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**COMMISSION STAFF WORKING DOCUMENT**

**Assessment of progress towards the objectives of the Energy Union and Climate Action**

*Accompanying the document*

**Report from the Commission to the European Parliament, the Council, the European  
Economic and Social Committee and the Committee of the Regions**

**State of the Energy Union 2023 Report**

**(pursuant to Regulation (EU) 2018/1999 on the Governance of the Energy Union and  
Climate Action)**

{COM(2023) 650 final}

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# 1. Introduction

## 1.1 Submission, review and assessment of the National Energy and Climate Progress Reports (NECPRs)

The Governance Regulation requires<sup>1</sup> Member States to report every two years on the progress achieved towards the implementation of their integrated national energy and climate plans (NECPs) through National Energy and Climate Progress Reports (NECPRs). By 15 March 2023, Member States were due to report for the first time on their progress towards implementing their NECPs for the period 2021-2030, and notably towards their objectives, targets and contributions set out therein, across the five dimensions of the energy Union including on greenhouse gas emissions and removals as well as the implementation or amendment of Member States policies and measures and their financing. Moreover, Member States had to report on progress towards their adaptation goals, as well as on the impact of their policies and measures on air quality and emissions of air pollutants.

Importantly, Member States were also due to report on the steps taken to establish a multilevel energy and climate dialogue<sup>2</sup> to engage with local authorities, civil society organisations, business community, investors and other relevant stakeholders and the public on energy and climate policies. The integrated nature of the reporting represents a significant reduction of administrative burden on the side of both the Commission and the Member States as compared to the multiple reporting and assessment obligations spread through the energy acquis prior to the entering into force of the Governance Regulation. This integrated reporting has also allowed for a more holistic assessment of progress with strong synergies.

The Commission's assessment of progress in this Staff Working Document is based on the Member States' objectives, targets and contributions as included within their NECPs, and framed by the content and timing of the submitted NECPRs. Eight Member States submitted a *prima facie* full progress report by the 15 March deadline, and 10 more submitted their progress report relatively close to the deadline. As of 1 October, twenty-six Member States submitted their *prima facie* full progress report.

To ensure comparability and limit the administrative burden on Member States, the progress reporting makes use of comparable energy statistics where available. As a result, the latest consolidated data in certain areas relates to 2021 or 2022.

The assessment is based primarily on the progress reports. It is complemented with other information and indicators where appropriate, with data quality and availability varying between topics. This is particularly important to consider developments since the start of Russia's war of aggression against Ukraine, which is not reflected in data with cut-off in 2021.

Member States are in the process of updating the NECPs in view of the increased energy and climate ambition and much-changed geopolitical situation since the submission of the original plans. The Union's response to the Russian invasion of Ukraine through the Commission's REPowerEU Plan has resulted, amongst others, in increased Union's energy ambitions. The final updated NECPs are due by 30 June 2024.

Following the submission of the progress reports, a quality assurance and control process was started, in which Member States resubmitted parts of the progress reporting to add or clarify information. This process has yielded good results in improving the completeness and consistency of the reported

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<sup>1</sup> Article 17 of Regulation (EU) 2018/1999

<sup>2</sup> Article 11 of Regulation (EU) 2018/1999

information, although it is not yet fully completed (56% complete by 1 October) in view of late submissions by the Member States.

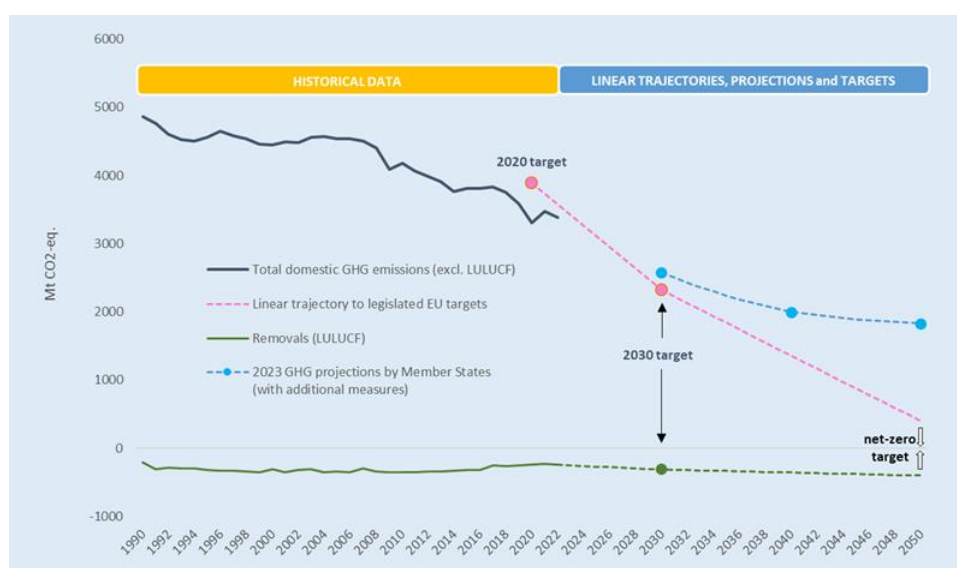
## 2. Progress towards meeting the objectives

### 2.1 Decarbonisation

#### 2.1.1 Greenhouse gas emission and removals

The “**Fit for 55**” package sets the EU on a path to reach its climate targets in a fair, cost-effective and competitive way. With most of its key proposals adopted by co-legislators,<sup>3</sup> Union policies are now **aligned with the updated 2030 target** as set in the **European Climate Law**. The implementation of the new legislation under the Fit for 55 package will enable the EU and its Member States to achieve a net domestic reduction of greenhouse gas emissions by least 55% compared to 1990 by 2030 (see also Chapter 1 of the Climate Action Progress Report 2023 – Emission trends and progress in climate action).<sup>4</sup>

**Figure 1: Total EU GHG emissions (excluding international aviation) and removals (1990-2022), linear trajectories to EU targets, and Member States’ latest GHG emissions projections (2022–2050).**<sup>5</sup>



The preliminary data for **2022** show that EU GHG net emissions decreased by around 3% in 2022 continuing the overall downward trend of the past 30 years. After the strong rebound in greenhouse gas (GHG) emissions in 2021 following the unprecedented fall in 2020 due to the COVID-19 pandemic, EU emissions in 2022 are expected to be back in line with the 30-year descending trend achieved before the pandemic. According to provisional data, total EU domestic GHG emissions (i.e. excluding LULUCF and international aviation) decreased by 2.4% in 2022 compared to 2021, whilst EU GDP grew

<sup>3</sup> This includes in particular the revised EU Emissions Trading System Directive, including a new ETS for buildings, road transport and fuels, the Market Stability Reserve, the Effort Sharing Regulation, CO2 standards for cars and vans, the Land Use, Land Use Change and Forestry Regulation, the Carbon Border Adjustment Mechanism, the establishment of the Social Climate Fund, FuelEU Maritime, the Alternative Fuel Infrastructure Regulation (AFIR), ReFuel EU Aviation, the Energy Efficiency Directive and the Renewable Energy Directive. There is only one remaining proposal still pending with co-legislators, i.e. the proposal for a revised energy taxation directive.

<sup>4</sup> The legislation as adopted is estimated to result in a net domestic reduction of greenhouse gas emissions by 57% compared to 1990 by 2030.

<sup>5</sup> Notes: (1) Historical GHG emissions and removals (1990-2022) are based on European Environment Agency’s 2023 GHG Inventory and Approximated emissions and removals. (2) Linear trajectories for GHG emissions and removals (2022-2050) are based on the legislated EU 2030 targets, while emissions and removals by 2050 reflect estimates from the different model-based analyses supporting the “Delivering the European Green Deal”. (3) The -55% 2030 target (EU Climate Law) considers a contribution of removals of -225 MtCO<sub>2</sub>eq.

by 3.5%. This translates into a reduction in GHG emissions of 30.4% compared to the 1990 base year (or 29% when international aviation is included). Reported GHG net removals from land use, land use change, and forestry (LULUCF) are also expected to increase by 14 million tonnes of CO<sub>2</sub> equivalent compared to 2021.<sup>6</sup> As a result, net GHG emissions for 2022 (i.e. including LULUCF) are expected to be 32.5% below the 1990 level (or 31.1% when international aviation is included).

For a more detailed assessment on the EU and Member States' progress towards climate mitigation targets, refer to the Climate Action Progress Report 2023 and its accompanying technical annex.

### ***Progress towards national objectives, targets and contributions for GHG emissions reduction***

All Member States reported on progress towards national objectives, targets and contributions (Annex I). However, reports varied across Member States and information were largely insufficient to provide a collective EU assessment.

### ***Climate neutrality***

More than half of Member States defined the objective to achieve climate neutrality by 2050 or earlier, in line with their national long-term strategies (Table 1). Austria indicated a later year for achieving climate neutrality (i.e. 2050) compared to what Austria had previously reported in an updated of its long-term strategy (i.e. 2040), while Estonia, Germany and Greece have formally indicated, for the first time, a target year to achieve climate neutrality.

**Table 1: Target years for climate neutrality and scopes reported in the NECP progress reports and national long-term strategies.**

Member State	Target year for climate neutrality		Total GHG emissions, excluding LULUCF, excluding international aviation		Total GHG emissions, including LULUCF, excluding international aviation	
	NECPR	LTS	NECPR	LTS	NECPR	LTS
Austria	2050	2040	Yes	yes		Yes
Belgium						
Bulgaria				yes		yes
Croatia				yes		
Cyprus		2050				yes
Czechia			Yes	yes		
Denmark	2050	2050		yes	Yes	yes
Estonia	2050			yes		yes
Finland	2035	2035	Yes	yes		yes
France	2050	2050	Yes	yes	Yes	yes
Germany	2045			yes		
Greece	2050		Yes		Yes	yes
Hungary	2050	2050	Yes			yes
Ireland						
Italy	2050	2050	Yes	yes		
Latvia	2050	2050	Yes	yes	Yes	yes

<sup>6</sup> Approximated 2022 data could suggest a break to the declining trend in the LULUCF sink observed in recent years. However, the assessment takes into consideration the large uncertainty of these data and as it will possibly be subject to larger revisions.

Lithuania	2050	2050			Yes	yes
Luxembourg	2050	2050				yes
Malta						yes
Netherlands			Yes			yes
Poland						
Portugal	2050	2050	Yes			yes
Romania			Yes			
Slovakia	2050	2050	Yes	yes		yes
Slovenia	2050	2050	Yes		Yes	yes
Spain	2050	2050	Yes	yes	Yes	yes
Sweden		2045		yes		

Sources: reportnet 3, LTS (compiled by LTS project, includes updated information)

### National GHG targets

Most of the Member States have also indicated quantitative national GHG targets up to 2050, but not for all required years (2030, 2040, 2050) and with different scope. Therefore, assessing progress against previously indicated national targets, such as those reported in their national long-term strategies submitted under Article 15 of the Governance Regulation (Table 2) is not straightforward. For the few cases where a comparison is possible, Member States have in general increased their climate ambitions.



**Table 2: National GHG emission milestones from NECPR and national long-term strategies (LTS). Excluding LULUCF, excluding international aviation**

NECPR (AR5 GWP)					LTS (and LTS updates) (AR4 GWP)				
Member State		2030	2040	2050	Member State		2030	2040	2050
Mt CO2e					Mt CO2e				
Austria		36			Austria		-	-	16
Belgium					Belgium		-	-	-
Bulgaria					Bulgaria		56	21	16
Croatia					Croatia		20	15	8
Cyprus					Cyprus		-	-	-
Czechia		118	70	39	Czechia		105	70	39
Denmark					Denmark		38	-	-
Estonia					Estonia		12	11	8
Finland		29	14	7	Finland		36	8.5	-1.5
France		312	197	81	France		311	187	65
Germany		439	150		Germany		438	149	-
Greece		61	56		Greece		57	-	5
Hungary		57			Hungary		45	29	5
Ireland					Ireland		-	-	-
Italy <sup>7</sup>		329			Italy		-	-	65
Latvia <sup>8</sup>		6.5	8.5		Latvia		9	4	-
Lithuania					Lithuania		-	14	10
Luxembourg		5.5	2.2	1.7	Luxembourg		-	-	-
Malta					Malta		11	0.8	0.4
Netherlands		113		11	Netherlands		-	-	-
Poland					Poland		-	-	-
Portugal		48	30	13	Portugal		39	21	9
Romania		118			Romania		-	-	-
Slovakia		33			Slovakia		34	28	14
Slovenia		13	7	2	Slovenia		-	-	-
Spain		221	101	29	Spain		222	102	29
Sweden					Sweden		26	9	-

Source: reportnet 3, LTS (compiled by LTS project, includes updated information)

<sup>7</sup> Original reported values have been corrected to reflect the correct unit metric.

<sup>8</sup> Original reported values have been corrected to reflect the correct unit metric.

**Table 3: National GHG emission milestones from NECPR and national long-term strategies (LTS). Including LULUCF, excluding international aviation**

NECPR (AR 5 GWP)					LTS (and LTS updates) (AR 4 GWP)				
Member State		2030	2040	2050	Member State		2030	2040	2050
Mt CO2e					Mt CO2e				
Austria					Austria				-0.5
Belgium					Belgium				
Bulgaria					Bulgaria		47	13	9
Croatia					Croatia				
Cyprus					Cyprus		6	2	
Czechia					Czechia				
Denmark		23			Denmark				-8
Estonia				0	Estonia		17	11	5
Finland			0	0	Finland		17	3	-18
France		272	143	14	France		271	133	-2
Germany					Germany				
Greece		56	50		Greece				5
Hungary					Hungary		41	25	
Ireland					Ireland				
Italy					Italy				
Latvia <sup>9</sup>		4	8		Latvia		10		
Lithuania		16	7	0	Lithuania		13	6	
Luxembourg		50	17	10	Luxembourg		7		
Malta					Malta		1.1	0.8	0.4
Netherlands					Netherlands		49		11
Poland					Poland				
Portugal					Portugal		39	22	9
Romania					Romania				
Slovakia					Slovakia				7
Slovenia		11	5	0	Slovenia		7	3	
Spain		186	67	-8	Spain		185	65	-8
Sweden					Sweden				

Source: reportnet 3, LTS (compiled by LTS project, includes updated information)

The GHG emission projections supporting the NECP progress reports show that for the economy-wide greenhouse gas emissions reductions, emissions by 2030 reduce under existing and planned measures by 45 % and 50 % respectively below 1990 levels. This is an improvement compared to the 41% below 1990 levels under existing and planned measures estimated in the 2020 EU-wide assessment of National Energy and Climate Plans<sup>10</sup>, but it falls short of the EU 55% reduction target, showing clearly that additional implementation efforts are needed.

<sup>9</sup> Original reported values have been corrected to reflect the correct unit metric.

<sup>10</sup> COM (2020) 564 final

### ***Progress towards ESR targets***

The Effort Sharing Regulation (ESR) covers greenhouse gas emissions accounting for around 60% of total domestic EU emissions. It covers emissions from domestic transport (excluding CO<sub>2</sub> emissions from aviation), buildings, agriculture, small industry, and waste. The legislation sets binding national targets to reduce emissions in these sectors by 2030 compared to 2005 levels, which are translated into binding national emission limits for the period 2021-2030.

Based on the GHG inventories, EU-wide emissions in the ESR sectors in 2021 remained 3.3% below the aggregated emissions limit. The emissions exceeded national emission limits in five Member States: Austria, Cyprus, Denmark, Ireland and Italy.<sup>11</sup> Forward-looking GHG projections show that EU-wide ESR emissions would reduce by 32% in 2030 compared to 2005 levels. This is below the EU-wide ESR target to reduce ESR emissions in 2030 by 40% compared to 2005 levels. For a more detailed assessment on the EU and Member States progress towards the ESR national limits, refer to the Climate Action Progress Report 2023 and its accompanying technical annex.

### ***Progress towards LULUCF targets***

The land use, land-use change, and forestry (LULUCF) sector plays a crucial role in achieving the EU's climate neutrality goal. The sector includes emissions and removals from the use of soils, trees, plants, biomass and timber, and is responsible for both emitting and absorbing CO<sub>2</sub> from the atmosphere. **For the EU, the LULUCF sector absorbs more greenhouse gases than it emits, achieving significant net carbon removals.** The sector also provides biomaterials that substitute fossil or carbon intensive materials, an equally important role in the transition to a climate-neutral economy. However, **carbon removals from the sector have declined at a worrying speed in the last years.** The revised LULUCF Regulation<sup>12</sup> sets out how the land use sector contributes to the EU's climate goals, namely through a land-based **net carbon removals target of 310 million tonnes of CO<sub>2</sub> equivalent by 2030.** To reach this objective, targets are allocated to Member States, based on the total managed land area within their territory.

In 2021, the EU's carbon sinks were a net removal of -230 Mt CO<sub>2</sub>-eq. Moreover, the trend of recent years persisted, and the size of the carbon sink is continuing to decrease. With current LULUCF accounting rules applicable to the period 2021- 2025, the 'accounted' balance for 2021, produced a slight accounted credit of -14 Mt CO<sub>2</sub> -eq. Nine Member States showed potential net accounting debits and sixteen Member States showed potential net accounting credits.

Projections on reported emissions and removals, delivered by Member States in March 2023, have been assessed for progress LULUCF towards the 2030 targets. Projections with existing measures show EU total net removals of -239 MtCO<sub>2</sub>eq for 2030 and -260 MtCO<sub>2</sub>eq with additional measures, leaving a gap of between around 50-70 MtCO<sub>2</sub>e to meet the 2030 target. This means that the EU is not, according to projections, on track to meet the 2030 net removal target of -310 MtCO<sub>2</sub>eq. For a more detailed assessment see Chapter 4 of the Climate Action Progress Report).

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<sup>11</sup> The final ESR emissions for 2021 will be only determined after a comprehensive review in 2027, when the compliance cycle for each of the years 2021 to 2025 will take place. These five Member States will need to use flexibilities to comply with their annual target.

<sup>12</sup> Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review (OJ L 107, 21.4.2023, p. 1).

### 2.1.2 Climate adaptation

In face of climate change increasingly affecting the energy sector and climate mitigation efforts, Article 4 of the Governance Regulation required Member States to include climate adaptation goals into their National Energy and Climate Plans, as appropriate, in support to the achievement of the Energy Union objectives, at least in the “Decarbonisation” dimension.

The Regulation’s requirements for adaptation goals are formulated partly in a conditional way. Outside the Decarbonisation dimension’s greenhouse gas emissions part, such goals were mandatory only if applicable. The relationship of these adaptation goals to those set out in the national adaptation policies (on which reporting was required under Article 19 of the same Regulation<sup>13</sup>) has also been a source of confusion. This has led to diverging interpretations among Member States of how adaptation is to be tackled in the National Energy and Climate plans, which makes it challenging to horizontally assess the progress achieved.<sup>14</sup>

Hazards considered relevant by the Member States for the Energy Union included changes in frequency and intensity of extreme weather events like heatwaves, droughts, stronger storms as well as an increased amount of precipitation. Several Member States (France, Czech Republic, Finland, Greece) related vulnerabilities to the following Energy Union dimensions: Decarbonisation: GHG emissions and removals, Decarbonisation: renewable energy, and Energy Security. For most of the other Member States, only the Decarbonisation dimension was targeted. In some cases, all Energy Union dimensions were addressed (e.g., Austria and Croatia). It was sometimes the case that specific links between vulnerabilities/risks and dimensions were not sufficiently detailed, or the language was quite general (e.g., Romania, Netherlands, and Latvia).

Examples of vulnerabilities and risks cited include:

- Spain identifying the vulnerability of the energy system to water scarcity under the Research, innovation and competitiveness dimension.
- Finland identifying a reduction in the availability and quality of biomass as a risk across Decarbonisation (GHG emissions and removals and renewable energy).
- Portugal identifying concerns around water availability, droughts, and fire risks, impacting renewable energy production (especially hydropower) as part of the Decarbonisation: renewable energy dimension.

To deal with these risks, Member States introduced both overarching national adaptation goals and sector specific adaptation goals in linked sectors such as agriculture, buildings, forestry, energy, infrastructure, and transport. Twenty Member States mentioned adaptation goals, the majority fully addressing the identified risks (14 fully, 8 partially). In most cases, the adaptation goals are not organised along the Energy Union dimensions, the NECP only refers to adaptation policies in general. fourteen Member States detailed the adaptation goals in the NECP itself, 4 only partially, while some of the NECPs only included adaptation action in policies and measures chapters, with adaptation goals not explicitly included.

Examples of adaptation goals include:

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<sup>13</sup> An assessment of the Member States’ adaptation policy reporting under Article 19 of the Governance Regulation is included in the Climate Action Progress Report accompanying the State of the Energy Union Report.

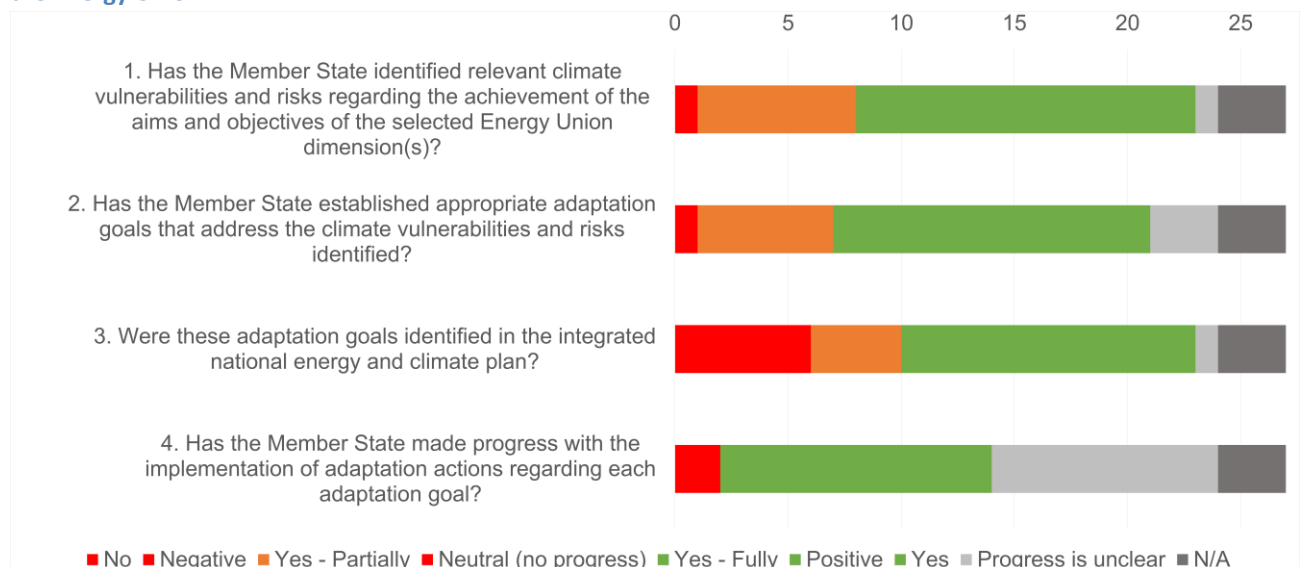
<sup>14</sup> Further analysis of Member State reporting on adaptation goals supporting Energy Union objectives is included in chapter 7 of the European Topic Centre on Climate change adaptation and LULUCF (ETC-CA)’s report about the status of reported national adaptation actions in 2023 (to be published)

- Slovakia substantially strengthening research and the production of technical bases, to prepare by 2021 an action plan for adaptation with clear measures to accelerate the integration of climate change adaptation in all areas.
- Spain’s adaptation goals focusing on plans to avert, minimize and address the climate risks of reduced hydroelectricity production, reduced cooling water resources for power plants, impacts of coastal floods on energy infrastructure and impacts on ports interfering with the trading of energy products.
- Romania presenting policies and measures in agriculture, rural development, and forestry, with specific aim at addressing climate adaptation.

Monitoring and evaluation frameworks for adaptation goals are either recent or under development in the Member States, and operate under national adaptation strategies or plans, rarely considering synergies with the Energy Union dimensions. Thirteen Member States reported clear progress with the implementation of adaptation actions for each adaptation goal. Examples include:

- Austria reported the mainstreaming of adaptation into local energy strategies and the optimization of network infrastructure.
- Finland stated climate change is already being considered in energy policy scenarios, whereby renewable energy sources other than bioenergy are being subsidized, and new measures are taken to adapt the energy infrastructure.
- Malta reported progress among others, in creating incentives to incorporate green features and measures in buildings.

**Figure 2: Overview of the assessment of progress on climate adaptation action supporting the objectives of the Energy Union**



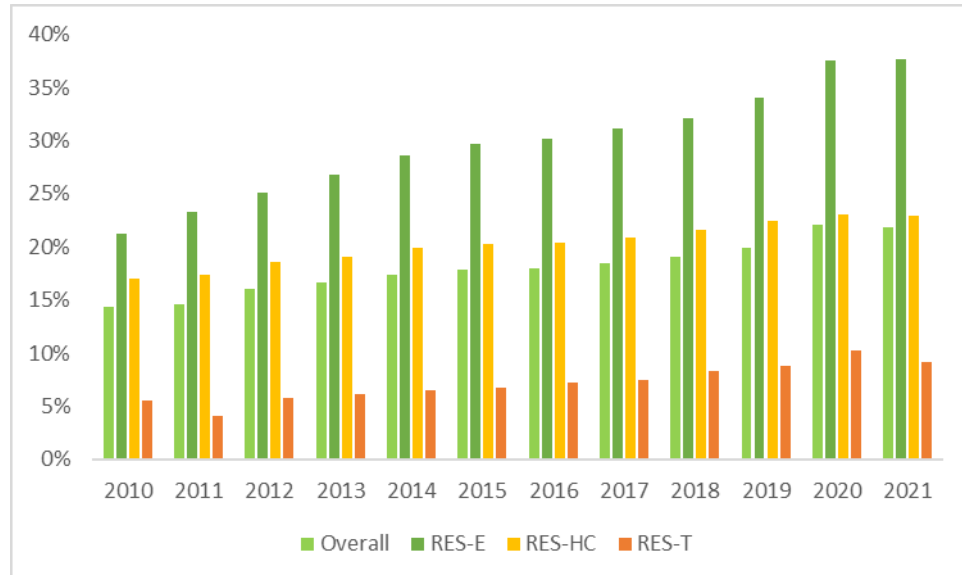
### 2.1.3 Renewable energy

#### 2.1.3.1 Overall renewable share

In 2021, the EU reached a share of 21.8 % of renewable energy in gross final energy consumption, a slight reduction compared to 2020 (22%), which can be explained to a large degree by a higher overall energy consumption as economic activity picked up following the lifting of COVID restrictions. Moreover, several Member States saw their shares dropping. In absolute terms, the consumption of renewable energy increased by approx. 5% compared to 2020, with 220 804 Mtoe compared to 209 595 Mtoe the year before.

Putting the progress in the context of the pathway towards 2030, the 2021 RES share of 21.8% is slightly below the target of the binding interim trajectory share of 22.2% for 2022.<sup>15</sup> **based on the 2030 target of 32% in RED II and would be more than 2 percentage points below this trajectory when considering the updated target of 42.5% (the milestone would be slightly above 24%).** On average, the overall renewable energy share has been increasing by 0.67 percentage points annually since 2010. The new 2030 EU target of 42.5% (and even more so the aspirational target of 45%) will require a much faster growth in the coming years. Progress has been especially strong in the **electricity sector**, with an increase in the renewables share from 21.3% in 2010 to 37.6% in 2021. The progress in **heating and cooling** (from 17% to 22.9%), and **transport** (from 5.5% to 9.1%). While final numbers for 2022 are not available yet, an acceleration of renewables deployment can be expected, although not yet at the level required for the updated 2030 target. 2022 saw especially strong increases in newly installed capacities for solar PV and wind which were 45% (wind) and 47% (solar PV) higher than in 2021. Moreover, in 2022, sales of heat pumps rose by 39% compared to 2021<sup>16</sup>. The solar thermal market increased by almost 12%<sup>17</sup>.

Figure 3: EU-27 RES-shares 2010-2021 (%)



Sources: Eurostat SHARES

The renewable energy shares in 2021 vary widely across Member States, reflecting the different starting positions and national targets set for each Member State in RED I and the national contributions set in the National Energy Climate Plans. Sweden achieved the highest renewable energy

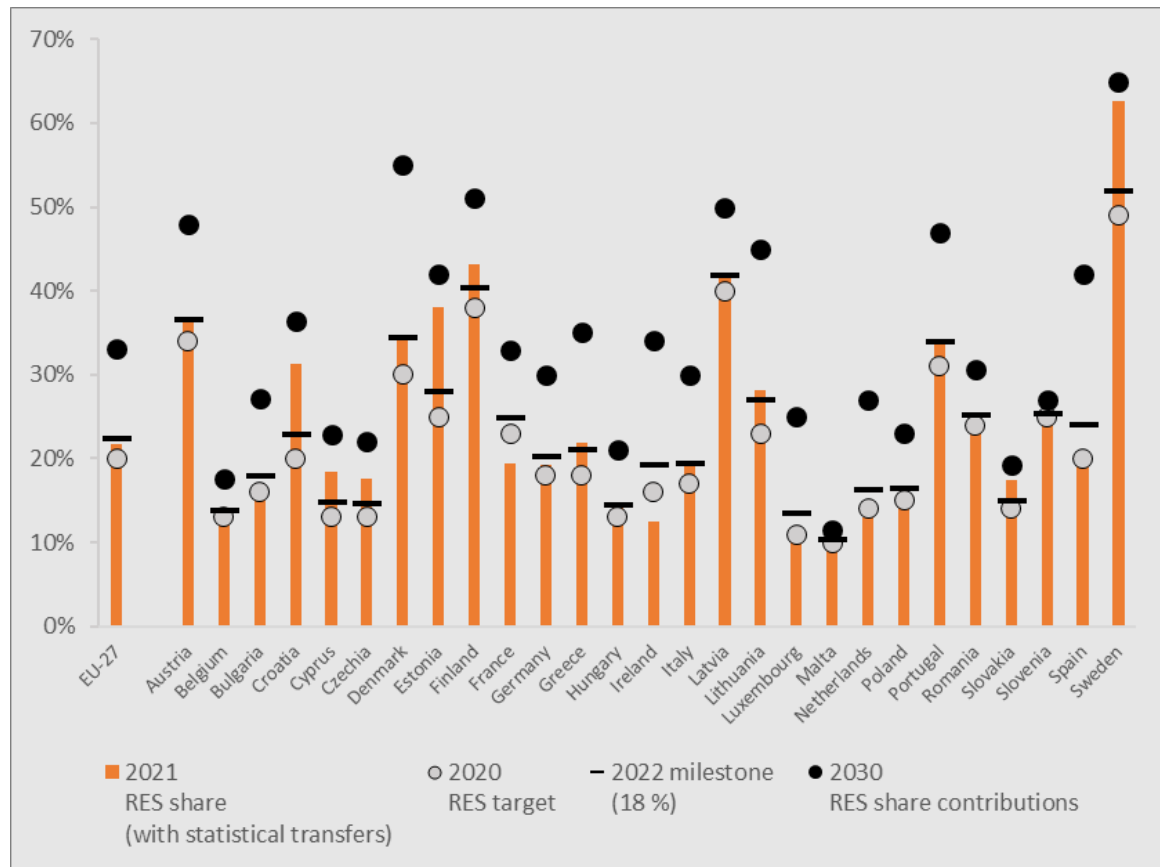
<sup>15</sup> Governance Regulation Article 4

<sup>16</sup> [Market data – European Heat Pump Association \(ehpa.org\)](https://ehpa.org/)

<sup>17</sup> [Solar thermal and concentrated solar power barometer 2023](#)

share in 2021 (63%), followed by Finland (43%) and Latvia (42%). The lowest renewable energy shares were seen in Luxembourg, Malta, Ireland, the Netherlands in Belgium, all with a share not higher than 13%. Several Member States saw substantial drops in the share, especially Bulgaria with a drop of 6.3 percentage points (mainly due to the reduction in bioenergy resulting from the lack of transposition of the relevant rules) and Ireland with a drop of 3.7 percentage points (due to not engaging in statistical transfers and a reduction of bioenergy). Others such as Estonia (with a rise of almost 8 percentage points) saw greater increases, especially due to not (or less) engaging in statistical transfers.

**Figure 4: Member States RES shares 2021 with statistical transfers vs. 2020 target, 2022 milestone and 2030 RES share contribution**



**Source: Eurostat SHARES, RED, NECPs, calculation (2022 milestone)**

Considering both national deployment and currently notified statistical transfers, the following Member States had in 2021 a share below their 2020 binding renewable energy target under RED I: France (3.7 percentage point lower than the 2020 target), Ireland (3.5 p.p.), the Netherlands (1 p.p.) and Romania (0.6 p.p.). This means that these Member States will have to take, within one year, additional measures to cover the gap within the duration of one more year<sup>18</sup>. The following Member States have used statistical transfers in 2021 to meet the baseline: Belgium, Luxembourg, Slovenia and Malta. These countries bought renewables surpluses from Denmark, Czechia, Finland and Estonia (see 2.1.3.6 for more details).

Three Member States were already high above their 2022 milestone: Sweden (63%, milestone: 52%), Estonia (38%, milestone: 28%) and Croatia (31%, milestone: 23%).

<sup>18</sup> according to Art. 32 (4) Governance Regulation

### 2.1.3.2 RES-Electricity

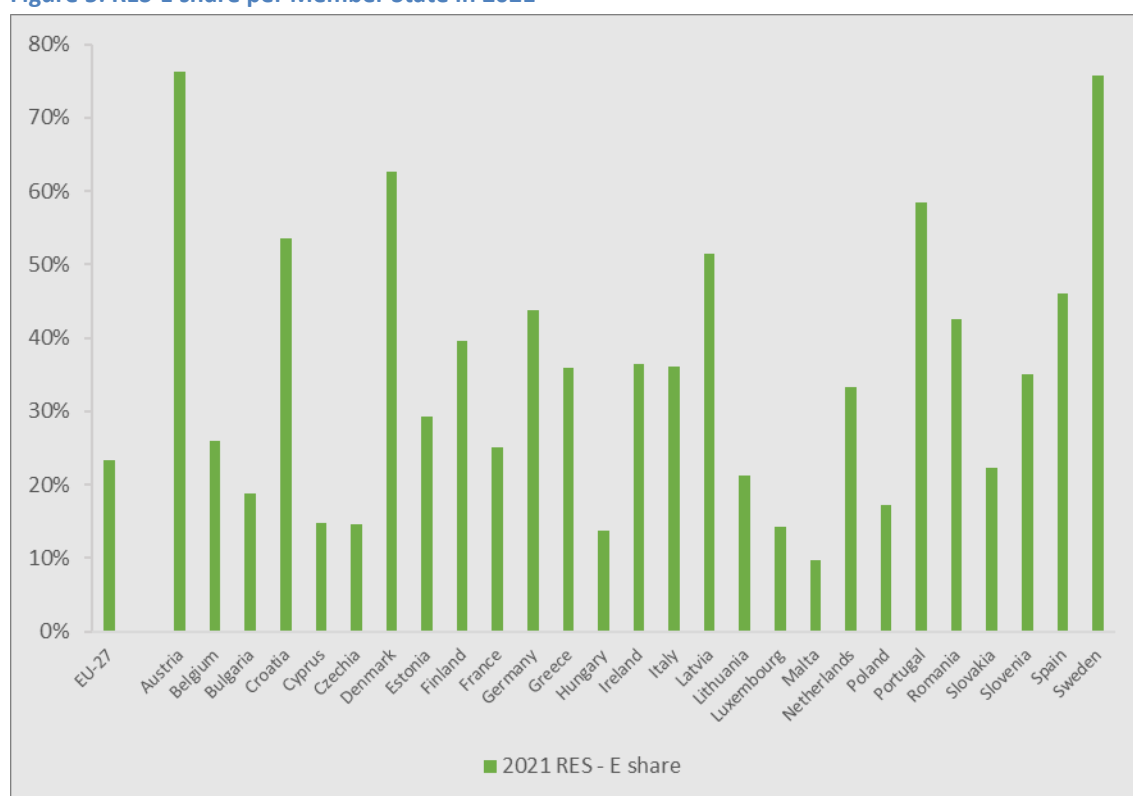
Between 2010 and 2021, the share of RES technologies in the total electricity generation has seen a continuous increase. The sector had a renewables share of 37.6%, a modest increase of 0.3 percentage points due to overall higher energy demand compared to the very strong increase of 3.4 percentage points from 2019 to 2020.

The largest share in RES-E technology was hydro with 348 TWh production in 2021, followed by 339 TWh for onshore wind, 159 TWh for solar PV, 93 TWh for solid biomass, 53 TWh for biogas and 48 TWh for offshore wind. Geothermal electricity (7 TWh), solar thermal (5 TWh) and bioliquids (4 TWh) played minor roles in the RES-E mix.

The installed **RES-E generation capacity** observed in 2021 corresponds to the results shown for RES-E production above. In 2021, the technology with the highest installed capacity was wind onshore with 173 GW with an increase from 2020 to 2021 of 11 GW added. Solar PV capacity increased from 136 GW to 162 GW and now has the second largest generation capacity. Hydro had the third largest generation capacity (152 GW), the total installed capacity has remained largely unaltered. Wind offshore increased from 14.5 GW in 2020 to 15.1 GW in 2021. Biomass (16 GW), Biogas (11.3 GW), Bioliquids (1.2 GW) and Geothermal (0.9 GW) had a relatively smaller share of the RES-E generation capacity in 2021.

In the **RES-E sector**, Austria had the highest RES-E share in 2021 with 76.2%, followed by Sweden (75.7%) and Denmark (62.7%). Five Member States remained under 15% in 2021: Malta (9.7%), Hungary (13.2%), Luxembourg (14.2%), Czechia (14.5%) and Cyprus (14.8%).

Figure 5: RES-E share per Member State in 2021



Source: Eurostat SHARES

Eighteen Member States reported on the assessment of the support for electricity from renewable sources. Six Member States (DE, ES, HU, IT, NL, SI) finished the assessment, four (AT, BE, CY, IE)



reported the assessment was ongoing, and for the remaining eight the assessment has not yet been done. Of the six Member States that finished their assessment, five included information on the effectiveness of the schemes but provided limited or unclear information on the distributive effects. The support schemes investigated vary a lot, including tariff incentives, fiscal incentives, investment supports, grant schemes and tenders to complete scheme for renewable energy production including renewable electricity.

### *2.1.3.3 RES-Heating & Cooling*

Between 2020 and 2021, the share of renewables in this sector stagnated at approximately 23 %. The consumption of renewable energies in the RES-H&C sector has increased gradually between 2010-2020.<sup>19</sup> In 2021, RES-H&C consumption at EU-level reached 110 Mtoe.

Solid biomass was and remains the largest renewable energy contributor to the sector with 88 845 ktoe (including renewable municipal waste). However, energy consumption from heat pumps increased sharply and stood at 14 682 ktoe, biogas at 3 945 ktoe, solar thermal heating at 2 518 ktoe, bioliquids at 684 ktoe<sup>20</sup> and geothermal heating at 912 ktoe.

The European Union-wide heat pump market data for 2021 confirm its increased deployment in the heating and cooling segment, with a 34% year-on-year growth. This was spurred partially by policies in several countries favourable to electrifying heating needs (e.g., France, Finland, Sweden) and the increase in summer cooling needs for the area of reversible heat pumps in cooling mode. The upwards trend for heat pumps accelerated in 2022 (see 2.1.3.1.) Other sectors have boosted the increase in total renewable heat consumption – biogas, renewable municipal waste, solar energy and bioliquids. Between 2020 and 2021, the distribution between the various renewable heat sectors worked to the benefit of heat pumps (from 12.7 to 13.1%) and to a lesser extent for solid biofuel (from 75,3 to 75,5%). The share decreased for biogas from 3.9 to 3.5%, for renewable municipal waste from 3.8 to 3.7%, and for solar from 2.4 to 2.2%. The share of geothermal energy remained at 0.8% and bioliquids remained at 1.1%.

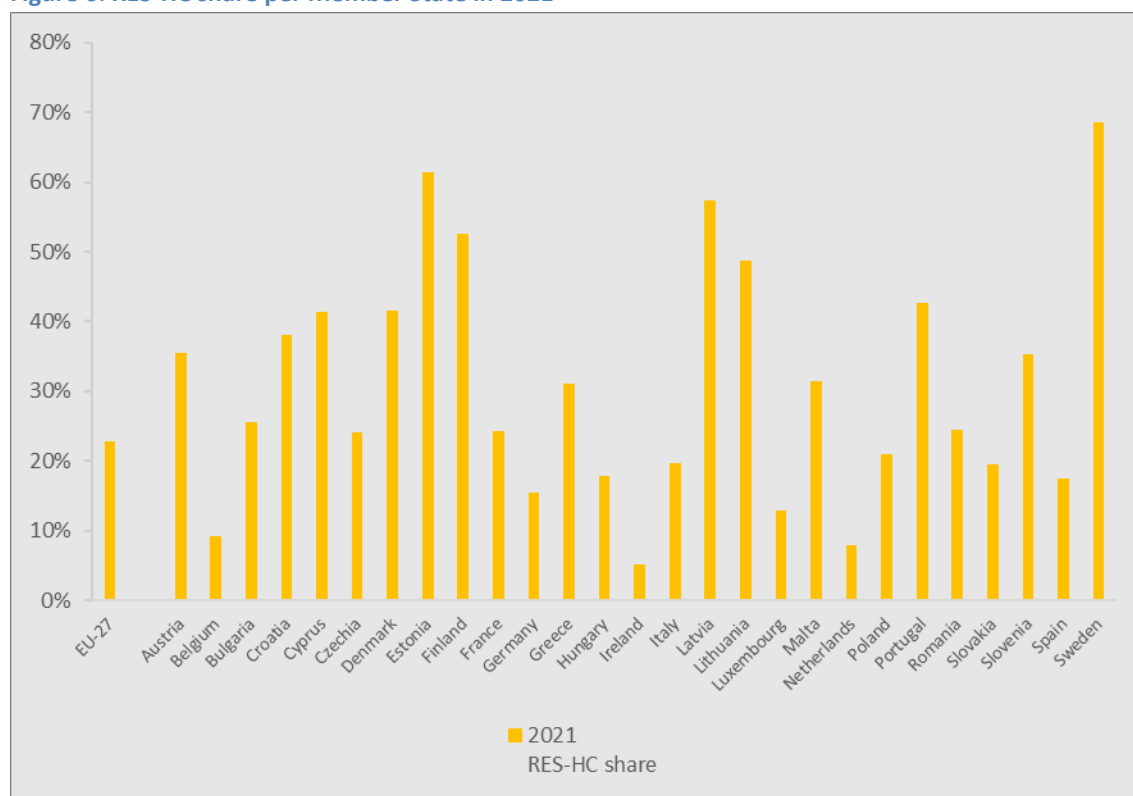
In the **Heating and Cooling sector**, Sweden (68.6%) had the highest share of renewable energy in 2021, followed by Estonia (61.3%), Latvia (57.4%) and Finland (52.6%). In contrast, Ireland (6.3%), the Netherlands (8.1%) and Belgium (8.4%) had the lowest renewable energy share in Heating and Cooling. Bulgaria (from 37.2 to 25.6 percentage points) and Denmark (51.1 to 41.5) both saw their shares strongly reduced, linked mainly to bioenergy accounting, while Malta showed a strong increase by more than 8 percentage points (23.0 to 32.4 percentage points), which is strongly linked to changes in the possibility to account cooling towards the RES share.

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<sup>19</sup> Since the Delegated Act establishing the methodology to calculate renewable cooling was adopted on 14 December 2021, the renewable heating and cooling shares for 2020 do not yet include contribution from renewable cooling.

<sup>20</sup> Compliant bioliquids only

Figure 6: RES-HC share per Member State in 2021



Source: Eurostat SHARES

### **Renewable energy in buildings**

On the newly introduced reporting categories of renewable energy consumed in and produced by buildings, only limited information from Member States was received which was in addition not easily comparable.

Most of the Member States reported information regarding **final energy consumption from renewables in buildings for heating purposes**. The most reported fuel/technology is (in descending order for 2021): biomass (21 countries), heat pumps (19), solar thermal systems (17), geothermal systems (12) and other decentralised renewable sources (8).

**Renewable heat produced and fed into the grid** was also reported frequently, the most for biomass (12 countries in 2021), followed by other decentralised renewable sources (8), geothermal systems (7), heat pumps (5) and solar thermal systems (4).

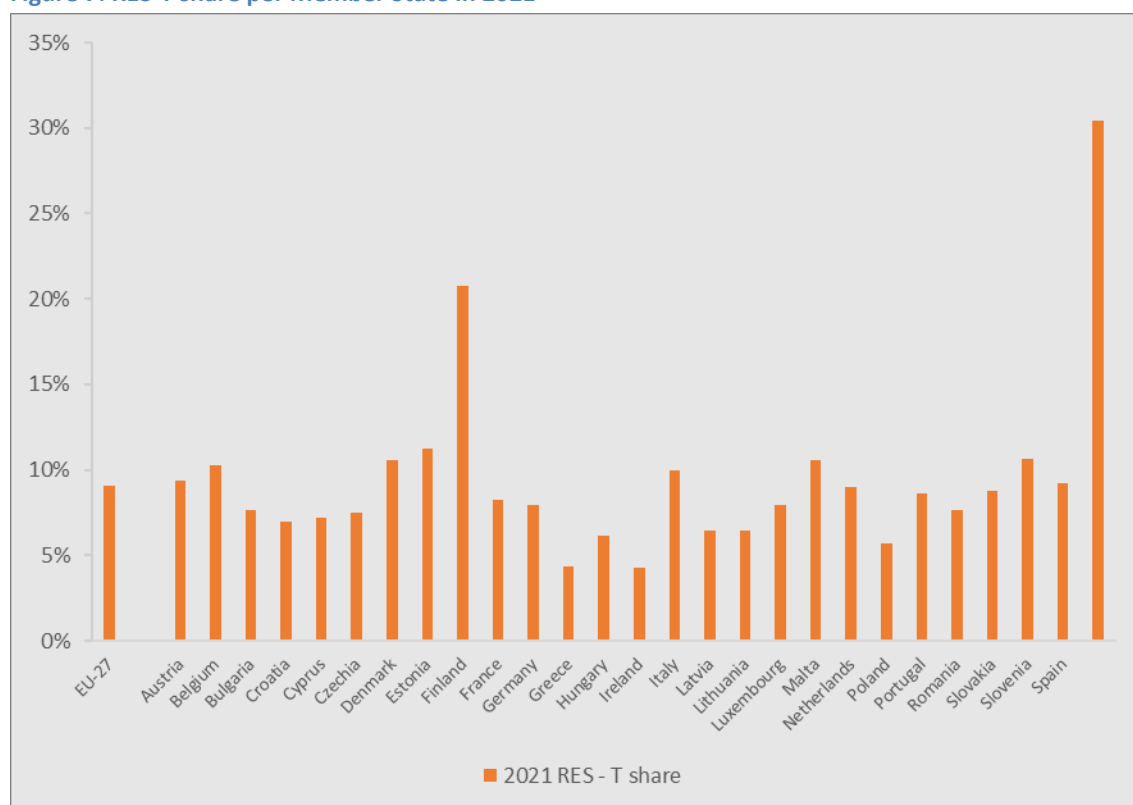
**Renewable electricity production in buildings** was reported the most for solar PV systems (15 countries in 2021), and to a lesser extent for other decentralised renewable sources (4) and biomass (4).

#### 2.1.3.4 RES-Transport

The transport sector remained in 2021, with a share of 9.1% (down from 10.25% in 2020), the sector with the lowest penetration of renewables. Overall, progress in the consumption of renewable energies in the RES-T sector has been slow compared especially with the power sector over the last decade. The decline of the renewables share in 2021 compared to 2020 can be attributed to a large extent to the overall increase of mobility. Biofuels remain with 17 Mtoe (compared to 16 Mtoe in 2020) the largest source of renewable energy. The share of Annex IX biofuels continues to increase and represents around 5.5 Mtoe. However, biofuels based on food and feed crops continue to have the highest share (10 Mtoe). The use of renewable electricity for transport was, at approx. 1.645 Mtoe, slightly lower than in 2020 (1.68 Mtoe).

The highest share of renewable energy in the transport sectors in 2021 can be observed in Sweden, where the RES-T share stood at 30.4%, followed by Finland with 20.7%. Only six further Member States surpassed 10% in their RES-T share: Estonia (11.2%), Malta and Slovenia (both 10.6%), Denmark (10.5%), Belgium (10.3%) and Italy (10%). Four Member States were lower than 7%: Poland (5.7%), Hungary (6.2%), Latvia (6.4%) and Lithuania (6.5%).

Figure 7: RES-T share per Member State in 2021



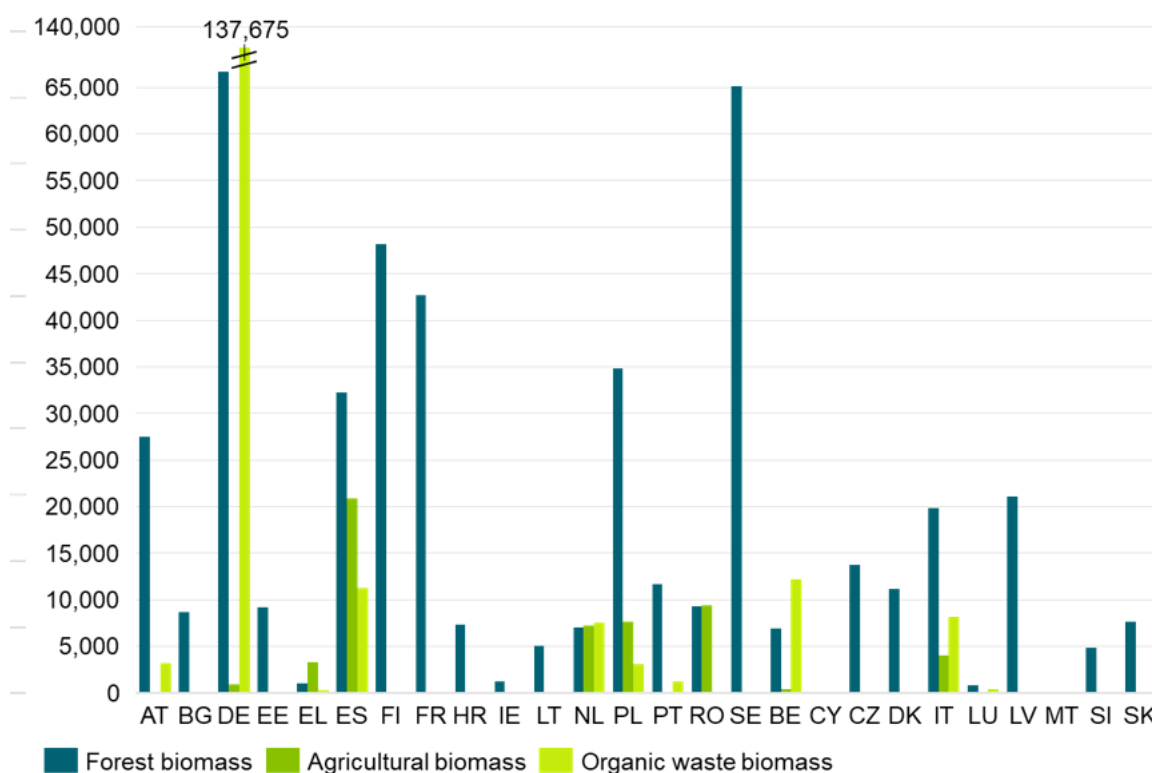
Source: Eurostat SHARES

### 2.1.3.5 Other trajectories

#### Indigenous production of biomass for energy use

26 Member States<sup>21</sup> have reported their data on biomass supply (Figure 8). Their indigenous production can be seen in the Figure 9 below. According to the reported data, Germany has a significant production of organic waste biomass (137,675 thousand m<sup>3</sup>). It also produces the largest share of forest biomass (66,658 thousand m<sup>3</sup>) in the EU, followed by Sweden (65,102 thousand m<sup>3</sup>). Spain has the highest volumes of agricultural biomass (20,844 thousand m<sup>3</sup>).

**Figure 8: Primary supply of solid biomass in 1000 m<sup>3</sup> for energy production, indigenous production in 2021**

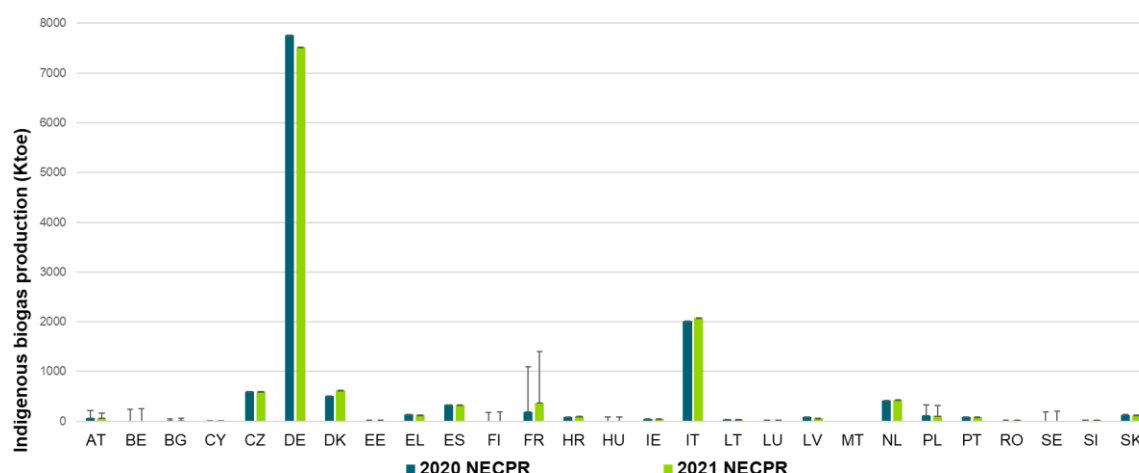


**Source: EUROSTAT, Supply of biomass, annual data**

In 2020, according to the reported data, Germany was the largest producer of biogas, with 52.8 % of the total amount produced (7,765 ktoe), followed by Italy that accounted for 13.7% (2,018 ktoe), France 7.4% (1,090 ktoe) Czechia (4.1%, 595 ktoe), and Denmark (3.4%, 505 ktoe). In 2021, Germany remained the largest producer, accounting for 50.4% of the total production (7,518 ktoe), followed by Italy (13.9%, 2,078 ktoe), France 9.4% (1,404 ktoe) and Denmark (4.2%, 625 ktoe), which overtook Czechia (4.0%, 591 ktoe) in biogas production.

<sup>21</sup> All Member States except Hungary reported data on biomass supply:  
[https://ec.europa.eu/eurostat/databrowser/view/NRG\\_CB\\_BM/default/table?lang=en&category=nrn.nrg\\_quant.nrg\\_quanta.nrg\\_cb](https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_BM/default/table?lang=en&category=nrn.nrg_quant.nrg_quanta.nrg_cb).

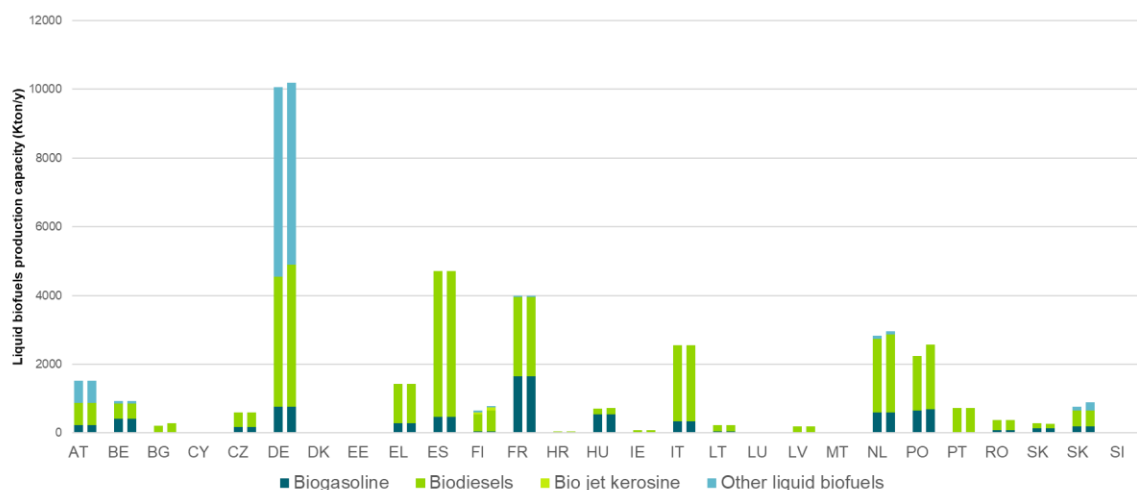
Figure 9: Indigenous biogas production in 2020 (left bar) and 2021 (right bar) per Member State.



Source: NECPRs

When it comes to liquid biofuels, Germany reported the biggest production capacity in both 2021 and 2022 (10,058 and 10,180 kton, respectively), followed by Spain (4,701 kton for both years) and France with a capacity of 4,000 kton for both years.

Figure 10: Liquid biofuel production capacities in 2020 (left bar) and 2021 (right bar) per Member State.



Source: Eurostat table NRG\_INF\_LBPC

21 Member States reported in the NECPRs regarding the evolution of bioenergy supply and whether that has an impact on the overall and sectoral trajectories for renewable energy from 2021 to 2030. 8 Member States<sup>22</sup> stated that there were no significant impacts or updates to be reported. Of the remaining 13 Member States, Hungary and Latvia stressed the impacts related to Russia’s war of aggression against Ukraine. Sweden emphasized that prices have risen because of the energy crisis. Some Member States (Estonia, Slovakia) reported that changes in legislation impact biomass use for energy production. Others (Italy, Slovenia) reported an expected increase in the use of biomass for energy production, in the years leading up to 2030.

Energy from Waste-to-energy plants can be accounted towards the renewable energy shares, but only as regards the biodegradable part of the waste. There are very few Member States which do not

<sup>22</sup> AT, BG, CY, CZ, DK, EL, FI, and PT.

operate such plants. Exceptions are Bulgaria, Croatia, Malta and Romania. For those reporting values, the share of biodegradable waste used (which is determining the renewables' share of the energy produced) is usually around 50%, Denmark (85%), Hungary (8%) and Austria (20%) being notable exceptions.

21 Member States reported in the NECPRs regarding the evolution of bioenergy supply and whether that has an impact on the overall and sectoral trajectories for renewable energy from 2021 to 2030. 8 Member States<sup>23</sup> stated that there were no significant impacts or updates to be reported. Of the remaining 13 Member States, Hungary and Latvia stressed the impacts related to Russia's war of aggression against Ukraine. Sweden emphasized that prices have risen because of the energy crisis. Some Member States (Estonia, Slovakia) reported that changes in legislation impact biomass use for energy production. Others (Italy, Slovenia) reported an expected increase in the use of biomass for energy production, in the years leading up to 2030.

#### 2.1.3.6 Cross-border collaboration and the use of cooperation mechanisms

Cooperation mechanisms are based on Articles 8-13 of RED II. They include several mechanisms through which Member States can cooperate on renewable energy such as statistical transfers, joint projects, or joint support schemes. A participation in the EU renewable energy financing mechanism is also an option for Member States to cooperate. Out of these mechanisms, Member States made most use of statistical transfers. Statistical transfers are particularly relevant to facilitate target achievement since they enable Member States that have reached a higher renewable energy share than their national target or trajectory to transfer their surplus to another Member State, based on a bilateral agreement. **Currently 6 agreements for statistical transfers were made for the year 2021 while 14 agreements were made for the year 2020.**

Statistical transfers reported by countries for reference year 2021 (thousands of tonnes of oil equivalent, ktoe)

**Table 4: Statistical Transfers 2021**

		Amount added to the share of renewables				
		Belgium	Slovenia	Germany	Luxembourg	Malta
Amount deduced from the share of renewables	Denmark	198.1	0	4.3	68.8	0
	Finland	11.4	0	0	0	0
	Czechia	0	17.9	0	0	0
	Estonia	0	0	0	0	5.2

The other cooperation mechanisms remained largely unused, whereby the already established joint support schemes between Germany and Denmark and Sweden and Norway continued to deliver results<sup>24</sup>. Nevertheless, the cross-border collaboration in the form of joint projects has improved and been incentivized following the implementation of the new instruments that are set up at EU level, notably the Renewable Energy Financing Mechanism<sup>25</sup> and the renewable energy window of the Connecting Europe Facility<sup>26</sup>. An example of this are the first three projects with a status of renewable

<sup>23</sup> AT, BG, CY, CZ, DK, EL, FI, and PT.

<sup>24</sup> For 2020, the joint support schemes resulted in statistical transfers of 50.84 GWh from Denmark to Germany and of 2644 GWh from Sweden to Norway.

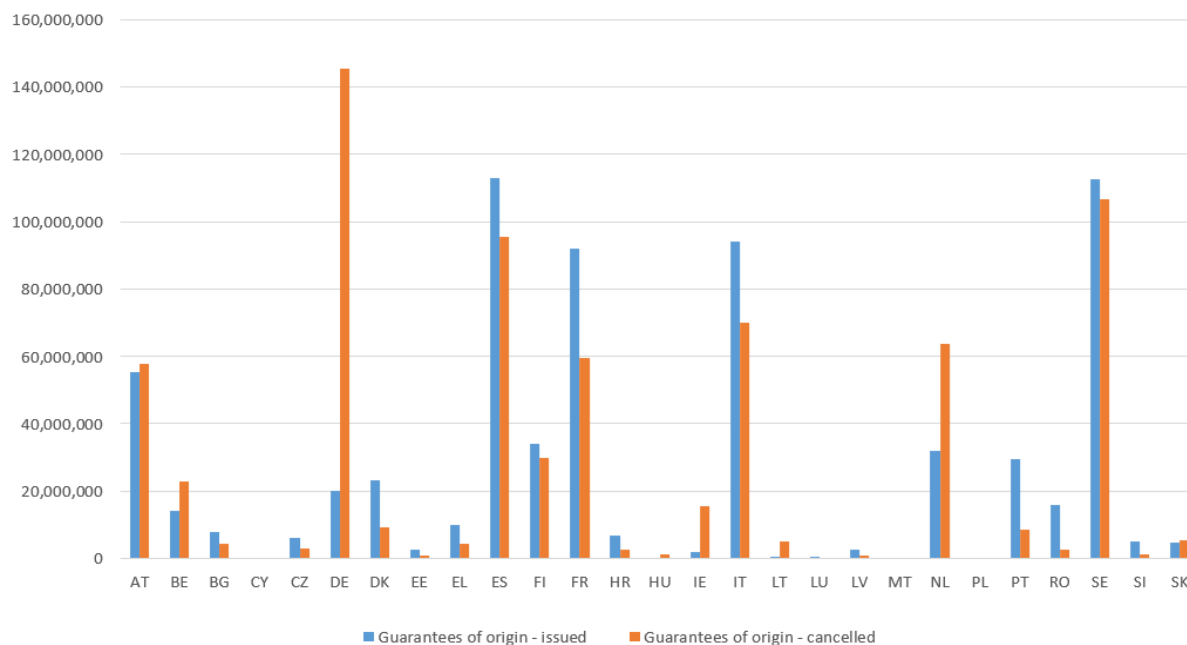
<sup>25</sup> [https://energy.ec.europa.eu/topics/renewable-energy/financing/eu-renewable-energy-financing-mechanism\\_en](https://energy.ec.europa.eu/topics/renewable-energy/financing/eu-renewable-energy-financing-mechanism_en).

<sup>26</sup> [https://energy.ec.europa.eu/topics/renewable-energy/financing/financing-cross-border-cooperation\\_en](https://energy.ec.europa.eu/topics/renewable-energy/financing/financing-cross-border-cooperation_en).

energy cross-border project<sup>27</sup>, as well as the first cross-border tender for renewable energy projects between Luxembourg and Finland, carried out by the Renewable Energy Financing Mechanism.<sup>28</sup>

### 2.1.3.7 Guarantees of origin

**Figure 11: Guarantees of origin issued and cancelled (number) in 2021 – electricity**



This reporting cycle is the first one where Member States are required to provide quantitative data on the implementation of Guarantees of origin scheme in Article 19 of the renewable energy Directive. Guarantees of origin (GOs) are used by suppliers to disclose the share of renewable energy to the final consumers. They are furthermore an essential component of the power purchase agreements (PPAs) which corporates use for investing in renewables and ensure competitive pricing of their energy supply. The number of GOs that can be issued in each Member State depends on the production of renewable energy, for the relevant carrier (electricity, gas, heating & cooling). Each GO represent 1 MWh. The number of GOs issued thus reflect the production of energy, while the number of GOs cancelled indicate the volume that is used by suppliers to disclose towards their consumers or used by corporates in PPA. However, some Member states do not to issue GOs to installations that are supported, and therefore there is not a direct correlation between the RES production and the actual number of GOs issued.

Italy, France and Spain are among the Member States that due to their size issue the highest number of **GOs for electricity**, but Sweden also comes into that group, mainly due to its large production of electricity from hydropower. It is furthermore notable from figure 11 that BE, DE and NL cancel a significantly higher number of GOs than they issue. This indicates a net import of GO certificates to these Member states. Only 5 MS currently report the use of GOs for gas, with DK and NL being the largest users. Only 3 MS report the use of GOs for heating & cooling.

<sup>27</sup> [https://commission.europa.eu/news/commission-adopts-first-list-renewable-energy-cross-border-projects-2022-08-30\\_en](https://commission.europa.eu/news/commission-adopts-first-list-renewable-energy-cross-border-projects-2022-08-30_en)

<sup>28</sup> [https://energy.ec.europa.eu/news/renewable-energy-financing-mechanism-sees-first-tender-established-2023-04-14\\_en](https://energy.ec.europa.eu/news/renewable-energy-financing-mechanism-sees-first-tender-established-2023-04-14_en)

## 2.2 Energy efficiency

Energy efficiency helps reduce overall energy consumption and is therefore central to achieving the EU's climate ambition, while enhancing present and future energy security and affordability. The Energy Efficiency Directive 2012/27/EU (EED), as amended by Directive (EU) 2018/2002 and Directive (EU) 2018/844, forms a key part of the European Union (EU) climate and energy legislation, setting the EU's energy efficiency targets and laying the foundation for measures to realise the full energy efficiency potential of the EU economy. In 2023, Directive (EU) 2023/1791 has been adopted, recasting the previous EED (hereinafter, "EED recast"). However, for the purposes of the present report, which covers the year 2021, the new provisions of the EED recast are not considered.

The EED requires all EU Member States to implement measures to improve energy efficiency throughout the different stages of the energy chain, from production to final consumption. These efforts are key to achieve the EU's energy efficiency targets and an essential contribution to the decarbonisation of the EU economy by 2050.

### 2.2.1 Progress towards indicative trajectory and 2030 savings contribution

In the period from 2005 to 2021, the EU energy consumption has followed a general downward trend, as depicted in Figure 12. In 2020, the EU met the target values set in the Energy Efficiency Directive (EED – Directive 2012/27/EU) for 2020 in terms of primary energy consumption (PEC) and final energy consumption (FEC), but the values registered are significantly influenced by the impact of the COVID-19 crisis and the lockdown measures imposed by national authorities to confront the crisis, which restricted importantly the overall activities and consequently reduced the energy demand. In 2021, PEC in the EU at 1311 Mtoe remained lower than in 2019, but was around 6% higher than in 2020, most probably affected by the COVID-19 crisis recovery.<sup>29</sup> This trend could indicate, if continued in the coming years, the structural improvements that took place in the two-year period. However, PEC and FEC values are still far away from the 2030 PEC and FEC targets<sup>30</sup>.

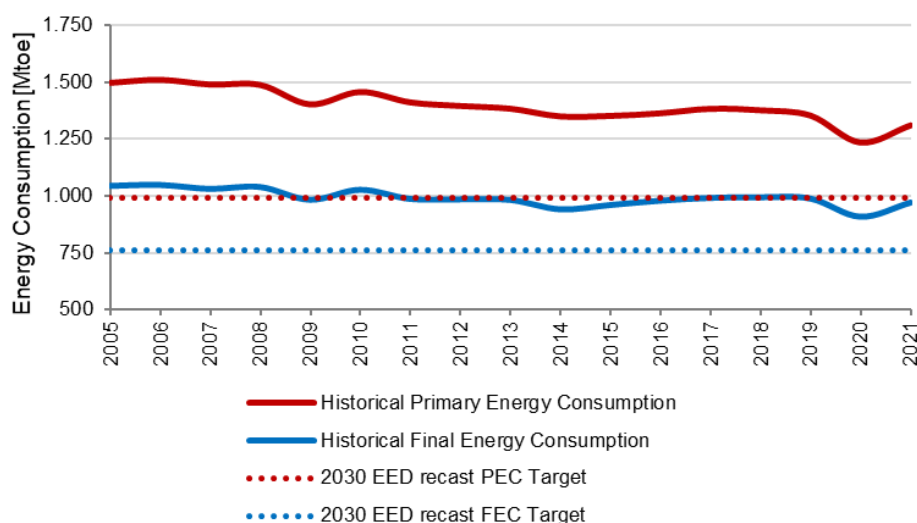
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<sup>29</sup> Paci D., Tsemekidi-Tzeiranaki, S., Clementi, E. L. (2023), Assessment of the 2023 NECP Reports: Monitoring Member States' progress in their energy and climate plans – Summary Report, JRC Technical Report, Publications Office of the European Union, Luxembourg, 2023 (under publication).

<sup>30</sup> As set out in Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)



Figure 12: Final and primary energy consumption trends of the EU27<sup>31</sup>



**Note: PEC and FEC 2030 Targets according to EED Recast 2023**

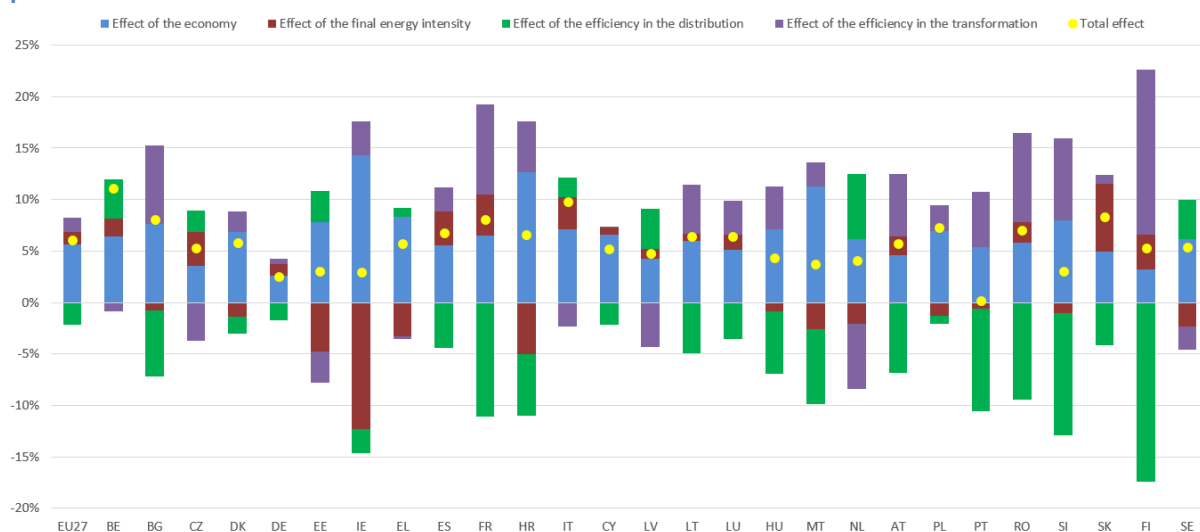
**Source: JRC elaboration on Eurostat data, 2023.**

Figure 13 presents a breakdown of the additive decomposition results in the period 2020-2021, showing the impact of the economic effects and further disaggregating the primary energy consumption into the effects of the final energy intensity and the efficiencies of the distribution and transformation. The economic recovery after the COVID-19 crisis was a determinant factor for the energy consumption increases in all Member States. Improvements in the final energy intensity<sup>32</sup> contributed to reduce energy consumption in 13 Member States. While efficiency in distribution improved, efficiency in the transformation sector worsened across the EU.

<sup>31</sup> The lines represent the historical trajectory between 2005 consumption and the 2021 consumption, and the dotted lines represent the targets to be reached in 2030 for PEC and FEC targets as set out in the EED recast.

<sup>32</sup> Two intensity indicators are often used as energy efficiency indicator for a country. They are presented as a ratio between energy consumption and activity data. In this case, final energy intensity is built as the ratio between final energy consumption and gross domestic product (GDP) of EU27.

**Figure 13: Contribution of different effects on the variation of the PEC in EU27 and Members States over the period 2020-2021.**



**Source:** JRC elaboration on Eurostat data

The reasons indicated for growing or stable consumptions (sorted from high to low recurrences) over the period 2020-2021 are summarised in Table 5.

**Table 5: Main reasons provided by Member States to justify growing or stable final energy consumptions (2020-2021)**

Sector	Reasons
Industry	Economic growth. Increase of value added. Increase of employment
Residential	Worsening of winter/summer conditions. Increase of disposable income of households.
Services	Economic growth. Worsening of winter conditions. Increase of value added. Increase of employment.
Transport	Increase of transport goods/passengers. Economic growth. Increase of value added.

**Source:** JRC elaboration on NECPR data

### ***Trends in consumption***

Final energy consumption in the EU in 2021 was 968 Mtoe and increased by 6,9% compared to 2020, although remaining lower than in 2019. In 2020, FEC reached its lowest value since 2005 and decreased by 8.0% compared to 2019, principally because of COVID-19 pandemics, which restricted the end-use activities and consequently the energy demand. The absolute final energy consumption<sup>33</sup> in 2021 has declined in 18 Member States since 2005, while in 8 Member States it had an increase, in

<sup>33</sup> Indicator ‘Final energy consumption (Europe 2020-2030)’ in the Eurostat dataset ‘Simplified energy balances’ (nrg\_bal\_s).

three cases (Lithuania, Malta and Poland) higher than 20%. In 2021, all Member States have experienced increases in total final energy consumption compared to 2020.

The sector with the most significant FEC increasing trend from 2020 to 2021 is the transport sector, with a 9,3% increase at the EU level. All the Member States (except Lithuania) reported increases in FEC in the transport sector from 2020 to 2021. The largest increases were noted in Italy (+21,8%), Spain (+16,5%) and Slovenia (+13,7%).

Energy consumption in the services sector experienced the second largest increase after the transport sector, with an annual increase at the EU level of 6.7% in 2021 compared to 2020. The most significant growth rates are observed in Slovakia (+27,1%), Bulgaria (+21,0), followed by Luxembourg (+12,4%). In Czechia, Greece and Slovenia, services consumption remained almost stable.

The industrial and residential sectors have registered increases in FEC levels by 4,1% and 5,5% respectively at the EU level. At Member State level, six countries did not report an increase of FEC in the residential sector, while three countries did not report an increase of FEC in the industrial sector. The largest increases were observed in Lithuania (+13,7%), Finland (+12,8%) and the Netherlands (+11,4%) for the residential sector, and in Lithuania (+8,3%), Slovakia (+7,8%) and Malta (+7,6%) for the industrial sector.

#### ***Contribution of different effects to the variation of residential FEC in 2020-2021***

For the residential sector, the exceptional situation of the pandemic crisis observed in 2020 led to a stable FEC compared to 2019, contrary to other main economic sectors which experienced decreases. This is probably due to increased teleworking activities, to home schooling and to the more time spent at home caused by the COVID-19 pandemic. In 2021, FEC in the residential sector increased by 5,5% compared to 2020. The combined impact of weather and wealth<sup>34</sup> led to a substantial increase of energy consumption, thereby offsetting the overall intensity improvements, at the EU level in the residential sector.

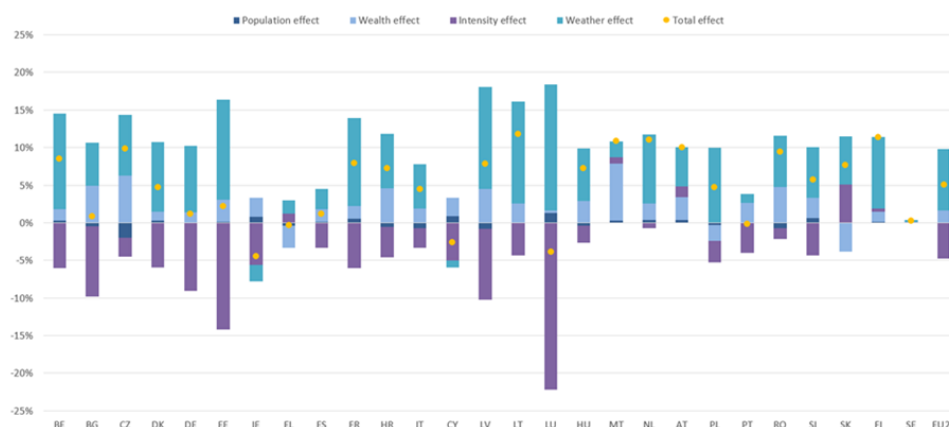
While trends vary from country to country, the Member States' results also suggest that weather and wealth effects were two important factors in growing the energy consumption in many countries. Warmer winter conditions in 2021 with respect to 2020 exerted a limiting force on consumption only for Ireland and Cyprus. Besides Greece, Slovakia, and Poland the wealth effects linked to growth of per capita floor area and disposable income exerted a rise in FEC in the remaining 24 Member States. Intensity<sup>35</sup> drops contributing to abate the energy consumption in almost all Member States, with the exceptions of Greece, Malta, Austria, Slovakia and Finland.

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<sup>34</sup> Total floor area (TFA)/population or gross domestic income (GDI)/population. It reflects changes in energy consumption due to changes in the wealth represented by the total floor area of dwellings (TFA) per capita for the heating end use and gross disposable income in purchasing power standard (GDI) per capita for all other end uses.

<sup>35</sup> The intensity effect is calculated as the ratio between final energy consumption and total floor area (TFA)/gross disposable income (GDI) of the residential sector.

Figure 14: Contribution of different effects on the variation of the residential FEC over the period 2020-2021.



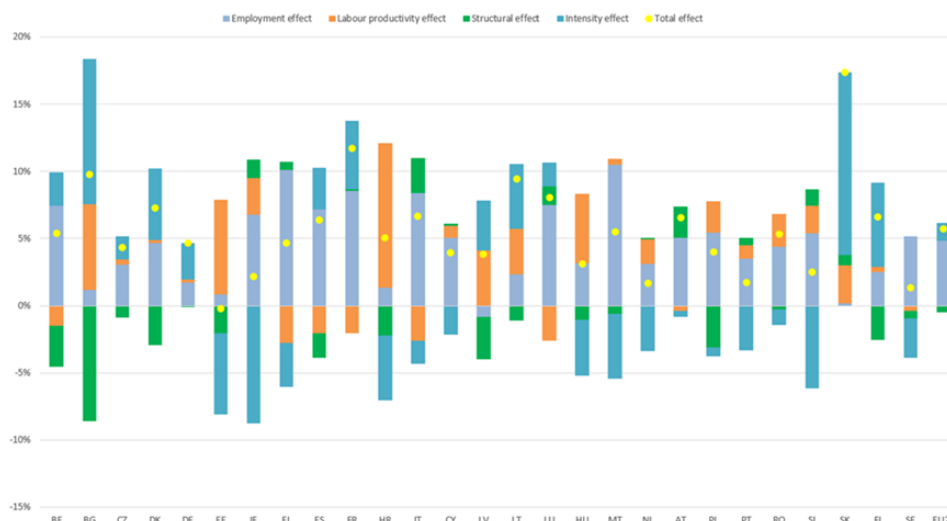
Source : Eurostat, JRC, Odyssee-Mure, 2023

### ***Contribution of different effects to the variation of the productive sectors FEC in 2020-2021***

Figure 14 provides a breakdown of the additive decomposition results in the productive sectors (industry, services and agriculture) in the Member States in the period 2020-2021. At the EU level, the activity effect drives the increase of final energy consumption. However, breaking down this effect into labour productivity (GVA/hours worked) and employment effect (hours worked), it is observed that only the latter effect is responsible for the energy consumption increase in 2021. Also, the intensity effect highlights an increase in final energy consumption, while the minor structural effect contributes to reducing consumption at EU level.

As already observed at EU level, the employment effect represents the most important driving factor in increasing various Member States' energy consumption, except for Latvia. These results can be explained bearing in mind the exceptional circumstances that each Member State faced in managing the Covid-19 pandemic crisis in 2020. The labour productivity effect raises FEC for most of the Member States, except for Belgium, Greece, Spain, France, Italy, Luxembourg, Austria and Sweden. The structural effect results highlight a shift from sub-sectors of higher energy intensity towards those of lower intensity in some Member States, except for Ireland, Greece, France, Italy, Cyprus, Luxembourg, Netherlands, Austria, Portugal, Slovenia and Slovakia. Finally, the intensity effect played an inhibiting role on the energy consumption for 15 countries (Estonia, Ireland, Greece, Croatia, Italy, Cyprus, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia and Sweden). In contrast, the others have experienced an increase in the final energy consumption per value added in monetary terms.

**Figure 15: Contribution of different effects on the variation of the FEC of productive sectors over the period 2020-2021.**



**Source: Eurostat, JRC, 2023.**

### 2.2.2 Exemplary role of public bodies' buildings – Article 5 of the EED

The public sector plays an important exemplary role in enhancing energy efficiency practices. Therefore, Article 5(1) of the EED requires Member States to ensure yearly renovations, as from 1 January 2014, of 3% of the total floor area of heated and/or cooled buildings owned and occupied by their central government and not in compliance with minimum energy requirements. Alternatively, Member States may opt for an alternative approach (under Article 5(6) of the EED) and achieve energy savings that are equivalent to or greater than those that Article 5(1) requires for the same building stock. Tables 6 and 7 provide a summary of the progress made by the Member States in 2021 in connection with Article 5(1), for the default and the alternative approach, respectively. 2021 represents the starting year of the new obligation period 2021-2030, thereby making it premature to derive definite trends.

Compared to the Annual Reports submitted in 2022, there is a lack of information on these issues in the reports submitted in 2023.

As shown in Table 6, none of the 12 Member States that have chosen the default approach achieved its annual target in terms of renovated floor area in 2021. Moreover, four Member States (Hungary, Romania, Latvia and Portugal) provided either no or incomplete information for Article 5. Therefore, Member States will have to step up their efforts as early as possible in the next years of the obligation period to be able to meet the savings requirement for the whole obligation period ending in 2030.

**Table 6: Implementation status of Article 5 of Member States, which have chosen the default approach (Article 5(1)), based on the assessment reports of Member States.<sup>36</sup>**

MS	Central government buildings with floor area > 250 m <sup>2</sup> as at 1/1/2021		Article 5, annual requirement	Article 5 progress in 2021			Central government buildings with floor area > 250 m <sup>2</sup> as at 1/1/2022	
	All [m <sup>2</sup> ]	Which did not meet the energy performance requirements [m <sup>2</sup> ]	Floor area renovation obligation [m <sup>2</sup> ]	Renovated floor area [m <sup>2</sup> ]	Annual obligation achieved in 2021 in terms of floor area [%]	Total renovated floor area over the period 2021 to 2021 (reference year)	All [m <sup>2</sup> ]	Which did not meet the energy performance requirements [m <sup>2</sup> ]
BG	2,571,112	1,761,062	52,832	23,475	44.4%	23,475	2,645,171	1,765,211
EE	1,386,400	853,951	25,619	18,681	72.9%	18,681	1,374,435	835,310
EL	212,725	200,725	6,022	0	0.0%	0	212,725	200,725
ES	11,273,677	9,198,323	275,950	234,688	85.0%	234,688	11,181,083	8,957,807
HU	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
IT	16,485,850	13,380,603	401,418	132,160	32.9%	132,160	16,485,850	13,248,443
LT	0	2,084,688	62,541	34,290	54.8%	34,290	n/a	1,996,800
LU	126,253	61,050	1,832	0	0.0%	0	126,253	61,050
LV	1,560,732	n/a	n/a	63,769	n/a	63,769	1,477,613	n/a
PT	801,489	41,612	1,248	n/a	n/a	n/a	1,683,167	383,425
RO	6,706,840	6,225,080	186,752	n/a	n/a	n/a	6,706,840	5,937,897
SI	957,014	890,992	26,730	0	0.0%	0	965,103	899,081

Source: JRC elaboration on NECPR data

<sup>36</sup> The column “Annual obligation achieved in 2021 in terms of floor area [%]” displays the actual obligation achievement for the year 2021 (if available), which is expressed as the ratio of renovated floor area in 2021 to the respective annual renovation obligation for countries opting for the default approach (Article 5(1)). The colour-code system was used to depict the level of obligation achievement: green circles would indicate countries which fully reached or exceeded their obligation in 2021, while the yellow and red circles show countries which fell short of their 2021 obligation by up to 0-50% and 50-99%, respectively.

**Table 7: Implementation status of Article 5 of Member States which have chosen the alternative approach, based on the assessment reports of Member States.<sup>37</sup>**

MS	Central government buildings with floor area > 250 m <sup>2</sup> as at 1/1/2021		Article 5 progress in 2021		Central government buildings with floor area > 250 m <sup>2</sup> as at 1/1/2022	
	All [m <sup>2</sup> ]	Which did not meet the energy performance requirements [m <sup>2</sup> ]	Primary energy savings achieved in year 2021 [ktoe]	Final energy savings achieved in year 2021 [ktoe]	All [m <sup>2</sup> ]	Which did not meet the energy performance requirements [m <sup>2</sup> ]
AT	n/a	765,125	n/a	0.35	n/a	749,822
BE	n/a	767,766	0.97	0.87	n/a	764,715
CY	2,405,077	319,353	0.53	0.28	2,405,690	308,218
CZ	2,405,077	1,599,209	n/a	0.38	2,405,690	1,582,054
DE	4,800,000	2,900,000	n/a	n/a	4,800,000	2,900,000
DK	1,760,000	1,164,000	n/a	n/a	1,845,000	1,130,000
FI	n/a	2,195,943	n/a	220.00	n/a	2,158,600
FR	21,700,000	0	-15.00	-24.00	0	0
HR	4,309,174	1,506,918	0.27	0.20	4,419,242	1,351,846
IE	n/a	354,793	0.40	n/a	n/a	354,793
MT	167,166	49,215	21.66	6.28	167,166	45,016
NL	n/a	n/a	n/a	-0.20	8,500,000	n/a
PL	n/a	875,653	496.23	n/a	n/a	848,998
SE	n/a	2,044,132	n/a	-0.59	n/a	2,101,420
SK	n/a	1,213,397	n/a	5.81	1,338,089	1,338,089

**Source: JRC elaboration on NECPR data**

Looking at Table 7, all Member States that have chosen the alternative approach, except for the Netherlands, reported the value (in m<sup>2</sup>) of the central government buildings not meeting the energy performance requirements (for both years 2021 and 2022). On the contrary there are some discrepancies on the energy savings reported by Member States. Some of them have reported both primary and final energy savings (Belgium, Cyprus, France, Croatia and Malta), while Ireland and Poland only primary savings. Austria, Czechia, Finland, the Netherlands, Sweden and Slovakia have counted their savings in terms of final energy. Germany and Denmark did not report any savings.

Finally, regardless of the chosen approach, five Member States notified a larger non-compliant total floor area in 2022 with respect to the previous year (2021): i.e. Bulgaria (+0.2%), Portugal (+89.1%), Slovenia (+0.9%), Sweden (+2.7%) and Slovakia (+9.3%).

### 2.2.3 Energy savings obligation – Article 7 of the EED

Article 7 EED requires Member States to achieve an annual amount of cumulative end-use energy savings for the entire obligation period that currently runs from 2021 up to 2030. The obligation could be met by new policy measures that are adopted during the obligation period from 1 January 2021 to 31 December 2030 or by new individual actions adopted during or before the previous period, provided that the individual actions that trigger energy savings are introduced during the following period. To that end, Member States should be able to make use of an energy efficiency obligation scheme, alternative policy measures, or both.

<sup>37</sup> Since no Member State reported information about the article 5 savings, it is not possible to calculate the ratio of achieved annual energy savings in 2021 compared to the annual energy saving obligation for countries opting for the alternative approach (Article 5(6)).

The 2023 National Energy and Climate Progress Reports (NECPRs) are the first reporting iteration for the obligation period 2021-2030. Table 8 below shows the data reported by the Member States about the new energy savings achieved in 2021 under Article 7 EED (in ktoe), comparing it with two benchmarks: their trend of new annual savings averaged over 2018-2020, and the equivalent new annual savings needed in 2021.

**Table 8: New annual savings (in ktoe/year) reported for 2021 by the Member States under Article 7 EED and benchmarks**

	<b>New annual savings reported for 2021 (ktoe/year)</b>	<b>Equivalent new annual savings for a rate of 0.8%/year<sup>38</sup> (ktoe/year)</b>	<b>Achieved in 2021 vs. 0.8%/year (%)</b>	<b>2018-2020 average of new annual savings (ktoe/year)</b>	<b>Achieved in 2021 vs. 2018-2020 average (%)</b>
<b>Austria</b>	116.53	215.96	54.0%	747.82	15.6%
<b>Belgium</b>	275.61	289.22	95.3%	259.64	106.1%
<b>Bulgaria</b>	23.64	79.24	29.8%	35.91	65.8%
<b>Croatia</b>	83.32	23.45	355.2%	27.01	308.5%
<b>Cyprus</b>	54.40	4.42	1231.3%	76.17	71.4%
<b>Czechia</b>	119.90	200.64	59.8%	186.38	64.3%
<b>Denmark</b>	63.67	116.62	54.6%	165.20	38.5%
<b>Estonia</b>	65.59	22.93	286.1%	121.91	53.8%
<b>Finland</b>	462.90	164.15	282.0%	515.88	89.7%
<b>France</b>	2072.00	1185.07	174.8%	1955.86	105.9%
<b>Germany</b>	3691.35	1735.64	212.7%	2869.43	128.6%
<b>Greece</b>	34.55	132.71	26.0%	252.09	13.7%
<b>Hungary</b>	45.33	143.84	31.5%	131.07	34.6%
<b>Ireland</b>	65.69	94.18	69.7%	90.73	72.4%
<b>Italy</b>	1128.00	926.85	121.7%	926.20	121.8%
<b>Latvia</b>	45.77	32.00	143.0%	122.13	37.5%
<b>Lithuania</b>	177.47	42.65	416.1%	100.75	176.2%
<b>Luxembourg</b>	20.00	33.51	59.7%	14.38	139.1%
<b>Malta</b>	1.93	1.49	129.5%	5.51	35.0%
<b>Netherlands</b>	751.53	401.69	187.1%	642.73	116.9%
<b>Poland</b>	552.02	557.00	99.1%	276.53	199.6%
<b>Portugal</b>	104.97	122.55	85.7%	143.58	73.1%
<b>Romania*</b>					
<b>Slovakia</b>	106.02	74.85	141.6%	80.64	131.5%
<b>Slovenia</b>	51.94	39.44	131.7%	45.94	113.0%
<b>Spain</b>	270.16	669.25	40.4%	547.79	49.3%
<b>Sweden*</b>					
<b>Total**</b>	<b>10384.29</b>	<b>7309.35</b>	<b>142.1%</b>	<b>10341.28</b>	<b>100.4%</b>

\* data of energy savings achieved in 2021 not yet available at time of assessment

<sup>38</sup> 0.24% for Cyprus and Malta; calculated for all Member States based on the target they reported in their National Energy and Climate Plans (NECPs) in 2019, with two simplifying assumptions: (1) savings would have a lifetime of at least 10 years; (2) the same rate of savings would be achieved each year from 2021 to 2030.



**\*\* sum for 25 Member States**

**Source: data reported by the Member States in their NECPR 2023 (first column), their first National Energy and Climate Plan in 2019 (second column) and in previous reporting to the Energy Efficiency Directive (fourth column).**

By 7 September 2023, 25 Member States<sup>39</sup> had reported energy savings data for 2021. These reported new annual energy savings amount to 10384 ktoe/year. The equivalent amount of new annual savings corresponding to the target of 0.8%/year<sup>40</sup> is 7309 ktoe/year for these 25 Member States altogether. Reported savings are thus 42.1% higher than needed savings.<sup>41</sup>

The average of new annual energy savings in 2018-2020 for the same 25 Member States was 103<sup>41</sup> ktoe/year. The energy savings reported for 2021 are therefore about the same as the trend in the years 2018-2020 (for these 25 Member States). However, the EED recast has revised the required equivalent rates of new annual savings, with a progressive increase.<sup>42</sup>

Due to the cumulative nature of the energy savings obligation, the results achieved in the first years of a period are essential for the likelihood of achievement of the target. A higher rate of savings than needed does not mean that a Member State will achieve its target. However, a significantly lower rate of savings in the first years of a period can be very difficult to compensate in the remaining years of the period.

Figure 16 below provides information on the distribution per main type of policy instrument for reported energy savings in 2021 (left) and numbers of reported policy measures (right). Energy or CO<sub>2</sub> taxes and Energy Efficiency Obligation Schemes (EEOS) represent half of the reported savings (26% and 24% respectively), while they represent only 9% of the number of measures (5% and 4% respectively). Financing schemes and instruments represent half of the number of measures, while they represent 19% of the reported savings.

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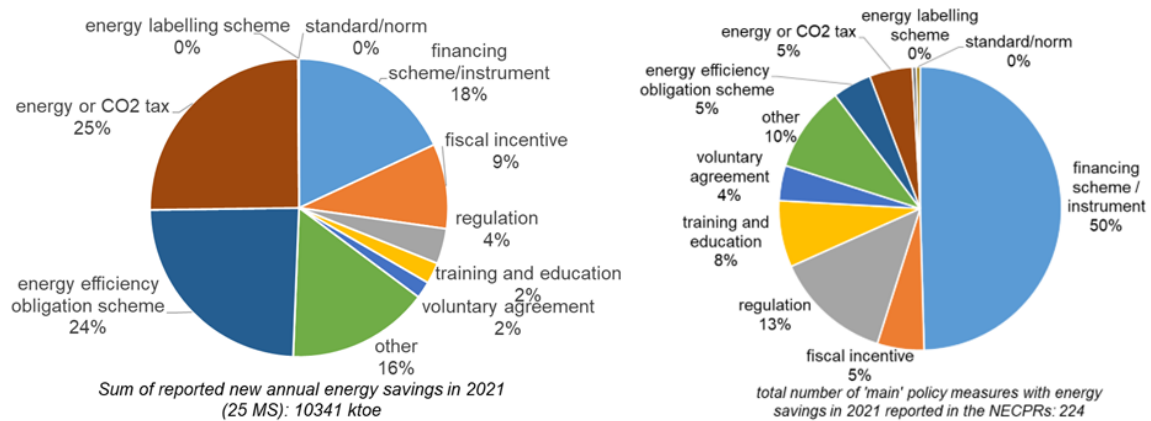
<sup>39</sup> At that time, the data submitted by Romania and Sweden did not include data about energy savings achieved in 2021.

<sup>40</sup> This rate is 0.24%/year for Cyprus and Malta. The amount of needed new annual savings has been calculated here based on the amount reported by the Member States in their National Energy and Climate Plans due by 31 December 2019.

<sup>41</sup> This figure should be taken with caution, as needed savings were calculated with two simplifying assumptions: (1) savings would have a lifetime of at least 10 years; (2) the same rate of savings would be achieved each year from 2021 to 2030. In practice, needed savings may be higher, for example in those instances where reported savings have a short lifetime (e.g. energy and CO<sub>2</sub> taxes).

<sup>42</sup> 0.8%/year in 2021-2023, 1.3% in 2024-2025, 1.5% in 2026-2027 and 1.9% from 2028 onward. Except for Cyprus and Malta (0.24% in 2021-2023 and 0.45% in 2024-2030).

**Figure 16: Share of new annual energy savings achieved by type of policy measure (left) and distribution of the number of reported ‘main’ policy measures per type of policy measure (right) at EU-level (data for 24 Member States)**



**Source: DG ENER’s own calculations based on the data submitted by the Member States in their NECPR 2023 about the policy measures reported to Article 7(1) for the period 2021-2030 and related new annual energy savings for 2021 (data available for 24 Member States).**

It should be noted that Member States may report energy savings per group of policy measures<sup>43</sup>. Moreover, 2021 is the first year of the current obligation period 2021-2030. The distribution of energy savings per policy instrument then gives a higher weight to policy measures with short lifetime (e.g. energy and CO<sub>2</sub> taxes), compared to what they will represent in cumulative terms over 10 years<sup>44</sup>.

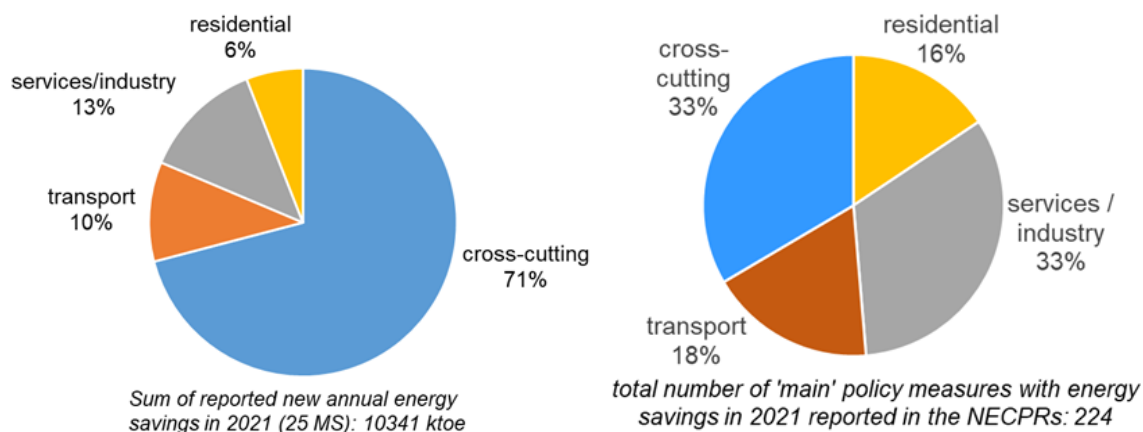
Figure 17 below provides the same type of distribution per type of end-use sector targeted by the policy measure. In case a policy measure covers several sectors, it is included in the “cross-cutting” category. The largest share of energy savings reported by Member States results from such cross-cutting measures (74%), while they represent 34% of the number of policy measures. Cross-cutting measures have indeed a larger scope than measures targeting a given sector.<sup>45</sup>

<sup>43</sup> In case of energy savings reported per group of policy measures, the data does not include the distribution of energy savings among the policy measures included in this group. To build the figure, the energy savings of a group of measures were allocated to the ‘main’ measure in this group (i.e. the first one listed in the reported data).

<sup>44</sup> Energy savings from energy and CO<sub>2</sub> taxes have an equivalent lifetime of 1 year. So, 1 ktoe in 2021 from an energy tax will make 1\*1 = 1 ktoe of cumulative savings over 2021-2030. On the contrary, energy savings from renovation programmes have a lifetime of more than 10 years. 1 ktoe in 2021 from a renovation program will make 1\*10 = 10 ktoe of cumulative savings over 2021-2030.

<sup>45</sup> This is one of the reasons why they represent the largest share of savings (as in the period 2014-2020). The low share of savings in the residential sector can be partly explained because policy measures targeting buildings are considered cross-cutting (residential and services).

**Figure 17: Share of reported cumulative energy savings by sector at EU-level (data for 24 Member States)**



**Source: DG ENER's own calculations based on the data submitted by the Member States in their NECPR 2023 about the policy measures reported to Article 7(1) for the period 2021-2030 and related new annual energy savings for 2021 (data available for 24 Member States).**

By 7 September 2023, 26 Member States<sup>46</sup> have reported in their NECPRs a total of 224 policy measures (or groups of measures) to Article 7 EED with energy savings data. Member States with the highest number of reported measures are Slovakia (41), Belgium and Germany (25 each), and Cyprus (21). At the opposite, two Member States have reported a single policy measure with energy savings in 2021: France (white certificates scheme) and Luxembourg (EEOS).<sup>47</sup> 175 of the 334 single measures<sup>48</sup> are new compared to the policy measures previously reported in the 2014-2020 period. 13 Member States are currently implementing an EEOS. Moreover, Spain's EEOS includes from 2023 a white certificates scheme, adding to the three other white certificates schemes in the EU (France, Italy and Poland).

20 Member States mentioned that at least one of their policy measures or group of measures is contributing to energy poverty alleviation (with a total of 42 policy measures or group of measures).<sup>49</sup> However, only 12 Member States reported an amount of energy savings related to energy poverty alleviation (for a total of 14 policy measures or group of measures).

- Energy Audit Obligation – Article 8 of the EED

To optimise energy savings in the industrial sector, Article 8 of the EED requires companies that are not small or medium enterprises to carry out an energy audit or to implement an energy management system at least once every four years. In their NECPRs, Member States were required to state the total estimated number of large companies in their territory to which Article 8(4) of the EED is applicable and the number of energy audits carried out in those enterprises. The overview for 2020 and 2021 is shown in Figure 18 below.

For 2021, only Austria and Romania did not report information on the number of large companies. While only Austria did not report the energy audits carried out in those companies. On the contrary,

<sup>46</sup> Romania did not report information about Article 7 EED in its NECPR. Sweden reported information about its energy and CO2 taxes, but without energy savings data.

<sup>47</sup> Sweden reported a single type of measures (energy and CO2 taxes) but did not report data about energy savings in 2021 yet.

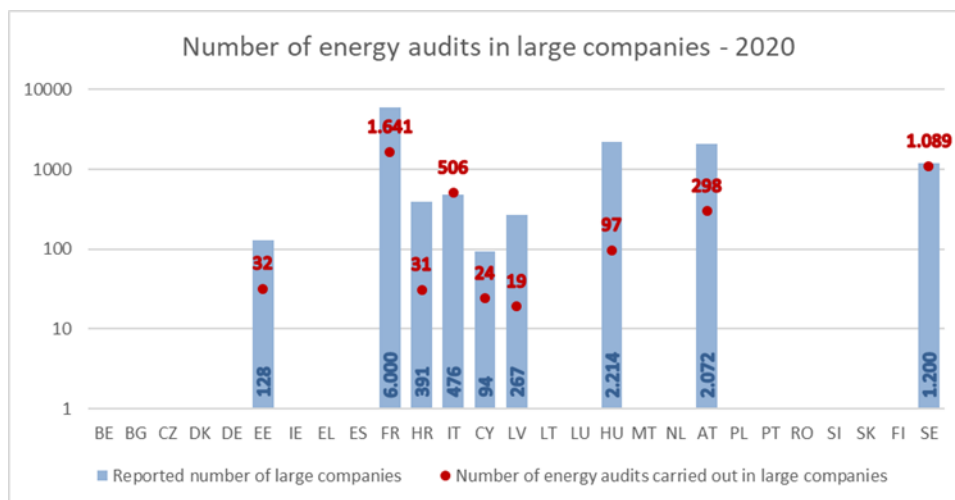
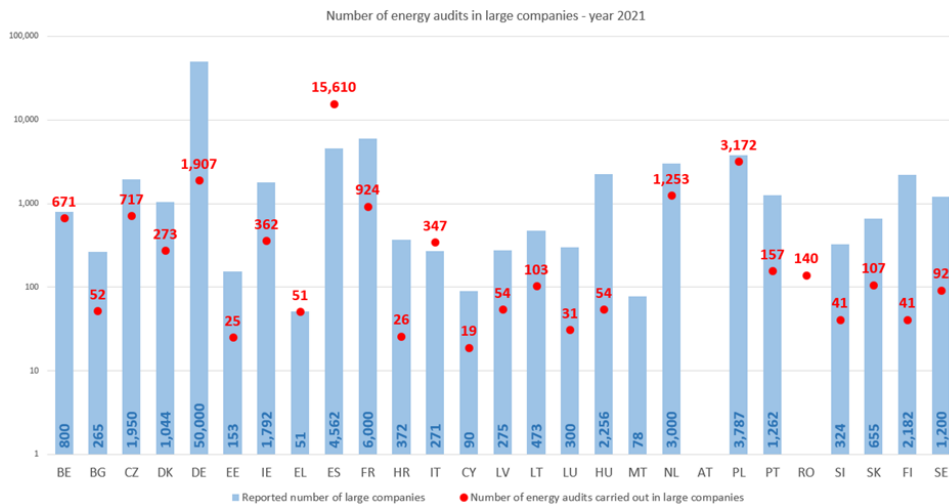
<sup>48</sup> This number of measures is higher than the number of measures or group of measures with energy savings data, as this is the number of single measures (and some of these single measures are included in a group of measures as regards reported energy savings).

<sup>49</sup> Some of these policy measures are fully dedicated to energy poverty alleviation. Others contribute to energy poverty alleviation among other objectives.

for 2020 much information was missing, as only Belgium, Estonia, Ireland, France, Croatia, Italy, Cyprus, Latvia, Luxembourg, Hungary, Austria, Poland and Sweden had reported both the number of large companies and the energy audits carried out (for the latter category also Romania has reported its numbers).

In general, the mismatches observed between the two values in the same year can be explained by the fact that energy audits are not required on a yearly basis, but at least every four years. In addition, given the circumstances of the COVID-19 pandemics, a certain number of companies may have postponed their energy audits.

Figure 18: Energy audits carried out in large companies in 2021 and 2020.



#### 2.2.4 Progress towards the long-term strategy for renovation

Article 2a of the EPBD required Member States to submit their Long-Term Renovation Strategy (LTRS) by March 2020. The Commission has analysed the national strategies with a view to sharing best practices between the Member States. The national strategies and the Commission's assessment were a key contribution to the national Recovery and Resilience Plans in which building renovation features prominently.

The great majority of 2020 strategies include a good overview of policies targeting public buildings and provide a long-term roadmap towards the 2050 goal of decarbonising the building stock, including in most cases specific intermediate milestones for 2030, and to a lesser extent for 2040. The strategies generally comply with the requirements of the EPBD, but the Commission's analysis highlighted that not every LTRS is sufficiently ambitious towards the 2050 decarbonisation goals. Furthermore, the differences in Member States' approaches when setting national milestones made it difficult to assess the ambition at EU level<sup>50</sup>.

The NECPR includes specific reporting tables for Member States' milestones and progress indicators of the long-term strategy for the renovation of the national stock of residential and non-residential buildings. Even if with some important differences in sub-indicators (e.g., residential vs non-residential buildings, entries in 2020 being more complete than in 2021) on average, completeness of the reported data appears to be limited in most of the topics and indicators except for the only mandatory field reporting on the contribution of buildings to the Union's energy efficiency target. More details and deeper analyses on Member States reporting on progresses towards the long-term strategy for renovation are included in the *Report on renovation of the national stock of residential and non-residential buildings and on nearly zero-energy buildings*.

#### **Building stock**

Member States reported data of the residential, non-residential, and public building stock, in terms of number of buildings and/or floor area, with different degrees of completeness: data for residential buildings are the most complete one with 20 and 17 Member States reporting data on the number of buildings for 2020 and 2021 respectively; on the other hand, 18 countries reported some information for non-residential buildings and 14 on public buildings.

Member States use different approaches to define their worst performing stock, such as energy class, age, energy consumption, as resulted by the analysis of the last long term building renovation strategies. In the NECPR, a total of 6 countries defined worst performance according the primary or final energy consumption in kWh/m<sup>2</sup>, while no information was found in 12 other countries.

The fields on worst performing buildings have generally a lower completeness in the NECPRs. In the case of residential buildings, 9 countries reported on their number of worst performing buildings for 2020, only 6 for 2021. The heterogeneity in their definition determines a wide range of shares representing the worst performing segment of national building stock: according to reported data it was in 2020, on average, 43% of the total number of residential buildings, but ranging from 5-6% in Finland and Sweden to more than 90% in Cyprus. A similar variability can be detected also in the public and non-residential sectors. In some countries, the respective shares are close to what reported for residential, in others it is possible to spot important differences. Harmonisation in the definition of

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<sup>50</sup> Castellazzi, L., Paci, D., Zangheri, P., Maduta, C., Economidou, M., Ribeiro Serrenho, T., Zancanella, P., Ringel, M., Valentova, M. and Tsemekidi Tzeiranaki, S., (2022) Assessment of first long-term renovation strategies under the Energy Performance of Building Directive (Art. 2a), EUR 31309 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-58990-7, doi:10.2760/535845, JRC128067

worst-performing buildings is needed to allow for equal distribution of renovation efforts across Member States.

Data on primary and final energy consumption as well as GHG emissions are also reported, but the many missing data prevent to draw general conclusions or to calculate aggregated data at EU level. In terms of final energy consumption (FEC, i.e. the most complete dataset, with nearly 60% of Member States having reported at least data on total FEC in the residential sector in 2020), the short-term evolution from 2020-2021 indicates a general increase (from 3-7% depending on the sector at EU level, based on the Member States that reported data), with some exceptions in the residential sector. In the worst performing segments of the building stock, a general decrease in FEC is observed. Reported data on GHG emissions are scattered and incomplete: in the residential sector, out of the 9 Member States that have reported data for 2020 and 2021, data show an overall steady trend of GHG emissions between the two years.

### Renovation rates

Despite the central role of renovation in energy and climate policies and the fact that some Member States have set renovation milestones, data on renovation rates in NECPR are highly incomplete, with only 7 Member States reporting in this field. Data are also scattered across countries, years, depth of renovation (light/medium/deep), building use (residential/non-residential/public), and unit measure (building units/floor area). This makes it very difficult to have a complete synthetic overview, to perform comparisons and to draw general conclusions at EU level. The only data reported on renovation rates are from 4 Member States (Ireland, Hungary, Lithuania, and Luxemburg), whereas other Member States provided additional data on renovations in the milestones indicators (for example, Italy, as progress toward its targets, Italy indicated a deep-equivalent renovation rate of 2.4% and 3.1% for 2020 and 2021, respectively).

The Commission's analysis of Long-term Renovation Strategies<sup>51</sup> revealed that renovation target indicators are not standardised across the EU, that not every LTRS is sufficiently ambitious towards the 2050 decarbonisation goals and that more efforts, resources, and sustainable solutions will be necessary to prepare for climate change and contribute to climate neutrality in line with the European Green Deal.

With a good level of completeness, NECPRs show a wide variety of specific additional milestones and indicators of the long-term strategy for the renovation of the national stock of residential and non-residential buildings. It is possible to group these indicators, set by Member States, in three main categories:

- **Improvement of the building stock:** 16 Member States reported at least one target or milestone within this category, with a variety of approaches and indicators, such as: the indication of a renovation rate, a target floor area or number of buildings to be renovated; the specific increase in the share of NZEBs or buildings in high energy classes; the phasing-out of the worst performing buildings. One country has set a specific target for social housing, while some countries for state-owned or central government buildings.
- **Reduction in energy consumption:** 18 Member States indicated at least one target or milestone related to reducing energy consumption in the building sector.
- **Reduction in GHG emissions:** 10 Member States reported at least one target or milestone related to reducing CO<sub>2</sub> or GHG emissions.

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<sup>51</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC128067>

Other targets indicated regard technical systems, installation of PV panels, information and advice to SMEs and citizens.

As a first-of-its-kind exercise to track the evolution of the building stock in Member States, the NECPR evidenced the need to further increase efforts in stock-taking and reporting as well as harmonizing of milestones and indicators of the renovation of buildings in the EU. To this respect, the Commission is working on the standardisation of renovation indicators, to improve comparability of strategies and reporting. The 2023 major revamping and updating of the Building Stock Observatory is aimed to provide an additional contribution in this regard. Furthermore, in the context of the EPBD revision, the LTRs will evolve into Building Renovation Plans with more targeted indicators and will continue to be part of the governance regulation and the integrated national energy and climate reporting.

### **Contribution to energy efficiency targets**

NECPR obligations require Member States to describe how progress towards the milestones in the long-term renovation strategy contributed to achieving the Union's energy efficiency targets in accordance with Directive 2012/27/EU. This requirement is open to descriptive and/or quantitative information and the responses show a variety of interpretation from Member States and, as a mandatory element, the reporting rate in this field is close to 100% of the submitted NECPRs. However, in some cases, the responses failed to provide references to specific milestones or targets, leaving space for improvements and need for additional specification.

### **Nearly Zero-Energy Building (NZEB)**

In accordance with Article 9 of the EPBD, NZEB became the new building standard in the Member States by 31 December 2020. NZEB performance requirements have progressively increased over the last decade and make an important contribution to the decarbonisation of EU's building stock.

Member States have established national NZEB definitions and provided numerical indicators for primary energy use expressed in kWh/(m<sup>2</sup>y) that appear on average less ambitious than the benchmarks presented in the Commission's 2016 Recommendation<sup>52</sup>. A direct comparison of national definitions among Member States is not always possible because approaches vary due to differences in the specific climate, market, energy mix, construction traditions and other local conditions<sup>53</sup>.

The progress towards NZEBs is reported by 16 countries. In terms of number of buildings, for 12 Member States it is possible to compare 2021 and 2022 data.<sup>54</sup> In six countries the total number of NZEBs more than doubled in the period considered, whereas the overall number of NZEBs, obtained by aggregating the data of the countries which reported for both years, increased by 12% from 2021 to 2022.

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<sup>52</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC123143>

<sup>53</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC112898>

<sup>54</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC130528>

## 2.3 Ensuring energy security

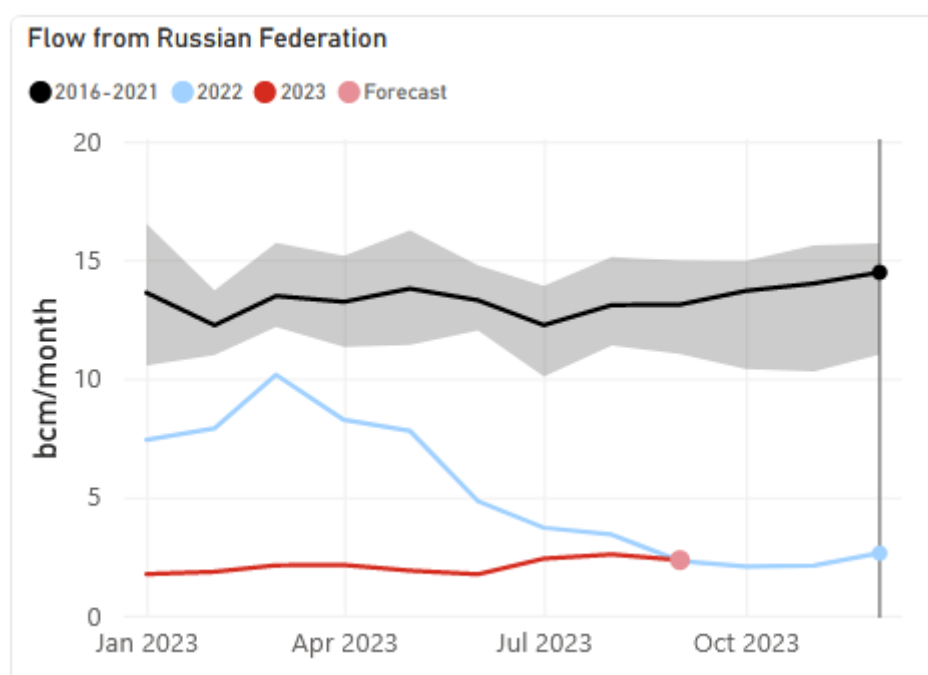
Both the global pandemic of 2020 and Russia's illegal and unprovoked invasion of Ukraine have exposed EU vulnerabilities and have shown the importance of a resilient energy system. Ensuring secure and affordable access to energy for all Europeans is a crucial precondition for the success of the EU Green Deal. This requires diversified supply sources, managed demand, and adequacy between supply and demand in all circumstances, including through storage.

Overall, most Member States set national objectives and targets related to energy security in the 2019 NECPs. These objectives take diverse forms and range for instance from the construction and use of energy storage facilities to the construction of LNG terminals or the reduction of energy import dependency. These commitments strengthen EU energy security. Ireland and Spain are the two only Member States which did not set any target nor objective to enhance their energy security and independence.

### 2.3.1. Diversification of energy sources

A key part of ensuring secure and affordable supplies of energy to Europeans involves diversifying supply routes. This includes identifying and building new routes that decrease the dependence of EU countries on a single supplier of natural gas and other energy resources. This objective has become more pressing since Russia's invasion of Ukraine and the consequent reduction of gas flows from the Russian Federation to the EU, which are today well below the historical levels (Figure 19). Thanks in part to the efforts made by the Member States and the Commission to find alternative supply sources, the EU managed to withstand this drop in Russian gas deliveries.

Figure 19: Evolution of the gas flows from Russian Federation



Source: JRC

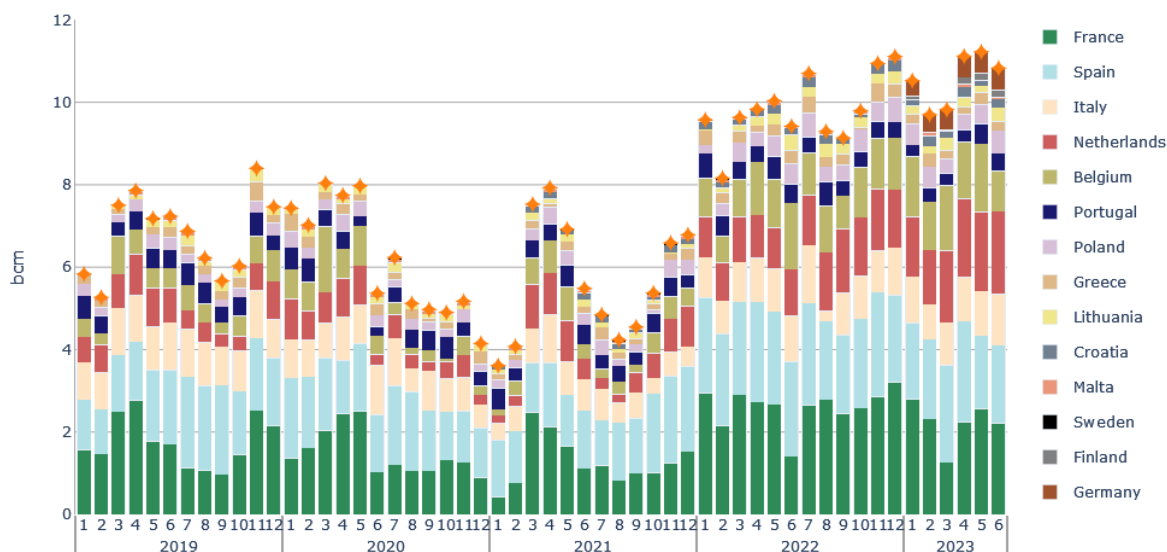
In the NECPRs, only 7 Member States reported at least one specific quantifiable target or objective for the diversification of energy sources (Bulgaria, Croatia, Greece, Hungary, Italy, Luxembourg and Poland). However, almost all these Member States registered some progress, which is a very positive



development for EU energy security. These targets were most often related to the increase in RES and biofuel production.

Related to this-subdimension, the European Commission also notes that several Member States have set non-quantifiable objectives such as the commissioning of new, or expansion of existing, LNG terminals or the increase of domestic oil and gas production (e.g. Bulgaria), which are all developments that support EU security of supply and on which they all registered some progress. It should be noted that LNG, by nature a diversified global source, has considerably increased since 2022 and is now the first source of gas supply to the EU (Figure 20).

**Figure 20: Monthly gross LNG imports in EU Member States**

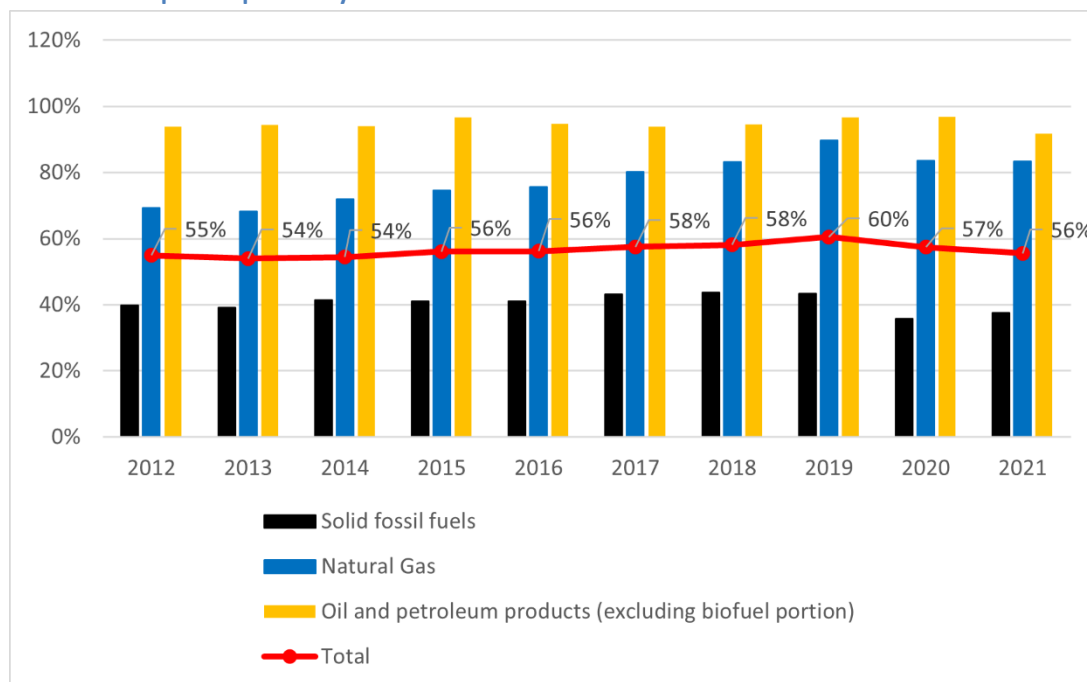


**Source: JRC (based on GIE ALSI Transparency Platform)**

Progress towards reducing energy import dependency from third countries is mixed. Only 6 Member States have set quantifiable targets and objectives for the reduction of energy import dependency from third countries (Bulgaria, Croatia, Estonia, Greece, Italy, Poland). Among the countries that set dedicated targets, some reported no significant progress (e.g. Greece) or even registered a worsening of the situation (e.g. Croatia, Poland). Only Bulgaria, Italy and Estonia have registered some progress. This appears insufficient within the context of the current geostrategic situation. European energy autonomy and resilience should be strengthened as indicated through REPowerEU and the remaining high dependency on fossil fuels imports (Figure 21).

The EU’s fossil fuels import dependence has been largely stable during the past 9 years, increasing by 1 percentage point in 2021 compared to 2012. However, this indicator should be interpreted with caution since Eurostat’s dataset only goes only until 2021 and therefore excludes the consequences of the Russian invasion of Ukraine. Further to changes to the overall level of dependence on third country fossil fuel suppliers, the composition of this dependence has changed with many Member States undergoing significant shifts away from fossil fuels imports from Russia since 2022.

Figure 21: EU27 import dependency on fossil fuels



Source: DG ENER based on Eurostat data<sup>55</sup>

### 2.3.2. Reduction of demand

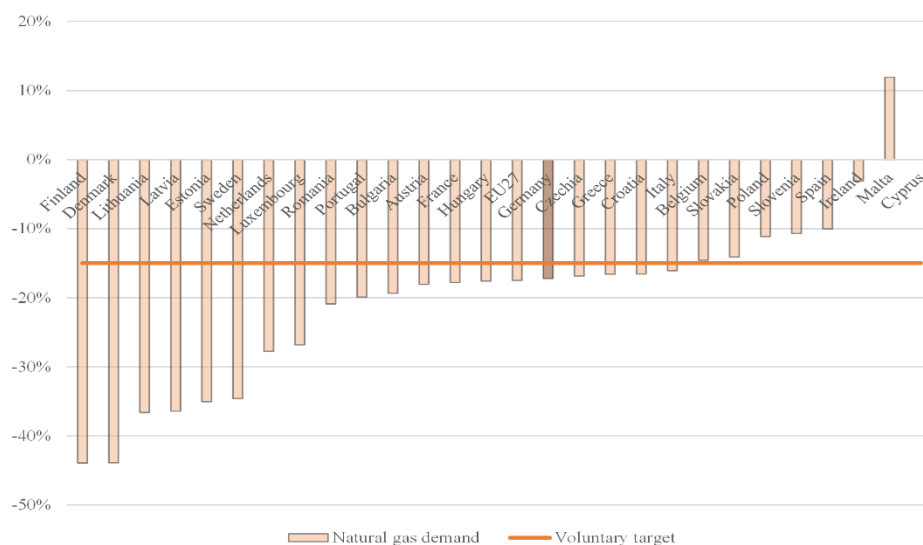
Saving energy is the safest, cheapest and cleanest way to improve energy security and end EU dependence on Russian fossil fuels. Saving energy was therefore one of the central pillars of RePowerEU.

Gas demand reduction measures, including those coordinated at EU level in an emergency regulation, have played a key role in making up for the reduction of gas flows from Russia: between August 2022 and August 2023, the overall gas consumption in the EU has decreased by 18 % or 73 bcm compared to the average of the previous 5 years<sup>56</sup>. Some Member States outperformed the EU average (such as Finland and Denmark which both achieved a reduction of 44 %), while others particularly underperformed (such as Ireland which only achieved a reduction of 3 %, or Malta which even increased its gas consumption by 12 % compared to the reference period). These savings were achieved through a mix of short-to-medium term measures (such as information campaigns and fuel-switching) and long-term measures (such as energy renovation of buildings, heat pump roll-out, etc.).

<sup>55</sup> [https://ec.europa.eu/eurostat/databrowser/view/NRG\\_IND\\_ID\\_custom\\_7179305/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_ID_custom_7179305/default/table?lang=en). Note: Individual national data includes intra-EU trade. For EU aggregates, the net imports in principle cancel out all intra-EU trade (abstracting from statistical discrepancies in reported trade data: imports reported by country A from country B are not always exactly the same as exports by country B to country A).

<sup>56</sup> DG ENER Chief Economist data.

**Figure 22: Change in natural gas demand between August 2022 and August 2023**



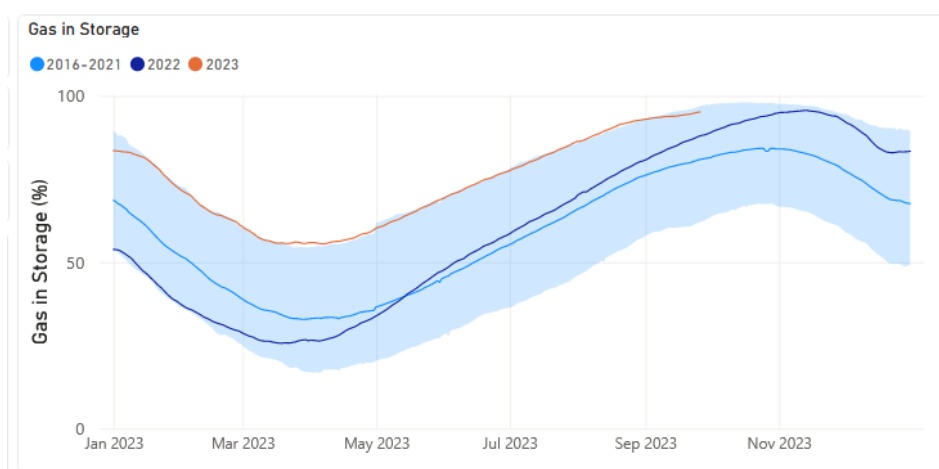
**Source: DG ENER Chief Economist Team based on ESTAT NRG\_CB\_GASM (sub-series IC\_CAL\_MG subtracted by TOS) in TJ (as of 29 September 2023, 11:00)**

### 2.3.3. Ability to cope with constrained or interrupted supply of an energy source

The ability to cope with constrained or interrupted supply of an energy source is a critical indicator of the resilience of an energy system and thus of overall energy security.

During the past year, gas storage played an instrumental role in safeguarding the EU's security of gas supply and in helping the EU energy system cope with the constrained supply of Russian fossil fuels. Following the adoption of the Gas Storage Regulation (EU/2022/1032) in June 2022 and of the Implementing Regulation (EU/2022/230) in November 2022, Member States now must meet filling targets to ensure a minimum level of storage in the EU in the winter season. Storage operators are now also certified in close contact with the European Commission to reduce the risk of external interference. As of September 2023, all Member States were on track to meet their targets, ensuring a filling level of 95% in early October 2023 (Figure 23).

**Figure 23: Evolution of EU UGS filling level compared 6-gas year average and range**



**Source: JRC (raw data from AGSI+ Transparency Platform)**

In terms of preparedness of the gas sector, 14 Member States have submitted their updated National Risk Assessment (Czechia, Denmark, Greece, Spain, Finland, Ireland, Italy, Luxembourg, Malta, Netherlands, Poland, Portugal, Sweden, Slovenia), 9 Member States have submitted their updated Preventive Action Plan (Czechia, Denmark, Finland, Ireland, Italy, Luxembourg, Malta, Portugal, Sweden), and 13 Member States have submitted their Emergency Plan (Austria, Belgium, Czechia, Germany, Denmark, Finland, Ireland, Italy, Luxembourg, Malta, Portugal, Romania, Sweden). These documents are currently being assessed by European Commission services. The European Commission is in close contact with those Member States that have not submitted their assessments and/or plans.

As for the electricity sector, all 27 Member States submitted the Risk Preparedness Plan in 2022, and the European Commission released an opinion on each of them. Most Member States set quantifiable targets or objectives related to the ability to cope with constrained or interrupted supply of an energy source (only Ireland, Latvia and Romania had not set any related target or objective). However, only few Member States reported targets that both enhance the resilience of their power system and their gas system (Czechia, Lithuania and Sweden). Overall progress appears positive with most countries having achieved significant progress on the resilience of their gas and power systems. In the next iteration of this exercise, it would be positive if all Member States would set targets for the resilience of both their power and their gas systems.

Several Member States also reported objectives related to the development of electricity storage and flexibility (Belgium, Bulgaria, Croatia, Italy, Malta, Portugal, Romania and Slovenia), on which they also reported good progress. This is a very positive development, as storage and flexibility will be critical in ensuring the stability of the future power system featuring an increasing share of intermittent renewables.,. System flexibility (see section 2.4.3) and deploying storage for electricity in line of the Commission's Recommendation (2023/C 103/01) is a key element of energy security.

#### 2.3.4. Other targets and non-quantifiable objectives related to energy security

Several Member States (Austria, Denmark, Estonia, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Slovenia, Sweden) reported other targets and objectives related to energy security. These range from an ambition to increase the share of renewables in the electricity system, support biomethane production to reduce annual outage minutes in electricity supply.

It is difficult to provide a general assessment on the progress made on these objectives, since these are by definition very diverse. However, most Member States that set targets related to diversification and to reducing dependencies did not report significant progress. The European Commission however notes the positive progress reported by Sweden on its security of oil supply.

Lastly, most Member States also set several non-quantifiable objectives and targets. These range from the building of interconnections with the neighbours, the promotion of storage and flexibility targets to the extension of the lifetime of nuclear power plants. All Member States with such objectives reported progress. The objectives contribute to enhance energy security in the EU and are therefore welcomed by the European Commission.

## 2.4 Achieving an interconnected internal energy market

### 2.4.1 Electricity interconnectivity

Based on the received data<sup>57</sup>, in 2021, 20 MS had electricity interconnectivity levels above both the 2020 (10%) and 2030 (15%) EU targets. Of those, 10 did not report an own 2030 target value, 8 overachieved their 2030 target value (often set equal to the 15% EU target), while 2 (BE/RO) report a target value to substantially increase interconnectivity by 2030. 3 MS (FR, EL, RO) have an interconnectivity level above the 2020 target but are still below their own target value and the EU target for 2030. 4 MS are still below the 2020 EU connectivity target of 10%: 3 of those (IT, IE, CY: the latter two have no current electricity interconnection with other EU MS) report a target value to increase interconnectivity by 2030, while Spain does not report an interconnectivity target value for 2030. Overall, Member States have made good efforts to increase cross-border capacity and the completion of various Projects of Common Interest should further improve the interconnectivity levels. Some Member States (CZ, IT, PT, RO, SI, SE) are reporting delays in the completion of the projects in particular due to permitting issues. Still further efforts are required to meet the 2030 objectives, especially in terms of timely delivery of the planned cross-border projects.

### 2.4.2 Infrastructure projects

Energy infrastructure is a key enabler for energy transition, helps integrate renewable energy contributes significantly to the integration of the energy market and ensures security of supply across the EU.

The Trans-European Networks for Energy (TEN-E) policy together with the Connecting Europe Facility for Energy (CEF-E) are big contributors to this success. Between its launch in 2014 and the end of 2022, CEF has already allocated EUR 6.26 billion of EU grants, supporting 124 actions on studies (EUR 510 million) and 43 actions on works (EUR 5.75 billion) in gas, electricity, smart grids, CO<sub>2</sub> networks and cross-border renewable energy projects. 162 actions worth EUR 6.24 billion concern PCIs under the TEN-E policy, the remainder are cross-border renewable energy.

### 2.4.3 Energy system flexibility

Grid developments should be coupled with improvement of energy system flexibility to cope with variations in electricity generation from renewable energy resources. Flexibility solutions such as demand response and storage enable the adjustment of the electricity system to the variability of generation and consumption patterns. This results in an efficient use of grid infrastructure and renewable electricity generation by minimising curtailments and reducing the costs of electricity systems, and ultimately the energy prices for consumers.

An efficient integration of the intraday markets and balancing markets across the European Union is also enabling market actors to adjust close to the delivery date of the energy and, hereby, contribute to an optimal use of the energy system, promoting active participation and demand response. Moreover, the Electricity Directive (EU) 2019/944 requires Member States to put in place appropriate measures and provide incentives to distribution system operators to procure market-based flexibility services to efficiently operate their networks and to avoid costly network expansions. While the timely and correct transposition of the related provisions on flexibility in the Electricity Directive (EU) 2019/944 is of utmost importance, development of flexibility services remains slow among Member States.

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<sup>57</sup> Since MS used their own data sources the calculation might not be fully consistent between MS

Some Member States are reporting significant progress made towards the integration of intraday and day ahead-market with full market coupling of the member states end 2022 or further integration of the balancing market (HR, DK, EL). While these improvements are welcome, integration of balancing markets through EU platforms remain too scattered and effects on price signals and system flexibility remain unclear.

On the other hand, not all Member States appear to have defined national objectives relating to energy system flexibility. Regarding those who have, the national objectives vary in terms of adaptability and measurability. The national objectives address development of renewable energy production, procurement of flexibility and renewable resources for balancing purposes, integrated network planning, accompanied by the use of digital infrastructure and the development of smart grids.

Some Member States have already progressed further with the integration of flexible energy sources in their electricity systems. Among those Member States is Sweden, who has defined six national objectives for flexibility solutions to identify and remove obstacles and promote flexibilities such as demand response and storage. Greece has put in place clear frameworks regarding participation and operation of demand response, making progress to attract demand response for the energy markets. In addition, while some Member States are reporting on a framework to enable the deployment of storage capacities and batteries in line with their objectives (EL, LT), progress on this crucial aspect for energy system flexibility remain quite limited, or not documented.

#### 2.4.4 Non-discriminatory participation in energy markets

Non-discriminatory participation in energy markets is a key pillar of energy market liberalisation. It is fundamental to ensure competition between technologies and market parties and, crucially, to ensure that costs are thereby kept as low as possible for consumers. In addition, it is a key tool for decarbonisation. A successful energy transition is one where renewables, demand response and storage are fully integrated into energy markets and utilised to their maximum potential, thereby reducing the need for reliance on electricity generated from fossil-fuel power plants.

Wherever possible, all technologies should follow common rules. However, where market rules could implicitly favour conventional generation, the Electricity Regulation requires Member States to update these rules to allow all technologies to offer any services that they are technically capable of providing. Furthermore, where market interventions by transmission system operators are required to adjust the market outcome for system operation reasons, curtailment should take place on a market basis or where this is not possible, renewables should be curtailed last and be compensated for curtailment.

Only 16 Member States (BG, HR, CY, CZ, EE, FI, EL, IT, LV, LT, LU, PL, PT, SK, SI, SE) reported on this topic, and indicated to have set targets and objectives to facilitate the non-discriminatory participation of certain market actors. Most reported positive progress on the integration of renewables, demand response and energy storage in a non-discriminatory way through day ahead and intraday market coupling. Some reported on balancing market objectives or progress to enable independent aggregators and citizen energy communities. One Member State replied about plans for retail price deregulation. The replies focussed exclusively on electricity but generally covered very different topics and are therefore not comparable. Further integration of key market players such as aggregators, and energy service companies will be crucial in the years to come to accelerate the clean energy transition.

#### 2.4.5 Consumer participation in the energy system and benefits from self-generation and new technologies, including smart meters

Consumer participation in the energy system is vital for achieving a sustainable and efficient energy future. With the increasing emphasis on environmental responsibility and the need to reduce carbon emissions, many EU Member States are setting ambitious goals to involve consumers in the energy transition.<sup>58</sup>

One key aspect of this transition is the adoption of self-generation and new technologies, including the widespread implementation of smart meters, an essential tool to facilitate consumer engagement by providing access to information. The progress made by EU Member States towards their national objectives is promising. These efforts demonstrate a collective commitment to embracing innovative solutions and sustainable practices in the energy sector. However, challenges remain, such as the need for accelerated smart meter rollout and the development of clear progress indicators in certain cases.

Based on the reported information, the roll-out of smart meters is relatively successful in 17 Member States, however 6 Member States have made limited progress, with 4 Member States reporting no roll-out at all. This limits the accessibility of accurate and real-time information to consumers, which is crucial for supporting their efforts to reduce demand or adapt consumption to times when it is more favourable for the energy system.

#### 2.4.6 Electricity system adequacy

Capacity Mechanisms have been introduced in several EU Member States to give more revenue predictability and ensure security of supply, enabling Member States under certain conditions, to provide subsidies to power generators and other technologies, such as demand response and storage.

As they can have a significant impact on the internal electricity market and because the costs of these mechanisms are paid by electricity consumers, Regulation (EU) 2019/943 introduced, for the first time, a framework at European level to govern capacity mechanisms.

Regulation (EU) 2019/943 requires Member States with an adequacy concern, to develop and execute an implementation plan (market reform plan), setting out how they intend to address the root causes of their adequacy problem with market reforms. To ensure that the internal market level-playing field is preserved, the rules prescribe that subsidies are granted only when an adequacy issue exists or will arise in the future. Robust assessments, whether performed nationally or at EU level, are fundamental to evaluate security of supply risks and act, if necessary. These assessments should be based on a common European methodology (ERAA methodology) adopted by ACER in 2020.

With regards to national assessments, the implementation of the relevant ERAA methodology to assess adequacy at national level diverges significantly across Member States. Some Member States undergo high-quality and comprehensive assessments, while some others apply oversimplified approaches that diverge substantially from the EU-methodology.

Setting a reliability standard is necessary for any robust decision-making regarding adequacy. It enables a Member State to decide whether measures are needed to ensure that resource adequacy risks remain within limits. That is why under Regulation (EU) 2019/943 Member States implementing or intending to implement a capacity mechanism must set their own reliability standard at national level. So far, only a few Member States have reportedly calculated the reliability standard according to the framework. Overall, references to progress on electricity system adequacy remain vague and

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<sup>58</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC127631>

do not allow to draw conclusion. In view of increasing energy security, France reported to explore further regional cooperation on capacity building.



## 2.5 Research & innovation and competitiveness

### 2.5.1 Translating the SET Plan objectives and policies

The European Strategic Energy Technology Plan (SET Plan) provides a platform of cooperation among Members for the coordination of their R&D efforts. It is a key instrument of the research, innovation, and competitiveness dimension of the Energy Union. The SET Plan is currently being revised to meet the objectives of the European Green Deal, REPowerEU, ERA and the Green Deal Industrial Plan.

The Clean Energy Transition Partnership co-funded under Horizon Europe is a successful EU cross-sectoral cooperation between national and regional research and innovation programmes in EU Member States and Associated Countries to support the implementation of the SET Plan. The partnership pools more than EUR 500 million in national funding with roughly EUR 500 million of EU funding to support jointly agreed R&I priorities.

Overall, 20 Member States reported on measures implementing the SET Plan objectives and policies at national level<sup>59</sup>. In this regard, there is a variety of national approaches. Most Member States reported on comprehensive research-funding programs, which support the development of the wide range of technologies included in the scope of SET Plan Implementation Working Groups. The most frequently reported measures relate to renewable energy technologies; energy systems; energy efficiency in buildings, sustainable and efficient energy use in industry; and renewable fuels and bioenergy. In contrast, least addressed were nuclear safety, positive energy districts and HVDC & DC technologies.

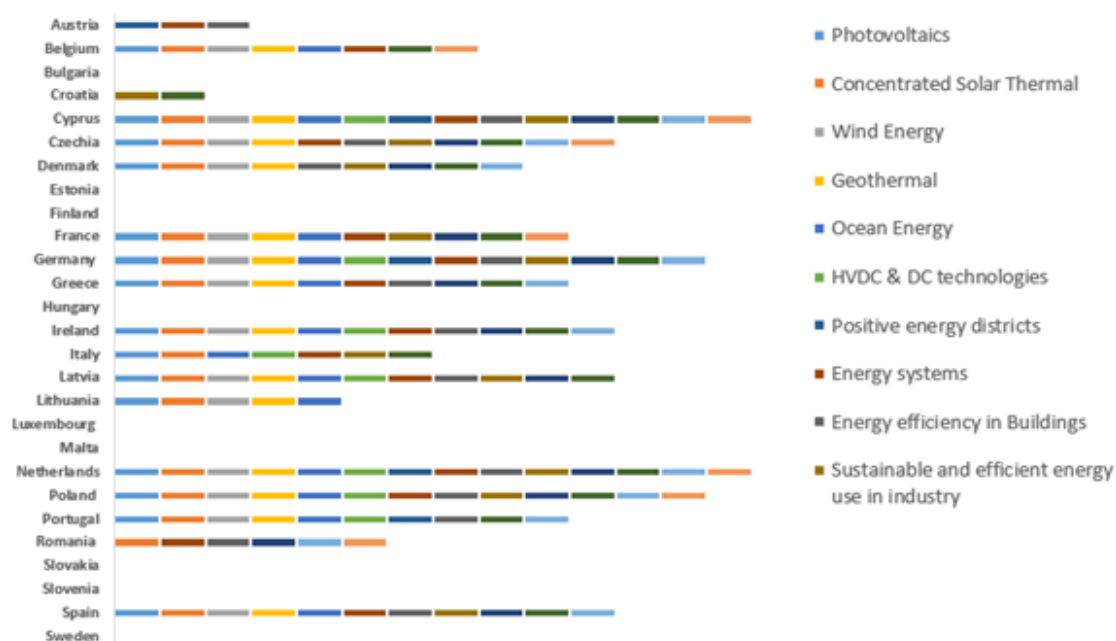
Among the 20 Member States which reported national measures implementing SET Plan objectives (e.g., the development of a research funding program or support for projects), 12 Member States also provided information on the progress of their implementation (e.g., number of demonstration projects supported, spending on R&D etc.) noting progress toward the achievement of at least one of their targets. The most frequently used progress indicator is public spending in terms of the budget dedicated to research programs or number of financed projects.

For the remaining reports, in the case of 3 Member States, it is too early to assess progress, as support measures implementing the targets are not yet in place or have only been implemented recently. 5 Member States provided no indicators. The information in the reports refers to “new measures” with a timeline to 2030; therefore, it does not allow the assessment against pre-existing targets.

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<sup>59</sup> Currently, the SET Plan activities are clustered into 10 research and innovation actions, implemented by 14 Implementation Working Groups (IWGs). Member States are represented in the Steering Group (SG), while in the work of the IWGs, apart from representation of Member States, there is also participation from a number of different non-state actors - such as academia, industry, business associations etc. Therefore, much of the work within the IWGs may not entail the direct engagement from the Member States, which would explain differences between SET Plan data collection from the technology IWGs, and NECP reporting.

Figure 24: Measures implementing the SET Plan objectives as reported in the integrated energy and climate progress reports



Source: JRC based on the NECPRs

### 2.5.2 Public and, where available, private spending in research and innovation relating to clean energy technologies

Overall, 19 Member States provided some information on quantifiable national objectives relating to public spending on R&I, and 5 reported against a target. Of the 13 Member States that reported data for both 2020 and 2021, 12 recorded an increase in R&I investment (AT, CZ, DE, FI, FR, LT, MT, NL, PT, RO, ES, SE), and only one a slight decrease (EL). In addition, 5 Member States also included some information on private expenditure on R&I, only 1 providing a target.

The public R&I spending indicated by Austria, Czechia, Finland, France, Denmark, Germany and Spain is comparable to the values reported under respective headings by these Member States to the IEA<sup>60</sup>. The Netherlands and Slovakia seem to only consider part of the spending reported to the IEA as relevant in the context of the NECPR. There is no comparative value for Greece, while there appear to be encoding errors with the values provided by Lithuania, Malta, Portugal, Poland, Romania and Sweden. As several Member States report only partially and as there are seemingly encoding errors, it is difficult to provide an informed assessment at EU level, beyond stressing the need to improve capacity and consistency in monitoring and reporting of R&I spending in clean energy technologies.

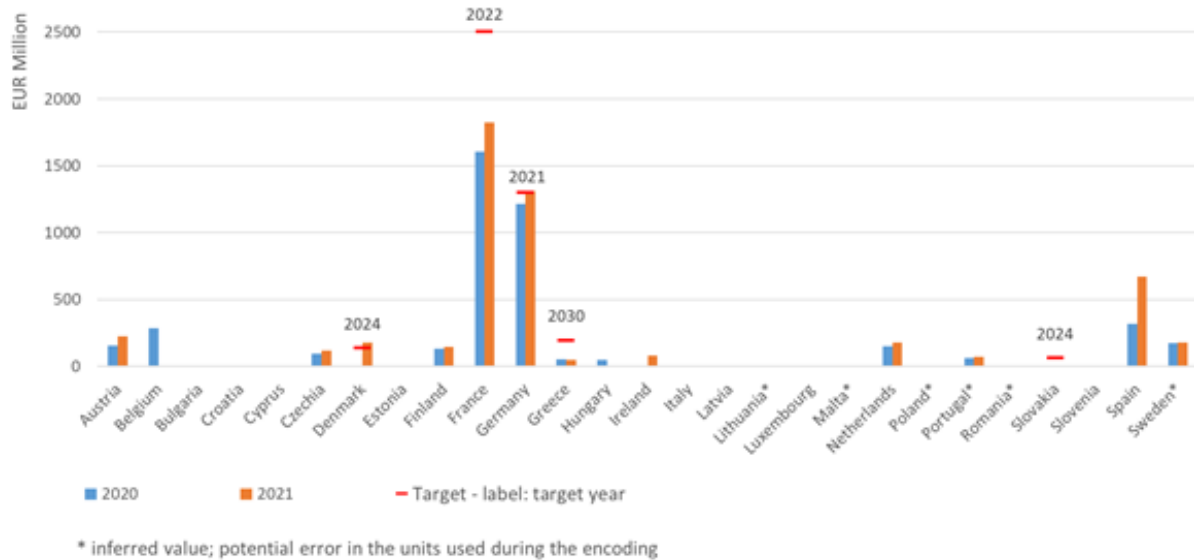
With regards to the targets for public R&I investment in clean energy technologies included in the reporting by 4 Member States:

- In 2021, Denmark and Germany have already achieved their objectives. Denmark invested 30% over the annual target set for 2024, and Germany just surpassed the target set for 2021.
- France would have had to increase expenditure by over a third between 2021 and 2022 to reach the 2022 target.

<sup>60</sup> The IEA's Energy Technology RD&D Budgets database allows users to track trends in spending by energy technology in IEA countries. Data is collected from central or federal government budgets. The following Member States are IEA Members: AT, BE, CZ, DE, DK, EL, ES, FI, FR, HU, IE, IT, LT, LU, NL, PL, PT, SE, SK (EL and LU do not report) IEA, 2023. [Energy Technology RD&D Budgets](#).

- Slovakia will have to more than double the public R&I investment each year to reach the level targeted for 2024.
- Greece has reported on a longer-term target for 2030, which implies a 17% annual increase in R&I investment from 2021 onwards (a slight decrease was reported between 2020 and 2021).

**Figure 25: Progress towards quantifiable national objectives for total public spending in research and innovation as reported in the integrated energy and climate progress reports**



**Source: JRC based on the MS integrated energy and climate progress reports**

Overall, 18 MS reported on non-quantifiable national objectives related to public spending on R&I. There are significant differences in the Member States' approach on reporting. Several (e.g. Austria, the Netherlands) provided detailed breakdowns of numerous national programs, while others provided more general information on R&D funding.

Member States reported a wide range of targets related to the development of clean technologies. In several cases, the support measures or programs were technology specific. For instance, France reported investments in the infrastructure for Small and Modular Reactors and research on modern reactors, Romania focused on nuclear energy including participation in the programme for research, development and innovation for Generation IV reactors – ALFRED, while Estonia focused on the development of hydrogen valleys and energy storage technologies. Germany reported the increase of international cooperation as one of national objectives, indicating both engagement in multinational platforms (Mission Innovation, Technology Cooperation Programs within IEA) and bilateral initiatives, such as a joint R&D call with the Netherlands on "Electrochemical materials and processes for green hydrogen and green chemistry". Based on the submitted information, 15 MS reported on progress towards the fulfilment of at least one of their national targets. Most indicators refer to budgetary spending channelled through research programs. Other aspects included an expected increase of scientific research output (e.g. patents), as well as the development of smart specialisation strategies.

### 2.5.3 Long term decarbonisation targets

Out of 23 Member States who submitted NECPRs, 15 provided information on progress towards national objectives on the deployment of technologies for decarbonising energy- and carbon-intensive industrial sectors. In the case of 11 Members States, progress toward at least one of their objectives was also reported.

Despite varying national approaches, most of the Member States focused on measures supporting the decarbonisation of industry. Several reported the development of national strategies and funding programs facilitating industrial transformation. For instance, Austria - (transformation of the economy), France (industry decarbonisation strategy and support for low carbon industrial processes), Germany (support scheme for CCS and CCU in industry, scheme to support the decarbonisation of industry, avoidance of climate change relevant process emissions from industry; support scheme for increasing energy and resource efficiency in industry), Estonia (energy efficiency and resource productivity), Italy (decrease of emission in hard-to-abate sectors), Portugal (industry decarbonisation towards net-zero) and Spain (strategic projects for economic recovery and transformation – industrial decarbonisation). Progress toward targets was demonstrated by in terms of public budget allocated for the targets and the number of projects funded and companies supported (AT, CY, DK, EE, FR, PT, ES).

In terms of quantifiable targets, the Netherlands reported a decrease of the CO<sub>2</sub> emission factor of electricity production to about 50% of the 2000 value, reaching 0.3 kg/kWh in 2021. This reports progress toward the objective of “National Climate Agreement: electricity production 100% CO<sub>2</sub> neutral by 2050”. Germany assessed that the "Support scheme for increasing energy and resource efficiency in industry" led to a decrease of 2362 kt CO<sub>2</sub> equivalents in 2021. Overall, Germany reported the highest number of national financing programs, adding up to 180 projects and EUR 74 million support in 2021.

Hungary reported detailed technology quantitative targets and progress toward them, as follows:

- reaching 240 MW electrolyser capacity by 2030 (in 2023, 2.5 MW was installed).
- reaching 6 GW of PV capacity by 2030 (4GW in operation in 2022).
- 1300 local e-buses in operation by 2029 (79 e-buses were in operation in 2022, and 157 delivered in 2023).
- the increase of smart meters deployment (467 870 smart meters in 2022).

#### 2.5.4 Competitiveness

Overall, 13 Member States reported information on the progress towards national objectives related to competitiveness, 8 of which noted progress in this field. A more detailed analysis on energy subsidies can be found in the *2023 competitiveness progress report* adopted at the same time as this staff working document.

Recurring competitiveness targets, which are also easily quantifiable, were the increase in the number of patents (reported on by Italy, Portugal and Hungary) or accelerating growth of SMEs and start-ups (reported on by France and Italy).

Austria provided details on the contribution of the EU program Important Project of Common European Interest (IPCEIs) for Austrian companies participating in projects related to energy storage, microelectronics, and hydrogen. Belgium (Flanders Region) submitted information on support provided to innovation clusters.

Several countries referred to economic indicators like improving labour productivity and export value (Estonia), ranking within the global competitiveness index (Latvia), guaranteed access to energy resources at a competitive price level (Lithuania), or improvement of the energy efficiency of their economy (Bulgaria).

## 2.6 Energy subsidies

The total amount of energy subsidies in EU27 increased from EUR 177 billion (2015) to EUR 216 billion by 2021. As a direct consequence of the energy crisis, this amount is expected to reach nearly **EUR 390 billion** in 2022.

Member States created **230 temporary subsidy instruments** as a response to the energy price crisis, for a total estimated value of **EUR 195 billion**. Many of these measures, taken by Member States to protect households and commercial and industrial consumers, are expected to be phased out in 2023 or once energy prices return to stable levels.

The crisis led to a temporary **surge in fossil fuel subsidies** (primarily natural gas and road fuel), reaching **EUR 123 billion in 2022**. For 2023, initial estimates indicate that fossil fuel subsidies remained at a similar level: around EUR 110 billion as support measures linked to the price crisis continued into 2023.

**Subsidies granted to renewable energies decreased** from EUR 88 billion in 2020 to **EUR 86 billion** in 2021 and to ~87 billion in 2022. This is mainly due to market-based subsidy instruments like Feed-in tariffs, Feed-in premiums, and Contracts for Difference, because high market prices led to reimbursements flowing from energy producers to the governments.

A significant portion of temporary instruments were aimed at **households**, which received **EUR 58 billion in support from temporary instruments**. Support to the road transport sector reached **EUR 23 billion**, while cross-sectoral subsidies were **EUR 69 billion**.

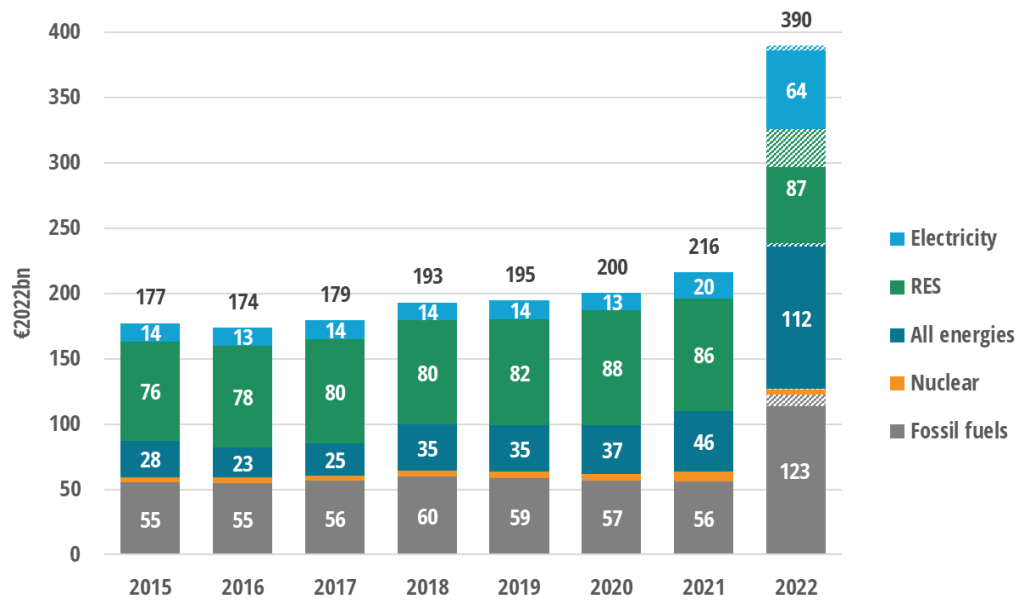
This year was the first time that Member States reported on the phasing out of energy subsidies as part of their NECPR. This helped validate and improve the quality of the energy subsidies database and provide insight on the planned end-date of fossil fuel subsidies. There is a planned end-date (before 2025) for 47% (EUR 58 billion) of total FFS (EUR 123 billion). Only about 1% (EUR 1.7 billion) of the FFS have an end-date in the medium term (2025-2030). For the remaining 52% (EUR 64 billion<sup>61</sup>) of these FFS, there is either no end-date yet or the end-date has been set after the year 2030.

A more detailed analysis on energy subsidies can be found in the *Report on energy subsidies in Europe* adopted at the same time as this staff working document.

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<sup>61</sup> This amount includes EUR 10 billion fossil fuel subsidies that are still under review.

Figure 26: Subsidies by main energy source / energy carrier in the EU27 (2015-2022; EUR2022bn)



Source: Enerdata, Trinomics, 2023

NB: 2022 are preliminary results, some amounts contain yet unconfirmed figures (represented with hatching).

## 2.7 Energy poverty

Tackling energy poverty affecting households across Europe has been a pressing issue for years now and has recently intensified because of the energy crisis that unfolded in 2021-2022. On the other hand, this crisis has also acted as a catalyst, prompting the need for immediate action or a re-evaluation of previous efforts. As evidence that this process is still very much ongoing, there has been minimal reporting on the relevant mitigation policies that have been implemented and/or the progress made towards the objective of reducing the number of households experiencing energy poverty so far.

Various countries in the EU have recognised the urgency of tackling this problem and have established national objectives and strategies to mitigate energy poverty. Based on the Commission's overview, a wide range of approaches and outcomes can be observed among EU member states. These include the establishment of qualitative national targets, which stress the importance of enabling all segments of society to afford their essential energy and mobility needs at reasonable prices. Some countries have set specific targets tied to eligibility criteria for implementing direct tariffs or bill support and dedicated funds. Additionally, several Member States have developed comprehensive national strategies, often in conjunction with energy efficiency and housing renovation policies and programmes. Greece, for example, has introduced the Energy Poverty Action Plan as part of its NECP, aiming to radically combat energy poverty. In France, various measures have been implemented to address energy poverty inequalities, including subsidies for energy-efficient renovations and aid for low-income households. Spain also addresses energy poverty through its NECP, aligning with the National Strategy against Energy Poverty.

In conclusion, European Member States employ diverse approaches to address energy poverty, based either on quantitative targets or more qualitative assessments. While some countries have seen positive progress, others face challenges in providing clear progress assessments. Nonetheless, the recognition of energy poverty as a critical issue and the formulation of strategies to alleviate it represent significant steps toward ensuring that every citizen can access affordable and indispensable energy services.

### **Energy poverty definitions**

Defining energy poverty at the national level is the initial step towards establishing a stable legislative framework. Accurately identifying the problem and understanding its context is fundamental to effective policymaking, whether at local, national, or EU levels.<sup>62</sup> This process facilitates the translation of political commitments into long-term and medium-term strategies and operational action plans, fostering coordination among various stakeholders and all relevant actors working in this field.

Across EU Member States, there is a notable diversity in defining energy poverty. Most countries do not, or do not yet, provide an explicit definition of energy poverty. Among those who do, the definition is not necessarily official. A few countries have established precise legal definitions, while most of the others have yet to provide official interpretations. There is clearly scope for the Commission to provide additional guidance to the Member States, in particular through the EU-level definition of energy poverty established in the recast Energy Efficiency Directive (EU/2023/1791<sup>63</sup>) the upcoming revision of the energy poverty Recommendation, and the Coordination Group on Energy Poverty and Vulnerable Customers<sup>64</sup>, which functions as a dialogue platform.

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<sup>62</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC130057>

<sup>63</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL\\_2023\\_231\\_R\\_0001&qid=1695186598766](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2023_231_R_0001&qid=1695186598766)

<sup>64</sup> <https://eur-lex.europa.eu/EN/legal-content/summary/energy-poverty-and-vulnerable-consumers-coordination-group.html>

## Energy poverty indicators

Energy poverty has been firmly acknowledged and legislated within EU law, with Member States bearing the responsibility of assessing the number of energy poor within their respective territories and implementing remedial measures in case of significant incidence<sup>65</sup>. Quantitative data on the number of affected households provides essential insights into the scale and nature of the problem in different countries. Effective policies and interventions must consider these varying situations to address the unique challenges faced by households in energy poverty across Europe.

The share of households unable to keep their homes adequately warm decreased from 8% in 2020 to 6.9% in 2021. Only Spain reported a strong increase between 2019 and 2021. All Member States are impacted, although with substantial geographical diversity, with values ranging from 1.4% in Finland to 22.5% in Bulgaria. It should be noted that these reported values do not yet reflect the increase of households unable to keep their homes adequately warm in 2022 as a result of the spike in energy prices. At the same time, Member States have put in place a significant number of emergency measures last winter that have contributed containing the impact of the energy crisis on the most vulnerable households.

## 2.8 Just transition

To ensure a just transition towards net-zero, a coordinated, cross-policy approach is essential, in line with the Council recommendation on ensuring a fair transition towards climate neutrality,<sup>66</sup> including to invest in a skilled workforce as a strategic asset and to support the most vulnerable during the transition.

On skills, this approach involves increasing the workforce and providing opportunities for the re-skilling of individuals already active in roles related to the evolving clean energy transition. It is crucial to ensure that no one is left behind in this transformation. Often, challenges arise from inadequate coordination among various policy domains (energy, environment, employment, education, migration) and governance levels (EU, national, regional, local).

The impacts of NECPs on jobs, workers, and regions across Europe vary depending on the country's specific circumstances, employment structures and plans. While some countries and industries anticipate positive outcomes in terms of job creation and economic growth, others face significant challenges, particularly in regions heavily reliant on fossil fuel industries. Nonetheless, it appears that these plans are in general designed to alleviate adverse outcomes via specific interventions, reskilling initiatives, and assistance for impacted communities, all with an emphasis on sustainable and inclusive development.

Against the background of rising labour and skills shortages, policies to support the right skills in the labour market and incentives for worker transitions out of polluting sectors are of key importance in achieving the transition towards climate neutrality on the ground while leaving no person behind. For example, In France, the "France 2030" investment plan has launched a call for expressions of interest to support companies in their training and skill development needs, particularly in green hydrogen, renewable energy, and industrial decarbonization sectors. In Greece, funds will be allocated to support entrepreneurship, R&D and business infrastructure and to strengthen human resources and the skills of the workforce in the affected areas, mainly lignite mining regions.

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<sup>65</sup> Article 3 of Regulation (EU) 2018/1999

<sup>66</sup> 2022/C 243/04 of 27 June 2022; see also COM (2021)801 and SWD (2021)452 of 14 December 2021



Some Member States are actively working to promote human rights and gender equality within this context under their NECPs. For instance, Cyprus is revising its NECP to focus on how proposed policies and measures will affect vulnerable groups, aiming to safeguard human rights in the face of climate change. France also highlights its efforts to protect human rights by implementing measures to address climate change impacts, providing adaptation and recourse options for vulnerable individuals. These actions are driven by the goal of ensuring dignified living conditions for all citizens despite climate-related challenges.<sup>67</sup>

Conducting a gender analysis as part of an NECP assessment can offer a valuable starting point for advancing a just and socially inclusive energy transition, especially if an intersectional perspective is adopted. Cyprus plans to include a section on gender equality in its revised NECP, aiming to reduce the gender employment gap, particularly in jobs related to clean energy policies. France stands out with its commitment to addressing gender-related barriers within the energy sector. The country enforces equal pay for women and men, promotes gender diversity in traditionally male-dominated fields, and measures progress through the gender equality index. The results show consistent improvement, demonstrating the positive impact of these measures on company practices.

As Europe continues its transition to clean energy and in the context of the Council Recommendation on ensuring a fair transition towards climate neutrality<sup>68</sup>, it is crucial to monitor and evaluate the effectiveness of these measures in promoting human rights and gender equality to assess EU commitments to ensure a more sustainable, just, and socially inclusive future for all.

## 2.9 Links with the European Semester

The European Semester is part of the European Union's economic governance framework. This yearly exercise, in which member states align their budgetary and economic policies with the rules agreed at EU level, has strong synergies with the governance mechanism provided by the Governance Regulation.

This is reflected in the country specific recommendations adopted under the European Semester. The recommendations adopted in 2019 and 2020, are clearly aligned with the NECPs set out at the end of 2019, as they provide most of the Member States with targeted recommendations in relation to challenges identified in their NECPs as applicable, notably in the areas of renewable energy, energy efficiency and the supporting energy infrastructure.

In response to the Russian war of aggression in Ukraine, and the related EU-wide challenges with regard to energy prices and security, the 2022 and 2023 recommendations increased these synergies further by emphasizing the systemic need across all Member States to reduce their reliance on and diversify their imports of fossil fuels, and put in place the necessary supporting policies, notably with regard to renewable energy, efficiency and the supporting energy infrastructure, to achieve this.

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<sup>67</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC132894>

<sup>68</sup> 2022/C 243/04

## 3 Policy and measures to achieve the objectives

### 3.1 Progress in implementing policies and measures

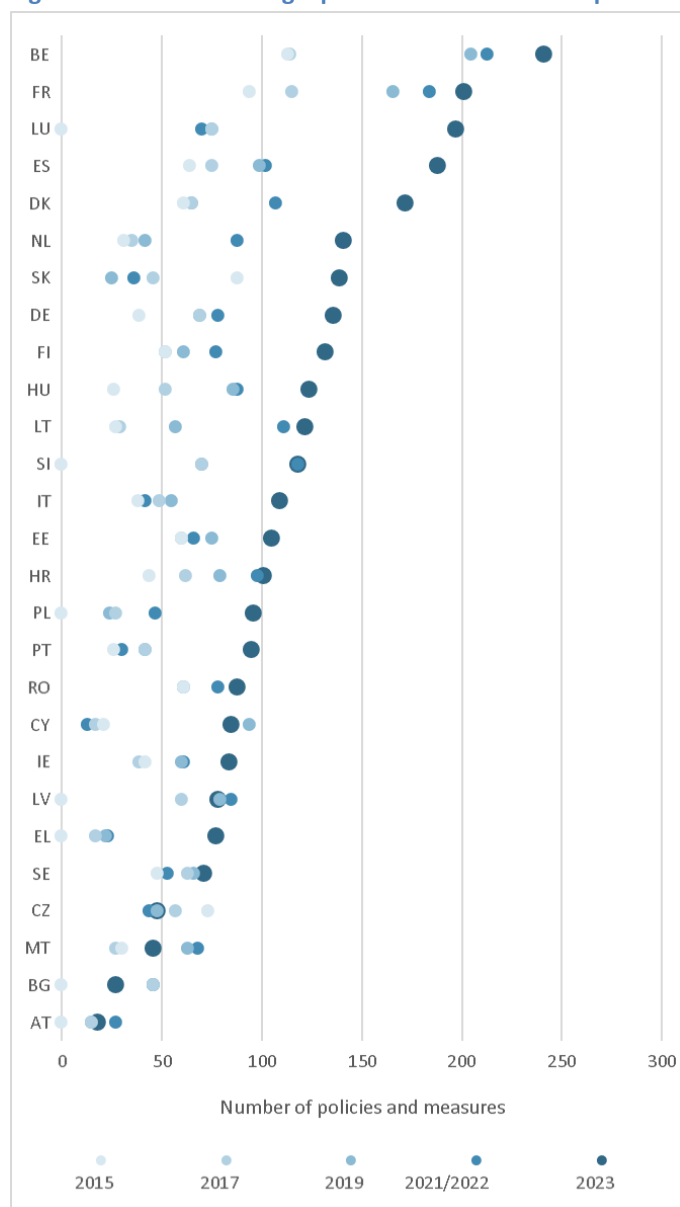
Member States have been reporting their greenhouse gas policies and measures in the EEA database since 2015. In 2023, this reporting has been expanded to include policies and measures covering all 5 dimensions of the Energy Union in an integrated manner.

The total number of single PaMs reported increased from 2052 in 2021 to 3039 in 2023. There are on average 113 single PaMs per Member State. This is a 48% increase compared to 2021/2022, however the increased scope should be taken into consideration (filtering for the decarbonisation dimension, closer to the scope of the previous reporting exercise, the increase of reported single PaMs remain sizeable, around 16%).

Although the number of PaMs has increased, there are still significant differences among Member States in the number of reported PaMs. Belgium, Spain, Luxembourg and France reported the most individual measures and Bulgaria, Austria, Greece and Malta the least (Figure 27). A main reason is that some Member States report their PaMs at a highly disaggregated level, while other Member States report their PaMs in a more aggregated level.

Compared to the previous reporting exercise (2021), Cyprus and Luxembourg substantially increased the number of reported PaMs (followed by Spain, Portugal, Finland, Italy and Estonia), while Bulgaria, Austria and Malta decreased significantly.

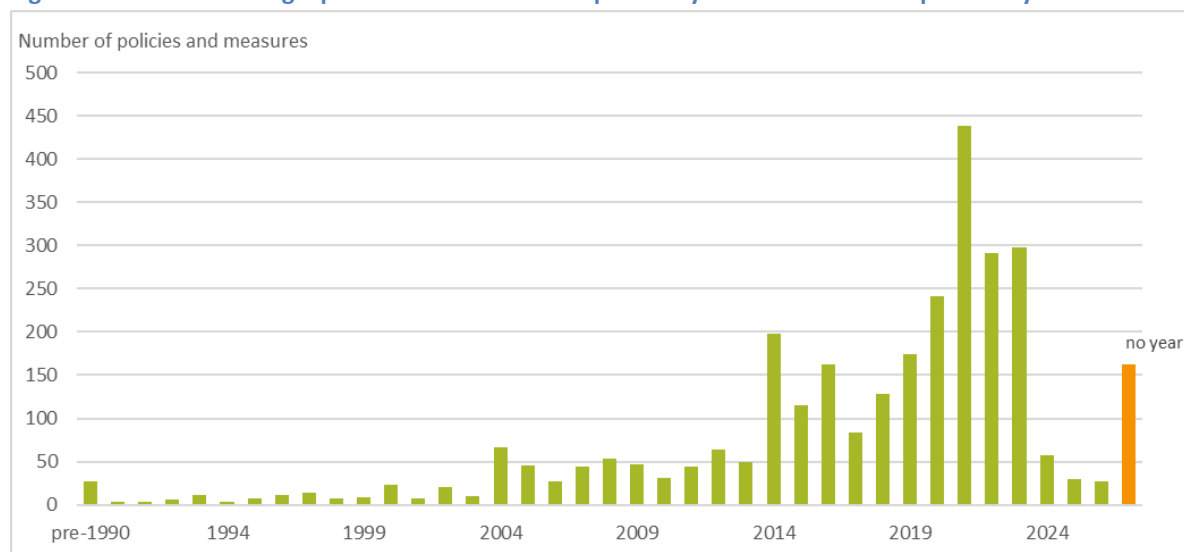
Figure 27: Number of single policies and measures reported by Member States in different reporting years.



Looking at the starting year of these reported PaMs (Figure 28), we see that there is a large increase of newly implemented PaMs, i.e. those put in place following the adoption the NECPs (879 new PaMs, around 29% of the total).<sup>69</sup> This increase in PaMs might reflect that many Member States have and will have to implement new policies and measures to meet their 2030 climate and energy objectives.

<sup>69</sup> as determined based on update status and start year.

**Figure 28: Number of single policies and measures reported by EU Member States per start year.**



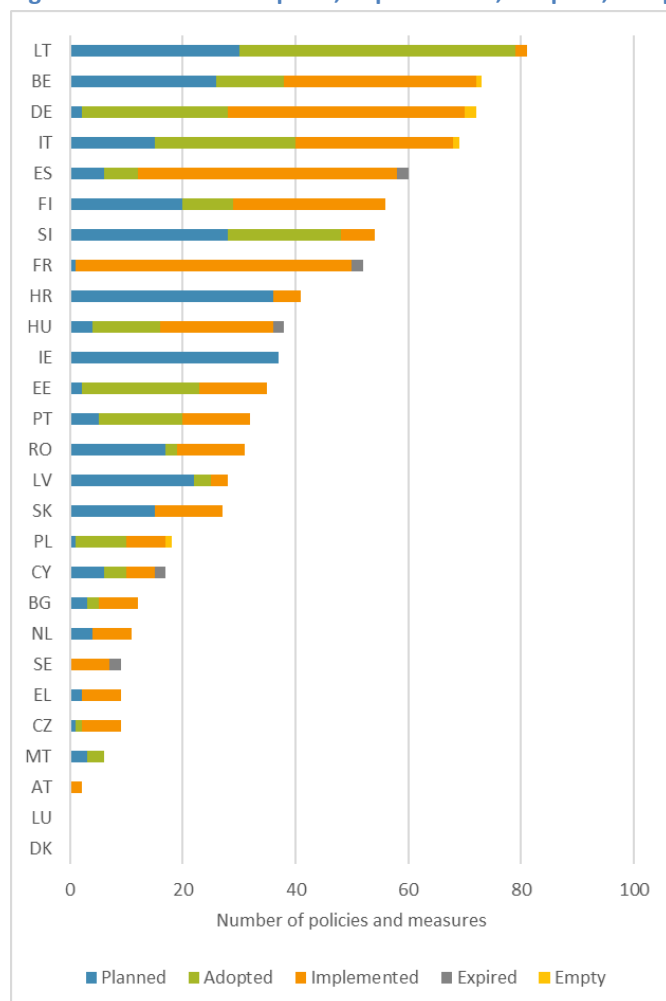
When we look at the status of these new PaMs, 286 (33%) are planned, 219 (25%) are adopted and 359 (41%) are implemented, showing that additional action is being taken.

With respect to sectors, most new PaMs target energy supply (28% of PaMs), energy consumption (27%) and transport (25%). At the same time, we see that relatively more new PaMs target agriculture (14% new compared to 11% overall) and LULUCF (9% new compared to 7% overall).

With respect to the instrument type, most new PaMs are economic (51% of PaMs), regulatory (33%) and/or planning (17%) instruments. Relatively more new PaMs are economic instruments (51% new compared to 43% overall) and planning instruments (17% new compared to 13% overall), while we see a slight decrease in the share of regulatory and fiscal measures.

Most new PaMs reported are national (90%), with only a small number being regional, local, or covering two or more countries.

Figure 29: Number of expired, implemented, adopted, and planned new\* single policies and measures.



**Notes:**

\* New since the adoption of the NECP, as determined based on update status and start year

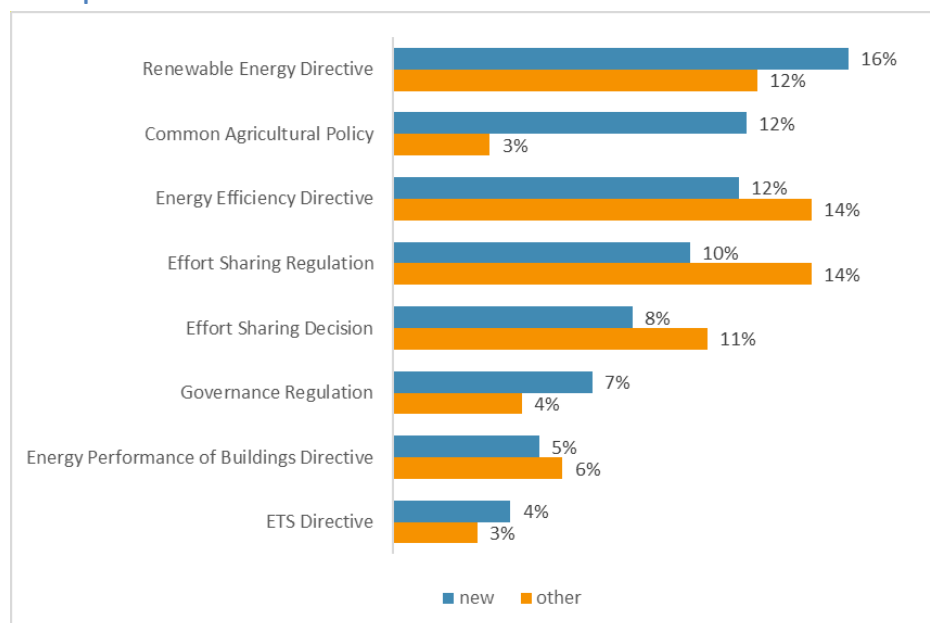
2379 PaMs were reported to contribute to GHG emissions and removals (reported by 27 MS), 594 to renewables (24 MS), 865 to energy efficiency (26 MS), 204 to energy security (19 MS), 170 to the internal energy market (20 MS) and 115 to research, innovation and competitiveness (19 MS).<sup>70</sup> This distribution reflects that with regard to certain areas, i.e. GHG emissions and removals and energy efficiency, structured reporting on policies and measures has been in place before on which the integrated reporting builds. At the same time there are 10 MS that did not yet report policies and measures in all dimensions.

Most single national policies and measures are implemented in response to one or more Union policies. Measures were reported to be implemented in response to 55 listed policies, the most mentioned ones are shown in Figure 30 below. It can be noted that Member States also report PaMs against new Union policies such as the Recovery and Resilience Facility Regulation (32 PaMs), the European Climate Law (19 PaMs), the Regulation on risk-preparedness in the electricity sector (7

<sup>70</sup> As a PaM can contribute to multiple dimensions there is some double counting. 2050 PaMs have been indicated to contribute to 1 dimension, 729 to 2 dimensions and 252 to 3 or more dimensions.

PaMs), the Regulation on coordinated demand-reduction measures for gas (4 PaMs) and the Union renewable energy financing mechanism (4 PaMs).

**Figure 30: Share of single policies and measures reported by Member States linked to the 7 most common Union policies.**



An exploratory analysis was made to determine to what extent the different types of policies and measures<sup>71</sup> referred to in the Governance Regulation and its annexes could be readily identified in the progress reports. The coverage per type of measure is very diverse<sup>72</sup>, as for all Member States measures related to the Energy Efficiency Directive can be identified, while for only one Member State measures “to assess, make transparent and reduce the need for must-run capacity that can lead to curtailment of energy from renewable sources” can be identified. It ranges from a Member State for which only 4 out of 53 types of measures could be identified, to a Member State for which 33 out of 53 types of measures could be identified.

### 3.1.2 Progress towards financing

In 2023, the first call for proposals of the EU renewable energy financing mechanism was published. The call is based on the voluntary participation of Luxembourg as contributing country that pays 40 million EUR into the mechanism, while Finland is the host country where solar PV projects with total capacity up to 400 MW will be built and will generate renewable energy. For the next 15 years, Luxembourg and Finland will share the statistical benefits of the electricity that is produced by the supported projects. The Commission is in the process of organising the next call for proposals in 2024.

In 2023 the Connecting Europe Facility and its window on renewable energy cross-border projects was implemented through two successful calls. Under the first call, two of the renewable energy cross-border projects were granted support for studies that will advance the cooperation, namely – the offshore wind park ELWIND, developed between Estonia and Latvia, and the hydrogen value chain project CICERONE, developed between Spain, Italy, Netherlands, and Germany.

<sup>71</sup> Approximately 53 distinct types of measures are referred to in the Governance Regulation, of which 45 could be reliably identified through key-word searches.

<sup>72</sup> The limitations of the key-word searches and the fact that certain types of measures only have to be reported where applicable needs to be taken into consideration.

In accordance with Article 17(2), point (a), Article 21, point (b)(7) of Regulation (EU) 2018/1999 Member States have to report information on progress towards financing the policies and measures, or group of policies and measures, including a review of actual investments against initial investment assumptions.

Unfortunately, some Member States (Austria, Italy, Romania) did not report information on the financing of PaMs, while the information of the Member States which reported data are often incomplete or inconsistent. This lack of proper reporting on investment needs and funding sources is problematic because it fails to accurately identify funding needs and gaps, which is essential for sound strategic planning and implementation. It also does not make it possible to assess the effectiveness of public support and its impact on public finances.

Overall, the most important data gaps related to the actual investments made and appropriate accounting of the source of the funds employed (national public, European, private funds). A few Member States fail to report any support from the EU budget, which appears inconsistent with other information available at the EU central level, for instance on allocation from the Cohesion policy funds. Overall, the high level of incompleteness support does not allow to provide an actual division among national, European and private funds allocated by the Member States.

In addition, it is not possible to compare the different Member States' submissions as timelines for investment assumptions might differ. It is important to acknowledge that implementation periods of single PaMs reasonably differ because investment assumptions, especially when related to financial allocations to specific national financing schemes/programmes or specific investments, are determined by national procedures determining budgetary allocation for the specific measure. In the framework of the next reporting cycle, it will thus be important to reflect on ways to increase the consistency and comparability of the reported information on financing.

## 3.2 Reported effects and costs of policies and measures

### 3.2.1 Indicators used to monitor progress on PaMs

The role of an indicator is to better understand progress in implementing PaMs. 17 Member States reported indicators for at least one PaM. In total 750 indicators (537 quantified) were reported for 466 PaMs. Ideally, the reporting of indicators should include the indicator description with a unit, the years, and values. This is however not always provided, and often only qualitative information is reported, i.e. the description and a unit, without quantitative data.

### 3.2.2 GHG emission savings

18 Member States reported **quantitative ex ante savings** for at least one year and at least one PaM. This has decreased from 23 Member States reporting such information in the 2021 reporting round. In total ex ante savings were reported for 521 PaMs. Expected (ex-ante) emissions savings from PaMs are important information to assess the progress to be expected from the planned or implemented measures, although there is no specific guidance provided on methods for assessment of ex ante impacts for reporting under Governance Regulation (or its predecessor the Monitoring Mechanism Regulation). This makes comparison and aggregation of emissions savings particularly difficult.

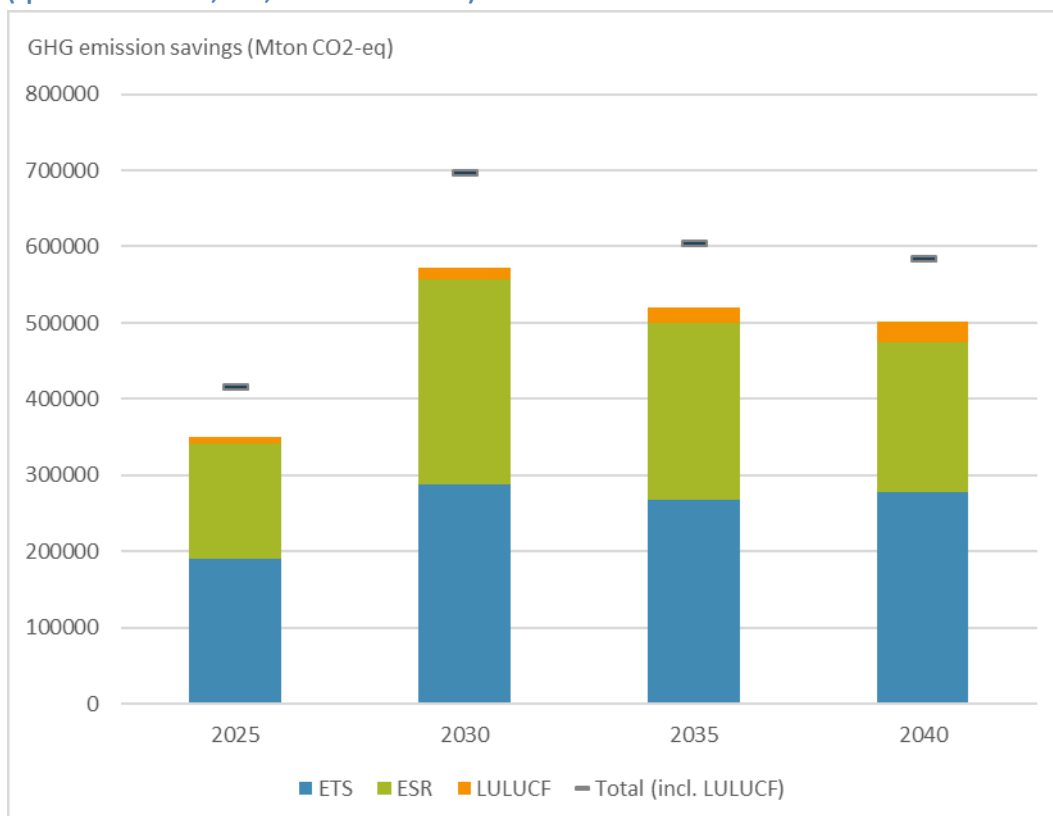
The total reported yearly savings amount to 407 Mt CO<sub>2</sub>-equivalent in 2025, 703 Mt CO<sub>2</sub>-equivalent in 2030, 577 Mt CO<sub>2</sub>-equivalent in 2035 and 537 Mt CO<sub>2</sub>-equivalent in 2040. The reported savings appear to be incomplete, considering that the drop after 2030 is not consistent with expectations for increasing savings over time. Of the total number of single and grouped PaMs reported by EU27 Member States, 460 had ex ante emission savings reported for 2025 different from zero and 495 had

ex ante savings reported for 2030. For 2035 and 2040, reporting was less complete, with respectively 435 and 373 single or grouped policies and measures.

**Figure 31: Number of policies and measures with ex ante emission savings in 2025 to 2040 (split between ETS, ESR, LULUCF and total).**



**Figure 32: Reported expected emission savings in Mt CO<sub>2</sub>-eq. of policies and measures in EU Member States (split between ETS, ESR, LULUCF and total)**





The reported emission savings are to a large extent reported for policies and measures belonging to the projection scenario with existing measures (WEM). This is not surprising considering that expired, implemented, or adopted policies and measure make up a large share of the reported policies and measures. Nevertheless, also substantial emission savings are reported for planned policies and measures, with some included in the projection scenario with additional measures (WAM), but also a large share not (yet) included in a projections scenario (NIP).

**Figure 33: Reported expected emission savings in Mt CO<sub>2</sub>-eq. of policies and measures in EU Member States (split between WEM, WAM and NIP)**



**Ex post emissions savings** from PaMs are essential information to assess the effectiveness and efficiency of national climate PaMs. In 2023, 7 Member States reported quantitative data on ex post emission savings. This is very incomplete compared to the reporting on ex ante emission savings. In total ex post savings were reported for 144 PaMs.

In 2023, Member States had the opportunity to report as well ex-ante and ex-post effects of policies and measures on renewable energy production and energy efficiency, as well as projected and realised costs and benefits in these areas. Only three Member States (Belgium, Ireland, and Malta) reported these voluntary data.

### 3.2.3 Impacts on air quality and emissions to air

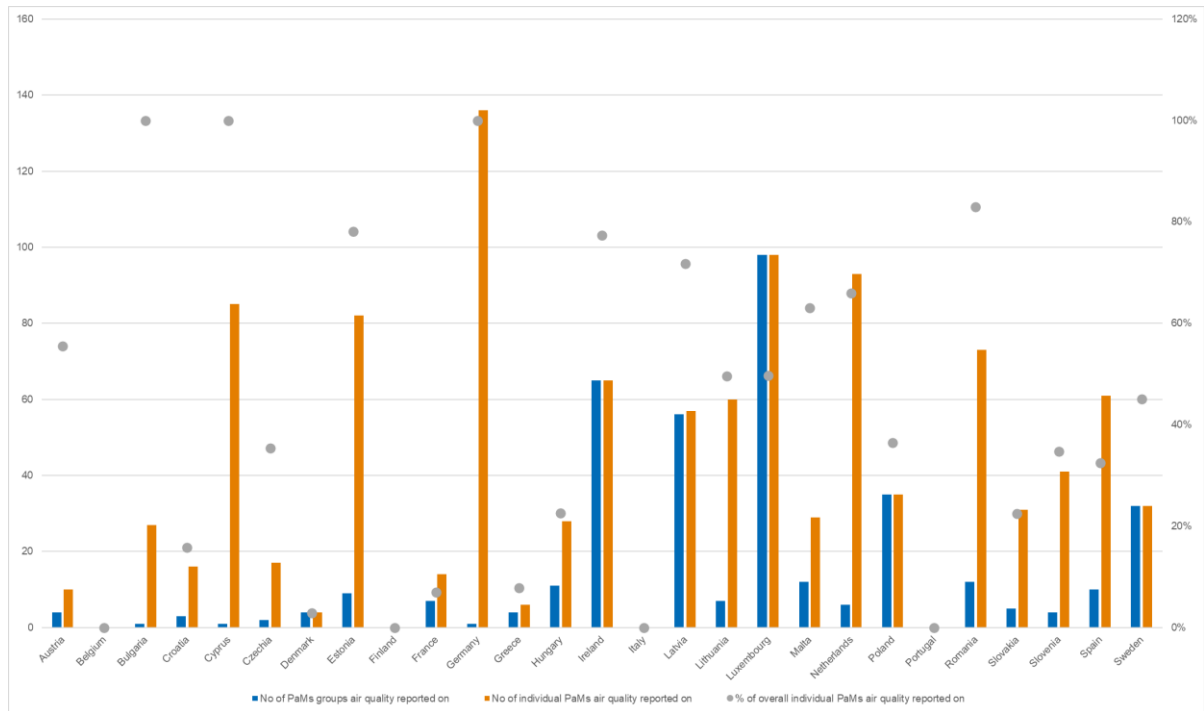
Member States are required to report, as far as possible, the impacts on emissions of air pollutants from the implementation of the policies and measures in their NECP, in projected future years.

The extent to which Member States reported on these impacts varies strongly. While 3 Member States report impacts for (almost all their) PaMs, most cover a (much) smaller share of PaMs, and 4 Member States did not report impacts on air quality and emissions to air for any PaMs.

Looking at the different pollutants:

- For NO<sub>x</sub>, 22 MS reported impacts (6 only qualitative). For 12 MS there is a reduction of emissions, while for the others the impact of proposed policies and measures on air pollutants is less clear (both in terms of size and direction of impacts).
- For NH<sub>3</sub>, 19 MS reported impacts (7 only qualitative). For 11 MS there is a reduction of emissions, while for the other the impact of proposed policies and measures on air pollutants is less clear.
- For PM<sub>2.5</sub>, 20 MS reported impacts (7 only qualitative). For 12 MS there is a reduction of emissions, while for the other the impact of proposed policies and measures on air pollutants is less clear.
- For SO<sub>2</sub>, 17 MS reported impacts (4 only qualitative). For 11 MS there is a reduction of emissions, while for the other the impact of proposed policies and measures on air pollutants is less clear.
- For NMVOC, 17 MS reported impacts (5 only qualitative). For 12 MS there is a reduction of emissions, while for the other the impact of proposed policies and measures on air pollutants is less clear.
- Six Member States reported impacts on various other pollutants, e.g. on black carbon, dioxine, methane and PM10.

Figure 34: Number of policies for which impacts on air quality and emissions to air are reported.



## 4 Regional cooperation

Increased regional cooperation can bolster the EU's energy union across its five dimensions. Most of the Member States reported on their progress in implementing regional cooperation, with most Member States reporting some progress in at least one of their regional cooperation initiatives or projects. Insufficient information on progress was reported only in some cases, and in even fewer cases was no information reported at all.

Reported regional cooperation projects or initiatives span across the five dimensions. Most reported projects relate to more than one dimension. The majority focus on energy security, internal energy market and decarbonisation, with fewer projects or initiatives related to energy efficiency and research, innovation, and competitiveness. Some Member States report cooperation only in 1 dimension, while 5 Member States report cooperation in all five dimensions (Figure 35).

Several Member States, for instance, report progress on the implementation of regional cooperation through regional forums such as the Pentilateral Energy Forum, a regional energy cooperation among Austria, Belgium, France, Germany, Luxembourg, the Netherlands, and Switzerland, which was created in 2005. This forum contributes to objectives related to energy security, an integrated internal energy market and decarbonising the economy, for instance through a study on system flexibility in the Penta region (incl. synergies from regional cross-border exchange of flexibility) and by working on implementing the risk preparedness regulation.

Similarly, several Member States report progress through their activities in the North Seas Energy Cooperation, which facilitates the development of the offshore grid development and the large renewable energy potential in the region. agreeing, for instance, to reach at least 260 GW of offshore wind energy by 2050<sup>73</sup>

Five regional groups were set up within framework of the EU Energy Platform. The Platform was established in April 2022 to support the EU's security of supply and access to affordable energy, including international outreach, demand aggregation, and efficient use of EU gas infrastructures. The regional groups agree on action plans on gas demand, including potential gas demand reduction, infrastructure opportunities and supply options. On 1<sup>st</sup> June 2022, for instance, the Regional Energy Platform for South-East Europe agreed on an action plan to diversify supply and bolster energy security due to the disruption of gas supplies from Russia.

Some Member States also referred to strategies (e.g. the EU Strategy for the Adriatic Ionian Region and the Mediterranean CCS Strategic Plan, the EU Strategy for the Baltic Sea Region (EUBSR), the Strategy for the Danube Region (EUSDR)) as well as to the preparation of joint (regional) risk assessment related to the security of natural gas supply (Ukrainian group and Belarusian group).

Some Member States highlighted cooperation on market integration in the context of projects implemented by ENTSO-E (IGCC, MARI and PICASSO projects, CORE CCR and South-eastern Europe Regional Security Coordinator), Interreg programmes, CEF (e.g. the Baltic Synchronisation project) TEN-E initiatives as well as the SET roadmap and the TARES technical assistance project.

Many Member States also reported about bilateral cooperation with other Member States as well as bilateral gas solidarity agreements or multi-countries Memorandum of Understanding.

Some Member States reported about bilateral cooperation with non-EU countries (e.g. Croatia with Bosnia and Herzegovina, Montenegro and Albania, or Greece together with Israel, Egypt, Jordan, Saudi

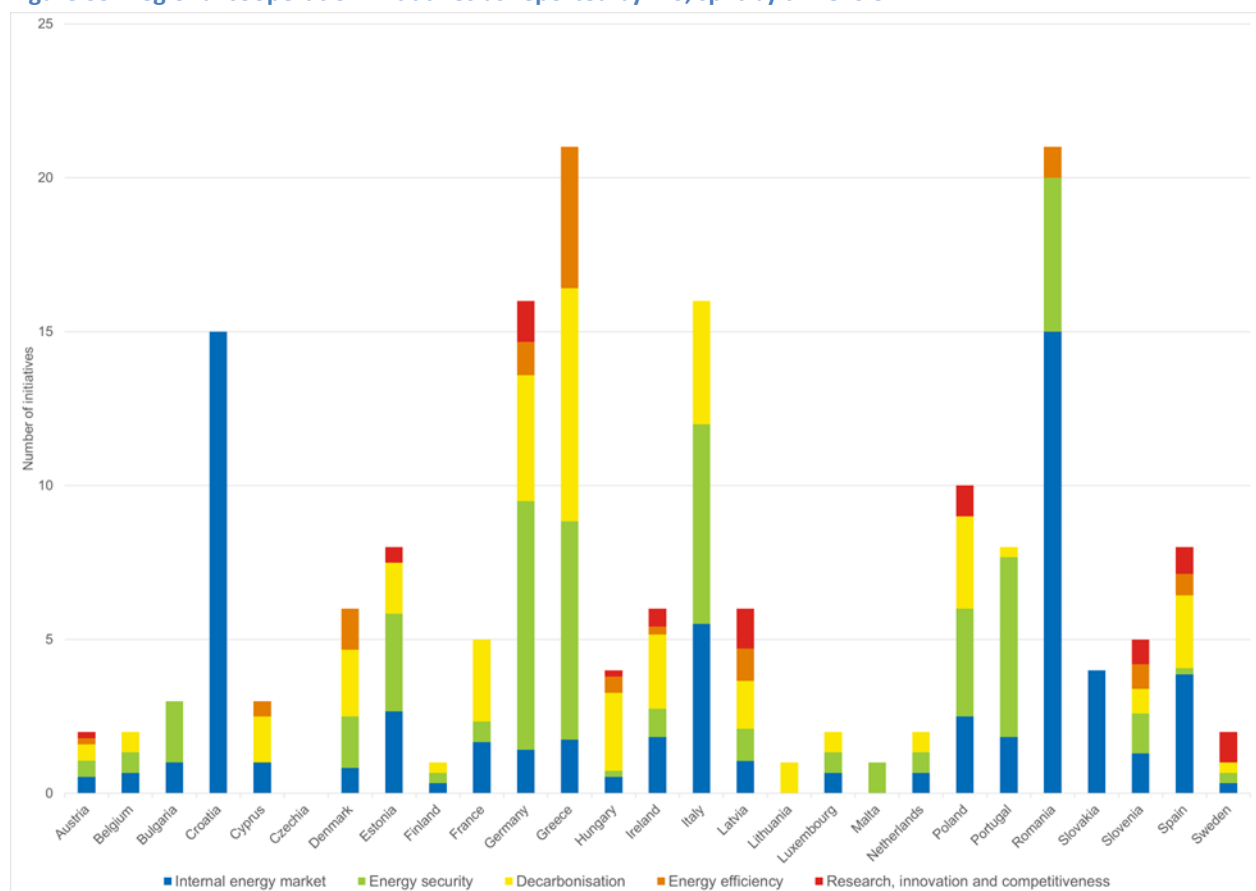
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<sup>73</sup> [220912 NSEC Joint Statement Dublin Ministerial.pdf \(europa.eu\)](#)

Arabia, United Arab Emirates, USA and Italy with Tunisia, Switzerland and Montenegro) or multilateral in the frame of the Transatlantic Partnership for Energy and Climate Cooperation. Several references have been made to the Union for the Mediterranean (Gas platform, Regional Electricity Market Platform and Renewable Energy and Energy Efficiency Platform), the Organization of the Black Sea Economic Cooperation (BSEC) and the Eastern Mediterranean Gas Forum (EMGF) - enhancing regional cooperations both among the EU Member States as well as with non-EU countries.

Progress was also reported on the strengthening of cross-border infrastructure in electricity, gas and hydrogen (see also Section 2.4). Progress was for instance reported on the development of the Celtic Interconnector between France and Ireland, while a third interconnector between Estonia and Latvia has become operational in early 2021. Similarly, a new gas interconnector between Poland and Slovakia was inaugurated in August 2022. It was also reported that in 2021 the planned Melita TransGas natural gas pipeline between Malta and Italy was upgraded to become hydrogen ready.

**Figure 35: Regional cooperation initiatives as reported by MS, split by dimension.**



**Notes: in case an initiative contributes to 2 dimensions, each dimension is counted for 0.5; where to 3 dimensions, each is counted for 0.33 etc.**

## 5 Multilevel climate and energy dialogues

Most of the Member States reported activities related to the set up of national multilevel climate and energy dialogue that they were required to set up, if not already in place, in line with the Article 11 of the Governance Regulation - in which local authorities, civil society organisations, business community, investors and other relevant stakeholders and the general public should be able to actively engage and discuss the achievement of the Union's climate-neutrality objective and different scenarios envisaged for energy and climate policies, including for the long term, and review progress. Integrated national energy and climate plans may be discussed within the framework of such a dialogue.

Various levels of maturity of the dialogue can be identified. Some have been in place for several years and are well established such as the Energy Efficiency Platform in Germany or Austria, which highlights the National Climate Change committee, established since 2017, which meets annually, and which discuss and supports the co-ordination of climate change related measures, gathering representatives of the relevant federal ministries, federal provinces and local government, representatives of social partners as well as from science, energy and industry interest groups, environmental NGOs and the political parties represented in the first chamber of the Parliament. Other Member States indicate processes that are only in place since 2022 or in the process of being set up. Several Member States (Bulgaria, Croatia, Italy, and Romania) specifically indicate that such dialogues are being set-up in their countries through the NECPlatform<sup>74</sup> project, funded by the LIFE Clean Energy Transition sub-programme.

Some Member States succeeded in putting their process in perspective, highlighting the regularity (and sometimes the permanence) of the initiatives, qualifying and quantifying the activities, the outcomes and the impacts reached (Germany, Netherlands).

Inclusion of local authorities has been a strong focus for several Member States (Italy, France) but is not prominent in most Member States. In France, the Climate and Resilience Act of 2021 mandates the creation of Regional Energy Committees with representatives of the State, local authorities, energy companies and civil society organisations active in the field of energy and climate, as well as approved environmental protection associations. France also reports on the various consultations and public debates organised over the last years in the context of the French Energy-Climate Strategy including a "tour de France des régions" and a "youth forum").

Several Member States, however, did not sufficiently describe their multilevel climate and energy dialogues: some do not refer, for instance, to the periodicity of the activities reported, the long-term perspective, the active engagement process with the local authorities or with key stakeholders etc. Some only list punctual consultations or events without explaining the overall approach or how the initiatives listed are interlinked. Other Member States stated that they set-up multilevel climate and energy dialogues without describing sufficiently the parties involved nor the processes put in place (Czech Republic, Slovakia). Member States are encouraged to better define the quality and the impacts of the dialogues and to demonstrate the active engagement of the parties involved. They are encouraged to explain how the views expressed in these consultations have been considered.

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<sup>74</sup> The NECPlatform project, funded by the LIFE Clean Energy Transition programme, brings together six Member States (Bulgaria, Croatia, France, Italy, Portugal and Romania) and provides for the creation of platforms (in the 6 partner states) for multilevel dialogue on climate and energy.

Overall, Member States refer to engagement with most of the actors listed in the Article 11. Not all the Member States described sufficiently how the local authorities have been involved. Only Luxembourg reported involving investors.

Many Member States limited the scope of the multilevel climate and energy dialogue to the NECPs development process, while the Regulation seeks for a more comprehensive framework, referring to the 'different scenarios for energy and climate policies including the long term'.

9 Member States (Bulgaria, Cyprus, Estonia, Hungary, Italy, Portugal, Slovenia, Spain, Sweden) also reported about public consultations (Article 10 of the Governance Regulation) that have been put in place (or will be organised) on their integrated energy and climate plans, without putting them in the perspective of the set up of multilevel energy and climate dialogues.

## 6 Conclusion and lessons learnt

- **Progress towards the Union's 2030 targets for energy and climate**

In 2022, despite the EU's continuing economic recovery, with GDP growing by 3.5% on yearly basis, the EU greenhouse gas (GHG) net emissions declined by 3%, continuing the overall downtrend of the past 30 years. However, the pace of emission reduction needs to pick up, to almost triple the average annual reduction achieved over the last decade, to achieve the EU's 2030 GHG reduction target (i.e. -55%) and the EU's 2050 climate neutrality objective. EU Member States' aggregated projected GHG emissions also fall significantly short of medium and long-term EU climate objectives, even when both existing and additionally planned measures are considered.

In 2021, the EU reached a share of 21.8 % of renewable energy in gross final energy consumption, a slight reduction compared to 2020 (22%), which can be explained to a large degree by a higher overall energy consumption as economic activity picked up following the lift of COVID restrictions. In absolute terms, the consumption of renewable energy increased by approx. 5% compared to 2020, with 220 804 Mtoe compared to 209 595 Mtoe the year before.

In 2021, primary energy consumption in the EU was 1311 Mtoe, around 6% higher than in 2020, most probably affected by the COVID-19 crisis recovery but remained lower than in 2019. However, PEC and FEC values are still far away from the 2030 PEC and FEC targets. The absolute final energy consumption in 2021 has declined in 18 Member States since 2005, while in 8 Member States it increased. In 2021, all Member States have experienced increases in total final energy consumption compared to 2020.

Based on the received data<sup>75</sup>, in 2021, 7 Member States<sup>76</sup> (IT, FR, IE, CY, EL, ES, RO) were below the 2030 interconnection target, with 4 (IT, IE, CY, ES) also remaining below the 2020 interconnection target. Overall, Member States have made good efforts to increase cross-border capacity and the completion of various Projects of Common Interest should further improve the interconnectivity levels. Still further efforts required to meet the 2030 objectives, in particular in terms of timely delivery of the planned cross-border projects.

Overall, the assessment shows that substantial ambition and implementing efforts are still needed to deliver on the 2030 increased Union's objectives.

- **The reporting, review, and assessment process**

2023 was the first year in which the progress on the implementation of the integrated national energy and climate plans was **reported and assessed in an integrated manner**. The fact that the reporting was done through an e-platform, based on templates laid down in an implementing regulation<sup>77</sup>, and with additional reporting guidelines to Member States, contributed substantially to **simplify the reporting process and increase the comparability** of data, facilitating the subsequent review and assessment.

At the same time, still more can be done to further improve the comparability and understanding of the reported data to strengthen the subsequent assessment, e.g., by further aligning with other data

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<sup>75</sup> Since Member States used their own data sources the calculation might not be fully consistent between them.

<sup>76</sup> Cyprus and Ireland currently have no electricity interconnection with other EU Member States.

<sup>77</sup> 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.

collection processes, refining and simplifying the reporting templates, further improving reporting guidelines, and exchanging best practices.

This work should be picked up in the preparation for the next reporting cycle in 2025, with the continued assistance of the European Environmental Agency and in consultation with the Energy Union Committee and Climate Change Committee and their working groups related to reporting. The Commission will also consider further streamlining in the upcoming review pursuant to Article 45 of the Governance Regulation.

Additionally, the current reporting obligations in the Governance Regulation and its implementing acts as well as the reporting guidelines to Member States will need to be aligned with the evolved energy and climate acquis which resulted from the Fit for 55 package and the relevant REPowerEU initiatives.