European Commission

Joint Research Centre

Covenant of Mayors 2025 Energy Report

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2026

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JRC146590
EUR 40751

PDF ISBN 978-92-68-40369-3 ISSN 1831-9424 doi:10.2760/4530095 KJ-01-26-254-EN-N

Luxembourg: Publications Office of the European Union, 2026

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How to cite this report: Hernandez Moral, G., Kuster, C., Bezerra, P., Palermo, V. and Melica, G., *Covenant of Mayors 2025 Energy Report,* Publications Office of the European Union, Luxembourg, 2026, https://data.europa.eu/doi/10.2760/4530095, JRC146590.

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Abstract

This report provides an in-depth analysis of the progress made by European Covenant of Mayors signatories in reducing their energy consumption and increasing renewable energy production. The analysis is based on data from over 2 300 municipalities across the EU-27 and EFTA and provides insights into the energy consumption patterns, renewable energy production and planned actions. The report highlights that, between the baseline year and the most recent inventories, total energy consumption has fallen by approximately 6%. However, energy consumption forecasting based on current trends indicates that municipalities are likely to miss of their initial energy consumption estimates by 2030, underscoring the need for accelerated action, enhanced policy support and increased investment in energy efficiency and renewable energy deployment. While further research on the underpinning causes of the observed trends would be required, this report provides recommendations for local authorities, EU level policy makers and researchers on how to progress towards EU's climate objectives to address the ambition-implementation gap.

Acknowledgements

Authors would like to thank the European Commission's Directorate-General for Energy (DG ENER) and Directorate-General for Climate Action (DG CLIMA) for their leadership and strategic guidance in the context of the Covenant of Mayors initiative.

Authors would also thank the Covenant of Mayors Office for taking care of relations with signatories, and in particular the IT team for managing the MyCovenant reporting platform and cooperating with the Joint Research Centre in order to continuously improve the data collection process. Special thanks go to Massimo Clemente for his continuous support in managing the Covenant of Mayors dataset and to Bagdagul Tan for the cover page.

1. Introduction

By 2050, the European Union (EU) aims to become the world's first climate-neutral continent, and municipalities play a vital role in achieving this goal. As highlighted by the Intergovernmental Panel on Climate Change (IPCC), urban areas can drive significant reductions in greenhouse gas emissions and increase resource efficiency through the systemic transition of infrastructure and urban form towards net-zero emissions (IPCC, 2023). Given their proximity to citizens, municipalities can exert considerable influence across various sectors. Through local energy and climate plans, they can contribute to the implementation of EU energy and climate policies. For instance, municipalities can establish renewable energy communities, streamline permitting procedures for renewable energy installations, enhance the energy efficiency of their own buildings and educate citizens about building energy renovation options. Additionally, they can promote sustainable mobility options and create more liveable cities and urban settings.

The EU Covenant of Mayors (EU CoM) and the Global Covenant of Mayors (GCoM) have played a pivotal role in raising awareness on climate change among local governments, providing them with methodologies and approaches to develop effective local climate and energy plans. Over the past decade, local authorities have been setting greenhouse gas (GHG) emission reduction targets and adopted plans to tackle the key emitting sectors in their territories. Moreover, they have set adaptation goals and adopted plans addressing the climate hazards and vulnerabilities in their territories. Furthermore, there is a growing emphasis on addressing energy poverty, recognising the need for a just and inclusive transition that ensures no one is left behind in the pursuit of a climate-resilient future.

This report on Energy Figures complements the Covenant of Mayors 2025 Assessment report[1] which presents an overview of the status of the initiative in relation to the mitigation, adaptation and energy poverty pillars, and is also based on the sixth release of the GCoM 2025 data set (Bezerra et al., 2026). This report presents key energy figures and actions for European municipalities (EU-27 and EFTA) reporting their energy activity inventories, including energy consumption and energy supply, and their estimates on energy savings and energy production by the target year 2030 for each sector targeted by their action plans. The distribution of signatories by EU-27 Member State and EFTA is presented in Annex 1 (section 9.2).

It should be noted that several improvements to increase the accuracy of the results and the transparency in the methodology have been performed from the previous version of this report (Franco et al., 2024) to the current version. Therefore, a direct comparison of the values from the previous report cannot be performed. The main differences are listed below:

[1] Covenant of Mayors 2025 Assessment Report: https://publications.jrc.ec.europa.eu/repository/handle/JRC146551

- **Broader scope**: the current version of the report expands the municipalities assessed from EU-27 with 2030 commitments, to EU-27 and EFTA with both 2030 and 2050 commitments. The results are presented in a separate manner, allowing to make comparisons among the groups of municipalities. EFTA signatories are limited in number, but the results are presented in the annex. Moreover, this report does not include signatories that have reported under CDP-ICLEI Track. In the previous report these signatories were considered only within the actions analysis section, as the data related to energy in CDP-ICLEI Track is limited and does not contain the same level of disaggregation as the one reported in the MyCovenant platform. To maintain a clear narrative throughout the report, these signatories have not been included in the present edition.
- **Methodological improvements:** while the main methodology to assess energy throughout the report remains largely the same as in the previous edition, some improvements have been performed in the calculation of population values and selection of inventories, among other. Results are presented in a more systematic, transparent and clearer manner, and the report is complemented with an annex where further information on the methodological choices and data limitations is provided.
- **Clarity in extracting Covenant insights**: in order not to distort results, Covenant signatories that are also participating to the Climate Neutral and Smart Cities Mission (43 signatories) have been discarded from the current report, as their level of ambition and scope could render their energy values not comparable to the rest of Covenant signatories. The list of discarded municipalities is available in annex 1, section 9.1.4.

It should be acknowledged that the results presented in this document correspond to a broad yet not necessarily representative sample of local authorities in the EU. Therefore, conclusions cannot be generalised to the EU level.

1.1. Sustainable energy and climate action plan (SECAP) process

The Sustainable Energy and Climate Action Plan (SECAP) is the key document to translate into climate action the vision of local authorities for both mitigation and adaptation to climate change, as well as energy poverty reduction, in line with the European Union's climate and energy policy framework, including the European Green Deal (European Commission, 2023) and the European Climate Law (European Commission, 2021). Updated detailed methodological guidance on how to develop a SECAP covering mitigation, adaptation and energy poverty is publicly available (Bastos et al., 2025; Davide et al., 2025; Hernandez Moral, G., Pittalis, M., Bezerra, P., Palermo, V., Treville, 2025; Palermo et al., 2025; Pittalis, M., Palermo, V. and Bezerra, 2025; Todeschi et al., 2025). Guidelines on how to report the SECAP through online platforms can be accessed through the Covenant EU website.[2]

Within two years of signing up to the initiative, municipalities have to approve and submit their SECAP. Such a SECAP is the key document through which the Covenant signatory presents its vision and target, together with the measures to be implemented to achieve its climate mitigation target,

[2] EU Covenant of Mayors – Reporting: A reference methodology for local authorities to monitor robust climate and energy strategies: https://eu-mayors.ec.europa.eu/en/Reporting

adaptation goals and energy poverty objectives. The SECAP covers the geographical area under the jurisdiction of the local authority and includes actions by both public and private sectors.

In the mitigation pillar, the SECAP has to contain the results of the baseline GHG emission inventory, a GHG emission reduction target aligned to the EU's climate and energy targets. In particular, such as the target to reduce net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels, as set out in the European Climate Law (European Commission, 2021) and becoming climate neutral by 2050. The SECAP may as well cover a longer period, in which case it is advised that the plan contains intermediate targets and goals for the year 2030. In the adaptation pillar, the SECAP includes the assessment of climate risks and vulnerabilities within the territory, the definition of at least one adaptation goal, and a set of actions (including at least three key actions) to increase the resilience of the critical sectors and vulnerable groups. Lastly, signatories should also define an indicator to assess energy poverty, define an energy poverty objective and at least one key energy poverty action.

Therefore, a local authority willing to develop a climate mitigation plan should start by developing a baseline emission inventory (BEI), standing as the reference against which the achievements of the emission reductions in the target year can be measured. The BEI quantifies the level of GHG emissions in a base year according to a common methodological approach (Bastos et al., 2025), identifying the main emitting sectors and consequently prioritising areas for action. To calculate these emissions, signatories should assess the energy consumption in their municipalities. These values are then multiplied by the corresponding emission factors to calculate the GHG emissions. Following the SECAP submission, local authorities should present, ideally every two years, a monitoring report with its corresponding monitoring emission inventory (MEI), enabling to follow the performance of their proposed actions according to their declared ambitions, and to assess progress towards the EU's climate and energy targets.

1.2. Energy data reported by municipalities

Regarding energy data, MyCovenant template requires signatories to report four main items:

(a) **Energy consumption:** their final energy consumption (activity data) for both their baseline emission inventory and subsequent monitoring years. This data is then multiplied by the appropriate emission factor (also provided by municipalities) to determine the level of emissions in various sectors.

(b) **Energy supply**: additionally, signatories are also requested to report energy generation data, which is not included in the total emissions calculation, but is used to derive emission factors for grid-supplied energy (i.e., electricity and district heating/cooling).

(c) **Overall estimates by 2030:** estimated energy savings and renewable energy production by the target year 2030 for each relevant sector/subsector. This action plan level information provides an overall picture of the expected impact of their action plan in 2030, as summarised in "My Actions Overview" within MyCovenant.

(d) **Action-level estimates:** estimate energy savings and renewable energy production for mitigation actions outlined in their action plan, reported at the individual action level ("My Actions Details"). Note that these estimates are only mandatory for key actions[3].

The annex (section 9.1.2) provides further insights on the categories used in this report for each of these datasets versus those present in the MyCovenant.

1.3. Analysed data in this report and structure

This report presents energy data reported in the MyCovenant platform by EU-27 and EFTA signatories. This includes action plans and monitoring reports from signatories with 2030 or 2050 commitments. Due to the limited number of EFTA signatories, the results corresponding to this region are presented in the annex 2 (9.2), and energy consumption / supply levels or shares of energy carriers or sectors' relative importance have not been factored in in the analysis.

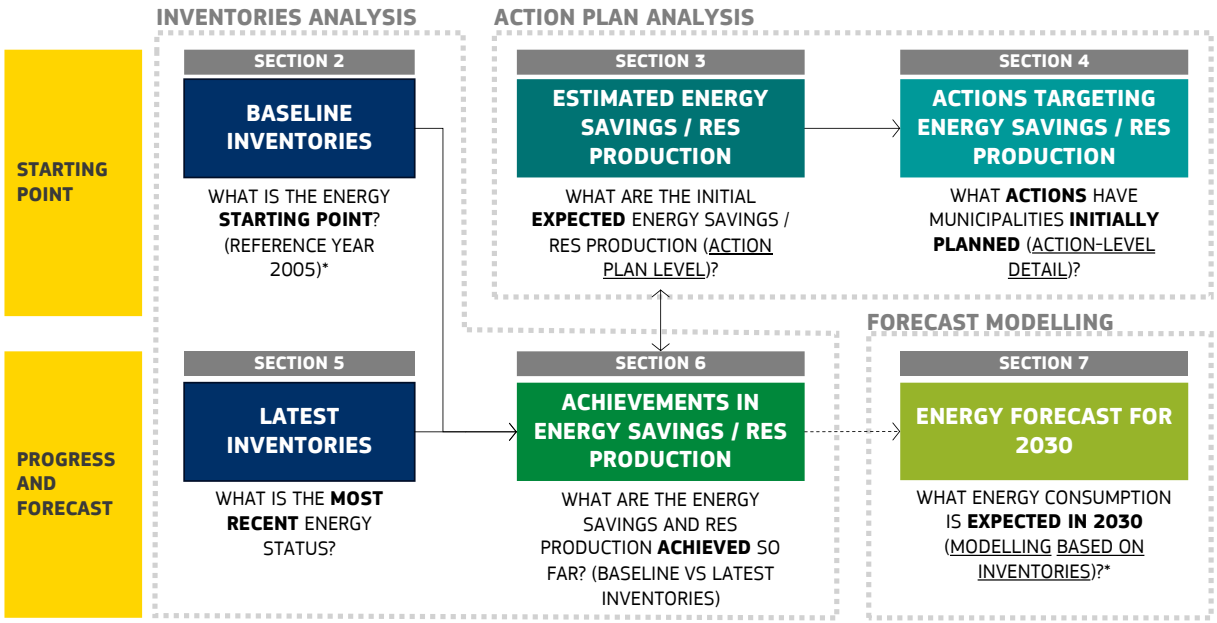
Results of EU-27 signatories are presented separately according to their commitment (2030 or 2050), thus, a comparison between both ambition levels within the Covenant can be drawn. However, Covenant signatories that are also involved in the Horizon Europe 100 Climate-Neutral and Smart Cities Mission[4] have been excluded from this analysis, as their ambition levels and scope are beyond those of the Covenant. Please refer to the annex to see excluded signatories (section 9.1.4).

The main questions covered by the report are depicted in the figure below **Figure 1**. The main objective is to understand where Covenant signatories stand with respect to energy in the past (starting point), present (progress so far), and future (forecast). To do so, three main types of assessment are proposed: inventories analysis, action plan analysis and forecast modelling.

[3] Key actions are those considered of high relevance by signatories, because are key to deliver the expected targets and should be monitored more closely. For the analysed signatories, at least 3 key mitigation actions and 3 key adaptation actions should be reported in the MyCovenant platform. However, it is not mandatory to report non-key actions within the platform.

[4] Climate Neutral and Smart Cities Mission: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en

Figure 1. Structure of the report



*See methodological approach on inventories selection

Source: JRC elaboration

The types of assessment are explained below:

- **Inventories analysis**: inventories reported by signatories as BEI (baseline emission inventory) or MEI (monitoring emission inventory) are used to present the starting point or the latest data reported by each signatory. As cities can report more than one inventory, only one inventory has been selected to depict the starting point: "baseline inventory" throughout the text. To harmonise baseline years across signatories where several inventories exist, the baseline inventory closest to 2005 has been selected. If the city counts on more than one inventory, the latest is designated in this report the "latest inventory". This approach avoids double counting and aims at defining a common starting point for the baseline assessment. See annex (section 9.1.3) for further insights on the methodological choices.
- **Action plan analysis**: information related to estimated energy savings and RES production by 2030 are reported by cities at action plan level (under the "My Actions Overview") section. These reflect what the expectations of the municipalities are by 2030 in terms of impact. Moreover, cities also report details at action level (under "My Actions Details"). Ideally, the total aggregation of action-level estimates should correspond to those reported in "My Actions Overview"; nevertheless, only key actions are mandatorily reported.
- **Forecast modelling**: lastly, based on the information reported in the inventories, it is possible to model the energy consumption expected by 2030, which in turn helps to understand the energy trend followed by the Covenant signatories.

All in all, this structure allows to understand the energy status of the signatories from different perspectives. Firstly, the results on the initial status are presented (see **starting point** in **Figure 1** above): baseline inventories (section 0), estimated energy savings and renewable energy production at action plan level (section 3), complemented by the initially planned actions (section 4).

Then, the assessment of progress is presented in three stages (see **progress and forecast** in **Figure 1** above). First, the latest inventories reported by signatories (section 0) are presented. Next, the information presented in the baseline inventories is contrasted with the latest inventories (section 6). This allows to observe what the real progress (i.e. as reported by municipalities) has been so far in energy savings and renewable energy production. Finally, based on all the inventories reported by signatories (i.e. not only reported in this document as "baseline" and "latest") a modelling exercise is performed to forecast the energy consumption trend from 2005 to 2030, recognising the uncertainty associated with data quality and modelling assumptions.

In the tables below the number of signatories analysed in the EU-27 and EFTA, both for 2030 and 2050 commitments are presented, as well as the population covered in each case. The included sections correspond to those available in the SECAP template.

As it can be observed from **Table 1**, there are significant variations in the number of plans that can be analysed depending on how many local authorities have reported specific contents. For instance, while data on energy consumption is available in all local authorities' reported data, only around a third of them report on local energy production in EU-27. This discrepancy may also be influenced by factors such as the emission inventory year, as local energy production may have been limited in earlier years, potentially affecting the availability of reported data.

Table 1. EU-27 and EFTA signatories with 2030 or 2050 commitments: number of signatories reporting information in the template and population covered

EU + EFTA 2030		Number of signatories				Population (million)				Section
		Baseline EI		Latest EI		Baseline EI		Latest EI		
		[EU27]	[EFTA]	[EU27]	[EFTA]	[EU27]	[EFTA]	[EU27]	[EFTA]	
INVENTORIES	**Energy consumption**	2 305	2	1 115	2	54.54	0.21	32.80	0.22	2.1 and 5.1
	Energy supply									
	Local electricity production	793	1	671	1	30.47	0.13	23.55	0.13	2.2.1 and 5.2.1
	Purchases of renewable energy certificates	206	0	257	0	5.87	0	11.02	0	2.2.2 and 5.2.2
	Local heat/cold production	33	1	23	0	6.34	0.13	2.66	0	2.2.3 and 5.2.3
	Achievements in energy savings and renewable energy generation									
	Energy savings	1 114[1] EU-27				33.01				6.1
	Renewable energy generation	340 EU-27				17.00				6.2
		Number of signatories				**Population (million)**				
		[EU27]		[EFTA]		[EU27]		[EFTA]		
ACTION PLANS	**Estimated energy savings and renewable energy production**					-				
	Estimated energy savings	1 989		0		46.53		0		3.1
	Estimated renewable energy production	1 719		0		42.44		0		3.2
	Actions targeting energy savings and renewable energy production									
	Actions targeting energy savings	1 542		0		38.39		0		0
	Actions targeting renewable energy production	1 083		0		25.36		0		4.2

[1] In this section only inventories with equivalent sectors have been considered. There is one signatory that has not reported the sectors in the baseline versus the latest inventory, and it has been removed from this section's analysis. No EFTA signatories have been considered in this analysis.

Source: JRC elaboration based on GCoM reported through the MyCovenant platform

The following tables present the national-level disaggregation of signatories with a 2030 or 2050 commitment reporting energy consumption in the baseline (**Table 2**) or in the latest inventories (**Table 3**). As it can be observed, Spain, Italy and Belgium count on the largest set of signatories.

Table 2. EU-27 and EFTA signatories with 2030 or 2050 commitments: number of signatories reporting energy consumption in the baseline inventory and population covered (national disaggregation)

Energy consumption baseline inventory (EU-27+EFTA)							
Countries	**Signatories**		**Population**		**Energy consumption (TWh/year)**		**Energy consumption per capita (MWh/year)**
Austria	1	0.04%	11756	0.02%	0.52	0.05%	44.00[1]
Belgium	377	16.36%	8187092	15.01%	202.54	20.46%	24.74
Bulgaria	2	0.09%	96743	0.18%	0.62	0.06%	6.42
Croatia	37	1.61%	776852	1.42%	9.43	0.95%	12.14
Cyprus	2	0.09%	104000	0.19%	1.71	0.17%	16.40
Czechia	30	1.30%	2529182	4.64%	42.76	4.32%	16.91
Finland	8	0.35%	727771	1.33%	18.08	1.83%	24.84
France	10	0.43%	2528243	4.64%	59.62	6.02%	23.58
Germany	6	0.26%	4088208	7.50%	86.30	8.72%	21.11
Greece	42	1.82%	2105363	3.86%	25.24	2.55%	11.99
Hungary	60	2.60%	3445321	6.32%	52.66	5.32%	15.28
Ireland	5	0.22%	1076148	1.97%	22.69	2.29%	21.08
Italy	700	30.37%	13288857	24.36%	240.77	24.33%	18.12
Latvia	3	0.13%	95506	0.18%	1.13	0.11%	11.81
Luxembourg	1	0.04%	20869	0.04%	0.82	0.08%	39.21[1]
Netherlands	2	0.09%	97566	0.18%	2.26	0.23%	23.18
Poland	10	0.43%	1053859	1.93%	19.00	1.92%	18.03
Portugal	35	1.52%	1741380	3.19%	39.09	3.95%	22.45
Romania	18	0.78%	1148616	2.11%	8.84	0.89%	7.70
Slovakia	1	0.04%	91957	0.17%	0.97	0.10%	10.57
Slovenia	7	0.30%	361607	0.66%	5.09	0.51%	14.08
Spain	941	40.82%	10609798	19.45%	140.27	14.17%	13.22
Sweden	7	0.30%	359073	0.66%	9.32	0.94%	25.97
TOTAL EU	**2305**	**100%**	**54545767**	**100%**	**989.70**	**100%**	**18.14**
Norway	1	50.00%	85000	40.02%	2.62	52.29%	30.77[1]
Switzerland	1	50.00%	127400	59.98%	2.39	47.71%	18.74
TOTAL EFTA	**2**	**100%**	**212400**	**100%**	**5.00**	**100%**	**23.55**

[1] Austria, Luxembourg and Norway present higher per capita values, as signatories have reported industry non-ETS or industry ETS energy consumption values

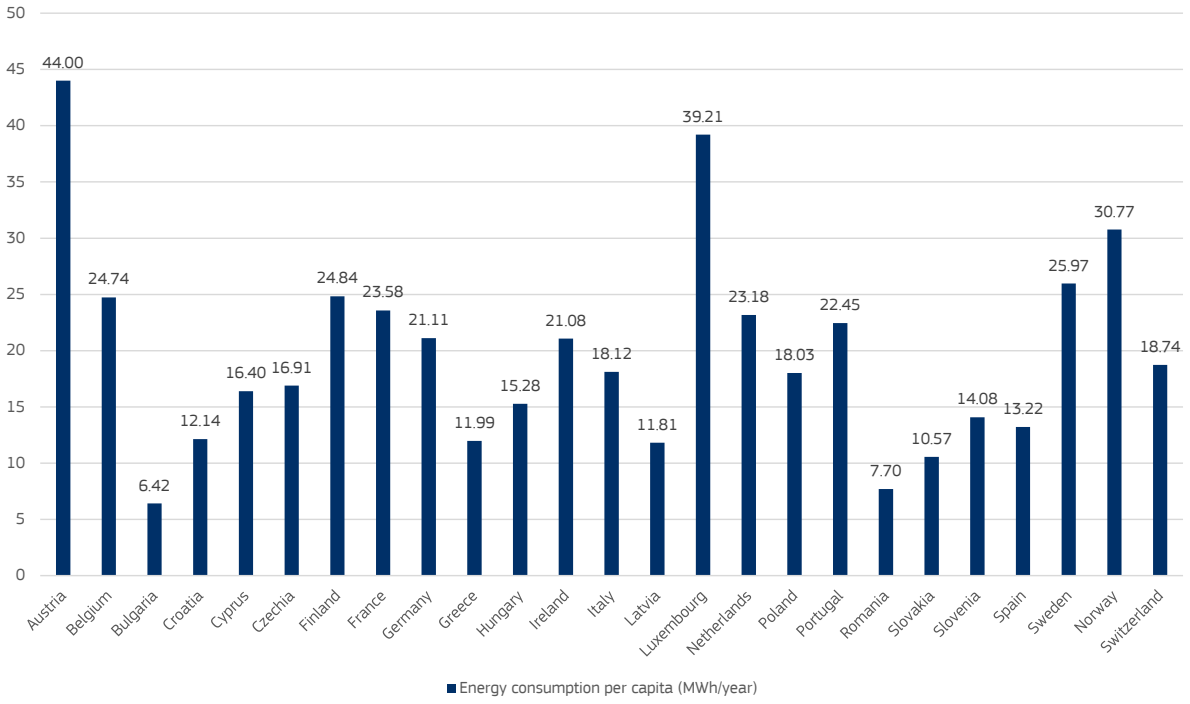
Source: JRC elaboration based on GCoM reported through the MyCovenant platform

Table 3. EU-27 and EFTA signatories with 2030 or 2050 commitments: number of signatories reporting energy consumption in the latest inventory and population covered (national disaggregation)

Energy consumption latest inventory (EU-27+EFTA)							
Countries	**Signatories**		**Population**		**Energy consumption (TWh/year)**		**Energy consumption per capita (MWh/year)**
Austria	1	0.09%	11756	0.04%	0.42	0.07%	36.12
Belgium	238	21.35%	4972868	15.16%	114.80	19.70%	23.09
Bulgaria	-	-	-	-	-	-	-
Croatia	14	1.26%	484861	1.48%	6.46	1.11%	13.33
Cyprus	2	0.18%	105345	0.32%	1.34	0.23%	12.68
Czechia	6	0.54%	834415	2.54%	9.77	1.68%	11.71
Finland	6	0.54%	679900	2.07%	17.28	2.96%	25.41
France	5	0.45%	2029020	6.19%	50.62	8.69%	24.95
Germany	4	0.36%	4135002	12.61%	81.14	13.93%	19.62
Greece	7	0.63%	510249	1.56%	5.47	0.94%	10.73
Hungary	12	1.08%	1347260	4.11%	19.09	3.28%	14.17
Ireland	1	0.09%	278767	0.85%	6.78	1.16%	24.33
Italy	323	28.97%	8438073	25.72%	152.87	26.24%	18.12
Latvia	3	0.27%	97226	0.30%	0.97	0.17%	9.96
Luxembourg	-	-	-	-	-	-	-
Netherlands	1	0.09%	68599	0.21%	1.31	0.22%	19.05
Poland	7	0.63%	663659	2.02%	10.56	1.81%	15.90
Portugal	13	1.17%	977788	2.98%	14.74	2.53%	15.08
Romania	6	0.54%	462141	1.41%	3.59	0.62%	7.77
Slovakia	1	0.09%	89872	0.27%	0.93	0.16%	10.37
Slovenia	-	-	-	-	-	-	-
Spain	459	41.17%	6295627	19.19%	75.29	12.92%	11.96
Sweden	6	0.54%	320733	0.98%	9.26	1.59%	28.86
TOTAL EU	**1115**	**100%**	**32803161**	**100%**	**582.69**	**100%**	**17.76**
Norway	1	50.00%	94500	42.59%	1.98	43.76%	20.94
Switzerland	1	50.00%	127400	57.41%	2.54	56.24%	19.97
TOTAL EFTA	**2**	**100%**	**221900**	**100%**	**4.52**	**100%**	**20.38**

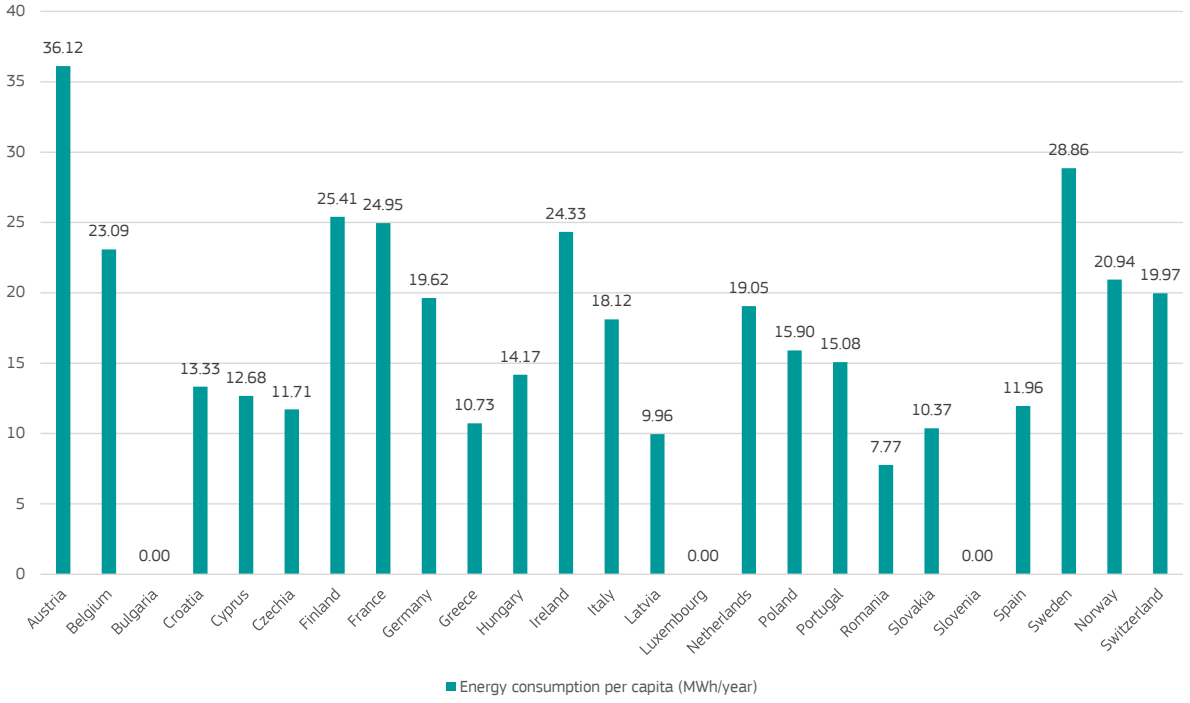
Source: JRC elaboration based on GCoM reported through the MyCovenant platform

Figure 2. Energy consumption per capita reported in baseline inventories EU-27 and EFTA with 2030 or 2050 commitments (national level disaggregation) [2 307 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 3. Energy consumption per capita reported in the latest inventories EU-27 and EFTA with 2030 or 2050 commitments (national level disaggregation) [1 117 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

2. Baseline inventories: energy consumption and supply in EU-27

In this section, the analysis focuses on EU-27 signatories with a commitment for 2030 or 2050 and analyses the energy consumption and supply reported in the earliest emission inventory that is closest to the year 2005. See annex 1 for further insights on inventory selection (section 9.1.3).

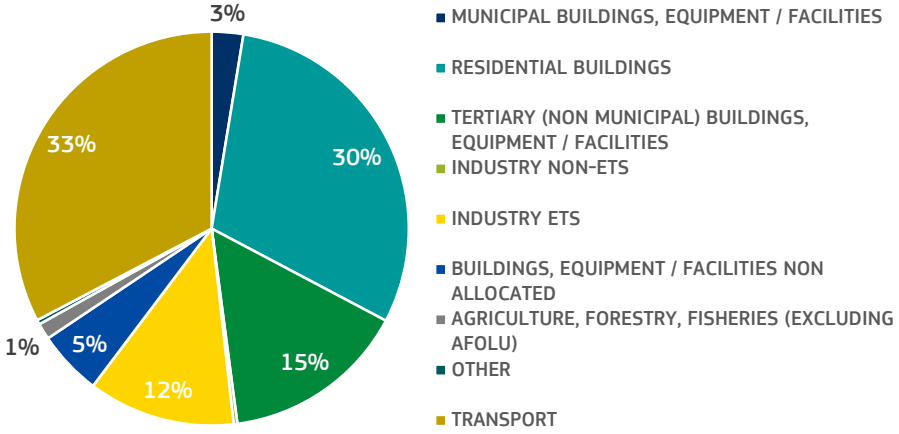
All signatories analysed have reported at least energy consumption estimates in one or more of the sectors considered [5] (section 2.1). However, only a subset of these signatories has reported energy supply, either related to local electricity production (section 2.2.1), purchases of renewable energy certificates (section 2.2.2), or local heat/cold production (section 2.2.3). Therefore, for instance, a city reporting local electricity production, has always reported energy consumption, but not necessarily has reported on purchasing renewable energy certificates or local heat / cold production.

2.1. Baseline energy consumption

Considering signatories in EU-27 with 2030 or 2050 commitments, 2 305 municipalities have a baseline inventory, representing 54.54 million inhabitants, reporting a total energy consumption of 989.70 TWh/year. Looking at the sectors with the highest share of energy consumption, transport has the highest share with 32.70 % and the highest per capita value with 5.93 MWh/year per capita, followed by residential buildings (30.16 %) with 5.47 MWh/year per capita, see **Figure 4** and **Table 4**. In terms of energy carrier associated with the greatest share of total energy consumption, fossil fuels dominate the scene (67.64%) representing 12.27 MWh/year per capita, followed by electricity (24.82%) representing 4.50 MWh/year per capita as shown in **Figure 5** and **Table 4**.

Table 4 summarises the absolute, percentage and per capita values, showing that except for the residential buildings and transport sectors mentioned above, tertiary (non-municipal) buildings and industry ETS show a per capita energy consumption averaging 2.5 MWh/year, while the rest of the sectors have a per capita consumption less than 1 MWh/year.

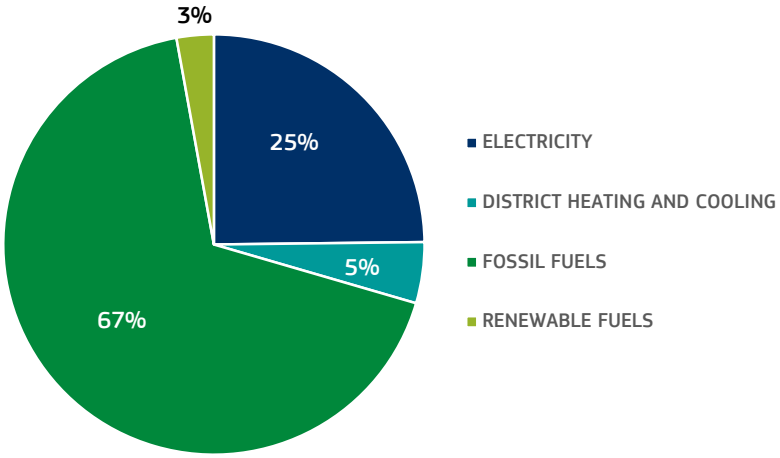
Figure 4. Shares of final energy consumption by sector reported in baseline inventories EU-27 with 2030 or 2050 commitments [2 305 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

[5] Municipal buildings, equipment/facilities, residential buildings, tertiary (non-municipal) buildings, equipment/facilities, industry non-ETS, industry ETS, buildings, equipment/facilities non-allocated, transport, agriculture, forestry, fisheries or other non-allocated.

Figure 5. Shares of final energy consumption by carrier reported in baseline inventories EU-27 with 2030 or 2050 commitments [2 305 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

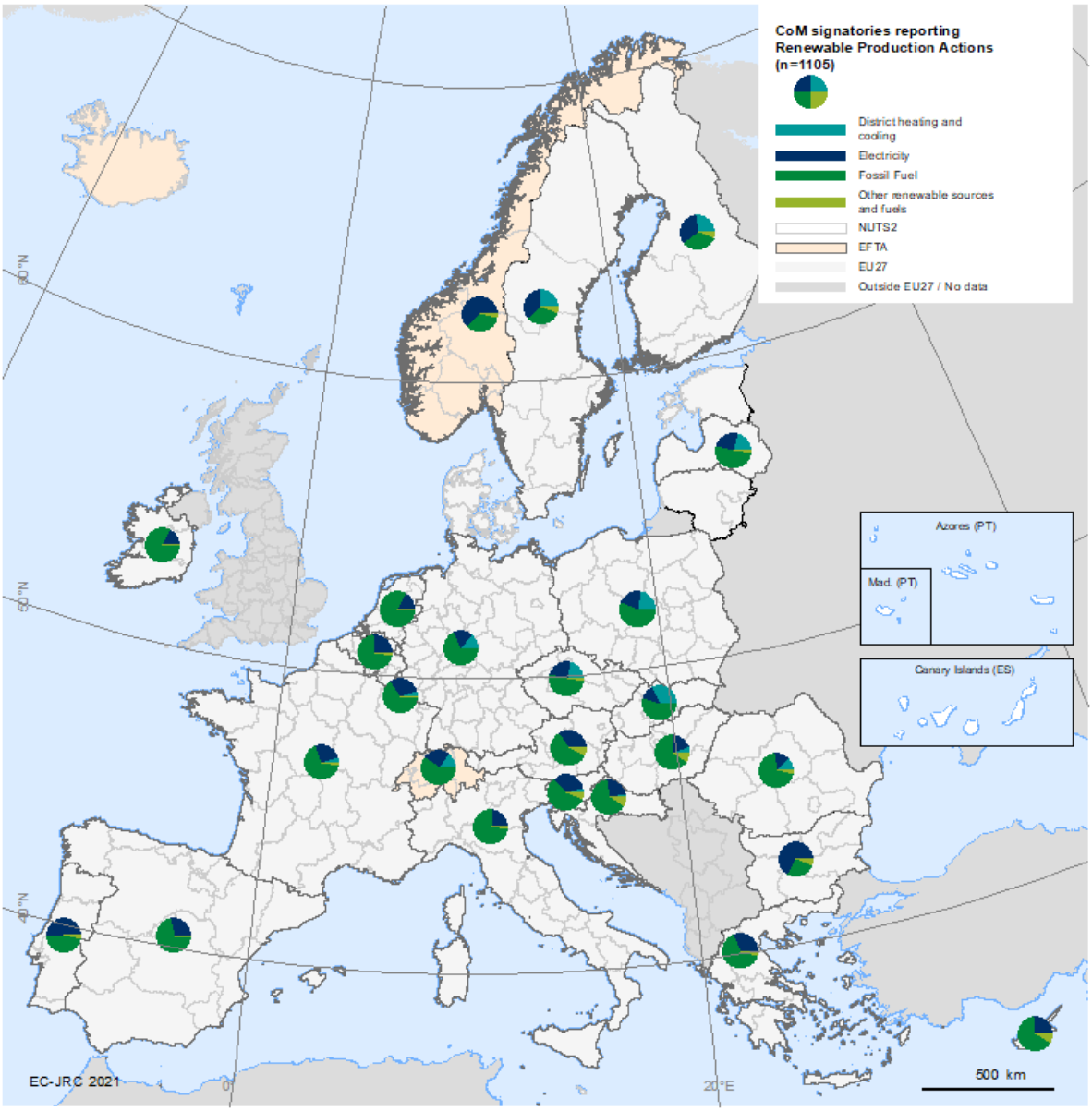
Table 4. Energy consumption reported in baseline inventories related to 2030 or 2050 commitments – EU-27 [2 305 signatories]

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**	SHARE	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**
	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Municipal buildings, equipment/facilities	13.6885	3.3128	8.4631	0.1276	**25.5920**	2.59%	0.2510	0.0607	0.1552	0.0023	**0.4692**
Residential buildings	82.1406	20.9139	176.3655	19.0838	**298.5037**	30.16%	1.5059	0.3834	3.2333	0.3499	**5.4725**
Tertiary (non-municipal) buildings, equipment/facilities	77.3883	7.1148	62.8015	2.7929	**150.0975**	15.17%	1.4188	0.1304	1.1514	0.0512	**2.7518**
Industry Non-ETS	1.4478	0.2883	1.2029	0.0433	**2.9822**	0.30%	0.0265	0.0053	0.0221	0.0008	**0.0547**
Industry-ETS	51.7906	1.8367	64.2895	1.4908	**119.4076**	12.07%	0.9495	0.0337	1.1786	0.0273	**2.1891**
Buildings, equipment/facilities non-allocated	10.3869	10.3516	31.6630	0.2042	**52.6057**	5.32%	0.1904	0.1898	0.5805	0.0037	**0.9644**
Agriculture, Forestry, Fisheries	2.4125	2.0769	8.6746	0.0497	**13.2136**	1.34%	0.0442	0.0381	0.1590	0.0009	**0.2422**
Other non-allocated	0.8244	0.5792	2.2604	0.0197	**3.6837**	0.37%	0.0151	0.0106	0.0414	0.0004	**0.0675**
Subtotal stationary energy	240.0795	46.4741	355.7205	23.8120	**666.0861**	67.30%	4.4014	0.8520	6.5215	0.4366	**12.2115**
Subtotal transport	5.5237	0	313.6852	4.4070	**323.6159**	32.70%	0.1013	0	5.7509	0.0808	**5.9329**
TOTAL	245.6032	46.4741	669.4057	28.2190	**989.7020**	100 %	4.5027	0.8520	12.2724	0.5173	**18.1444**
SHARE	24.82%	4.70%	67.64%	2.85%	**100 %**						

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

The following figure represents the share of energy consumption per carrier at national level, including the abovementioned signatories. Electricity consumption includes both renewable and non-renewable sources; fossil fuels reported by signatories include natural gas, liquid gas, heating oil, diesel, gasoline, lignite, coal and other fossil fuels, whereas other renewable sources and fuels include plant oil, biofuel, solar thermal, geothermal, other biomass and biogas.

Figure 6. Shares of final energy consumption by carrier reported in baseline inventories for EU-27 with 2030 or 2050 commitments (national level distribution) [2 305 signatories].



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

2.2. Baseline energy supply

The following **Table 5** summarises the number of signatories having reported a baseline emission inventory including energy supply data.

Table 5. Overview of signatories with 2030 or 2050 commitments having reported energy supply

Energy supply	No. municipalities	Population (million inhab.)
Local electricity production	793	30.54
Purchases of renewable energy certificates	206	5.87
Local heat/cold production	33	6.54

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

2.2.1. Local electricity production

Most used technologies for local electricity production reported by a subsample of 793 signatories are photovoltaics, with 63.06 % of the total reported local electricity production and hydroelectric (21.21 %), as shown in **Figure 7**.

Furthermore, renewable energy covers the highest share, 93.47 %, of total production. It is worth to note that for "electricity only" plants, the CoM guidebook recommends reporting only plants <20MW, which might explain the very low share of fossil fuel power plants. In per capita terms, the reported local electricity production amounts to 0.04 and 0.59 MWh/year for non-renewable and renewable technologies, respectively. See **Table 6** for a complete overview of the total electricity production by technology and per capita values.

All in all, data suggests that local electricity production plays a limited role in baseline emission inventories, representing 13.98% of the electricity consumption of the analysed 793 signatories having reported data on local electricity production.

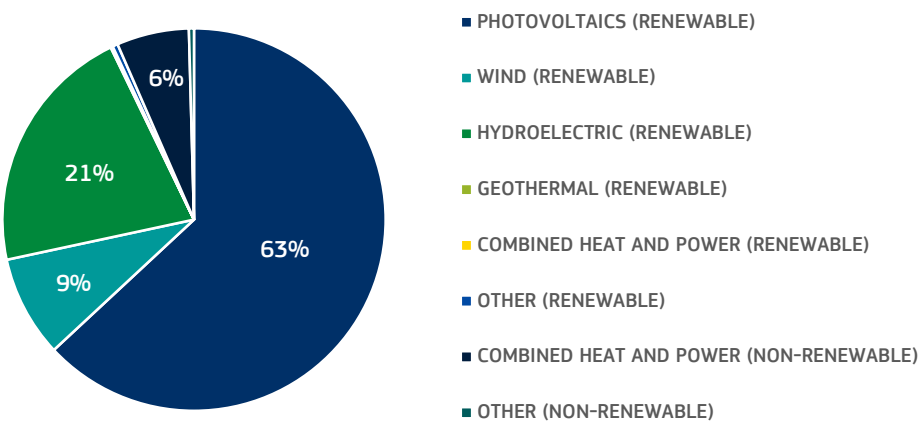
Table 6. Local electricity production in baseline inventories related to 2030 or 2050 commitments - EU-27 [793 signatories]

Energy production technology	Non-renewable	Renewable	TOTAL	SHARE	Non-renewable	Renewable	TOTAL
	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Photovoltaics	-	12.10	12.10	63.06%	-	0.3972	0.3972
Wind	-	1.65	1.65	8.57%	-	0.0540	0.0540
Hydroelectric	-	4.07	4.07	21.21%	-	0.1336	0.1336
Geothermal	-	0.03	0.03	0.13%	-	0.00081	0.00081
Local electricity production plants - Combined Heat and Power	1.17	0.01	1.18	6.16%	0.038	0.0004	0.0388
Local electricity production plants - Other	0.082	0.085	0.167	0.87%	0.002	0.0028	0.0055
TOTAL	1.25	17.94	19.19	**100 %**	0.040	0.589	0.6299
Share of total electricity production	6.53%	93.47%	**100 %**				
Share of total electricity consumption*	0.91%	13.07%	**13.98%**				

*Compared to the total electricity consumption in baseline inventories of the 793 local authorities reporting local electricity production

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 7. Shares of local electricity production by technology, reported in baseline inventories related to 2030 or 2050 commitments– EU-27



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

2.2.2. Purchases of renewable energy certificates

The purchases of renewable energy certificates account for a total of 1.39 TWh/year for 206 signatories in EU-27 with 2030 or 2050 commitments, with per capita figures of 0.23 MWh/year (**Table 7**).

When these certificate purchases are compared with the electricity consumption reported by the same signatories, they appear to cover roughly 3.5% of total electricity use, indicating a limited contribution to overall consumption.

Table 7. Purchases of renewable energy certificates in baseline inventories related to 2030 or 2050 commitments – EU-27 [206 signatories]

Renewable energy certificates	Renewable electricity	**TOTAL**	SHARE	Renewable electricity	**TOTAL**
	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]
Purchases Guarantees of Origins (within the municipality boundaries)	1.3825	1.3825	99.17%	0.2354	**0.2354**
Sales Guarantees of Origins (within the municipality boundaries)	0.0116	0.0116	0.83%	0.0020	**0.0020**
TOTAL	1.3941	1.3941	100%	0.2374	**0.2374**
Share of total electricity consumption*	3.51%				

*Compared to the total electricity consumption in baseline inventories (only for local authorities reporting renewable energy certificates)

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

2.2.3. Local heat/cold production

Local heat/cold production information has been reported in the baseline of 33 CoM municipalities with an overall population of 6.54 million inhabitants. Considering local heat/cold supply, the highest share (64.34 %) of local heat/cold production corresponds to district heating (heat only), followed by

combined heat and power (CHP), with 35.40 %. See **Table 8** for a complete overview of the total production by technology.

Furthermore, when compared with renewable energy technologies, non-renewable energy has the highest share, with 96.48 %. As shown in the **Table 8** below, the per capita production with non-renewable fuels amounts to 1.107 MWh/year versus 0.04 MWh/year of renewable production. **Figure 8** shows the shares of the most representative both renewable and non-renewable heat/cold production sources and technologies.

Lastly, it can be observed that in the 33 signatories analysed, local heat and cold production covers 40.26 % of the district heating consumption, mostly from non-renewable sources.

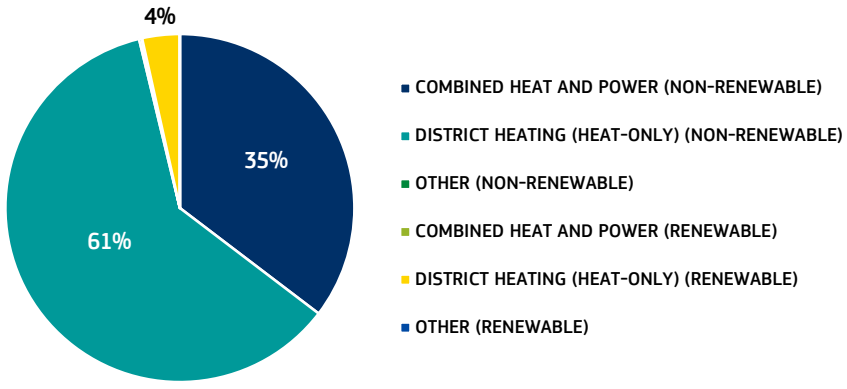
Table 8. Local heat/cold production in baseline inventories related to 2030 or 2050 commitments - EU-27 [33 signatories]

Energy production technology	Non-renewable	Renewable	TOTAL	SHARE	Non-renewable	Renewable	TOTAL
	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Combined Heat and Power	2.653	0.003	2.656	35.40%	0.4055	0.0004	0.4059
District heating (heat-only)	4.567	0.261	4.828	64.34%	0.6979	0.0399	0.7378
Other	0.019	-	0.019	0.25%	0.0029	-	0.0029
TOTAL	**7.239**	**0.264**	**7.503**	**100%**	**1.1063**	**0.0403**	**1.1466**
SHARE ON TOTAL HEAT/COLD PRODUCTION	96.48%	3.52%	100%				
SHARE ON TOTAL DISTRICT HEATING CONSUMPTION*	38.84%	1.42%	40.26%				

* Compared to the total district heating consumption in baseline inventories of the 33 municipalities reporting local heat/cold production.

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 8. Shares of local heat/cold production by energy source and technology, reported in baseline inventories related to 2030 and 2050 commitments – EU-27



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

3. Estimated energy savings and renewable energy production

This section analyses the planned energy savings and renewable energy production by 2030 reported by signatories in their action plans. Action plans have been considered in sections 3.1 and 3.2, only if the signatory had reported some estimates on energy savings or renewable energy production within the "My Actions Overview" section of the MyCovenant platform. Therefore, there might be action plans with both energy savings and renewable energy production, or just one of them.

This section focuses on the initial estimates by each signatory allowing to analyse their initial expectations.

3.1. Estimated energy savings

Estimated energy savings by 2030 have been reported by 1 989 signatories with 2030 or 2050 commitments, representing 46.53 million inhabitants, accounting for a total of 208.10 TWh/year energy savings (4.86 MWh/year per capita) (see **Table 9** for further details).

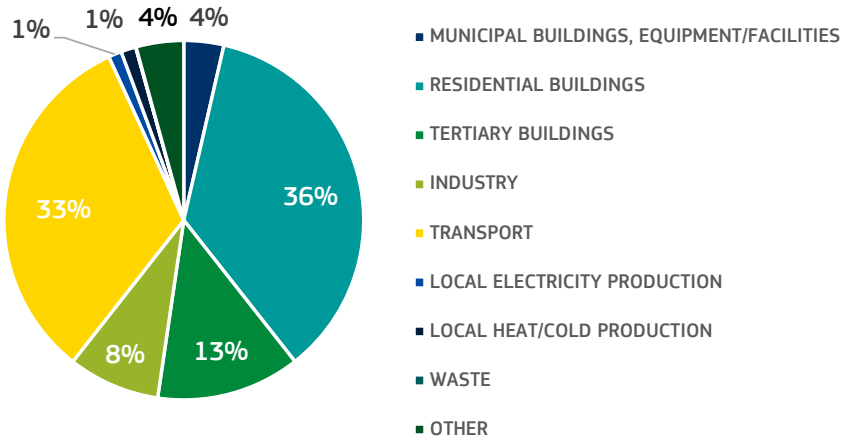
The highest shares of energy savings are expected in residential buildings (35.80 %), followed by transport (32.58 %) and tertiary (non-municipal) buildings (12.93 %) (see **Figure 9**). **Table 9** provides an overview of estimated energy savings across CoM sectors as declared by signatories.

Table 9. Estimated energy savings by 2030 declared by EU-27 signatories with 2030 or 2050 commitments [1 989 signatories]

Sector	Energy savings	Share	Energy savings per capita
	[TWh/year]	[%]	[MWh/y*pc]
Municipal buildings	7.48	3.59%	0.18
Residential buildings	74.50	35.80%	1.74
Tertiary (non-municipal) buildings, equipment /facilities	26.91	12.93%	0.63
Industry (excluding IPPU)	17.19	8.26%	0.40
Transport	67.80	32.58%	1.58
Local electricity production	2.46	1.18%	0.06
Local heat/cold production	2.78	1.34%	0.07
Waste	0.08	0.04%	0.002
Others	8.90	4.28%	0.21
TOTAL	**208.10**	**100 %**	**4.858**

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 9. Shares of estimated energy savings by sector – EU-27 [1 989 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

3.2. Estimated renewable energy production

There are 1 719 signatories with 2030 or 2050 commitments (representing 42.44 million inhabitants) reporting a total of 53.12 TWh/year (1.25 MWh/year per capita) of renewable energy production (see **Table 10** for further details). As also shown in **Figure 10**, residential buildings hold the highest share of renewable energy production (51.29 %), followed by tertiary (non-municipal buildings) (15.91 %) and transport (12.33 %).

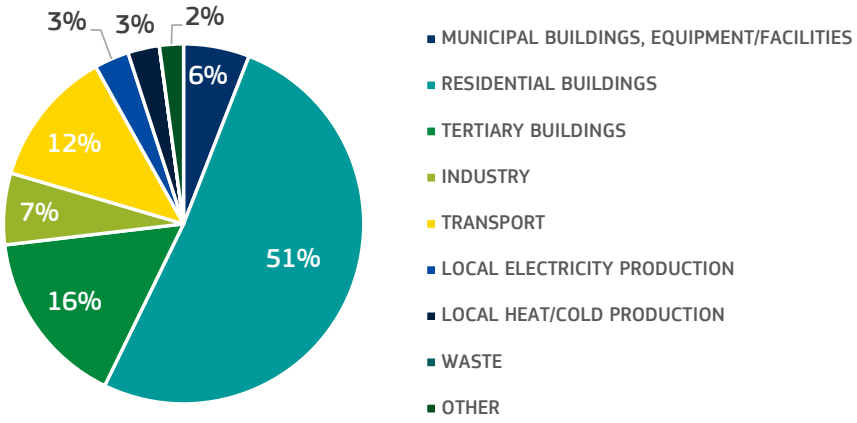
Table 10. Estimated renewable energy by 2030 declared by EU-27 signatories with 2030 or 2050 commitments [1 719 signatories]

Sector	Renewable energy	Share	Renewable energy per capita
	[TWh/year]	[%]	[MWh/y*pc]
Municipal buildings	3.149	5.93%	0.074
Residential buildings	27.248	51.29%	0.642
Tertiary (non-municipal) buildings, equipment /facilities	8.451	15.91%	0.199
Industry (excluding IPPU)	3.416	6.43%	0.081
Transport	6.551	12.33%	0.154
Local electricity production	1.655	3.12%	0.039
Local heat/cold production	1.504	2.83%	0.035
Waste	0.003	0.01%	0.001
Others	1.145	2.15%	0.027
TOTAL	**53.122**	**100 %**	**1.252**

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

The low share of the renewable energy reported for “Local electricity production” sector is mainly linked to the fact that numerous actions on renewables have been included under other sectors. For instance, PVs are often found under “Residential buildings” (see section 4). Therefore, looking transversally across sectors helps to understand the ambitions and approaches of municipalities in relation to renewable energy production.

Figure 10. Shares of renewable energy production by sector – EU-27



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

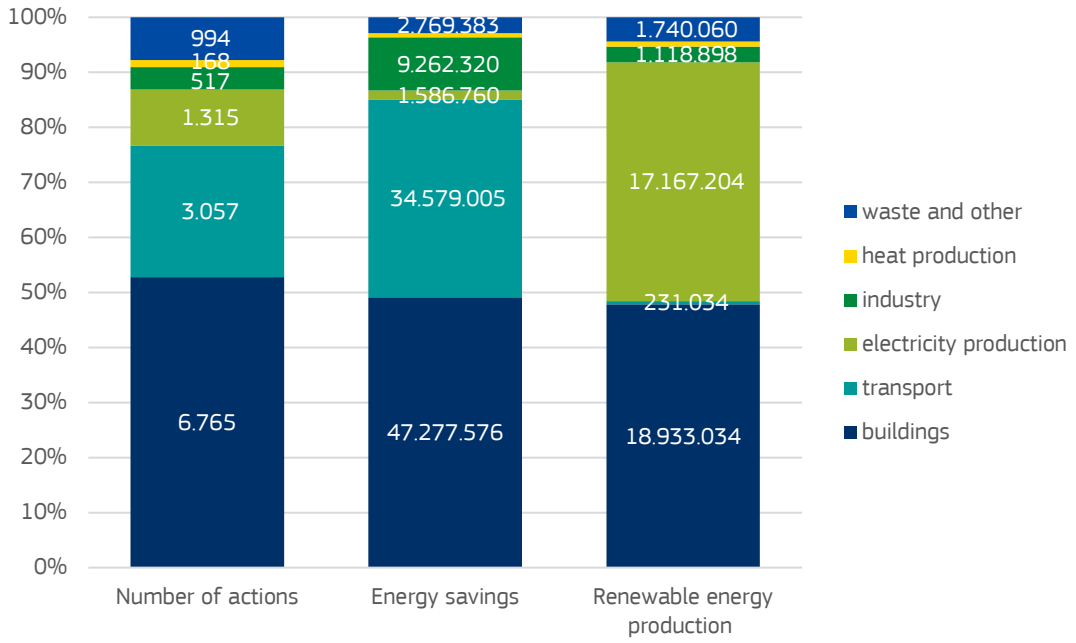
4. Actions targeting energy savings and renewable energy production

This section provides an overview of the actions reported by signatories in their action plan, focusing on energy savings and renewable energy production as reported in "My Action Details" section of the MyCovenant platform. It includes all actions planned by EU-27 signatories who have made commitments for 2030 and 2050, regardless of whether energy savings and renewable energy production can be observed in their monitoring updates or not (i.e. by comparing baseline inventories vs latest inventories).

A total of 62 117 mitigation actions have been reported through the MyCovenant platform by 1 603 signatories with commitments in 2030 and 2050. Out of those, 12 816 actions include figures on energy savings (96.2 TWh/y) or renewable energy production (39.6 TWh/y).

Most of the reported actions (6 765) are linked to the building sector, followed by the transport (3 057 actions, 24%) and the electricity production (1 315 actions, 10%) sectors. In terms of total impact of energy savings, the balance of sectorial contributions changes, with industry contribution reaching almost 10% of the total energy savings reported, with only 4% of actions targeting this sector. For renewable energy production, almost all contributions come from two sectors only, namely buildings (48%) and local electricity production (42%) (**Figure 11** and **Table 11**).

Figure 11. Mitigation actions reporting energy savings or renewable energy production and estimated impact by sector



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Placing a deeper focus on the reported mitigation actions for energy savings or renewable energy generation, more details can be observed in the next sections 4.1and 4.2.

Table 11. Mitigation actions reporting energy savings or renewable energy production and estimated impact by sector

Sector	No. actions	Energy savings (MWh/y)	Renewable energy production (MWh/y)
Buildings	6 765	47 277 576	18 933 034
Transport	3 057	34 579 005	231 034
Industry	517	9 262 320	1 118 898
Electricity production	1 315	1 586 760	17 167 2041
Heat production	168	761 463	368 453
Waste and other	994	2 769 383	1 740 060
TOTAL	12 816	96 236 508	39 558 682

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

4.1. Actions targeting energy savings

Based on the data reported in My Covenant by 1 542 signatories (covering a population of 38.39 million inhabitants), it is possible to analyse the reported local actions that declared estimated energy savings. A total of 10 644 individual actions with estimates for energy savings were reported in 1 542 action plans linked to 2030 and 2050 commitments, accounting for a total of 96.24 TWh/y, see **Table 12**. The analysis is performed from three perspectives: energy savings achieved at sectoral level (**Figure 12**), main action types (**Figure 13**) and main action areas of intervention (**Figure 14**). The share of actions targeting each sector shows a balanced contribution from three sectors, namely transport, municipal buildings and residential buildings, representing 28%, 24% and 22%, respectively, of the total actions reported. However, these same sectors are not the largest contributors to the total expected energy savings. The highest share of energy savings reported at action level by signatories corresponds to transport actions with 36% of the total energy savings reported at action level, followed by residential buildings (26%) and tertiary buildings (17%). Actions in the municipal buildings sector have the lowest contribution of energy savings, while actions in industry and tertiary buildings contribute the most.

Figure 12. Share of actions and energy savings per sectors in EU-27 in signatories with commitment 2030 and 2050 [1 542 signatories, 10 644 actions, 96.24 TWh/y]

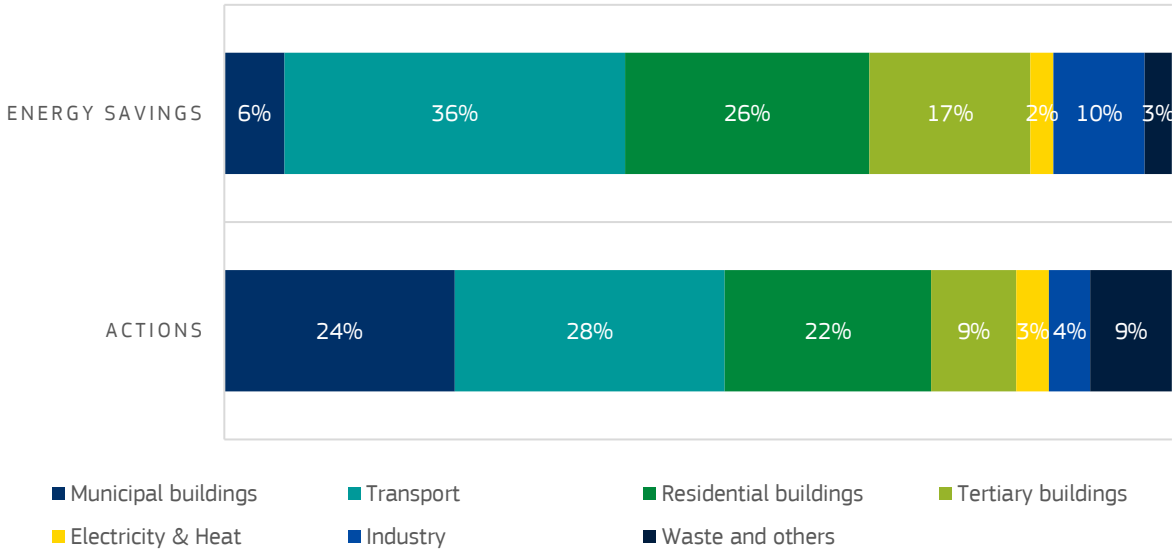


Table 12. Estimated energy savings by 2030 declared at action level by EU-27 signatories with 2030 or 2050 commitments [1 542 signatories]

Sector	Actions	Energy savings	Savings per action
	[Number]	[TWh/year]	[MWh/year]
Municipal buildings	2 587	6.12	2 366
Residential buildings	2 320	24.81	10 694
Tertiary (non-municipal) buildings, equipment /facilities	957	16.35	17 082
Industry (excluding IPPU)	462	9.26	20 048
Transport	3 033	34.58	11 401
Local electricity and heat production	367	2.35	6 398
Waste and others	918	2.77	3 019
TOTAL	10 644	96.24	9 042

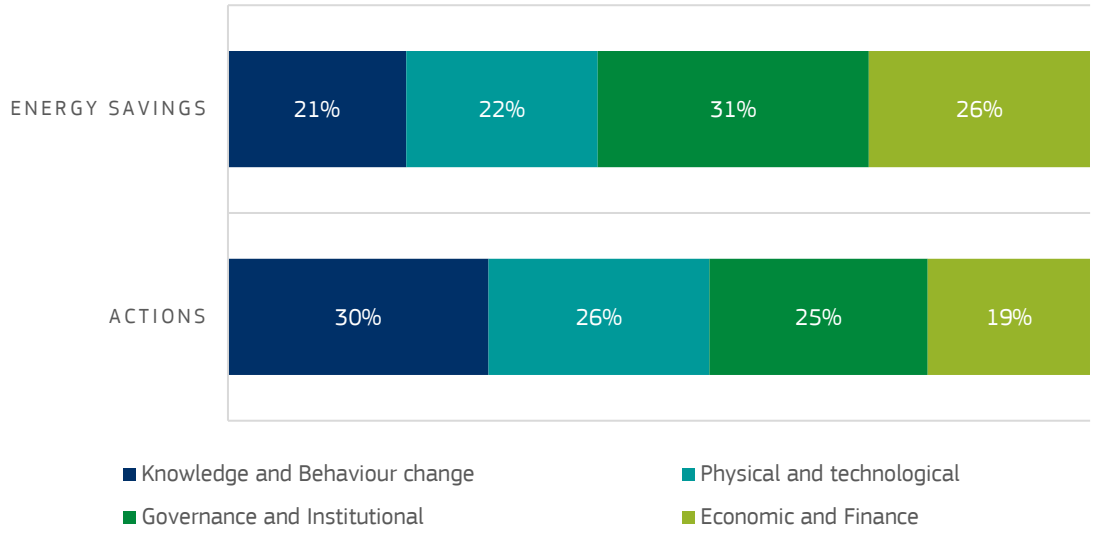
[1]Actions without any sector assigned have been discarded: 7 actions in total

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

The share of actions classified by action type and their energy savings estimates are reported in **Figure 13**. The distribution of actions by action type appears quite balanced, with the greatest share represented by knowledge and behavioural (30%) followed by physical and technological (26%), almost in parallel with governance and institutional actions, (26% and 25% respectively) and economic and finance measures (19%). Regarding their contribution in terms of total energy savings, a similar balance is observed, with all types contributing to around 25-30%. However, the relative order of the contribution changes when compared to the relative number of actions by type. Knowledge and behavioural change actions have a smaller relative share when it comes to energy savings potential.

See the figure below and refer to the annex (section 9.1.2) for further insights into the action types and how these relate to "policy instruments".

Figure 13. Share of actions[1] according to main action types in EU-27 [1 542 signatories]

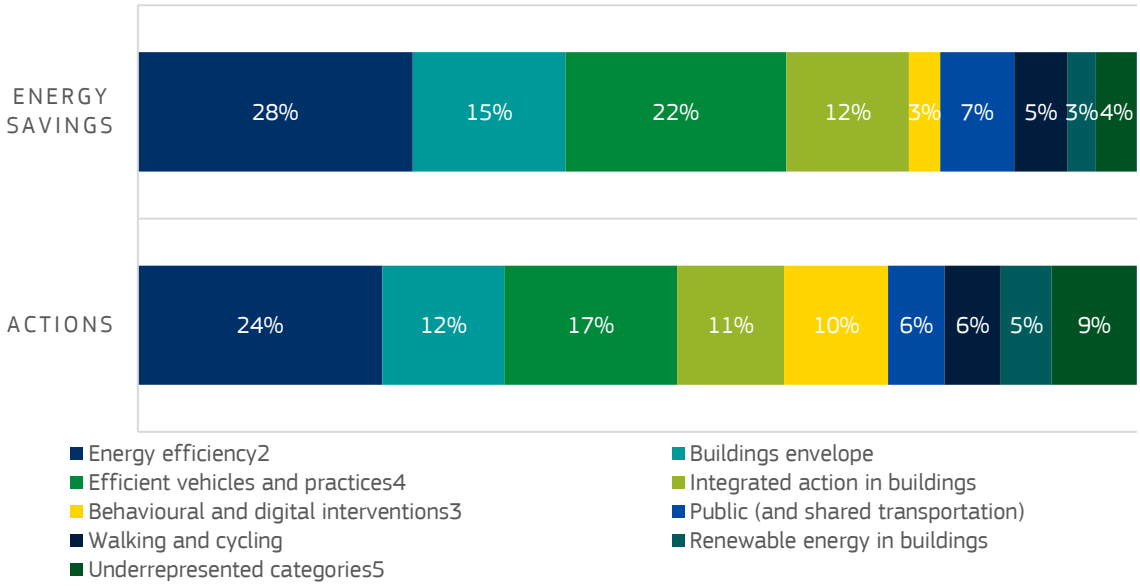


[1] Actions with no reported policy instrument have been discarded: 2 632 actions

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Lastly, regarding the action's areas of intervention (**Figure 14**), municipalities focused their attention on energy efficiency in buildings (24%) and efficient buildings and practices (17%). **Figure 14** below presents an overview of actions and energy savings per areas of intervention.

Figure 14. Main action areas of intervention in EU-27 for signatories with 2030 and 2050 commitments [1 542 signatories]



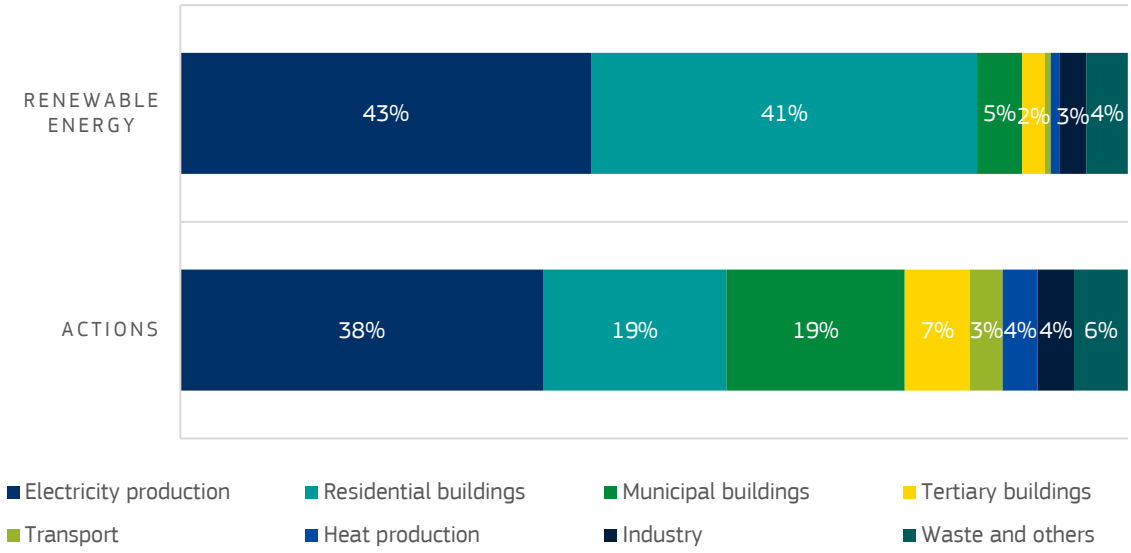
1 Actions with no area of intervention, or with an area of intervention defined as "other" have been discarded. This includes 1 707 actions.
2 Energy efficiency actions refer to appliances, light, space heating or water
3 Behavioural and digital interventions include behavioural changes and ICT technologies
4 Efficient vehicles and practices also include electric vehicles
5 Among the areas of interventions, underrepresented categories include urban planning, renewables for power and heat, district heating/cooling and CPH, distribution and storage (power and heat), agriculture and forestry related (incl. urban regeneration) and waste and wastewater management.

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

4.2. Actions targeting renewable energy production

Based on the data reported in My Covenant by 1 083 municipalities with action plans with 2030 or 2050 commitments (25.36 million inhabitants), a total of 3 109 individual actions estimated renewable energy production. The analysis is performed from two perspectives: expected renewable energy production at sectoral level and actions' areas of intervention identified for actions in the sectors of "local electricity production" and "local heat/cold production".
The highest share of actions reporting estimates for renewable energy production is reported under "local electricity production" (38%), followed by "residential buildings" and "municipal buildings" (19% both). Observing the sectorial contributions in terms of total renewable energy production estimates, the sectors "local electricity production" and" residential building", account for 84% of the total, with "local electricity production" being the most significative.

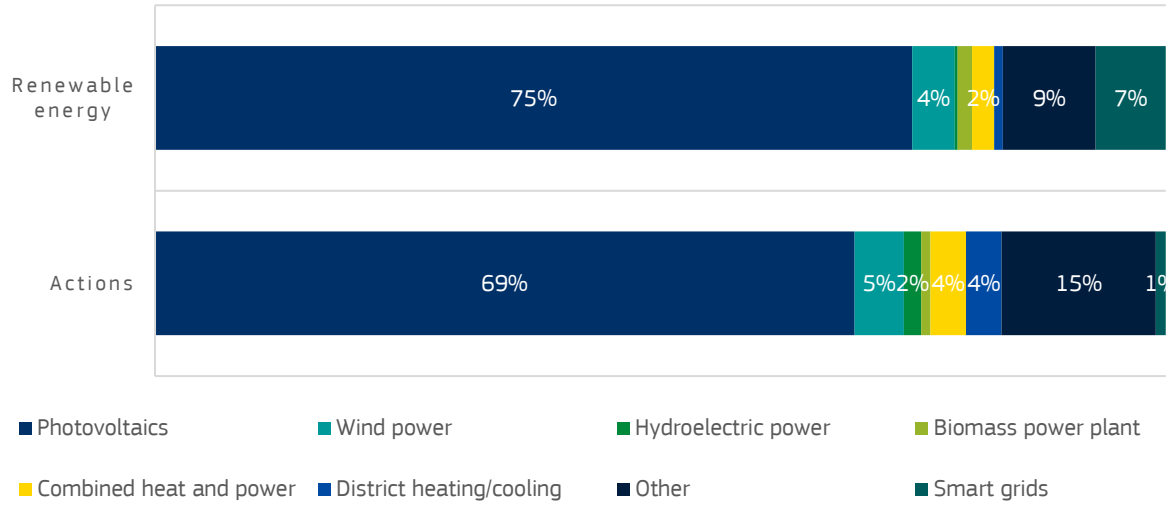
Figure 15. Share of actions and renewable energy production per sectors in EU-27 in signatories with commitment 2030 and 2050 [1 083 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

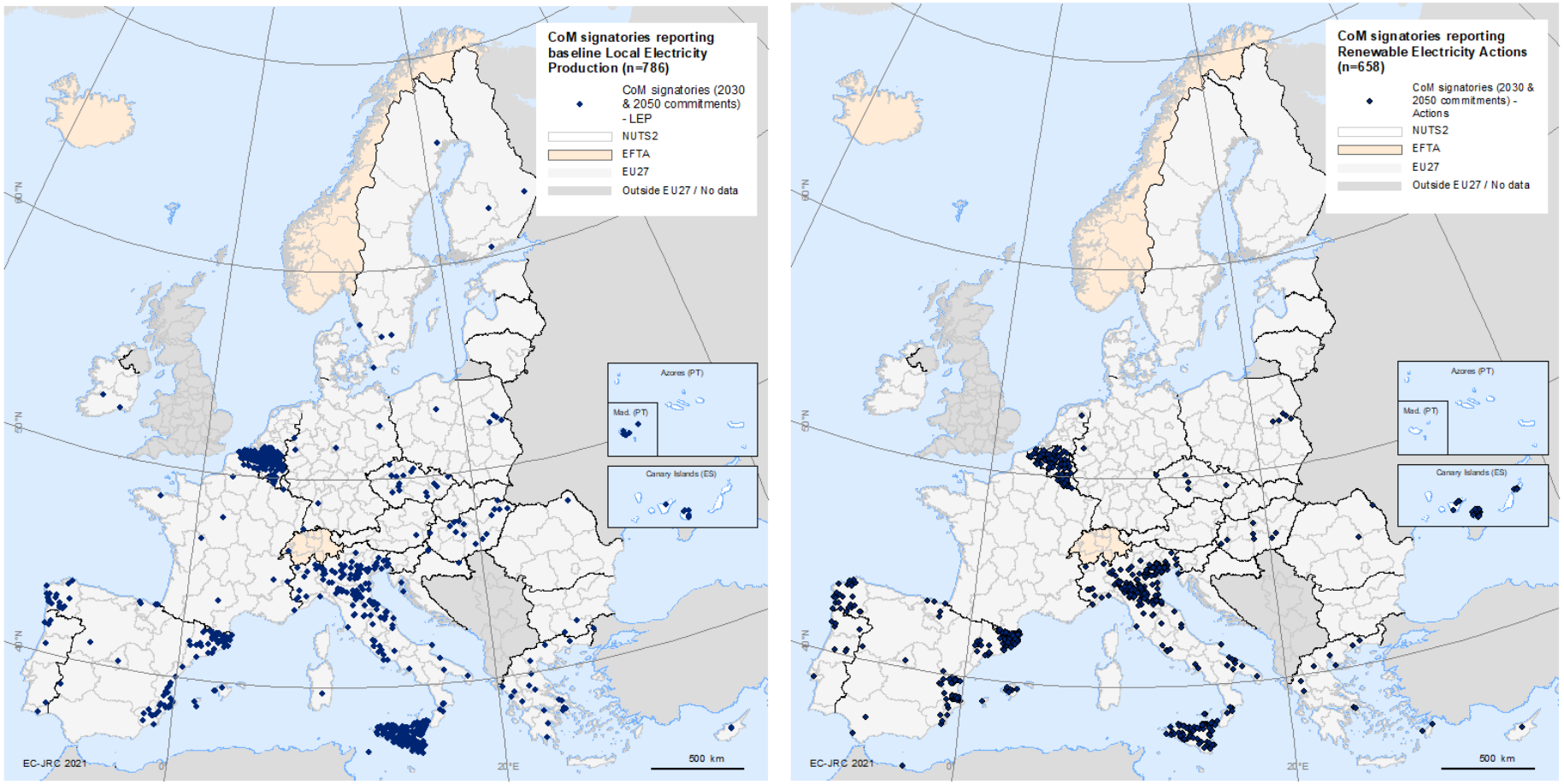
Looking closely at the 'local electricity production' (LEP) and 'local heat/cold production' (LHCP) sectors, a total of 1 305 actions report estimates of renewable energy production. For these sectors, signatories may record in the "area of intervention" field information about the primary electricity or heat source and other technological details that support RES penetration such as smart grids. From the reported actions, it can be observed that most of them are related to the use of photovoltaics, with the highest contribution in terms of actions (69%) and total renewable energy production (75%). Considering the given "areas of intervention" categories, and discarding 'other', actions concerning smart grids provide the second largest contribution to the total estimated renewable energy output reported for these sectors.

Figure 16. Main action areas of intervention in the LEP/LHCP sectors [1 305 actions]



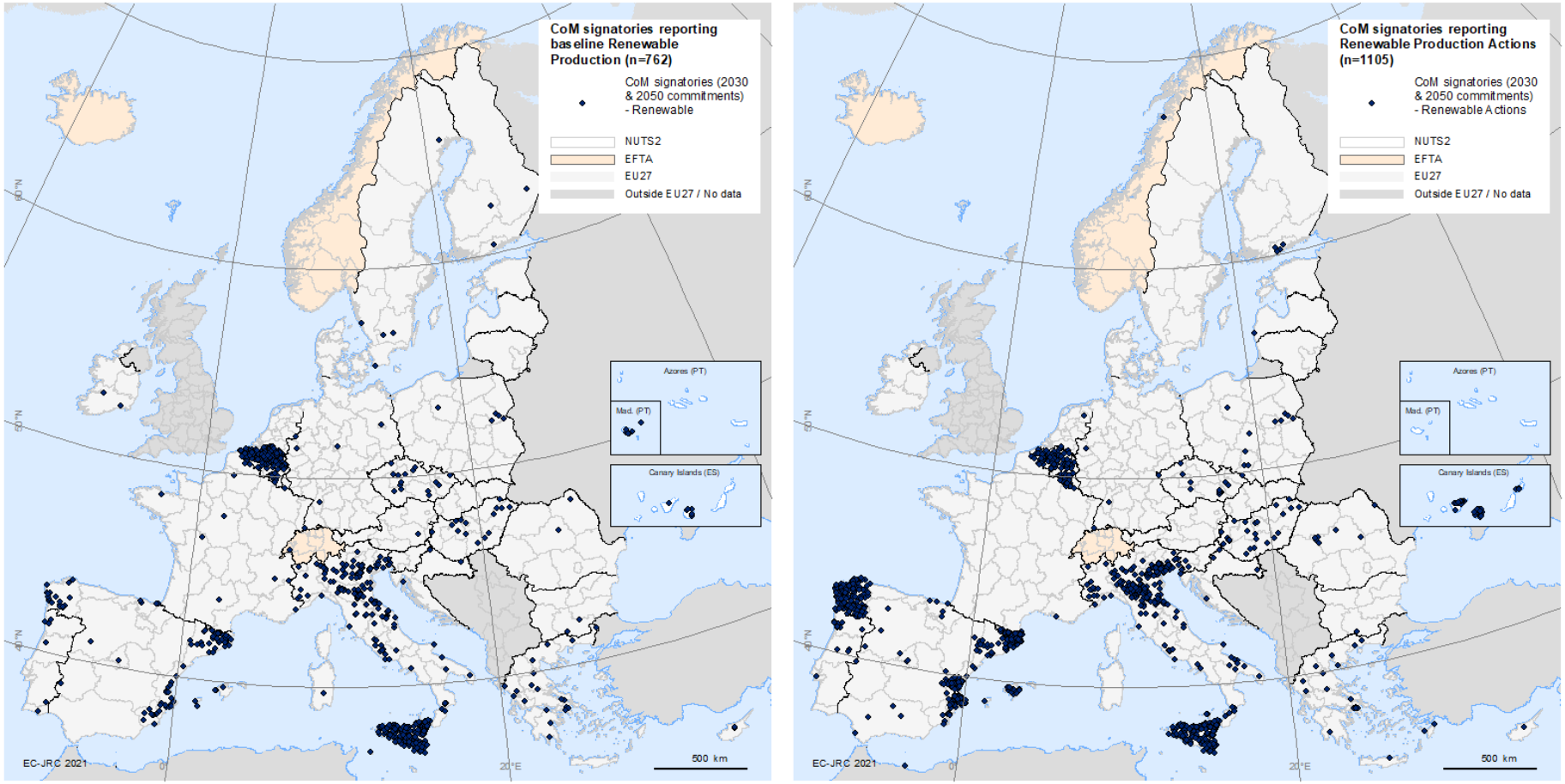
Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 17. Comparison of signatories reporting baseline local electricity production [786 signatories] (a) versus signatories reporting actions on local electricity production (b)



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 18. Comparison of signatories reporting baseline renewable production (all sources) [762 signatories] (a) versus signatories reporting actions on renewable energy production (all sources) [1 105 signatories] (b)



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 17 shows signatories having reported on local energy production in their baseline inventories compared those having included actions on renewable electricity production, b. It can be noted that the number of signatories having planned actions in this sector is slightly lower (118 municipalities) than those that have included local RES in their baselines. However, through the maps it is possible to highlight that signatories in Italy, Spain, Portugal and Greece kept consistency from baseline to action planning.

Moreover, this can be compared to the situation presented in **Figure 18** where the 762 signatories reporting overall renewable energy production (all sources) are mapped (a), and compared to the 1 105 signatories including actions with renewable energy production estimates. This comparison shows that renewable energy production (regardless of the source) is present within actions planned by municipalities, even though renewable energy production had not been reported in the baseline inventories.

5. Latest inventories: energy consumption and supply in EU-27

Following the baseline emissions inventory (BEI), signatories should monitor the performance of their action plans in the subsequent years and generate their corresponding monitoring emission inventories (MEIs). Nonetheless, not all municipalities comply with this requirement, while some report multiple inventories. In the analysis performed in this section, to avoid double counting, if there is more than one inventory reported by a given signatory, the most recent is selected. All in all, 1 115 inventories in EU-27 with a 2030 or 2050 commitment, representing 32.80 million inhabitants.

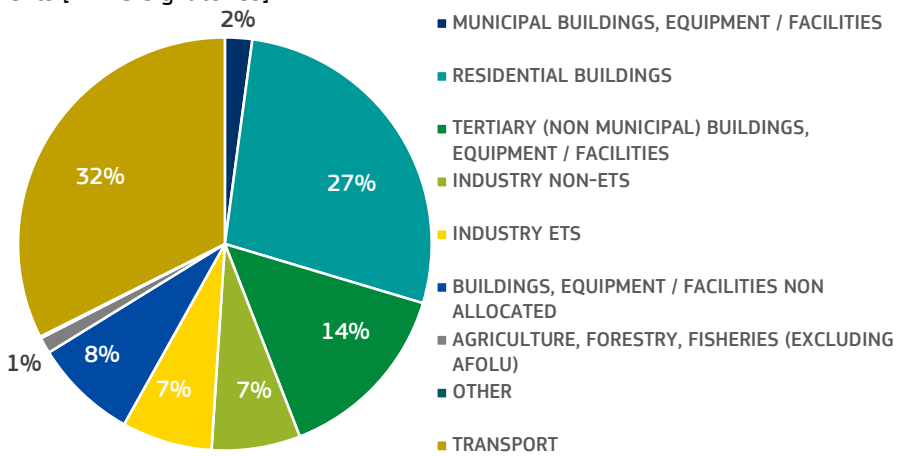
5.1. Latest energy consumption

Looking at the latest 1 115 inventories submitted by EU-27 signatories with 2030 or 2050 commitments, the sector with the highest share in the reported energy consumption is transport (32.41 %), followed by residential buildings (27.50 %) (see **Figure 19**). In terms of carriers, fossil fuels hold the greatest total share of energy consumption (67.05%), followed by electricity (23.67%), as shown in **Figure 20**.

Similarly, examining the per capita consumption, fossil fuels represent the highest consumption figure, with 11.91 MWh/year per capita. On the other hand, renewable fuels have the lowest value, with 0.68 MWh/year per capita. Meanwhile, for the sectors, transport has the highest consumption per capita value, with 5.75 MWh/year per capita, followed by residential buildings with 4.88 MWh/year per capita.

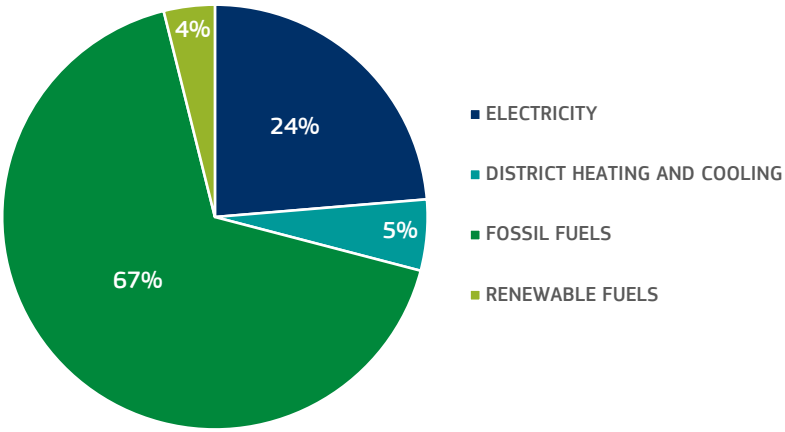
See **Table 13** for the absolute and per capita values, respectively, of the energy consumption reported in latest inventories, and **Figure 19** and **Figure 20** for the visualisation of the shares for the most significant sectors and fuel sources in each of the commitments.

Figure 19. Shares of final energy consumption by sector reported in latest inventories EU-27 with 2030 or 2050 commitments [1 115 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 20. Shares of final energy consumption by carrier reported in latest inventories EU-27 with 2030 or 2050 commitments [1 115 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Table 13. Energy consumption reported in latest inventories related to 2030 or 2050 commitments – EU-27 [1 115 signatories]

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**	SHARE	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**
	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Municipal buildings, equipment/facilities	5.7824	2.052	4.451	0.128	**12.413**	**2.13%**	0.176	0.063	0.136	0.004	**0.379**
Residential buildings	44.8972	10.423	92.536	12.367	**160.223**	**27.50%**	1.369	0.318	2.821	0.378	**4.886**
Tertiary (non-municipal) buildings, equipment/facilities	45.264	4.806	33.480	0.769	**84.319**	**14.47%**	1.380	0.146	1.021	0.023	**2.570**
Industry Non-ETS	16.446	4.083	17.511	2.378	**40.418**	**6.94%**	0.501	0.124	0.534	0.072	**1.231**
Industry-ETS	13.627	0.373	26.912	0.296	**41.208**	**7.07%**	0.415	0.011	0.820	0.009	**1.255**
Buildings, equipment/facilities non-allocated	8.561	8.031	30.291	0.259	**47.142**	**8.09%**	0.261	0.245	0.923	0.008	**1.437**
Agriculture, Forestry, Fisheries	1.042	1.632	4.644	0.038	**7.356**	**1.26%**	0.032	0.050	0.142	0.001	**0.225**
Other non-allocated	0.217	0.066	0.495	0.003	**0.781**	**0.13%**	0.007	0.002	0.015	0.0001	**0.024**
Subtotal stationary energy	135.836	31.466	210.32	16.238	**393.87**	**67.59%**	4.141	0.959	6.412	0.495	**12.007**
Subtotal transport	2.101	0.000	180.375	6.355	**188.831**	**32.41%**	0.064	0.000	5.499	0.194	**5.7565**
TOTAL	**137.937**	**31.466**	**390.695**	**22.594**	**582.701**	**100%**	**4.205**	**0.959**	**11.91**	**0.689**	**17.763**
SHARE	**23.67%**	**5.40%**	**67.05%**	**3.88%**	**100%**						

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

5.2. Latest energy supply

Table 14 summarises the number of signatories holding more than one inventory having reported energy supply data in their latest inventory.

Table 14. Overview of signatories with 2030 or 2050 commitments having reported energy supply in the latest inventory

Energy supply	No. municipalities	Population (million inhab.)
Local electricity production	671	23.55
Purchases of renewable energy certificates	228	10.04
Local heat/cold production	20	4.93

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

5.2.1. Local electricity production

The highest share of local electricity production for signatories with a 2030 or 2050 commitments, corresponds to photovoltaics with 49.78 % (see **Figure 21**), followed by wind (17.66 %) and hydroelectric (21.77 %). Combined heat and power follows with a lower share, of 10.20 % and the remaining energy sources can be considered as insignificant (geothermal and other local electricity production plants). Local electricity production represents 16.04% of the total electricity consumption of the same 671 signatories analysed, playing a limited role (**Table 15**). As also shown in **Table 15**, the reported local electricity production amounts to 0.06 MWh/year per capita for non-renewable energy and 0.62 MWh/year per capita for renewable technologies.

Table 15 and **Figure 21** provides an overview of the total production by technology and the shares of the most representative electricity production sources and technologies.

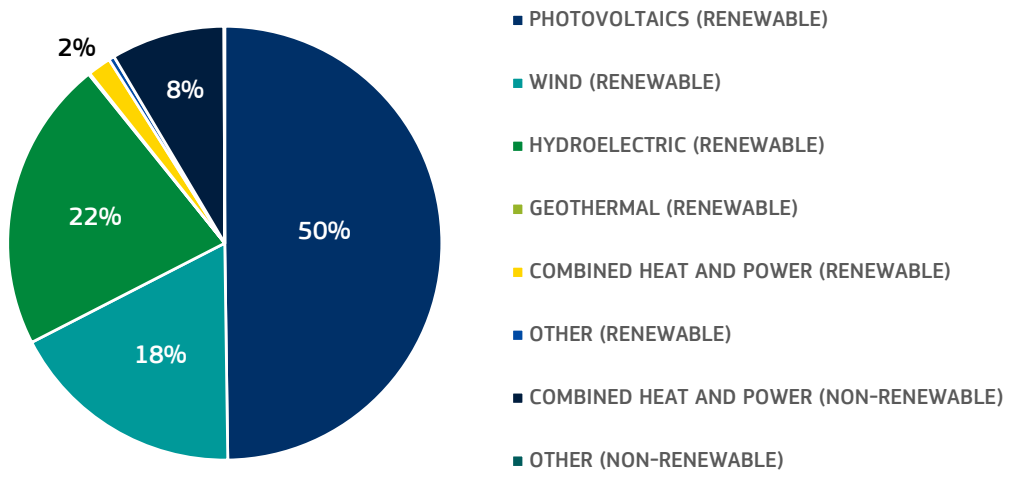
Table 15. Local electricity production in latest inventories related to 2030 or 2050 commitments - EU-27 (units TWh/year) [671 signatories]

Energy production technology	Non-renewable	Renewable	TOTAL	SHARE	Non-renewable	Renewable	TOTAL
	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Photovoltaics	-	7.9444	**7.9444**	49.78%	-	0.337	0.337
Wind	-	2.8189	**2.8189**	17.66%	-	0.120	0.120
Hydroelectric	-	3.4750	**3.4750**	21.77%	-	0.147	0.147
Geothermal	-	0.0154	**0.0154**	0.10%	-	0.001	0.001
Local electricity production plants - Combined Heat and Power	1.3504	0.2779	**1.6283**	10.20%	0.057	0.012	0.069
Local electricity production plants - Other	0.0096	0.0679	**0.0775**	0.49%	0.001	0.003	0.004
TOTAL	1.3600	14.5996	**15.9595**	100%	0.058	0.620	0.678
SHARE OF TOTAL ELECTRICITY PRODUCTION	8.52%	91.48%	100%				
SHARE OF TOTAL ELECTRICITY CONSUMPTION*	1.37%	14.68%	16.04%				

*Compared to the total electricity consumption in latest inventories (only for the 671 local authorities reporting local electricity production)

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 21. Shares of local electricity production by technology, reported in latest inventories related to 2030 or 2050 commitments – EU-27



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

5.2.2. Purchases of renewable energy certificates

Looking at the latest 257 signatories with 2030 commitment reporting purchases of renewable energy certificates in their latest inventories (compared to 206 in the baseline inventories), a total of 1.57 TWh/year (0.14 MWh/year per capita) electricity is purchased through certificates (**Table 16**). The figure shows an increased reliance on renewable energy certificates which could signal an increased awareness of this scheme. However, similarly to the baseline inventories, purchase of renewable energy certificates plays a limited role in covering electricity consumption from signatories (3.12 % share of total electricity consumption).

Table 16. Purchases of renewable energy certificates in latest emission inventories related to 2030 or 2050 commitments – EU-27 [257 signatories]

Renewable energy certificates	Renewable electricity	**TOTAL**	SHARE	Renewable electricity	**TOTAL**
	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]
Purchases Guarantees of Origins (within the municipality boundaries)	1.5786	1.5786	99.99%	0.14320	0.14320
Sales Guarantees of Origins (within the municipality boundaries)	0.0002	0.0002	0.01%	0.00002	0.00002
TOTAL	1.5788	1.5788	100 %	0.14322	0.14322
SHARE OF TOTAL ELECTRICITY CONSUMPTION*	3.12%				

*Compared to the total electricity consumption in latest inventories for the 257 local authorities reporting renewable energy certificates.

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

5.2.3. Local heat/cold production

Local heat/cold production information has been reported by 23 municipalities, covering a population of 2.66 million inhabitants) in their latest inventories that have reported it. As shown in

Figure 22, the highest share of local heat/cold production corresponds to non-renewable CHP, with 45 %, followed by combined heat and power renewable (23 %) and district heating (heat-only) (non-renewable) (16 %). See **Figure 22** for the complete description of the total production by technology.

Furthermore, comparing non-renewable with renewable energy technologies, non-renewable energy has the highest share, with 65.09 % (**Table 17**). From **Table 17** it is also evident that the per capita production with non-renewable fuels amounts to 1.41 MWh/year compared to 0.76 MWh/year of renewable production. Lastly, it can be observed that local heat/cold production plays a strong role, as it covers 80 % of the total district heating consumption.

Due to the limited number of signatories reporting local heat/cold production overall, it is not possible to draw any definitive conclusions on this energy source.

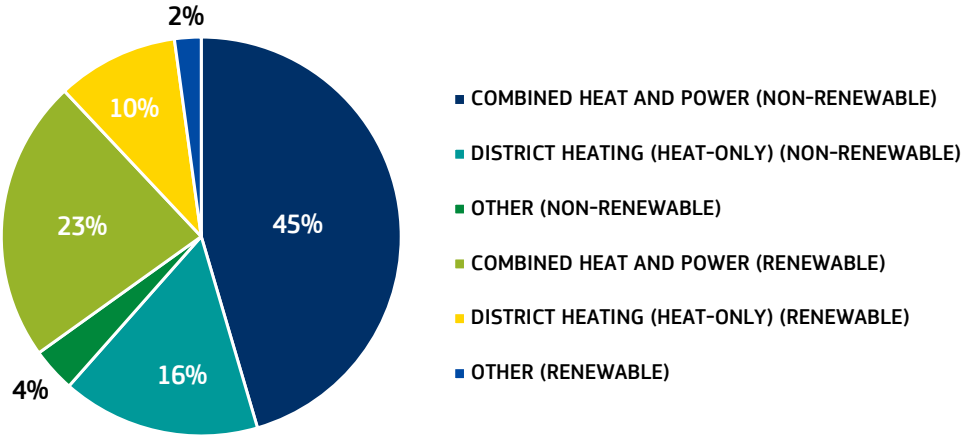
Table 17. Local heat/cold production in latest emission inventories related to 2030 or 2050 commitments - EU-27 [23 signatories]

Energy production technology	Non-renewable	Renewable	TOTAL	Share	Non-renewable	Renewable	TOTAL
	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Combined Heat and Power	2.638	1.330	**3.968**	68.38%	0.990	0.499	**1.489**
District heating (heat-only)	0.931	0.571	**1.502**	25.89%	0.349	0.214	**0.563**
Other	0.208	0.125	**0.333**	5.73%	0.078	0.047	**0.125**
TOTAL	**3.777**	**2.026**	**5.803**	100 %	**1.417**	**0.760**	**2.177**
SHARE ON TOTAL HEAT/COLD PRODUCTION	65.09%	34.91%	100 %				
SHARE ON TOTAL DISTRICT HEATING CONSUMPTION*	52.06%	27.93%	79.99%				

* Compared to the total district heating consumption in latest inventories for the 23 local authorities reporting local heat/cold production

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 22. Shares of local heat/cold production by energy source and technology, reported in latest emission inventories related to 2030 and 2050 commitments– EU-27



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

6. Achievements in energy savings and renewable energy generation (baseline compared to latest inventories)

Sections 3 and 5 presented the baseline and most recent figures for energy consumption and production. By comparing these figures, the energy savings (baseline versus latest) and renewable-energy generation (baseline versus latest) achieved so far can be quantified. Consequently, the analyses described in the following sections 6.1 and 6.2 include only signatories that have provided at least two inventories.

6.1. Energy savings

Considering 1 114 signatories[6] (33.01 million inhabitants in their latest inventories) having reported at least two inventories and looking at the sectors common to both baseline and latest inventories, the indicative achievement in energy savings can be calculated.

As shown in **Table 18**, at the sectoral level, transportation is the largest contributor to energy savings, with a baseline of 194.64 TWh/yr falling to 180.15 TWh/yr (−14.49 TWh/yr representing −7 %). Residential buildings rank second, declining −11.7 TWh/yr (−9.8%). Together these sectors appear to be driving energy savings in CoM 2030/2050 municipalities, achieving a combined reduction of 26.4 TWh/yr (see also **Figure 23.** Energy savings observed when comparing baseline vs latest inventories for equivalent sectors EU-27 with 2030 or 2050 commitments (units TWh/year) [1114 signatories]**Figure 23**). Tertiary buildings also decreased (-5%). Agriculture forestry and fisheries and industry increased marginally.

Table 18. Energy savings related to 2030 or 2050 commitments in EU-27: baseline vs latest inventory [1114 signatories]

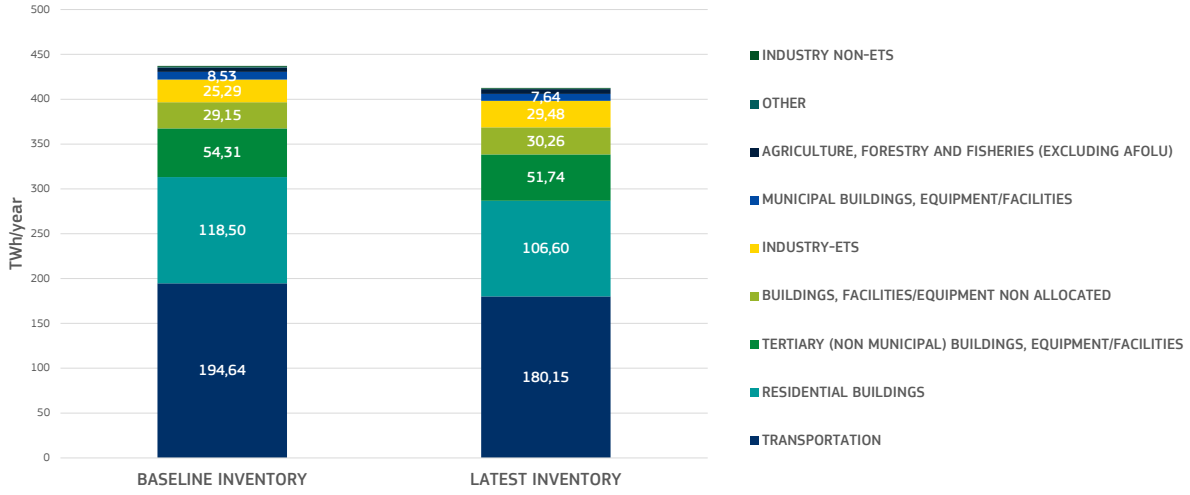
Sector	Baseline		Latest inventory		Difference	
	[TWh/year]	[%]	[TWh/year]	[%]	[TWh/year]	[%]
Municipal buildings, equipment/facilities	8.53	2%	7.64	2%	**-0.89**	**-10%**
Residential buildings	118.50	27%	106.60	26%	**-11.90**	**-10%**
Tertiary (non-municipal) buildings, equipment/facilities	54.31	12%	51.74	13%	**-2.57**	**-5%**
Industry Non-ETS	0.87	0%	0.82	0%	**-0.05**	**-6%**
Industry-ETS	25.29	6%	29.48	7%	**4.19**	**17%**
Buildings, equipment/facilities non allocated	29.15	7%	30.26	7%	**1.11**	**4%**
Agriculture, Forestry, Fisheries (excluding AFOLU)	4.92	1%	5.43	1%	**0.51**	**10%**
Other	0.90	0%	0.57	0%	**-0.33**	**-37%**
Transportation	194.64	45%	180.15	44%	**-14.49**	**-7%**
Total	**437.12**	**100%**	**412.69**	**100%**	**-24.43**	**-6%**

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

[6] In this section only inventories with equivalent sectors have been considered. There is one signatory that has not reported the sectors in the baseline versus the latest inventory, and it has been removed from this section's analysis.

However, Industry-ETS reflect a different trend, with energy use increasing by 16.6 TWh/yr. This growth might be linked to expanded industrial activity and could potentially offset gains made elsewhere. It is worth to note that it is not recommended for Covenant signatories to include Industry-ETS within their inventories, as these sources are addressed through the EU emissions trading system.

Figure 23. Energy savings observed when comparing baseline vs latest inventories for equivalent sectors EU-27 with 2030 or 2050 commitments (units TWh/year) [1114 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

6.2. Renewable energy production

Considering 340 signatories (17.00 million inhabitants in their latest inventories) having reported renewable energy production in both the baseline inventory and at least one monitoring inventory, aggregate renewable energy production increased substantially between the two inventories, from approximately 5.43 TWh/yr in the baseline to 13.48 TWh/yr in the latest inventories (a net increase of 8.04 TWh/yr, representing roughly 131% of the figures reported in the baseline) (**Table 19**).

It is worth noting that this analysis is based on available data as reported by signatories. For instance, some signatories reported energy supply data in their baseline inventories but not in their latest inventory. Therefore, for consistency, the analysis focuses only on input data that were present in both inventories and excludes the missing supply types. To ensure rigour in the result, apparent outliers due to reporting errors were also removed.

Table 19. Renewable energy production related to 2030 or 2050 commitments in EU-27: baseline vs latest inventory [340 signatories]

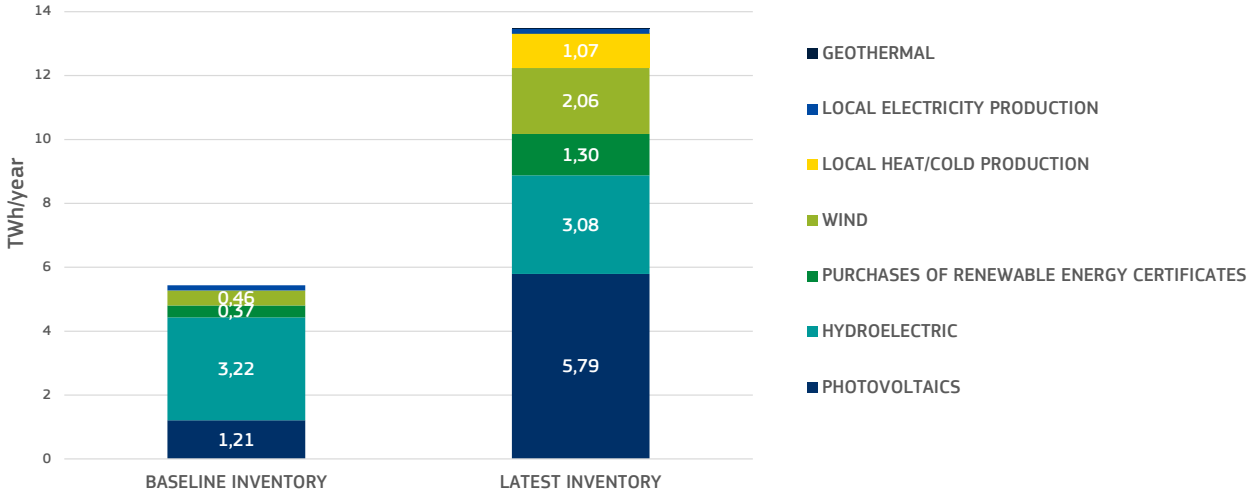
Sector	Baseline		Latest inventory		Difference	
	[TWh/year]	[%]	[TWh/year]	[%]	[TWh/year]	[%]
Photovoltaics	1.21	22%	5.79	43%	**4.58**	**379%**
Hydroelectric	3.22	59%	3.08	23%	**-0.14**	**-4%**
Renewable energy certificates	0.37	7%	1.30	10%	**0.92**	**247%**
Wind	0.46	9%	2.06	15%	**1.60**	**345%**
Heat/Cold	0.00	0%	1.07	8%	**1.07**	**n.a.**

Electricity	0.16	3%	0.15	1%	**-0.01**	**-6%**
Geothermal	0.00	0%	0.02	0%	**0.02**	**n.a.**
Total	**5.43**	**100%**	**13.48**	**100%**	**8.04**	**148%**

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

The figures shown (**Figure 24**) reveal a clear shift toward solar and wind technologies, which together account for the most significant growth in renewable energy production. Photovoltaics emerged as the dominant driver, contributing to over half of the total net increase (4.58 TWh/yr of 8.0 TWh/yr). Wind energy, while still smaller in absolute terms, showed the strongest relative growth trajectory. Hydroelectric, the largest source in the baseline, remained relatively stable. These trends suggest signatories are prioritising solar and wind investments to meet their 2030 and 2050 climate commitments.

Figure 24. Renewable energy production observed when comparing baseline vs latest inventories EU-27 – commitment 2030-2050 (units TWh/year) [340 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

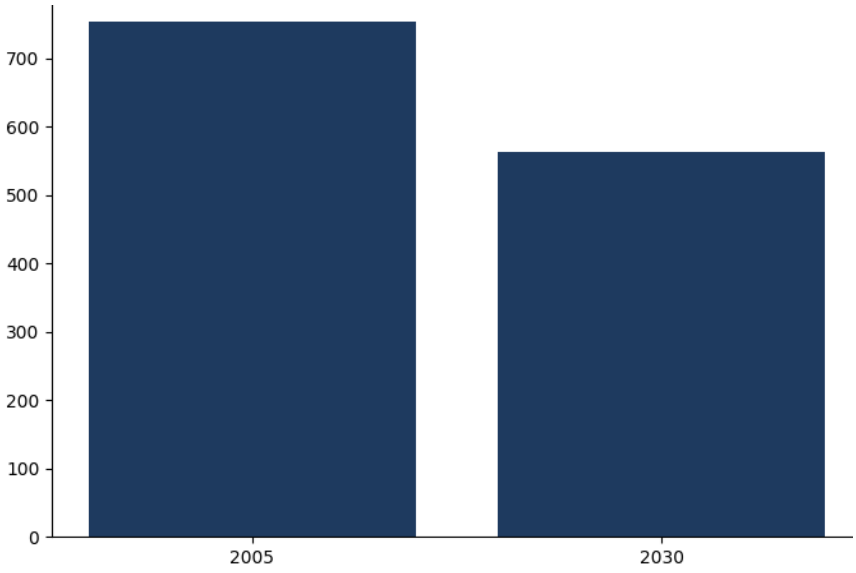
7. Energy consumption forecast for 2030

Considering only 925 signatories from EU-27 with a commitment to 2030 or 2050 that reported initial estimates for energy savings and reported a MEI, the energy consumption is forecasted for 2030. To this end, an analogous forecasting methodology as the one described in (Melica et al., 2024) for GHG emissions was applied (see annex 1, section 9.1.6, for the overview of the statistical methodology).

It is worth noting that the present methodology involves uncertainties arising from both the estimation of 2005 baseline inventories and the forecasting model itself. Additionally, values are calculated only from available data, specifically the subset of signatories with several inventories, and the subset of sectors common to both baseline and monitoring periods (hence a sub-sample of 925 signatories). Consequently, this analysis provides an indicative forecast of energy consumption rather than definitive measurements.

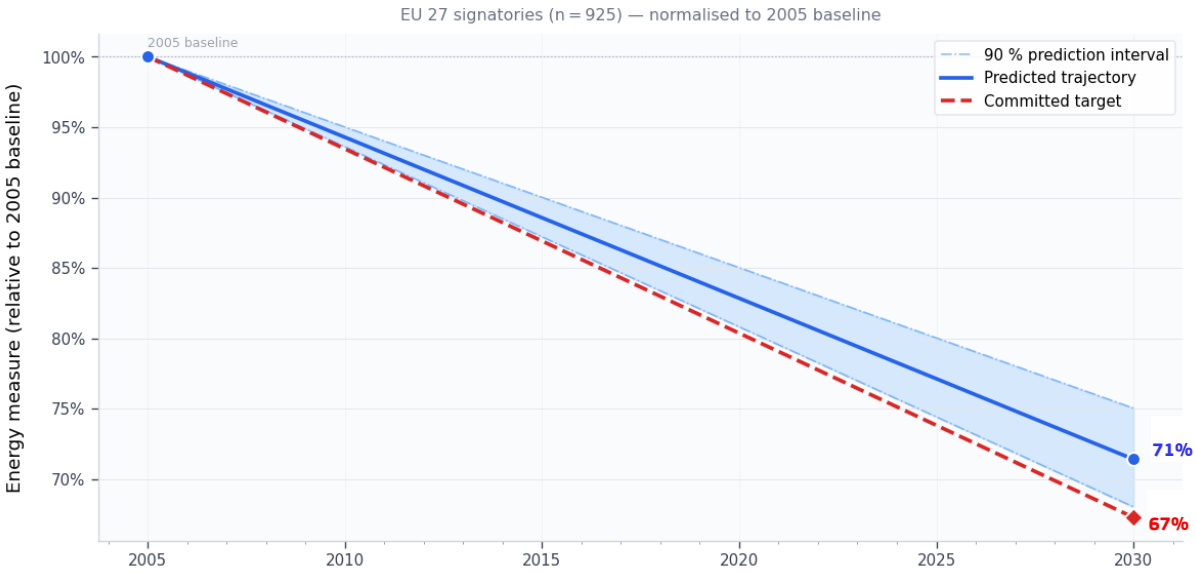
Figure 25 and **Figure 26** present the same aggregate energy consumption trajectory against committed energy savings targets expressed relatively to the 2005 calculated baseline. Starting from a baseline of approximately 754.6 TWh/year in 2005, consumption is projected to decline to around 563.5 TWh/year by 2030, against an anticipated target of 538.87 TWh/year. In this way, municipalities accomplished a mean annual rate energy savings of 8.63 TWh/year, falling short from the initially reported/estimated rate of 9.88 TWh/year. Therefore, the predicted energy savings reaches +29% by 2030 , falling short to meet the reported savings of +33%. As with the energy savings, the predicted trajectory diverges increasingly from the target over time, indicating a structural gap between current performance trends and the reductions pledged by signatories.

Figure 25. Mean yearly energy consumption EU-27 (units TWh/year) [925 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 26. Aggregate energy forecast vs committed targets EU-27 (units %) [925 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

8. Conclusions

The European Union aims to become climate-neutral by 2050, and municipalities are pivotal in realising this ambition. Through their local energy and climate plans, municipalities achieved significant progress in implementing EU energy and climate policies, with initiatives such as the EU Covenant of Mayors providing essential support. This report presents key energy figures and actions of European municipalities, underscoring their contribution towards a climate-resilient future.

The analysis presented in this report relies on data reported by municipalities, which carries inherent limitations. One of the primary concerns is the potential for errors or inconsistencies in the self-reported data. Despite the data cleaning methodology developed by the JRC, there may be variations in the quality and accuracy of the information provided, which can impact the reliability of the results. Additionally, the distribution of signatories to the CoM EU is not uniform across all regions, with a higher concentration of signatories from countries, such as Spain, Italy and Belgium. This may introduce a bias in the analysis, as the results may be more representative of the experiences and characteristics of signatories from these regions. Furthermore, for some elements of the analysis (most notably values on energy supply, or signatories with a 2050 commitment, overall), the number of signatories is limited, which can reduce the statistical value and the reliability of the results. It is also important to note that the data may not be representative of all municipalities, as only signatories to the CoM are included in the analysis. The analysis has been designed to be as transparent and robust as possible, with a focus on highlighting the trends and patterns that emerge from the data. However, it is essential to interpret the results with caution, recognising the potential biases and limitations of the data.

The following conclusions summarise the main findings of this report (based on initial planning data (section 8.1), progress and forecast (section 8.2) and highlight the key takeaways for municipalities, policymakers and other stakeholders (section 8.3).

8.1. Starting point

The analysis of **baseline inventories** across 2 305 Covenant signatories (54.54 million inhabitants) in EU-27 reveals a total energy consumption of 989.70 TWh/year. The energy profile within the baseline inventories reflects a strong dependence on fossil fuels, which account for 67.64% of total consumption, followed by electricity at 24.82%. The transport sector emerges as the largest energy-consuming sector (32.70%), followed closely by residential buildings (30.16%). This baseline configuration underscores the significant transformation required to meet the EU's 2050 climate neutrality objectives.

At this initial stage, it is also possible to compare **baseline inventories against the estimated savings and renewable energy production by 2030** reported by 1 989 and 1 719 signatories respectively within "My Actions Overview" section. Overall, this subset of signatories[7] pledges 208.10 TWh/year in energy savings and 53.12 TWh/year in renewable energy production.

The comparison between **estimated savings and renewable energy production by 2030 and the planned actions** (reported through action level detail through MyCovenant) reveals both

[7] As explained in previous sections, there is no information for all signatories on their estimated energy consumption and renewable energy production by 2030.

strengths and weaknesses in the strategic approach of signatories. A total of 62 117 actions (1 603 signatories) has been reported, of which 17% targets energy savings (totaling 96.24 TWh/year) and 5% targets renewable energy production reaching 39.6 TWh/year. While these figures cannot be directly compared to the estimates presented in "My Actions Overview" (208.10 TWh/year in energy savings and 53.2 TWh/year renewable energy production) due to the difference in the number of signatories[8], a substantial gap in the impact (i.e. expected energy savings and renewable energy production) becomes apparent. This discrepancy suggests either an under-reporting of action-level estimates (particularly for non-key actions as they are not mandatory), or overly optimistic aggregate projections.

The **sectoral distribution of planned actions** aligns reasonably well with the estimated savings by 2030, with transport, residential buildings and tertiary buildings receiving most of the attention. Moreover, almost a quarter of the reported planned actions target municipal buildings (24%) but reap only 6% of total energy savings. This disparity suggests that while municipal buildings are a key focus area for local authorities, the potential for energy savings in this sector may be limited, or that actions planned may not be sufficiently ambitious to unlock deeper energy savings. In contrast, transport, residential and tertiary sectors, which are responsible for a larger share of energy consumption, may offer more significant opportunities for energy savings, and the planned actions in these areas may be more effective in achieving the desired reductions.

8.2. Progress and forecast

The data reported in monitoring inventories reveals a mixed picture of progress. Across the 1 114 signatories with **comparable sets of inventories**, total energy consumption has decreased by 24.43 TWh/year in their latest inventories, representing a 6% reduction from baseline levels. This achievement is primarily driven by progress in the transport sector (14.49 TWh/year savings, 7% reduction) and residential buildings (11.90 TWh/year savings, 10% reduction). Tertiary buildings have also contributed modestly to energy savings (2.57 TWh/year savings, 5% reduction). Municipal buildings and facilities show 10% of energy savings; however, this contribution is limited (0.89 TWh/year savings) as the baseline energy consumption was already low compared to the rest of the sectors (8.53 TWh/year). These results demonstrate that local climate action is yielding tangible benefits, particularly in sectors where local authorities have direct influence through planning, infrastructure or public awareness campaigns.

Renewable energy production has shown remarkable growth. Among the 340 signatories reporting renewable energy production in both baseline and latest inventories, production increased from 5.43 TWh/year to 13.48 TWh/year, a 148% increase. Photovoltaics have been the dominant driver in this growth, contributing 4.58 TWh/year of the total 8.04 TWh/year increase. Wind energy has also expanded significantly (345% growth), while hydroelectric production has remained relatively stable. This rapid expansion of renewable energy generation demonstrates the technical and economic viability of local renewable energy deployment and provides a positive outlook for future progress.

[8] 1 542 and 1 083 signatories respectively have reported information at action level on energy savings and renewable energy production, versus 1 989 and 1 719 signatories reporting energy savings and renewable energy production in their estimates by 2030 (My Actions Overview)

The energy forecasting exercise, based on 925 signatories with sufficient data, projects an energy consumption reduction of 28.6% by 2030 relative to the 2005 baseline. This translates to an expected consumption of approximately 563.5 TWh/year by 2030, down from a baseline of 754.6 TWh/year. However, this forecast falls short of the 32.7% reduction that signatories had estimated / reported at initial planning stages (538.87 TWh/year). The analysis indicates a mean annual rate of energy savings of 8.63 TWh/year, below the initially estimated rate of 9.88 TWh/year.

This gap underscores the need for accelerated action, enhanced policy support and increased investment in energy efficiency and renewable energy deployment.

8.3. Overall recommendations

The following recommendations are based on the analysis of data from the Covenant of Mayors presented in this report and aim to provide guidance for municipalities, EU level policy makers, researchers and the general public on how to achieve the EU's climate objectives. However, it is essential to note that attributing the underlying causes of energy consumption trends and the impact of specific policies or actions is a complex challenge. Further research would be necessary to fully understand the relationships between different factors and to identify the most effective strategies for reducing emissions. Therefore, these recommendations should be considered as a starting point for discussion and further investigation, rather than a definitive guide.

To achieve climate neutrality, municipalities should prioritise energy efficiency and renewable energy deployment in their climate action plans. The focus should be placed on high-energy consumption sectors like transport, residential and tertiary buildings to maximise savings. More ambitious actions are needed to unlock deeper energy savings, particularly in municipal buildings, which would also contribute to leading by example. Moreover, it would be desirable that action-level reporting captures the full scope of planned measures, including non-key actions, to enable more accurate monitoring of progress.

Continuous enhanced financial and technical support is necessary to help municipalities bridge the ambition-implementation gap. Support should prioritise energy efficiency in buildings and renewable energy deployment, particularly in sectors where municipal leverage is limited. Reporting mechanisms, such as those of the CoM, are necessary to track progress, and assess the implementation of the actions.

On the research front, further investigating the methodological challenges identified in this report, including inconsistencies between aggregate and action-level report, variations in inventory selection and limited data availability for certain sectors would strengthen the results and the progress's assessment. Longitudinal studies tracking the evolution of local energy strategies over time would provide valuable insights into the factors that enable or constrain successful climate action.

Lastly, the findings of this report highlight the need for coordinated efforts at all levels of governance to achieve the EU's climate objectives.

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List of abbreviations and definitions

Abbreviations	Definitions
BEI	Baseline Emission Inventory
CDP	Carbon Disclosure Project
CoM	Covenant of Mayors
CHP	Combined Heat and Power
CRF	Common Reporting Framework
DG	Directorate General
EC	European Commission
EFTA	European Free Trade Association
ETS	Emission Trading System
EU	European Union
GCoM	Global Covenant of Mayors
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
IT	Information Technologies
IPPU	Industrial Processes and Product Use
JRC	Joint Research Centre
LHCP	Local heat and cold production
LEP	Local electricity production
MEI	Monitoring Emission Inventory
NDC	Nationally Determined Contribution
SEAP	Sustainable Energy Action Plan

Abbreviations	Definitions
SECAP	Sustainable Energy and Climate Action Plan
TWG	Technical Working Group
UNFCCC	United Nations Framework Convention on Climate Change

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9. Annexes

9.1. Annex 1. Methodology followed

This annex aims to provide further insights on the methodological choices followed in the report. It focuses on the following topics: data processing, emission inventories selection, population figures and energy forecast.

9.1.1. Data processing

For the present report, the data is extracted from a 'frozen' version of the MyCovenant PostgreSQL database as of January 2025. The signatories and the action plans are selected according to the following main criteria:

- Signatories with initiative status corresponding to ‘published’ (i.e., active, compliant with the reporting requirements) or ‘on-hold’ (i.e., active, but suspended due to non-compliance);
- Action plans with submission status ‘submitted’ or ‘resubmitted'.

Signatory’s profiles were excluded if they had initiative status corresponding to ‘unpublished’ (i.e., signatories that never concluded the registration process: 256 profiles) or ‘under evaluation’ (i.e., not yet formally confirmed as signatories: 188 profiles). Besides, action plans with submission status ‘under completion’ (i.e., not submitted) were also excluded (3 874 plans).

Along the extraction process from MyCovenant, an important challenge consisted of linking each action plan with its commitments. A careful examination had to be performed, plan by plan, considering the date of submission of the plan, the level of completeness of the templates related to the plan, and most importantly, the presence of a reduction target.

The overall procedure was carried out in different stages. On a first stage, the raw data extraction was performed. Then, on a second stage, the available data was integrated into structured tables, adding extra information such as the GCoM identification codes for each organisation-signatory in the GCoM platform.

On a third stage, the main information quality-harnessing procedure was performed. To assess energy use and emissions, the first step was to develop a method for identifying unusual energy consumption data by comparing city-level energy use with national per capita averages from Eurostat and IEA. The process separates electricity from thermal energy (like heating fuels), excludes the industry sector, and focuses on commercial, public services, road transport, and residential sectors. City data is then compared to national averages for each sector, and outliers are flagged if electricity use per person is five times higher than the national maximum, thermal energy use per person is two times higher, or if energy use is extremely low (below 0.01 MWh/year per capita). This method helps filter out unrealistic or incorrect energy consumption reports.

After completing the outlier screening process, a more exhaustive analysis is performed on the subset of inventories initially tagged as being outliers. Some outliers might be rare but plausible, and if an evident error is detected, it can be corrected. For example, if the city reports in kWh instead of MWh, or in activity per capita instead of absolute activity. Only if the reported values appear to be incomplete or to make no proper sense, then the inventory is removed. Finally, internal coherence is checked regarding past inventories, verifying that there are no outlier values which cannot be empirically justified.

Regarding the internal consistency rules applied for cleaning the reported energy supply values, the following was implemented. In addition, energy supply is compared with energy consumption, and only if the energy produced was much greater than the consumption (over 150 times the reported consumption), it was taken out from the validated data set.

For certified green electricity purchases, the reported purchases were compared with electricity consumption, and they were validated only if the energy purchased was not greater than 1.05 times the electricity consumption.

On the commitments and mitigation actions included in the signatories' energy and climate action plans (SEAPs/SECAPs), the validation process consisted of an initial screening aiming at detecting evident inconsistencies in the reported data. After an initial assessment of acceptable commitments, they should consist of reasonable GHG emission reduction targets, both under BEI and business as usual (BAU) scenarios, not greater than a 100 % reduction of the baseline emissions. Then, following an empirical analysis, the proposed GHG emission reduction estimates were validated only if they were not greater than 2.2 times the targeted baseline emission reduction and less than the total baseline emissions. Likewise, estimated energy savings reported by the cities were checked for excluding values that were greater than 1.2 times the energy consumption.

Finally, the new cleaned and structured tables were submitted for publication (Bezerra et al., 2026), following the FAIR (Findability, Accessibility, Interoperability, and Reusability) guiding principles for scientific data management and stewardship (Wilkinson et al., 2016).

9.1.2. Data categorisation: MyCovenant reporting vs this report

The report analyses four main datasets: (a) energy consumption, b) energy supply, c) estimated energy savings and renewable energy production (target year 2030) and d) estimates at action level). The following provide a comparison of how the data is organised and reported in MyCovenant versus how it is presented in this report, highlighting the differences in data presentation and allowing for a clear understanding of the data organisation and analysis.

a) Energy consumption: Final energy consumption is reported for the following carriers as reported in **Table 20**.

Table 20. Final energy consumption energy carriers' disaggregation: My Covenant vs this report

My Covenant reporting		**This report**
Energy carrier	**Disaggregation (MyCovenant)**	**Energy carrier**
Electricity	n/a	Electricity
District heating and cooling	n/a	District heating and cooling
Fossil fuels	Natural gas	Fossil fuels
	Liquid gas	
	Heating oil	
	Diesel	
	Gasoline lignite	
	Coal	
	Other fossil fuels	
Renewable energies	Plant oil	Renewable fuels

	Biofuel	
	Other biomass	
	Solar thermal	
	Geothermal	
	Biogas	

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Additionally, final energy consumption data are reported for the following main sectors and subsectors (**Table 21**):

Table 21. Final energy consumption sectors and subsectors: My Covenant vs this report

My Covenant reporting		**This report**	
Sector	**Subsector (MyCovenant)**	**Sectors**	**Subsector**
Stationary energy / buildings	Municipal buildings, equipment/facilities	Stationary energy	Municipal buildings, equipment/facilities
	Public lighting		Public lighting
	Tertiary buildings, equipment/facilities		Tertiary buildings, equipment/facilities
	Residential buildings		Residential buildings
	Industry Non-ETS		Industry Non-ETS
	Industry ETS		Industry ETS
	Buildings, equipment/facilities non-allocated		Buildings, equipment/facilities non-allocated
	Agriculture/Forestry/Fisheries		Agriculture/Forestry/Fisheries
	Other		Other
Transport	Municipal fleet	Transport	Transport
	Public transport		
	Private and commercial transport		

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

b) Energy supply: The energy supply is reported in MyCovenant in the BEIs and MEIs in three different sections (local electricity production, purchases of renewable energy certificates, and local heat/cold production). Local authorities could, for instance, report certified green electricity but not report any local heat/cold production. Energy supply data are reported according to the following structure (**Table 22**):

Table 22. Energy supply categories: My Covenant vs this report

My Covenant reporting		**This report**	
Energy supply categories	**Subcategories**	**Energy supply categories**	**Subcategories**
Local/distributed electricity production (Renewable energy only)	Wind	Local electricity production	Wind
	Hydroelectric		Hydroelectric
	Photovoltaics		Photovoltaics
	Geothermal		Geothermal
	Other		Other
Local/distributed electricity production	Combined Heat and Power		Combined Heat and Power
	Other (ETS and large-scale plants > 20 MW not recommended)		Other (ETS and large-scale plants > 20 MW not recommended)
Certified green electricity	Purchases Guarantees of Origins (within municipality boundaries)	Renewable energy certificates	Purchases Guarantees of Origins (within municipality boundaries)

	Sales Guarantees of Origins (within the municipality boundaries)		Sales Guarantees of Origins (within the municipality boundaries)
Local heat/cold production	Combined Heat and Power	Local heat/cold production	Combined Heat and Power
	District heating (heat-only)		District heating (heat-only)
	Other		Other

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

c) Estimated energy savings and renewable energy production (target year 2030):
Signatories report in MyCovenant within "My Actions Overview", the estimated savings and renewable energy production they aim at achieving in the target year. Only information linked to the initial action plan is considered, as it is in this moment where the "targets" are established. Estimated energy savings and renewable energy production by the target year are reported for the following mitigation sectors (**Table 23**):

Table 23. Estimates by 2030 – considered sectors: My Covenant vs this report

My Covenant reporting	**This report**
Sectors	**Sectors**
Municipal buildings, equipment/facilities	Municipal buildings, equipment/facilities
Tertiary (non-municipal) buildings, equipment/facilities	Tertiary (non-municipal) buildings, equipment/facilities
Residential buildings	Residential buildings
Industry	Industry
Transport	Transport
Waste	Waste
Local Electricity Production	Local Electricity Production
Local Heat/Cold Production	Local Heat/Cold Production
Others	Others

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

In this context, it is worth to note that there are four sectors classified as key: municipal buildings, tertiary (non-municipal) buildings[9] , residential buildings and transport. According to the Covenant Guidelines, municipalities have to assess at least three out of four key sectors in their BEIs/MEIs; and ensure that their actions address at least two key sectors. For this reason, these sectors are better represented in the data reported by the local authorities, where for instance waste assessments are sometimes lacking. This insight can contribute to interpreting the presented results and available data.

d) Estimated energy savings and renewable energy production (actions – level):

Action-level data is presented in section 4, focusing on expected energy savings (section 0) or renewable energy production (section 4.2). To enhance this report's clarity, the categories of areas of intervention and policy instruments used in MyCovenant have been simplified. However, these

[9] Tertiary buildings refer to buildings used for services (e.g. offices of private companies, banks, commercial and retail activities, private schools, hospitals, etc.). Local authorities should report all final energy consumption due to operation (e.g. electricity for pumping, natural gas for heating, etc.) of private water supply system, solid waste and wastewater treatment and disposal facilities.

categories occur in combination with each other and the sector. For instance, for the "buildings" sector, specific "areas of intervention" are available, which are linked to their corresponding "policy instrument", depending on the scope of the action. Ideally, the combinations of sector + area of intervention + policy instrument should be observed jointly to reclassify the actions. In the present report a simplification effort has been explored by contemplating the lists of possible "areas of intervention" and "policy instruments" in an isolated manner. This allows for a clearer and more straightforward analysis.

For the "areas of intervention", the following correlations have been used in this report (**Table 24**):

Table 24. Areas of intervention correlation MyCovenant reporting versus this report

My Covenant reporting	**This report**
Areas of intervention	**Areas of intervention**
Building envelope	Envelope
Energy efficiency in buildings	
Energy efficiency in industrial processes	Energy efficiency (appliances / light / space heating / water)
Energy efficiency in space heating and hot water	
Energy efficient electrical appliances	
Energy efficient lighting systems	
Renewable energy for space heating and hot water	Renewable energy in buildings
Industry renewable energy	
Integrated action	Integrated action
Behavioural changes	Behavioural change and digital
Information and communication technologies	
Cleaner efficient vehicles	Efficient vehicles and practices (incl. electric vehicles)
Eco driving	
Electric vehicles	
Modal shift to walking and cycling	Walking and cycling
Car sharing pooling	Public (and shared) transportation
Improvement of logistics and urban freight transport	
Modal shift to public transport	
Mixed use development and sprawl containment	Urban planning
Road network optimisation	
Biomass power plant	Renewables for power and heat
Hydroelectric power	
Photovoltaics	
Wind power	
Combined heat and power	District heating/cooling and CPH
District heating cooling network	
District heating cooling plant	
Smart grids	Distribution and Storage (power and heat)
Agriculture and forestry related	Agriculture and forestry related (incl. Urban regeneration)
Tree planting in urban areas	
Urban regeneration	
Waste and wastewater management	Waste and wastewater management
Industry other	*Other or non-specified (not considered in the analysis)*
Other	
-	

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Aiming to simplifying the current document and the analysis observed a significant modification is the introduction of the action types which simplify the currently existing policy instruments. There

are four action types: 1) physical and technological, 2) economic and finance, 3) governance and institutional and 4) knowledge and behaviour change. These categories provide a concise overview of how municipalities are structuring their action plans to create an enabling environment, facilitating easier analysis and comparison.

The following correlations have been established between "policy instruments" (in an isolated manner) versus action types:

Table 25. Policy instruments correlation MyCovenant reporting versus action types used in this report

My Covenant reporting	**This report**
Policy instruments	**Key type measures**
Energy management	Physical and technological
Land use planning (in transport)	
Energy carbon taxes	Economic and Finance
Grants and subsidies	
Third party financing	
Road pricing	
Integrated ticketing and charging	
Energy certification labelling	Governance and Institutional
Energy performance standards	
Public procurement	
Mobility planning regulation	
Voluntary agreements with stakeholders	
Building standards	
Energy suppliers' obligations	
Land use planning (in other sectors)	
Awareness raising training	Knowledge and Behaviour change
-	*Other or non-specified (not considered in the analysis)*
Not applicable	
Other	

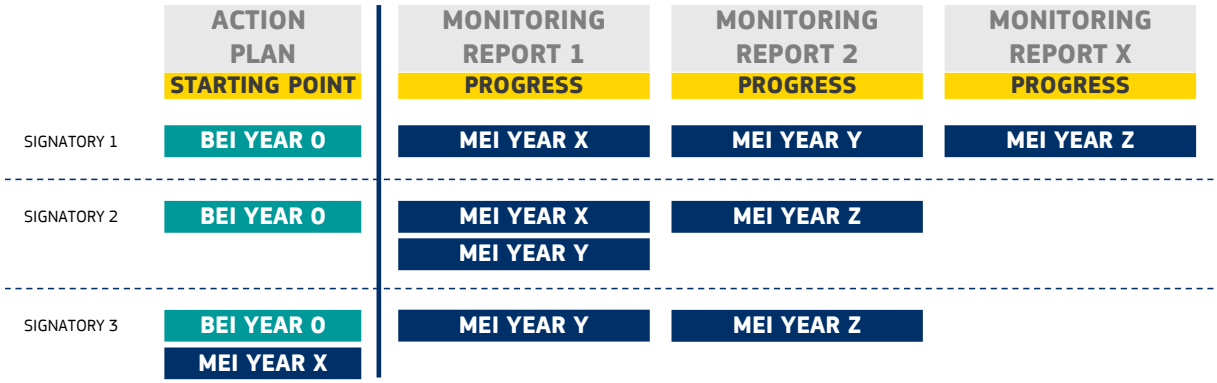
Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

9.1.3. Inventories selection

The current report introduces a methodological approach on how inventories are selected for the analysis performed in sections 0 (baseline inventories), 0 (latest inventories) and 6 (achievements in energy savings / RES production).

Due to the reporting structure of MyCovenant, "BEIs" (Baseline Emission Inventories) are submitted at an initial stage, when submitting an action plan, whereas "MEIs" can be reported both at the action plan stage, and also in the monitoring report stages. There is no limit to the number of inventories that can be submitted at any stage. Consequently, the inventory status for different signatories might look like this:

Figure 27. "BEI" and "MEIs" reporting at action plan versus monitoring report stages



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

For the purpose of this report, the distinction between "BEIs" (Baseline Emission Inventory) and "MEIs" (Monitoring Emission Inventories) is not considered, and the assessment focuses solely on the year of the inventory and its completeness. To prevent duplication, only a maximum of two inventories are considered for each signatory: one designated as the "baseline" inventory and, if available, a second one designated as the "latest" inventory.

Notably, 2005 is the year with the highest number of submitted inventories, making it a key reference point. As a result, when designating a "baseline" inventory for this report, priority is given to inventories with a reference year closest to 2005, rather than simply selecting the earliest available inventory. This approach aims to provide a more accurate representation of the situation at a particular point in time[10].

Lastly, there are limited number of "MEIs" as compared to "BEIs". Therefore, a similar approach to that followed with the "baseline" inventories cannot be followed for "latest" inventories, as in many cases municipalities have only reported two inventories.

For these reasons, the main conditions to classify inventories as "baseline" or "latest" within this report have been the following:

- If the municipality has reported only one inventory, this inventory has been selected as the "baseline" inventory.
- If the municipality has reported two inventories, the earliest one is considered a "baseline" inventory whereas the latest one is designated the "latest" inventory.
- If the municipality has reported more than two inventories, the most recent inventory is considered the "latest". From the remaining ones, the closest to 2005 (absolute year difference) is considered a "baseline" inventory.

[10] In the energy consumption forecast presented in section 7, the same reasoning has been applied. The year 2005 has been selected as the baseline year, as the data from a larger number of inventories could be directly used, without needing to model the results with a linear regression using inventories from a previous or later year.

9.1.4. Climate Neutral and Smart Cities and Covenant signatories

A total of 43 signatories has been excluded from the present analysis, which correspond to Covenant and Cities Mission signatories, as their level of ambition and scope could render their energy values not comparable to the rest of Covenant signatories and could distort the results. The main reasons are the following:

— **Ambition level**: cities involved in the Cities Mission aim for climate neutrality by 2030, which is translated into an emissions reduction target of around – 80% and a residual emission strategy which aims at compensating the remaining emissions via carbon removal strategies or carbon credits. Depending on the signed commitment, the

— **Scope of emissions inventories:** municipalities involved in the Cities Mission need to report emissions in all sectors, broadening the GHG considered beyond CO_2 and methane emissions, and including nitrous oxide, F-gases, sulphur hexafluoride and nitrogen trifluoride.

The countries and name of the 43 municipalities are listed below.

Table 26. List of Covenant and Cities Mission signatories not considered in this report

Country	#	Covenant and Cities Mission signatory
Belgium	3	Antwerp, Leuven, La Louvière
Bulgaria	2	Sofia, Gabrovo
Czechia	1	Liberec
Finland	5	Tampere, Espoo, Turku, Lahti, Lappeenranta
France	3	Communauté urbaine de Dunkerque, Paris, Marseille
Germany	3	München, Münster, Dresden
Greece	3	Kozani, Ioannina, Kalamata
Hungary	2	Budapest, Pécs
Ireland	2	Dublin City Council, Cork City Council
Italy	8	Comune di Padova, Torino, Bologna, Bergamo, Firenze, Parma, Prato, Roma
Latvia	1	Liepāja
Netherlands	1	Groningen
Norway	1	Stavanger
Poland	2	Wrocław, Łódź
Portugal	3	Lisbon, Porto, Guimarães
Slovakia	1	Košice
Spain	2	Valencia, Zaragoza

Source: JRC elaboration based on GCoM reported through the MyCovenant platform and Cities Mission data

9.1.5. Population

Population values are used throughout the report to calculate per capita values and provide an indication of the overall representativeness of a given number of signatories.

The population values used are those reported by signatories without using any external source. In My Covenant platform, signatories can report population values when they adhere to the initiative ("population adhesion") and they can voluntarily input updated population values linked to a given inventory. In both cases, the year to which the population relates is known, via a) the date of adhesion or b) inventory year. However, population values linked to the inventories are not always

available. Moreover, while the submission date of the action plans is also known, there is no specific population value linked to the action plans.

Population values are used in three cases throughout this report: when analysing 1) baseline inventories, 2) latest inventories or 3) action plans. To understand whether reported population values are reliable, for each signatory, the population at the adhesion has been compared to the population in the baseline and latest inventories, when available, and the increase / decrease across the years calculated. As a result, several outliers have been detected, suggesting that some values might have been reported incorrectly. For this reason, the rules described below (**Table 27**) have been applied to select the most reasonable population value in each case: either the population at the adhesion, or the population reported in an inventory.

Most of the times (97,9% for population values linked to baseline inventories, 99,5% for population values linked to latest inventories and 98,7% for population values linked to action plans) the default option has been chosen. However, if the absolute yearly population variation between the different data points was higher than 10%, or the given value was not available (e.g. population linked to a given inventory) the population value was checked and refined, if necessary, as reported in **Table 27**.

Table 27. Population selection rules

Case	Section	Default choice	Alternative
Baseline inventories	2	Population reported in the baseline inventory. If there is no population value, apply population value (either population adhesion or population latest inventory) from the closest year to the baseline inventory year.	If the difference remains significant, a manual check has been applied.
Latest inventories	5, 6	Population reported in the latest inventory, if there is no population value, apply population value (either population adhesion or population baseline) from the closest year to the latest inventory year.	If the difference remains significant, a manual check has been applied.
Action plans	3, 4	Population at adhesion.	Apply population value (either population adhesion or population baseline) with the lowest absolute year difference to the latest inventory.

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

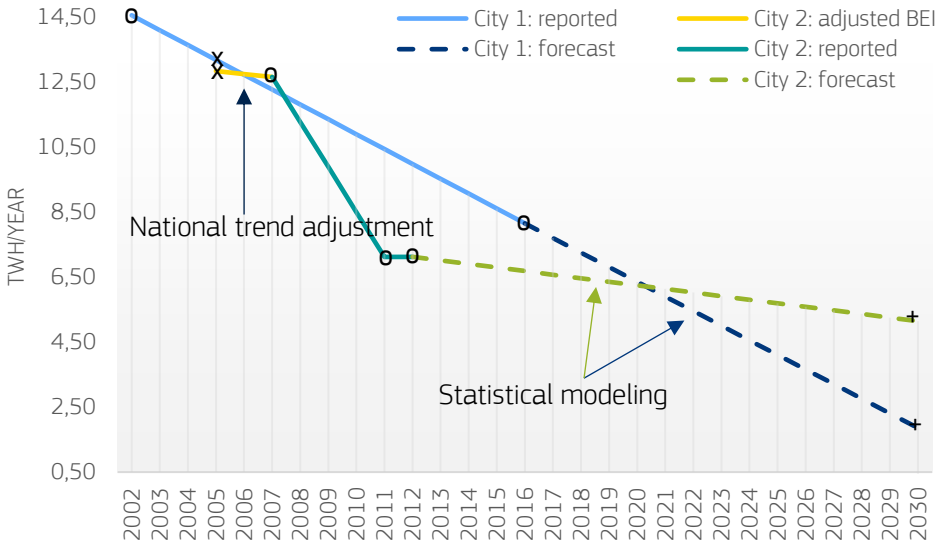
9.1.6. Energy forecast

Firstly, the base year was set to 2005, being the reference year for measuring the performance of the cities' actions. In this way, for cities reporting a base year earlier than 2005, the estimated energy consumption in 2005 was taken according to the linear equation between the municipality's reported baseline inventory and its last monitoring inventory (see **Figure 28**, the 2005 estimation of "city1"). Meanwhile, for cities with a base year occurring after 2005 (see **Figure 28**, for "city2"), their corresponding baseline energy consumption were adjusted according to the factor f, which considered the National Energy consumption (taken from IEA-EDGAR data base: https://edgar.jrc.ec.europa.eu/dataset_ghg70#p1) for 2005 NE_{2005} , and for the base year NE_{base}, as in

$$f = \frac{NE_{2005}}{NE_{base}}.$$

The models for estimating the municipalities' energy consumption in 2030 followed a machine learning methodology, minimising the error over the last known value, see (Franco et al., 2022). The input data for the development of the models consisted in the municipalities' reported energy inventories for their baseline and the following monitoring inventories, projecting their energy activity up to 2030, as shown in **Figure 28**.

Figure 28. Picture of the statistical methodology for the estimation of the cities' energy consumption. Cities report their energy inventories (marked with o) for a given year, and their consumption is estimated for 2005 (marked with x) and forecasted to the target year (marked with +) of 2030.



Source: Own elaboration

Therefore, each municipality had a sparse time series with a yearly frequency, being sparse because many years in between the base and the last monitoring years had missing values. Hence, firstly, the imputation of data was performed, building the yearly time series on which the algorithms could learn the stochastic process explaining their behaviour. This was done by continuing the linear trend between the years holding the known energy values (see again **Figure 28**). Secondly, the best model was identified for each city (i), according to the minimum error ($error_i$) for the predicted value ($\hat{y}_{it}$), computed over the last known energy value (y^*_{it}). Such a last known energy value consisted in the value coming from the city's last MEI. This error was computed for each city as the mean absolute percentage error, given by:

$$error_i = \frac{|\hat{y}_{it} - y^*_{it}|}{y^*_{it}}. \qquad (1)$$

In this way, the last known value was left out for validation, and the best model was identified achieving the minimum prediction error. Here, according to Eq. (1), the methodology obtained a mean prediction error of 14%.

Finally, the complete time series was fitted again under the same functional form of the identified model, and the corresponding prediction was taken for the cities' energy consumption in the target year 2030.

Under this methodology, the time series were modelled after three different approaches, automatically selecting the best model from the three.

One approach consisted in a Double Exponential Smoothing (DES) (Box et al., 2016), characterising the level and the trend of the series, according to

$$\hat{y}_{t+1} = L_t + T_t,$$

where L_t and T_t, respectively, stand for the smoothed level and trend of the time series.

A second approach consisted in an Auto-Regressive Integrated Moving Average process (Box et al.; 2016), commonly known as an ARIMA(p,d,q), implementing linear filters to characterize the series, in the form of

$$\hat{y}'_t = Z_t + \sum_{j=1}^{p} \phi_j y'_{t-j} + \sum_{j=1}^{q} \theta_j Z_{t-j},$$

where y' stands for the differentiated series to the order of *d*, and *p* and *q* respectively stand for the number of lagged observations and the number of standard-normal innovations included in the process. The ARIMA(p,d,q) models were validated by the Ljung--Box test (see again (Box et al., 2016)), checking that no significant correlation among the residuals was left unexplained.

The third and last approach to modelling the series consisted in an auto-regressive feed-forward neural network with one hidden layer, estimating non-linear functions with a fair level of complexity (Hornik et al. 1989), but not too complex as the behaviour being modelled was rather simple (with no seasonality component). This architecture was examined with different number of neurons, namely 3, 5, 7 or 10 neurons in the single hidden layer, receiving as input from 1 to 5 lagged observations (depending on the available data).

9.1.7. Data limitations

The analysis presented in this report is based on data reported by municipalities, which may be subject to various limitations. One of the primary concerns is the potential for errors or inconsistencies in the data reported by cities. As the data is self-reported, there may be variations in the quality and accuracy of the information provided, which can impact the reliability of the results.

Additionally, the distribution of signatories to the Covenant of Mayors is not uniform across all regions, with a higher concentration of signatories from certain locations. This may introduce a bias in the analysis, as the results may be more representative of the experiences and characteristics of cities from these regions. For example, Spain and Italy have a disproportionately high number of signatories, which may influence the overall trends and patterns observed in the data.

Furthermore, for some elements of the analysis (most notably values on energy supply, or signatories with a 2050 commitment, overall), the number of signatories is limited, which can reduce the statistical value and the reliability of the results. This is particularly true for some energy supply values or values for signatories with a 2050 commitment, making it challenging to draw robust conclusions.

It is also important to note that the data may not be representative of all municipalities, as only signatories to the Covenant of Mayors are included in the analysis. This may exclude municipalities that are not participating in the initiative, or those that may not have the capacity or resources to report data.

To mitigate these limitations, the analysis has been designed to be as transparent and robust as possible, with a focus on highlighting the trends and patterns that emerge from the data. However,

it is essential to interpret the results with caution, recognising the potential biases and limitations of the data.

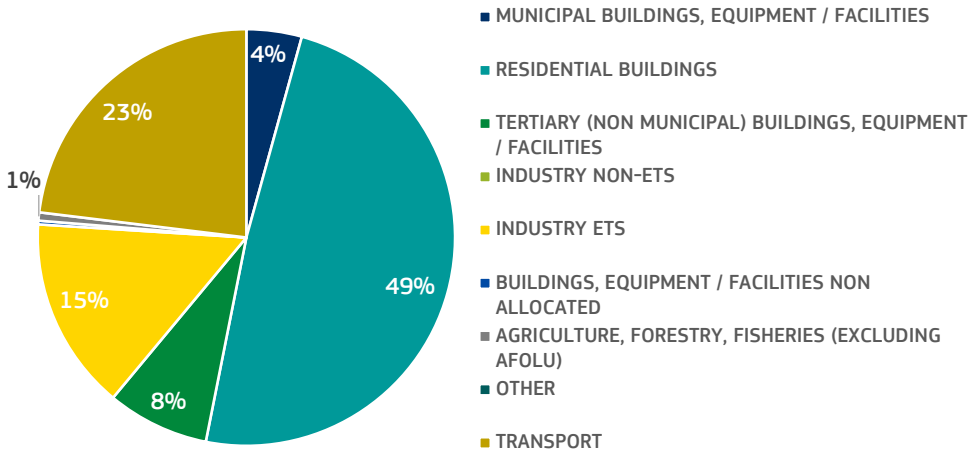
9.2. Annex 2. EFTA results reporting

This annex provides the results for the CoM municipalities in EFTA countries for analysis conducted in this report. Due to the limited number of signatories (2), these insights have not been used to extract conclusions about the energy status.

9.2.1. Baseline inventories: energy consumption

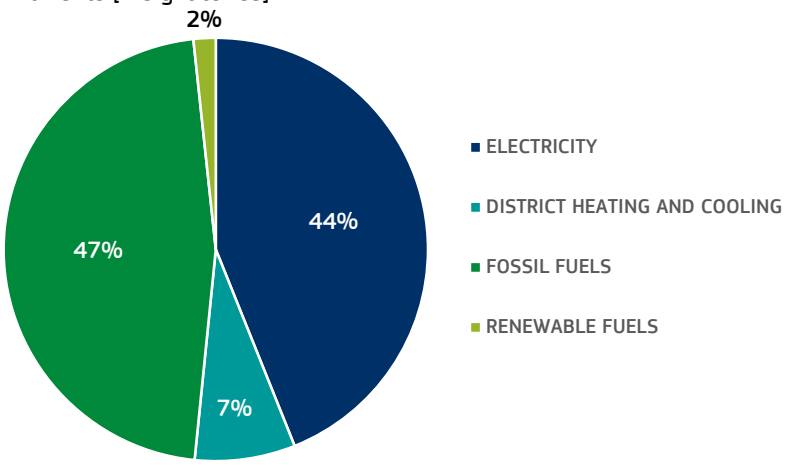
The 2 EFTA signatories having reported energy consumption data in their baseline inventories with a 2030 or 2050 commitment, are Asker (Norway) and Lausanne (Switzerland) representing 0.21 million inhabitants. Their results are presented below (**Figure 29** and **Figure 30**).

Figure 29. Shares of final energy consumption by sector reported in baseline inventories EFTA with 2030 or 2050 commitments [2 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 30. Shares of final energy consumption by carrier reported in baseline inventories EFTA with 2030 or 2050 commitments [2 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Table 28. Energy consumption reported in baseline inventories related to 2030 or 2050 commitments – EFTA [2 signatories]

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**	SHARE	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**
	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Municipal buildings, equipment/facilities	0.122	0.047	0.045	0.0004	**0.214**	**4.29%**	0.573	0.223	0.212	0.001	**1.010**
Residential buildings	1.127	0.336	0.896	0.084	**2.443**	**48.83%**	5.308	1.580	4.216	0.397	**11.501**
Tertiary (non-municipal) buildings, equipment/facilities	0.366	-	0.030	-	**0.396**	**7.92%**	1.723	-	0.141	-	**1.864**
Industry Non-ETS	-	-	-	-	**-**	**0%**	-	-	-	-	**-**
Industry-ETS	0.542	-	0.206	-	**0.748**	**14.97%**	2.554	-	0.972	-	**3.526**
Buildings, equipment/facilities non-allocated	-	-	0.014	-	**0.014**	**0.29%**	-	-	0.067	-	**0.067**
Agriculture, Forestry, Fisheries	0.032	-	-	-	**0.032**	**0.64%**	0.151	-	-	-	**0.151**
Other non-allocated	-	-	-	-	**-**		-	-	-	-	**-**
Subtotal stationary energy	2.189	0.383	1.191	0.0844	**3.847**	**76.93%**	10.309	1.803	5.608	0.398	**18.119**
Subtotal transport	0.009	-	1.146	-	**1.155**	**23.07%**	0.040	-	5.393	-	**5.433**
TOTAL	**2.198**	**0.383**	**2.337**	**0.0844**	**5.002**	**100%**	**10.349**	**1.803**	**11.001**	**0.398**	**23.552**
SHARE	**43.94%**	**7.66%**	**46.71%**	**1.69%**	**43.94%**						

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

9.2.2. Baseline inventories: energy supply

Only the municipality of Lausanne from EFTA countries reported energy supply values in the baseline emission inventories, as shown in **Table 29**and **Table 30**. The purchase of renewable energy certificates was not included in any signatories' reports.

While no relevant conclusion can be extracted from only one signatory, results are presented in the following subsections.

9.2.2.1. Local electricity production

Table 29. Local electricity production in baseline inventories related to 2030 or 2050 commitments - EFTA [1 signatory]

Energy production technology	Non-renewable	Renewable	TOTAL	Share	Non-renewable	Renewable	TOTAL
	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Photovoltaics	-	0.00006	**0.00006**	0.04%	-	0.00049	0.00049
Wind	-	-	-	-	-	-	-
Hydroelectric	-	0.157	**0.157**	99.96%	-	1.22986	1.22986
Geothermal	-	-	-	-	-	-	-
Local electricity production plants - Combined Heat and Power	-	-	-	-	-	-	-
Local electricity production plants - Other	-	-	-	-	-	-	-
TOTAL	-	0.157	**0.157**	100.00%	-	1.23035	1.23035
SHARE ON TOTAL ELECTRICITY PRODUCTION	0%	100.00%	**100%**				
SHARE ON TOTAL ELECTRICITY CONSUMPTION*	0.00%	7.13%	7.13%				

*Compared to the total electricity consumption in BEI (only for local authorities reporting local electricity production)

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

9.2.2.2. Local heat/cold production

Table 30. Local heat/cold production in baseline inventories related to 2030 or 2050 commitments – EU-27 [1 signatory]

Energy production technology	Non-renewable	Renewable	TOTAL	SHARE	Non-renewable	Renewable	TOTAL
	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Local heat/cold production plants - Combined Heat and Power	-	-	**-**	0%	-	-	**-**
Local heat/cold production plants - District heating (heat-only)	0.379		**0.379**	100%	2.974		**2.974**
Local heat/cold production plants – Other	-	-	**-**	0%	-	-	**-**

TOTAL	0.379	0	**0.379**	100%	2.974		**2.974**
SHARE ON TOTAL HEAT/COLD PRODUCTION	100%	0%	**100 %**				
SHARE ON TOTAL DISTRICT HEATING CONSUMPTION*	98.96%	0%	98.96%				

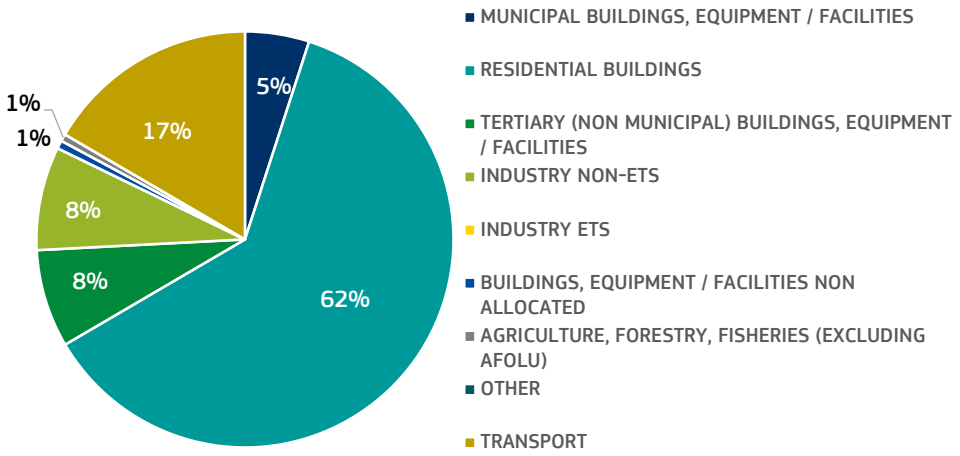
* Compared to the total district heating consumption in baseline inventories (only for local authorities reporting local heat/cold production)

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

9.2.3. Latest inventories: energy consumption

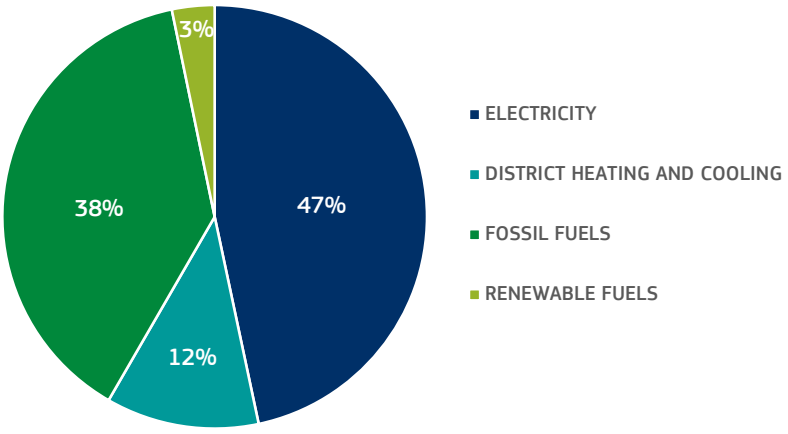
Asker (Norway) and Lausanne (Switzerland) have reported energy consumption data in their latest inventories, representing 0.22 million inhabitants. Their results are presented below in **Figure 31** and **Figure 32** and in **Table 31**.

Figure 31. Shares of final energy consumption by sector reported in latest inventories EFTA with 2030 or 2050 commitments [2 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 32. Shares of final energy consumption by carrier reported in latest inventories EFTA with 2030 or 2050 commitments [2 signatories]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Table 31. Energy consumption reported in latest inventories related to 2030 or 2050 commitments – EFTA [2 signatories]

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**	SHARE	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	**TOTAL**
	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[TWh/year]	[%]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]	[MWh/y*pc]
Municipal buildings, equipment/facilities	0.150	0.043	0.032	0.0001	**0.225**	**4.98%**	0.677	0.192	0.146	0.0005	**1.015**
Residential buildings	1.213	0.484	0.978	0.1087	**2.784**	**61.58%**	5.468	2.184	4.410	0.490	**12.552**
Tertiary (non-municipal) buildings, equipment/facilities	0.344	-	0.001	-	**0.345**	**7.62%**	1.549	-	0.003	-	**1.552**
Industry Non-ETS	0.337	-	0.027	-	**0.364**	**8.05%**	1.520	-	0.120	-	**1.640**
Industry-ETS	-	-	-	-	**-**	**0.00%**	-	-	-	-	**0**
Buildings, equipment/facilities non-allocated	-	-	0.029	-	**0.029**	**0.63%**	-	-	0.129	-	**0.129**
Agriculture, Forestry, Fisheries	0.026	-	-	-	**0.026**	**0.57%**	0.115	-	-	-	**0.115**
Other non-allocated	-	-	-	-	**-**	**0%**	-	-	-	-	**-**
Subtotal stationary energy	2.070	0.527	1.067	0.1088	**3.773**	**83.42%**	9.329	2.376	4.808	0.4905	**17.003**
Subtotal transport	0.041	-	0.671	0.0378	**0.749**	**16.58%**	0.184	-	3.024	0.171	**3.379**
TOTAL	**2.111**	**0.527**	**1.738**	**0.1467**	**4.522**	**100%**	**9.513**	**2.376**	**7.832**	**0.661**	**20.382**
SHARE	46.67%	11.66%	38.43%	3.24%	100%						

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

9.2.4. Latest inventories: energy supply

Only the municipality of Lausanne (Switzerland) representing 0.13 million inhabitants from EFTA countries reported energy supply values in the baseline emission inventories. No data on renewable energy certificates nor local heat/cold production have been reported, despite data on local heat/cold consumption has been reported (**Table 32** and **Figure 33**).

9.2.4.1. Local electricity production

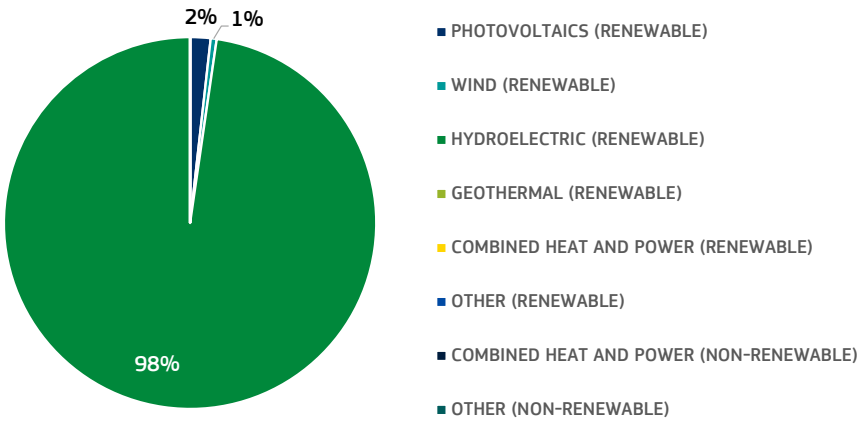
Table 32. Local electricity production in latest inventories related to 2050 commitments - EFTA [1 signatory]

Energy production technology	Non-renewable [TWh/year]	Renewable [TWh/year]	TOTAL [TWh/year]	SHARE [%]	Non-renewable [MWh/y*pc]	Renewable [MWh/y*pc]	TOTAL [MWh/y*pc]
Photovoltaics	-	0.011	**0.011**	1.77%	-	0.0864	**0.0864**
Wind	-	0.003	**0.003**	0.52%	-	0.0253	**0.0253**
Hydroelectric	-	0.607	**0.607**	97.71%	-	4.7672	**4.7672**
Geothermal	-	-	**-**	0%	-	-	**-**
Local electricity production plants - Combined Heat and Power	-	-	**-**	0%	-	-	**-**
Local electricity production plants - Other	-	-	**-**	0%	-	-	**-**
TOTAL	0.000	0.622	**0.622**	100%	0.000	4.8789	**4.8789**
SHARE OF TOTAL ELECTRICITY PRODUCTION	0%	100%	**100%**				
SHARE OF TOTAL ELECTRICITY CONSUMPTION*	0.00%	29.44%	29.44%				

*Compared to the total electricity consumption in latest inventories (only for local authorities reporting local electricity production)

Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

Figure 33. Shares of local electricity production by technology, reported in latest inventories related to 2030 and 2050 commitments– EFTA [1 signatory]



Source: JRC elaboration based on GCoM data reported through the MyCovenant platform

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