

Is Europe on track with climate resilience?

– Status of reported national adaptation actions in 2023



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Key messages

Climate-related hazards and key affected sectors

- Heat waves, droughts, floods and heavy precipitation are the most reported observed extreme weather events, while changing temperatures and hydrological variability are the most common chronic hazards.
- For most temperature- and water-related hazards the majority of countries reported an expected increase of frequency and/or intensity for the future.
- Greater uncertainty surrounds the trends for wind- and solid mass-related hazards.
- Health, agriculture, forestry and biodiversity are the most reported affected sectors, in line with reporting from 2021.

Climate risk assessments

- National climate risk assessments (CRAs) are increasingly used to inform adaptation policy development. Almost half of the reporting countries have delivered these new assessments since 2021, although countries with legal obligations for repeated climate risk assessments are still an exception and a minority of countries are yet to produce their first national overarching assessments.
- New multi- or cross-sectoral risk assessments and thematic or sector-specific studies have been conducted equally as often, consolidating the previous trend towards higher diversity of assessment designs.
- Several countries have begun to tackle strategic knowledge gaps that are crucial to more systemic adaptation (i.e., cross-border and international climate risks; cross-sectoral interactions; complex, compound and cascading risks), but the rate and extent of progress is still limited.

Adaptation policies and priorities

- The adaptation policy landscape is gradually evolving and climate laws are increasingly emerging as an instrument to give greater legal power to such policies. Nine new national adaptation strategies and/or plans have been approved and adopted by countries since 2021, while others are still in the process of revising and adopting them.
- Climate laws are increasingly emerging as an instrument to give greater legal power to adaptation policies: 10 European Environment Agency (EEA) member countries currently have an adopted climate law with provisions for adaptation.
- The adaptation priorities reported by the countries are overall consistent with those reported in 2021. As adaptation policies are long-term, priorities remain stable through the various policy update cycles.
- Some slight differences in the adaptation priorities reported by countries concern the energy and coastal areas sectors, which were reported more frequently than in the previous reporting cycle.

Adaptation governance

- Mechanisms for horizontal policy integration and multi-level coordination have been further developed and are now in place in almost all countries.
- Governance-related challenges are a persistent barrier to the implementation of adaptation actions in many countries, even where well-developed governance frameworks are in place. These challenges include difficulties in coordination due to limitations in financial, technical and human capacities.

- Soft, collaboration-based forms of governance still predominate. Legal requirements to enforce horizontal policy integration and binding vertical governance frameworks that stipulate adaptation planning by regional and/or local authorities are increasing.
- Sub-national adaptation policymaking is further progressing in all countries, mostly due to voluntary and bottom-up initiatives. Multi-level networks and collaborative mechanisms are reported to be crucial to advancing local adaptation, supporting sub-national governments and stakeholders through capacity building activities, information provision, guidance and financing schemes.

Implementation and finance

- Adaptation is increasingly mainstreamed in the sectors most directly affected by climate change: water resources, agriculture, forestry, biodiversity, tourism, insurance, emergency and crisis management, environment, transport, urban planning and buildings as well as marine spatial planning.
- Adaptation is increasingly mainstreamed into sectoral policies, programmes, and legal and regulatory frameworks related to water policies, urban policies, disaster risk reduction and management policies, the common agricultural policy, sustainable development, environmental impact assessments and more often strategic environmental assessments.
- Measures to increase adaptive capacity and reduce vulnerability include awareness-raising, capacity-building, information provision, guidance, decision support, web-portals, newsletters, training, inclusion of climate change in educational programmes and strategic project implementation.
- Although assessing the cost of adaptation remains a challenge and is often only done partly, all Member States report increasing sector costs due to adaptation. A common methodology to assess costs and track financing of implementation of adaptation strategies and plans is still not available.
- European Union (EU) funds play a major role in financing adaptation action for most Member States. Some also reported dedicated national adaptation funds to finance the implementation of national or sectoral adaptation actions.

Monitoring, reporting and evaluation

- Monitoring, reporting and evaluation (MRE) activities continue to be more common in EEA member countries, with at least one of the three MRE activities either being performed or planned in all reporting countries. Evaluation is still less used than monitoring and reporting, but the number of countries engaging in it is growing.
- An indicator-based approach for MRE is often reported, although the indicator types and how they contribute to evaluation purposes are not always clear.
- Ensuring that the different levels of MRE - national, regional and local level - are connected is important to gain a more comprehensive understanding of what is being monitored, reported and evaluated and to improve efficiency of MRE activities more broadly.
- Few countries reported exactly how MRE feeds back into the development of adaptation policy, despite its potential to influence decision-making.

National adaptation actions contributing to a resilient Energy Union

- Member States reported in their integrated national progress reports on energy and climate on the direct impacts of climate change through extreme weather events and the interaction with energy demand and supply system. Under potential future impacts, changes in frequency and intensity of extreme weather events like heat waves (hot spells), droughts, stronger storms, as well as an increased amount of precipitation, are reported.

- The reported hazards seem to be in line with those hazards reported under Article 19 of the GovReg on national adaptation actions. However, due to the different reporting structures, a direct comparison cannot be made.
- Strategic and overarching national adaptation goals and sector specific adaptation goals are almost equally reported. They address either climate resilience, the urge to adapt the economy, society and environment to the adverse effects of climate change, or outline action for affected sectors such as agriculture, buildings, forestry, energy, infrastructure and transport.
- In most EU Member States, monitoring and evaluation frameworks for measuring progress of implementation towards meeting the adaptation goals are under development or recently implemented. If operational, these frameworks are mostly structured around adaptation measures outlined in national adaptation strategies or plans, or follow an indicator-based approach, and might not consider synergies with the Energy Union dimensions.
- A few EU Member States highlighted the principles of adaptation in their reports: the importance of addressing synergies between climate change mitigation and adaptation, avoiding insufficient adaptation action, or maladaptation and the role of prevention.

1 Introduction

A July 2021 Eurobarometer survey found that European citizens believe climate change is the most serious problem facing the world (EC, 2021b) – 77% of people surveyed in 2023 consider climate change to be a serious problem (EC, 2023). A majority of Europeans think that the European Union (56%), national governments (56%), and business and industry (53%) are responsible for tackling climate change. 35% hold themselves personally responsible. More than 8 in 10 respondents think that it is important that their national government (86%) and the European Union (85%) take action. This European Topic Centre on Climate change adaptation and LULUCF (ETC-CA) Technical Paper ‘Is Europe on track with climate resilience? – Status of reported national adaptation actions in 2023’ provides relevant information on how climate change is being tackled in Europe, based on information provided by European Union (EU) Member States and European Environment Agency (EEA) member countries.

The ETC-CA Technical Paper assesses the information reported by EU Member States and EEA member countries in 2023 ⁽¹⁾ following the provisions of Article 17 and Article 19 of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action (GovReg) (EU, 2018) ⁽²⁾. As 2023 is the second cycle of reporting under Article 19, this paper aims to highlight findings that go beyond what countries reported in 2021 (EEA, 2022). This is the first time that Member States were required to report their adaptation goals in integrated national energy and climate plans (NECPs, under the integrated national energy and climate progress reporting) and thus this paper includes the key findings from this reported information as well. The official deadline to report to the European Commission was 15 March 2023, however this assessment considers information submitted until 11 September 2023. All Member States reported on Article 17 and on Article 19; 2 EEA member countries (Iceland and Switzerland) voluntarily reported on Article 19 ⁽³⁾.

The technical paper reflects on the key messages of the 2022 EEA report ‘Advancing towards climate resilience in Europe —Status of reported national adaptation actions in 2021’ and reiterates where these messages can be confirmed or where more specific information has been provided. It showcases more recent figures and tables of climate-related hazards, vulnerability and risks, adaptation policies and priorities, adaptation governance, implementation and financing as well as monitoring, reporting and evaluation.

2 Climate-related hazards, vulnerabilities and risk

2.1 Key observed and future climate hazards

In the 2023 reporting templates, the section on climate hazards was restructured, keeping in line with the GovReg. In addition to the indication of which hazards have been observed, countries were also able to add a qualitative assessment of future climate hazards. They could indicate whether, on the basis of their evaluations, the hazards, both acute and chronic, were expected to increase, remain without significant change, decrease or have unclear or unknown future evolution trends.

⁽¹⁾ Reporting national adaptation actions under the Regulation on the Governance of the Energy Union and Climate Action is mandatory for EU Member States and voluntary for EEA member countries that are not EU Member States. Of those non-EU EEA member countries, Iceland and Switzerland reported by the cut-off date of 30 June 2022. In this technical paper, the information from the reporting that covers only the EU-27 is referred to as ‘Member States’. Elsewhere, the more general terms ‘countries’ is used, where necessary specifying which countries this refers to (e.g. EEA-32 member countries).

⁽²⁾ Wherever this report refers to Article 17, it specifically refers to Article 17 (2)(d) and wherever it refers to Article 19 it refers to Article 19 (1) and Part 1 of Annex VIII of the GovReg (EU, 2018).

⁽³⁾ Wherever this report refers to countries, it refers to all reported information, including this from the non-EU Member States that voluntarily reported by the cut-off date. Member States is used when only referring to the reporting of EU Member States. This report refers to the reporting in 2023, unless stated differently, e.g. when also information from the 2021 reporting is included for comparison reasons.

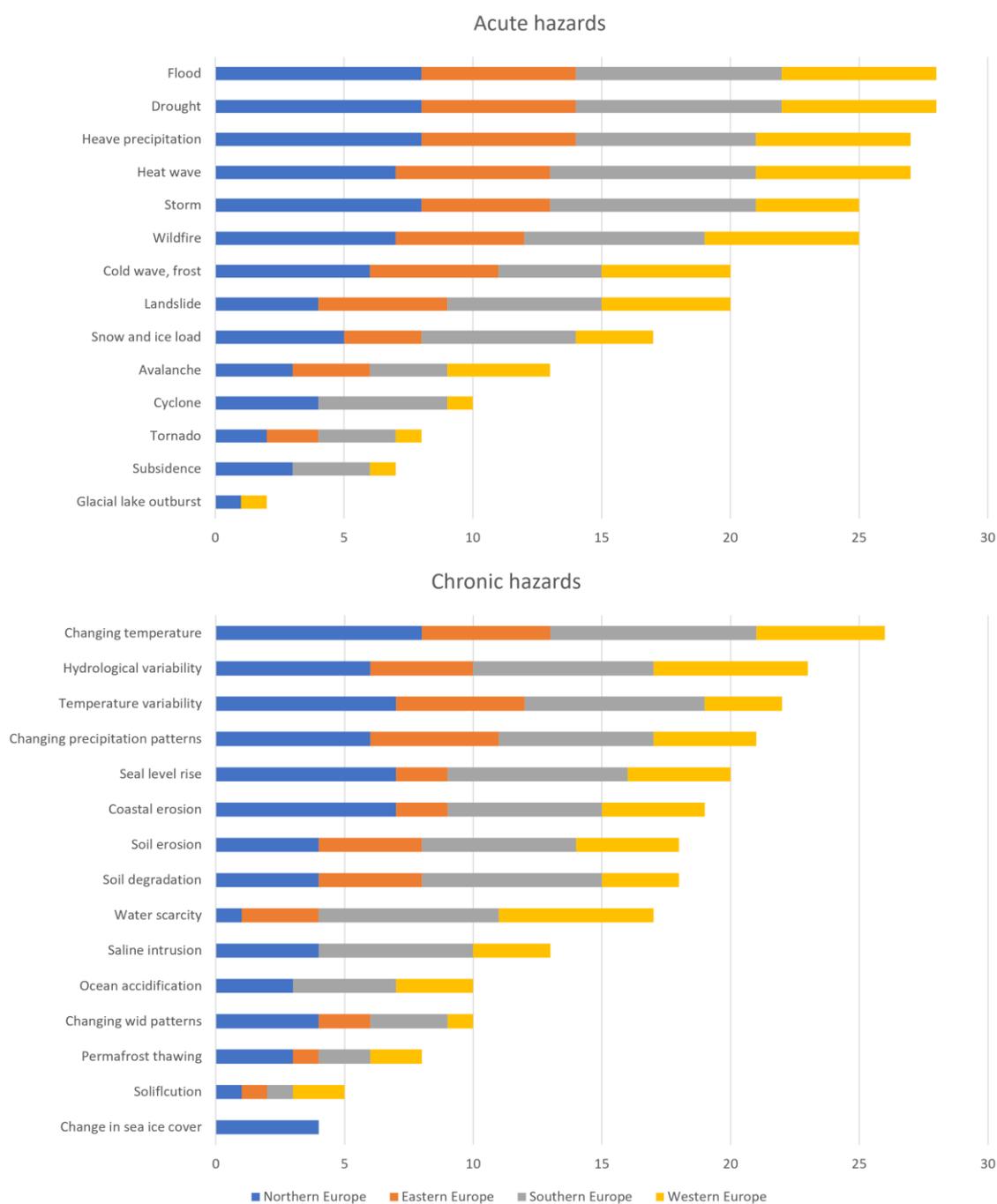
The observed acute hazards are consistent with those reported in 2021. Once again, floods and drought are the most reported hazard (by 28 out of 29 countries), followed by heavy precipitation and heatwaves, reported by 27 countries (Figure 1, upper part). The fifth and sixth most reported hazards, by 25 countries, are wildfire and storms. For the wildfire hazard, this is a big change compared to 2021 when it was ranked tenth. This may be due to the fact that in summer 2022 wildfires severely affected all of Europe marking the second-worst wildfire season in the European Union since 2000 when the Copernicus' European Forest Fire Information System records began (JRC, 2023).

The most reported chronic hazard in 2023 remains the changing temperature (by 26 out of 29 countries), as in previous years (Figure 1, lower part). Temperature variability ⁽⁴⁾ was reported more often, eventually ranking third among chronic hazards (in 2021 it was seventh). Precipitation and/or hydrological variability as well as changing precipitation patterns and types are second and fourth, respectively. Sea level rise is the fifth chronic hazard, reported by 20 countries (similar to 2021, and not of relevance for landlocked countries).

There are no significant geographical differences among the reported hazards, except for some very specific hazards of northern European regions (change in sea ice cover) or hazards that do not seem to affect Eastern European and/or land-locked countries (cyclone, subsidence, saline intrusion and ocean acidification).

⁽⁴⁾ Defined in the reporting guidelines as deviations of the [temperature] from a given mean state (including the occurrence of extremes, etc.) at all spatial and temporal scales beyond that of individual weather events (IPCC, 2022).

Figure 1. Number of observed acute and chronic hazards reported in 2023

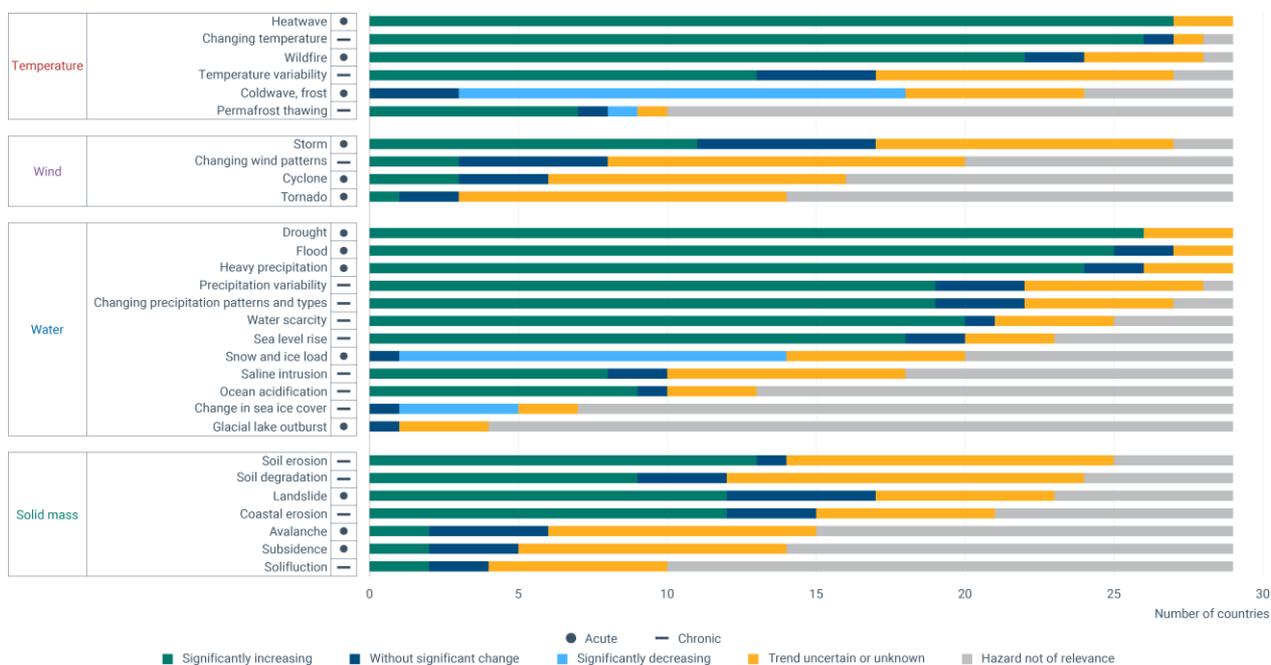


Note: The geographical classification of countries is consistent with the [UN geo-scheme for Europe](#) (UN DESA, n.d.), and with the similar nomenclature frequently used in EEA and Commission climate-related assessments. Northern: Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania and Sweden; Eastern: Bulgaria, Czechia, Hungary, Poland, Romania and Slovakia; Southern: Croatia, Cyprus, Greece, Italy, Malta, Portugal, Slovenia and Spain; and Western: Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland. Total number of countries: 29.

Source: Based on the reporting under [GovReg Art. 19](#) (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

Regarding the expected future hazards, countries showed cohesion in reporting the increase of heatwaves, drought, flood, heavy precipitation and wildfire among the acute hazards, and changing temperature, water scarcity, changing precipitation patterns and types, sea level rise, precipitation and hydrological variability among the chronic hazards. Countries reported that some hazards will be less frequent and/or intense in the future, i.e., acute cold wave frost, acute snow/ice load and chronic change in sea ice cover (Figure 2).

Figure 2. Key future hazards reported in 2023



Note: Based on the reporting from all EU Member States and from Iceland and Switzerland. Total number of countries: 29.

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

For some types of hazards, the assessment of the future occurrence is generally uncertain, in particular for wind-related hazards such as cyclone, storm, tornado and change of wind patterns as well as soil mass-related hazards like avalanche, subsidence, soil degradation and soil erosion (Figure 2Figure 3). This may in part be due to the difficulty of projecting these types of hazards into future scenarios and making a robust assessment. Reducing this knowledge gap is an element that could be taken into consideration in future assessments also to achieve the goal of smarter adaptation as it was set out in the European Adaptation Strategy (EC, 2021a) which aims to further improve knowledge and reduce uncertainty.

2.2 Key affected sectors

This section of the reporting template was completely restructured in 2023. Countries, in line with the provisions of the Governance Regulation, were asked to indicate the impacted sector and, for each, a qualitative assessment of the various risk components: the nature of the hazard, its likelihood, the vulnerability of the sector, and finally an assessment of the overall risk in the future. For each of these items, countries could give an assessment ranging from low to high or not applicable. Overall, countries reported 275 key affected sectors ⁽⁵⁾, on average more than 10 sectors per country ranging from 2 to 19 sectors. In 2021, a total of 232 sectors ⁽⁶⁾ was reported. Countries reporting more than 15 key affected

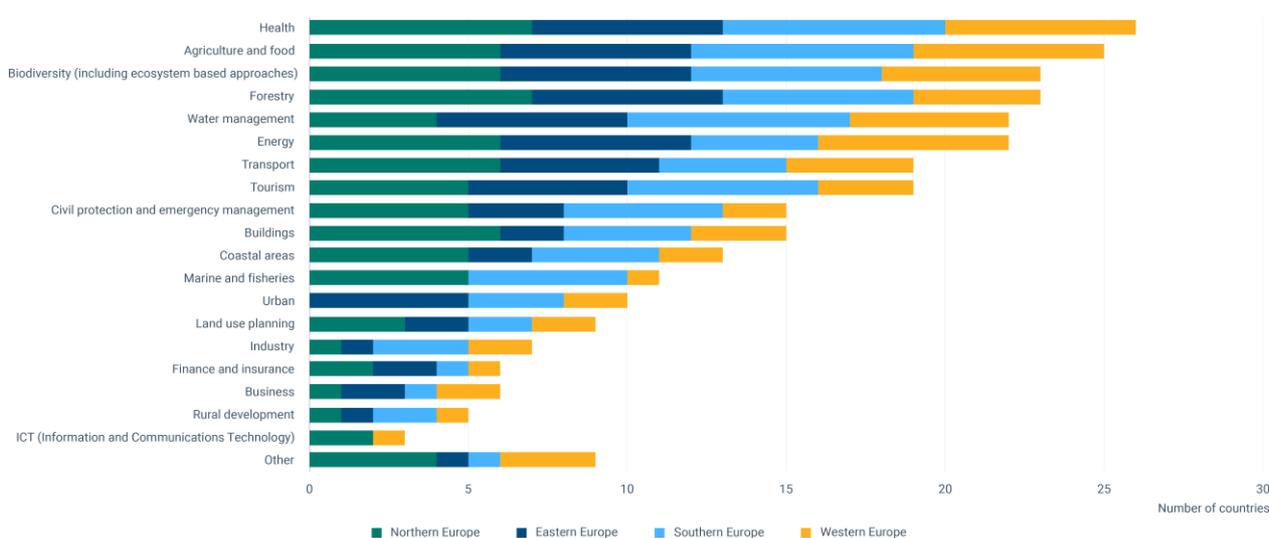
⁽⁵⁾ This figure includes all 27 EU Member States plus Switzerland. Iceland did not report Key affected sectors.

⁽⁶⁾ In 2021 four EU Member States did not report any key affected sector, neither was there a voluntary reporting of key affected sector by any of the EEA member countries that are not EU Member States.

sectors in 2023 are Denmark, Italy, Portugal, Romania, Spain and Sweden and countries reporting less than five sectors are Cyprus, Estonia, France, Luxembourg, Slovenia and Switzerland.

In general, counting unique occurrences ⁽⁷⁾, the sectors that are reported as most impacted in Europe are health, agriculture, forestry and biodiversity (Figure 3). This is consistent with what was reported in 2021. An interesting change from the previous reporting cycle concerns the energy sector. Energy ranks fifth among the most climate-impacted sectors, while in the previous reporting period, the sector was mentioned less often and overall ranked seventh. In terms of geographical distribution, no significant differences emerge between countries in the northern, southern, eastern or western areas of Europe⁸. Marine and fisheries are confirmed to be a concern for countries in the north, south and west of Europe, but not for countries in the east. This is also attributable to the fact that most eastern countries do not have an outlet to the sea. Finally, the information and communications technology (ICT) sector is an area of concern in very few countries so far, all being in northern or western Europe. In 2021, only northern countries had included the ICT sector, while in 2023 the Netherlands also reported the sector.

Figure 3. Key affected sectors per geographical area reported in 2023



Note: Based on the reporting from all EU Member States and Switzerland. No information from Iceland could be included in this analysis. Total number of countries: 28.

Some countries indicated the same sector several times to add additional details. For the purposes of this analysis, when this situation arose, the sector was counted only once. Each key affected sector reported could also be linked to more than one of the predefined list of sectors in the Footnote 4 of Annex I of the Implementing Regulation (EU, 2020). Because of these principles, 276 key affected sectors reported results in 288 data points in the graph above.

The geographical classification of countries is consistent with the UN geo-scheme for Europe (UN DESA, n.d.), and with the similar nomenclature frequently used in EEA and Commission climate-related assessments. Northern (7 countries): Denmark, Estonia, Finland, (Iceland), Ireland, Latvia, Lithuania and Sweden; Eastern (6): Bulgaria, Czechia, Hungary, Poland, Romania and Slovakia; Southern (8): Croatia,

⁽⁷⁾ There is no limit to the number of key affected sectors reported by a country. Some countries linked a key affected sector to the same item from the list of key affected sectors specified in footnote 4 of Annex I in the Implementing Regulation (EU, 2020) to add additional details. For the purposes of this analysis, when this situation arose, the sector was counted only once, helped by the fact that the assessment of hazard, likelihood, vulnerability and risk levels were the same.

⁽⁸⁾ The differences in occurrences of the ‘business’ and ‘industry’ sectors compared to the previous reporting cycle are due to the fact that in 2021 the two sectors were indicated together, while in 2023 countries can indicate them separately. The occurrences of both sectors in 2023 coincide perfectly with those in 2021 with the exception of Italy, which included the ‘industry’ sector in the current reporting cycle while it did not do so in the previous one.

Cyprus, Greece, Italy, Malta, Portugal, Slovenia and Spain; and Western (7): Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland.

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

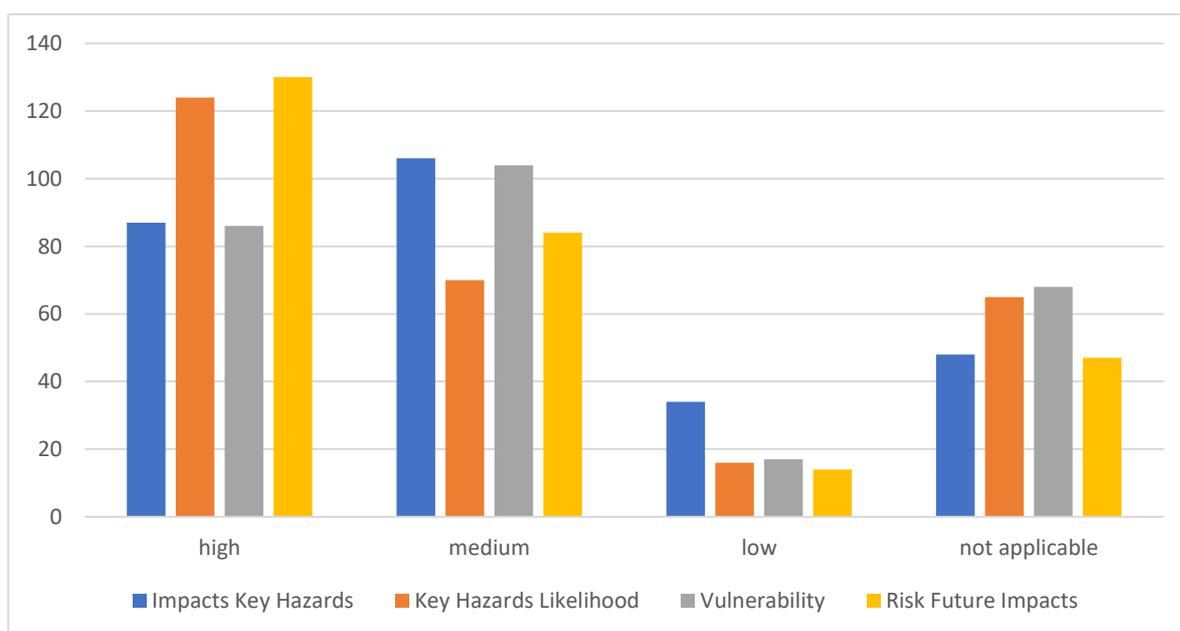
Going into the various risk components, it can be observed that among the reported sectors, health and water management are more commonly identified as ‘highly’ impacted, while tourism is often reported as ‘lowly’ impacted. However, it should be pointed out that countries were asked to make a qualitative assessment without a common list of criteria. This means that the assessments of different countries cannot be directly compared because the same score can express different types of assessments from country to country. Despite this limitation, a ‘medium’ rating prevails (106 out of 275 occurrences representing 39%), followed by a ‘high’ rating (87 occurrences representing 32%) in the assessment of hazards.

As regards the likelihood of impact, there is a prevalence of key affected sectors where there is a high probability of impact (124 out of 275 or 45%), followed by medium probability (70 occurrences or 25%).

The qualitative assessment of vulnerability is very similar to the one on impacts of key hazards when it comes to ‘high’ or ‘medium’ (respectively 31 and 38%), whereas in 25% of the sectors the qualitative assessment for vulnerability was ‘not applicable’.

In the future, countries anticipate a ‘high’ risk for most sectors (130 out of 275, namely 47%), while for 31% of sectors the future risk is expected to be ‘medium’.

Figure 4. Overall score of key affected sectors for each component of risk



Note: Based on the reporting from all EU Member States and Switzerland. No information from Iceland could be included in this analysis. Total number of countries: 28.

Impacts key hazards: observed impacts of key hazards, including changes in frequency and magnitude; Key hazards likelihood: likelihood of the occurrence of key hazards and exposure to them under future climate, drawing upon the best available climate modelling science; Vulnerability: vulnerability, including adaptive capacity; Risk Future Impacts: risk of potential future impacts.

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

2.3 Climate risk assessments

2.3.1 Progress in climate risk assessments

The reported information demonstrates further progress in assessments of climate-related hazards, vulnerabilities and risks, confirming that enhancement, expansion, and deepening of the knowledge base on climate risks is a continuous process in many countries. Within the short time span since the first reporting cycle in 2021, a significant share of countries reported further substantial achievements in updating or conducting new climate risk assessments (CRAs) and related efforts (such as development of assessment methodologies and content enhancement of web-based CRA databases). Altogether 14 countries, which equates to half of all countries that reported in 2023, mentioned new climate risk and vulnerability assessments and/or new climate risk-related information that is considered relevant from the national policy-making perspective (Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Poland and Sweden). The respective CRA studies were mostly conducted or completed since the first reporting cycle in 2021, while some are of less recent origin, but were not reported previously (Iceland and Germany).

The newly available CRAs differ in terms of scope as regards content, geographic coverage, and territorial scale, thus continuing a trend towards increasing diversity in assessment designs that is traceable through a series of previous EEA reports (EEA, 2018, 2020, 2021). That diversity of assessment approaches does not only unfold across countries but can sometimes occur within individual countries. For example, since 2021 Finland has finalized a cross-sectoral CRA at national level, a multi-sectoral assessment of regional vulnerabilities, and sector-specific impact and vulnerability analyses. From the 2023 reporting, there emerges a quite balanced ratio between comprehensive multi- or cross-sectoral CRAs and thematically focused or sector-specific assessments, in terms of both number of countries and number of studies. Five countries (Austria, Croatia, Finland, Germany and Iceland) report assessment exercises that appear to qualify as centralized and coordinated national multi-/cross-sectoral CRAs. Two countries (Finland and Poland) have delivered country wide CRAs at sub-national assessment scales, and two further countries have prepared new climate projections at national (Ireland) and sub-national (France) scales plus a climate status report (Ireland). In comparison, six countries have elaborated new thematic or sector-based assessments with national coverage. The sectors and thematic issues addressed tend to be broad, extend significantly beyond river basin and flood risk management, which was one of the most often reported sectors in 2021, and sometimes include social and economic aspects (France and Hungary). A more detailed analysis according to different types and forms of CRAs and CRA-related knowledge production is given below.

- Completion of **national multi- or cross-sectoral CRAs** or broad climate change assessments was reported by Austria, Croatia, Germany, Finland, Italy, Ireland and Iceland. Croatia and Finland have conducted new comprehensive national CRAs during preparation of their revised national adaptation policies, while Italy has updated its national risk analysis contained in the National Adaptation Strategy (NAS). In Austria, the domestic research community in an IPCC-style initiative has elaborated a new scientific assessment report on structural changes needed to achieve mitigation, adaptation and broader social-ecological goals in an integrated way, which is currently being incorporated into the ongoing second revision of the Austrian NAS and National Adaptation Plan (NAP). Germany reported a national study on the climate-induced damage potentials and economic impacts of climate change from 2020. In Ireland, the second edition of the 'Status of Ireland's Climate' report was finalized in 2021, while Iceland has published its third report on the effects of climate change on the national territory already in 2018.
- New **thematic or sector-specific assessments at national scale** have become available in at least six countries (Denmark, Finland, France, Greece, Hungary, Ireland and Sweden), plus a cost-benefit analysis at the **regional level** in Flanders (Belgium). The thematic focus varies between coverage of several sectors from a sector-specific lens (Finland and Hungary), obligatory updating of risk assessments by (sectoral) national authorities (Sweden), national flood risk assessments for coastal and fluvial flooding (Denmark), biodiversity and ecosystems (Greece), socio-economic

aspects of climate change (Hungary), and the costs of inaction on climate change (France). In the face of the significant resource needs of periodically repeated comprehensive CRAs, and vis-a-vis the almost omnipresent lack of financial resources reported by countries, thematically focused CRAs offer an alternative by addressing critically important sectors and issues in a targeted way.

- Seven countries (Belgium, Finland, France, Hungary, Italy, Poland and Sweden) explicitly mention **sub-national CRAs** or regional climate projections with mostly multi-sectoral assessment designs. These assessments are either focused on specific sub-national territories (e.g. Flanders in Belgium; six cities in Italy; several overseas territories in France; and vulnerability of tourism destinations in Hungarian micro-regions) or provide CRA data at regional or local scales with country-wide geographic coverage (assessment of climate-related regional characteristics and vulnerabilities in Finland; and spatial assessment of climate change risks for municipalities as part of the KLIMADA 2.0 project in Poland). In Sweden, a national evaluation shows that most regional authorities have updated their climate and vulnerability analysis, as required by national regulations.
- Several countries explicitly report about the publication of updated climate risk knowledge on **dedicated (sub-)national CRA web-portals** on an ongoing basis (Belgium, Greece, Hungary and Poland). For example, in Hungary the National Adaptation Geo-Information System (NAGiS) is used as a central knowledge provision tool for making vulnerability and climate impact information available to the public. Switzerland has in recent years built up a National Centre for Climate Services. While not directly traceable from the reported information, it is fair to assume that web-based knowledge brokerage of regularly upgraded CRA information is practiced also in several other countries.
- Several countries highlight progress and substantial achievements in **development of CRA-related methodologies** (Denmark, Germany, Hungary, Iceland, Italy and Poland). Published examples include a study on the modelling of climate-induced damage and damage potentials in Germany, new methodologies for coastal flood risk assessment (Denmark and Iceland), new climate indicators in Italy, and a technical manual for calculating climatic indicators for sustainable urban development in Poland.

Table 1: National and sub-national climate risk assessments in EEA member countries

Country	Year	Assessment product (title or reported description, in English)
Austria	2022	APCC ^a Special Report: Structures for climate-friendly living
Belgium	2022	Flanders: Cost-benefit analysis of climate adaptation
	2021-2023	Flanders: Climate impact, vulnerability and risk data on sub-national climate portal (regular content enhancement)
Croatia	2022	National multi-sectoral climate risk assessment
Finland	2023 ^b	Cross-sectorial and sectorial climate risk and vulnerability assessment
	2023 ^b	Assessment of climate-related regional characteristics and vulnerabilities
	2021-2023	Vulnerability assessments as part of sector adaptation plans
France	2023	ONERC ^c annual report to the Prime Minister and the Parliament: Heat waves in the context of climate change
	2022	ONERC ^c annual report to the Prime Minister and the Parliament: Foresight at the service of adaptation to climate change
	2021	Regionalised climate projections for overseas territories (Guadeloupe, Martinique, Saint-Martin, Saint-Barthélemy, Reunion)

Country	Year	Assessment product (title or reported description, in English)
Germany	2020	Assessment of risks associated with climate change: damage potentials and economic impacts of climate change and adaptation measures (incl. new methodology for modelling of damage potentials)
Greece	2022	Baseline analysis for climate adaptation of the biodiversity and ecosystems sector (LIFE-IP AdaptInGR)
	2021-2023	National GIS Maps Portal on Climate Change (content enhancement based on climate projection data produced by LIFE-IP AdaptInGR)
Hungary	2021-2023	Further development of the National Adaptation Geo-Information System (NAGIS) (regular content enhancement)
	2021-2023	Scientific assessments on socio-economic aspects of climate change (expected impacts of climate change on human health of vulnerable population groups, domestic migration processes, internal labour market processes)
	2021-2023	Scientific assessments of sector-related and thematic vulnerability issues (agriculture, urban flooding, housing stock, climate change effects on geological hazards)
	2021-2023	New methodology for complex vulnerability assessments of tourism products
Iceland	2018	Climate change and its effects on Iceland. Report of the Scientific Committee on Climate Change.
	2020	Methods for Coastal Flood Risk Assessment: An overview of methods used in Scandinavia and the UK and a discussion of their suitability for Iceland
Ireland	2021	Status of Ireland's climate (2 nd edition)
	2020	High-resolution climate projections for Ireland: a multi-model ensemble approach. EPA Research Report.
Italy	2021	Risk analysis: climate change in six Italian cities (update of climate risk analysis contained in the NAS)
	2022	Climate indicators in Italy in 2021
Poland	2021-2023	Assessment of climate change-related risk for municipalities (in the frame of the KLIMADA 2.0 project), including methodology for spatial assessment of changes in risk levels at municipal scale
		KLIMADA 2.0 web portal (regular content enhancement)
	2022	Natural and climatic indicators for sustainable urban development: Manual and technical guidance for cities
Sweden	2021	Evaluation of the climate adaptation work by sectoral and regional authorities (including obligatory updates of their climate and vulnerability analyses)

^a APCC - Austrian Panel on Climate Change

^b Publication reported to be in progress

^c ONERC - Observatoire National sur les Effets du Réchauffement Climatique

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a)

When comparing the progress achieved in completing CRAs in 2023 to updates foreseen in 2021, it appears that only a fraction of the countries that in 2021 communicated plans to develop or update national CRAs in the near future have proceeded to delivering new results at the beginning of 2023 (Austria, Denmark, Finland, Hungary and Italy). This may indicate that generating national CRAs is a time- and resource-intensive process that is often hampered by a range of challenges and barriers and requires flexibility.

Gaps between those countries that are well progressed in CRAs and a few countries that are lagging behind continue to persist. Only a few countries did not report any new information that would indicate progress

in developing CRAs. In the Baltic countries (Estonia, Latvia and Lithuania), risk assessment activities since 2021 appear to focus mostly on disaster risk assessments, with climate change aspects being considered to unclear extents under the umbrella of civil protection and disaster management policies. As regards three countries without any national comprehensive CRA so far, Slovenia states – as in 2021 – that the first vulnerability assessments for sectors and municipalities are still ongoing, while Czechia is currently engaged in an ongoing national CRA about drought risk. Malta is currently undertaking the ‘Climate Vulnerability Risk Assessment of the Maltese Economy’, aiming to improve the understanding on the degree of vulnerability and risks to which society, the economic sectors, and the natural environment are exposed to, in a more quantitative approach. Gaps between an increasing number of countries with high levels of ambition and a regularly updated, growing knowledge base, on the one hand, and a minority of countries that are still lacking their first national CRA and assessment experience, on the other hand, thus continue to persist.

Efforts to address strategic knowledge gaps are emerging, but only in a limited number of countries and still at a rather slow pace. A few countries have started to tackle persistent knowledge gaps that have been recognized as crucial to more systemic approaches to adaptation (EEA, 2018, 2020, 2021; EC, 2021a; IPCC, 2022). The Netherlands and Spain report that the ongoing development of their new national CRAs has a dedicated focus on considering cascading effects and complex risks. The conceptual framework of impact chains used by Germany is in favor of consideration of systemic climate risk, as well. Sweden and Finland are sharpening their focus on international and cross-border risks and putting an emphasis on cross-sectoral interactions, thus moving towards a ‘systemic’ understanding of vulnerability. Some countries (e.g. Austria and Ireland) explicitly report that their domestic research programs are designed to respond to persisting or emerging knowledge gaps through dedicated projects.

2.3.2 National governance of climate risk assessments

CRAs and their review at periodic update cycles are increasingly institutionalized through new or re-enforced legal requirements, often enacted under national climate laws. Availability of up-to-date climate risk information and periodical repetition of CRAs is needed to account for changes in risk and vulnerability levels and to inform policy revision. It is also in favour of avoiding stranded investments, lock-in effects and maladaptation. The number of countries that explicitly mention mandatory legal requirements for conducting national and/or sub-national CRAs has increased. Especially in several of those countries where climate laws have been newly enacted or amended, preparation and regular updates of CRAs have been legally anchored in national climate legislation and are usually coupled to revision cycles of the NAS, NAP and/or regional adaptation plans (Finland, Greece, Ireland and Spain). The Finnish Climate Act 2022 requires that updated NAPs shall include an up-to-date assessment of climate risks and vulnerabilities and that a regional risk assessment is to be carried out when necessary. Similarly, there is now an obligation to prepare a national CRA report every five years under the new Spanish Climate Law. In Ireland, CRAs are required as part of statutory sectoral adaptation plans, which are stipulated by the Irish Climate Law, while in Greece CRAs are a mandatory component of the NAS and the Regional Adaptation Plans (RAPs), as prescribed by the new Greek Climate Act. In both Ireland and Greece, pre-existing legal requirements have been transposed to the new climate laws. Pre-existing legal or political requirements for CRAs in Sweden (tasked to national sector authorities and regional administrations), France (annual thematic national reports by ONERC, vulnerability analysis as part of statutory regional territorial development plans and inter-municipal climate-air-energy plans) and Germany (six-year cycle) have been retained. However, overall, the countries with legal obligations for CRAs, including their periodicity, remain a minority.

Legislation offers ample opportunities to regulate key elements of CRAs, including procedural quality criteria and the linkages to adaptation policy-making. Climate laws, or legal requirements for CRAs in other pieces of legislation, typically stipulate the following elements related to CRAs: timing and frequency of update cycles (most often, 5 years); alignment of assessments with the adaptation policy cycle and use of the information for revisions of NAS/NAP; institutional responsibilities for conducting and/or coordinating the CRA; involvement of advisory bodies or stakeholders; focus and thematic scope, e.g., coverage of especially vulnerable sectors, systems, groups, and indigenous communities (e.g. Finland). In adaptation governance systems, where statutory responsibilities have been decentralized to sectoral or regional

authorities, sometimes also obligations to report to central coordinating bodies and procedural rules are in place (e.g. Greece, Sweden and Ireland). In most of the countries without legal obligations for CRAs, it would appear that (non-binding) policy commitments, either through government resolutions or statements in the NAS/NAP policy documents, for periodic updating of national CRAs are in place. In general, more and more countries are moving towards aligning the frequency and timing of national CRAs with their adaptation policy cycle.

Project-based enhancement of the knowledge base on climate vulnerabilities and risks in an incremental and cumulative process which continues to be a widespread model of knowledge production and can support and complement systematic and periodical renewal of synthesis assessments. From the reported information, it can be extracted that in many countries individual CRA research projects on various issues continue to play a major role in producing issue-specific CRA information and feeding into the national knowledge base on climate risks in an incremental and cumulative way. This process takes place on an ongoing basis through sequences of smaller projects under national climate research programs, which are, ideally, strategically aligned with adaptation policy-making needs and directed at filling knowledge gaps (e.g. Austria, Ireland and the Netherlands), in the frame of European research projects (e.g. the Netherlands), or by means of large funding projects with central national coordination (e.g. Poland).

Tendencies towards standardization of CRAs are beginning to emerge. None of the countries explicitly mentions the use of CRAs as a baseline. However, approaches towards standardizing CRAs in order to guide their repeated implementation and foster comparability are beginning to emerge. Two countries (Germany and the Netherlands) explicitly mention applying the ISO 14091 standard for their national CRAs. Germany has developed a common, yet flexible framework based on the methodology of impact chains that facilitates comparison of changes in risk and preparedness. Moving towards standardization creates the opportunity to compare changes in risk, vulnerability and preparedness levels over time by replicating CRAs in a comparable, coherent and transparent way. Experience with the application of such frameworks is still limited, but it is a development that may deserve more attention in the future.

Novel approaches to closer coupling of national CRAs with MRE systems support a move towards CRA as a continuous process in specific countries. In many countries, CRA and MRE systems appear to be rather separate and parallel processes, often with different bodies and actors involved. Although both processes are expected to inform and support adaptation policy-making, systematic linkages are often underdeveloped, and their potential to reciprocally support each other remains underexploited so far. Information reported by Sweden and Finland sheds light on innovative approaches in that regard and aids the conclusion that both countries are in the process of developing or already applying methods and procedures that support more systematic alignment of CRA and MRE. Sweden has established an online reporting mechanism for the obligatory climate risk assessments by national sector authorities and regional administrations, which includes standardized reporting format and questions to increase coherence in the system. Based on the reports received, the Swedish Meteorological and Hydrological Institute (SMHI) regularly takes stock of changes and reports on progress annually. Finland reports to work on a model for risk and vulnerability assessments that allows for a process of continuously updating the knowledge base. In effect, these approaches support a move from repeating full-blown CRAs at fixed time intervals towards continuous assessment, which may have potential to be more resource-efficient and to support policy learning more effectively.

Lack of data, knowledge and information is among the most frequently reported barriers to progress in adaptation, including CRAs. Often, though not exclusively, the reported gaps in knowledge relate explicitly to CRAs (Greece and Slovenia) or other issues relevant to CRAs (Italy, Slovakia, Spain and Sweden). These gaps include limited capacity for systemic risk assessments (Estonia), challenges in tackling knowledge gaps addressed by actions in the NAS (Cyprus), gaps in climate research (Hungary), inadequate identification of climate risks and translation of climate risk information into actionable solutions (Finland). Austria and Bulgaria explicitly mention the challenge of coping with uncertainties. In many cases, barriers hampering progress in CRAs would appear to be a secondary consequence of primary limitations in financial and human resources, which are identified as barriers to adaptation by almost all countries. For example, Latvia states explicitly that CRAs are a resource-intensive process, which allows updating only in longer cycles.

2.3.3 Foreseen reviews and updates of climate risk assessments

Roughly two thirds of the countries are either already engaged in ongoing work towards revising and updating their CRAs, or report about respective plans in the near future. These countries include Austria, Belgium, the Czechia, Cyprus, Denmark, Estonia, Finland, Germany, Greece, Hungary, Iceland, Ireland, Latvia, Lithuania, the Netherlands, Portugal, Romania, Spain and Switzerland.

- Eleven countries (Austria, Finland, Germany, Greece, Iceland Ireland, Latvia, the Netherlands, Portugal, Spain and Switzerland) are currently working on **comprehensive, multi- or cross-sectoral national CRAs** or have scheduled such in the near- to mid-term future. Often, ongoing or planned updates of national CRAs are coupled to established revision cycles of national adaptation policies (NAS/NAP) (e.g. Austria, the Netherlands and Switzerland), and in several countries they are even stipulated by national regulations requiring revisions of CRAs at fixed intervals (e.g. Finland, Germany, Ireland and Spain). Among the countries with CRA work already in progress, Austria will complete the update of its literature-based meta-analysis of climate vulnerabilities, impacts and risks as part of the second NAS/NAP revision within 2023; Iceland's Scientific Committee will release a scientific assessment report on climate change and climate impacts in 2023; the ongoing Portuguese project on the 'National Roadmap for Adaptation 2100', including storylines of the evolution of climate vulnerabilities and impacts, economic costs of inaction, and investment needs for adaptation, is planned until end of 2023; Greece has scheduled its update of the national CRA under the LIFE-IP AdaptInGR project for end of 2024; and the 2nd Dutch CRA shall be completed by the end of 2025. Cyprus states that update of the national CRA is expected through scientific work done by the 'Cyprus Initiative on Climate Change'. Although not yet started, further national CRAs are on the agenda in the following countries: Ireland has committed to developing a stand-alone climate risk assessment by 2025, Switzerland plans to re-evaluate its national climate risk analysis in 2024; and Latvia foresees a new CRA until 2026. Updating of national CRAs in Finland, Germany and Spain follows statutory revision cycles, e.g., five years in Spain and six years in Germany. As required under the new Climate Law in Spain, the first report on the evolution of climate change, impacts and risks is scheduled in 2025 and shall inform preparation of the second work program under the NAP.
- Several countries report ongoing or planned work on **new high-resolution climate projections** (Belgium, Estonia, Ireland and the Netherlands). In some of these countries, development of new climate scenarios is strategically, i.e., time-wise, aligned with renewals of national CRAs and adaptation policy revision cycles (the Netherlands, Ireland and Germany) and aims at providing homogeneous sets of projections for the entire country (e.g. Ireland). In other cases, updating of climate projects appears to be triggered by the latest IPCC AR6 (IPCC, 2022) (e.g. Estonia).
- Several countries (Czechia, Denmark, Romania and Spain) have initiated new **thematic or sectoral climate risk assessments** at national scale. In Czechia, the ongoing PERUN project (2020-2026/2027) researches climatic extremes, has a focus on drought risk and aims at creating a research center for climate change research in the long term. In Denmark, projects have recently been initiated to i) better map watercourse flooding, ii) assess direct and indirect costs and damage of climate change, and iii) better differentiate between climate related and climate change related effects and risks. Moreover, an update of the previous national CRA on coastal risks is planned within a few years. Spain intends to conduct a systematic analysis of public investments in adaptation and of the economic impacts of climate change through a project funded by the EU's Technical Support Instrument. Spain also reports that several sectoral assessments of impacts, vulnerability, risks and adaptation are being developed or updated, in line with the work program under the NAP 2021-2030. In the frame of policies on disaster risk reduction, Romania reports efforts to improve its national risk assessment methodology to allow better consideration of multiple hazards, multiple risk, urban risk, disaster losses, and cross-sectoral issues, including in the context of climate change.

- As regards **CRA at sub-national assessment scales**, Lithuania is working on a country-wide vulnerability analysis of municipalities.
- Advancement of **web-based CRA knowledge provision** is explicitly mentioned by Hungary, which aims at further extension of the NAGiS in terms of both thematic and territorial information modules.
- Several countries report recent and ongoing efforts for **advancing methodologies of future CRAs** (Denmark, Hungary, Finland, Spain, Portugal, the Netherlands and Romania).

2.4 Good practices

Providing good practice examples ⁽⁹⁾ of how the national government can support CRA efforts at sub-national levels, Germany reported the Expert Dialogue Climate Impacts, which is an informal forum bringing together the Federal Environment Agency, the national met service and the environment agencies of the state governments. The states are also benefiting from achievements at national level by using methodologies developed by the federal level as a frame of reference (guidelines for climate impact and vulnerability assessments and monitoring and evaluation guidelines). Several countries reported good practices that relate to the assessment of climate vulnerabilities, impacts, and risks ⁽¹⁰⁾ and demonstrate good potential to support planning and implementation of practical adaptation measures. In Italy, three transnational (LIFE, and bilateral Interreg Italy-Croatia) and regional (Veneto) projects have developed pilot solutions for urban heat island forecasting and health warning systems, transboundary and transferable assessment methods for coastal climate risks, and a high-resolution forecasting model for coastal risks of the northern Adriatic coastline. A Lithuanian project on municipal adaptation to climate change currently produces climate projections and local vulnerability assessments. Poland and Greece both report national knowledge support measures for sub-national key actors in adaptation: Poland has provided guidance for cities on calculating climate and adaptation indicators, and in Greece the responsible Ministry provides open access to climate projections, data and maps produced by the LIFE-IP AdaptInGR project.

3 Adaptation policies and priorities

3.1 Landscape of adaptation policies

The adaptation policy landscape is gradually evolving (Figure 5). By 2023, all EEA member countries reported adaptation policies in place, with more and more countries having concluded the entire policy cycle one or more times.

Compared to the previous reporting cycle, a considerable number of countries formally updated their existing NAS, NAP or related adaptation policies. These countries are: Czechia (updates of NAS and NAP adopted in 2021), Estonia (NAS's Action Plan 2021-2025 approved in 2021), Finland (new NAP 2030 adopted in 2022), Ireland (Climate Action Plan approved in 2022), Lithuania (targets and objectives updated in National Climate Change Management), Romania (Action Plan implementing the National Strategy for Sustainable Development), Slovakia (new Action plan for the implementation of the Slovak Republic Climate Change Adaptation Strategy adopted in 2021) and Spain (new Work Programme 2021-2025 that implement the NAS).

⁽⁹⁾ For each of the reported good practices, countries select one or multiple areas the good practice relates to. In 2023, 50 good practices reported by 12 countries in total relate to 116 areas as defined in [footnote 19 of the implementing regulation](#) (EU, 2020).

⁽¹⁰⁾ No topic was selected more often for the good practices at national level in 2023 than 'assessment of climate impacts, vulnerability and risks to climate change, including adaptive capacity'. From one fifth of the measures related to this topic in 2021, it is now an aspect of almost 40% of the reported good practices. Elements related to climate modelling activities and methodologies are only reported as being related to some good practices, both in 2021 and in 2023.

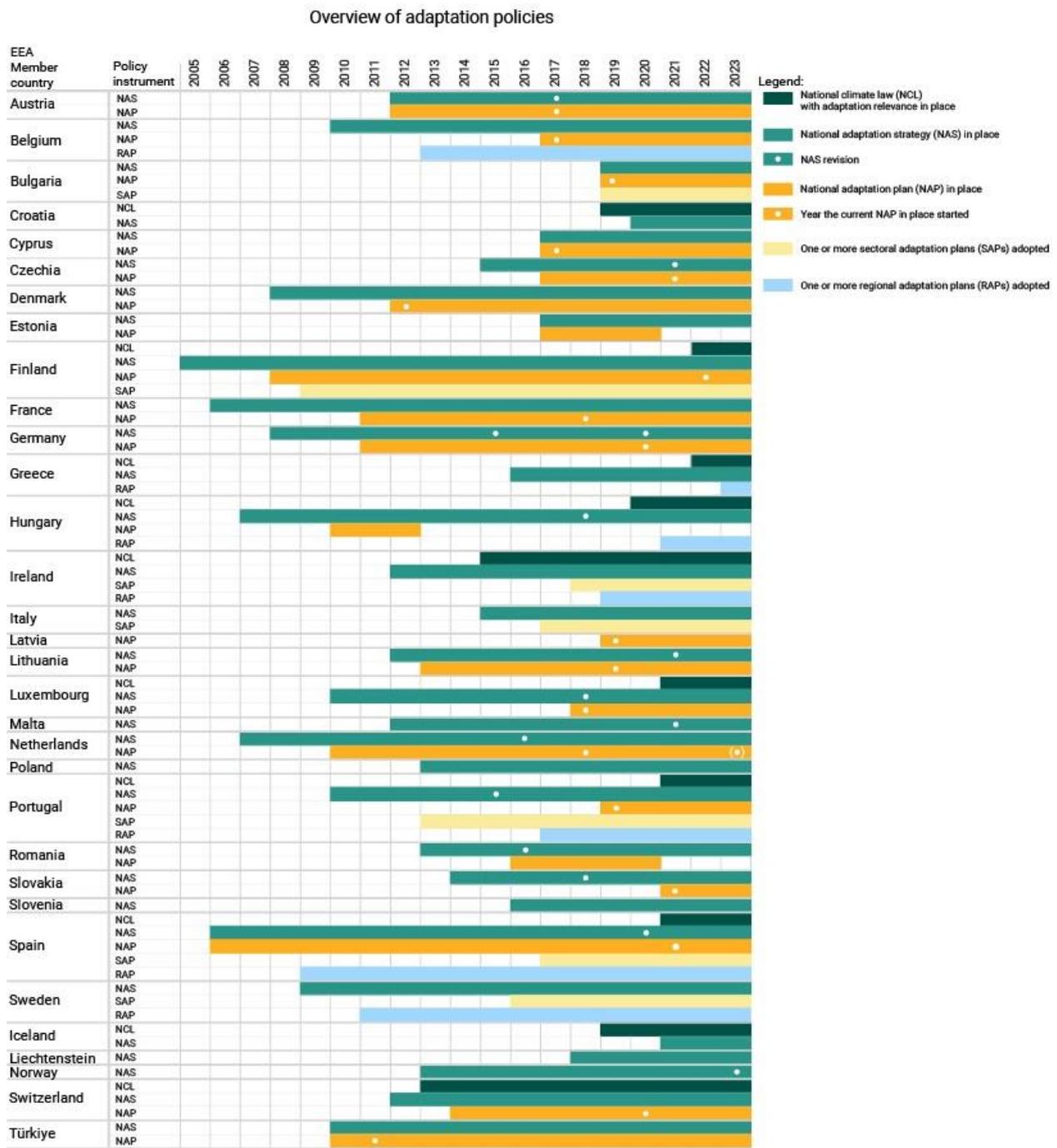
Another group of country is in the process of updating/approving their new NAS or NAP or otherwise re-adjusting the respective policy setting: Austria (2023), Belgium (2023), Denmark, Estonia (NAS will be included in the new Environmental Development Plan to be adopted in 2023), Germany (2nd NAS planned for 2024 as part of the forthcoming Climate Adaptation Act), Hungary (new NAP under adoption, revised NAS scheduled for 2024), Ireland (NAS), Italy, Lithuania (NAP announced for 2024), the Netherlands (new NAP in 2023, new NAS scheduled for 2026), Poland (update of NAS started in 2021), Portugal (validity of NAS extended until end of 2025 by newly approved NECP 2030), Romania (revision of NAS and NAP ongoing) and Sweden (NAS scheduled for 2023). Luxemburg for example will update the NAS and plans to have new fields of action such as governance, international context and awareness raising.

National policies are also following the evolution of European policies. In the information reported in 2023, reference is made to the Multiannual Financial Framework 2021-2027 (European Council, 2020) (Poland, Portugal and Slovenia), as well as the latest updates to the policies that make up the European Green Deal (EC, 2019) and the Next Generation EU (EC, 2020) (Bulgaria, Latvia and Lithuania).

European legislation sets an example that Member States follow when it comes to climate acts. Following the approval of the European Climate Law (EU, 2021) as part of the Green Deal package, more and more countries are proceeding to adopt laws with binding legal targets than the Adaptation Strategies and Plans. Compared to the previous reporting cycle some countries (e.g. Finland, Greece, Ireland, Luxembourg, Portugal and Spain) approved or amended climate acts. Slovakia and Slovenia reported that they are working on the development of national climate laws. Going beyond climate laws that include adaptation, Germany is going to develop a dedicated Climate Adaptation Act until 2024 as part of the climate action programme. This is the legislative instrument that has been identified to respond to the adaptation commitment of current Government's Coalition Agreement.

Legislation at the national level is also evolving in ways other than the traditional national adaptation strategies and plans and climate laws. In some countries, there are additional legislative instruments that complement the adaptation policy framework and that were reported in 2023. Some countries approved additional legislative documents to manage specific hazards: the Netherlands periodically updates the Dutch Delta Programme, and the respective three Delta Plans (flood risk management, freshwater supply, and spatial adaptation); Poland has developed a plan for 'Counteracting the Effects of Drought' in 2021 and incorporated climate adaptation in the National Urban Policy 2030 as well as in River Basin Management Plans and River Basin Risk Management Plans; and Denmark delivered the final guidelines for hazard prevention and risk mitigation measures in urban planning in 2022, following an amendment of the Danish Planning Act.

Figure 5: Overview of adaptation policies



Notes :
 Estonia: NAP 2021-2025 is finished but will not be adopted as a separate policy document due to changes in the national strategic planning. The NAP will be integrated into ministries and other governmental authorities' work plans.
 Ireland: a climate action plan (CAP) is made every year. While the CAPs contain adaptation actions that can feed into the Sectoral Adaptation Plans (SAPs) made under the current National Adaptation Framework, these CAPs are not NAPs.
 The Netherlands: the Delta Programme 2023 is reported as 'other policy' relevant for adaptation.

References:
 EU, 2013, Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC (OJ L 165, 18.6.2013, p. 13-40).
 EU, 2018, Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action (OJ L 328, 21.12.2018, p. 1-77).
 EC, 2018, Commission Staff Working Document 'Adaptation preparedness scoreboard country fiches accompanying the document Report from the Commission to the European Parliament and the Council on the implementation of the EU Strategy on adaptation to climate change' (SWD(2018) 460 final).
 EEA, 2020, Monitoring and evaluation of national adaptation policies throughout the policy cycle, EEA Report No 6/2020, European Environment Agency (<https://www.eea.europa.eu/publications/national-adaptation-policies>) accessed 9 June 2021.
 EEA, 2022, Advancing towards climate resilience in Europe: status of reported national adaptation actions in 2021, EEA Report No 11/2022, European Environment Agency (<https://www.eea.europa.eu/publications/advancing-towards-climate-resilience-in-europe>) accessed 10 July 2023.

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

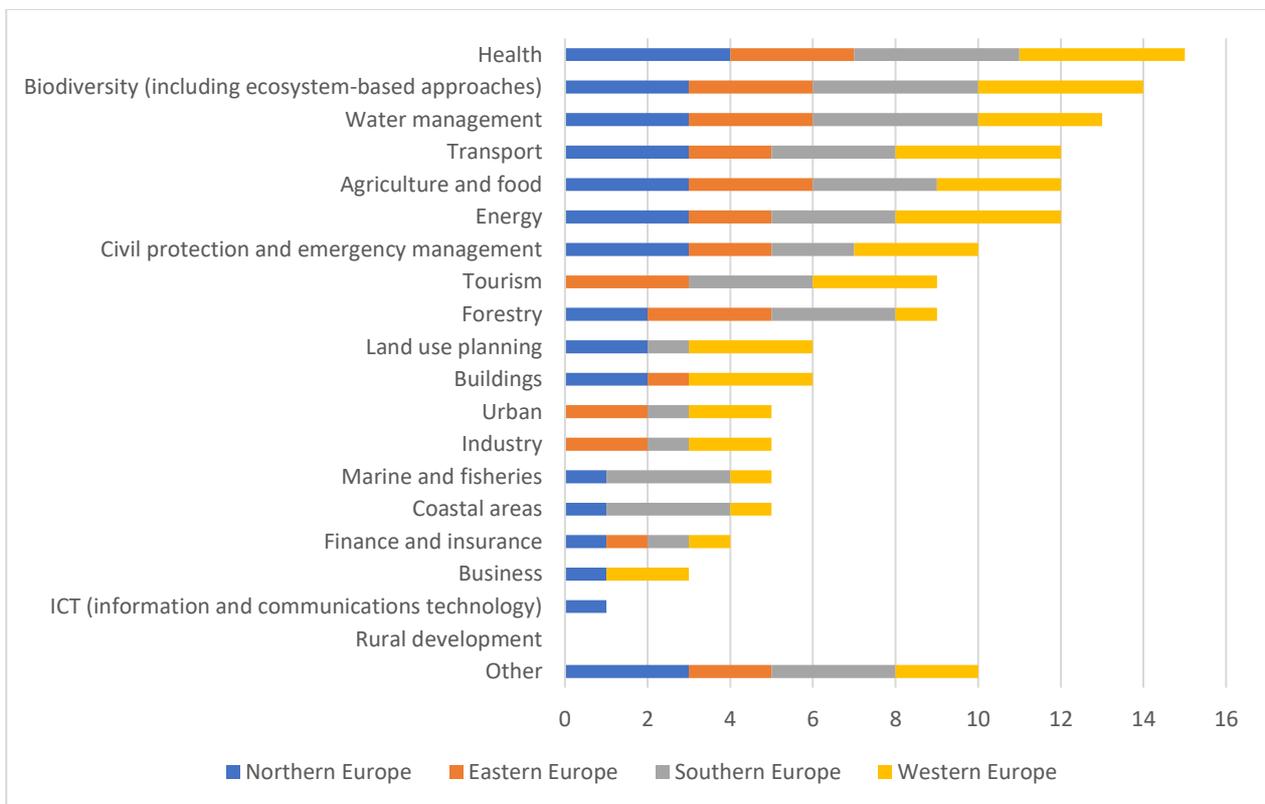
3.2 Adaptation priorities

Compared to the previous reporting cycle, the differences in adaptation priorities have not changed significantly. This is also because adaptation policies normally have long-term horizons, which are not subverted by simply updating action plans. For example, Hungary has updated its adaptation policies without disrupting its priority areas, but instead adding a new area (urban/settlement development) to the previously reported priorities.

In 2023, 15 countries reported their priorities in sectoral terms, the same number as in 2021. The remaining 12 EU Member States and the two EEA member countries (Iceland and Switzerland) reported their priorities in terms of general objectives.

Regarding sector-level priorities, there are only small differences from those reported in the previous reporting cycle. For example, Hungary and Cyprus reported in 2023 more information about policy sectors.

Figure 6. Priority sectors



Note: Based on the reporting from EU 15 Member States. For 12 EU Member States, Switzerland and Iceland, no detailed information on priority sectors was reported as part of the ‘adaptation priorities’ or ‘summary of national strategies’.

Each item reported in the adaptation priorities is replaced by one item from the list of key affected sectors defined in Footnote 4 of the implementing regulation (EU, 2020).

The geographical classification of countries is consistent with the UN geo-scheme for Europe (UN DESA, n.d.), and with the similar nomenclature frequently used in EEA and Commission climate-related assessments. Northern (4 countries) = Denmark, Estonia, Ireland and Lithuania; Eastern (3) = Czechia, Hungary and Romania; Southern (4) = Croatia, Cyprus, Malta and Spain; and Western (4) = Austria, Belgium, Germany and Luxembourg.

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

Figure 6 shows that the energy sector has risen slightly in the priorities of the various countries. This is consistent with the key affected sectors.

In terms of geographic distribution, the trends in 2023 are very similar to those in the previous reporting cycle. The priority areas reported are evenly distributed among the four European geographic areas. The only exception, in line with the 2021 report, is tourism, which is not a priority for any of the northern European countries. Eastern European countries have not reported priorities for the marine sectors, namely 'Marine and Fisheries' and 'Coastal areas.' Two out of three countries with detailed adaptation priority sectors are landlocked.

The priorities of the 15 countries and the key affected sectors reported by them are consistent. However, there are also small differences. For instance, forestry is reported as a key affected sector by 12 of these countries, but only nine include it as a priority. Looking at individual countries, it appears that Luxembourg, Cyprus and Estonia in particular included key affected sectors among the priorities (12, 10 and 7 respectively) although they were not reported as key affected sectors (they respectively reported one, two and three key affected sectors). On the other hand, Lithuania, Ireland and Romania reported respectively 16, 13 and 9 key affected sectors, several not mentioned as priority sectors in the adaptation priorities.

4 Adaptation governance

4.1 Institutional arrangements and governance at the national level

The use of national climate laws for putting into place more stringent legal instruments to enforce adaptation policies across sectors and levels has increased, but it is still limited to a minority of countries. The trend towards institutionalizing adaptation policy structures and processes by means of regulatory frameworks, which emerged from the 2021 reporting, continues to gain pace. As the diffusion of national climate laws is progressing, more and more countries are having national legislation in place that defines binding requirements for the planning, implementation and governance of adaptation. Various countries have national legislative instruments (either dedicated climate laws, or other legal requirements) making provisions for adaptation. Depending on the country, the aspects regulated by climate laws comprise legal mandates for the NAS and/or NAP, obligatory climate risk assessments (see Chapter 2), review and revision cycles of policy documents and CRAs, political and coordination responsibilities, allocation of roles in adaptation processes, horizontal and vertical coordination bodies, scientific advisory bodies, and reporting requirements. Establishing clear formal framework conditions by means of governmental authority usually benefits the enfolding of more informal governance modes. In five countries (Finland, Greece, Ireland, Portugal and Spain), national climate laws have been newly introduced or amended since 2021, introducing or re-confirming varying requirements:

- The new Finnish Climate Act (2022) requires revision and adoption of a new NAP at least every 2nd parliamentary term; in between, the up-to-dateness of the NAP and the need for new measures must be assessed. The Act specifies the structure and contents of the NAP.
- The National Climate Law of Greece was enacted in 2022. It retains main components of the former legal framework for climate adaptation: formal endorsement of the NAS, requirement for the thirteen Regional Authorities to develop and implement Regional Adaptation Plans (RAPs), and the National Climate Change Adaptation Committee (NCCAC) and the Scientific Committee for Climate Change (SCCC). The new Climate Law, however, amends the mandates of the NCCAC and SCCC, requires all central government departments to mainstream adaptation across sectoral strategies and plans, establishes a National Adaptation Observatory, introduces annual national reporting requirements, and better defines roles, responsibilities and synergies between governance structures for mitigation and adaptation. The NAS now has a minimum time horizon of ten years and is evaluated every five years by the responsible Ministry. NAS and RAPs are subject to review every five years by the responsible Ministry and the Regional Authorities. For the revision of the NAS, the Ministry of Climate Crisis and Civil Protection (MCCCP) requests the opinion of the NCCAC.

- The amended Climate Act (2021) of Ireland maintains requirements for development and approval of the NAS and for the preparation of sectoral adaptation plans in priority sectors. New provisions include that two or more ministries can jointly prepare a sectoral adaptation plan to promote better cross-sectoral cooperation, and that each Local Authority (LA) must prepare a Climate Action Plan, including both mitigation and adaptation measures and requiring updating every five years.
- Amended in 2021, the Portuguese Climate Law stipulates a substantial number of provisions for adaptation: creation of a climate action portal; development of municipal and regional climate action plans; development of sectoral adaptation plans; additional monitoring and reporting processes (including with regard to the national budget); introduction of climate legislative impact assessment; integration of climate risks in the decision-making of public and private institutions and agents; establishment of the Climate Action Council as an independent advisory body; and review of the NAS every ten years with an update halfway.
- In Spain, the Law on Climate Change and Energy Transition was adopted in 2021. It mandates the NAP (PNACC) and states that it will be developed through Work Programmes, to be implemented over five-year periods. The recent Work Programme 2021-2025 itself provides information on the entities responsible for implementing them and specifies the associated reporting, monitoring and evaluation mechanisms.
- In Latvia, the National Regulation No. 675 'GHG inventory, projections and adaptation to climate change reporting systems', adopted in October 2022, establishes procedures for preparing, monitoring and reporting of national adaptation measures. The responsible Ministry is currently preparing the Climate Law, which shall include a section on adaptation.
- Although of less recent origin, but reported in 2023 for the first time, Iceland amended its Climate Change Act in 2019, taking up legal mandates for development of the NAS and the NAP.

A few additional countries report that they are currently preparing or planning climate laws with provisions for adaptation. In Slovakia, the Ministry of Environment is working on a draft law on climate change and low-carbon transformation. The draft law reflects the EU climate goals, the binding nature of climate plans, the obligation to develop strategies and action plans at the regional and local level, and the ways of developing adaptation strategies, implementation plans and other adaptation documents at the national level. In Slovenia, the process of preparing a climate law that will incorporate adaptation-related provisions has started in 2022; adoption is expected within 2023. In Germany, the Coalition Agreement of the current federal government is committed to developing a legal framework in form of a dedicated stand-alone Climate Adaptation Act until 2024. It will include the 2nd NAS, which shall also address socially just adaptation, the international dimension and obligations for reporting. The law may incorporate provisions for joint Federal/Länder financing for adaptation and mitigation measures.

The share of countries with national legal requirements for adaptation planning at sub-national levels continues to increase, but top-down regulatory frameworks for multilevel steering remain a minority model. Legal obligations for regional and/or local governments to set up adaptation plans can be an important driver of vertical policy implementation. Compared to 2021, more countries explicitly report that they have top-down coercive frameworks in place that require sub-national authorities to develop adaptation measures and, in several cases, to report about their implementation. Based on reported information, the fraction of countries with statutory requirements for sub-national adaptation planning has grown to at least nine countries (Croatia, Denmark, Finland, France, Greece, Ireland, Latvia, Portugal and Sweden). These obligations can derive from national climate laws (Croatia, Finland, Greece, Ireland and Portugal) or from other laws with significance for adaptation (Denmark, France, Latvia and Sweden). While in Greece and Ireland obligations for sub-national entities did exist before 2021, in both countries respective provisions have been strengthened by new climate laws. In Finland, obligations to produce climate plans at the municipal, sub-regional and regional level will be considered in a separate government proposal amending the Climate Act.

Portugal provides a recent example of rather comprehensive provisions for sub-national adaptation by means of the National Climate Law. Since its recent amendment in 2021, it stipulates the development of municipal and regional climate action plans in a two-year timeframe. The mandatory climate action plans cover both mitigation and adaptation and are required by municipalities, all inter-municipal communities (NUTS3 level) and all regional development and coordination commissions (approximate to NUTS2 level). The plans shall promote proper vertical integration and establish municipal adaptation action programs, to be implemented until 2030.

France and Sweden provide earlier examples of legal requirements for sub-national adaptation planning and/or monitoring and reporting that derive from instruments other than national climate laws. In France, since 2015 the law on the New Territorial Organisation of the Republic requires the regional plan for development, sustainable development and territorial equality (SRADDET) to include a section on adaptation to climate change. Mandatory for all inter-municipal bodies with more than 20,000 inhabitants, the territorial climate-air-energy plan (PCAET) includes a vulnerability assessment, a strategy with quantified objectives, a programme of actions, and a monitoring and evaluation system. In Sweden, the 32 sectoral agencies and all 21 county administrative boards are subject to the Adaptation Ordinance, which includes requirements to draw up adaptation action plans and to monitor the municipalities' adaptation work. This framework has recently been advanced to a continuous monitoring and reporting system that requires these authorities to report to the central coordinating institution SMHI. In addition, the Planning and Building Act provides legislative guidance and demands for municipalities.

Some countries without direct legal obligations for sub-national authorities reported information that illustrates that regional or local adaptation can be influenced by instruments at the national level also in an indirect way, e.g., by mainstreaming adaptation in formal planning procedures. For example, in Slovenia Strategic Environmental Assessment (SEA) of municipal spatial plans evaluates consideration of climate change impacts. In addition, new spatial planning legislation requires regional spatial plans to include climate change impact assessments.

Despite the growing number of countries that are embedding vital elements of their adaptation policy systems in binding legal frameworks, soft and collaboration-based forms of vertical and horizontal governance still predominate. In the majority of countries, adaptation continues to be a largely non-binding policy field, i.e., policy-making and planning is mostly a voluntary task of sectoral and sub-national authorities, and coordination across levels and sectors works in non-hierarchical and rather informal ways. In any case, this does not allow any statement on implementation progress or effectiveness of adaptation policies or measures. Informal governance does not preclude adaptation policies from being effective, especially if a supportive governance framework with stakeholder participation and engagement, active actor alliances, funding and incentives, policy inputs from the national level, knowledge provision and capacity-building is in place.

Government units responsible for adaptation policy-making undergo organizational changes, but allocating policy ownership in environment-related Ministries remains a stable model. In several countries, the name and organizational structure of the central government bodies mandated with political and coordination responsibilities for national adaptation policy-making has changed, often following governmental reorganization after elections. Since 2021, more countries have installed explicitly named 'climate ministries', which may signal a gain in political relevance and commitment, and which are usually in charge of both adaptation and mitigation policies. Examples include the Ministry for Climate Crisis and Civil Protection in Greece, the Ministry of Climate and Energy in Latvia, and the Ministry of Environment, Climate and Energy in Slovenia. Central government entities with responsibility for adaptation at national level are missing only in countries with a strong federal and de-centralized state system, e.g., in Belgium most responsibilities for adaptation are allocated at the level of regional authorities.

National coordination bodies and mechanisms for horizontal policy integration and multilevel coordination are in place in almost all of the countries, displaying a large, growing and partly dynamic diversity of institutional arrangements and governance mechanisms across, and partly within Member States. High-level inter-ministerial or inter-sectoral coordination bodies concerned with developing, steering,

monitoring and reviewing national adaptation policies are established in most countries, which is consistent with the 2021 reporting. Their mandate is often anchored in national climate laws or other regulations. New examples include the Inter-Ministerial Committee on Climate Change in Romania and the Climate Action Commission (CAC) in Portugal. Coordination work at technical and operational level is often tasked to dedicated adaptation working groups, which can be permanent bodies (e.g. Belgium, Croatia, France, Germany, Greece, Ireland, Slovenia and Spain) or temporary, task force-like groups, e.g., for development or revision of the NAS/NAP (e.g. Estonia) or for steering national adaptation web portals (e.g. Denmark). In some countries, NAS/NAP development and implementation is steered by several thematic working groups (e.g. Czechia and Portugal). Task forces can also be installed for specific sector-related coordination tasks, e.g., the newly formed Task Force between Danish Coastal Authority and Danish EPA. Scientific advisory bodies, which have started to emerge in the 2021 reporting, have diffused to additional countries. In some countries, the adaptation governance system has developed a considerable degree of internal differentiation, with several high-level bodies coexisting and sharing responsibilities. For example, the recently amended Portuguese Climate Law foresees establishment of the Climate Action Council (as independent advisory body), the Climate Action Commission (as political coordination body), and the NAS Coordination Group (as more technical coordination unit). Similarly, while in Spain the Spanish Climate Change Office remains the central coordination body of the NAP, several other national coordination and participation bodies are tasked with adaptation issues, e.g., the National Climate Council, the Coordination Commission of Climate Change Policies, the Sectoral Conference on the Environment, and the Working Group on Impacts and Adaptation.

However, a few countries also state that no coordination across national authorities exists (Bulgaria), or that it will be established only in the near future (Poland). Some countries (e.g. Latvia and Lithuania) appear to have rather de-centralized governance models, where responsibilities for coordinating and implementing measures are allocated to Ministries and other institutions addressed as implementing actors in the NAP.

4.2 Barriers, gaps and challenges related to national governance

Insufficient governance, lacking coordination capacities, in terms of institutional, financial, technical and human capacities, and complex coordination mechanisms are a barrier to coherent and effective implementation of adaptation in many countries, even in some of those with seemingly mature governance frameworks in place. Almost all countries reported substantial and altogether manifold barriers, gaps and challenges directly related to the governance of adaptation. In fact, shortcomings in organizing and implementing coordination and collaboration across sectors, levels and actors are among the most often identified issues and appear to hamper considerably implementation progress. Interestingly, this includes many of the countries that have established – often seemingly well-developed – coordination mechanisms, institutional arrangements and legal regimes for adaptation (e.g. Finland, Germany, Greece, Portugal and Sweden). This demonstrates that existence of coordination bodies, cooperation structures, and regulatory frameworks is a necessary, but in itself insufficient, precondition for coherent implementation of adaptation policies and does not automatically translate into effective adaptation actions. More than half of all countries report gaps in coordination, cooperation and policy coherence, which are often connected to unclear responsibilities, lack of awareness, and low political saliency. They are also obviously a result of the complexity of adaptation as a highly cross-sectoral, cross-level and multi-actor policy field.

Barriers to horizontal policy integration at national level are more often explicitly mentioned (e.g. Czechia, France, Germany, Greece, Malta, the Netherlands, Poland, Slovakia, Spain and Sweden) than gaps in vertical coordination across levels (e.g. Czechia, Germany and Slovakia). Five countries refer specifically to missing legal requirements for enforcing adaptation (Cyprus) or to (sectoral) gaps in legislation (Belgium, Denmark, Finland and Sweden). Poor coordination is often a direct consequence of limitations in institutional, technical and human capacities, which are reported as a barrier by more than half of all countries. Lack of financial resources is most often mentioned (15 countries); lack of institutional and administrative capacities (seven countries), expertise, skills, and training (10 countries) as well as of

permanent personnel (seven countries) contribute to similar extents to insufficient coordination capacities. As Greece mentions, lack of staff can also hamper access to available funding.

4.3 Cooperation on a transnational and international scale

In most countries, international and transnational cooperation on adaptation issues continues to advance with a large number and diversity of forms and modes, confirming that this element of the EU adaptation strategy is well-developed. Countries reported many and varied activities, structures, processes and topics related to transnational cooperation on adaptation issues, allowing them to adequately address transboundary climate risks, manage shared border-crossing resources (e.g. river basins, maritime and coastal environment, and biodiversity) and coordinate national adaptation policies and actions across borders.

Major international conventions and multilateral policy frameworks addressing climate adaptation (e.g. Paris Agreement, UN Sendai Framework for Disaster Risk Reduction 2015-2030, and the UN 2030 Agenda for Sustainable Development) continue to play a crucial role in all countries, facilitating to strengthen the links between adaptation, sustainable development and disaster risk reduction. Coordination mechanisms and institutional structures for implementing the obligations of those international policy frameworks are increasing (e.g. Croatia).

EU funding schemes for transnational cooperation (e.g. EU Interreg Programmes) and research (e.g. Horizon Europe, ERA-NET and ERA-NET+) continue to be strong enablers of transnational adaptation efforts for most Member States (e.g. Austria, Croatia, Czechia, Denmark, Germany, Italy, Ireland, Slovakia, Slovenia and Spain), supporting national adaptation policy processes and leading to the implementation of cross-border adaptation measures. In Croatia, for example, 18 projects have been funded under the Interreg Program Italy-Croatia, altogether involving all counties, many municipalities and islands and stakeholders from the Adriatic area, together with the Italian counterparts. Furthermore, several Member States reported the involvement of regional and local governments in the EU Mission on Adaptation to Climate Change (e.g. Austria, Belgium, Czech Republic, Denmark, Finland, Greece, Ireland, Italy, Lithuania, Poland, Romania and Sweden), confirming continuity with the commitment to contribute to put the EU's adaptation strategy into practice.

4.4 Institutional arrangements and governance at the sub-national level

Sub-national approaches to climate adaptation continue to represent key factors to further progress with local adaptation and to reach the national adaptation goals, and they are crucial components for scaling up local climate actions and for the vertical coordination of adaptation policies across all administrative levels (national-regional-local). Soft, collaboration-based forms of vertical steering and a supportive governance framework for sub-national levels are still more common than top-down regulatory frameworks and obligations for adaptation policymaking at the sub-national level.

4.4.1 Top-down regulatory approaches

In most of those countries with established top-down regulatory approaches, the numbers of adaptation strategies and plans developed at regional and local levels continue to increase and advance. In Poland, 40% of local authorities with more than 20,000 inhabitants have officially adopted the adaptation plan, and some of those local authorities already reported to the Ministry of Climate and Environment on the implementation of urban adaptation plans. In Denmark, despite there being no national obligation to update the local adaptation plans, most of the municipalities have reviewed and updated their plans, either in connection with the municipal plans every four year, or as part of the voluntary Danish city network (DK2020-network). Where sub-national governments are lagging on mandatory adaptation policy-making, national coordination bodies offer further support to develop and implement adaptation strategies and action plans. For example, in Croatia, the Fund for Environmental Protection and Energy Efficiency in cooperation with the Ministry responsible for climate policy announced two public calls for co-financing the development and implementation of sub-national adaptation strategies and action plans.

4.4.2 Voluntary and bottom-up approaches

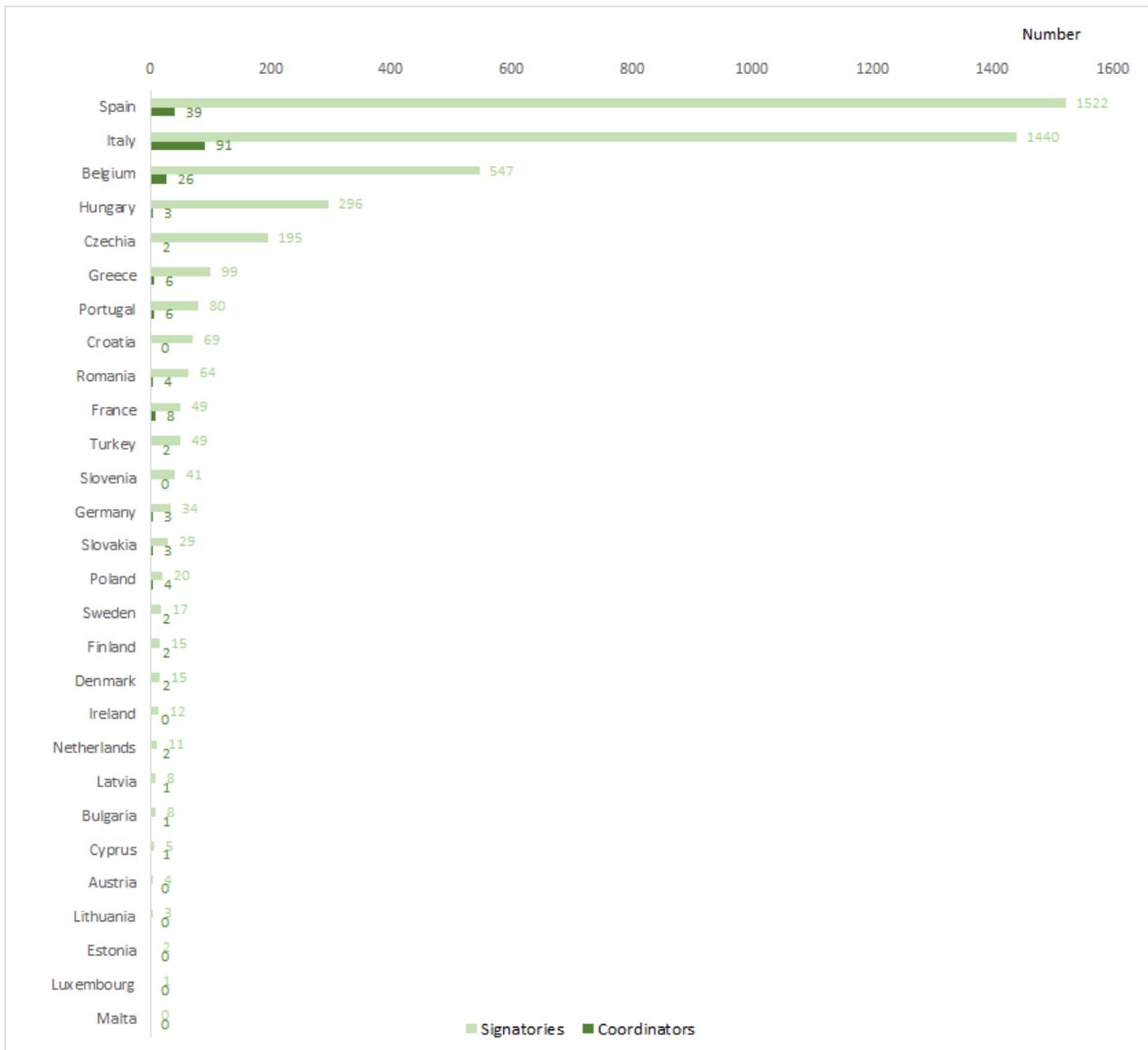
Besides the top-down regulatory frameworks, all countries are further progressing with adaptation policymaking at sub-national levels benefitting from voluntary and bottom-up initiatives. In most countries, collaboration-based forms of vertical steering and a supportive governance framework for sub-national levels comprise policy inputs, capacity building (knowledge generation and provision, advisory services and training), cross-level dialogue, support for participation in city networks, as well as funding and financing. For example, in Estonia most local governments developed integrated local energy and climate plans using national guidelines and benefitting by a multi-level cooperation between the Ministry of Environment and the Association of Estonian Cities and Municipalities. In Italy, several regional governments and municipalities approved their own adaptation strategies and plans and are implementing the related measures; the National Platform on Adaptation to Climate Change was recently published as an e-platform to inform and support public authorities in decision-making processes and a dedicated funding line for the implementation of adaptation measures in biggest cities was established. In Luxembourg, all 102 communes are involved in climate mitigation and adaptation policy through a Climate Pact between the State and the municipalities, where the national level provides financial support communes to implement mitigation, energy efficiency and adaptation measures.

An increasing number of cities and municipalities are developing their local adaptation strategies and plans as signatories of the Covenant of Mayors (CoM) initiative (e.g. Czechia, Finland, Greece, Hungary, Italy, Latvia, Poland, Romania, Slovakia, Slovenia and Spain). Covenant territorial coordinators (e.g. regional governments) and covenant supporters (e.g. regional development agencies) continue offering crucial support to local authorities through capacity building, technical assistance, networking activities and involvement in European projects for the implementation of adaptation measures at the local level (Figure 7, Map 1). In Finland, the forerunner Helsinki was followed by all cities of the metropolitan area, which developed their sustainable energy and climate action plans (SECAPS) with adaptation strategies and action plans under the Covenant of Mayors framework, and the national Sustainable Urban Living programme approved in 2021 includes new regional adaptation measures to be implemented in broader collaboration with sub-national governments and relevant stakeholders. In Greece, the Region of Attica, Covenant territorial coordinator, established the CLIMATTICCA network, aiming to support regions and local authorities to tackle adaptation issues. In Romania, the national Municipalities Association supports and assists Covenant municipalities to develop their strategies and action plans.

The data show that for each CoM signatory, on average 5.8 adaptation actions are planned in their strategies and actions plans. Of these, 1.3 are completed actions, 3.4 are ongoing actions and 1.1 are not yet started (Figure 8).

Furthermore, several countries reported the involvement of regional and local governments in the EU Mission on Adaptation to Climate Change (e.g. Austria, Belgium, Czechia, Denmark, Finland, Greece, Ireland, Italy, Lithuania, Poland, Romania and Sweden), confirming the crucial involvement of sub-national governments to accelerate the implementation of their adaptation strategies and plans.

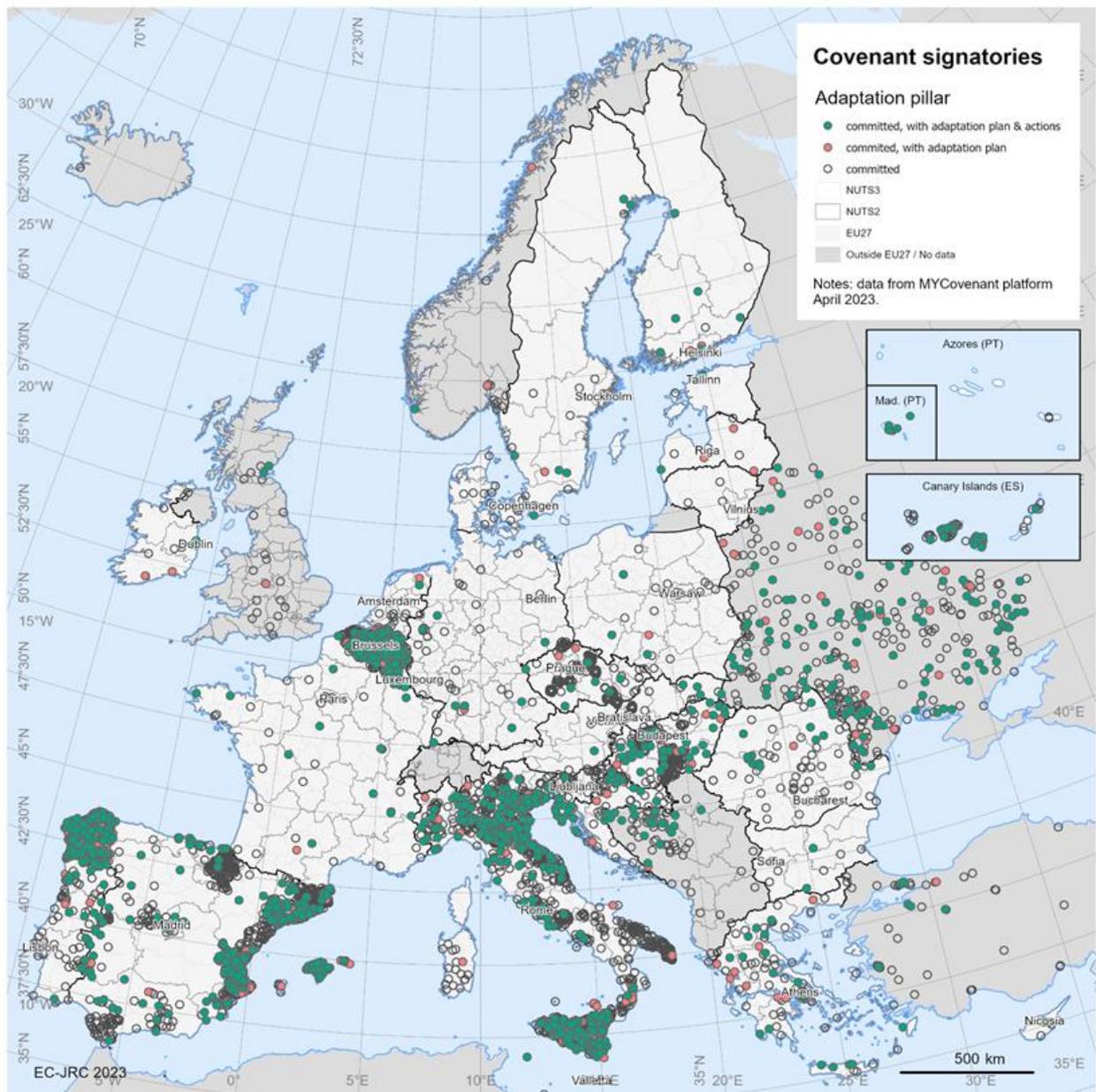
Figure 7: Number of Covenant of Mayors Europe signatories and coordinators with an adaptation commitment



Note: Based on data submitted in MyCovenant (updated April 2023).

Source: GCoM - MyCovenant, 4th Release - April 2023. European Commission, Joint Research Centre (JRC) [dataset] (Baldi et al., 2023).

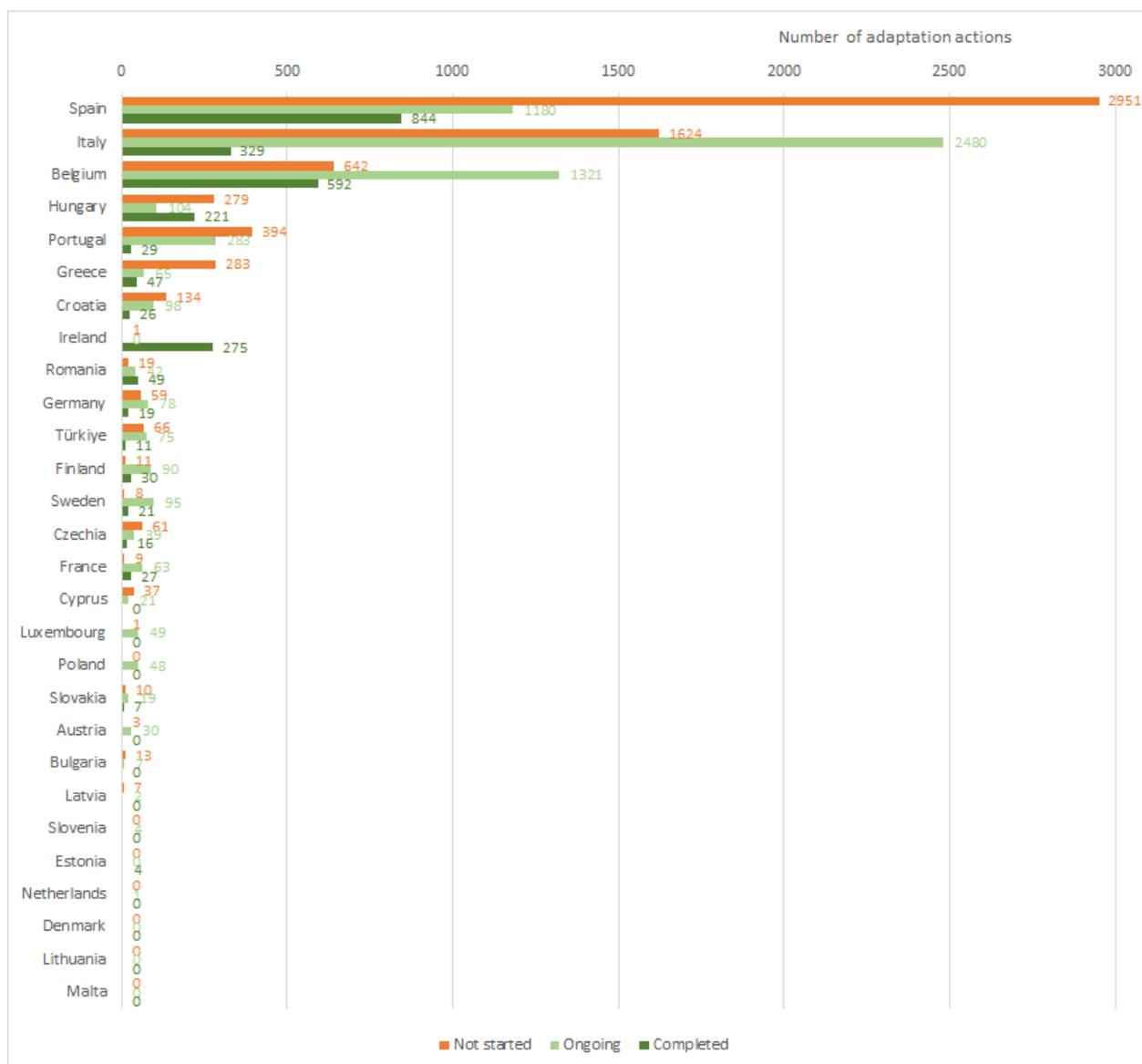
Map 1: Covenant of Mayors Europe signatories and coordinators with an adaptation commitment



Note: Based on data submitted in MyCovenant (updated April 2023).

Source: GCoM - MyCovenant, 4th Release - April 2023. European Commission, Joint Research Centre (JRC) [dataset] (Baldi et al., 2023).

Figure 8: Number of adaptation actions identified by Covenant of Mayors Europe signatories per country



Note: Based on data submitted in MyCovenant (updated April 2023).

There are no actions submitted for Denmark, Lithuania or Malta.

Source: GCoM - MyCovenant, 4th Release - April 2023. European Commission, Joint Research Centre (JRC) [dataset] (Baldi et al., 2023).

4.5 National level measures to include and address stakeholders

The 2023 reporting on measures in adaptation policy to engage with vulnerable groups and the private sector very closely reflects and complements the information submitted by countries in 2021. New examples provided by countries in 2023 fit within the context previously established in the first reporting cycle (EEA, 2022). Only countries providing examples of measures, additional to those already included in the 2021 assessment report, are explicitly noted here.

Vulnerable populations are increasingly included in participatory processes of stakeholder engagement during the development of national adaptation policy (e.g. Ireland) and considered in the prioritization of adaptation actions (e.g. Finland). Research on social equality and fairness is also used to inform policy (e.g. the Netherlands and Spain). Adaptation initiatives, research projects to better understand conditions and needs, and provision of adaptation information specifically target vulnerable groups.

The private sector also participates in the development (e.g. Luxembourg) and implementation of national adaptation policy in several countries, with more limited involvement in monitoring and evaluation. In some cases, the private sector is responsible for the selection and prioritisation of adaptation measures (e.g. Slovakia) and implementation of plans and measures. Cooperation with the private sector is occasionally outlined in national adaptation policy (e.g. Finland), specifically in terms of risk-sharing within the market (e.g. Czechia), or through the establishment of formalised public-private partnerships for the preparation and implementation of adaptation measures at regional and local levels (e.g. Slovakia).

There is increased evidence of information to support private sector adaptation, including online platforms and resources (e.g. Belgium and Denmark), as well as climate-related information days, seminars and conferences aimed at private companies (e.g. Estonia). Research projects raise awareness on the need for businesses to adapt to the risks and seize the opportunities of climate change (e.g. Finland and Ireland), and the development of a sector specific risk assessment tool assists local stakeholders in making strategic decisions on risk and vulnerability (e.g. Portugal). Urban adaptation guidelines also indicate the importance of involving entrepreneurs (e.g. Poland). Private sector stakeholders are offered opportunities for funding and support to develop innovative adaptation projects from national funds aimed at climate change adaptation (e.g. Finland and Poland).

4.6 Sub-national trends in stakeholder engagement

Similar to the national level, many new good practice examples to engage with vulnerable groups and the private sector at the sub-national level were reported in 2023 that support the main messages derived from the 2021 reporting on stakeholder engagement (EEA, 2022). This section presents only new examples of measures reported by countries, additional to those already included in the previous assessment report.

There are sub-national adaptation initiatives to engage with and address vulnerable stakeholders (e.g. Italy), projects focused on better understanding the conditions and needs of vulnerable groups to inform adaptation planning (e.g. Belgium and Poland), and efforts to provide adaptation relevant information to vulnerable groups. At the regional level, vulnerable populations are sometimes involved in the development of climate policy or addressed by adaptation strategies. Municipalities also regularly engage with stakeholders particularly vulnerable to climate change impacts.

Collaboration between the public and private sectors is an important aspect of adaptation at the sub-national level. The role of the private sector ranges from participating in setting strategic objectives (e.g. Emilia Romagna, Italy) and designing and monitoring climate change policies (e.g. Spain), to consulting on adaptation strategies (e.g. Belgium). Local authorities even involve entrepreneurs in the implementation of adaptation measures (e.g. Latvia).

Many sub-national adaptation projects rely on public-private collaboration. This includes cooperation to incorporate climate adaptation in the planning, design and development of the spatial environment (e.g. Flanders, Belgium), as well as workshops and dialogue meetings to contribute ideas and identify needs in projects (e.g. flood management in Denmark). Public and private entities even work together to develop sectoral plans (e.g. water reuse in Portugal).

While businesses provide data (in some cases powered by artificial intelligence) to regional governments (e.g. Helsinki, Finland), regional and local governments also support the private sector in dealing with climate impacts (e.g. Ireland) or provide incentives to them for adapting (e.g. Vilnius, Lithuania). Forums support dialogue between relevant public and private parties cooperating on adaptation at the sub-national level (e.g. Emilia Romagna, Italy).

4.7 Good practices

Several countries have reported good practice examples of institutional arrangements and governance at the national level. The Office of Climate Service and Adaptation in Iceland (part of the Icelandic Met Office) is an example of a central national institution delivering scientific and expert advice as well as support services to the national adaptation policy process. In Austria, an informal, temporary, cross-level working group, composed of adaptation and disaster risk reduction experts from federal government and state

administrations, has worked on cross-cutting measures for self-responsible risk precaution of the NAP, based on a mandate by the Conference of State Environment Ministers. As an example for multi-level governance efforts, the Estonian Ministry responsible for adaptation is promoting agenda setting at local levels by cooperating with the Association of Estonian Cities and Municipalities through various cooperation and exchange formats. In the Netherlands, local and regional authorities as well as the Water Management Ministry are performing stress tests, collaborating in a network and engaging in risk dialogues under the Delta Programme for Spatial Adaptation. The Climate Action Regional Offices (CARO) in Ireland are regional governance structures, knowledge hubs and agents of multi-level coordination that support municipalities in their local adaptation work. Several countries mentioned good practices related to national support for sub-national levels in the form of knowledge provision, i.e., by brokering knowledge, tools and data. These include web-based collections of adaptation measures in the Netherlands, a manual on the use of indicators for adaptation in urban development in Poland, the newly installed Climate Change Adaptation Resource Centre in France, a national adaptation web hub in Greece, and climate adaptation portals at the regional level (Wallonia, Flanders) in Belgium. The Climate Pact in Luxembourg serves a platform for the engagement of national and local authorities, with resources provided to municipalities including a catalogue of local level measures to help tackle biodiversity and climate change issues, and the possibility to achieve a thematic certification for adaptation to climate change, including level of implementation.

5 Implementation and financing

5.1 Adaptation mainstreaming

The number of countries that reported on mainstreaming of climate change into sectors or sectoral policies, plans and programmes directly affected by climate change impacts has further increased. Efforts to include or integrate climate change consideration has further increased in sectors such as green, tourism and insurance (e.g. Denmark, Portugal and Spain), as well as in emergency and crisis management, disaster risk reduction and flood risk management, and river basin management (e.g. Austria, Belgium, Estonia, Finland, Latvia, Malta, Portugal, Romania, Slovakia and Spain). In the area of transport (e.g. road, railway and waterway) and construction, Finland reported new information and Greece reported mainstreaming efforts in marine spatial planning, biodiversity, forest, energy and climate. Finland reported that first and pilot regional drought management plans have been developed. Sectorial Adaptation Plans (SAPs) and National Adaptation Plans (NAPs) are reported as key policy instruments that support effective integration (mainstreaming) of adaptation into existing national and sectoral policies, strategies, plans, programs and processes (e.g. Bulgaria, Ireland, Luxembourg, Portugal, Romania, Spain and Sweden). In a similar way, the Netherlands reported that integrated climate adaptation requirements in sectoral policies are necessary, which keeps the relevant ministries responsible for their policy areas (e.g. health, built environment, agriculture and horticulture, water management and protection of vital and vulnerable infrastructure such as energy, ICT, transport, drinking water, sewage and nuclear facilities). Switzerland reported for the first time and highlighted that one aim of the National Adaptation Strategy (NAS) is to better integrate adaptation to climate change into sectoral policies at all levels. Latvia, for example, reported mainstreaming of climate change and adaptation into the cultural strategy as well as into the architecture strategy.

Mainstreaming climate change into plans contributes to adaptation and examples are reported by France, like in the Territorial Coherence Scheme and the Local Urban Plan, natural risk prevention plans, urban transport plans, regional health and environment plans, strategic seafront document plans or action plans for marine environments on the coast, park charters in certain areas or water development and management (master) plans. Also, administrative strengthening of adaptation via mainstreaming was reported, for example, by Italy, identifying modalities, tools and competent actors (authorities) for the introduction of climate change adaptation principles, measures and actions in the national, regional and local plans and programs. Diverse mainstreaming and integration are reported as well by Luxembourg,

Portugal, Spain and Romania, providing examples of different policies, plans, programmes and strategies that incorporate climate change issues.

When it comes to mainstreaming into environmental assessment procedures, further progress was reported regarding Environmental Impact Assessment (EIA) in terms of the use of online tools, methodologies, checklists and guidance (e.g. Austria, Belgium, Croatia, Finland, Portugal, Slovakia and Spain). Finland for example reported about first learning from guidelines application and suggestions to improve further. Also, Greece reported first experiences with the developed guidance, where now legal obligations will further strengthen the use and application thereof. Opinions to the Strategic Environmental Assessment (SEA) report are reported by Greece and Italy. France and Portugal reported that climate change issues are considered in SEA. Ireland reported that SEA might be recognised as perhaps the most flexible and capable instrument of climate policy integration available internationally and nationally, which can strongly support mainstreaming into plans and programmes. Ireland additionally reported that first experiences were made with the existing SEA guidance and its application.

Finally, Portugal reported that with the adoption of the Portuguese Climate Law, policies and legal proposals need to run through a climate impact assessment. As part of the existing evaluation system/tool in Portugal, also climate impacts will be measured.

The number of countries integrating climate change impacts into their national Disaster Risk Management (DRM) frameworks and sectoral planning (e.g. national civil protection plans, national disaster risk management plans, national risk assessments, drought management plans, flood risk management plans and river basin management plans) has further increased (e.g. Belgium, Denmark, Estonia, Malta, Poland, Portugal, Romania and Slovakia). Countries reported further progress on the integration of climate change adaptation into DRM mainly referring to national and sectoral climate risk assessments (e.g. Estonia, Finland and Latvia). Portugal reported mainstreaming efforts in coastal management, with national CRA to be integrated into local master plans. No relevant efforts to achieve better and more appropriate recovery have been reported. Stronger cooperation with insurance companies, vertical and horizontal governance, more comprehensive land use planning and the adequate distribution of economic and human resources are still needed. Denmark reported a mandatory annual fee for fire insurance companies, and the amount available is managed by a national authority (Danish Natural Hazards Council) to partly cover the costs for damages caused by storm surge, drought, windfalls and floods.

5.2 Increasing adaptive capacity and reducing vulnerability

More countries reported efforts to increase adaptive capacity in 2023. Only seven countries reported that they have not started to assess the increase of adaptive capacity, compared to 10 in 2021. Different activities were reported in 2023 which are seen as important and relevant for countries, such as awareness raising, capacity building, increasing knowledge and support to regional and local level (e.g. Austria, Greece, Ireland and Portugal) or information provision, guidance, decision support, supporting climate proofing of projects, newsletter, web-portals or educational programs (e.g. Austria, Belgium, Finland, Greece, Ireland and Portugal) or standards (e.g. Finland).

Other reported items that foster the increase of adaptive capacity are sectoral programs and plans (e.g. Bulgaria, Greece, Ireland, Latvia and Slovakia). Also, the strengthening of local activities like local or municipal adaptation strategies and plans were reported as supporting the increase of adaptive capacity (e.g. Denmark, Ireland, Poland and Portugal). Ireland reported the close and strong alignment of research efforts with national adaptation priorities.

5.3 Finance

Assessing the cost of adaptation remains a challenge and is often only done partly (e.g. at the federal level, or sector level). Many Member States report challenges related to the immaturity of the monitoring, reporting and evaluation systems for tracking implementation (and especially financing). A common methodology to assess costs and track financing of implementation of adaptation strategies and plans is still not available, yet all Member States report increasing sector costs due to adaptation.

As in the previous reporting cycle, most countries' NASs, NAPs, SAPs and RAPs do not have dedicated budgets or financing streams for implementation. Thus, they are not able to allocate dedicated financial resources for implementing adaptation actions, even though these measures often need to be implemented within the respective budgets of the responsible ministries.

Some Member States report quantitative adaptation finance information, mainly from EU and other (research) funds, but also from public budget annual expenditure. Most Member States reported support gained by EU funding instruments to coordinate adaptation policies (the Multiannual Financial Framework 2021-2027 or the Next Generation EU).

The majority of countries report no dedicated adaptation funds for financing implementation. However, compared to the 2021 reporting, several more countries reported having dedicated national adaptation funds or parts of funds to finance the implementation of national or sectoral adaptation actions (Italy, Germany, Greece, Latvia, Portugal and Spain).

5.4 Good practices

France reported different reports from recent years that contained recommendations of adaptation, e.g., Extreme weather events in a changing climate (2018), Nature-based solutions for adapting to climate change (2019) or Foresight for climate change adaptation (2022). Additionally, a plan for resilient and concerted water management was showcased as a good practice for mainstreaming efforts.

Greece reported on the creation of an online National Adaptation Hub that pools together adaptation relevant data, information, good practices and approaches can also contribute to reaching out to stakeholders, including stakeholders particularly vulnerable to climate change impacts. The National Adaptation Hub has been developed under the LIFE IP AdaptInGR project and was launched in October 2022. Pursuant to Art. 25 of the National Climate Law, the Hub will form of part the National Adaptation Observatory. One of the objectives of the Hub is to raise awareness among different target groups on adaptation, including citizens and promote the sharing of good practice among adaptation stakeholders.

Spain reported on progress in some areas such as social studies on perceptions, attitudes and knowledge on climate change issues confirming that most of the Spanish population believes that climate change is real, is the result of human activity and is dangerous. Thus, also the awareness of the risks arising from climate change is high. Practical knowledge of self-protection against climate change hazards is progressively increasing. The adoption of the Law 7/2021, of 20 May, on Climate Change and Energy Transition, has reinforced and further improved the governance on adaptation. The Spanish PNACC 2021-2030 and the Work Programme 2021-2025 are the new planning and programming instruments to foster public governance of adaptation. Financial instruments and resources for adaptation have also been reinforced (Recovery and Resilience Facility, PIMA Adapta plan and others). A practical example of aggregate effects resulting from adaptive capacity can be found in the evolution of high temperature-induced mortality. Since 2004, the implementation of the National Plan of Preventive Actions on the Effects of Excess Temperatures on Health has improved adaptation to heat. Recent studies indicate that the level of adaptation to high temperatures in Spain over the last 35 years (1983-2018) can be considered adequate for a large part of the territory. However, there are territorial differences that require further ambition in the implementation of adaptation measures (Follos et al., 2021).

5.4.1 Examples of national adaptation funds

Austria: KLAR! Climate Change Adaptation Model Regions

The Program 'Climate Change Adaptation Model Regions for Austria - KLAR!' is funded by the Austrian Climate and Energy Fund and offers a process-oriented approach for clusters of municipalities to raise awareness for climate change adaptation and implement concrete actions on regional level ⁽¹¹⁾.

The concept is based on two phases. In a first step, regions submit a general concept to apply for the KLAR! Program. Regions (clusters of municipalities) nominated for funding develop a regional adaptation concept

⁽¹¹⁾ <https://klar-anpassungsregionen.at/>

for their communities and regions with a minimum of 10 specific adaptation measures within the first year. In the following two years, the KLAR! regions implement these adaptation measures. In the continuation phase, with a duration of three years, further adaptation measures are developed, and existing ones monitored and continued.

In June 2023, 89 Austrian regions were members of KLAR! and in the process of reducing damage caused by climate impacts and taking advantage of opportunities as they arise. The overall budget for KLAR! 2022 was five million euros from the national level; additional funding comes from the regional and community level. KLAR! adaptation measures can also be combined with EU funds such as LEADER.

Germany: Climate Adaptation in Social Institutions

The German funding program ‘Climate Adaptation in Social Institutions’ supports social institutions in preparing themselves against the consequences of climate change such as heat, heavy rain or floods ⁽¹²⁾. It is intended to tackle and implement the necessary climate adaptation processes in the health, care and social sectors. The aim of the program is to provide incentives for the transformation of these sectors by promoting exemplary model projects that inspire others to follow and take action. Projects are to be implemented primarily in regions that are or will be particularly affected by the climate crisis (so-called climate hotspots). The program runs from 2020 to 2023 and has a volume of 150 million euros. The first funding opportunity was open until 15 December 2020, and was marked by a great response.

Italy: Experimental Program of Interventions for Adaptation to Climate Change in Urban Settings

The Program aims at increasing the resilience of communities subject to the risks from climate change, with a particular focus on heat waves and extreme rainfall and drought phenomena, through the implementation of adaptation measures ⁽¹³⁾. Adaptation measures funded are: Green/blue measures (Key Type Measure (KTM) D1), Grey measures (KTM C1), and Soft measures (KTM E).

The total fund allocation is 79,372,058 euros for three years. A specific amount was allocated to each municipality:

- 40% of the fund is allocated to ‘Metropolitan cities’ (e.g. Rome, Milan, Messina);
- 30% is allocated to municipalities >100,000 inhabitants;
- 30% is allocated to municipalities between 100,000 and 60,000K inhabitants.

Based on the reported information, EU funds play a much larger role in funding and financing adaptation implementation than national funds. This can be explained by the fact that the EU budget for 2021 to 2027 has a climate action spending target of 30% for the entire EU budget and even a 37% climate action spending share for each national recovery plan. The percentages refer to mitigation and adaptation in the same way.

Many NASs and NAPs have a system to track the implementation of single adaptation measures or projects or financing actions through indicators or criteria. However, still no particular detail is provided on the methodology, nor the progress made. Assessing the costs of adaptation remains a challenge and is often only done partly (e.g. federal level or sector level). Some Member States can provide general figures (e.g. Austria, Belgium, Bulgaria, Cyprus, the Netherlands and Slovakia). The main challenge remains that no clear-cut criteria are available to define the share of adaptation effort in a single project. However, all countries report increasing sector costs due to adaptation actions.

⁽¹²⁾ <https://www.z-u-g.org/anpaso/>

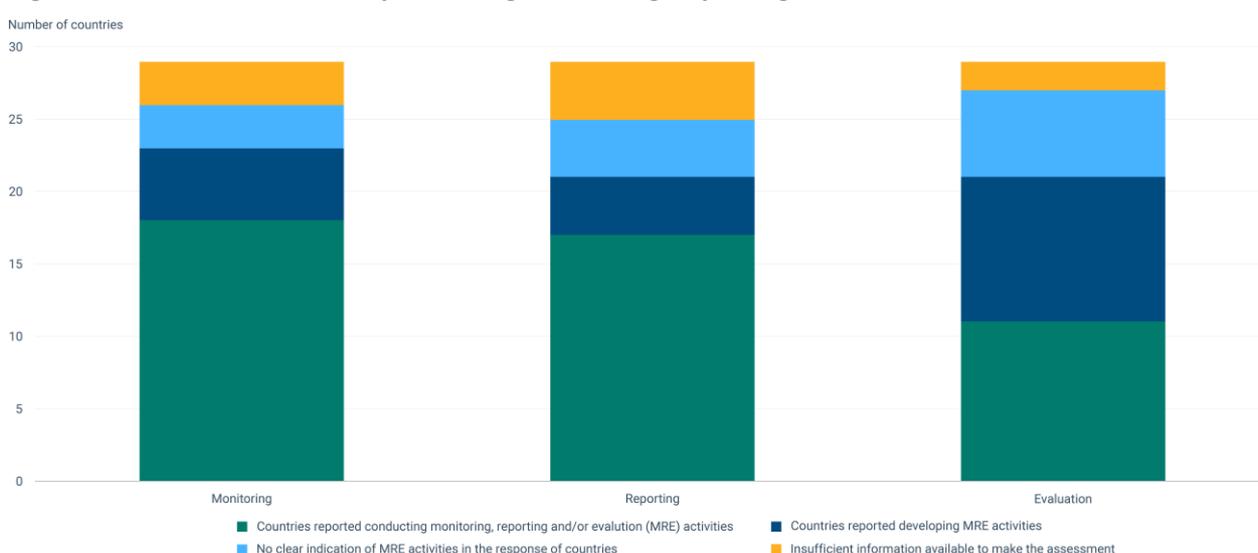
⁽¹³⁾ <https://www.mase.gov.it/pagina/programma-sperimentale-di-interventi-ladattamento-ai-cambiamenti-climatici-ambito-urbano>

6 Monitoring, reporting and evaluation

6.1 Landscape of MRE activities

A growing number of EEA member countries are conducting monitoring, reporting and evaluation (MRE) related measures and/or are planning to do periodic reviews of their national adaptation strategy (NAS) or national adaptation plan (NAP) as stated in previous EEA reporting (EEA, 2022). Based on the data submitted in 2023, around half of the countries reported progress in MRE actions. Some member countries, such as Greece, have since previous 2021 reporting completed the intended MRE plans and related projects, used methods and tools. However, the depth and detail of actions varied between countries which, considering the timeline and nature of adaptation policy cycles, is understandable. There is also some difficulty in interpreting the stage that countries had reached in terms of reporting the development and progress on MRE systems. The information on the reported MRE activities is presented in Figure 9.

Figure 9. Number of countries performing monitoring, reporting and evaluation activities



Note: Based on the reporting from all EU Member States, Iceland and Switzerland. Total number of countries: 29.

Insufficient information available to make the assessment: this category includes instances, where: 1) Member countries do not explicitly state that activities are taking place or are being planned, but where the reported information hints at the possibility and likeliness of such an activity to exist; 2) Member countries refer to published outputs available online but do not include a translation of the key information.

Source: Based on the reporting under [GovReg](#) Art. 19 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023a).

As part of MRE, reporting refers here to activities, where countries collect data, information or activities and that are communicated on the national level. This is distinguished from EU-level reporting, which all countries included in this technical paper are, de facto, engaging in. National level reporting can include regular (annual, biannual or other interval) or irregular forms of reporting and different countries communicate using different approaches.

Compared to the 2021 reporting, progress can be identified in evaluation activities. A growing number of countries report to perform or plan to perform evaluation and a smaller number of countries report unclear or missing information on evaluation. Despite an apparent positive trend, evaluation is still comparatively less common in the reporting countries compared to monitoring and reporting activities. Performing evaluations is often a challenging and time-consuming task, which may explain why evaluation is reported to be less common.

How MRE activities are envisioned by reporting countries to influence policy development is not always clear. In some countries this link is explicitly stated. For example, in Poland, prior to the creation of the

NAS, the Ministry of Climate and Environment carried out an assessment activating multiple actors across sectors to evaluate the implementation of the objectives assumed in the previous NAS. In other countries, climate risk and vulnerability assessments were reported to influence the development of NAPs and NASs. Thinking critically about what MRE is supposed to achieve and to which ongoing or planned policy processes MRE can be connected is important to make sure that MRE activities generate added value.

6.2 Methodological approaches to MRE

Some of the reporting countries provide information on the different methodological approaches that they adopt when performing MRE activities. Several countries reported novel information on the methods used for MRE compared to the previous reporting.

The role of indicators is still important in the reporting countries, and there is reported new activity on that front. For example, Belgium reported that indicators to measure the impact of climate change adaptation measures on the regional (Flemish) and local level is under development. In Finland, a project on developing a new set of criteria for monitoring climate impacts, vulnerabilities and implementation of adaptation measures is currently underway and will be finalized by the end of 2023. In Latvia, new national legislation adopted in 2022 established procedures for monitoring and reporting on national adaptation measures. Part of this process involves developing new indicators on climate change impacts and vulnerabilities. Slovakia is currently preparing new methodological guidelines for, among other things, obtaining and evaluating data in the field of adaptation and mainstreaming climate risks across policy sectors. It was also reported that indicators for monitoring the implementation of adaptation measures are being developed. In Greece, as part of the creation of a new National Adaptation Observatory, an indicator-based system including other tools was reported to be established. Further, it was emphasized that developing multi-purpose indicators, which benefit more than one sector, is prioritized. Luxemburg for example described for each NAP measure indicators for monitoring the progress of the implementation. The definition of indicators is, however, a difficulty during the implementation of the strategy. When updating the NAS and NAP, indicators will be defined to monitor the implementation of the measure. However, it is difficult to set indicators to assess whether a sector is sufficiently adapted to the effects of climate change.

In addition to quantitative indicators, countries also reported on new developments in diversifying the methodology of MRE. For example, Greece reported that qualitative indicators are currently under development. Two countries reported that there has been new activity in engaging with stakeholders in MRE. Slovakia reports that the evaluation of strategic priorities is conducted by performing qualitative assessments through engagement of the Adaptation Working Group, which consists of stakeholders from different sectors in society. In the Netherlands, it was reported that stakeholders will be involved in the setting up of the new national monitoring and evaluation system. However, even though indicators play a significant role in MRE activities across countries, the indicators utilised for MRE purposes are not always specified.

6.3 Sub-national MRE

For sub-national adaptation measures in relation to MRE, the scale and depth of activities reported vary. Depending on the member country, the sub-national activities were either implemented in many municipalities and on regional scales and in many cities, whereas in other countries there were only a few local regions or none with an MRE and NAP framework in place. Some member states report that the monitoring and evaluation of actions and processes implemented and reported on a sub-national scale are conducted in conjunction with the NAP/NAS or other adaptation related programmes (Belgium, Cyprus, France, Latvia, the Netherlands, Romania and Sweden). Most (Austria, Croatia, Czechia, Denmark, Estonia, Finland, Greece, Ireland, Lithuania, Poland, Portugal, Slovakia and Spain) state that municipalities and regions are more or less responsible for the implementation and evaluation of their respective strategy or measures on a local level. Some bigger cities, such as Prague, have their own adaptation strategy with an evaluation and progress reporting framework included whereas some adaptation plans are planned to be executed in conjunction with an energy and climate plan (e.g. Tallinn and Tartu). Poland, for example, reports that for all Polish cities with more than 100,000 inhabitants, a municipal adaptation

plan was prepared for each city and that currently reports on the implementation of the plans are being prepared. A few countries reported that they either have no overview of implementation of MRE related measures planned under sub-national activities (Slovenia) or that the coordinating actor, such as the Ministry of Environment, do not require a full report from the municipalities regarding their adaptation efforts on a local level (Bulgaria). Some member states also reported that they are currently in early stages of developing a system for tracking sub-national adaptation activities (Italy and Hungary).

The data provided to this section did not always concentrate on sub-national MRE activities, rather it gave an update of the situation of adaptation actions in general. This might be due to the sometimes-vague definition of what MRE means in relation to adaptation actions and policy processes. Furthermore, not many countries reported specifically where information regarding the adaptation actions at the sub-national level is presented or found. Some mentioned (e.g. Romania) official channels and/or websites, e.g., the Covenant of Mayors website are used for such communication efforts, but the countries did not report the usage of such global channels on a systematic level in relation to MRE.

6.4 Good practices

When it comes to good practices, most countries that reported progress imply that the role of a coordinating actor, such as a ministry, governmental agency, or an institute of environmental protection (or such) is often significant when both scaling the adaptation actions or when evaluating their progress. Countries also report on the importance of regional networking (usually either through research or expertise networks) when preparing for climate change impacts. France, for instance, reports on such regional networks, where the emphasis on building the links is on the science-society-decision making nexus. Many state as well that since the local plans are often rather recent, a thorough progress report is yet to be conducted or that it is important to at least establish a regular assessment or MRE framework of the implementation and progress of the sub-national plans and actions in general.

Moreover, it might be beneficial for countries to scrutinize how various climate risk assessments (CRA) and MRE related actions overlap. This might aid in identifying the relevant policy tools, in particular for evaluation purposes, which are oftentimes reported as being challenging and at times unclear due to, e.g., difficult to measure types of indicators.

7 Information on the progress with adaptation goals included in the NECPs

In 2023, EU Member States reported for the first time on the progress made with the implementation of their integrated national energy and climate plans (NECP). Article 17 of the Governance Regulation (EU, 2018) defines the conditions of the integrated national energy and climate progress reporting (NECPR). The progress reporting is biennial and covers, among other areas, information on adaptation which may affect the delivery of Energy Union objectives and targets and the long-term Union greenhouse gas emission reduction commitments under the [Paris Agreement](#) (UNFCCC, 2015). It is covering all dimensions⁽¹⁴⁾ of the Energy Union. The structure, format, technical details and process of the progress reporting is defined by the second implementing regulation (EU, 2022) to the Governance Regulation.

This chapter provides an overview of the reported information under the mandatory reporting⁽¹⁵⁾ and, where possible, showcases information submitted under selected voluntary elements of the reporting⁽¹⁶⁾. In the first part of the progress reporting, Member States reported on the inclusion of their adaptation goals in NECPs and were requested to answer four questions. The first question, with a mandatory

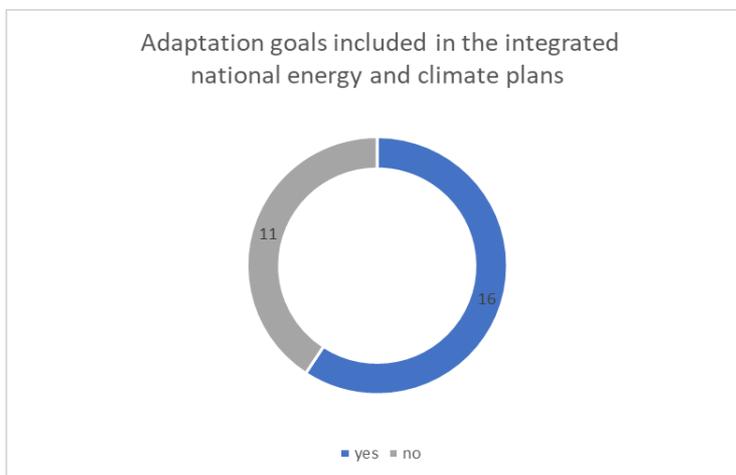
⁽¹⁴⁾ Decarbonisation: GHG emissions and removals, Decarbonisation: renewable energy, Energy efficiency, Energy security, Internal energy market, Research, innovation and competitiveness

⁽¹⁵⁾ Vulnerabilities, including adaptive capacities, risk of potential future impacts, adaptation goals, progress of implementation towards meeting the adaptation goals

⁽¹⁶⁾ Challenges, gaps and barriers; foreseen actions, budget and timeline, overview of the content of sub-national strategies, policies, plans and efforts

character, focused on the inclusion of adaptation goals to current NECPs (Figure 10). Sixteen Member States reported that their NECPs include adaptation goals. Eleven indicated that their NECPs does not include adaptation goals.

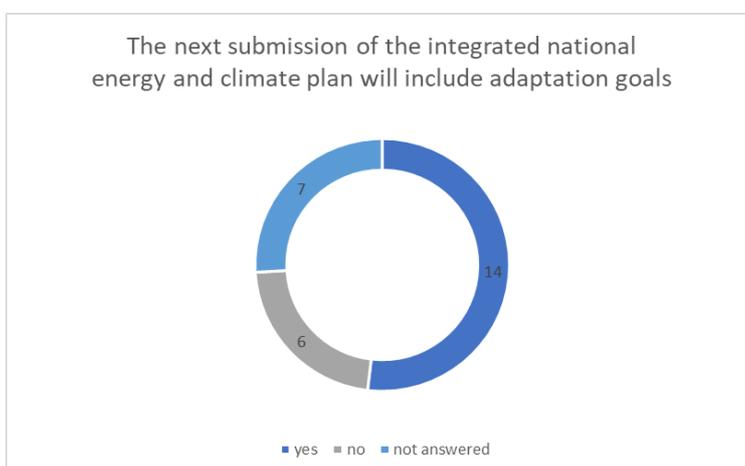
Figure 10. Adaptation goals included in the integrated national energy and climate plans



Source: Based on the reporting under [GovReg](#) Art. 17 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023b).

The three remaining questions were voluntary to answer, therefore not all Member States reflected on them. Most Member States though elaborated on the second question as well (Figure 11), with 14 stating that their next NECP submission will include adaptation goals. Six Member States indicated that their next NECP will not cover adaptation goals, while seven did not answer the question.

Figure 11. The next submission of the integrated national energy and climate plan will include adaptation goals



Source: Based on the reporting under [GovReg](#) Art. 17 (EU, 2018) through [Reportnet 3](#) in 2023 (EEA, 2023b).

The last two voluntary questions aim to gain an overview of the existing adaptation goals, included either in the current NECPs, or in other relevant documents. Many Member States provided a general overview of their adaptation goals, objectives or priorities anchored in national adaptation strategies (NASs) or national action plans (NAPs), sectoral adaptation plans (SAPs), or other documents focusing on climate change mitigation, sustainable development or environmental policy.

In the second part of the progress reporting Member States were asked to report information on adaptation, which may affect the delivery of Energy Union objectives and targets and the long-term Union GHG emission reduction commitments under the Paris Agreement by reflecting on three key areas:

national circumstances, strategies and plans, and monitoring and evaluation. The reporting is guided by 10 fields, out of which four are mandatory (or mandatory, if applicable). The ten fields cover all dimensions of the Energy Union. The assessment presented in this technical paper focuses on the four mandatory fields ⁽¹⁷⁾ because information reported on them is complete and comprehensive.

7.1 Vulnerabilities, including adaptive capacities that are relevant to the Energy Union dimension selected

When it comes to vulnerabilities, including adaptive capacity in the obligatory dimension ‘Decarbonisation: GHG emissions and removal’, Member States reported direct effects of climate change impacts due to extreme weather events, floods, heatwaves or drought to the demand and supply of the energy system (Austria, Estonia, Hungary, Latvia, Luxembourg, Poland, Portugal, Romania and Slovakia). In addition, the reduction of energy production, for instance, hydropower (Croatia) or nuclear power (Germany, Slovakia) and the related lack of cooling water was reported. A decrease in agriculture and forestry production as well as a decrease of carbon sequestration combined with negative climate impacts on the amount of biomass available for energy production was reported by Czechia, France, Greece and Spain. Additionally, Finland, France and Lithuania reported challenges in forest management and limits for biomass production for energy production due to climate change impacts were reported (Finland, France and Lithuania).

Reported information on the voluntary dimension ‘Decarbonisation: renewable energy’, Member States reported the vulnerability of forest biomass production to climate change impacts and thus a decreased availability of biomass and challenges for forest management (Austria, Czechia and Finland). Droughts decrease the production of hydropower as well as the optimal operation of power plants, which was reported by Czechia, Germany, Greece and Spain. Additionally, Denmark and Romania reported that extreme weather events like floods effect the energy infrastructure and demand. Czechia and Greece reported that extreme weather events and snowy/cloudy winter decreases the production of photovoltaic. Austria and Germany reported about the increased demand for renewable energy but also that the supply is influenced by weather and climate. France reported about challenges with water resources for renewable energy. Ireland reported that climate change affecting wind may also affect generation from both onshore and offshore.

For the voluntary reported dimension ‘Energy Efficiency’, Germany, Latvia and Romania reported about negative impacts of extreme events on the distribution network, an increased electricity demand due to overheating in summer and decrease in electricity demand in winter. Spain reported that efforts in making buildings and real-estate more energy efficient can also reduce climate impacts.

In the ‘Energy Security’ dimension, more frequent extreme events can reduce the outputs from power plants and interrupt transmission lines and energy supply as reported by Czechia, France, Germany, Greece, Latvia and Poland, or challenges in forest management like Finland reported.

When it comes to the dimension of ‘Internal energy market’, Romania reported that extreme weather events may affect energy infrastructure and energy demand and Spain reported that the increase of frequency and magnitude of extreme events on coastal areas may affect facilities and their safety on the coast.

The last voluntary dimension reported was ‘Research, innovation and competitiveness’ where Romania reported that extreme weather events may affect energy infrastructure and energy demand, while Spain highlighted the still existing information gap along the energy sector and water-energy nexus.

7.2 Risk of potential future impacts that are relevant to the Energy Union dimension selected.

In the obligatory dimension of ‘Decarbonisation: GHG emissions and removal’ under risk of potential future impacts, Member States reported heat and heat-waves (hot spells), drought, extreme weather

⁽¹⁷⁾ Vulnerabilities, including adaptive capacities that are relevant to the Energy Union dimension selected.

Risk of potential future impacts that are relevant to the Energy Union dimension selected.

Adaptation goals that are relevant to the Energy Union dimension selected.

Progress of implementation towards meeting the adaptation goals

events with stronger storms as well as an increased amount of precipitation and its intensity (Croatia, Estonia, France, Germany, Greece, Latvia, Luxembourg, Romania, Poland and Spain). The same Member States also reported impacts of climate change on re- and forestry and the challenge in capturing carbon and carbon sequestration in forest, land and agriculture ecosystems. Austria, Cyprus and Czechia reported that changes in the energy demand are likely due to climate change and climate vulnerability as well as the decrease in energy consumption for heating and an increase in energy demand for cooling. The consequences and impacts of climate change may pose a potential threat to business continuity and supply chains (Germany, Slovakia and Sweden). A decrease in energy production from hydropower was reported from Croatia, and France reported that climate change impacts will affect the electricity system. Austria reported that changes in the number of heating and cooling days are expected, and France stressed that uncontrolled air-conditioning development could produce new summer demand peaks. Portugal reported that climate change impacts need to be taken into account in mitigation options. Hungary reported about an ongoing project that investigates the climatic and geological vulnerability of the Hungarian energy supply and that the results will be integrated into the NAGIS system. Ireland reported, particularly relevant to this dimension, the Energy and Gas Networks Sectoral Adaptation Plans (SAPs) and the Agriculture, Forestry and Seafood SAP. For example, the agriculture, forestry and seafood adaptation plans identify the risks posed to carbon sequestering by soil quality being impacted by excesses in precipitation or drought, reduced resilience and vitality of forests causing an increasing maladaptation leading to habitat losses and capacity to sequester carbon. Increased frequency of uncontrolled fires is also a critical risk to forestry, agriculture and peatland.

Under the voluntary dimension ‘Decarbonisation: renewable energy’, possible changes in the availability of renewable energy (wind, solar, biomass, hydropower) due to (changes in) extreme events such as floods, heavy precipitation and storms and reduced water availability especially during summer are expected (Austria, Denmark, Finland, Greece, Ireland, Romania, Poland, Spain and Sweden). Malta and the Netherlands are currently assessing the risk of potential future impacts on renewable energy.

In the ‘Energy efficiency’ dimension, Member States reported voluntarily that less and warmer cooling water can lead to reduced energy efficiency (Austria and Spain) and that milder winter might increase energy efficiency and warmer summer lead to higher cooling demand as reported by Denmark. Malta and the Netherlands are currently assessing the risk of potential future impacts on energy efficiency.

When it comes to the dimension of ‘Energy security’, some Member States such as Austria voluntarily reported that possible changes in the availability, due to extreme events and reduced water availability especially during summer, of renewable energy (wind, solar, biomass, hydropower) are expected as well as challenges for transmission and distribution networks due to extreme weather events, as reported by Poland. On the one hand Denmark reported a potential for more biomass production, and Finland on the other hand reported that the availability and quality of biomass might become worse. Germany and Greece reported an increase of energy demand for cooling and Spain reported that extreme events have an impact on energy supply infrastructure and water shortage for cooling power plants. A focus on climate-proofing and water resilience was reported by the Netherlands. Malta is currently assessing the risk of potential future impacts on energy security.

‘Internal energy market’ dimension reporting by Austria notes expected possible changes in the renewable energy availability due to extreme events and reduced water availability, especially during summer, of renewable energy (wind, solar, biomass, hydropower) as well as a decrease in energy consumption for heating and increase of energy consumption for cooling as well as changes in the availability of renewable energy. The Netherlands reported that technological development in the energy and electricity field such as storage and decentralised generation can help reduce the impacts of climate risks. Malta is currently assessing the risk of potential future impacts on the internal energy market.

7.3 Adaptation goals that are relevant to the Energy Union dimension selected

All Member States reported on the obligatory ‘Decarbonisation: GHG Emissions and Removals’ dimension of the Energy Union, while 13 of the Member States briefly reported on at least one or more dimensions

of the Energy Union where reporting had a voluntary character (Austria, Croatia, Denmark, Finland, France, Greece, Ireland, Latvia, Malta, Poland, Romania, Spain and Sweden).

Strategic and overarching national adaptation goals and sector specific adaptation goals are almost equally reported. They address either climate resilience, the urge to adapt economy, society and environment to the adverse effects of climate change, or outline action for affected sectors such as agriculture, buildings, forestry, energy, infrastructure and transport. Most of the time the adaptation goals of NASs or NAPs were reported.

The reporting also shows that Member States' adaptation goals (defined in their national adaptation policies, for example NAS), are usually not organised along the Energy Union dimensions. While it is not a requirement to organise adaptation policies along the Energy Union dimensions, the NECPs may specify how the included adaptation goals are addressing the Energy Union dimensions, especially decarbonisation. Based on the reporting, it is evident that, in practice, several NECPs only refer to adaptation policies in general and do not make clear how the goals defined are supporting the dimensions of the Energy Union.

A significant number of Member States (Austria, Bulgaria, Belgium, Croatia, Finland, France, Ireland, Lithuania, Poland, Romania, Spain and Sweden) focused on sector specific adaptation goals and highlighted priority (and often key affected) sectors from the perspective of the Energy Union agenda. The most frequently occurring sectors were agriculture (Estonia, Ireland, Lithuania and Poland), buildings (Austria, Belgium and Romania), energy – including renewable energy sources, energy efficiency, energy security, innovation (Austria, Bulgaria, Croatia, Finland, France, Ireland, Lithuania, Poland, Romania, Spain and Sweden), forestry (Austria, Finland, Lithuania and Spain), and transport and infrastructure (Belgium, Ireland and Lithuania). Austria highlighted the importance of integrated soil protection. Bulgaria referred to the role of circular economy, while France reflected on the transition to a low carbon economy. Estonia elaborated on the impacts of peat extraction; Austria and Spain addressed the importance of carbon sinks.

Five Member States (Denmark, Italy, Germany, the Netherlands and Slovenia) stated that they do not have adaptation goals defined, or their adaptation goals are not defined along the lines of the Energy Union dimensions.

A few Member States highlighted principles of adaptation in their reports: the importance to address synergies between climate change mitigation and adaptation (Austria, Lithuania and Poland), avoiding insufficient adaptation action or maladaptation (Austria and France), the role of prevention (Austria and Latvia), and the provision of emergency sources for energy and transmission (Poland).

7.4 Progress of implementation towards meeting the adaptation goals

In general, the information reported on progress of implementation towards meeting the adaptation goals showcases that in most Member States monitoring and evaluation frameworks for measuring progress on adaptation are under development or being recently implemented. If operational, these frameworks are often structured around adaptation measures outlined in NASs and NAPs or follow an indicator- or criteria-based approach and might not consider synergies with the Energy Union agenda.

Fourteen Member States (Austria, Belgium, Bulgaria, Cyprus, Estonia, Finland, France, Greece, Ireland, Lithuania, Malta, Poland, Portugal and Spain) declared progress being made under the adaptation agenda and illustrated the progress of implementation with complementary examples.

Under the mandatory dimension 'Decarbonisation: GHG emissions and removals', Austria highlighted continuous awareness-raising efforts for avoidance of maladaptation and for mainstreaming of good adaptation aiming to prevent measures conflicting with mitigation. Cyprus referred to cooperation with wider regional authorities, municipalities, community groups and private local enterprises under various projects (CAMP-Cyprus, COASTANCE project for coastal zone adaptation, MAREMED project on adaptation in coastal areas). In Estonia, the planned adaptation activities in the period of 2021 to 2025 lay in the fields of natural environment and bioeconomy, while greater emphasis is placed on more efficient use of primary energy and increasing the share of renewable energy in the final consumption. The National Adaptation

Hub of Greece has been launched in October 2022, bringing together adaptation information and resources, including information and resources on NECP-related sectors. Malta's Environment and Resources Authority has recently released the 'Green Paper on Greening Buildings in Malta: Initiatives for Green Walls and Roofs for Residential, Commercial, and Industrial Buildings' and launched the Green Your Building Scheme. Poland reported that investments were made, among others, in electricity transmission networks as adaptation measures. In particular, investments in 400 kV lines are gradually replacing the 220 kV lines, which are worn out and less resistant to extreme weather situations. Portugal provided a detailed overview of progress in implementing its action programs goals focusing on municipal and adaptation plans, consumption of water in urban areas, contingency and adaptation plans of telecommunication companies, coastal erosion and irrigation. In Spain, a set of strategic and planning documents were published, mainstreaming climate change adaptation into forestry and combating desertification in June 2022.

Eleven Member States (Croatia, Czechia, Denmark, Germany, Hungary, Italy, Latvia, Luxembourg, the Netherlands, Romania and Slovenia) stated that information on progress of implementation towards meeting adaptation goals is for various reasons not available. Three potential issues might be the obstacle behind missing information: no specific adaptation goals defined along the lines of the Energy Union dimensions (and therefore the possibility to report is limited), lack of national MRE frameworks facilitating the collection and interpretation of data, and ongoing evaluation with expected results only in the upcoming years.

Those dimensions of the Energy Union where reporting is voluntary were reported on to a limited extent (Austria, Finland, France, Greece, Poland and Sweden).

8 Conclusions

This ETC-CA Technical Paper gives a snapshot of the situation in 2023, and highlights areas where new information was provided or progress occurred in the last two years, based on information reported on national adaptation actions. Due to the nature of the adaptation policy cycle, along with resource intense climate risk assessments, long term strategic planning, implementation of short-, mid- and long-term adaptation measures and challenges with their MRE, significant progress cannot be showcased. On the other hand, it is evident that in the last two years, countries have been continuously improving different aspects of their adaptation planning, key activities took place in parallel and further progress has been made.

8.1 Lessons learned

Experience from this second reporting cycle under the GovReg shows an increased quality of information on observed and future hazards, key affected sectors and sub-national adaptation. This provides a better picture of which climate hazards countries are concerned about, outlining the key affected sectors where strengthened mainstreaming might be needed, or illustrating diverse action taken at the regional and local levels.

Gaps and challenges remain in the reporting regarding spending on climate change adaptation, good practice and MRE. The first might be caused by the lack of a common methodology to assess costs and track the financing of the implementation of adaptation strategies and plans. In the latter case, development of unified criteria defining representative good practice or excellence might be beneficial. While insufficient adaptation, or maladaptation, seems to be better understood, finding the right characteristics of 'best' adaptation is challenging. Furthermore, many of the MRE systems are relatively new and immature. Gaining solid experience with MRE would reveal the real performance of adaptation actions in Europe and their influence on decision-making.

Another important aspect of the 2023 reporting on adaptation actions regards the wide range of policy instruments and how countries use them to support national adaptation initiatives. The landscape of climate adaptation policy documents is increasingly complex as a result of specific national circumstances,

strengthened coordination between governance levels as well as mainstreaming at these different governance levels. In addition, there is a movement towards using more legally binding instruments (e.g. climate laws, including adaptation). An overview of these different adaptation policy instruments, their adoption rules and key content would facilitate a clearer understanding of adaptation governance across the countries.

Different interpretations of the reporting elements or countries lacking the type of requested information still occurred, making the assessment of information challenging.

Reporting on Article 17 of the GovReg was new to all reporting actors, thus the information presented in this report is a first brief assessment of the mandatory parts of the reporting. The results showcase the different understanding of the scope and varying interpretation of the reporting structure, resulting in heterogeneous information being reported. Continuous exchange between DG CLIMA, EEA and all EU Member States and EEA member countries on the lessons learned from the second reporting on Article 19 and the experience with the first reporting on Article 17 could prove useful – aiming at deepening the understanding of the relevance of adaptation reporting and progressing towards sound reporting and the deriving of relevant messages to progress further in the implementation of adaptation actions across Europe.

8.2 Future directions

Ten years have passed since the adoption of the first European Adaptation Strategy (EC, 2013) and in 2023 the Governance Regulation (EU, 2018) celebrates its fifth anniversary. In the last decade all Member States, and non-EU EEA Member Countries built a solid ground for adaptation. In Europe, now the time has come to bring strategic planning into practice and shift the focus towards implementation, measuring progress and reaching climate resilience. The 2021 EU Strategy on adaptation to climate change is being implemented, the first European Climate Risk Assessment is being developed and robust activities are being launched under the Mission on Adaptation to Climate Change. An analysis of the reported information from all countries shows that inspiration and mutual learning between all actors engaged in adaptation actions appears crucial and essential, while also happening and successful.

The first progress assessment performed under the European Climate Law is due by 30 September 2023, and will spotlight the consistency of EU measures with ensuring progress on adaptation, assess the collective progress made by Member States on adaptation and the consistency of relevant national measures with ensuring progress on adaptation. The above-mentioned activities aim to enhance both national and European adaptation action and keep Europe on track to climate resilience.

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List of Abbreviations

Abbreviation	Name
CoM	Covenant of Mayors
CRA	Climate Risk Assessment
EC	European Commission
ETC-CA	European Topic Centre on Climate change adaptation and LULUCF
EEA	European Environment Agency
EIA	Environmental Impact Assessment
ERA-NET	European Research Area-Network
ERA-NET+	European Research Area-Network plus
EU	European Union
GHG	Greenhouse Gas
GovReg	Energy Union Governance Regulation
ICT	Information and Communications Technology
IPCC	Intergovernmental Assessment of Climate Change
KLAR!	Climate Change Adaptation Model Regions for Austria
KTM	Key Types of Measures
MRE	Monitoring, Reporting and Evaluation
MS	Member State of the European Union
NAGIS	National Adaptation Geo-Information System
NAP	National Adaptation Plan
NAS	National Adaptation Strategy
NECP	National Energy and Climate Plan
NECPR	National Energy and Climate Progress Reporting
RAP	Regional Adaptation Plan
SAP	Sectoral Adaptation Plan
SEA	Strategic Environmental Assessment

References

Baldi, M., et al., 2023, Global Covenant of Mayors - A complete collection of action plans and monitoring reports from MyCovenant reporting platform (GCoM - MyCovenant, 2023, Fourth release), European Commission Joint Research Centre (JRC) (<https://data.jrc.ec.europa.eu/collection/id-00354>) accessed 2 October 2023, European Commission Joint Research Centre (JRC).

EC, 2013, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'An EU strategy on adaptation to climate change' (COM(2013) 216 final).

EC, 2019, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions - The European Green Deal (COM(2019)640 final).

EC, 2020, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Europe's moment: Repair and Prepare for the Next Generation (COM(2020)456 final).

EC, 2021a, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Forging a climate-resilient Europe — the new EU strategy on adaptation to climate change' (COM(2021) 82 final).

EC, 2021b, 'Eurobarometer survey - Climate Change - July 2021' (<https://europa.eu/eurobarometer/surveys/detail/2273>) accessed 11 July 2023.

EC, 2023, 'Eurobarometer survey - Climate change - July 2023' (<https://europa.eu/eurobarometer/surveys/detail/2954>) accessed 5 September 2023.

EEA, 2018, *National climate change vulnerability and risk assessments in Europe, 2018*, EEA Report No 1/2018, European Environment Agency (<https://www.eea.europa.eu/publications/national-climate-change-vulnerability-2018>) accessed 10 April 2019.

EEA, 2020, *Monitoring and evaluation of national adaptation policies throughout the policy cycle*, EEA Report No 6/2020, European Environment Agency (<https://www.eea.europa.eu/publications/national-adaptation-policies>) accessed 9 June 2021.

EEA, 2021, *Europe's changing climate hazards — an index-based interactive EEA report*, EEA Web Report, European Environment Agency (<https://www.eea.europa.eu/publications/europes-changing-climate-hazards-1/climate-hazards-indices>).

EEA, 2022, *Advancing towards climate resilience in Europe: status of reported national adaptation actions in 2021*, EEA Report No 11/2022, European Environment Agency (<https://www.eea.europa.eu/publications/advancing-towards-climate-resilience-in-europe>) accessed 10 July 2023.

EEA, 2023a, 'Reportnet 3', National climate change adaptation planning and strategies [2023] (<https://reportnet.europa.eu/public/dataflow/895>) accessed 11 August 2023.

EEA, 2023b, 'Reportnet 3', National climate change adaptation planning and strategies [2023] (<https://reportnet.europa.eu/public/dataflow/897>) accessed 11 August 2023.

EU, 2018, Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action (OJ L 328, 21.12.2018, p. 1-77).

EU, 2020, Commission Implementing Regulation (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council and repealing Commission Implementing Regulation (EU) No 749/2014 (OJ L 278, 26.8.2020, p. 1-136).

EU, 2021, Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243, 9.7.2021, p. 1-17).

EU, 2022, Commission Implementing Regulation (EU) 2022/2299 of 15 November 2022 laying down rules for the application of Regulation (EU) 2018/1999 of the European Parliament and of the Council as regards the structure, format, technical details and process for the integrated national energy and climate progress reports (OJ L 306, 25.11.2022, p. 1-98).

European Council, 2020, Council Regulation (EU, Euratom) 2020/2093 of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027 (OJ L 433I, 22.12.2020, p. 11-22).

Follos, F., et al., 2021, 'Evolution of the minimum mortality temperature (1983–2018): Is Spain adapting to heat?', *Science of The Total Environment* 784, p. 147233 (DOI: 10.1016/j.scitotenv.2021.147233).

IPCC, 2022, 'Annex II: Glossary', in: *Climate change 2022: impacts, adaptation and vulnerability. Contribution of Working Group II to the sixth assessment report of the Intergovernmental Panel on Climate Change*, Intergovernmental Panel on Climate Change, p. All/1-All/51.

JRC, 2023, *Advance report on forest fires in Europe, Middle East and North Africa 2022.*, Technical report No JRC133215, European Commission, Joint Research Centre (<https://publications.jrc.ec.europa.eu/repository/handle/JRC133215>) accessed 26 June 2023.

UN DESA, n.d., Classification and definition of regions, (<https://esa.un.org/MigFlows/Definition%20of%20regions.pdf>) accessed 7 July 2022, United Nations Department of Economic and Social Affairs.

UNFCCC, 2015, 'The Paris Agreement', United Nations Framework Convention on Climate Change (http://unfccc.int/paris_agreement/items/9485.php).

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