydrogen, Biogas, for the development of Offshore Wind and Offshore Energies in Spain, for the sustainable management of Mineral Raw Materials; Energy Storage Strategy, Electric Energy Transmission Grid 2026 planning, Strategy against Energy Poverty, Recovery, Transformation and Resilience Plan and associated Strategic Plans (MITECO, Strategic Framework for Energy and Climate).

11 *EU-wide assessment of updated draft integrated national energy and climate plans. An important step towards more ambitious energy and climate targets for 2030 in the framework of the European Green Pact and REPowerEU, COM (2023) 796 final.*

12 European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, EU-wide assessment of updated draft integrated national energy and climate plans. *An important step towards more ambitious energy and climate targets for 2030 under the European Green Pact and REPowerEU, COM (2023) 796 final.*

TABLE 1. PNIEC OBJECTIVES, 2023-2030

Objectives TO 2030	PNIEC 2021-2030	PNIEC 2023-2030
Reduction of GHG emissions (% compared to 1990)	23	32
Renewables (% of final energy use)	42	48
Energy efficiency (% of final energy)	39.5	44
Renewables in electricity generation (%)	74	81
Reduction of energy dependence (%)	61	51

Source: Draft update of the PNIEC (2023-2030) (MITECO, June 2023. Allegations received until 4/09/23).

Among the instruments for achieving these objectives is the Recovery, Transformation and Resilience Plan (PRTR), which allocates 163 billion euros to ecological transition, half of which (82,583 billion) contributes to the climate objectives of mitigation and energy transition, with just over 30 percent of the budget having been executed by October 2023 with a climate contribution (Table 2). The Addendum to the PRTR, which provides Spain with an additional 93,5 billion euros, includes

TABLE 2. PROGRAMMED AND EXECUTED BUDGET OF STRATEGIC OBJECTIVES WITH CLIMATE CONTRIBUTION IN PRTR (INCLUDING ADDENDUM)

Strategic objectives		Budget programmed (Millions of €)	Budget executed (Millions of € and %)			
Strategic objectives	Ecological transition axes					
	Strategic autonomy: REpower	1. Biodiversity and ecosystems	Nature conservation	1,649	1,400	84.9
			Water management	9,100	2,144	23.6
			Adaptation to climate change	0,958	0,240	25.1
	2. Climate change mitigation and energy transition		Energy efficiency	25,589	6,560	25.6
			Sustainable mobility	14,659	5,489	37.4
			Renewable energy	9,569	3,014	31.5
			Storage	2,140	1,206	56.4
	3. Combating pollution waste management and circular economy		Pollution reduction	3,014	2,232	74.1
			Waste management and circular economy	4,950	791	16.0
Territory	Transversal axes					
		Green employment	378	704	186.2	
		Green research	9,192	894	9.7	
		Sustainable production systems	1,386	463	33.4	
Total			82,584	25,138	30.4	

Source: MITECO, Ecological Transition in the PRTR. Implementation Report, December 2023

7 billion euros in funding, of which nearly 4,200 billion euros will be allocated to the Renewable Energy, Renewable Hydrogen and Energy Storage PERTE (ERHA), whose actions will provide continuity to projects to promote self-consumption and storage in the productive and household sectors, or to strengthen and develop energy communities.

3. Macroeconomic impact of climate change

Climate change, both because of the physical risks it entails if no decisive action is taken, and because of the transition risks arising from the necessary adaptation and transformation of the production model, is currently a huge challenge in the macroeconomic sphere. There is a broad consensus¹³ that the economic losses derived from the materialisation of the physical risks associated with global warming would be much higher than the costs associated with the implementation of an ambitious climate change mitigation and adaptation strategy, and that the transition costs would be reduced to the extent that a gradual and orderly transition process, with a high degree of international coordination, is carried out without delay.

In the case of Spain, existing estimates from the exercises carried out by the *Network for Greening the Financial System* (NGFS)¹⁴ indicate that, if these risks were to materialise in the coming decades, both those associated with chronic phenomena (phenomena (rising temperatures, desertification or rising sea levels) and those linked to extreme or severe meteorological phenomena (floods, storms or fires), economic activity would suffer substantial drops (Figure 2)¹⁵.

The impact of physical and transition risks on the dynamics of activity, employment, prices and credit would not be negligible; moreover, the impacts would be heterogeneous across regions, sectors, firms and households, and could even affect some groups within these groups more intensely¹⁶.

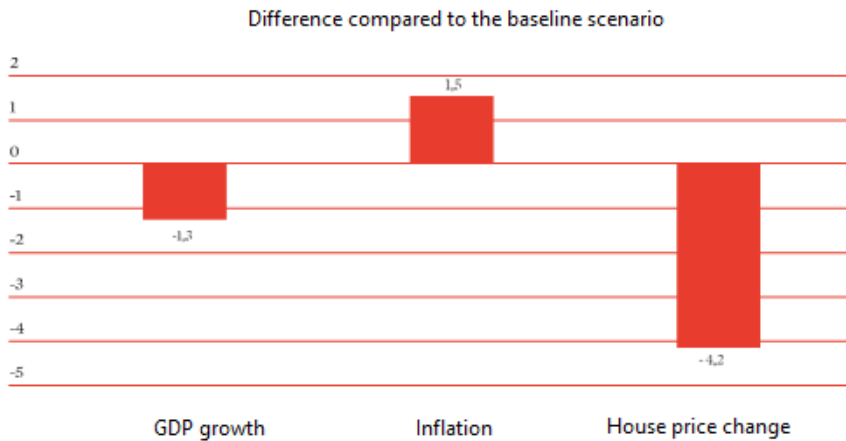
The impact of physical risks would be on the supply side, as a result of disruptions in the production process, deterioration of physical capital, lower productivity in some sectors due to the impact of climate change and possible consequences on business demographics. This has a heterogeneous effect at the sectoral level, as discussed below, depending on the exposure

13 Hidalgo Pérez, A.I. (2020), *Impactos, vulnerabilidad y adaptación al cambio climático en la actividad aseguradora*, Spanish Climate Change Office. Ministry for Ecological Transition and the Demographic Challenge, Madrid.

14 Network of central banks and supervisors created at the end of 2017 whose objectives are to contribute to the development of climate and environmental risk management in the financial sector, share best practices, undertake analytical work and help mobilise finance to support the transition to a sustainable economy.

15 Hernández de Cos, P. Presentación del Gobernador del Banco de España, *Implicaciones económicas y financieras del cambio climático*, Club Última hora, 16 February 2024.

16 Banco de España (2022), *Annual Report 2021*.

FIGURE 2. MACROECONOMIC IMPACT OF DROUGHTS AND HEAT WAVES IN SPAIN *

* Impacts are defined as the differences with respect to a baseline scenario in growth rates at the one-year horizon. The impacts have been estimated by the Banco de España in line with the narrative and sectoral shocks of the ECB's and the European Systemic Risk Board's drought and heat wave scenario.
Source: NGS and Banco de España, Presentación del Gobernador del Banco de España, *Implicaciones económicas y financieras del cambio climático*, Club Última hora, 16 February 2024.

of each sector to the consequences of climate change of each sector to the consequences of climate change. This has a heterogeneous effect at the sectoral level, as discussed below, depending on the exposure. But there would also be impacts on the demand side, as uncertainty about the impact on employment, inflation and wealth would condition the consumption and investment decisions of households and businesses.

The implementation of decarbonisation policies both with strict climate policies and by boosting innovation would significantly reduce the economic costs associated with the materialisation of the extreme and chronic physical risks of a scenario of inaction¹⁷.

Beyond the strictly physical risks, there are the transition risks. The transition itself carries a cost for achieving the objective of decarbonising economies that may also have negative effects on household purchasing power, corporate profitability, financial market stability and public finances¹⁸. However, the transition also offers opportunities to modernise the productive fabric, generate wealth and jobs and reduce Spain's energy dependence on foreign countries¹⁹. In fact, Spain has a series of strengths, such as abundant renewable resources, a competitive business ecosystem favourable to the energy transition, a citizenry that is aware of the

17 Hernández de Cos, P. Presentación del Gobernador del Banco de España, *Implicaciones...; op. cit.*

18 Pisani-Ferry, J. 21-20 climate policy is macroeconomic policy, and the implications will be significant, Policy Brief, August 2021.

19 CES Report 2021.

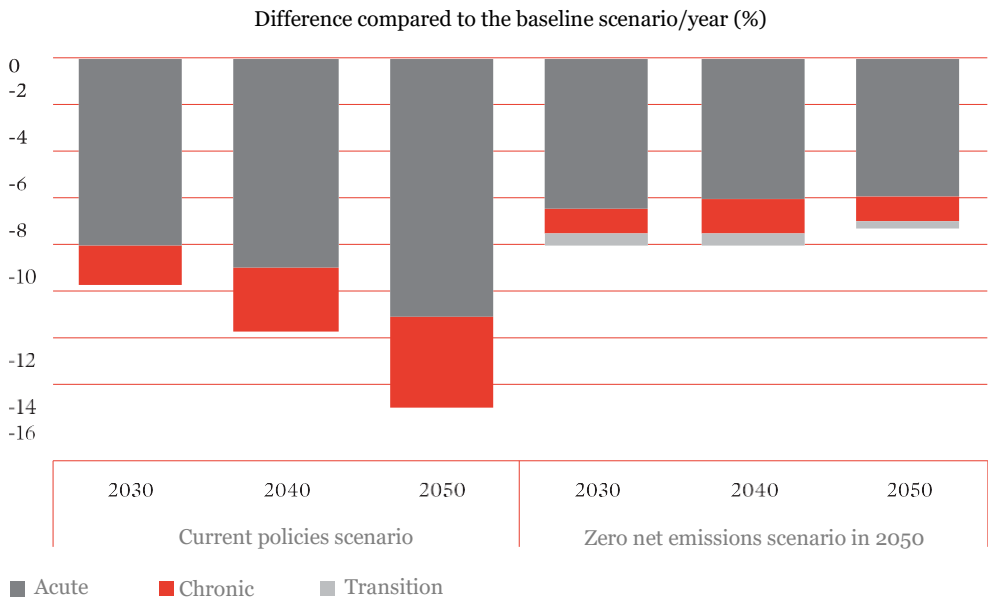
fight against climate change and, above all, a roadmap to carry out this transition, as mentioned above.

Indeed, the articulation of public policies that actively contribute to this transition is key, both in their design and in their ambition and speed of implementation, as they will influence the magnitude of transition risks and their macroeconomic impact (Figure 3).

A slow transition jeopardises the achievement of emissions targets in time, increasing the possibility of environmental risks becoming irreversible, while an excessively rapid and disorderly transition can lead to economic, employment and social imbalances that generate disaffection and unrest among citizens, and may jeopardise the progress needed to drive the transition.

Public investment and the regulation of economic activity must be fundamental levers to promote this ecological transition, without ignoring the need for this transition to be fair. Estimates show that in the case of Spain, compared to a theoretical scenario in which there is no climate change, the risk of not acting means a negative impact on the growing GDP, which, moreover, would become chronic in some cases.

FIGURE 3. EFFECT OF CLIMATE CHANGE ON GDP IN SPAIN



Note: the figure shows the impact on GDP under different scenarios compared to a hypothetical (and impossible) baseline scenario in which physical and transition risks do not materialise. This baseline scenario represents a world in which climate change does not occur. Climate change therefore has a negative impact on GDP in each plausible scenario, but the magnitude of the losses differs between scenarios.

Source: NGFS and Banco de España, Presentación del Gobernador del Banco de España, *Implicaciones económicas y financieras del cambio climático*, Club Última hora, 16 February 2024.

4. Impact on productive sectors in Spain

All productive sectors face, to a greater or lesser extent, the risks derived from climate change. To minimise them, productive activities must act on two fronts at the same time: on the one hand, in establishing a strategy for adapting to the physical impacts that are occurring or may occur and/or worsen in the short and medium term and, on the other hand, in decarbonising their activity in the medium and long term. In both cases, the risk of not acting is very high.

However, the extent of this risk is uncertain. Indeed, this uncertainty is perhaps one of the factors that may limit investment in adaptation and mitigation strategies, even though it is essential to improve the resilience of the Spanish economy, given its particular vulnerability to climate risks, and to gain competitiveness in a new economic environment (through cheaper energy and an improved position in emissions trading).

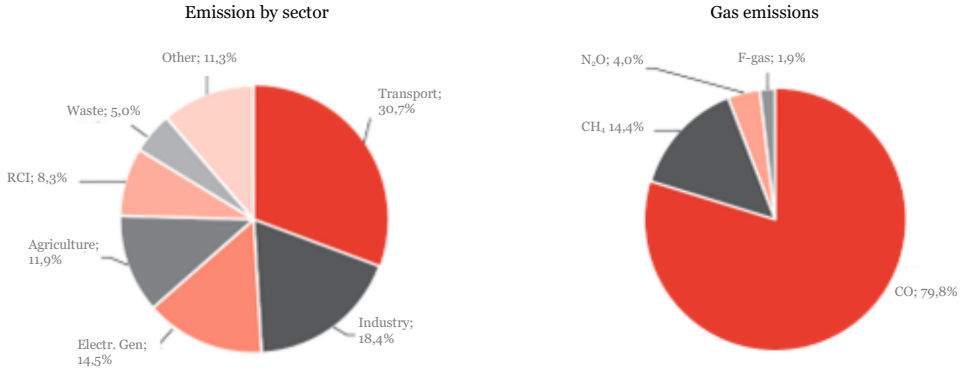
The adaptation and mitigation challenges of the different productive sectors in Spain are addressed below, ordered according to their greater impact on climate risks, the need for decarbonisation or their role as a driving force in the green transition (Table 3).

Thus, the agricultural and tourism sectors are identified in the National Adaptation Plan as those most affected by climate change. Activities such as transport, industry and energy, although also affected by climate risks, have a greater role to play in mitigating or combating climate change. In fact, these three activities together account for 63.6 per cent of greenhouse gas emissions in Spain, so their decarbonisation is a priority and the transition risks are more decisive.

TABLE 3. PRODUCTIVE SECTORS AND CLIMATE CHANGE IN SPAIN

Productive sector	Climate change impact	Emissions contribution	Key sectors
Primary s.	✓ ✓ ✓	✓ ✓	
Manufacturing industry	✓	✓ ✓ ✓	✓
Energy	✓	✓ ✓	✓ ✓
Construction	✓ ✓	✓	
Services			
Tourism	✓ ✓ ✓	✓	
Transports	✓	✓ ✓ ✓	
ICT	✓	✓	✓ ✓ ✓
Financial	✓	✓	✓ ✓ ✓
R&D	✓	✓	✓ ✓ ✓
Strategy/Response	Adaptation	Mitigation	Potential

Source: own production.

FIGURE 4. GREENHOUSE GAS EMISSIONS BY SECTOR AND TYPE, 2022

Source: MITECO (2023): *Inventario Nacional de Emisiones a la Atmosfera. Emisiones de gases de efecto invernadero*. November 2023.

Finally, the financial, ICT and R&D sectors, in addition to addressing adaptation and mitigation challenges, can be seen as both drivers of adaptation and levers of change for the transition itself.

4.1. SECTORS MOST VULNERABLE TO THE PHYSICAL RISKS OF CLIMATE CHANGE

Primary sector

The primary sector is very vulnerable to the impact of the climate crisis, so that, on the one hand, the modification of temperature and precipitation patterns and their distribution throughout the year and, on the other hand, the incidence of extreme weather phenomena can have a negative impact on water availability, the increased risk of flooding, the salinisation of aquifers in crops near the coastline, or the increased incidence of animal morbidity and mortality, among many other effects.

According to the projections of the IPCC's Fifth Assessment Report, a scenario of an average local temperature increase of around 2 °C will have serious impacts on the sector, of a contrasting and non-uniform nature throughout Spain. For example, the positive effect of increased CO₂ on photosynthetic rates may be offset by higher temperatures or reduced precipitation: while about 10 per cent of the projections for 2030-2049 show yield gains of more than 10 per cent, another 10 per cent of the projections show losses of more than 25 per cent compared to the end of the 20th century. The impact of climate change on livestock farming is complex due to the diversity of livestock systems; in any case, the variation in temperature and precipitation can affect aspects related to reproduction, metabolism and the health of production processes.

In terms of their impact on the fisheries and aquaculture sector, it should be noted that the temperature absorption capacity and CO² emissions of the oceans are being affected by climate change, leading to temperature changes, acidification and deoxygenation of waters and deviations in ocean currents, as well as the disappearance of marine species and habitats. It is estimated that in the last 30 years the number of marine heat waves has increased by more than 50 per cent, and it is predicted that by 2100 ocean temperatures could rise by 1-4°C worldwide²⁰.

It is therefore urgent to adopt planned measures to adapt to the climate crisis, including the definition of the corresponding production and investment strategies, and taking into account scientific and technological advances, as well as the level of regional development, given that not all regions or activities have the same potential to adapt to the uncertainty of the impacts and evolution of the climate. These measures may be technical, technological, economic, political, land-use, information and regulatory measures, including adjustments to management or farm structures (Box 2).

BOX 2. IMPACTS OF THE CLIMATE CRISIS AND ADAPTATION MEASURES
IN THE AGRICULTURE, FISHERIES AND AQUACULTURE SECTOR

ACTIVITY	POTENTIAL IMPACTS	ADAPTATION MEASURES (various time frames for applicability and tools)
AGRICULTURAL PRODUCTION	<p>Damage and/or loss of crops due to increased demand and reduced water availability.</p> <p>Production and yield disruptions due to extreme weather events (heat waves, periods of drought, torrential rains).</p> <p>Land erosion and soil degradation due to intense rainfall.</p> <p>Increased vulnerability of soils and irrigation and irrigation systems to salinisation.</p> <p>Reduction of arable land due to sea level rise.</p> <p>Change in the behaviour of pests and diseases.</p> <p>Shortening of vegetative cycles of crops.</p> <p>Increased production costs due to higher water demand.</p>	<p>Irrigation design and planning.</p> <p>Strategies: monitoring and evaluation of crops, introduction of long-cycle and drought-resistant varieties and species, introduction of changes in crop rotation, redesign of pest and disease control systems.</p> <p>Adaptation Indicator System.</p> <p>Training and capacity building programmes for farmers.</p> <p>Incentives for sustainable agricultural practices.</p> <p>Promotion of energy crops.</p> <p>Soil erosion control in vulnerable areas.</p> <p>Improvement of risk and crisis management tools.</p>

20 Marine Stewardship Council, international non-profit organisation for the protection of the oceans [MSC response to the Intergovernmental Panel on Climate Change (IPCC) report on the ocean and the cryosphere, 25 September 2019].

BOX 2. IMPACTS OF THE CLIMATE CRISIS AND ADAPTATION MEASURES ON THE AGRICULTURE, FISHERIES AND AQUACULTURE SECTOR (*continued*)

ACTIVITY	POTENTIAL IMPACTS	ADAPTATION MEASURES (various time frames for applicability and tools)
AGRICULTURAL PRODUCTION	<p>Northward displacement of areas suitable for certain crops.</p> <p>Increased competitiveness of some areas to the detriment of others.</p> <p>Impact on the agricultural insurance sector.</p>	<p>Institutional communication mechanisms between administration and farmers.</p> <p>Strengthening of R+D+i (reduction of the gap between the scientific community and farmers).</p>
LIVESTOCK PRODUCTION	<p>Heat stress in livestock due to increased maximum temperatures.</p> <p>Increased animal morbidity and mortality.</p> <p>Decrease in livestock production due to diet mismatch.</p> <p>Reduced pasture availability due to prolonged drought.</p> <p>Reduced carrying capacity of pastures.</p> <p>Increased production costs due to maintenance of conditions in intensive farms.</p> <p>Difficulty of natural adaptation and reduction diversity of livestock species.</p> <p>Change in pest and disease patterns.</p> <p>Impact on the livestock insurance sector</p>	<p>Improve livestock management: access to water sources, reduction of animal density on farm, avoid animal movement, changes in diet and feeding schedules, use of native breeds.</p> <p>Control of thermal comfort: ventilation, design of facilities.</p> <p>Optimise pasture management.</p> <p>Creation of institutional communication mechanisms between administration and farmers.</p> <p>Genetic improvement of livestock.</p> <p>Improvement of animal health levels.</p> <p>Incentives for sustainable livestock farming practices.</p> <p>Elaboration of a protocol for livestock emergencies.</p> <p>Improvement of risks and crises management tools.</p> <p>Training and capacity building programmes for farmers.</p> <p>Strengthening of R+D+i (reduction of the gap between the scientific community and farmers).</p>
FISHERY AND AQUACULTURE SECTOR	<p>Changes in bathymetric distribution (depth) and geographical distribution of fishery species.</p> <p>Trends in abundance and/or biomass.</p> <p>Cultural heritage.</p> <p>Change in catch composition and reduction in landings value.</p> <p>Reduction in the number of fishing trips/fishing days.</p> <p>Presence of allochthonous species.</p> <p>Changes in the contribution of fishery products to food security</p>	<p>Spatial-temporal planning following ecological, economic and social objectives.</p> <p>Diversification of fishing activity patterns with respect to exploited species.</p> <p>Interaction between different sectors and fishing interests.</p> <p>Limitation of economic incentives to fisheries with good conservation status.</p> <p>Transboundary management of fish stocks.</p> <p>Adaptative and collaborative fishing pressure control.</p> <p>Active participation of fishermen in resource management.</p> <p>Public investment.</p> <p>Diversification of markets.</p>

BOX 2. IMPACTS OF THE CLIMATE CRISIS AND ADAPTATION MEASURES ON THE AGRICULTURE, FISHERIES AND AQUACULTURE SECTOR (*continued*)

FISHERY AND AQUACULTURE SECTOR	<p>Reduced production and yields.</p> <p>Inability to grow crops.</p> <p>Increased incidence of diseases, emergence of new diseases.</p> <p>Changes in calcification. Acidification in molluscs.</p> <p>Changes in spawning patterns. Death of fish due to algal upwelling.</p> <p>Changes in fish and fishmeal supply.</p> <p>Fluctuation in raw material prices.</p>	<p>Reduce feed and fishmeal supply.</p> <p>Substitute new formulas.</p> <p>Increase efficiency in the use of water and recirculation systems.</p> <p>Promote integrated multi-trophic aquaculture (IMTA).</p> <p>Introduce new marine, animal and plant crops. Diversification of species.</p> <p>Planning and design of the most suitable sites.</p> <p>Implement risk prevention systems.</p> <p>Promote investment in R+D+i and technology transfer.</p> <p>Promote the contracting of insurance against damage to aquaculture stocks.</p>
---------------------------------------	--	---

Source: Prepared by the authors based on MAPA, Impacts, vulnerability and adaptation to climate change in the agricultural sector. Aproximación al conocimiento y prácticas de gestión en España (2016), MAPA, Observatorio de Acuicultura, Impactos del Cambio Climático sobre la Acuicultura en España (2014), CSIC-MITECO, Vulnerabilidad y desarrollo de estrategias de adaptación al cambio climático en los recursos pesqueros y los ecosistemas marinos asociados. (VADAPES) (2021).

In terms of adaptation, the CAP Strategic Plan (PEPAC), in the area of the so-called “environmental architecture”, includes a series of measures that guide and encourage more sustainable agronomic and livestock management practices, to which we could add a better adaptation of the agricultural insurance system, or the modernisation of irrigation systems.

The agricultural sector accounted for 11.9 per cent of total greenhouse gas emissions in 2022²¹, with a year-on-year increase of 0.5 per cent, largely as a result of the increase in manure management (6.6 per 100), which has not been able to compensate the reductions in other activities. Of this percentage, more than 7% corresponds to livestock (largely due to methane emissions from livestock) and around 4% to the agricultural sector. The complexity of the sector in terms of heterogeneity and territorial dispersion adds to the difficulty of implementing measures and actions to reduce GHG emissions from the primary sector aimed at improving the carbon content of Spanish soils, or the management of livestock²². In any case,

21 MITECO, National GHG Emissions Inventory 2022 (March 2024).

22 In 2022, the average population of non-dairy cattle increased by 64%, white pigs by 93% and Iberian pigs by 351% compared to the base year. The categories enteric fermentation and manure management integrate emissions from livestock (MITECO, GHG Inventories Report 1990-2022, edition 2024).

the measures included in the PEPAC, which allocates 40% of its budget to climate action, in line with the PNIEC guidelines for the agricultural sector, have begun to be implemented. On the other hand, the potential of the energy-intensive and highly fossil fuel-dependent fisheries and aquaculture sector, especially maritime transport, to mitigate GHG emissions through decarbonisation should be noted. This is based on the recognition of the fall in emissions from the European fishing fleet (50% between 1990 and 2020) thanks to improved energy efficiency, but also as a consequence of a reduction in the size of the fleet. In Spain, a reduction of 59% in the size of the fishing fleet in terms of power is estimated for the same period, while the application of new technologies would have allowed for an increase in energy efficiency²³ (Box 3).

On the other hand, and given that the primary sector has the particularity of generating emissions and acting as a sink, given the capacity of the soil and crops, as well as the oceans, to capture CO₂, together with measures to adapt to the effects of climate change, there is a clear need to also promote its active role in mitigation. In this respect, it should be noted that the European institutions are working on a proposal to create a legal framework for certifying carbon sequestration activities.

Tourism sector

Climate change also represents an enormous challenge for the tourism sector, one of the fundamental pillars of the Spanish economy, which accounts for around 12% of GDP and employment. Climate change impacts the tourism sector in several ways: affecting natural resources, deterioration of key infrastructures, as well as changes in tourism supply and demand, with a particular impact on coastal and snow destinations.

Increases in temperature during the summer season, the high tourist season in most of Spain, the reduction of rainfall on the peninsula, the rise in sea level, or the increase in the frequency and duration of heat waves affect the attractiveness of Spanish tourism, degrading natural resources (from beaches, natural landscapes and/or high mountains), reducing the climatic comfort of tourists or limiting water resources.

A study by the European Commission's *Joint Research Centre* estimates the degree of vulnerability of various regions of Spain to climate change²⁴. In scenarios of average annual temperature rises of three and four degrees Celsius

23 CES Report 3/2023 *Fisheries, aquaculture and the processing industry in Spain. Challenges for their sustainability*.

24 Matei, N.A., García-León, D., Dosio, A., Batista e Silva, F., Ribeiro Barranco, R., Císcar Martínez, J.C., *Regional impact of climate change on European tourism demand*, Publications Office of the European Union, Luxembourg, 2023. JRC.

BOX 3. PROPOSALS TO REDUCE GHG EMISSIONS FROM THE PRIMARY SECTOR**In agriculture:**

- ✓ Proper use of fertilisation: soil analysis, doses adapted to crop needs, complementarity of organic and inorganic fertiliser use, adjustment of nitrogen supply to crop needs.
- ✓ Optimisation of fertiliser use (organic and inorganic).
- ✓ Crop rotations that optimise the use of resources (fertilisers, etc).
- ✓ Alternative use of leguminous plants.
- ✓ Use of management techniques that avoid losses of soil organic carbon.
- ✓ Reduction of fuel consumption due to improved combustion of agricultural machinery.
- ✓ Elimination of agricultural residue burning: use as biomass in boilers, or incorporation into soil.

In livestock farming:

- ✓ Correct management of manure and liquid manure: e.g., liquid manure emptying in pig housing, covering of liquid manure ponds, solid-liquid separation of liquid manure, or manufacture of compost from solid fraction of liquid manure.
- ✓ Use of alternative methods: anaerobic biodigestion (centralised and in small rural digesters), liquid manure treatment, etc.
- ✓ Correct land application (injection vs. fan spreading, etc.).
- ✓ Enteric fermentation.
- ✓ Diet modification to reduce methane emissions.

Use of renewable energies to replace fossil fuels:

- ✓ Replacement of diesel boilers with biomass boilers.
- ✓ Solar irrigation.

In fisheries:

- ✓ Promoting the use of renewable and low-carbon fuels.
- ✓ Boosting the construction of modern, energy-efficient ships.
- ✓ Improving the qualification of human resources to design, build and operate these ships. Definition of a base year for emission reductions that does not penalise the fisheries sector and recognises the efforts made since 1990.
- ✓ Implementation of holistic strategy, finding synergies between the different links in the chain.
- ✓ Improved institutional support and targeted funding and credit measures from European institutions (the current limitations of the European Maritime, Fisheries and Aquaculture Fund do not allow its use for decarbonisation).

In aquaculture

- ✓ Boosting extensive shellfish systems: shellfish fix large amounts of carbon, by generating calcium carbonate (CaCO₃) shells through the bicarbonate in seawater.
- ✓ Boosting seaweed farming: algae can transform dissolved inorganic carbon (DIC).
- ✓ Boosting Integrated Multi-Trophic Aquaculture (IMTA): the species used are fish in floating nurseries together with macroalgae and filter-feeding organisms (molluscs), so that while only one species is fed, three species are produced, which are also CO₂ fixers.

Source: prepared by the authors based on MITECO (Mitigation: Policies and measures in the agricultural and livestock sector), National Integrated Energy and Climate Plan (2021-2030), Spanish Aquaculture Observatory (Climate Change and Aquaculture) (FOESA 2013), and CES report 03/2023.

tourism demand for Spain as a whole is estimated to fall by 1.6% and 3.1% respectively. Although the temperature rises are expected to favour a relative deseasonalisation of demand, with increases in the months between October and May, this is not enough to offset the sharp fall in demand during July and August. In these high season months, the study forecasts a fall in tourism demand of almost 10% in the scenario of a rise of three degrees and of more than 15% in the scenario of a rise of four degrees.

Based on aggregated and anonymised data on card payments at POS terminals, a CaixaBank study shows that these changes in tourism patterns are already taking place, with a negative correlation between the growth in tourist spending and the average temperature. Analysis shows that the warmest areas of Spain saw slower growth in tourism spending between the peak seasons of 2019 and 2023, years when record temperatures were recorded. In addition, strong growth in tourism expenditure was recorded on the Atlantic coast and in certain rural tourism areas, compared to more moderate growth in the southern part of the Mediterranean coast.

For all these reasons, adaptation to climate change in the tourism sector must be integrated into the sector's plans, programmes and strategies, starting with the future Spanish Sustainable Tourism Strategy 2030. But not only does the supply side need to be more resilient to climate risks, it must also integrate mitigation and environmental and social sustainability into its business models, taking into account the environmental burden, climate constraints and the need to reduce the carbon footprint.

In terms of its contribution to combating climate change, tourism impacts on the climate and its balance in several ways²⁵. Firstly, through the transformation of the territory, with increased urbanisation, the construction of infrastructures and the mobilisation of natural resources that require co-ordination. Secondly, there are the effects of the means of transport used by tourists, which is a key factor in noise and air pollution; in fact, most of the CO₂ emissions attributed to the tourism sector are linked to transport. Thirdly, there is an increase in the consumption of water and energy resources and an accumulation of waste associated with spatial and temporal concentration of population; also causing increases in CO₂ emissions. However, the impact on the natural capital, its protection and conservation depend on tourism patterns and behaviour of visitors.

25 Martínez-Puche, A. (coord.) (2019): Informe sobre el impacto del turismo y su incidencia en la sostenibilidad desde el punto de vista territorial; SEGITTUR.

Spain's future Sustainable Tourism Strategy 2030 could provide an opportunity to promote medium- and long-term tourism planning that takes into account issues such as resource limitations of destinations, territorial inequalities, the needs of citizens, the externalities of tourism and the integration of tourism activities with other land uses.

Construction

In contrast to the two previous sectors, the construction sector will be driven by the impact of climate risks on economic activity and physical infrastructure, mainly transport infrastructure, but also energy and information and communication technology infrastructure, and by the need to adapt buildings.

The construction sector will have to act to increase the resilience of physical infrastructure, the degree of vulnerability of which varies widely. In the case of transport infrastructure, for example, port infrastructure can be affected and damaged by extreme wind and waves. The increased frequency of extreme weather events also affects airports. In the case of roads and railways, impacts come, for example, from torrential rainfall, landslide, falling materials or lack of drainage; from high temperatures and deterioration of the road surface; or the impacts of fires, snow, ice or wind. In 2018²⁶, 6 per 100 of the road sections of the total number of kilometres of the State Road network had significant deterioration as a result of some type of climatic event. In the General Interest Railway Network, this proportion rose to 12 per 100.

In any case, impact also depends on factors such as location, age or maintenance, among others. Infrastructure planning should incorporate criteria for adapting to the risks derived from climate change, both in the construction of new infrastructures or the extension of existing ones, as well as in the maintenance, prevention and surveillance services.

Likewise, the construction sector dedicated to building must ensure to improve the energy and water performance of buildings, in line with the projected future climate scenarios. The National Adaptation Plan identifies the following risks: loss and deterioration of comfort and habitability in dwellings, heat stress and reduction of thermal comfort in public spaces, or deterioration and deformation due to temperature changes in building elements and materials and street furniture.

26 Sections of the State network of land transport infrastructure potentially most exposed due to climate variability and change. (June 2018). CEDEX.

Finally, with respect to the climate change mitigation capacity of the construction, it should be noted that, although its emissions are not really high, the degree of energy efficiency of its final production does have an impact on climate. In fact, a large part of buildings in Spain are inefficient in energy terms, largely due to the fact that around 45 per 100 of building stock predates the introduction of energy efficiency criteria²⁷. As a consequence, the residential, commercial and institutional sectors contributed 8.3 per 100 of total GHG emissions in 2022, with almost two thirds attributed to dwellings and the remainder to institutional and commercial buildings. Thus, the construction sector must not only reduce emissions from its activity, but also contribute to the reconversion of the real estate sector by redirecting efforts to urban rehabilitation, regeneration and renovation. The “Plan for Housing Rehabilitation and Urban Regeneration” component of the PRTR focuses on this.

4.2. SECTORS MOST AFFECTED BY THE DECARBONISATION CHALLENGE

Transport sector

Transport faces potential disruptions or bottlenecks due to extreme weather events that can lead to power outages, supply disruptions, natural hazards or accidents. Transport services are interconnected and indispensable for the rest of economic and social activities, and therefore these problems affect the rest of the productive activities, as was evident during the coronavirus crisis or with the war tensions in the Middle East; or, more related to climate, with the effects of drought on the Panama Canal or on the transport of fossil fuels by river in Central Europe in the midst of the energy crisis. Moreover, climate change not only affects the physical environment, but is likely to influence future demand for energy, passenger and freight mobility behaviour and transport means choice patterns.

As noted in the discussion of the construction sector, the Spanish Adaptation Plan emphasises the physical risks faced by transport-related infrastructure and pays less attention to the adaptation of the services themselves. In fact, the adaptation of transport systems to climate change requires a broad perspective, with efforts in multiple areas, not only in the management of infrastructures to ensure their operation in adverse weather situations, but also from transport operators (which must be equipped with weather-resistant equipment

²⁷ According to the Housing Rehabilitation and Urban Regeneration Plan, integrated in the PRTR, 45% of the buildings are pre-1980. The first standard related to energy efficiency (Norma básica de edificación NBE-CT-79 sobre condiciones térmicas de los edificios) was introduced in 1979.

or vehicles and have emergency plans in place), or the regulatory authorities in the transport sector (which must, for example, ensure emergency transport in case of critical situations)²⁸.

However, in addition to adapting to climate risks, the transport sector is, above all, also called upon to continue its decarbonisation efforts, as it is the largest emitter of greenhouse gases in Spain. It accounts for 30.7 per 100 of total GHG emissions and, unlike other sectors, it has shown almost constant growth in its historical series, currently recovering pre-pandemic levels of emissions. This is mainly explained by the importance of road transport²⁹, the preference for the private car and the heterogeneous distribution of the population in the territory³⁰. In addition, since the emissions trading scheme has been extended to the entire transport sector, its decarbonisation has also become a key element for the economic profitability of the activity.

However, transport services are characterised by a high degree of heterogeneity, depending on the mode of transport concerned, the service provided (passengers or goods; light or heavy), the market structure in which it is provided (conditioned by infrastructure) or the size of the companies. There is therefore no single solution to improve energy efficiency or decarbonise this sector, different technologies have to be considered to achieve this.

In any case, the predominant approach, which was set out in the Safe, Sustainable and Connected Mobility Strategy 2030, is A-S-I (Avoid, to Avoid or reduce, Shift, to change, and Improve). In other words, decarbonisation must start by reducing trips and reducing trip distances (urban mobility plans), it must also encourage mode share/modal shift towards sustainable collective transport (creation of low emission zones) and, finally, it must improve the energy efficiency and sustainability of transport modes. The new PNIEC is very optimistic and expects a 25% reduction in transport emissions between 2020 and 2030.

Sectoral actions have concentrated mainly on the promotion of electric vehicles, so that the PRTR has dedicated an exclusive PERTE to their development. With the new PNIEC, the target for the electrified vehicle fleet is 5.5 million vehicles in 2030 (half a million more than in the previous Plan). However, the trajectory of electric vehicle registrations and recharging points is still far below the 2030 target. In addition,

28 European Environment Agency (2014), *Adaptation of transport to climate change in Europe Challenges and options across transport modes and stakeholders*.

29 85.4 per cent of passenger transport and 95.2 per cent of freight transport is by road, which directly translates into a high consumption of hydrocarbons (MITMA, *Estrategia de Movilidad Segura, Sostenible y Conectada 2030*, December 2021).

30 Spanish Government, *Estrategia España 2050*.

the new PNIEC establishes advances in the use of renewable energies in transport, with the objective that they should represent 25 per cent of energy consumption in 2030. Specifically, it proposes that 11% of consumption should come from hydrogen, advanced biofuels and biogas, double that of the new European Directive on renewables (5.5%).

It is clear that, both to adapt to climate change and to contribute to climate change mitigation, the sector will need to: invest heavily in fleet renewal, address the price gap between conventional and less carbon-intensive fuels, and adapt to the full deployment and development of biofuels and non-biological renewables production and infrastructure.

Industry sector

From the perspective of climate risks, within manufacturing, the most affected branch is the agri-food industry (the activity with the greatest weight in industrial GVA), due to the impact of climate change on the primary sector, the source of its raw materials. However, the whole of activity may also suffer the consequences of climate risks. These can range from physical damage to facilities, interruptions in supply chains or reduced availability of certain resources - water being a paradigmatic case in point - to alterations in industrial processes themselves due to changes in production conditions - such as the effect of higher temperatures on cooling systems. Furthermore, the industrial sector will have to offer new products, services and production processes aimed at facilitating the adaptation and mitigation of the rest of the sectors, and can to some extent be considered a driving force in the fight against climate change.

Beyond its adaptation, industry, as the second largest sector in terms of emissions (18.4 per cent), has ample room to make progress in its decarbonisation. But not all its sub-branches are affected by this challenge with the same intensity. For example, for the electro-intensive industries, which include companies dedicated to the iron and steel, metallurgy, cement and chemical industries, energy is an important part of their production costs, together they represent an important part of the demand for electricity in Spain and have also been under the EU emissions trading scheme for some time³¹.

The automotive industry - which accounts, directly and indirectly, for a significant part of Spanish GDP, employment and exports - is also undergoing an absolute paradigm shift marked by the conjunction of the green and digital transitions. As has been pointed out, the electric vehicle is emerging as

31 CES Report 2021.

BOX 4. LINES OF ACTION OF THE INDUSTRIAL DECARBONISATION PROGRAMME

- Decarbonisation of energy sources through: electrification of processes, incorporation of hydrogen, more intensive use of renewable fuels, use of renewables for self-consumption or use of renewable heat, e.g., solar thermal energy.
- Integrated energy management of industrial processes, mainly through heat recovery in production processes, energy use of secondary flows (including process gases) or substantial improvements in energy efficiency.
- Carbon capture, storage and use.
- Decarbonisation through the optimisation of the use of natural resources, the promotion of the use of secondary raw materials, the eco-design of products, the use of waste by-products or the recovery of waste to replace fossil fuels.
- An increase in investment in R&D&I to support the aforementioned lines of action.

The PERTE also envisages the granting of aid to manufacturing companies participating in the Major Project of Common European Interest relating to the hydrogen industrial chain and the creation of a fund to support carbon offset contracts, to encourage decarbonising investments in manufacturing by reducing the uncertainty regarding the income that can be obtained from the sale of emission rights.

Source: based on Executive Summary. PERTE for industrial decarbonisation.

one of the fundamental axes of decarbonisation, which in industrial terms means a reconversion of the sector. Its value chain is integrating innovations to improve the energy efficiency of vehicles such as: energy recovery systems, the use of lighter materials, improvements in aerodynamics and rolling resistance, and greater connectivity and automation. Moreover, the electrification of the fleet is not the only decarbonising solution for the automotive industry; solutions are also emerging through improvements in combustion engines, with adaptation to renewable and low-carbon fuels (hydrogen, biofuels and synthetic fuels). All of this poses a challenge for the regulatory framework in which the activity is carried out, as it needs to combine stability with flexibility in order to be able to accommodate new innovative solutions. In short, the reduction of emissions, the improvement of energy efficiency, the more intensive use of renewable energies and the integration of the circular economy in production, in addition to favouring the decarbonisation of industry, favour its competitiveness (in a context of rising emission allowances) and improve energy security (by reducing its dependence on fossil fuels, mainly natural gas). Recognising the specificity of the industry

in its climate challenge, the PERTE for industrial decarbonisation was approved in December 2022, although it was not until the end of December 2023 that the regulatory bases for the calls for aid were published³².

Energy sector

Climate change will also have an impact on the energy sector. Renewable generation may also suffer from reduced availability of renewable resources (wind, solar, hydro and biomass). According to the Spanish Adaptation Plan, the projections point to a moderate increase in the solar resource and a certain downward trend in the wind resource, although with territorial variations. But the most relevant impacts are those linked to the reduced availability of water, which affects hydroelectric production and the potential use of biomass as a future source of energy, given that water is a key factor for the productivity of agricultural and forestry crops oriented towards biomass production. In addition, some non-renewable but non GHG-emitting energy technologies, such as nuclear power, require an intensive use of water, which in a scarcity scenario could also affect their production.

Climate risks may therefore have significant impacts on the energy model projected in the National Integrated Energy and Climate Plan (PNIEC)

BOX 5. ADAPTATION STRATEGY FOR THE ENERGY SECTOR IN THE PNACC

- Improve knowledge on the impacts of climate change on the production potential of renewable energies and translate the results into energy planning.
- Improve knowledge on the possible impacts of climate change on the functionality and resilience of energy generation, transmission, storage and distribution systems. To specify adaptation measures to avoid or reduce the identified risks.
- Improve knowledge on the impacts of climate change on energy demand and identify measures to avoid or limit peak demand, especially those associated with heat.
- Identify risks derived from extreme events in critical energy infrastructures and apply measures to avoid their loss of functionality.

Source: based on the National Climate Change Adaptation Plan (PNACC) 2021-2030.

³² Order ITU/1434/2023, of 26 December, which establishes the regulatory bases for aid for integrated action for the decarbonisation of manufacturing industry as part of the Industrial Decarbonisation PERTE within the framework of the Recovery, Transformation and Resilience Plan and makes the early call for the year 2024.

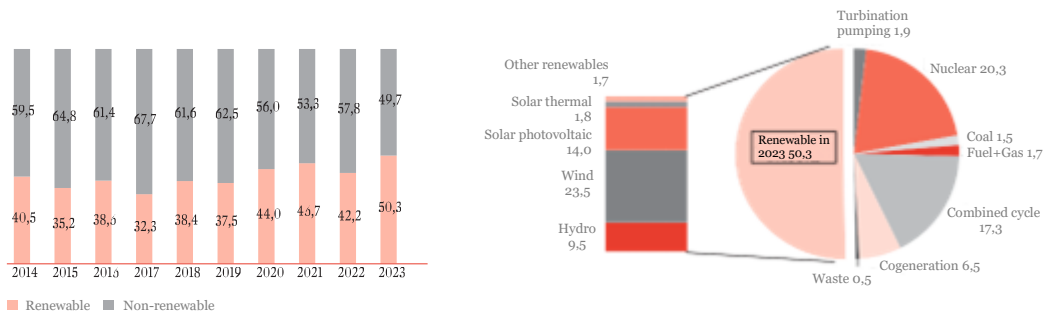
and given that an important part of decarbonisation relies on increasing renewable electricity production and the electrification of economic activity, it could jeopardise the achievement of decarbonisation targets in other productive sectors. In addition, it is more than likely that energy demand will vary in both quantity and time patterns.

On the other hand, the sector has been decarbonising for some time now, and has been particularly intense since 2017, mainly thanks to the increase in generation from renewables and the reduced share of coal-fired plants. In fact, in Spain the electricity generation sector is no longer the largest emitter, and its decarbonisation can be described as structural. Moreover, electrification is one of the driving forces behind decarbonisation of the economy in general, by facilitating the integration of renewable energies into energy systems and by helping to reduce the carbon footprint of electrifiable activities.

Decarbonisation of the electricity relies on the decentralisation of production, the active participation of consumers (both residential and industrial) and the penetration of digitalisation. A digitally hyper-connected electricity system blurs the traditional boundaries separating and defining supply and demand, generation and consumption, and facilitates decentralised or distributed local energy markets with a greater participation of renewable energies³³.

But the decarbonisation of the electricity sector faces important challenges, among others: the need to boost storage, investment in networks –to continue favouring the deployment of renewables, both in plants and self-consumption, including bi-directional and digitalised distribution, as well as international interconnection infrastructures that allow progress towards a more integrated European

FIGURE 5. RENEWABLES IN SPANISH ELECTRICITY PRODUCTION (Percentage)



Source: based on Red Eléctrica, Electricity System Report. Renewable energy summary report 2023 (March 2024).

33 CES Report 2021.

electricity market³⁴—, the review of the incentive model in a new macroeconomic environment and regulatory stability.

Indeed, new storage systems and new flexibility measures must be promoted, allowing greater capacity to adapt to the dynamic and changing conditions of both supply and demand, thereby avoiding electricity dumping and favouring a smoothing of wholesale prices. The PERTE on Renewable Energies, Renewable Hydrogen and Storage proposes green hydrogen as an opportunity for electricity storage and also as a solution for activities that are difficult to electrify (some electro-intensive industries fall into this category).

The deployment of self-consumption, on which the PNIEC is openly committed, is also subject to numerous tensions. After a 2022 financial year in which high energy prices and PRTR subsidies boosted self-consumption installations, both industrial and especially domestic, in 2023 there has been a slowdown in the rate of installations, which could be explained by several factors: the rise in interest rates, the consequent interest of households in accelerating their financial deleveraging, the lower profitability offered by this investment due to the fall in electricity prices and the loss of attractiveness of subsidies or grants, as it has been noted that they are slow to be granted and received. All this has caused, at the beginning of 2024, economic-financial difficulties for some business models designed around the deployment of self-consumption in Spain.

Furthermore, on its path towards decarbonisation, the sector continues to face challenges already pointed out by this Council in its 2021 Report, among others: 1) the persistence of bottlenecks in the Administrations to manage aid and subsidies; 2) the need to differentiate firm, viable and environmentally sustainable projects from others that may have a speculative nature or even have a negative environmental impact -for example, those that require evacuation power lines-; or 3) the scarce development of the figure of aggregators and renewable energy communities.

In short, the decarbonisation of the electricity sector must be accompanied by regulatory and normative changes that provide adequate signals and stability to investors and markets and, at the same time, protect consumers, involve local communities in decision-making and reflect the advantages of the energy transition.

34 CES Report 4/2017, *El sector eléctrico en España* and CES Report 2021.

4.3. KEY SECTORS IN THE FIGHT AGAINST CLIMATE CHANGE

Information and Communication Technologies

The information and communication technology (ICT) sector is a key element for both sectoral strategies for adaptation to the effects of climate change and to mitigate it.

Indeed, digital applications to facilitate adaptation to climate change are becoming more and more numerous and are related to access to information, data management, forecasting and artificial intelligence³⁵. ICT facilitate both short-term actions through early warning systems, for example, to mitigate the effects of adverse weather events on productive activity, and in the long term, to orient sectoral policies (agricultural, industrial or construction, among others) to strengthen the structural resilience of productive sectors in the face of climate change (for example, through predictive maintenance operations, use of digital twins to analyse resilience to climate changes, or adjustments of activity due to changes in demand, among others).

But ICTs are also a structural part of mitigation strategies in both production and consumption activities. Digitalisation is the enabling technology par excellence; it has even been argued that without digitalisation there will be no decarbonisation. There is a symbiotic relationship between the two challenges. On the one hand, digitalisation improves the energy efficiency of economic activities, facilitates the integration of renewable energies into electricity systems, and favours the incorporation of decarbonising technologies and new energy consumption management systems³⁶. On the other hand, decarbonisation offers a purpose to digitalisation, that of combating climate change.

Hyper-connectivity and/or the massive deployment of the Internet of Things, both in businesses and homes, allows for improved energy efficiency, for example, through the use of digitally controlled cooling and heating systems or the adjustment of energy consumption through smart home automation. In addition, the increasing penetration of digital technologies gives greater flexibility to the electricity system, mainly through smart and interconnected demand management, increased networking of devices with internet of things systems and the potential offered by the electrification of mobility and smart charging. It is key to the connected development of distributed generation, aggregators, virtual energy markets and exchanges supported by smart contracts (machine-to-machine, m2m). Digitalisation also offers solutions in the quest for sustainable, integrated and balanced mobility between

35 The International Telecommunication Union in its Recommendation ITU-T L.1501 (12/2014) on best practices in the use of ICTs to adapt to the effects of climate change.

36 IEA (2017): *Digitalization and energy*. OCDE/IEA, Paris.

public and private transport. Examples include the use of route planners that optimise fuel expenditure or the growing importance of mobility as a service through shared mobility platforms. In addition, digitalisation facilitates teleworking, videoconferencing and e-commerce, reducing the need for travel and thus emissions.

Although the decarbonising role of digitalisation was recognised in Article 6 of Law 7/2021 on climate change, the digital transformation still faces a series of challenges, one of the most important of which is to achieve the active participation of society as a whole. In this respect, it must be ensured that digital developments are inclusive and special attention must be paid to the digital divides which, in Spain, are mainly concentrated in the unequal digital penetration between rural and urban areas, in the digital backwardness of SMEs compared to larger companies and in the enormous differences in use caused by socio-demographic factors such as level of education or age.

Given their traction in both adaptation and mitigation, it is necessary to ensure that digital technologies themselves adapt to climate change. Reducing the potential physical vulnerability of ICTs to adverse weather conditions is essential to ensure the smooth functioning of communication networks and connectivity, e.g.,³⁷, ensuring the supply of essential electricity for the digital sector, improving the resilience of ICT infrastructures themselves, developing wireless services or developing and expanding alternative technologies/infrastructures.

In any case, the digital sector must make an effort to ensure that its positive contribution to the fight against climate change is not diminished by its direct impact on the environment. To this end, it must assume and integrate the challenge of decarbonisation in all its future developments, many of which are highly energy intensive, such as those related to the expansion of large data centres and their cooling needs or to the development of generative artificial intelligence systems and the training of large language models.

Financial sector

The challenge posed by the green transition requires that, together with the public investment effort, private investment must also be boosted, supported by an adaptation of the financial system to this challenge. In fact, the financial sector has a fundamental role to play in the fight against climate change, as a driver and lever for change due to its capacity to channel financing towards productive activity and to guide and facilitate resources for the transition.

37 ITU (International Telecommunication Union) (2017). *ICT and climate change. Final report*, 2017.

This has led to the need to incorporate climate risks into financial activity, which implies correctly identifying the degree of exposure of the sector based on the risks faced by the economic agents that are financed through them and incorporating this information into their usual risk management. Hence, in recent years a substantial effort has been made to understand these risks, both in terms of physical risks and transition risks. The aim is to understand the exposure of financial institutions to climate events through the carbon footprint present in their asset and liability portfolios and how this may affect the stability of the financial system and the economy as a whole³⁸.

Physical risks measure the direct consequences of climate events on the value of assets in sectors that obtain financing —fixed capital used for production, real estate assets or loan guarantees. These risks have a negative impact on business activity, affecting their financing needs. In addition, the materialisation of physical risks associated with long-term climate change would increase the likelihood of defaults by both households and businesses³⁹. As for transition risks, these are linked both to the direct or indirect financing of economic activities depending on their exposure to climate risk, both in terms of greenhouse gas emissions or carbon footprint reduction, and to the increased demands that the climate agenda places on the most polluting sectors, whose assets may suffer significant depreciation or become obsolete (stranded assets). Transition risks also arise with the emergence of new technologies or changes in consumption patterns aligned with a more sustainable economy.

The need to measure these risks has led to numerous initiatives in recent years. At the European level, progress has been made in the disclosure of consistent and comparable risk data so that supervisors, investors and other users can understand and assess the extent of banks' exposure to climate risks. Progress has been made in the implementation of the Taxonomy Regulation, which establishes common frameworks for identifying sustainable activities and investments⁴⁰. In addition, the ECB has been conducting climate resilience tests of the banking system since 2002 to identify vulnerabilities, good practices and management failures, and since 2023 it has been providing aggregate climate change indicators for the euro area⁴¹. However, the most innovative development is the approval of Regulation 2022/2453⁴²,

38 Kanutin, A. (2023), 'Bridging the climate data gap: indicators of climate change', in ECB Economic Bulletin, N.º 5/2023.

39 Banco de España, *Annual Report 2021*.

40 Regulation (EU) 2020/852 on establishing a framework to facilitate sustainable investment and amending Regulation (EU) 2019/2088

41 ECB (2023), *Towards climate-related statistical indicators*.

42 For the first time, during the first half of 2023, European credit institutions have started to publish information on their ESG risks in a standardised way as required by the Implementing Regulation (EU)2022/2453.

which from 2023 obliges entities considered significant⁴³ to publish systematic and standardised information on risks, although this information, which is the first time it has been published in a granular and comparable form, is complex and still requires more information to be interpreted correctly⁴⁴.

In any case, and for Spain, the data provided by the significant institutions, of which there are ten and which account for approximately 90 per cent of banking sector assets, estimate that 15 per cent of the portfolio is subject to physical risks. As regards transition risk, although the carbon footprint of the loan portfolio has been reduced in recent years, in line with the fall in emissions in the economy as a whole, and the slight recomposition of portfolios towards less polluting sectors, around 80 per cent of the loan and securities portfolio would be linked to highly polluting sectors⁴⁵. In addition, the risk associated with real estate loan guarantees, measured in terms of the energy efficiency of the properties, shows that many properties still do not have an energy efficiency certificate (64% of residential properties and 81% of commercial properties), although in terms of energy consumption this risk is lower (15% in residential mortgages and 37% in commercial mortgages).

The assessment of these risks in the financial sector has gained prominence in recent years in the broader context of ESG risks, driven by the Corporate Sustainability Reporting Directive 2022/2464, on which the ESC issued an opinion⁴⁶. Indeed, institutions are making efforts to incorporate this perspective: the level of detail of climate risks in prudential reporting has increased, risk management methods are being developed, the green taxonomy is being applied and climate stress tests are being conducted. However, they also face challenges such as lack of harmonisation of definitions, gaps in ESG data and difficulties in measuring impacts⁴⁷. To the extent that institutions improve their ability to measure, assess and anticipate these risks and incorporate them into their business strategy, their role as a lever or driver of the energy transition will increase, as they will be able to provide more targeted financing for investments that contribute most to the decarbonisation of the economy.

43 In view of ECB Regulation EU-468/2014 establishing the framework for cooperation within the Single Supervisory Mechanism, which sets out the provisions for the determination of the status of significant supervised entity.

44 Banco de España (2023), *Revista de Estabilidad Financiera*, autumn 2023.

45 Based on the provisions of Implementing Regulation (EU) 2022/2453, although it could be excessively broad. See Banco de España (2023), *Financial Stability Review*, autumn 2023.

46 CES Opinion 4/2024 on the Preliminary Draft Law regulating the framework for corporate reporting on environmental, social and governance issues.

47 Delgado, M. (2023), 'The role of central banks in sustainable finance'. XI Funseam International Business Symposium. Sustainable Finance: Challenges and Opportunities.

On the other hand, it is also worth noting the boost given to sustainable finance, especially since the implementation of the Action Plan⁴⁸, which has a mitigating role in the impact of the aforementioned risks on institutions' portfolios. Investors are increasingly demanding more issues of this type for their portfolios, and public and private issuers are committed to this, which explains the boom in sustainable finance. Moreover, the transition to a more sustainable economy will require significant resources for financing, much of which will come from the markets.

However, the sustainable debt market is still incipient (approximately 5 per cent of total issues in the Eurozone bond market), mostly green and social bonds⁴⁹. In Spain it has been growing progressively, reaching a total volume of 60,788 million euros in green bonds in 2023, which represents 18 per cent of the fixed-income market, excluding financing from the Public Treasury, which is the main issuer of these bonds.

Research, development and innovation

Adaptation to climate change will need to generate knowledge, methods and tools to be able to face the challenge and to be able to evaluate the measures or policies that are designed. This is why the National Plan for Adaptation to Climate Change included among its basic pillars the promotion of R&D&I, both from the perspective of scientific research and the development and implementation of technological innovation processes for adaptation to climate change. Echoing this need, the Spanish Science, Technology and Innovation Strategy for 2021-2027 envisages three strategic lines of R&D&I in energy and climate: climate change and decarbonisation, sustainable mobility and sustainable cities and ecosystems. Specifically, with regard to adaptation, it establishes the following lines of research: new methods for estimating the economic damage caused by climate change, turning points in the economics of climate change and the impact of natural disasters on local economies. In terms of climate change mitigation and decarbonisation, innovation and the technological solutions induced by it are a key lever. Globally, investment in energy R&D&I and innovation has increased exponentially over the last decade, as evidenced by the sharp rise in the number of patents registered in this field⁵⁰. Research activity is mainly focused on the development of technologies related to electric mobility, renewable gases in general, nuclear fusion and carbon capture, storage and use technologies.

48 COM (2018) 97 final.

49 Spanish Observatory on Sustainable Finance (2024). *Annual report OFISO. La financiación sostenible en España 2023*.

50 IRENA, *Patent Database INSPIRE*.

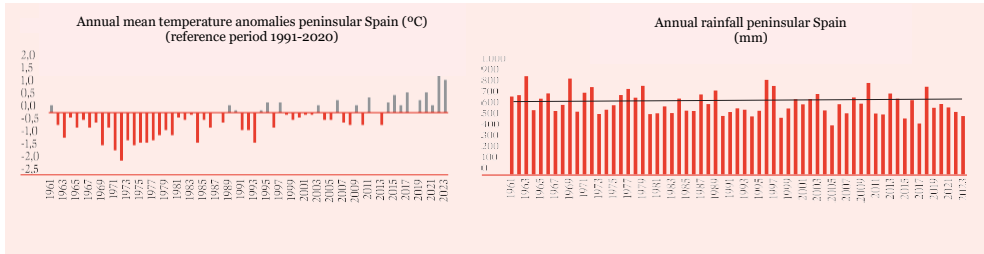
In Spain, this innovative drive in energy matters will face the problems that generally affect R&D&I and innovation and which have been pointed out by the ESC on numerous occasions, such as⁵¹: low levels of investment in public and private R&D, insufficient coordination in innovation between the different administrations —made difficult by the regulatory fragmentation between autonomous communities—, limited innovative absorption by small companies and insufficient supply of innovation-related skills. Overcoming these obstacles and promoting full interrelation between the set of public and private agents and institutions that contribute directly or indirectly to the generation, dissemination and application of knowledge is key to achieving the decarbonisation of the economy. The PRTR offers the opportunity to share risks when undertaking or implementing these innovations.

As a way of conclusion

Although adaptation and mitigation are interrelated strategies, there is a substantial difference between the two. On the one hand, climate change mitigation is part of a global strategy to reduce CO₂ emissions, it generates positive externalities at a global level and its results are perceived in the medium and long term. On the other hand, adaptation (understood as a strategy that favours the resilience of the activity, i.e., the capacity of a system to remain operative in the face of different external pressures) is more local in nature and its results are expected in the short and medium term. Given the necessary bottom-up approach, policies to tackle climate change in Spain must take into account factors such as the distribution of competences between the different administrations, the different socio-economic context, the demographic challenge faced by the different territories (depopulation, aging and floating population (tourism)), the technological possibilities and the limitations posed by digital divides. Consequently, greater coordination is needed between all levels and competences of the Administration for the establishment of urgent climate policies, strategies, objectives and actions, in particular, from a sectoral point of view in the bodies with competences in Climate Change, Environment, Energy, Industry, Transport and Tourism, at least. In any case, it will be necessary to increase collaboration between the public and private sectors for the design of joint strategies to combat climate change, both in terms of adaptation and mitigation. And, of course, the participation of economic and social agents will be necessary, as the challenges will be even greater in terms of the labour market and social cohesion, where the need for the transition to be carried out in a fair manner will be a major issue. The following sections of this publication deal with this issue in detail.

51 CES Report 2020.

BOX 6. ECONOMIC IMPACTS OF CLIMATE CHANGE



IMPACT OF CLIME CHANGE

- Heat and cold waves.
- Extreme climate events.
- Lower water availability.
- Coastal line flooding.
- Increase of forest fires.
- Changes in ecosystems
- Expansion of invasive alien species.

MACROECONOMIC IMPACT OF CLIMATE CHANGE

Physical risks

On the supply side: the result of changes in the production process, the deterioration of physical capital, lower productivity in some sectors and the possible consequences for business demographics.

On the demand side: uncertainty about the impact on employment, inflation or wealth conditions the consumption and investment decisions of households and firms.

Transition risks

Negative effects on household purchasing power, corporate profitability, financial market stability or public finances, the stability of financial markets or public finances.



Impact on activity dynamics, employment, prices and credit

- Not negligible.
- Heterogeneous across regions, sectors, firms and households (and the most vulnerable).
- Decarbonisation policies can significantly reduce the economic costs associated with the materialisation of physical risks.
- Public policies can help minimise the impact of transition risks.

BOX 6. ECONOMIC IMPACTS OF CLIMATE CHANGE (continued)

Impact on productive sectors in Spain		
Higher impact of physical risks	Primary	It will face serious losses in agriculture and livestock due to recurrent drought and in fisheries and aquaculture due to changes in temperature, acidification and deoxygenation of marine waters. Less CO ₂ absorption from soils and oceans. Need to boost its mitigating role as well.
	Tourism	Necessary adaptation due to the degradation of natural resources, the deterioration of key infrastructures and changes in tourist supply and demand, with special emphasis on coastal and snowy destinations. It must also integrate environmental and social sustainability into business models.
	Construction	It will be driven by the impact of climate change on physical infrastructure and the need for adaptation of buildings.
More affected by the decarbonisation challenge	Transport	It will be disrupted by extreme weather events and drought bottlenecks, with consequences for all other activities. In mitigation, there is no single solution due to heterogeneity between modes, services, market structure or business size. It faces fleet renewal, the future price gap between conventional and less carbon-intensive fuels, and the slow deployment of biofuels and renewables of non-biological origin infrastructures.
	Industry	Climate risks can lead to physical damage to facilities, disruptions in supply chains or reduced availability of certain resources, such as water, or changes in production conditions, such as increased cooling requirements. But the biggest challenge lies in reducing emissions, improving energy efficiency, using renewable energy more intensively and integrating the circular economy into production, to decarbonise its activity and favour its competitiveness.
	Energy	The most relevant impacts are associated with the reduced availability of water, which affects hydroelectric production and the potential use of biomass as an energy source, and changes in energy demand, both in terms of quantity and time patterns. Decarbonisation of the economy relies on increasing renewable production and electrification of economic activity. The electricity sector faces major challenges, including the need to boost storage, investment in grids, the review of the incentive model in a new macroeconomic environment and regulatory stability.

BOX 6. **ECONOMIC IMPACTS OF CLIMATE CHANGE** (continued)

Decarbonisation tractors	ICT	It is a driving force for the adaptation strategies of the rest by facilitating access to information, data management, forecasting and artificial intelligence applications - for example, it facilitates the implementation of early warning systems and predictive maintenance operations. It must therefore also reduce its physical vulnerability to climate change. It must also take up and integrate the challenge of decarbonisation into its future developments, many of which are highly energy intensive.
	Financial	Climate risks impact the financial sector's portfolio of assets and liabilities (an estimated 15 per cent of the portfolio is subject to physical risks and about 80 per cent to transition risks). Therefore, institutions need to improve their ability to measure, assess and anticipate the degree of exposure to these risks and incorporate them into their business strategy, which will strengthen their driving role in the transition to climate change.
	R+D+i	Scientific research and the development and implementation of technological innovation processes are basic pillars for climate change adaptation and mitigation. In order to strengthen its driving force, R&D&I must overcome the weaknesses it faces in Spain: low levels of public and private investment, insufficient coordination in innovation between administrations, limited innovative absorption by small companies and insufficient supply of innovation-related skills.

Conclusion:

Given the need for a bottom-up approach, policies to tackle climate change in Spain must take into account the distribution of competences between administrations, the different socio-economic context, the demographic challenge, the technological possibilities and the limitations posed by digital divides.

Both climate change adaptation and mitigation require greater coordination between all levels of government and collaboration between the public and private sectors for the design of joint strategies to combat climate change. And, of course, the economic and social agents must be involved, as the challenges are redoubled in terms of the labour market and social cohesion.

CLIMATE CHANGE AND EMPLOYMENT

As seen in the previous section of this publication, climate change is a challenge for key sectors of the Spanish economy. At the same time, mitigation measures and the transition to a low-carbon economy represent an opportunity. In particular, in terms of employment, it implies the creation of new jobs in green sectors, processes and products, as well as the introduction of new tasks, or tasks performed differently, in existing jobs.

An approach to this double condition of challenge and opportunity requires taking into account the different dimensions and variables that converge in the process. For this reason, the main projection works available at the international level⁵² (among others, those carried out at the OECD, ILO and Eurofound), referring to different countries and scenarios, will be reviewed as a means of identifying the main elements of debate around climate change management and employment. In addition, it shows already visible impacts on employment in Spain that point to important trends in the green transition and that could contribute to realising its full employment potential.

1. Employment impacts of climate change

To understand the impact of climate change on labour markets and its implications for policy development, it is necessary to distinguish the different mechanisms through which this process will take place. Climate change is expected to affect labour markets in a number of ways, each of which will have different implications for firms and workers. There are two main channels through which climate change may affect jobs: (1) direct impacts on ecosystems, and (2) impacts arising from both adaptation and mitigation policies⁵³.

52 Eurofound (2023): *Fit for 55 climate package: Impact on EU employment by 2030*; Eurofound (2019): *Energy scenario: Employment implications of the Paris Climate Agreement*. OCDE (2018): «Impacts of green growth policies on labour markets and wage income distribution: A general equilibrium application to climate and energy policies», *OECD Environment Working Paper* N.º 137.

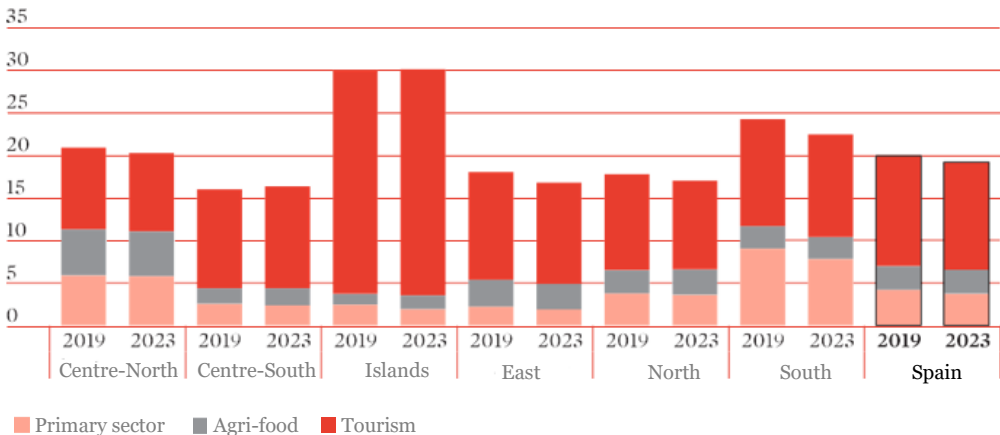
53 See chapter I of CES Report 2023, table 14.

1.1. Direct impact

Climate change poses challenges for the functioning of labour markets. In the case of Spain, climate change represents a huge challenge for several sectors, but mainly for two key sectors in terms of employment: agri-food and tourism (see section Economic impacts of climate change). Both sectors represent around 19 per cent of total employment in Spain, reaching 30 per cent in some regions, although their weight has fallen slightly in recent years (Figure 6). Although the greatest impacts are expected in the medium/long term, climate change would already take its toll on the agri-food sector, with an increasing loss of production value as a result of extreme weather events associated with climate change⁵⁴. In terms of employment, there would be around 60,000 fewer people employed in the primary sector in 2023 than in 2021, with the fall being concentrated in two of the Autonomous Communities most affected by drought in this period: Andalusia and Murcia (Figure 6). In any case, although the fall in employment in this sector has been particularly intense in the last two years (in 2021 there were 52,000 more employed than in 2011) coinciding with a period of intense drought, it is difficult to attribute the loss of employment in the primary sector exclusively to climate change, as this is a secular trend not only in Spain but also in the rest of Europe.

Climate change also represents a challenge for the tourism sector, one of the fundamental pillars of the Spanish economy, which accounts for 12% of GDP and employment. As we have seen in the section Economic impacts of climate change,

FIGURE 6. EMPLOYMENT IN THE MOST CLIMATE-DEPENDANT SECTORS (% over employment total)



Note: North: Galicia, Asturias, Cantabria and Basque Country; Centre-North: Castile and Leon, La Rioja, Navarre and Aragon; Centre-South: Extremadura, Madrid and Castile-La Mancha; South: Andalusia and Murcia; Levante: Catalonia and Valencian C; Islands: Canary and Balearic. Source: own INE microdata exploitation, Active population survey.

54 The estimate is based on the claims reported by Agroseguro. See COAG (2022); *Empieza la cuenta atrás: Impactos del cambio climático sobre la agricultura española.*

climate change impacts the tourism sector through various channels: affecting key resources and infrastructures, as well as changes in both national and international demand.⁵⁵ In terms of employment, although some changes in demand are already being observed⁵⁶, there is still no significant impact (Figure 6). However, if the forecasts for changes in demand described in the CES 2023 Report are confirmed, it is likely that there will be a territorial redistribution, i.e., there will be a fall in employment in the warmer regions (south and Mediterranean arc) while it will grow in the northern regions, especially in the high season. On the other hand, for Spain as a whole, it is possible that there will be a more uniform distribution of employment throughout the year, decreasing in high season and increasing between October and May, although without compensating for the loss of employment in the months of July and August.

As has also been seen in the section Economic impacts of climate change, one of the most important effects of climate change in Spain is a reduced availability of water, as a result of increasingly irregular rainfall, more intense periods of drought and a significant increase in temperature. Apart from the primary sector and, to a lesser extent, the tourism sector, there are other sectors that are heavily dependent on water and which could experience significant job losses in the future with less water. Examples include water supply and sanitation and most types of power generation, as well as various jobs in manufacturing and processing industries such as food, pharmaceuticals and textiles. Other sectors that rely heavily on water include jobs in health care and ecosystem management. As such, it is estimated that 95 per cent of jobs in the agriculture sector, 30 per cent of jobs in the industry sector and 10 per cent of jobs in the service sector are heavily water-dependent.⁵⁷

In contrast to these sectors, there are other sectors that can benefit in terms of employment from the implementation of measures to mitigate the direct effects of climate change. In particular, in the coming years, new jobs are expected to be generated in various activities in the construction sector, in industry and in the so-called “water sectors”, which are those that serve as a foundation for the water-dependent jobs in the previous paragraph. These include jobs linked to: (i) construction of green buildings, (ii) construction and management of water infrastructure, (iii) water resources management and ecosystem restoration and rehabilitation, (iv) installation of infrastructure for renewable energy generation, (v) household installation of solar thermal energy equipment

55 See chapter I of CES Report 2023 for more information.

56 Caixabank Research (2024): *El impacto del cambio climático en el turismo en España: análisis y perspectivas*.

57 United Nations (2016): United Nations World Water Development Report 2016: Water and Jobs.

(solar thermal boilers and solar water heaters) and (vi) professional service activities oriented towards sustainable construction.

1.2. Impact of ecological transition

Available estimates point to small and transitory aggregate employment effects of environmental policy in general, and of decarbonisation policies in particular. For the European Union, the impact assessment of the Fit for 55 initiative projects aggregate employment growth of between -0.3 and 0.5 per cent by 2030. In particular, it argues that with the right accompanying policies, such as the recycling of employment-friendly carbon tax revenues, the transition could create around 1 million jobs in the EU by 2030 (about 0.5 per cent of current employment), and 2 million jobs by 2050 (about 1 per cent of current employment), including medium-skilled and medium-wage jobs in the energy and construction sectors. However, the impact will vary across countries and sectors.⁵⁸ Cedefop forecasts additional employment growth of 1.2 per cent by 2030 associated with the implementation of the European Green Deal.⁵⁹ Similar results are obtained when using empirical analyses of the employment impact of previous episodes of environmental regulatory tightening (Table 4).

In the literature, in order to examine in more detail which types of jobs are likely to be most affected, it is common to classify them into three broad types (“green”, “white” and “brown”), according to their direct impact in terms of emissions and which would be affected differently (Box 7). The most common way to measure green jobs is to use the Occupational Information Network (O*NET), based in the United States.⁶⁰ However, transferring the information provided by O*NET to EU country data is not without difficulties, especially as “green jobs” tend to affect relatively small occupational groups, which need to be identified at a more granular level than the current Eurostat and country data collection allows.⁶¹

Previous studies on the incidence of green jobs in the European Union have reached divergent conclusions. The very broad definitions lead

58 For more information, Asikainen, T., Bitat, A., Bol, E., Czako, V., Marmier, A., Muench, S., Murauskaite-Bull, I., Scapolo, F., Stoermer, E. (2021): *The future of jobs is green*, Publications Office of the European Union, Luxembourg.

59 Cedefop (2021): *The green employment and skills transformation: insights from a European Green Deal skills forecast scenario*, Publications Office, Luxembourg.

60 Dierdorff, E., Norton, J., Drewes, D., Kroustalis, C., Rivkin, D., Lewis, P. (2009): «Greening of the World of Work: Implications for O*NET®-SOC and New and Emerging Occupations». Submitted to the National Center for O*Net Development, Raleigh, NC.

61 Vona, F. (2021): *Labour Markets and the Green Transition: a practitioner’s guide to the task-based approach*. Publications Office of the European Union, Luxembourg.

TABLE 4. IMPACT ON EMPLOYMENT OF CHANGES IN ENVIRONMENTAL REGULATIONS

Study	Period and scope	Results
Niggli, M., Rutzer, C. (2021) Environmental policy and heterogeneous labor market effects: evidence from Europe. WWZ Working paper 2020/09, University of Basel.	Study of the manufacturing sector in 19 EU countries during the period 1992-2010 when the stringency of environmental policy (EPS) almost tripled.	It finds negligible impact on aggregate employment, but shifts between low and high green potential jobs.
Mohammad, A. (2021). Employment Effects of Environmental Policies-Evidence From Firm-Level Data. IMF Working Papers 2021/140.	Panel of up to 5,300 companies from 31 countries over the years 2000-2015.	It finds that the net effect of EPS tightening on total employment has been small and temporary, with a peak after two years, and a coincident reallocation of employment from high- to low-emission firms and sectors.
Popp, D., Vona, F., Marin, G. and Chen, Z. (2020). The Employment Impact of Green Fiscal Push: Evidence from the American Recovery Act. NBER Working Paper 27321.	It examines green subsidies in the American Recovery and Reinvestment Act (ARRA) of 2009, rather than policies that directly increase the costs of polluting. 2013-2017.	It notes an increase in green jobs - increasing in particular the demand for manual workers in construction and waste management - together with very modest effects on aggregate employment.
Vona, F., Marin, G., Consoli, D., Popp, D. (2018). Environmental regulation and Green skills: an empirical exploration. <i>Journal of the Association of Environmental and Resource Economists</i> 5(4), 713-753. Walker, W.R. (2011). Environmental Regulation and Labor Reallocation: Evidence from the Clean Air Act. <i>American Economic Review: Paper and Proceedings</i> 101(3): 442-7.	2006-2014	It shows that environmental regulations in the US have not had a causal impact on aggregate employment, but increased the demand for green skills.
Marin, G., Vona, F. (2019). Climate policies and skills-biased employment dynamics: Evidence from EU countries. <i>Journal of Environmental Economics and Management</i> 98: 102253.	Examines the impact of rising energy prices (as a proxy for climate policies) on employment, using a panel of 14 EU countries over the period 1995-2011.	It notes that climate policies have been biased against manual workers and have favoured technicians.

Source: prepared by the authors.

to the conclusion that the ecological transition would promote up to 40 per cent of jobs in the European Union⁶². However, most commonly, analysts have opted for a narrower definition of green jobs and have estimated the current incidence of green jobs (jobs directly involving green tasks) at only a small percentage of total employment. For example, the IMF concludes that the employment-weighted green task intensity of occupations ranges between 2 per cent and 3 per cent for most advanced economies⁶³. Eurostat provides a classification of employment in “environmental goods and

62 For example, Bowen, A., Hancké, B. (2019): *The Social Dimensions of «Greening the Economy»: Developing a taxonomy of labour market effects related to the shift toward environmentally sustainable economic activities*. European Commission and LSE Consulting

63 FMI (2022): *World Economic Outlook April 2022 – Chapter 3: A Greener Labor Market: Employment, Policies, and Economic Transformation*.

services” in different industrial activities based on national accounts data. In the last 10 years, the weight of these jobs has increased by around 10 per cent, from 2.1 to 2.3 per cent of total employment in the European Union. The proportion of green jobs according to this definition ranges from 1.5 per cent in the Netherlands to almost 6 per cent in Estonia, with Spain accounting for 2.4 per cent of the EU as a whole²⁷ (Figure 7).

BOX 7. HOW TO MEASURE THE INCIDENCE OF “GREEN” AND “BROWN” JOBS?

Strictly speaking, green jobs can be defined as jobs in (sub)sectors directly related to green technologies and processes. For example, Eurostat defines a subset of industries producing environmental goods and services, based on national accounts data. Employment in these industries refers to jobs involving the development, production or maintenance of green technologies (e.g., renewables) and processes (e.g., recycling and reuse). Another possibility is to define jobs according to their pollution intensity. This would result in a relatively wide range of “green” jobs, as most service jobs have low carbon emissions. In contrast, brown jobs can be defined as jobs in (sub)sectors with high pollution intensity or emissions in processes or products.

Another way of defining green jobs is by considering the pollutant content of the final product, or the potential of a product or service to damage the environment. Indeed, the manufacture of combustion-engine cars is itself a relatively “clean” activity and therefore considered a “white” job, but some of its inputs and outputs contribute significantly to carbon emissions. It is therefore likely to undergo significant structural changes in the coming years. A definition based on final outputs would take more account of relevant supply chain linkages, but would also pose additional problems of data availability and measurement, especially outside agriculture and manufacturing, where there are no physical outputs.

A common approach adopted in the literature is to identify ‘green’ and ‘brown’ jobs at the occupational level. This approach is relevant especially in view of the strong occupational dimension of the ecological transition, which involves not only shifts between sectors, but also between occupations. A methodology that is very prominent in the literature is the green occupational labelling foreseen in O*NET for the US Standard Occupational Classification. This methodology assumes that the green transition, in particular, will promote employment for three categories of jobs: (i) jobs with new tasks and skill requirements, created to meet the needs of the green economy (“new and emerging green jobs”); (ii) existing jobs that require significant changes in tasks, skills or knowledge (“green jobs with enhanced skills”); and (iii) existing jobs that do not involve any green/new tasks (“white jobs”), but see growing demand as a result of the green transition. Other authors assess the “greening” of jobs in terms of the proportion of “green” tasks in an occupation, based on the green task labelling provided in O*NET. However, this task-based approach is not available for “brown” jobs. Some authors therefore propose to identify

BOX 7. HOW TO MEASURE THE INCIDENCE OF “GREEN” AND “BROWN” JOBS?

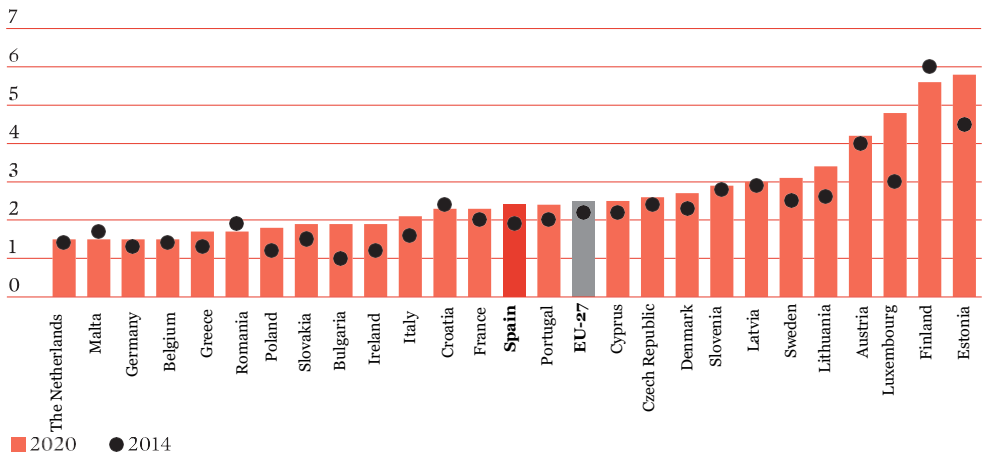
(continued)

brown’ jobs as occupations that occur at least 7 times more frequently in ‘brown’ sectors than in the rest of the economy, in order to examine whether there are certain types of occupations that are rather typical of ‘brown sectors’, as this could complicate the transition to other sectors. The IMF uses the same approach and complements it with an analysis at the sectoral level, in which sectors are considered to be “brown” on the basis of their emission intensities.

However, the application of these methodologies at occupational level to EU data is not without difficulties. The approach makes use of the Occupational Information Network (O*NET) job classification, which uses information at a highly disaggregated occupational level. To apply it to LFS data from the EU or the corresponding Member States, the information has to be aggregated to a higher level, as crosswalks from the US occupational classification (SOC) to the EU occupational classification (ISCO) are only available at a relatively high level of aggregation. Moreover, comparable cross-country information on employment by occupation across the EU is also available at most at 3-digit level, depending on the context. This obstacle can sometimes be overcome by using national level employment data, enterprise level data or matched employer–employee data. At EU level, a European Classification of Occupations, Skills and Qualifications (ESCO) has been developed. ESCO is an occupational information system along the same lines as O*NET, more adapted to the (heterogeneous) EU labour market. Recently, a classification of green skills and competences has been developed, and future work will examine its usefulness in identifying green jobs in EU LFS data. In addition, Cedefop will launch a Green Observatory to map the skills needed in the EU labour market.

FIGURE 7. EMPLOYMENT IN ENVIRONMENTAL GOODS AND SERVICES

(% over total employment)



Source: Eurostat.

TABLE 5. GREEN AND BROWN 3-DIGIT JOBS CNO

Concepts	Code	Description
Green jobs	242	Professionals in natural sciences.
	314	Natural science technicians and related associate professionals.
	719	Other structural construction workers.
	729	Other finishing workers in construction, installation (except electricians) and allied trades.
	944	Refuse collectors, waste sorters, sweepers and related trades workers.
Brown jobs	320	Supervisors in mining, manufacturing and construction engineering.
	761	Precision metal mechanics, ceramists, glaziers, glass workers and craftsmen.
	783	Textile, garment, leather, fur, leather and footwear workers.
	811	Mining and quarrying plant operators.
	812	Metal working plant operators.
	814	Operators in installations for the treatment and transformation of wood, the manufacture of paper, paper products and rubber or plastic materials.
	815	Operators of machines for the manufacture of textile products and leather and fur articles.
	816	Food, beverage and tobacco processing machine operators.
	819	Other stationary plant machinery operators.
	960	Construction and mining workers.
	970	Manufacturing industries workers.

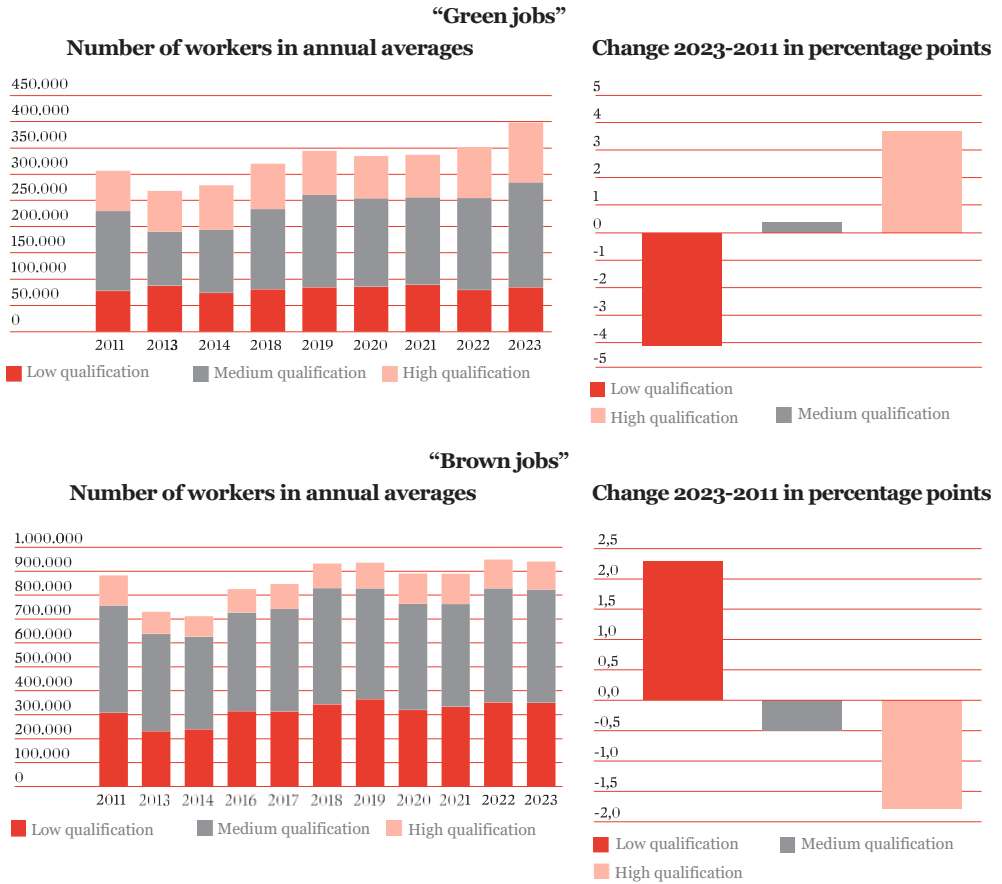
Source: National Classification of Occupations 2011

*Situation in Spain:
changes in the
composition of
green employment*

For Spain, also following a restrictive definition and identifying as green occupations only those with a high environmental component (Table 5), according to LFS data for 2023, they represent around 1.9 per cent of total employment. These results show that the aggregate effects on employment are limited.

(its share of total employment was 1.7 per cent in 2011). However, the position of green jobs has undergone small but important changes in the last decade in Spain (figure 8), which is very relevant. Climate policies have boosted the employment of high-skilled technicians (ISCO 2-3) and medium-skilled workers (ISCO 7) while the employment of low-skilled workers (ISCO 9) has stagnated. This process has also accelerated in recent years since the implementation of the Strategic Energy and Climate Framework and more recently driven by the Recovery, Transformation and Resilience Plan (RTRP). This outcome has important implications in terms of improving the quality of employment and also poses challenges in coordinating the supply and demand for skills in green jobs, including access to and supply of training and apprenticeships, as they will need to be carefully coordinated with policies to support green job creation.

FIGURE 8. EVOLUTION IN EMPLOYMENT 2011-2023 BY QUALIFICATION



Source: own use of microdata from INE, Labour Force Survey.

However, the economic adjustment due to the ecological transition will be felt most strongly in ‘brown’ jobs. These jobs, defined as jobs in pollution-intensive economic activities, will experience either an absolute contraction in labour demand or a significant structural transformation towards greener production processes, which could lead to changes in skill requirements.

In this sense, the impact of the green transition on brown job destruction could be likened to the impact of the digital transition. In the context of the digital transition, automation has particularly affected jobs with a high routine content, which mainly concern low- and medium-skilled jobs, especially in manufacturing⁶⁴. Given that brown activities are also

64 OCDE (2021). «What happened to jobs at high risk of automation?» *Policy Brief on the Future of Work*, January 2021.

concentrated in this sector and require mainly low to medium skills (Figure 8), it is likely that to some extent the two trends are mutually reinforcing.

While the secular shift from manufacturing to services has contributed to emission reductions in advanced countries, empirical research suggests that a significant part of the emission reduction is more a consequence of changes within the industrial sector than of the phasing out of polluting activities⁶⁵. In particular, there have been changes in the composition of goods produced and the use of greener technologies and processes.

The effects of these changes are unlikely to unfold in a homogeneous and equitable manner, concentrating in certain sectors, territories and demographic groups and generating gaps. In the case of regionally concentrated job losses, the time and expense required to relocate people can be considerable. If no action is taken, frictional unemployment can turn into structural and long-term unemployment. Finally, if new employment is found, displaced persons may suffer significant wage losses.

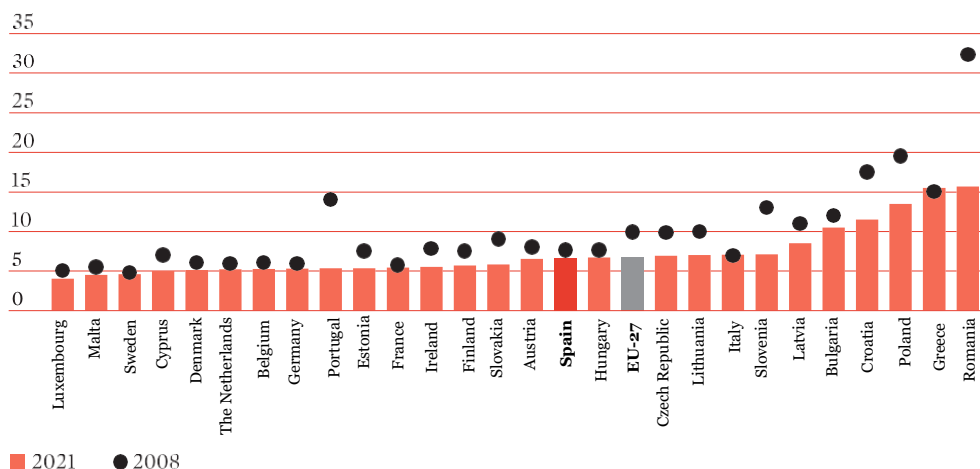
It is therefore essential to better understand where the bulk of the adjustment will fall so that policies and strategies take into account regional heterogeneities and address distributional risks, while including an assessment of the actual impact on employment. At the same time, it is important to take into account the methodological challenges faced in defining and projecting the magnitude of the adjustment cost, as the impact of the green transition on structural transformation at sectoral level remains highly uncertain for most sectors.

Available estimates show that employment in brown sectors has experienced a long decline in the EU. While figures vary according to definition and methodology, employment in these activities is around 7 per cent of total employment in the EU (Figure 9)⁶⁶. The highest rates are observed in Romania, Greece, Poland and Croatia, with Spain below the EU average. Identifying as brown occupations those associated with highly polluting activities (Table 5), according to LFS data for 2023, these represent around 4.5 per 100 of total employment in Spain (graph 8). While there are regional differences, most are around the national average with only a couple of regions significantly above or below it.

65 Copeland, B.R., Shapiro, J.S., Taylor, M.S. (2022). «Globalization and the environment», en Gopinath, G., Helpman, E., Rogoff, K. (eds.): *Handbook of International Economics: International Trade. Handbook of International Economics, Volume 5*, Elsevier: 61146.

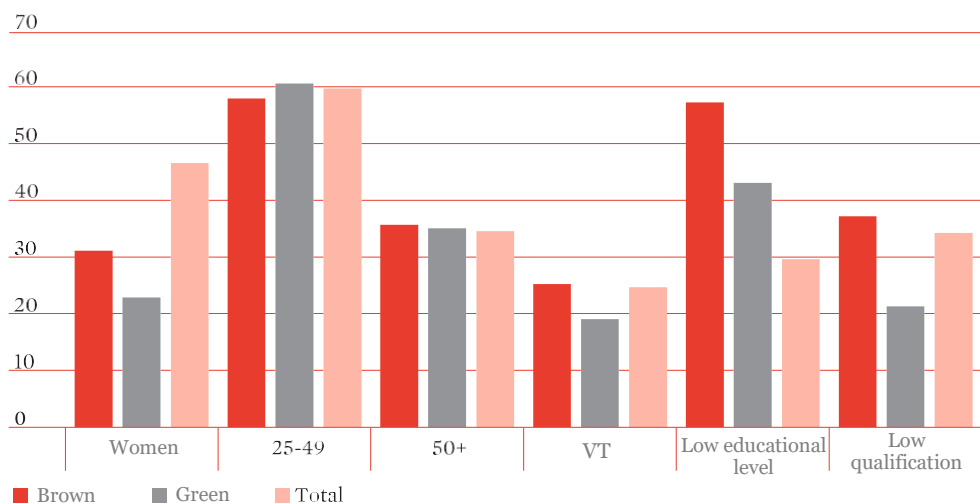
66 See Box 7 for more information and options to measure brown jobs.

FIGURE 9. EVOLUTION IN “BROWN” JOBS 2008-2021 (% over total employment)



Source: Anneleen Vandeplass & Istvan Vanyolos & Mauro Vigani & Lukas Vogel, 2022. «The Possible Implications of the Green Transition for the EU Labour Market» *European Economy - Discussion Papers* 176, (DG ECFIN), European Commission.

FIGURE 10. CHARACTERISTICS OF WORKERS IN BROWN AND GREEN JOBS



Source: own use of microdata from INE, Labour Force Survey.

Data on the gender, age and education distribution of employment in brown occupations suggest that most of the cost of adjustment will fall on low-educated, middle-aged men (25-49 years) (figure 10). Women are under-represented in both brown and, especially, green occupations. Older workers are slightly over-represented in brown occupations and given the lower job finding probability of these workers, it is possible that some may no longer find employment after being made redundant.

The success of the green transition requires a sufficient number of workers with the necessary skills to develop and implement environmentally sustainable technologies, processes and products.

The key role of green skills

These skills are of three broad types and relate to different milestones in workers' educational and employment pathways (Table 6).

The current demand for green skills, analysed from the requirements of online job offers, provides some relevant clues. The first is that most new jobs already require green skills. The second is that the higher the green content of the job, the higher the level of skills required. This is demonstrated by the fact that, in contrast to “brown” employment, “green” employment has grown proportionally more in higher-skilled occupations (figure 8). In the same vein, looking at the skill levels of workers, almost 60 per cent of workers in “brown” occupations have not completed secondary education, compared with 35 per cent in the aggregate economy and just over 20 per cent in “green” occupations.

TABLE 6. TYPES OF GREEN SKILLS AND IMPLEMENTATION

Types of green skills	Soft skills: informal competences related to the knowledge, skills, attitudes and values required to work, live and act in sustainable productive systems and societies. They include, among others, environmental awareness, creativity, adaptability to future environmental scenarios.
	Transversal: required to develop similar functions related to the green transition, with application in different jobs and sectors (e.g., sustainability reporting, environmental impact monitoring and assessment).
	Technical or specific: required in a given sector to implement the conditions, processes, services, products and technologies that improve their environmental performance (e.g., to protect ecosystems and biodiversity in a given sector/activity, extend green technologies, reduce energy and materials consumption).
Green qualification processes	Reskilling, aimed at the job transition of workers with obsolete skills due to the decline of their sector as a result of the green transition.
	Skilling and upskilling of people employed or seeking employment in established green sectors and jobs.
	Skilling (upskilling) of people working in sectors and jobs that may be changed to some degree by the green transition.
	New curricula, programmes and qualifications (<i>skilling</i>) for future workers in the new jobs arising from the green transition.

Source: own elaboration based on CEDEFOP (2021): *The green employment and skills transformation. Insights from a EGD skills forecast scenario* e InterAgency Working Group on *Work-based Learning (2022): Work-based learning and the green transition*.

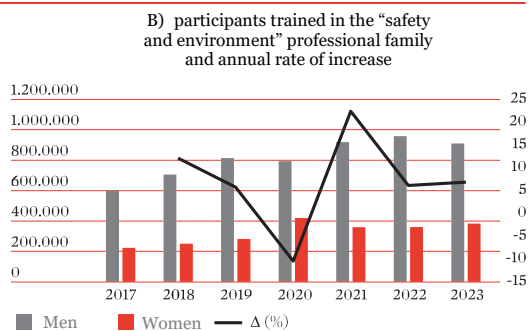
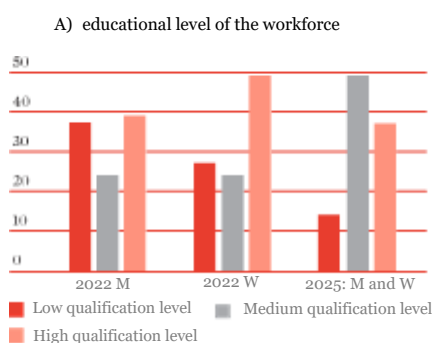
The starting conditions for the challenge of the green transition are heterogeneous. A recent analysis of the endowment of green skills among the employed population shows the relative disadvantage of southern and eastern European countries compared to northern countries⁶⁷. In the Spanish context, the main weaknesses that may limit the development of green transition competences are skills development for the green transition are summarised in Table 7.

Spain's position in tackling the green jobs transition

This situation translates into significant investment needs in training to tackle the green transition and in which Spain requires an effort slightly above the EU average 27 (Figure 11).

TABLE 7. SITUATION AND MAIN WEAKNESSES OF THE GREEN SKILLS EDUCATION AND TRAINING SYSTEM

- The supply of technical and STEM profiles will be insufficient to meet the needs of the green transition. In contrast to the increase in the number of university students enrolled in disciplines such as medicine, nursing or mathematics, engineering is failing to attract a sufficient number of students.
- Low presence of women enrolled in STEM degrees (36 per cent of the total, compared to 56 per cent of total university enrolments).
- In VET, enrolment in STEM studies decreases in higher cycles, which has an impact on the availability of specialised technical staff. Moreover, the gender gap is large: while 35.4 per cent of those enrolled in VET enrolled in STEM studies, only 9.7 per cent of women enrolled in STEM studies (2020-21 data).
- Significant imbalance between the skill levels of the labour force and the projected demand in the labour market (Figure A)
- The rate of young people enrolled in VET is significantly lower than the EU average (12 per 100 vs. 25 per 100).
- Insufficient agility of the education and training system in adapting to the needs of the labour market (Figure B).

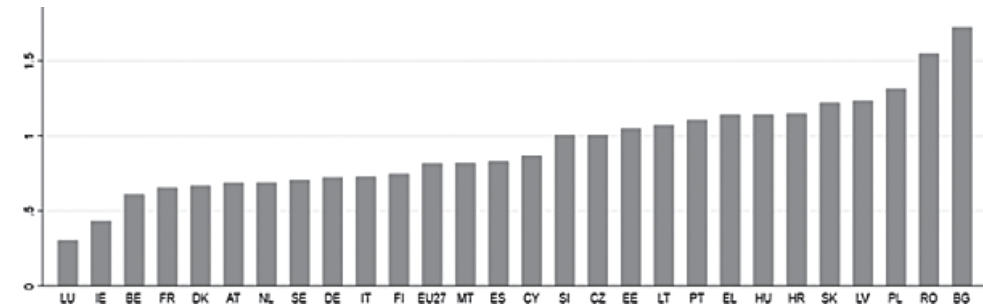


Note: in Figure B, training in ‘safety and environment’ is taken as indicative of the acquisition of green competences, although there may be green content in training in other occupational families.

Source: own elaboration based on Fundación Biodiversidad-MITECO (2023): *Empleo y transición ecológica. Yacimientos de empleo, transformación laboral y retos formativos en los sectores relacionados con el cambio climático y la biodiversidad en España* and Fundae.

67 OCDE (2023): *Job creation...op.cit.* This analysis has been translated into a *Green Skills Index*.

FIGURE 11. TOTAL COST OF GREEN SKILLS TRAINING OF THE WORKING POPULATION IN THE EU (Percentage of GDP)



Source: A. Vandeplass *et al.* (2022), *op.cit.*, p. 22.

2. PAE and green transition, the key role of skills

The impact of the green transition on employment highlights the need for employment policies to adapt accordingly. In the green transition scenario, employment policies face the challenge of accompanying workers in their reintegration into new sectors (and/or professions) or the adaptation of their jobs, as well as companies.

This is based on two main areas of action, which must be based on an adequate prospection of the needs of workers and companies. The first is training, which addresses the challenge of promoting (re)qualification, skills and lifelong learning for workers. The second area is to ensure that the green transition is also a just and inclusive transition in social, employment and territorial terms, conducive to the creation of quality jobs and that it contributes to anticipating and mitigating the negative impacts of the green transition. In this way, the just transition strategy must be articulated in a broad and coordinated framework, in which social protection, social and territorial cohesion, employment, education and training policies and industrial policy, among others, focus on minimising distributional risks and cushioning the costs of the transition.

Employment and green transition policies: skills development and just transition

In this respect, the European Green Pact and the initiatives deriving from it⁶⁸ have placed the skills of working people at the centre of

European policies, given their essential role in the transition towards climate neutrality.

These policies have been integrated into the pre-existing framework of the pre-existing framework of the Skills Agenda and its subsequent

68 Fundamentally, in the Industrial Plan for the Green Deal and REPowerEU.

update adapted to the needs arising from the pandemic⁶⁹, with a focus on different relevant angles. Firstly, by recognising the cross-cutting nature of sustainability and green and its relevance to all key competences for lifelong learning⁷⁰. Secondly, by guiding the adaptation of education and training systems to provide the necessary talent for the green transition⁷¹. Thirdly and finally, by emphasising training as a guarantee for a just transition⁷². More recently, attention has turned to the bottleneck risk that insufficient workers and skills may pose for the performance of the green transition. Thus, the Action Plan presented in March 2024 to address the shortage of workers and skills contains a specific training strand with initiatives on green skills⁷³. These objectives are supported by European funding which, to a large extent, underpins the orientation of green jobs and skills policies in the Member States. In this sense, in Spain, the boost to the green transition in the PRTR has a twofold, closely related aspect of boosting training in green skills and a specific focus on just transition (Table 8).

The aim of the Just Transition Strategy (ETJ) is to mitigate the negative impacts of the green transition on workers and territories, with a major focus on coal mines and coal-fired power plants. The actions, articulated in just transition agreements (currently fifteen) designed for each territory, include social protection initiatives, training, aid for business initiatives and investment projects or the provision of the environmental, digital and social infrastructures necessary for future economic viability

69 *Una nueva agenda de capacidades para Europa. Trabajar juntos para reforzar el capital humano, la empleabilidad y la competitividad*, COM (2016) 381 final and *Agenda de Capacidades europea para la competitividad sostenible, la equidad social y la resiliencia*, COM (2020) 274 final.

70 *Council Recommendation of 22 May 2018 on key competences for lifelong learning (2018/C189/01)*

71 On the role of vocational training specifically, see Council of the European Union (2020): *Osnabrück Declaration on vocational education and training as an enabler of recovery and just transitions to digital and green economies*, 30 November; *Council Recommendation of 24 November 2020 on vocational education and training (VET) for sustainable competitiveness, social equity and resilience, (2020/C417/01)*. In the same vein, *Council Recommendation of 16 June 2022 on apprenticeships for green transition and sustainable development (2022/C243/01)*, although in this case no reference is made to the area of training for employment and lifelong learning for workers.

72 *Council Recommendation of 16 June 2022 on ensuring a just transition to climate neutrality, 2022/C243/04*.

73 COM (2024) 131 final. At the European level, the promotion of new Skills Academies in clean industries, the co-financing of a greater number of Centres of Professional Excellence or a greater boost to foresight and the quality of data on skills is advocated. Likewise, the Member States are invited, with the participation of the social partners and other relevant actors, to equip themselves with strategic frameworks for the development of skills, to deepen the analysis of the labour market and to adapt training curricula to the future needs of employment and the productive fabric. As a complement, see the results of Eurobarometer⁵²⁹ (2023): *European Year of Skills: Skills shortages, recruitment and retention strategies in SMEs*.

TABLE 8. GREEN TRANSITION AND EMPLOYMENT ACTIONS UNDER THE PRTR AND JUST TRANSITION STRATEGY

Objectives	Lines of action	Endowment and green concentration	Origin
Green employment and skills promotion			
Skills development and green jobs	<p>Young employment (C23.I1)</p> <p>EMPLOYMENT- YOUNG EMPLOYMENT-TANDEM work-linked training programme. 25 per cent of the eligible activities are geared towards the development of green skills and jobs.</p> <p>Programme 'First professional experience in public administrations', with 20 per cent devoted to the development of green skills and jobs.</p>	<p>23.8M (25 per 100 of total)</p> <p>64M (20 per 100)</p>	PRTR
	<p>Employment Women and gender mainstreaming in SAPs (C23.I2)</p> <p>Support for women in rural and urban areas.</p>	26.3M (35 per 100)	
	<p>Acquisition of new skills for digital, green and productive transformation (C23.I3)</p>	107.4M (30 per 100)	
	<p>Reskilling and upskilling of the labour force linked to vocational qualifications (C20.I1)</p> <p>Sub-line on modular training for the reskilling and upskilling of workers.</p>	390.3M (40 per 100)	
	<p>New territorial projects for rebalancing and equity (C23.I4)</p> <p>Entrepreneurship and micro-enterprise line: new territorial projects addressing the demographic challenge and facilitating productive transformation, in particular towards a green and digital economy.</p>	55M (25 per 100)	
Just transition			
Improving the capacity and knowledge of the population in areas of just transition, with a focus on environment, energy efficiency and renewable energies	<p>Covenants/agreements for Just Transition in energy transition areas (C10.R1), with the aim of signing 12 FT Protocols.</p>		PRTR
	<p>Investments in Just Transition (C10.I1), which include a plan to support the professional requalification and labour insertion of people affected by the energy transition.</p> <p>Programme for training in professional families of "energy and water", "safety and environment" and "installation and maintenance" and obtaining professional certifications that enable the reintegration into the labour market of groups affected by the closures. Pilot aimed at 640 unemployed people in areas of just transition.</p> <p>Guidance, training, intermediation, job search assistance and job offer recruitment programme for unemployed people in areas of just transition (pilot aimed at 200 people).</p>		

of territories and to fix their population. In this way, the ETJ⁷⁴ Urgent Action Plan will be replaced by the Just Transition Fund, integrated in the Multiannual Financial Framework 2021-2027 and which has endowed Spain with 869 million euros to support the affected territories.

Finally, from a broader perspective of employment support in the framework of the ESF+, the Empleaverde+ programme, endowed with 44 million euros in the current programming period, co-finances actions for the acquisition or improvement of skills for the ecological transition⁷⁵.

3. The role of social dialogue and collective bargaining

The effects of climate change impact on jobs (creation-destruction-transformation dynamics), and in the training required for the new skills in demand (qualification-requalification dynamics), aspects that have just been addressed, but which are also projected in the sphere of labour relations. Policies to mitigate climate change and adapt to its effects also involve labour regulations⁷⁶, the actions of labour institutions and the instruments of labour relations stemming from collective autonomy (social dialogue, collective bargaining agreements and collective agreements, etc).

Within the necessary transversality of policies to contribute to the objectives against climate change, labour policies have an impact on the mitigation or reduction of climate change through different means (extension of teleworking⁷⁷, provision of sustainable mobility plans in projects, among others); and have a more marked impact on adaptation to its effects, being linked to compliance with the just climate or green transition, of which it forms part. The just transition not only imposes obligations of action on the Administration, but also involves the parties to labour relations, both from the point of view of compliance with the rules and the exercise of their collective autonomy. And it is necessary for it to involve the social partners through social dialogue, as the International Labour Organisation, among other global and European institutions, has affirmed⁷⁸.

74 Initially limited to the period 2019-2021, the Plan's actions have been extended until the effective programming of the Just Transition Fund in 2023.

75 The list of financial instruments for green transition will be completed with the Social Climate Fund (SCF), which is still in the negotiation phase. The actions of the FSC will be linked to the reforms and commitments undertaken in the Member States in their PNIECs. The focus of the FSC is on households, businesses and transport users that are particularly vulnerable to the extension of the GHG emissions trading scheme. In this respect, it does not foresee specific actions on workers at this stage. The FSC foresees an envelope of 72 billion euros for the whole of the European Union for the period 2025-2032.

76 This includes labour standards *stricto sensu* and general or sectoral standards on climate change with an impact on the labour sphere. An example of the former is the Workers' Statute Law; an example of the latter is the Law on Climate Change and Energy Transition.

77 Law 10/2021 of 9 July on distance work, which was agreed in the framework of social dialogue.

78 Most recently, see Report VI of the International Labour Conference (111th Session, Geneva, 2023), 'Achieving a just transition to environmentally sustainable economies and societies'

Adaptation labour policy has a clear scope in the protection of workers' health and safety, and the prevention of occupational risks arising from global warming-induced weather phenomena

Labour regulations in the face of the effects of climate change

including exposure to extreme and persistent temperatures, needs to be fully integrated. The Occupational Safety and Health Strategy (OSHES) 2023-2027 has incorporated this challenge (Objective 2) as part of the adaptation to the transformational socio-economic transitions at work. The socially agreed nature of the EESST thus highlights the value of social dialogue as a channel for the design of adaptation policies.

A specific action in this context is the modification of the regulations in relation to outdoor work, among others, which has expressly established the obligation to adopt certain protection measures against risks related to adverse meteorological phenomena, including extreme temperatures⁷⁹, measures which must be derived from the compulsory assessment of these risks. This emergency amendment takes into account the evidence that phenomena such as high temperatures, and their increasing duration, are not isolated events but an increasingly frequent trend.

This specific modification has a cross-cutting scope of application to many activities that may be affected by the new climatic conditions⁸⁰. But it is also necessary to guarantee preventive policies in the new green jobs by promoting research into the health and safety of workers in these sectors⁸¹.

The new normality that may be brought about by the meteorological alterations produced by global warming is, in fact, the perspective in which all policies for labour adaptation to the effects of climate change should be framed. In this respect, it is worth recalling the call for collective bargaining to establish agreements on the irregular distribution of working hours throughout the year, which may also serve, among other purposes, to protect health and safety at work⁸².

for all'. It affirms that social dialogue is an important mechanism for advancing the adoption of measures aimed at achieving a low-carbon economy.

79 Royal Decree-Law 4/2023, of 11 May, which amended Royal Decree 486/1997, of 14 April, establishing minimum health and safety provisions in the workplace. The new measures go beyond the provisions on limitations on working hours due to exposure to environmental risks contained in Royal Decree 1561/1995, of 21 September, on special working days, in view of the risks posed by a new climatic normality that had not been foreseen at the time.

80 The ITSS, for its part, incorporated the activity of monitoring these risks in its Strategic Plan 2021- 2023, and through the activation of special plans for the protection of workers against the risks of exposure to high temperatures due to the effects of global warming.

81 Commitment included in the EESST 2023-2027 within its Objective 2.

82 Workers' Statute Law (art. 34.2). Conventional clauses on the variability of working hours due to climatic circumstances are relatively frequent and traditional in some sectors such as construction.

83 Royal Decree-Law 32/2021, 28 December, on Urgent Measures for Labour Reform, Guarantee for Stable Employment and Transformation of the Job Market.

Another important area of adaptation instruments lies in the procedures for temporary reduction of working hours and temporary suspension of employment contracts for various reasons (ERTE the purpose of which is to preserve employment as an alternative to the termination of contracts, especially after the remodelling introduced by the socially agreed labour reform⁸³. Among other measures, an instrument was established, the RED Mechanism for employment flexibility and stabilisation, which, once activated by the Council of Ministers, allows companies to request measures to reduce working hours and suspend employment contracts, in two modalities⁸⁴. Of these, the activation of the sectoral modality is envisaged when permanent changes are observed in a given sector or sectors that generate the need for retraining and professional transition processes for workers.

The ERTE for COVID causes made it possible to hibernate company workforces and improve the recovery of productive activity as epidemiological circumstances permitted, safeguarding numerous jobs and the productive fabric. Similarly, the new internal flexibility mechanisms incorporated into labour regulations, although not specifically designed to deal with the effects of climate change on business activity, may be called upon to make it possible to preserve the productive fabric and jobs in the face of adverse episodes associated with global warming and to facilitate sectoral reconfiguration towards sustainable production processes in the context of the green climate transition (RED mechanism of sectoral modality). The key lies in the training actions that companies will be able to carry out to facilitate the retraining of workers for the new skills in demand, to which are linked the exemptions from social security contributions that companies will be able to benefit from voluntarily⁸⁵.

Another category of labour instruments functionally oriented to allow fair transitions are the social accompaniment measures and the external recovery plans foreseen in the procedures for the collective termination of employment contracts for economic, technical, organisational or production reasons (ERE for ETOP reasons)⁸⁶. The former, which must form part of the content of the company's consultation-negotiations with the RLT in order to avoid or reduce collective redundancies, or to mitigate their effects on the workers affected, may consist of

84 Workers' Statute Law (art. 47 bis) and Royal Decree 608/2023, of July 11, developing the RED Mechanism for Employment Flexibility and Stabilization.

85 Training actions "aimed at improving the professional skills and employability of workers" (Royal Decree 608/2023 of 11 July, cit.). See previous section on "active employment policies and green transition, the key role of skills".

86 Workers' Statute Law (art. 51, paragraphs 2 and 10) and Royal Decree 1483/2012, of 29 October, approving the Regulations on the procedures for collective dismissal and the suspension of contracts and reduction of working hours (Royal Decree 1483/2012, of 29 October).

87 Workers' Statute Law (arts. 4.2, b and 23).

among others, of outplacement measures or training or retraining actions that may contribute to the continuity of the business project and to the improvement of the employability of the workers.

Together with the aforementioned instruments, facilitating the upskilling and reskilling of workers through lifelong training is essential to provide opportunities for a just transition that, in turn, can contribute to the transformations of the productive model within the framework of climate change policies, even if it is not specific to climate change. In this sense, the exercise of the right to training⁸⁷ will be facilitated by a greater integration of the vocational training system, comprising training in the educational system (initial) and on-the-job training (training programmed by companies and training offered to employed persons-sectoral plans). The new configuration of Vocational Training⁸⁸ has led to progress towards this objective by integrating the offer of accreditable vocational training aimed at students in initial training and at the working population. The aim is for the system to offer training opportunities and professional support to all people (students, employed, unemployed) throughout their lives, in a flexible manner, and at the same time, to respond to the demand for skills⁸⁹, which can contribute to the generation of green jobs and to productive transformation in specific subsectors and activities.

The effectiveness of just transition policies in productive reconversion processes in sectors and territories, which may be induced by the effects of global warming, requires the participation of the social partners in their design.

Social dialogue at multiple levels (European and national, tripartite and bipartite, intersectoral and sectoral) also contributes to greater social acceptance of the measures to be implemented.

The space of social dialogue, European and national

It can be agreed that in the very idea-value of just transition, in its definition and scope in each case, the necessary participation of the social partners and the parties to labour relations, as actors directly involved and affected, is implicit. *The European social dialogue*. This area of social dialogue offers a necessary space for the social partners to jointly address the impacts on the economy and labour in relation to European policies for mitigating and adapting to climate change⁹⁰. The European Commission has a general position

88 Organic Law 3/2022, of March 31, 2022, on the Organization and Integration of Vocational Training.

89 Advances that, however, are not yet definitive in order to achieve full integration. See Report CES 1/2023, La formación dual en España: situación y perspectivas, pp. 129 et se.

90 The European social dialogue has already tackled another of the major transitions, the digital transition, through autonomous agreements that have brought about fundamental consensus among the most representative European business and trade union organizations, thereby achieving not only greater participation in the

for social dialogue on just transitions⁹¹, and a mandate from the Council and Parliament to involve the social partners in promoting dialogue on climate change and its social and gender equality aspects⁹². For its part, the Council of the European Union has stressed the importance of actively involving the social partners, while respecting their autonomy, in all stages of the design and implementation of the various public policies, including through social dialogue and collective bargaining⁹³.

The European social partners, in their Joint Work Program 2022- 2024, agree that among the important challenges currently facing workers and employers in the European Union is that of the green transition. Therefore, they understand that it is necessary to set up a framework of actions to ensure a just ecological/climate transition, accompanied by adequate funding and public investment, which seeks to contribute to the creation of quality jobs and to help companies and workers to adapt to change, including the need for new skills, their improvement, the redesign of jobs and improvements in the organization of work.

On the other hand, and in addition, it is necessary to continue to address the impact of climate change on subsectors and activities through sectoral European social dialogue agreements, a level of social dialogue that has been showing great dynamism through the 44 sectoral social dialogue committees currently in existence, and which is particularly suitable for tackling this challenge due to its proximity to the problems of the most affected sectors and subsectors. It is worth recalling, in this regard, the possibility of drawing up, on a voluntary basis, sectoral indicative roadmaps to achieve the European Union's climate neutrality objective⁹⁴, an instrument that may be relevant for addressing the just climate transition within the framework of social dialogue.

The European Economic and Social Committee (EESC), for its part, has contributed to the debate on social dialogue and collective bargaining in the ecological or climate transition through recent opinions, one of which is the opinion on social dialogue

elaboration of European Union policies, but also a greater participation in the development of the European Union's social policies. Thus, the European Framework Agreement on Digitization (EFA), signed by the European Trade Union Confederation, Business Europe, SME United and CEEP in June 2020, set out the general objective of achieving a consensual transition to enable the successful integration of digital technologies in the workplace, maximizing opportunities, and preventing and minimizing the risks of these processes for workers and companies.

91 Commission Communication of 25 January 2023, Strengthening social dialogue in the European Union: making full use of its potential for managing just transitions, COM (2023) 40 final.

92 Regulation EU-2021/1119 of 30 June 2021 establishing the framework for achieving climate neutrality (art. 9).

93 *Recommendation to ensure a just transition to climate neutrality (EPSCO Council, June 2022)*.

94 Regulation EU-2021/1119 of June 30, 2021, cit. (art. 10).

in the context of the ecological transition of 21 September 2022. In it, the EESC stresses that all levels of social dialogue - Europe, Member States, sectors, regions and workplaces - have crucial but distinct roles to play in managing and facilitating the ecological transition. Thus, the entire climate action policy framework must incorporate as an integral part an intensive involvement of trade unions and business organizations through a strong social dialogue⁹⁵.

Social dialogue in Spain. It is also necessary to address, in a structured and continuous manner, the treatment of the labour impact of climate change within the different levels of social dialogue at the internal level. The tripartite social dialogue between the Government and the social partners can be developed within its own framework in relation to the content and monitoring of the effects on activity and employment of the Just Transition Strategy (ETJ), in accordance with the provisions of Law 7/2021, of May 20, on Climate Change and Energy Transition⁹⁶. Furthermore, the Just Transition Agreements provided for in the aforementioned Law should be seen as a qualified instrument for the participation and dialogue of the social partners. In this sense, it should be recalled that, for years, an important dynamic of tripartite social dialogue has been developing at the level of the autonomous communities, where agreements have been signed on territorial development, employment and industrial policies, and even in some territories on energy transition⁹⁷, among others, consensus tools for the economic, labour and social articulation of the territories in which the autonomous governments and the most representative business and trade union organizations in these areas have been involved which could contribute with contents and experience for the elaboration of just transition agreements, which in essence respond to similar objectives.

On the other hand, it should be recalled that in the last legislature the social partners were convened in a tripartite social dialogue roundtable on the Recovery, Transformation and Resilience Plan (PRTR), to follow up on the reforms and investments in different components of the Plan⁹⁸. Two separate social dialogue roundtables

95 EESC opinion (2022/C 486/14) of 21.9.2022. The EESC calls for the promotion of social dialogue and stakeholder participation at all levels, and for ensuring that new green jobs are quality jobs, in line with the ILO's Decent Work Agenda and the European Pillar of Social Rights.

96 The ETJ should contain, among others, "instruments for monitoring the labour market in the framework of the energy transition through the participation of the social partners, as well as in the social dialogue roundtables."

97 A set of tripartite autonomous regional social dialogue agreements can be found in Memoria CES 2019 and 2020 (chapter II-2).

98 Component 10 of the PRTR (Just Transition Strategy) is the main reference for dialogue with the social partners in relation to this issue, but not the only one, at least components 3 (Environmental and digital transformation of the agri-food and fishing system), 6 (Sustainable, safe and connected mobility), 7 (Deployment and integration of renewable energies), 9 (Renewable hydrogen roadmap and its sectoral integration), and 12 (Industrial Policy Spain 2030) should be mentioned).

had been set up, one of them for the PERTEs. It should be noted the need to give continuity to this roundtable because of the importance of jointly monitoring the productive transformation of the sectors, the generation of green jobs, and the transitions between jobs and their impact at the regional and local levels.

On the other hand, sectoral social dialogue is also very relevant, since it is in the specific productive sectors where the social partners can propose and, where appropriate, agree on more precise mitigation and adaptation strategies adapted to their reality. In this sense, it might be advisable to promote a tool for knowledge, follow-up and monitoring of the productive and labour reality in the economic fabric, and particularly the demographic, ecological and digital transitions, such as sectoral observatories.

Within the scope of the bipartite autonomous dialogue between the most representative business and trade union organizations, the V Agreement for Employment and Collective Bargaining (V AENC) has incorporated a chapter on technological, digital and ecological transition. In relation to the ecological transition, energy decarbonization and the circular economy, the V AENC calls for these processes to be addressed early and effectively through collective bargaining. To this end, it considers it essential to identify new qualification and skills upgrading needs, redesign of jobs, organization of transitions between jobs or improvements in the organization of work. To this end, the signatory parties consider that it is a priority to promote training and information for workers to ensure their involvement in the adoption of measures required by climate change. Indeed, the promotion of the change in the production, energy and consumption model envisaged by the strategic energy and climate instruments, in the direction of achieving the climate neutrality objectives

Challenges for the collective bargaining

committed to by Spain, will also have consequences for the conditions in which work is provided and the organization of work. Public strategy tools call for the development of a shared vision of risks and a balanced distribution of responsibilities⁹⁹. The management of risks, but also of opportunities, can be addressed through the instruments of labour relations, including what is known as green collective bargaining.

Strictly speaking, this would be understood as the content of negotiating clauses included in collective bargaining agreements that relate to the environment, but collective bargaining agreements have before them a broader catalogue of aspects that can be addressed for climate change mitigation and adaptation. Among other things, it is worth considering the effects of the activity on the environment, establishing

⁹⁹ Government of Spain: National Plan for Adaptation to Climate Change 2021-2030, part of the strategic framework for energy and climate.

mechanisms to protect workers from the effects of global warming, to address the effects of global warming on the activity of companies, or training in labour skills in new production environments and green jobs, as well as clauses relating to employment in the transitions to climate change.

The Opinion of the European Economic and Social Committee on “Green collective bargaining: good practices and future prospects”¹⁰⁰ argues that, while fully respecting their autonomy, the social partners can contribute to combating climate change and finding solutions to the challenges of the ecological transition. The opinion suggests possible areas of action for green collective bargaining. Among other things, it envisages the creation of an “employee environmental officer” with various functions. In larger companies, in the EESC's view, these functions could be articulated through joint and joint environmental management committees. The EESC also suggests that collective agreements should include the promotion of training plans for company employees and managers on environmental issues, as well as negotiating and approving sustainable mobility plans in companies¹⁰¹, encouraging alternatives to the use of private cars; and contains recommendations on green collective bargaining and corporate social responsibility, as it considers that the measures arising from green collective bargaining can not only help companies to mitigate the negative consequences of climate change and take advantage of the opportunities offered by public mitigation policies, but also contribute to their corporate social responsibility strategy¹⁰².

In Spain, some studies have identified good practices in collective agreements whose content can be framed within the framework of green collective bargaining, which will hopefully be extended in view of the criteria and recommendations which, as mentioned above, are included in the 5th AENC in relation to the ecological transition. Conventional collective attention to the effects of climate change in the sense of mitigation, adaptation and just transition measures is, however, still a minority in some of the most affected sectors¹⁰³. Environmental protection clauses have been agreed in agreements in some sectors since before the current European energy and climate roadmap, albeit sometimes in declaratory terms of intentions, and sometimes in conjunction with occupational health

100 DOC 293 of 18 August 2023.

101 The Draft Law on Sustainable Mobility, currently before the Congress of Deputies, provides for the negotiation of sustainable mobility plans for large centres of activity (art. 26) and for companies and entities belonging to the public sector (art. 27).

102 In this regard, EFRAG, the association commissioned by the European Commission to develop a uniform system of corporate social assessment under Directive (EU) 2022/2464 [on] sustainability reporting by companies, highlights the positive impact of involving workers and their representatives in the adoption of measures.

103 See AA.VV. (Rodríguez Escanciano, S. dir.): *La negociación colectiva en el sector agrario*. Madrid (MTES), 2023.

TABLE 9. THE EUROPEAN UNION AND THE GREEN COLLECTIVE BARGAINING

European Union initiatives	<p>Council Recommendations of 16 June 2022 to ensure a just transition to climate neutrality.</p> <ul style="list-style-type: none"> – The Council considers that one of the cross-cutting elements to ensure a just ecological transition is to actively involve the social partners in the design and implementation of public policies. – Social dialogue and collective bargaining are essential for the design and implementation of transition strategies.
	<p>European Semester 2024: green collective bargaining (note from the Council Presidency to the members of the Permanent Representatives Committee to the EU).</p> <ul style="list-style-type: none"> – Possible contents of green collective bargaining are: the impact of green transition on employment and territorial and social cohesion, the creation of green jobs, upskilling and reskilling of workers to facilitate their transfer to other sectors, mobility of employees, efficiency in productive activity, or the transmission of information to workers through environmental representatives. – Member States are encouraged to identify recent national good practices and to reflect on measures to promote green collective bargaining.
	<p>Conclusions on more democracy at work and green collective bargaining for decent work and sustainable and inclusive growth (EU Council in its Employment, Social Policy, Health and Consumer Affairs formation, 27-28 November 2023).</p> <ul style="list-style-type: none"> – Social dialogue and collective bargaining are ideal instruments for training and retraining in the context of the green transition. – Green collective bargaining at all levels plays a key role in securing the objectives of the European Green Pact and the transition to a climate-neutral economy. – Green collective bargaining requires strong social partners and the promotion of social dialogue.

* Note from the Council Presidency giving guidance to the members of the Permanent Representatives Committee to the European Union on the development of green collective bargaining, the contributions of the Member States and the direction of discussions on the subject.

Source: Prepared by the authors on the basis of EU publications.

and safety protection¹⁰⁴. Specific clauses were only included in 9.4 of the agreements signed in 18.4 per cent of the workers covered by those agreements¹⁰⁵. Some sectors have also traditionally included clauses on the variability in the distribution of working hours to adapt to adverse weather conditions in their collective bargaining agreements, which can accommodate the trend need for protection against extreme weather conditions¹⁰⁶. In any case, and with a view to the future, it is important to have a cross-sectoral study, as well as more sectoral studies and the updating of existing studies, on the treatment in collective bargaining of mitigation, adaptation and ecological just transition measures.

104 See AA.VV. (Fernández López, M. F. dir.): *La negociación colectiva en la industria del papel y el sector de artes gráficas*. Madrid (MTES-CCNCC), 2009. AA.VV. (Gil Plana, J. Dir.): *La negociación colectiva en el sector del metal*. Madrid (MTES), 2021.

105 MTES: Estadística de Convenios Colectivos, datos de convenios firmados en 2023 acumulados hasta marzo de 2024.

106 See AA.VV. (Calvo Gallego, J. dir.): *La negociación colectiva en el sector de la construcción*. Madrid (MTES), 2021.

Finally, Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022, as regards sustainability reporting by companies¹⁰⁷, provides for the communication of sustainability information to employees' representatives and the issuing by them of an opinion to be communicated, where appropriate, to the company's management bodies. This information and consultation of workers' representatives on environmental sustainability issues could have the effect of boosting collective bargaining on these matters¹⁰⁸.

107 The transposition of Directive 2022/2464 through the Preliminary Draft Law regulating the Corporate Reporting Framework on environmental, social and governance issues was the subject of consultation with the Economic and Social Council, which issued its observations in Opinion 4/2024.

108 See recitals 9, 14 and 52 of the Directive 2022/2464 of 14 December.

BOX 8. CLIMATE CHANGE AND EMPLOYMENT

Climate change and the degradation of the environment pose significant challenges to employment and the risks will be higher in the medium-long term. On the contrary, mitigation measures and the transition to a low-carbon economy present an opportunity and, if well managed, can generate more and better jobs.

In particular, ⁽¹⁾ the changes in ecosystems and ⁽²⁾ changes in adaptation and mitigation policy (ecological transition) are likely to lead to changes in employment across sectors, firms, occupations and regions, as well as changes in content: new tasks or tasks performed differently.

In this context, the role of Active Employment Policies (AEPs), the Just Transition strategy, social dialogue and collective bargaining are essential to address the distributional consequences of climate policy and to deal with potential social and labour risks and adjustment frictions.

Impacts derived from changes in ecosystems

Expected

Fall in employment in the primary sector associated with a decrease in production. Territorial redistribution of employment in tourism activities. For Spain as a whole, more uniform distribution of employment throughout the year, decreasing in high season and increasing between October and May, although without compensating for the loss of employment in July and August.

Visible

Without significant impacts on employment.

Impacts derived from ecological transition

Expected

Aggregate employment effects of environmental policy in general, and of decarbonisation policies in particular, small and transitory. For the EU, the Fit for 55 impact assessment projects aggregate employment growth of between 0.3 and 0.5 per cent by 2030.

“Green” jobs, which involve tasks aimed at reducing the impact of economic activity on the environment, from waste recycling to R&D in green innovation, are expected to grow and are on average more skill-intensive than other jobs. However, they account for a small percentage of total employment.

“Brown” jobs, which relate to polluting activities, will either experience an absolute contraction in labour demand or a significant structural transformation towards greener production processes, which could lead to changes in skill requirements.

Visible

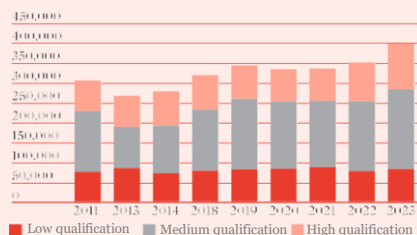
Growth in the share of “green” employment in both the EU and Spain and a fall in the share of “brown” employment over the last decade.

While aggregate employment effects are limited, the composition of green employment has undergone small but important changes over the last decade in Spain: climate policies have boosted the employment of high and medium-skilled technicians while the employment of low-skilled workers has stagnated (Figure 1).

BOX 8. CLIMATE CHANGE AND EMPLOYMENT (continued)

Impacts derived from ecological transition

FIGURE 1. EVOLUTION OF “GREEN” EMPLOYMENT 2011-2023 ACCORDING TO QUALIFICATION



Winners and losers

In Spain, climate change poses a Challenge for several sectors, mainly for two which are key in employment terms: the agri-food and the tourism sectors.

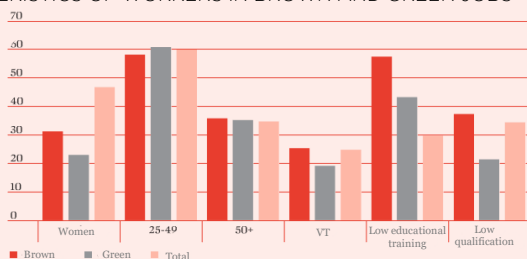
In addition to the primary sector and to a lesser extent the tourism sector, other sectors are heavily dependent on water and could experience significant job losses in a future with less water.

In contrast to these sectors, there are others that can benefit from the implementation of measures to mitigate the direct effects of climate change. In particular, in the coming years, new jobs are expected to be generated in various activities in the construction sector, in industry and in the so-called “water sectors”.

In addition to certain sectors and territories, the effects of these changes may be concentrated in certain demographic groups. Data on the gender, age and education distribution of employment in ‘brown’ occupations suggest that most of the cost of adjustment will fall on men in middle age groups (25-49 years) with low educational level (Figure 2).

Women are underrepresented both in green jobs and -specially- in green jobs. Older workers are slightly overrepresented in brown jobs and, given the lower probability for these workers to find a job, it is possible that some of them do not find a job after being made redundant.

FIGURE 2. CHARACTERISTICS OF WORKERS IN BROWN AND GREEN JOBS



What competences and qualification processes does the green transition require?

Types of green competences

Soft skills: informal competences related to the knowledge, skills, attitudes and values required to work, live and act in sustainable productive systems and societies. They include, among others, environmental awareness, creativity, adaptability to future environmental scenarios.

Transversal: applied to different employment and sectors (for example: sustainability report, monitoring and evaluation of environmental impact).

Technical or specific: required in a given sector to implement the conditions, processes, services, products and technologies that improve their environmental performance.

What competences and qualification processes does the green transition require?

Types of green competences

Reskilling, aimed at the transition to work of workers with obsolete qualifications.

Skilling and upskilling of people employed or seeking employment in green sectors and jobs.

Skilling (upskilling) of workers in sectors and jobs that may be affected by the green transition.

New curricula, programmes and qualifications (skilling) for future workers in new jobs arising from the green transition.

Situation and weaknesses of green skills in Spain

- Insufficient supply of technical and STEM profiles.
- Low presence of women enrolled in STEM degrees (36 per cent, compared to 56 per cent of the total number of female university students).
- The rate of young people enrolled in vocational training is significantly lower than in the EU27 (12 per 100 vs. 25 per 100).
- In VET, enrolment in STEM studies decreases in higher cycles, which has an impact on the availability of specialised technical staff. Moreover, the gender gap is also large.
- Imbalance between the skill levels of the labour force and the projected demand (oversupply of low and high skill levels; shortage of medium level).
- Insufficient agility of the education and training system in adapting to the needs of the labour market.

PAE and green transition

In the scenario of ecological transition, employment policies face the challenge of accompanying workers in their reintegration into new sectors (and/or professions) or the adaptation of their jobs, as well as companies. Two main objectives:

Boosting green jobs and green skills

- Development of green skills and green jobs.
 - Specific focus on young people (work-linked training and first professional experience in public authorities) and women.
 - Acquisition of skills and qualifications.
- Support for micro-enterprises and green entrepreneurship.

Funds to finance the actions

- PRTR (666.8 million euros).
- PRTR (9 million euros).
- Urgent Action Plan and Just Transition Conventions, which will be succeeded by the Just Transition Fund (173.8 million euros).

Just Transition

Ensuring the necessary social protection, social cohesion and territorial cohesion measures to cushion the costs of the green transition.

- Developing green knowledge and competences of people in FT areas.
 - FT covenants/conventions.
 - Professional re-qualification of people affected by the green transition.
 - Guidance, training, intermediation and re-employment support programme.
- Improving the employability and protection of the population affected by the FT.
 - Pre-retirement and compensated leave.
 - Job banks for workers affected by closures.
 - Plan to support the retraining and labour insertion of the affected populations.

BOX 8. **CLIMATE CHANGE AND EMPLOYMENT** (*continued*)**PAE and green transition**

- Prioritisation of CTJ areas in the renewable energy PERTE.
- Prioritisation in Empleoverde+ subsidies.
- Prioritisation of workers in CTJ in the dismantling of power plants and environmental recovery of abandoned mines.

The role of social dialogue and collective bargaining

Policies to mitigate climate change and adapt to its effects also involve labour regulations, the actions of labour institutions, social dialogue and the instruments of labour relations stemming from collective autonomy (collective bargaining agreements and agreements).

Labour standards and strategies

The Strategy for Safety and Health at Work (EESST) 2023-2027 has incorporated (Objective 2) the challenge of integrating the prevention of occupational risks arising from weather phenomena caused by global warming as part of the adaptation to socio-economic transitions transforming work, in general, and in new green jobs.

Other relevant instruments for adaptation are:

- The procedures for temporary reduction of working hours and temporary suspension of work contracts for various reasons (ERTE), whose purpose is the preservation of employment as an alternative to the termination of contracts.
- The RED Mechanism for employment flexibility and stabilisation, introduced by the socially agreed labour reform, in its sectoral modality, is foreseen when permanent changes are observed in a specific sector or sectors that generate needs for retraining and professional transition processes for workers.
- The social support measures and external outplacement plans provided for in collective redundancy procedures for economic, technical, organisational or production-related reasons (ERE for ETOP reasons).

The role of social dialogue, European and national

- The effectiveness of just transition policies in the processes of productive reconversion in sectors and territories, which may be induced by the effects of global warming, requires the participation of the social partners in their design.
- The European social partners, in their Joint Work Programme 2022-2024, address the shaping of a framework of actions to ensure a just ecological/climate transition. Sectoral social dialogue is particularly suited to meet this challenge because of its proximity to the issues of the sectors and sub-sectors most affected.
- At the national level, tripartite social dialogue can be developed in its own framework in relation to the monitoring of the effects on activity and employment of the Just Transition Strategy, provided for in Law 7/2021 of 20 May.
- Sectoral social dialogue is particularly relevant, where it would be advisable to promote sectoral observatories in the follow-up and monitoring of the demographic, ecological and digital transitions.
- In the sphere of bipartite autonomous dialogue between the most representative business and trade union organisations, the V Agreement for Employment and Collective Bargaining (V AENC), in relation to the ecological transition, energy decarbonisation and the circular economy, calls for these processes to be tackled early and effectively through collective bargaining.

Challenges for the collective bargaining

- The challenges posed by the effects of climate change on work can be addressed through labour relations instruments, including what is known as green collective bargaining, as has been pointed out, among others, by EU institutions.
- In Spain, some studies identify good practices in collective bargaining agreements, with treatment focusing mainly on clauses relating to environmental protection. Although collective bargaining attention to the effects of climate change is still a minority, it is expected to become more widespread, among other factors, in view of the criteria and recommendations included in the Fifth Collective Bargaining Agreement in relation to the ecological transition.

**SOCIAL IMPACT OF CLIMATE CHANGE: ADDRESSING
TRANSITION WITHOUT DEEPENING INEQUALITIES**

1. Climate change and the right to a healthy environment

The speed and intensity with which climate change is advancing means that we are already facing scenarios that a few years ago seemed distant in time. Its effect on human beings, the conditions in which their existence develops and their very survival are the main underlying concern in the debate on the future of the planet, although international commitments to tackle it have been conditioned by its consequences for economic development.

The vulnerability of ecosystems and that of societies are closely linked, so that climate change poses a risk to people's health and well-being, while also increasing inequality and the risk of poverty. On the one hand, climate change has accelerated in parallel with rapid socio-demographic changes that, globally, have increased pressure on resources, with extraordinary growth in population, consumption of energy, water, food, technology and other basic inputs. On the other hand, the consequences of climate change are projected directly onto society and the people in it, deteriorating essential elements of their quality of life and increasing social inequality. In addition, some responses to the consequences of climate change result in so-called “maladaptation”¹⁰⁹, i.e., actions that may produce negative environmental and social effects, such as increasing vulnerability or shifting

109 Concept coined and used in the National Plan for Adaptation to Climate Change (PNACC) and other institutional documents and international regulations. Thus, Regulation (EU) 2020/852 establishes six environmental reference objectives to which economic activities must not cause significant damage in order to be considered sustainable; one of these objectives is adaptation to climate change. Article 17 of the Regulation states that an economic activity causes significant harm to climate change adaptation “where the activity causes an increase in the adverse effects of current and projected future climate conditions on itself or on people, nature or assets”. The technical guidelines prepared by the European Commission for the application of the “do no significant harm” principle in the Resilience and Recovery Mechanism state that ‘significant harm to the objective of climate change adaptation can be caused either by (i) failing to adapt an activity to the adverse impacts of climate change where that activity is at risk of such impacts or (ii) maladaptation, where the implementation of an adaptation solution that protects one location (“people, nature or assets”) increases risks elsewhere (e.g. by building a levee around a parcel of land in a floodplain that results in the displacement of risk to a neighbouring unprotected parcel of land).

risks temporally or spatially; undermining current and future adaptation capacities or opportunities; producing disproportionate burdens for the most vulnerable; or, even leading to increases in greenhouse gas emissions. “Maladaptation” exacerbates inequalities, so that population groups at greatest risk of vulnerability are often the most affected by such actions.

A broad vision of just transition, not limited to regions and productive sectors, refers to the need to leave no one behind in the transformation process.

*Climate justice,
human rights,
equity and
governance*

From this perspective, it should be borne in mind that certain population groups, for reasons linked to their more unfavourable socio-economic circumstances or other variables such as gender or age may be particularly affected both by the direct impacts of climate change and by the costs of climate change adaptation measures, emission mitigation targets and energy transition. In this regard, concepts such as “climate justice” or “just resilience” are gaining ground in the debate on the social consequences of climate change and adaptation and mitigation measures (Box 9).

Incipiently, the evaluation of the first National Climate Change Adaptation Plan already warned of the need to include in the next NAPCC emerging issues and approaches linked to the adoption of a human rights approach to adaptation; considering vulnerability to climate change from a social perspective or moving towards an approach that promotes sustainable lifestyles to enhance adaptation.

The current NAPCC addresses this issue by noting how adaptation actions consistent with climate justice address short- and long-term risks through decision-making processes that address the principles of fairness, equity and accountability, including historically marginalised communities, equitably distributing benefits, burdens and risks¹¹⁰. The Paris Agreement (art. 7.5) already pointed out the need for climate change adaptation work to be carried out through a gender-responsive and participatory approach, taking into consideration vulnerable groups, communities and ecosystems.

The Spanish Constitution of 1978 (art. 45) was already ahead of its time in reflecting social concern for the protection of the environment, recognising the right to enjoy an environment suitable for the development of the individual, as well as the duty to conserve it. This opened up a normative space of connection with the well-being

110 MITECO, *Cambio climático: impactos, adaptación y vulnerabilidad. Guía resumida del sexto informe de evaluación del IPCC*, 2021.

BOX 9. EQUITY, HUMAN RIGHTS AND CLIMATE JUSTICE

Climate justice (1) implies that equity and human rights are at the heart of climate change decision-making and action.

It is a concept that has been widely used to refer to the historically unequal responsibility of countries and communities for the climate crisis. It suggests that countries, sectors and companies that have become richer through greenhouse gas-intensive activities have a responsibility to help those who are harmed by the effects of climate change, particularly the most vulnerable countries and communities, who have often contributed the least to the crisis.

Some of the main dimensions of climate justice include the following:

- **Structural inequalities:** given structural inequalities based on race, ethnicity, gender and socio-economic status, the effects of climate change can be felt inequitably, even within countries. The effects of climate change are more severely felt by women, as they have access to fewer resources to adapt and cope with abrupt changes. People with disabilities are more likely to suffer from the adverse effects of climate change (e.g., threats to their health, food security, access to water, energy and sanitation, and livelihoods), particularly in developing countries. Indigenous peoples, who protect 80 per cent of the world's biodiversity, face increasing threats to their existence, livelihoods and traditional knowledge.
- **Socio-economic inequalities:** the impacts of climate change and the resources needed to cope with it are unevenly distributed around the world. Low-income countries and vulnerable populations within them are more likely to suffer climate-induced losses and damages. The 10 per cent of households with the highest per capita emissions globally generate between 34 per cent and 45 per cent of all domestic greenhouse gas emissions, while the poorest 50 per cent of households generate between 13 per cent and 15 per cent.
- **Intergenerational inequality:** today's children and youth have not contributed to the climate crisis in any significant way, but they will be severely harmed by the effects of climate change as they move through life. As their human rights are threatened by the decisions of past generations, their rights must take centre stage in climate decision-making and action.

The concept of **just resilience** takes into account that people who are more vulnerable due to factors such as age, gender, place of residence, socio-economic status, among others) are more affected by the risks associated with climate change impacts and are less able both to undertake adaptation measures and to be heard. The just resilience approach seeks to take this reality into account in order to avoid having winners and losers, reducing the unequal burden of climate change risks and ensuring equity in the distribution of adaptation benefits.

Sources: prepared by the authors based on (1) PNUD. Climate Promise. "El cambio climático es un asunto de justicia: he aquí por qué" July 2023; and Eurofound (2023), *Anticipating and managing the impact of change. Impact of climate change and climate policies on living conditions, working conditions, employment and social dialogue: A conceptual framework*.

and quality of life of people that international commitments and community regulations and policies have been increasing, given the need to mitigate and adapt to climate change. As can be seen in the ESC Report 2023, the response to the recovery after the pandemic, the Next Generation EU Funds and the Spanish PRTR come to promote the eco-sustainable transformation that should have an impact on improving the welfare of the population and social cohesion, without losing sight of the redistributive aspects of the transition.

Likewise, the right to an adequate environment and a just environmental transition have been contemplated by the 2nd National Human Rights Plan, within the framework of the broader set of obligations of the Spanish State with respect to our country's progress in this area in the development of human rights. In this respect, the need to reduce vulnerability related to climate, natural disasters and pollution, in accordance with the principles of control and prevention, and the incorporation of the need to pay attention to particularly vulnerable groups in the measures proposed, are noteworthy.

Together with the progressive openness to the recognition of these rights, the increase in social awareness of the consequences of climate change on people's well-being and health is giving rise to the fact that, despite the fact that the European Convention on Human Rights does not contemplate the right to a healthy environment as such, there are already precedents of judicial pronouncements by the European Court, condemning national governments for failure to comply with their own climate objectives, in response to the claims brought by groups of citizens who are demanding more decisive action to prevent damage to their health and well-being¹¹¹.

On the other hand, it should be borne in mind that the social impact of climate change and of mitigation and adaptation measures goes beyond national borders.

Cross-border social effects and climate migrations

At the global level, the imbalance in the distribution of the effects of climate change exacerbates existing North-South inequalities. Indeed, according to the ILO ¹¹², climate and environmental change is becoming the greatest threat to poverty reduction and the achievement

of decent work, sustainable development and social justice. The potential for social and economic disruption is high and could jeopardise peace.

Due to the strong global interconnectedness of countries and economies, the impacts of climate change in third countries eventually affect other territories. One of the most obvious social consequences of this process is the intensification

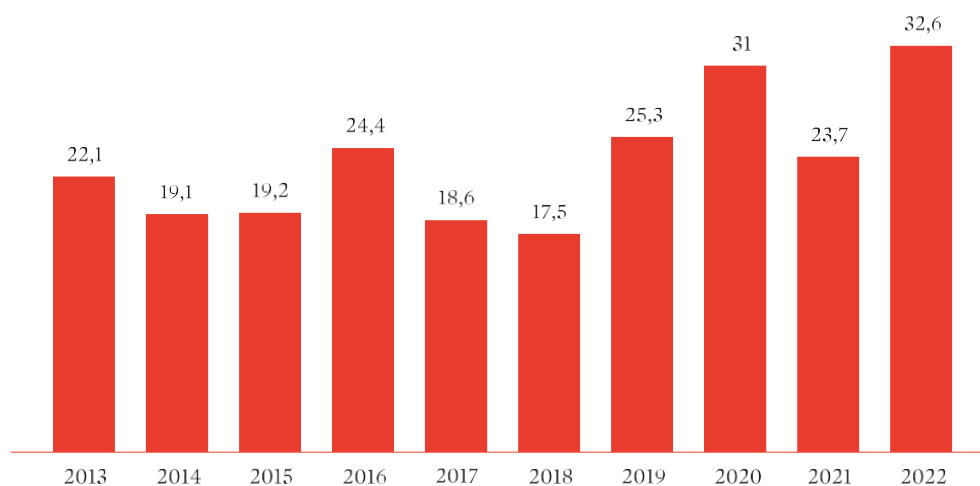
¹¹¹ European Court of Human Rights, *Fact Sheet-Climate Change*, (April 2024).

¹¹² OIT, Conference 2023.

of population displacement and conflicts due to rising sea levels, longer periods of drought, more frequent flooding and other extreme weather events associated with climate change. Globally, 32.6 million new displacements caused by natural disasters were recorded in 2022, the highest number recorded in the last decade, as a result of climate-related hazards such as storms, floods and droughts (Figure 12), with the highest number of internally displaced persons in Pakistan (8.2 million), the Philippines (5.4 million), China (3.6 million), India and Nigeria (each with 2.5 million). In addition, adverse climatic conditions may limit the financial capacity to migrate, so that especially the most vulnerable people may be trapped in the regions most affected by climate change¹¹³.

This is why national adaptation plans are obliged to adopt a transnational approach, as is the case in the PNACC 2021-2030, which includes a cross-cutting line of action on the transboundary effects of climate change, aimed at identifying the chains of impacts derived from climate change beyond our borders on aspects such as trade, transport and infrastructure or finance (among which, curiously, however, no mention is made of migration).

FIGURE 12. INTERNAL DISPLACEMENTS DUE TO NATURAL DISASTERS, 2013-2022
(Millions of people)



Source: Internal Displacement Monitor Centre, Global Migration Data Analysis (2023).

113 Eurofound (2023), *Anticipating and managing the impact of change. Impact of climate change and climate policies on living conditions, working conditions, employment and social dialogue: a conceptual framework*.

The main adaptation responses identified in the NAPCC 2021-2023 itself to avoid involuntary migration due to the effects of climate change lie in enhancing adaptive capacity through sustainable development; facilitating safe and orderly movements of people within states; reducing poverty, inequality and food and water insecurity; and strengthening institutions that reduce the risk of conflict and promote climate-resilient peace. As some studies¹¹⁴ are beginning to highlight, climate change adaptation and mitigation policies alone or their inappropriate design may not be sufficient to neutralise the effects of the unequal distribution of the social impacts of climate change, and may lead to a lack of acceptance and even rejection of these policies by the groups most affected by their consequences. For this reason, adaptation and mitigation must be accompanied by well-designed and equitably focused compensation measures.

2. Climate impact and social risks in Spain

As mentioned in previous sections of this publication, the year 2023 has been extremely warm, with an average temperature of 15.2 °C (1.3 °C above the 1991-2020 reference period), and an average rainfall of 536.6 mm over the peninsular territory, which is 84% above the normal value for the reference period.

Climate change, a process in which Spain is fully immersed, is having an impact in various areas. According to the latest IPCC report IPCC¹¹⁵ for the last third of this century and in a scenario of global

Spain, a country particularly affected by the risks to human well-being from climate change

warming above 1.5 °C, the desert and semiarid will extend over the eastern half of the Iberian Peninsula while the Mediterranean climate will spread northwards to occupy most of the Cantabrian coast. These risks are amplified by other human factors, such as unsustainable development, air and water pollution and habitat

degradation so-called cascading effects), making them increasingly complex and difficult to manage. From a quality-of-life point of view, the risks and threats to human well-being are multiple and geographically asymmetric, with the Mediterranean region, to which Spain belongs, being particularly vulnerable to impacts associated with average temperature rise, such as droughts, lack of fresh water and sea level rise, added to the thermal rise of its waters (Box 10).

¹¹⁴ Eurofound, *op. cit.*

¹¹⁵ MITECO, Cambio Climático: impactos, adaptación y vulnerabilidad. Guía resumida del Sexto Informe de evaluación del IPCC, Grupo de Trabajo II, (November 2022).

BOX 10. IMPACTS OF CLIMATE CHANGE IN SPAIN

Affected systems	Key representative risks	Socioeconomic impacts in Spain
Oceanic and terrestrial ecosystems	Socioecological coastal systems (sea level rise, groundwater salinisation, floods)	In Spain some 328,000 people are potentially affected in frequent flood zones every 10 years, and 977,000 may be affected within 500 years. The Spanish Institute of Oceanography (IEO-CSIC) and the Mediterranean Institute of Advanced Studies (IMEDEA) estimate that sea level rise in Spain has accelerated over the last 20 years, with an increase of 2.8 millimeters per year. In this context, with around 10,000 kilometers of coastline, the Iberian Peninsula is one of the most vulnerable areas in Europe due to global change. Rising sea levels may cause damage to coastal infrastructures, resulting in risks for economic activities, settlements, health, well-being, food and water security and cultural values in the short and long term. In addition, in 2022 sea surface water reached record temperatures, reaching 30 °C at the Valencia buoy in mid-August.
	Oceanic and terrestrial ecosystem services (desertification and forest fires, biodiversity loss, invasive species)	75 per cent of Spanish land is in the process of desertification and 20 per cent of what is safe today is expected to be at risk within 50 years (especially in regions such as Andalusia, Extremadura, C. La Mancha and almost all of Levante). In 2022 the number of hectares burned in Spain (more than 300,000) was the highest since 2006. On the other hand, species such as the tiger mosquito, present in a large part of Catalonia and Valencia, and large shoals of jellyfish can proliferate on the Spanish coasts in summer, mainly due to the thermal increase of the water. In addition, the increase in temperature can stimulate the predatory activity of some marine species, increasing their bioaccumulation.
	Water security	Due to the scarcity and irregularity of rainfall, the hydrographical basins of the northwest of the peninsula often have water storage values of less than 40 per cent of their capacity, and those that usually suffer from severe water stress, such as the Júcar or Segura river basins, sometimes have values around 10 per cent.
	Food security	In the medium term in the Mediterranean region, reductions of up to 17 per cent in agricultural productivity are expected in the worst scenarios. In addition, the increase in temperature is leading to a higher incidence of existing pests in Spain, causing changes that may modify the distribution and survival of bacteria such as Salmonella and Campylobacter.

BOX 10. IMPACTS OF CLIMATE CHANGE IN SPAIN (*continued*)

Affected systems	Key representative risks	Socioeconomic impacts in Spain
Transsectorial	Human health	In 2022 it is estimated that there were 4,744 deaths in Spain attributable to high temperatures, compared to just over a thousand attributable to cold, with the most vulnerable population being the elderly, pregnant women, infants and people with neurological diseases. In addition, the increase in atmospheric pollution, intensified by situations of blockage and stability generated by climate change, causes effects on cardiovascular and respiratory diseases (including an increase in allergies). In addition, there is an increase in the incidence of tropical diseases.
	Life level and equity	27,8 per cent of the Spanish population (13.1 million people) was at risk of poverty and/or social exclusion in 2021, which falls on groups with greater exposure to crises and traumatic events, less capacity to cope with these crises and more severe and lasting effects over time. The impact of droughts, contamination of aquifers, DANA or floods is greater on populations in Spain that were already in a situation of poverty and on those that have been impoverished by these factors. This vulnerability is accentuated when the actions have not been able to reverse or slow down the main processes attributable to local or regional causes (fires, floods in urbanised areas, droughts in aquifers and pollution of water surfaces).
	Human mobility	Spain has seven of the ten most water-stressed river basins in Europe, a water shortage that is expected to continue to grow, with the consequent threats to natural and social ecosystems. Desertification and drought in Spain are forcing population displacements, which could increase in some of the poorest regions, where they could also suffer the greatest economic losses. On the other hand, the exodus towards large cities due to the crisis of traditional agriculture will cause the natural resources of the areas surrounding these cities to be overexploited, including underground water resources, and the level of pollution in these areas will rise, causing a feedback of climate change.

Sources: Aemet, *Report on the State of the Climate of Spain 2022*; *Summary Guide to the Sixth Assessment Report of IPCC's Working Group II* (MITECO, 2022); *Population at Risk of Flooding in Spain in the First 10 Kilometers of Coastline* (Observatorio de Sostenibilidad 2019); *Climate Change and Food Security* (Generalitat de Catalunya, Scientific Advisory Committee on Food Security, May 2021).

Furthermore, the impact of effects such as droughts, pollution or floods is greater on populations living in poverty or those impoverished as a result of these factors, whose vulnerability is accentuated when actions have not been able to reverse or halt the main processes generated, as these are people who are more exposed to crises and traumatic events caused by climate change, with less capacity to cope with these crises and with more serious and lasting effects over time.

Among the most serious social impacts in Spain are those caused by drought, since water restrictions lead to depopulation, a reduction in crop yields, abandonment of agricultural land and higher prices for basic products. Likewise, those associated with flooding processes (frequently caused by the occupation of flood zones, intensive farming, soil compaction, infrastructures that disorganise natural drainage, defence works that aggravate the damage, and occupation of riverbeds) lead to considerable material damage, the destruction of housing and infrastructure, and even the loss of human lives. In both cases, the ultimate consequence is the displacement of the population, especially in the case of people living in poverty who do not usually have insurance against these risks, and for whom aid is slow to arrive¹¹⁶. As manifestations of the aggravation of extreme weather events, it is worth recalling that in Spain, more than 300,000 people are exposed to the risk of flooding while annual deaths attributable to excessive heat and the morbidity and mortality associated with pollution and poor air quality are on the increase (Box 10).

3. Impacts on health and health system

As recently highlighted by CES¹¹⁷, the environment in which people live their daily lives is also a key determinant of their state of health. Air pollution, rising temperatures, over-exploitation of natural resources, loss of biodiversity and the deterioration of the protective function of natural habitats are in themselves risks to human health that call for increased protection and prevention mechanisms.

The importance of addressing air and climate pollution simultaneously is increasingly recognised internationally. Nearly a quarter of the global burden of disease and mortality is attributable to environmental factors which, according to the WHO, accounts for 12.6 million deaths each year. And one of the most obvious triggers is climate change, the key indicator of which is the rise in global temperature, which has direct negative effects on health.

Climate change is not the only determinant of air quality, as air pollutant concentrations are associated with factors such as wind, temperature, topography, human activity, the interaction of local weather patterns, as well as the adaptation measures implemented¹¹⁸. However, it is clear that climate change contributes to worsen it, as the increase in temperature

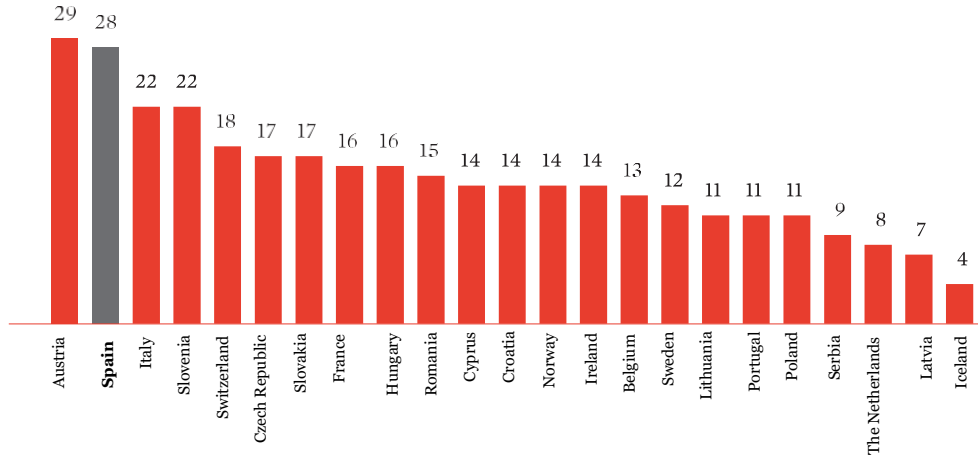
Climate change exacerbates the health consequences of poor air quality

116 European Antipoverty Network-Spain (EAPN-ES), Applied research on the impact of climate change on poor and socially vulnerable populations. Diagnostic report (2022).

117 CES Report 1/2024, *El sistema sanitario: situación actual y perspectivas para el futuro*.

118 Ministry of Health, Social Services and Equality, *Impact of climate change on health 2013*.

FIGURE 13. HOSPITALISATIONS OF PEOPLE OVER 65 YEARS OF AGE FOR RESPIRATORY DISEASE ATTRIBUTABLE TO OZONE PARTICLES (Per 100,000 inhabitants)



Source: Kienzler, S., Soares, J., González Ortiz, & A., Plass, D. (2022). *Estimating the morbidity related environmental burden of disease due to exposure to PM_{2.5}, NO₂ and O₃ in outdoor ambient air*. (Eionet Report – ETC HE Report 2022/11. European Topic Centre on Human Health and the Environment. European Environmental Agency.

correlates very directly with the increase in tropospheric ozone concentration, aggravating the health impact of air pollution (dangerous concentrations of fine particulate matter, nitrogen dioxide and tropospheric ozone) (Figure 13). Air pollution aggravates cardiovascular and respiratory diseases, exposure to chemicals, which can lead to endocrine disruption or the development of cancer, alteration of water quality, which is threatened by emerging pollutants, the health impact of noise pollution or the impact on the habitat, which increases the risk of new zoonoses¹¹⁹. In addition, the increase in winter temperatures brings forward the flowering of some species, lengthening their pollen season, increasing the time of exposure of the population and worsening the quality of life of people with allergies and respiratory problems. In the last two decades, in the context of the acceleration of the warming process, the effects of high temperatures on health have had their most serious exponent in the increase in heat-induced

Episodes of extreme heat, a health risk particularly present in Spain

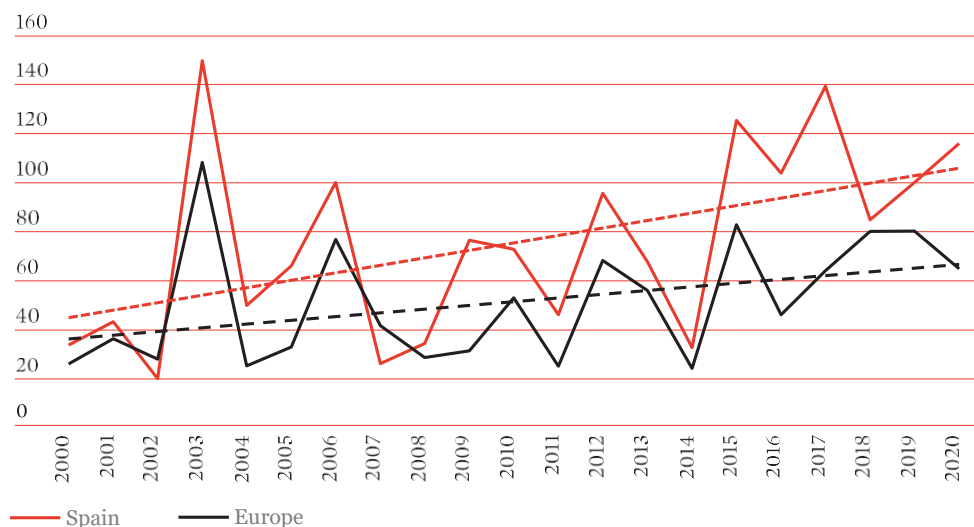
mortality. The geographical situation of Spain and its climatological characteristics are favouring an increase in the average temperature, with the extension of the warm season and an increase in maximum temperatures that negatively affect health, especially

for people in a situation of vulnerability due to a lack of resources to cope with it.

119 MITECO, *Strategic Plan for Health and the Environment, 2022-2026*.

FIGURE 14. ANNUAL HEAT-RELATED DEATHS, 2000-2020

(Per million of inhabitants)



Source: "The 2022 Europe report of the Lancet Countdown on health and climate change: towards a climate resilient future", 2023.

or due to their state of health -especially the elderly. The increase in extreme heat episodes over the last twenty years has had negative effects on the health of the population, with an increase in mortality directly attributed to high temperatures in Europe, which has risen from 26 to 65 per million in that period. The upward trend, however, is more pronounced in Spain, where heat-related deaths have reached 116 per million, well above the European average (Figure 14). It is therefore a particularly important challenge for our country to address adaptation measures especially aimed at populations that are particularly vulnerable for reasons of age, morbidity, physical condition or socio-economic reasons that make it difficult for them to adapt their homes, places and work habits to mitigate the damage of heat.

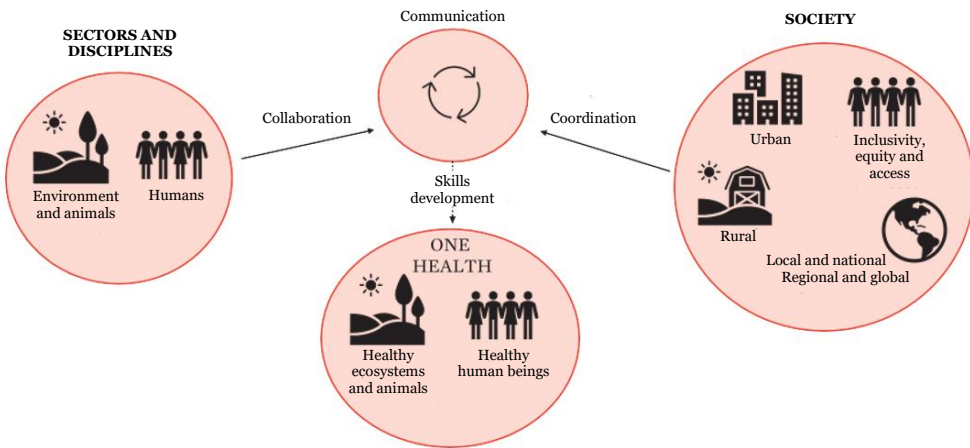
Health and well-being cannot be understood except in their complex interrelationship with the environment in which human existence takes place, and this is how it has been understood historically. But it is only as a result of the succession of health crises amplified in the context of globalisation and linked to human-induced changes in the climate that the idea of interdependence as an inescapable principle in the approach to health

*Healthy ecosystems
and the new "One
Health" approach*

has gained ground, crystallising in the "One Health" approach,¹²⁰ with the aim of being applied in the design of all public health policies at the international level.

120 WHO multisectoral approach "One Health", 2021.

FIGURE 1. WHO "ONE HEALTH" APPROACH



Source: prepared by authors based on WHO, *One Health*.

It is an integrated approach that seeks to balance and optimise the health of people, animals and ecosystems in a sustainable manner, recognising their close relationship and interdependence (Figure 1). This approach engages multiple sectors, disciplines and communities at various levels of society to work together to promote well-being and neutralise threats to health and ecosystems, helping to address the full range of disease control issues, from prevention to detection, preparedness, response and management, and to improve and promote health and sustainability. In this regard, the CES has recently¹²¹ highlighted the interest of having a national zoonosis monitoring plan, which integrates the approach to public health with the assessment of animal risks. As a development of this approach, the One Welfare perspective recognises the importance of linking animal and human welfare, achieving greater efficiency in livestock production and a higher level of environmental protection. It proposes at the same time to explore the possibilities of such a link for its benefits for people's physical and mental health.

The recent creation of the Health and Climate Change Observatory will serve to improve the monitoring of indicators related to the impact on health, combining efforts developed by different departments and contributing to the prevention, monitoring of extreme events dangerous to health, such as heat waves or torrential rains, anticipating future climate change scenarios and promoting research on health and climate change.

121 CES Report 1/2024, *op. cit.*

4. Sustainable urban planning and housing: problems and emerging inequalities

The speed of climate change, in a country like Spain, which is particularly affected by the intensification of periods of drought, projects a scenario of scarcity and rising prices of some resources essential for quality of life, such as water (whose quality is also worsening) and energy. The provision of these resources, the access to and use made of them and the way they are distributed among the population depends on numerous decisions in the public and private sphere, which determine individual and collective well-being.

Cities and municipalities are the political-administrative units closest to the citizens and have a series of crucial competences to address a response to climate change that is sensitive to the needs of their inhabitants and that neutralises or mitigates its social impacts: air quality, sustainable mobility or urban planning and housing policies are responsibilities that lie within the scope of local administrations, so that their orientation, initiative and level of involvement determine the extent of the repercussions of climate change on the population. In addition, local authorities play a leading role in preventing and addressing social vulnerability and in liaising with specialised organisations in the social action sector. Therefore, while cities and municipalities partly contribute to the acceleration of climate change, they also have the capacity and tools to generate effective climate change mitigation and adaptation solutions that, at the same time, improve the quality of life of the population, address the risk of deepening social gaps and avoid “maladaptation” measures.

Europe is one of the most urbanised regions in the world, with an estimated 80 per cent of the population expected to live in urban areas by the middle of this century¹²². From a sustainability point of view, compact, green and energy-efficient cities have a clear positive contribution to sustainable development, as recalled in SDG 11, which calls to “make cities and human settlements inclusive, safe, resilient and sustainable”. It should be noted that European cohesion policy has made Sustainable Urban Development (SUD) a mandatory element during the 2014-2020 programming period, consolidating the strategic dimension of the integrated approach, which is planned to be maintained in 2021-2027, where it is proposed to raise the minimum percentage of ERDF allocated to SUD to 6 per cent¹²³.

*The city, key element
in the solution to
climate change*

In terms of climate change, cities account for more than 70 per cent of global CO₂ emissions and consume more than 65 per cent of the world's energy, but have certain

122 European Commission, Urban Agenda for the EU. *Orientation Paper. Sustainable Use of Land and Nature-Based Solutions* (2017).

123 European Commission, *Sustainable Development Strategies Manual* (2020).

conditions, the availability of resources, infrastructure, services and economic and social capital, which make them a key player and part of the solution.

The European Climate Neutral and Smart Cities mission, developed under the Horizon Europe programme for 2021-2027, recognises the importance of urban environments, which occupy 4 per cent of Europe's land area but are home to 75 per cent of its citizens. The project aims to deliver 100 climate neutral and smart cities by 2030, acting as centres of experimentation and innovation with a view to implementing results in all European cities by 2050. Among the first ten EU cities to receive an EU Mission Label in October 2023 are four Spanish cities: Madrid, Valencia, Valladolid and Zaragoza. This label is aimed at facilitating access to sources of funding. Another 23 European cities obtained it in March 2024, among them two Spanish cities: Barcelona and Seville¹²⁴.

In Spain, the PRTR includes climate objectives in urban environments in most of its axes and components, such as the Sustainable Mobility Shock Plan, the implementation of low-emission zones and the transformation of urban transport, or the Housing Rehabilitation and Urban Regeneration Plan. For its part, the PNACC 2021-2030 seeks to integrate adaptation to climate change in territorial and urban planning, as well as in building, advancing in regulations to improve the energy and water performance of buildings, in line with the projected climate scenarios. In fact, the draft 2023- 2030 update goes even further by contemplating the integration of urban planning with sustainable mobility, promoting the development of smart cities, with a design projected towards pedestrians and cyclists, limiting car use in densely populated areas. In addition, the specific objective Smart cities and communities integrating available technologies in urban environments to improve sustainability and quality of life of citizens, aims to achieve climate neutrality in cities, with a systemic and multi-stakeholder approach, and with the citizen at the centre of decisions.

4.1. MAKING CITIES RESILIENT TO CLIMATE CHANGE: THE ROLE OF THE URBAN AGENDA

The impacts of climate change on quality of life are undeniable, which calls for responses at different scales within a multilevel and multi-stakeholder climate governance model that includes shared diagnoses and objectives, as well as instruments that adapt to the different territorial realities in which these effects manifest themselves. A significant step forward in the consolidation of this governance framework is the Spanish Urban Agenda (AUE, by its initials in Spanish).

¹²⁴ European Commission, Press releases 12 October 2023 and 21 March de 2024.

TABLE 10. DISTRIBUTION OF MUNICIPALITIES IN SPAIN, 2022

Large urban areas	Small urban areas	Non-urban areas
755 municipalities	381 municipalities	6,955 municipalities
9.3% of the municipalities	4.7% of the municipalities	86% of the Spanish municipalities
69.2% of the population	14.4% of the population	16.4% of the population
9.6% of the surface	13% of the surface	77.4% of the surface

Note: Large urban areas: single or multi-municipal areas with more than 50,000 inhabitants. Small urban areas: municipalities with between 5,000 and 50,000 inhabitants not included in the scope of large urban areas. Three filters are applied to determine whether a municipality or set of municipalities belong to a small urban area: core resident population, negative demographic trend and proportion of active population. Non-urban areas: municipalities not included in the previous categories.

Source: Urban Areas Spain, 2023. Ministry of Housing and Urban Agenda.

The Agenda provides a framework of reference and policies that integrate the criteria and objectives set out in the 2030 Agenda, especially SDG11 (Sustainable Cities and Communities), the United Nations New Urban Agenda, the Urban Agenda for the European Union and the Climate Summit. The overarching objective of the EUA is to promote sustainable urban development, based on the

The Urban Agenda, an instrument that brings together social, environmental and quality of life objectives

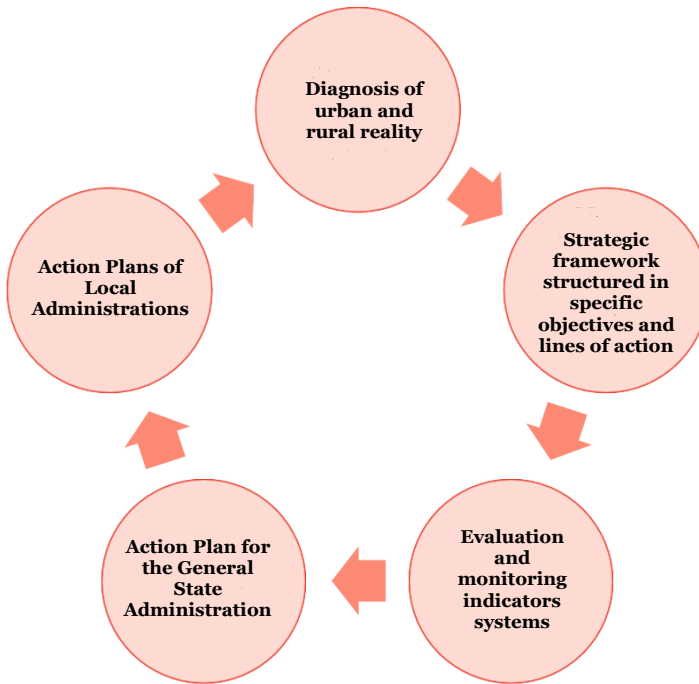
harmonisation of economic and social development with a focus on aspects such as increasing social welfare, reducing poverty, using natural resources more efficiently, reducing pollution and improving the environment, among others. Despite its name, the EUA is not limited to urban areas, but establishes a range of social, economic and environmental policies applicable to any municipality in rural or urban settings, regardless of its size.

The structure of the Spanish Urban Agenda is based on a diagnostic document, from which ten strategic objectives, 30 specific objectives and the lines of action to achieve them are derived. It also incorporates a system of indicators, some of them purely descriptive and others for evaluation and monitoring. Finally, it offers an Action Plan at state level that covers the Action Plans developed by local entities.

In this way, the EUA promotes a model of urban planning that exceeds the vision centred solely on the morphology of urban environments and, therefore, addresses major challenges such as sustainability or environmental quality from the perspective of the quality of life of those who live in towns and cities. This implies recognising the role played by municipalities as actors with the capacity to act and make decisions, in a multilevel governance scheme with regional and state governments¹²⁵.

125 Hernández-Partal, S. (2023). Los Planes de Acción Local de la Agenda Urbana Española: su papel en el urbanismo del siglo XXI. *Ciudad y Territorio Estudios Territoriales*, 55(217), 829-858.

FIGURE 2. STRUCTURE OF THE SPANISH URBAN AGENDA



Source: prepared by the authors.

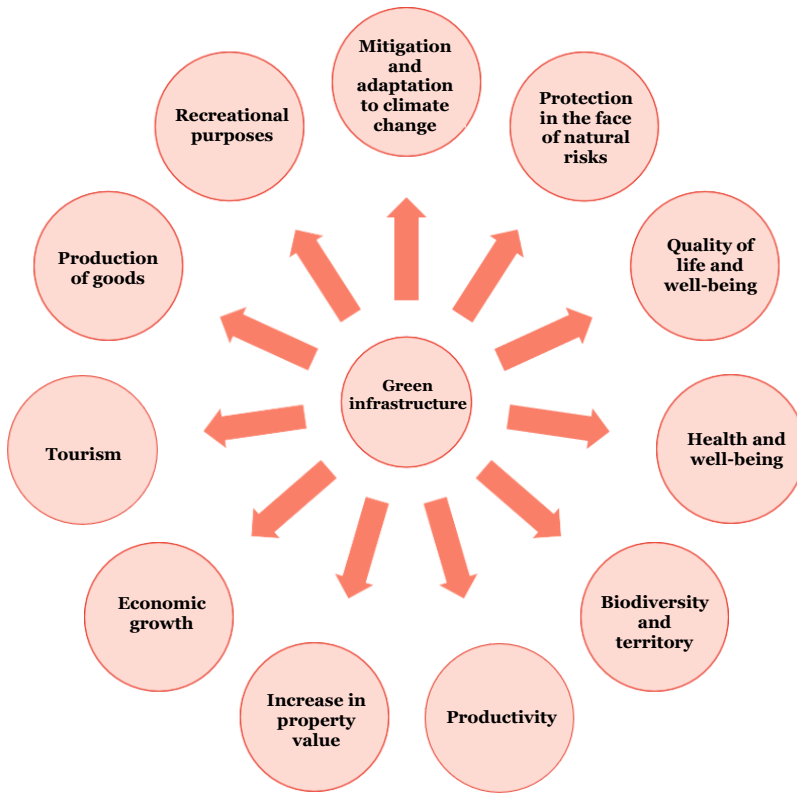
Urban green infrastructure as a vector for climate change adaptation and quality of life

The notion of Green Infrastructure (GI) stems from the European Green Infrastructure Strategy launched by the European Commission in 2013 with the aim of promoting the development of green infrastructure in all spatial areas and ensuring that it is taken into account in spatial planning¹²⁶. According to this strategy, GI is a policy approach based on natural

solutions, under the principle that the protection and valorisation of nature and natural processes, as well as the many benefits that human society derives from nature, are consciously integrated into spatial planning and territorial development. This approach to ecosystem-based policy solutions is, in turn, multifunctional and multiscale in nature, thus involving various actors at all levels of decision-making, from the European to the local level. At the local or municipal scale, Urban Green Infrastructure (UGI) aims to improve and enhance ecosystem services in the city. This includes urban green spaces (roadside trees, parks and gardens, green sports areas, etc.).

¹²⁶ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Green Infrastructure: Enhancing Europe's Natural Capital.

FIGURE 3. MULTIFUNCTIONAL CONCEPTION OF GREEN INFRASTRUCTURE



Source: taken from MITECO (2021), *Estrategia nacional de infraestructura verde y de la conectividad y restauración ecológica*, Third Government Vice-Presidency, MTERD.

other semi-natural or artificial elements (green facades and roofs, rain gardens, permeable pavements), as well as new designs and more efficient forms of management that emulate natural processes and improve urban biocapacity¹²⁷.

Nature-based solutions assume that green spaces and other elements of a city's green infrastructure should be understood and planned as a network of spaces, as a functional infrastructure to protect and promote the integrity of the ecological and cultural functions of the city or municipality, and to ensure the sustainability of urban areas. The contribution of ecosystems at the local level brings both health benefits (physical, psychological and emotional) and economic benefits, improving

127 Centro de Estudios Ambientales (2014), *La infraestructura verde urbana de Vitoria-Gasteiz*, Vitoria-Gasteiz Town Council.

the quality of life of their inhabitants and contributing to community empowerment. In this sense, the Spanish Urban Agenda, as a reference framework to achieve sustainability of urban policies, raises important connections with the objectives of Green Infrastructure. For example, when it states as an objective “to organise the territory and make rational use of land, conserve and protect it” (O.E.1) or ‘avoid urban sprawl and revitalise the existing city’ (O.E.2), among others.

Although they are not the only ones, the best known and most identifiable elements of the IVU are parks, gardens and green areas in general, which are part of the municipalities' sphere of competence¹²⁸. As a whole, the green space of a municipality has very positive effects on the life of its inhabitants, as it can not only produce an increase in physical activity, but it can also be articulated as a real natural health system, allowing cities to adapt to climate change (avoiding the effect of heat islands, improving air quality, adapting to the hydrological cycle, etc.). Along these lines, something that characterises municipalities in Spain is that the greater the demographic weight, the smaller the green surface area. In fact, municipalities with between 5,000 and 20,000 inhabitants have twice as much green area per capita as municipalities with more than 100,000 inhabitants.

Green area is also closely related to the compactness index of a municipality, understood as the ratio between the usable space of buildings (volume) and the space occupied by the urban surface (area). While compact building expresses the idea of urban proximity, increasing contact and interconnectedness among citizens, which is one of the basic principles in classical Mediterranean cities, an excess of compactness is not good, as it could be indicative of insufficient quality public space (green spaces, squares and pavements of a minimum width). As is the case with the green area index, the urban compactness index in Spanish municipalities is higher in relation to their demographic weight. On average, municipalities with more than 100,000 inhabitants have a very high index, which reflects the absence of public pedestrian space.

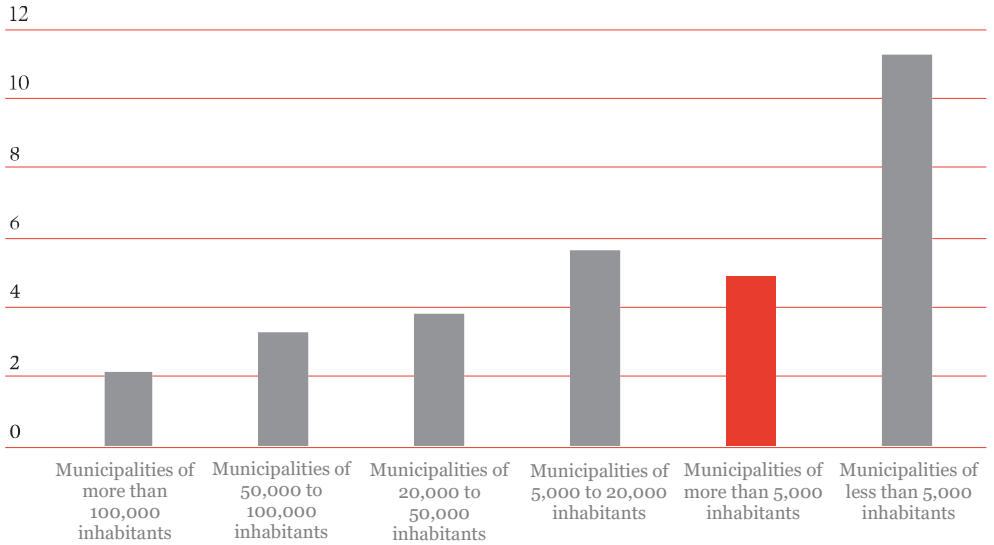
These and other indicators included in the descriptive database of the SUA are aimed at enabling municipalities in Spain to develop urban plans that pursue equitable, fair and sustainable development. However, insofar as it is a programmatic, non-regulatory framework, the success of the SUA is based on the political will of local and regional authorities and other actors involved to achieve the

The challenge of increasing green space in large municipalities

The challenge of gaining pedestrian public space

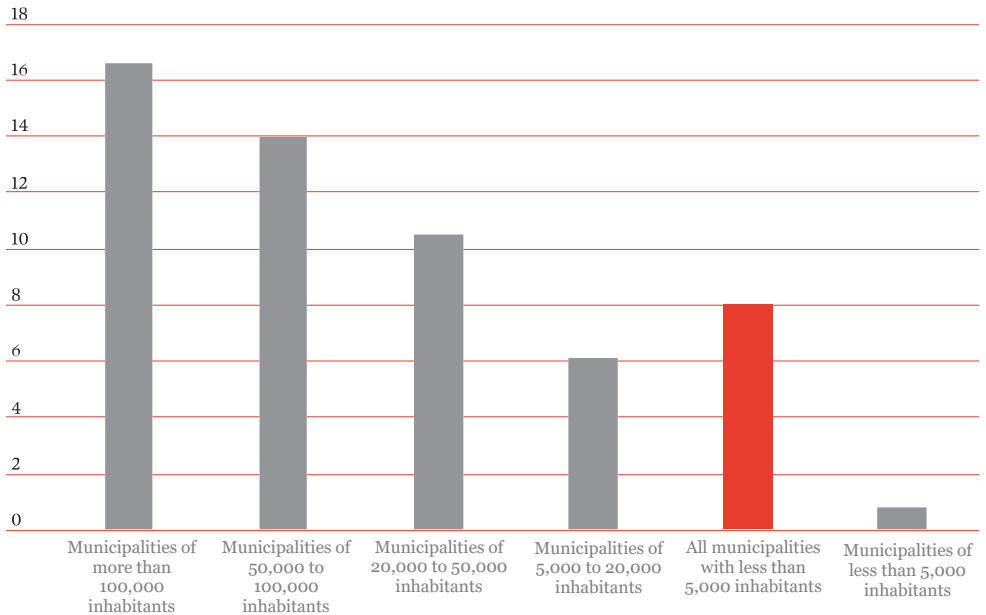
128 Article 25, Law 7/1985, of 2 April 1985, regulating the Bases of Local Government.

FIGURE 15. AREA OF GREEN SPACES
(Ha per 1,000)



Source: descriptive data from the Spanish Urban Agenda, 2023.

FIGURE 16. URBAN COMPACTNESS INDEX BY SIZE OF MUNICIPALITY
(Total built-up area by soil area (m²t/m²s))



Source: descriptive data from the Spanish Urban Agenda, 2023.

objectives pursued. In this sense, around 120 Local Action Plans are currently being developed in the more than 8,000 Spanish municipalities, which are the territorial expression of the implementation of the EUA.

The reduction of the carbon footprint of the compact city involves the regeneration of its neighbourhoods and the rehabilitation of urban centres to improve the quality

*Urbanism
challenges
and sustainable mobility*

of life of their inhabitants, creating, restoring or promoting cities of proximity. These are based on the concept of the '15-minute city' or chronourbanism, based on the idea that citizens should have the greatest number of services within reasonable walking, cycling

or public transport distance of their homes. This theoretical paradigm contrasts with a reality often characterised by an expansion of tourist and commercial uses of public space, the gentrification of traditional neighbourhoods and the disappearance of local commerce, as well as the increase in housing prices in a process in which, apart from the more or less aesthetic homogenisation of cities in different countries, the margins of the city are widening, forcing many of its inhabitants to make greater use of car transport, with the consequent loss of free time and increase in travel time, as well as in atmospheric emissions. One of the main challenges of sustainable urban planning and city management is therefore the search for a balance between the ideal of the city of proximity and the fulfilment of the objectives of sustainability and adaptation to climate change of cities with the different interests at stake that sustain the economic dynamism and employment of cities, without harming the inhabitants' levels of well-being or increasing social inequalities.

Within this framework, the Spanish Urban Agenda establishes a series of lines of action aimed at, on the one hand, fostering cities of proximity and, on the other, promoting sustainable modes of transport; both dimensions as part of a single strategic objective. On the side of the city of proximity, the need to move towards models of '15-minute cities' characterised by urban connectivity and universal accessibility, with proximity patterns between residence, work, main basic services and recreational areas; prioritising a healthier and more active pedestrian city through continuous, safe and responsible itineraries; promoting the development of transport to work plans, as well as teleworking strategies. On the sustainable mobility side, the lines of action include the development of urban mobility plans aimed at reducing private transport journeys and promoting efficient public transport systems. In addition, the supply of public transport must be adapted to the urban fabric as a whole and in integrated networks, in such a way as to avoid dynamics of exclusion or isolation. Mobility plans should also include measures such as park-and-ride facilities¹²⁹, promotion of the use of alternative energy and hybrid vehicles,

integration of cycling as public transport, integration of pedestrian and cycling networks with green areas; all within the framework of universal access to all transport systems.

With the aim of advancing in these lines of action, and in compliance with the commitments acquired in terms of sustainable mobility in the second phase of the Recovery, Transformation and Resilience Plan, in February 2024 the Council of Ministers approved and submitted to the Spanish Parliament a Sustainable Mobility Bill, on which CES¹³⁰ had previously issued its opinion, and in which it emphasised the need to further equity and the fight against inequalities in its different dimensions.

4.2. HOUSING, ENERGY AND CLIMATE CHANGE

In terms of housing and the impact of climate change on this component of well-being, Spain faces major challenges. Among them are the difficulties of households to maintain their homes at an adequate temperature, a basic condition for healthy comfort. This phenomenon, known as “energy poverty”, has been defined around its economic costs, as the sources for its measurement are based fundamentally on the capacity of households to meet these expenses. Therefore, economic factors such as the volatility of energy prices, the situation of the labour market or the economic situation of households are reflected in the evolution of this indicator. However, considering the full extent of the social impact of climate change requires taking into account the unequal territorial and social incidence of energy poverty, as well as its connection with the need to reduce dependence on fossil fuels. This requires further work on improving thermal efficiency in construction and renovation, especially in those dwellings that need it most, which tend to be precisely those of households with lower economic capacity and often located in areas that are particularly vulnerable to extreme weather events.

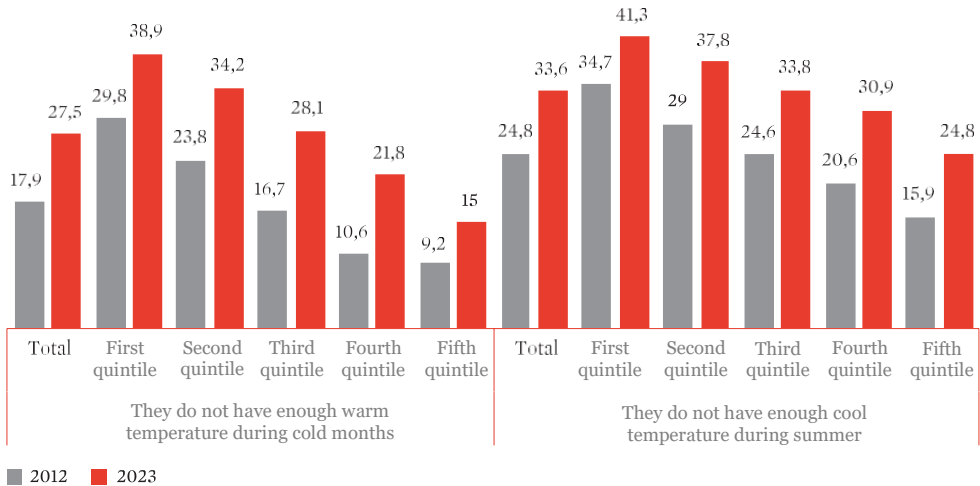
The new Housing Conditions and Energy Efficiency Module of the Living Conditions Survey (2023) reported a worrying situation in Spain, where 27.5 per cent of households do not have a sufficiently warm temperature during the cold months, while 33.6 per cent of households lack a sufficiently cool temperature during the

129 Park and Ride facilities are strategically located parking areas, usually at interchanges or intermodal public transport areas on the outskirts of cities. Their purpose is to encourage drivers to leave their private vehicles in these zones and continue their journey using public transport, bicycles or other sustainable mobility modes. By encouraging the use of public transport, the volume of cars on the road is reduced, leading to an improvement in the quality of the urban environment, reducing traffic congestion and promoting sustainability in mobility.

130 Opinion 12/2022 on the Draft Sustainable Mobility Bill.

FIGURE 17. HOUSEHOLDS SUFFERING FROM INADEQUATE TEMPERATURE ACCORDING TO HOUSEHOLD INCOME

(As a percentage)



Note: this rate reflects the percentage of households residing in dwellings that do not have the necessary material conditions to maintain an adequate temperature (insulation, heating and cooling system), irrespective of the household's economic capacity. Source: INE, Living Conditions Survey 2023 (Annual Module on Housing Conditions and Energy Efficiency, 30 April 2024).

summer (Figure 17). The significant territorial differences reflect both the different incidence of temperature extremes and disparities in the preparedness and quality of the housing stock to cope with them (for example, many Mediterranean homes on the coast are not even heated). In both cases, the Region of Murcia is the most affected (40.1 per cent in the case of winter temperatures and 46.6 per cent in the case of summer temperatures, compared to the regions with the least affected, such as Navarre in the first case (16.8 per cent) or Asturias in the case of summer temperatures (16.7 per cent). On the other hand, economic vulnerability accentuates the risk of energy poverty, as it is households with the lowest incomes that suffer the most from this important deficiency in their well-being, with repercussions on health, as we have seen (Figure 17). Thus in 2023, around 40 per cent of the lowest income households (quintile1) were unable to heat their homes in winter, affecting 15 per cent of the highest income households. The proportion of those unable to keep the house cool in summer increased across all income levels, with differences, however, ranging from 41.3 per cent of households affected in income quintile 1 to 24.8 per cent in the highest income quintile, highlighting the high impact of high temperatures especially on lower income households, in a scenario where heatwaves are becoming more frequent (Figure 17).

Therefore, tackling energy poverty with a view to achieving ‘fair resilience’ to climate change requires more than policies aimed at

subsidising energy costs, focusing on actions to promote infrastructure and housing that are resilient to the impact of climate change, while at the same time contributing to its mitigation through decarbonisation, improved thermal insulation and more efficient and less polluting installations that reach the households that need them most. By way of

Addressing energy poverty with a fair climate change resilience approach

example, it is worth mentioning the PREE 5000¹³¹, Programme, whose main objective is to promote the sustainability of buildings in Spanish municipalities with demographic challenges, through actions aimed at the thermal optimisation of homes, and the replacement of fossil fuel thermal generation facilities with renewable sources, the incorporation of regulation and control technologies, and the improvement of thermal efficiency in lighting. It has special support for vulnerable groups, addressing actions in residential buildings whose owners have been granted the social bonus, in line with the National Strategy against Energy Poverty 2019-2024. However, it is necessary to improve the monitoring of the level of uptake of this type of measures, especially those implemented from the deployment of funds associated with the PRTR, taking into account the need for the calls, requirements and financing to lead to an effective improvement in the housing stock with the greatest problems, which contributes both to the well-being of its inhabitants and to the objectives of decarbonisation.

5. Social impact in rural areas: a particularly at-risk environment

Spain's economic dynamism and population are increasingly concentrated in the territory, especially on the coast and around large urban areas, leaving rural areas with an uncertain future. Around 16 per cent of Spain's population lives in rural areas, with a steady downward trend. The territorial imbalance is aggravated by the effects of climate change, which cause an increase in extreme weather events, droughts, rising sea levels and altered ecosystems. The quality of life in rural areas is particularly severely affected by climate change, through the indirect effects of its serious repercussions on the agricultural sector, the main livelihood of a significant part of the population in this environment, and the confluence of other problems that seriously affect it, such as ageing and depopulation.

The demographic challenge in rural areas is a long-standing process and is the result of a wide range of factors, such as the lack of job opportunities for young people and

¹³¹ Energy rehabilitation programme for existing buildings in municipalities with demographic challenges (PREE 5000 Programme), included in the Regeneration and Demographic Challenge Programme of the Urban Rehabilitation and Regeneration Plan of the Recovery, Transformation and Resilience Plan, approved by the Council of Ministers, at the proposal of the Ministry for Ecological Transition and the Demographic Challenge, on 3 August by Royal Decree 691/2021.

the lack of services, which can be exacerbated by the particular impact on rural areas of the damage caused by natural disasters associated with climate change and the scarcity of basic resources, particularly water. For this reason, as the CES has pointed out, it is still necessary to develop a comprehensive policy, based on planning, supported by technological development and innovation for the management of an integral water cycle, capable of guaranteeing its sufficiency, in quantity and quality, for the different uses throughout the territory, its efficiency, savings and return to the environmental system in optimum conditions.

It is important to promote instruments such as those contained in Axis 1 of the National Strategy against the Demographic Challenge¹³² (Promoting ecological transition), which includes various programmes and actions aimed at stabilising the rural population, such as the Programme of aid for public and private projects in municipalities of less than 5,000 inhabitants, which are connected with the objectives of reducing the social impact of climate change in this environment. This strategy aims to promote green investments, the improvement of energy efficiency in buildings, equipment and public infrastructures, the promotion of the generation and consumption of renewable energies in general and, in particular, of self-consumption and local energy communities, and sustainable mobility, guaranteeing the participation of small municipalities in the deployment of recharging infrastructure and the promotion of electric vehicles.

6. Sustainable consumption and lifestyles

Lifestyles have important impacts on the environment and can play a key role in addressing the climate crisis, provided they are supported by appropriate public policies (e.g., on transport infrastructure or energy efficiency). Adaptation to and mitigation of climate change requires a rethinking of individual choices underlying different lifestyles and habits, especially purchasing and consumption patterns, towards more sustainable lifestyles that can be promoted through a range of public policies, as highlighted by the United Nations Environment Programme¹³³. This organisation points out the importance of addressing the needs of people and local environments, facilitating the existence of realistic and attractive options; involving people as key actors in initiatives and measures; preventing the required interaction and cooperation from being perceived as an interference in private life; demonstrating accountability and exemplarity on the part of public authorities as well as communicating good practices and success stories nearby in order to convey the idea of a new social contract based on more sustainable lifestyles.

¹³² Adopted by the Council of Ministers on 29 March 2019.

¹³³ United Nations Environment Programme, *Visions for Change Recommendations for Effective Policies on Sustainable Lifestyles*. 2011.

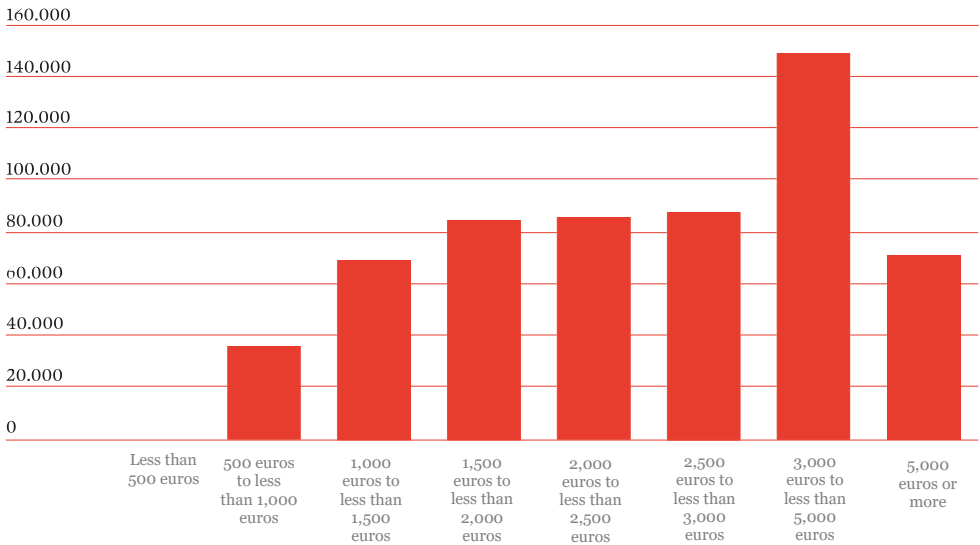
Consumers' awareness of the impact of their purchasing choices on the environment and on the fight against climate change is very important, but it often puts them in a dilemma of having to bear the higher price of the more sustainable options, which are unaffordable for many households. For example, the

Information and costs: barriers to sustainable consumption and lifestyles

electrification of the vehicle fleet, for which a huge amount of PRTR funding has been earmarked, continues to face inequalities in the economic capacity to purchase vehicles (Figure 18), while car sharing options through car sharing platforms are increasingly expanding, albeit limited mainly to large cities.

Of the various consumption options, food choices play a decisive role in guiding the food system and consolidating sustainable and resilient production models and practices, as assumed by the PNACC 2021- 2030, which estimates that one third of the food produced is currently wasted, a circumstance incompatible with the need to feed a growing population in a context of agricultural production diminished by the impact of climate change. The CES has had occasion to express its views on this issue¹³⁴, considering that it is particularly important to encourage a change in consumption patterns and the implementation of

FIGURE 18. USE OF THE ELECTRIC VEHICLE BY INCOME LEVEL
(Number of households by net monthly income bracket)



Source: INE, Survey of essential characteristics of the population and dwellings, 2021 (published February 2023).

134 CES Opinion 5/2022 on the Preliminary Draft Law on the prevention of Losses and Food Waste.

more sustainable and healthier habits, and to convey to consumers the need to promote responsible behaviour in food management in order to reduce food waste as far as possible. To this end, the value of food must be conveyed through the implementation of more awareness-raising actions throughout society. In the CES's view, all social players should be involved in the design and implementation of such initiatives, including, of course, and without wishing to be exhaustive, consumer associations, the social partners, educational and training centres of all types and purposes, and the general public itself.

It is also necessary to be able to rely on relevant information for such decisions in a context where “green” is increasingly represented as a claim that is not always based on the sustainability of the value chain of products. In this sense, the protection of consumer’s rights in the context of the green transition connects the essential right to a healthy environment with the guarantee of the right to make informed purchasing decisions, contributing to the mainstreaming of more sustainable consumption patterns. The new Directive (EU) 2024/825 of the European Parliament and of the Council, not yet transposed into Spanish law,¹³⁵ regulates the prohibition of misleading unfair commercial practices, such as practices associated with the early obsolescence of goods, misleading environmental claims (“eco-imposture”), misleading information about the social characteristics of products or traders’ companies, or non-transparent and non-credible sustainability labels.

The younger generation is becoming more aware of the impact of climate change, while the role of the education system is becoming increasingly important. In fact, *Education, key to successfully tackling ecological transition* Law 7/2021, on Climate Change contemplated the importance of education and training of Spanish society in the responses to climate change, proposing to strengthen knowledge of its implications, training for a low-carbon and resilient technical and professional activity in the face of climate change and the acquisition of the necessary personal and social responsibility. It also included the revision of the treatment of climate change and sustainability in the basic curriculum of the education and university system, a proposal channeled through the LOMLOE and the LOU.

¹³⁵ Directive (EU) 2024/825 of the European Parliament and of the Council of 28 February 2024, amending Directives 2005/29/CE and 2011/83/EU as regards empowering consumers in the green transition through better protection against unfair practices and through better information.

However, with an average age of 45.3 years in Spain and 20 per 100 of the population over 65 years of age, it must be borne in mind that the processes of relearning, awareness-raising and co-responsibility for consumption decisions cannot focus solely on the new generations.

The intergenerational perspective of the impact of climate change must also be taken into account, as age is a factor that influences both vulnerability (older people and younger children are more vulnerable in terms of health and capacity to adopt adaptation measures), and the long-term impact of climate change (today's children and youth will pay a greater toll in their adult lives than their parents and grandparents are assuming), as well as attitudes and sustainable lifestyles, where there are significant generational differences.

7. Gender impact of climate change

Globally, it has been women, especially young women, who have led the major climate mobilisations of recent years. They are also more affected by some consequences of climate change, such as rising extreme temperatures, environmental degradation and natural disasters¹³⁶, especially older women living alone and/or in isolated municipalities in rural settings, as well as single-parent households.

Women show greater environmental awareness than men and greater commitment in their involvement in daily life decisions with an impact on environmental sustainability (Table 11). They also suffer more frequently from energy poverty, especially non-EU immigrant women and single-parent households. Moreover, as highlighted in the CES Report 1/2022, despite their fundamental contribution to sustainability and to raising awareness on the need to step up measures to combat climate change¹³⁷, women are underrepresented in key sectors for the green transition, such as energy and transport, as well as in decision-making in areas relevant to tackling the consequences of climate change and the ecological transition, which is worrying in a scenario in which much of the drive for economic activity in the coming years relies on the momentum of the green transition.

¹³⁶ Instituto de las Mujeres, *Género y Cambio Climático. Un diagnóstico de situación* (2020).

¹³⁷ Among the most recent examples is the aforementioned judgement of the European Court of Human Rights, which condemned the Swiss government for failing to meet its own greenhouse gas emission reduction targets, in response to an application filed by the Swiss Association of Elderly Women for Climate.

TABLE 11. GENDER, SUSTAINABILITY AND CLIMATE CHANGE

(Indicators covered by the IQ 2023 Report on Gender Equality in the EU)

	Spain		UE	
	Women	Men	Women	Men
Attitudes and public behaviours on climate change and its mitigation				
Personal responsibility to try to reduce climate change (% 15+, 2018)	64	60	62	61
Avoid animal products (% 16-74, 2022)				
Usually	32	27	31	23
Sometimes	43	40	43	41
Never	25	33	26	36
Avoid single-use plastic products (% 16-74, 2022)				
Usually	55	50	49	42
Sometimes	39	42	44	46
Never	6	8	7	11
Choose environmentally friendly options in childcare activities (% 16-74, 2022)				
Usually	53	56	51	49
Sometimes	39	34	41	41
Never	7	10	8	10
Make friendly choices in household activities on a daily basis (% 16-74, 2022)				
Usually	62	60	59	53
Sometimes	31	33	35	39
Never	6	7	6	8
Tertiary graduates in natural sciences and technology (% 15+, 2021)				
Natural Sciences and Technologies	32	68	36	64
Natural Sciences	51	49	56	44
Technologies	26	74	28	72
Energy				
People who are not able to keep their home warm enough (% +16, 2021)				
65+	15	13	8	6
Low educational level	20	19	12	12
Single	20	18	10	9
Single parents	26	25	12	11
Non-EU migrants	30	27	12	13
People with disabilities	22	21	12	11
People in arrears on utility bills (% +16, 2021)				
16-24	11	13	8	9
Low educational level	11	13	9	10
Single	20	18	10	9
Single parents	26	25	12	11

TABLE 11. GENDER, SUSTAINABILITY AND CLIMATE CHANGE (*continued*)

(Indicators covered by the IQ 2023 Report on Gender Equality in the EU)

	Spain		UE	
	Women	Men	Women	Men
Non-EU migrants	21	22	11	12
People with disabilities	10	12	8	9
Persons employed in the energy sector (% +15, 2022)	31	69	24	76
Transport				
Persons that choose means of transport with low carbon emissions (% 16-74, 2022)				
Usually	46	44	42	41
Sometimes	40	41	39	41
Never	14	14	19	18
Persons that use the car as main means of transport during a typical week (% 16-74, 2022)	63	69	66	70
Persons that use public transport as main means of transport during a typical week (% 16-74, 2022)	40	34	32	29
Persons that walk as main means of transport during a typical week (% 16-74, 2022)	51	47	46	43
Persons employed in the transport sector (% 15+, 2022)	21	79	22	78
Decision making				
Senior managers in national ministries dealing with environment and climate change (% 2022)	35	65	44	56
Members of parliamentary committees dealing with environment and climate change (% 2022)	39	61	30	70

Source: *European Institute for Gender Equality, IQ 2023, Special thematic report: European Green Pact* (EIGE Survey on Gender Gaps in Unpaid Care, Individual and Social Activities, European Social Survey, Eurostat LFS, EU-SILC, Education Statistics, EIGE Women and Men in Decision-Making).

By way of conclusion

Climate change strategy has focused on adaptation and mitigation measures, with a clear focus on the consideration of impacts on the economy and productive sectors. More recently, concern for the social impact of climate change and strategies to address it are gaining ground, as the vulnerability of ecosystems and that of societies are closely linked.

Climate change poses a risk to health, quality of life and social cohesion, increasing inequality and the risk of poverty. The climate justice or just resilience approach makes it necessary to place equity and human rights

at the centre of climate change decision-making and action, considering that people who are more vulnerable due to various factors are more affected by the risks associated with the impact of climate change. It also makes it necessary to prevent and address the social consequences of “maladaptive” practices, which exacerbate inequalities.

Climate change adaptation and mitigation policies alone may not be sufficient to neutralise the effects of the unequal distribution of the social impacts of climate change, and must be accompanied by compensation measures with an equity perspective to avoid the rejection of policies to promote the ecological and energy transition by the groups most affected by its consequences.

Increased awareness of the social impact of climate change and the need for a fair distribution of the costs of the ecological transition provides an opportunity to further engage society in building resilient living environments in the face of climate change and the risks of inequalities to social cohesion.

Cushioning the social consequences of climate change requires a cross-cutting roadmap that acts across many policy areas, not strictly environmental or sectoral, through initiatives that promote education and environmentally friendly lifestyles; boost the role of the urban agenda, eco-efficient housing and sustainable mobility; respond to the specific needs of rural communities; and incorporate gender mainstreaming, intergenerational justice and dialogue with social partners.

BOX 11. SOCIAL IMPACTS OF CLIMATE CHANGE

Social impact of climate change: addressing transition deepening inequalities

Climate change poses a risk for the population health and well-being, increasing inequality and poverty risk.

The acceleration of this process in parallel to rapid sociodemographic changes, which increase pressure on natural resources, is also coupled with actions that can lead to negative environmental and/or social effects (“maladaptation”), deteriorating essential elements of the quality of life and increasing inequality.

- Social impact of climate change and the mitigation and adaptation measures go beyond national frontiers.
- The unbalanced distribution of climate change impacts exacerbates existing North-South inequalities.
- Population displacement and conflict are identified by rising sea levels, longer periods of drought, more frequent flooding, among other factors.

Concepts such as “climate justice” or “just resilience” make their way through the debate about social consequences of climate change and the adaptation and mitigation measures, in a process of just transition not limited to productive regions and sectors, which responds to the need to leave nobody behind.

Climate impact and social risks in Spain**Opportunities**

Take advantage of available tools: PNACC 2021-2023, which includes adaptation actions consistent with climate justice by addressing short- and long-term risks) and the II National Human Rights Plan, which specifies the need to reduce vulnerability related to climate, natural disasters and pollution and incorporates the need to pay attention to particularly vulnerable groups.

Challenges

In a scenario of global warming above 1.5 °C, the IPCC indicates that in the last third of the 21st, the warm desert and semi-arid climate will extend over the Eastern half of the Iberian Peninsula and the Mediterranean climate will extend northwards to occupy part of the Cantabrian coast. In Spain, more than 300,000 people are exposed to the risk of flooding, while annual deaths attributable to excessive heat and morbidity and mortality associated with pollution and poor air quality are on the rise.

Impacts on health and the health system**Opportunities**

Interdependence as an inescapable principle in addressing health is embodied in the integrated “One Health” approach, which seeks to balance and optimise the health of people, animals and ecosystems in a sustainable way.

The creation of the Health and Climate Change Observatory will serve to improve the monitoring of indicators related to health impacts, pooling efforts and contributing to the prevention and monitoring of extreme events hazardous to health.

Challenges

Nearly a quarter of the global burden of disease and mortality is attributable to environmental factors, one of the most obvious triggers being the global rise in temperature, correlated with the increase in tropospheric ozone concentration.

According to the WHO, this accounts for 12.6 million deaths per year, and is more pronounced in Spain, where heat-related deaths reach 116 per million, well above the European average.

Sustainable Urban Planning and Housing: emerging dilemmas and inequalities

Opportunities

The Mediterranean city model, predominant in Spain, offers ideal conditions for promoting urban planning models that address major challenges such as sustainability or environmental quality from the perspective of the quality of life of those who live in towns and cities.

Policy schemes such as the Spanish Urban Agenda, together with other national and European instruments, offer diagnoses, tools, methodologies and funding mechanisms so that local entities can develop responses to climate change, improving air quality, sustainable mobility or housing policies.

In addition, Spain has an Energy Rehabilitation Programme for existing buildings in municipalities with demographic challenges (PREE 5000 Programme) whose objective is to promote the sustainability of buildings (thermal optimisation of dwellings and thermal generation installation with renewables).

Challenges

Cities are the main consumers of energy and are responsible for a high percentage of CO₂ emissions into the atmosphere. In order to revert the climate impact they cause, ecosystemic policies are needed in which all the municipalities involved participate, in a multilevel and multi-stakeholder climate governance model that includes shared objectives and instruments adapted to the different territorial realities.

In Spain the so called “energy poverty” (households’ difficulty in keeping their homes at an adequate temperature -for healthy comfort) is particularly relevant, with lower-income households being the most affected by this deficiency.

Social impact in rural areas: a particularly at-risk environment

Opportunities

Axis 1 of the National Strategy against the Demographic Challenge includes programmes and actions aimed at stabilising the rural population, promoting green investments in order to reduce the social impact of climate change in rural areas (improving the energy efficiency of buildings, public equipment and infrastructures, promoting the generation and consumption of renewable energies and developing sustainable mobility).

Challenges

The economic and population concentration around the coast and large urban areas leave rural areas with an uncertain future, aggravated by the effects of climate change. This affects economic development, but also ageing, depopulation and worsening quality of life.

Tackling the demographic challenge involves improving job opportunities for young people, reversing the deficit of services and, in particular, seeking ways to reverse the impact of damage caused by natural disasters associated with climate change and the scarcity of basic resources, especially water.

Sustainable consumption and lifestyles

Opportunities

Adaptation and mitigation of climate change requires a rethink of individual decisions on living habits, purchasing and consumption patterns, towards more sustainable lifestyles.

UNEP points out the importance of addressing the needs of local people and environments by facilitating realistic and attractive choices.

Public authorities have a responsibility to translate the idea of a new social contract based on more sustainable lifestyles.

Regulatory developments such as Directive 2024/825 can improve consumer and user protection in the framework of the ecological transition.

BOX 11. **SOCIAL IMPACTS OF CLIMATE CHANGE** (continued)**Sustainable consumption and lifestyles****Challenges**

Among the consumption options, food plays a decisive role in consolidating sustainable and resilient production models and practices, as assumed by the PNACC 2021-2030, which estimates that one third of the food produced is currently wasted, which is incompatible with the need to feed a growing population in a context of agriculture production that is highly vulnerable to the impact of climate change.

Sensitivity-raising and awareness raising actions are necessary, involving all relevant actors (Administrations, consumer associations, social partners, education and training centres and the public itself).

Education and training is key, reinforcing knowledge, training for a low-carbon and resilient technical and professional activity in the face of climate change and the acquisition of the necessary personal and social responsibility.

Gender impact of climate change**Opportunities**

Women's increased ecological commitment and contribution to sustainability has a major impact on the collective awareness of the need to step up action on climate change. This is illustrated by the fact that globally it has been women, especially young women, who have led the major climate mobilisations of recent years.

Challenges

Despite women's contribution to environmental awareness, it is women who are most affected by some of the consequences of climate change, especially older women living alone and/or in isolated municipalities or rural environments, as well as single-parent households.

They also suffer more frequently from energy poverty, especially non-EU immigrants and, again, single-parent households.

It is therefore necessary to reverse the under-representation of women in key sectors for the green transition, such as energy and transport, as well as in decision-making areas relevant to tackling the consequences of climate change and the ecological transition.

Climate change poses a risk for health, quality of life and social cohesion, increasing inequality and poverty risk.

The climate justice or just resilience approach makes it necessary to place equity and human rights at the centre of decision-making and action in this area, considering that people in vulnerable situations are most affected by the associated risks.

Cushioning the social consequences of climate change, incorporating the idea of compensation alongside those of mitigation and adaptation, requires a cross-cutting roadmap that acts from many policy areas, and not strictly from environmental or sectoral ones, with initiatives that promote education and environmentally friendly lifestyles; promote the role of the urban agenda, ecoefficient housing and sustainable mobility; respond to the specific needs of rural communities; and incorporate the gender perspective, intergenerational justice and dialogue with social partners.



CONSEJO ECONÓMICO
Y SOCIAL ESPAÑA