



JRC TECHNICAL REPORT

Covenant of Mayors 2022 Energy figures

*Energy activity and savings of
cities and local governments
committed to climate change
mitigation and adaptation*

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Abstract

Cities and local authorities are key players in addressing climate change. Since 2008, the European Commission endorses and supports their efforts through the Covenant of Mayors for Climate and Energy (CoM) and notably through the provision of capacity building, technical assistance, sharing of best practices and peer learning opportunities. The initiative helps consolidate best practices to monitor and report on energy consumption and GHG emissions as well as on risks and vulnerabilities at the local level, allowing decision makers to identify priority sectors, set emission reduction targets and adaptation goals and plan relevant measures.

This report complements the Covenant of Mayors 2022 Assessment report (Melica et al., 2022), describing the CoM energy activity and estimated savings, based on data declared through the MyCovenant reporting platform. It examines energy consumption and production, and offers an overview on the progress made on energy savings and renewable energy generation.

Overall, fossil fuels have the greatest weight in total consumption, followed by electricity, district heating and cooling and lastly, with the minimum share, renewable fuels, suggesting that the transition to a greener energy system still requires more time and additional efforts to achieve EU targets. Meanwhile, the sector with the highest share in the reported consumption is residential buildings, followed by private and commercial transport.

Regarding local electricity production, the highest shares for EU-27 signatories correspond to photovoltaics, hydroelectric power, wind power, and combined heat and power (CHP). On the contrary, for non-EU signatories, the highest shares of local electricity production are associated with CHP, hydroelectric power, and geothermal power. Considering local heat/cold production, the highest shares for both EU-27 and non-EU signatories correspond to district heating (heat only) and CHP, using mostly non-renewable energy sources and covering a high percentage of the entire heat/cold baseline consumption.

Examining the renewable energy production, EU-27 signatories estimate producing 0.65 and 1.05 MWh/year per capita, respectively for 2020 and 2030 commitments. Lower estimates are declared by non-EU signatories, with 0.18 and 0.24 MWh/year per capita, respectively for 2020 and 2030 commitments.

The key findings show that the energy savings accomplished by EU-27 signatories amount to 117 TWh/year for 2020 (based on 1 775 signatories) and 27 TWh/year for 2030 commitments (based on 400 signatories), which correspond to 1.45 and 1.17 MWh/year per capita, respectively. On the other hand, the energy savings accomplished by signatories in the rest of Europe (non-EU) amount to 20.5 TWh/year (1.48 MWh/year per capita) for 2020, but for 2030 signatories were unable to achieve mean positive savings, mainly due to the atypical increasing consumption behaviour of the city of Bursa. Nonetheless, without such a city, signatories accomplished a mean annual rate of per capita energy savings of 0.09 MWh/year. In particular, among Covenant signatories having monitored their advances, the highest yearly savings rates correspond to the cities of Dortmund, Mariupol, Budapest and Marbella, saving 1.45, 0.95, 0.85 and 0.72 TWh/year, respectively.

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1 Introduction

Cities and local authorities are key actors in the fight against climate change. The Sixth Assessment Report (AR6) from the Intergovernmental Panel on Climate Change (IPCC) highlights the increasing diversity of actors in the global effort against climate change, with non-state and sub-national actors (including cities) playing a growing role. Furthermore, it highlights that urban areas can create opportunities to increase resource efficiency and mitigate greenhouse gas (GHG) emissions through the systemic transition of infrastructure and urban form towards net-zero emissions (IPCC, 2022).

The European Union (EU) has committed to becoming the world's first climate-neutral continent by 2050¹. To this end, in 2021 the European Commission (EC) has adopted a package of proposals to make the EU policies in various domains fit for achieving an interim 55% emission reduction by 2030, compared to 1990 levels. The energy crisis that followed Russia's invasion of Ukraine has shown the need for a further acceleration of the clean energy transition, to reduce Europe's dependency on unreliable suppliers and volatile fossil fuels.

Acknowledging that the impacts of climate change are already occurring today, the EU strategy on adaptation to climate change aims to make adaptation smarter, swifter and more systemic and to increase support for international climate resilience. In this regard, it intends to support the further development and implementation of adaptation strategies and plans at all levels of governance and aims to spread adaptation awareness to every single local authority, company and household².

In this context, local involvement and public participation are key points of attention for the EU: Member States are required to establish multilevel climate and energy dialogues involving local authorities as well as other stakeholders to engage and discuss the achievement of the EU climate neutrality objective. The importance of transnational networks of cities and local authorities to stimulate the development of renewable energy and energy efficiency is acknowledged at EU level.

Being the level of governance closest to citizens, cities and local authorities may influence and take action on several sectors: through local energy and climate plans, they can contribute to the implementation of EU energy and climate policies. For example, they can get involved in renewable energy communities or accelerate permitting procedures for renewable energy installations, they can improve the efficiency of their own buildings and raise citizens' awareness of building energy renovation options, they can promote sustainable mobility options and create more liveable cities. To increase the resilience of their territories, they can implement nature-based solutions in their own buildings and public infrastructure, as well as embed high-performance resiliency standards in city planning and building codes; additionally, they can promote climate awareness and disaster risk preparedness within their employees as well as with citizens and businesses.

The EU Covenant of Mayors (EU CoM) and the Global Covenant of Mayors (GCoM) have been instrumental in spreading awareness on climate change among local governments and in providing methodologies and approaches to develop local climate and energy plans. For more than a decade now, cities and local authorities have been setting GHG emission reduction targets and adopted plans to tackle the key emitting sectors in their territories. More recently, they started to set adaptation goals and to adopt plans addressing the climate hazards and vulnerabilities in their territories. The energy poverty dimension is also gaining increasing importance, in order to achieve a just transition that leaves no one behind.

1.1 The Covenant of Mayors: history, commitments and reporting requirements

The Covenant of Mayors was launched by the EC in 2008, with a target for participating cities to reduce greenhouse gas (GHG) emissions in their territories by at least 20% by 2020 through the development and implementation of a Sustainable Energy Action Plan (SEAP). The initiative was very well received by cities and

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

² Among the actions from the EU Strategy of particular relevance to CoM signatories:

- increase funding opportunities to implement adaptation actions at the local scale;
- improve monitoring frameworks, develop indicators, and record data on climate-related losses (i.e., EU Risk Data Hub);
- create a "policy support facility" (CoM EU) to further support local and regional governments for a more systemic adaptation;
- promote nature-based solutions for adaptation (biodiversity co-benefits)
- promote a socially-just transition, recognizing the higher impact of climate risks on vulnerable population groups, and avoiding reinforcing inequalities.

local governments all over the EU and beyond, with thousands of signatories of all sizes, backgrounds and levels of experience joining enthusiastically and with regional and national authorities endorsing and supporting their efforts.

In 2014, based on the experience of the Covenant of Mayors and acknowledging the vulnerability of urban areas to the unavoidable impacts of climate change, the Commission launched Mayors Adapt, a similar voluntary initiative with a focus on climate adaptation in cities. The Covenant of Mayors and Mayors Adapt then merged in 2015 resulting in the Covenant of Mayors for Climate & Energy, which set a new target in line with the EU headline target of 40% GHG emission reduction by 2030 and integrated the adaptation pillar. Then, in 2017, the Covenant of Mayors for Climate and Energy and the Compact of Mayors joined forces becoming the GCoM, currently the world's largest coalition of cities and local governments voluntarily committed to fight climate change.

As a result of the EU's commitment to reducing its net GHG emissions by at least 55% by 2030 and becoming climate neutral by 2050, in April 2021 the EU chapter of the GCoM initiative announced its renewed ambition³, with participating cities pledging to the goal of climate neutrality by 2050 and to tackling in an integrated manner the three pillars of the initiative, namely climate mitigation, climate adaptation, and energy access and poverty.

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. Detailed methodological guidance on how to develop a SECAP (Bertoldi, 2018) as well as guidelines on how to report the SECAP⁴, covering both mitigation and adaptation, are publicly available in the Common Reporting Framework (GCoM, 2018). Besides, the energy poverty pillar has been recently launched and is now publicly available (GCoM, 2022). Some key requirements of the initiative are briefly illustrated hereafter.

Within two years of signing up to the initiative, local authorities 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 and adaptation goals. The SECAP covers the geographical area under the jurisdiction of the local authority and includes actions by both public and private sectors. On mitigation pillar, the SECAP has to contain the results of the baseline GHG emission inventory, a GHG emission reduction target based on the country's or region's Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) and a clear outline of the actions (including at least three key actions) that the local authority intends to take in order to reduce its GHG emissions. 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. On the adaptation pillar, the SECAP includes the assessment of climate risks and vulnerabilities within the territory and a set of actions (including at least three key actions) to increase the resilience of the critical sectors and vulnerable groups.

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 (Bertoldi, 2018), identifying the main emitting sectors and consequently prioritising areas for action. Following the SEAP/SECAP submission, cities 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.

1.2 The role of the Joint Research Centre in the Covenant of Mayors

The Joint Research Centre (JRC) of the EC was entrusted since the launch of the initiative with the role of providing scientific, methodological and technical support to the EU CoM initiative, to ensure its coherence with EU climate and energy policies as well as its scientific credibility. One of the key tasks of the JRC is to assist signatories with the preparation and implementation of their action plans through the development of methodological guidebooks. With the extension of the CoM beyond the EU, the JRC has been responsible for adapting the CoM EU methodology to the environmental, economic and political conditions of other world regions. In this process, the JRC works closely with the consortium operating the EU Covenant of Mayors

³ https://eumayors.eu/index.php?option=com_attachments&task=download&id=1017

⁴ Covenant of Mayors Office. (2020). Reporting guidelines. <https://eu-mayors.ec.europa.eu/en/home?task=download&id=815>

Office⁵, with the Global Covenant of Mayors secretariat⁶ as well as with other offices managing regional Covenants^{7,8,9} with the goal of ensuring the feasibility of these methodologies. The JRC also contributes to the definition and regular update of the reporting framework.

The JRC is responsible for the evaluation of submitted action plans and the provision of feedback to signatories¹⁰, with the objectives of verifying the compliance of the plan with the Covenant commitments, principles and methodological approaches as well as of assessing the credibility of the action plan in relation to the set targets and goals. Through its feedback, the JRC may provide further guidance and suggestions to CoM signatories for the potential improvement of their plans. The JRC is also responsible for publishing open datasets and assessment reviews of submitted action plans and monitoring reports¹¹.

In the context of the GCoM, the JRC collaborates with partners and other research institutions for aggregation reports¹² and co-chairs the GCoM technical working group (TWG) on data. This TWG cooperates with cities and city networks to develop an efficient and robust assessment, planning, reporting and monitoring framework by ensuring that the global initiative benefits to the maximum extent from the work, knowledge and resources placed over the years. A key output of the TWG on data has been the GCoM Common Reporting Framework (GCoM, 2018), which ensures compatible and comparable reporting approaches for signatories worldwide. Specific aspects of the Covenant are also explored in dedicated studies (e.g. multi-level governance models in the Covenant (Melica et al., 2018); review of reporting platforms (Bertoldi, Kona, Rivas, & Dallemand, 2018); projections towards Paris Agreement targets (A. Kona, Bertoldi, Monforti-Ferrario, Rivas, & Dallemand, 2018; Franco et al., 2022b); methods on indirect emission accounting (A. Kona, Bertoldi, & Kılış, 2019); climate mitigation policies (Palermo, Bertoldi, Apostolou, Kona, & Rivas, 2020); impacts of mitigation actions on air quality (Monforti-Ferrario et al, 2018; Peduzzi et al., 2020) and key factors enabling higher climate ambition (Rivas, Urraca, Bertoldi, & Thiel, 2021)). Finally, given the policy relevance of the initiative, the JRC prepares scientific publications on its outcomes and its impacts on local and EU policies in order to evaluate the policies adopted by local governments and their path towards the targets. Since 2013, the JRC has published a series of assessment reports on the Covenant of Mayors status, e.g., Cerutti et al., 2013 or Melica et al., 2022, in order to track the overall progress of the initiative on the basis of action plans and monitoring reports transmitted by Covenant cities to the EC.

This report on *Energy Figures* complements the Covenant of Mayors 2022 Assessment report (Melica et al., 2022), which presents an overview of the status of the initiative in relation to the mitigation and adaptation pillars, and is also based on the second release of the GCoM 2021 data set (Baldi et al., 2022). This report presents key energy figures and actions for European cities and local authorities reporting their energy activity inventories, including energy consumption and energy supply, and their estimates on energy savings and energy production by the target year (notably 2020 and 2030) for each one of the sectors targeted by their action plans. This report considers only the sectors that cities report in their BEI as well as their MEIs, presenting the energy consumption, savings and renewable energy generation for signatories from Europe EU-27 and Europe non-EU-27 (non-EU from now on), distinguishing between 2020 and 2030 commitments (see Annex 1 for the distribution of signatories by country and commitment for EU-27 and non-EU).

1.3 Energy data reported by cities

As far as energy data are concerned, the MyCovenant template requires signatories to report final energy consumption (activity data) for their baseline emission inventory and subsequent monitoring emission inventories years. These data are then multiplied by the appropriate emission factors (also reported by cities) to obtain the level of emissions in various sectors. Signatories are also requested to report energy generation data, which are not accounted for in the total emissions, but are used to calculate emission factors for grid supplied energy (i.e., electricity and district heating/cooling). Finally, cities are requested to report estimated energy savings and renewable energy production by the target year for each relevant sector/subsector and for the key mitigation actions of their action plan.

⁵ <https://eumayors.eu/about/support-the-community/office.html>

⁶ <https://www.globalcovenantofmayors.org/about/>

⁷ <http://com-east.eu/en/>

⁸ <https://www.com-med.org/en/>

⁹ <https://comssa.org/en/>

¹⁰ Only to signatories from Europe, Eastern Partnership, Southern Partnership, and Sub-Saharan Africa.

¹¹ The complete collection of action plans and monitoring reports from MyCovenant reporting platform is available at <https://data.jrc.ec.europa.eu/collection/id-00354>

¹² The latest GCoM aggregation report is available at <https://www.globalcovenantofmayors.org/impact2021/>

Final energy consumption is reported for the following carriers:

- Electricity
- District heating and cooling
- Fossil fuels, further split into:
 - Natural gas
 - Liquid gas
 - Heating oil
 - Diesel
 - Gasoline
 - Lignite
 - Coal
 - Other fossil fuels
- Renewable energies, further split into:
 - Plant oil
 - Biofuel
 - Other biomass
 - Solar thermal
 - Geothermal
 - Biogas
 - For the sake of simplicity, in this report non-grid-supplied energy is grouped under fossil fuels and renewable energies.

Additionally, final energy consumption data are reported for the following main sectors and subsectors:

- Stationary Energy / Buildings:
 - Municipal buildings, equipment/facilities
 - Public lighting
 - Tertiary buildings, equipment/facilities
 - Residential buildings
 - Industries
 - Agriculture/Forestry/Fisheries
- Transport:
 - Municipal fleet
 - Public transport
 - Private and commercial transport

Energy supply data are reported according to the following structure:

- Certified green electricity:
 - Purchases Guarantees of Origins (within the municipality boundaries)
 - Sales Guarantees of Origins (within the municipality boundaries)

- Local/distributed electricity production (Renewable energy only):
 - Wind
 - Hydroelectric
 - Photovoltaics
 - Geothermal
 - Other
- Local/distributed electricity production:
 - Combined Heat and Power
 - Other (ETS and large-scale plants > 20 MW not recommended)
- Local heat/cold production:
 - Combined Heat and Power
 - District heating (heat-only)
 - Other

Estimated energy savings and renewable energy production by the target year are reported for the following mitigation sectors/subsectors (when relevant):

- Municipal buildings, equipment/facilities
- Tertiary (non-municipal) buildings, equipment/facilities
- Residential buildings
- Industry
- Transport
- Waste
- Local Electricity Production
- Local Heat/Cold Production
- Others

2 Energy consumption and savings in EU-27

2.1 2020 commitments – EU-27

In this section, the analysis focuses on EU-27 signatories with a commitment for the target year of 2020.

2.1.1 BEI energy consumption

Considering signatories in EU-27 with 2020 commitments, there are 5 595 signatories with a BEI, representing 136.6 million inhabitants. It can be seen that the type of fuel associated with the greatest total share of consumption corresponds to fossil fuels (68%), followed by electricity (23%), while the sector carrying the highest share of energy consumption is residential buildings (31%), followed by private and commercial transport (25%). See Tables 1-3 for the absolute, percentage and per capita values, respectively, and Figures 1-2 for the visualisation of the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it is informative to recognize that fossil fuels represent the maximum consumption value, with 11.3 MWh/year per capita, while renewable fuels have the lowest value, with 0.39 MWh/year per capita. Focusing on the activity sectors, residential buildings has the highest consumption value of 5 MWh/year per capita, followed by private and commercial transport, with 4 MWh/year per capita; while other sectors, such as municipal buildings, industry-ETS, municipal fleet, public transport, and agriculture, forestry and fisheries all have a per capita consumption less than 1 MWh/year.

Table 1. Energy consumption reported in BEIs related to 2020 commitments – EU-27 (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	25.7971	9.2375	22.3274	0.5805	57.9426	2.56%
Residential buildings	171.2125	67.0493	420.6918	35.0626	694.0161	30.68%
Tertiary (non-municipal) buildings, equipment/facilities	170.6537	21.7628	152.9863	1.6162	347.0191	15.34%
Industry Non-ETS	114.8895	13.6203	167.2040	4.1636	299.8774	13.26%
Industry-ETS	2.1181	0.0002	3.2912	1.1227	6.5322	0.29%
Buildings, equipment/facilities non-allocated	34.2116	28.6935	90.3715	7.2292	160.5058	7.10%
Subtotal - Stationary energy	518.8824	140.3637	856.8723	49.7749	1565.8932	69.22%
Municipal fleet	0.9417		4.3061	0.0134	5.2612	0.23%
Public transport	3.7721		14.4293	0.1909	18.3923	0.81%
Private and commercial transport	0.8859		551.5425	2.5199	554.9483	24.53%
Transport non-allocated	1.3521		106.2105	0.2807	107.8432	4.77%
Subtotal - Transport	6.9518		676.4884	3.0049	686.4451	30.34%
Agriculture, Forestry, Fisheries	1.5317	0.9258	6.8704	0.0180	9.3459	0.41%
Other non-allocated	0.2051	0.1777	0.1498		0.5327	0.02%
Subtotal - Other	1.7368	1.1035	7.0202	0.0180	9.8786	0.44%

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
TOTAL	527.57	141.467	1540.38	52.798	2262.217	
SHARE	23.32%	6.25%	68.09%	2.33%		

Source: JRC elaboration based on GCoM data

Table 2. Energy consumption reported in BEIs related to 2020 commitments – EU-27 (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	1.14%	0.41%	0.99%	0.03%	2.56%
Residential buildings	7.57%	2.96%	18.60%	1.55%	30.68%
Tertiary (non-municipal) buildings, equipment/facilities	7.54%	0.96%	6.76%	0.07%	15.34%
Industry Non-ETS	5.08%	0.60%	7.39%	0.18%	13.26%
Industry-ETS	0.09%	0.00%	0.15%	0.05%	0.29%
Buildings, equipment/facilities non-allocated	1.51%	1.27%	3.99%	0.32%	7.10%
Subtotal - Stationary energy	22.94%	6.20%	37.88%	2.20%	69.22%
Municipal fleet	0.04%		0.19%	0.00%	0.23%
Public transport	0.17%		0.64%	0.01%	0.81%
Private and commercial transport	0.04%		24.38%	0.11%	24.53%
Transport non-allocated	0.06%		4.69%	0.01%	4.77%
Subtotal - Transport	0.31%	0.00%	29.90%	0.13%	30.34%
Agriculture, Forestry, Fisheries	0.07%	0.04%	0.30%	0.00%	0.41%
Other non-allocated	0.01%	0.01%	0.01%		0.02%
Subtotal - Other	0.08%	0.05%	0.31%	0.00%	0.44%
TOTAL	23.32%	6.25%	68.09%	2.33%	

Source: JRC elaboration based on GCoM data

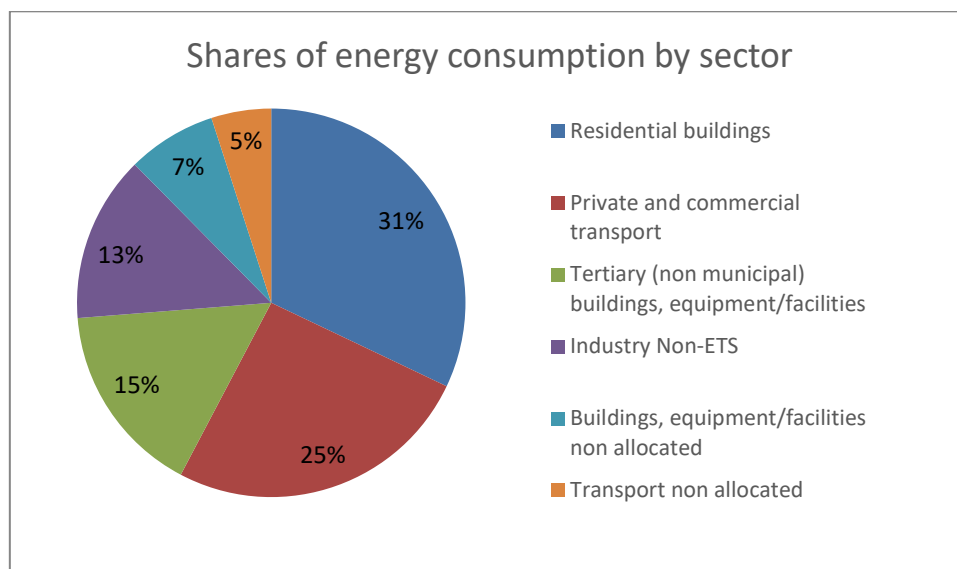
Table 3. Energy consumption reported in BEIs related to 2020 commitments – EU-27 (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1888	0.0676	0.1634	0.0042	0.4242
Residential buildings	1.2533	0.4908	3.0796	0.2567	5.0804
Tertiary (non-municipal) buildings, equipment/facilities	1.2492	0.1593	1.1199	0.0118	2.5403
Industry Non-ETS	0.8410	0.0997	1.2240	0.0305	2.1952
Industry-ETS	0.0155	0.0000	0.0241	0.0082	0.0478

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Buildings, equipment/facilities non-allocated	0.2504	0.2100	0.6615	0.0529	1.1749
Subtotal - Stationary energy	3.7983	1.0275	6.2725	0.3644	11.4627
Municipal fleet	0.0069		0.0315	0.0001	0.0385
Public transport	0.0276		0.1056	0.0014	0.1346
Private and commercial transport	0.0065		4.0374	0.0184	4.0624
Transport non-allocated	0.0099		0.7775	0.0021	0.7894
Subtotal - Transport	0.0509	0.0000	4.9521	0.0220	5.0249
Agriculture, Forestry, Fisheries	0.0112	0.0068	0.0503	0.0001	0.0684
Other non-allocated	0.0015	0.0013	0.0011		0.0039
Subtotal - Other	0.0127	0.0081	0.0514	0.0001	0.0723
TOTAL	3.8619	1.0356	11.2760	0.3865	16.5600

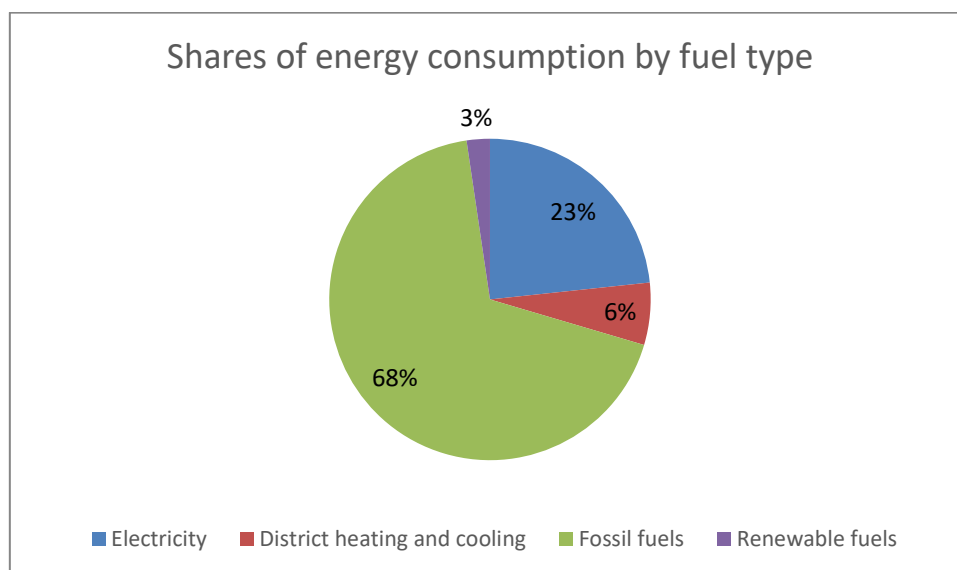
Source: JRC elaboration based on GCoM data

Figure 1. Shares of final energy consumption by sector, reported in BEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

Figure 2. Shares of final energy consumption by fuel source, reported in 2020 BEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.2 BEI energy supply

Examining the reported energy output from the signatories having reported a BEI, there are 1 516 signatories having also reported some local heat/cold or electricity production.

2.1.2.1 Local electricity production and purchases of renewable energy certificates

The highest share of local electricity production corresponds to photovoltaics, with 38% of the total reported local electricity production. This can be partially explained by the geographical location of the majority of this subset of signatories, whose median latitude is 44 degrees north, where solar irradiation is expected to be significant. See Table 4 for the complete description of the total production by technology. Furthermore, comparing non-renewable with renewable energy technologies, renewable energy has the highest share in total production, with 71%, representing 24% of the BEI electricity consumption for the cities reporting local

electricity production. In per capita terms, see Table 5, the reported local electricity production amounts to 0.4 and 1 MWh/year for non-renewable and renewable technologies, respectively. Figure 3 shows the shares of the most representative electricity production sources and technologies.

Lastly, examining purchases of renewable energy certificates, there are 246 signatories reporting purchases. These signatories come mainly from Belgium (53%), Italy (35%), and Netherlands (3%). For all of these signatories, they report a total of 1.6 TWh/year in purchases, representing 3% of their total BEI electricity consumption. In per capita terms, the purchases amount to 0.17 MWh/year per capita.

Table 4. Local electricity production in BEIs related to 2020 commitments - EU-27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		26.8163	26.8163	37.88%
Wind		5.5181	5.5181	7.80%
Hydroelectric		17.8004	17.8004	25.15%
Geothermal		0.0107	0.0107	0.02%
Local electricity production plants - Combined Heat and Power	17.8616	0.0433	17.9048	25.29%
Local electricity production plants - Other	2.6995	0.0349	2.7345	3.86%
TOTAL	20.5611	50.2237	70.7848	
SHARE OF TOTAL ELECTRICITY PRODUCTION	29.05%	70.95%		
SHARE OF TOTAL ELECTRICITY CONSUMPTION*	3.90% (9.78%)	9.52% (23.9%)		

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

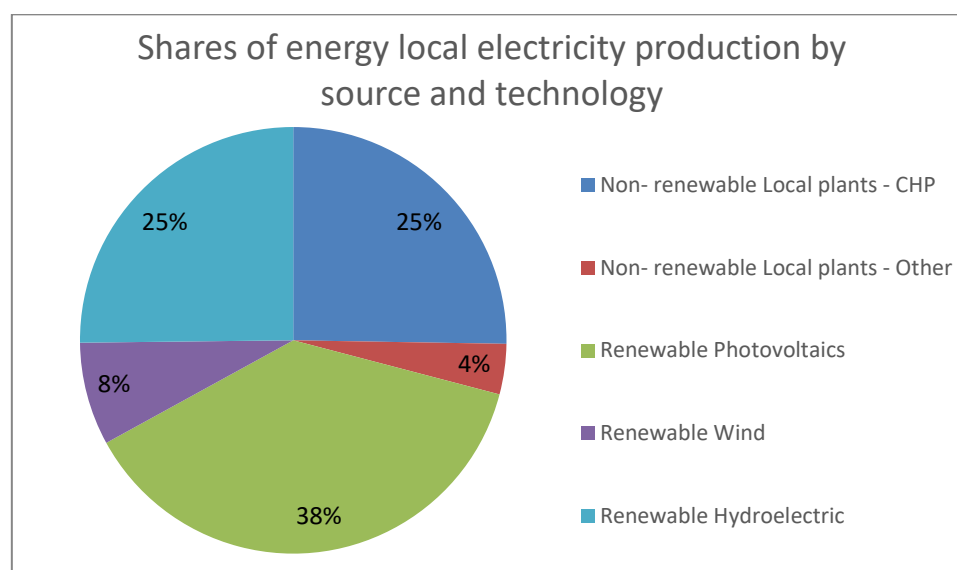
Source: JRC elaboration based on GCoM data

Table 5. Local electricity production in BEIs related to 2020 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.5344	0.5344
Wind		0.1100	0.1100
Hydroelectric		0.3548	0.3548
Geothermal		0.0002	0.0002
Local electricity production plants - Combined Heat and Power	0.3560	0.0009	0.3568
Local electricity production plants - Other	0.0538	0.0007	0.0545
TOTAL	0.4098	1.0009	1.4107

Source: JRC elaboration based on GCoM data

Figure 3. Shares of local electricity production by energy source and technology, reported in BEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.2.2 Local heat/cold production

Considering local heat/cold supply, the highest share of local heat/cold production corresponds to combined heat and power (CHP), with 53% of the total reported local heat/cold production, followed by district heating (heat only), with 40%. See Table 6 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 98%, representing almost the totality of the BEI heat/cold consumption for the cities reporting local heat/cold production. As shown in Table 7, the per capita production with non-renewable fuels amounts to 3.3 MWh/year. Figure 4 shows the shares of the most representative heat/cold production sources and technologies

Table 6. Local heat/cold production in BEIs related to 2020 commitments - EU-27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Local heat/cold production plants - Combined Heat and Power	32.0661	0.7358	32.8019	52.91%
Local heat/cold production plants - District heating (heat-only)	24.3111	0.4633	24.7744	39.96%
Local heat/cold production plants – Other	4.4234	0.0003	4.4236	7.13%
TOTAL	60.8005	1.1994	61.9999	
SHARE ON TOTAL HEAT/COLD PRODUCTION	98.07%	1.93%		
SHARE ON TOTAL HEAT/COLD CONSUMPTION*	42.98% (119%)	0.85% (2.4%)		

* Compared to the total heat/cold consumption in BEI (only for cities reporting local heat/cold production)

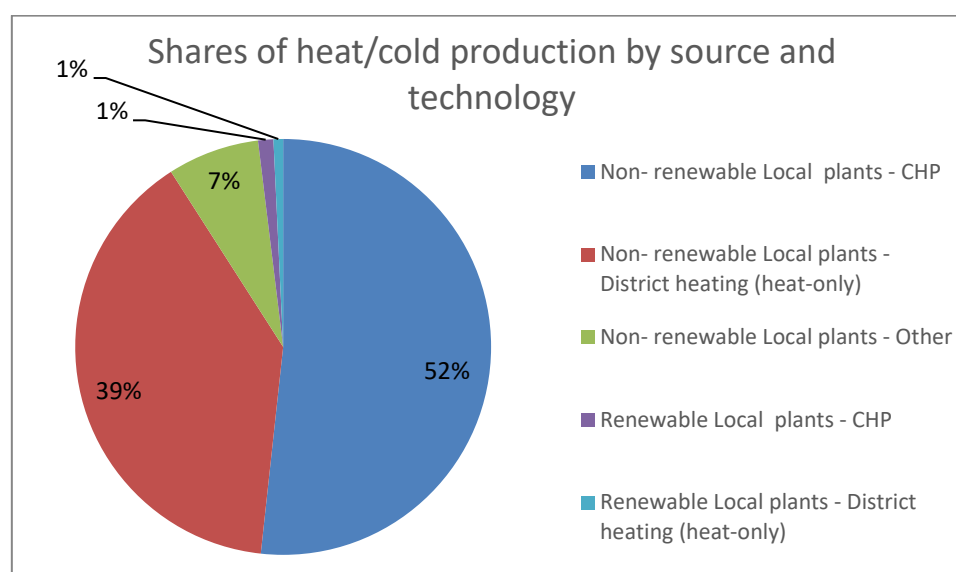
Source: JRC elaboration based on GCoM data

Table 7. Local heat/cold production in BEIs related to 2020 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Local heat/cold production plants - Combined Heat and Power	1.7452	0.0400	1.7853
Local heat/cold production plants - District heating (heat-only)	1.3232	0.0252	1.3484
Local heat/cold production plants – Other	0.2407	0.0000	0.2408
TOTAL	3.3091	0.0653	3.3744

Source: JRC elaboration based on GCoM data

Figure 4. Shares of local heat/cold production by energy source and technology, reported in BEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.3 Estimated energy savings and renewable energy production

Signatories are asked to report their estimates on energy savings and energy production by the target year, for each sector targeted by their action plan. Examining the reported estimated savings and renewable energy production from the signatories having reported a BEI, there are 4 214, out of the 5 595, having also reported some estimated savings or renewable energy production.

2.1.3.1 Estimated savings

The highest share of estimated savings corresponds to stationary energy, with 45% of the total estimated savings, followed by transport (34%). The details can be seen in Table 8. The total savings represent 12.9% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 9, signatories estimated that they would have been able to save, on average, 2 MWh/year per capita, by 2020. Figure 5 shows the shares of each activity sector in the total estimated savings.

Table 8. Estimated energy savings by 2020 declared by signatories – EU-27 (units TWh/year).

Sector	Estimated energy savings	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	78.9571	44.74%
Transport	60.1745	34.10%
Local electricity production	3.9541	2.24%
Local heat/cold production	6.9201	3.92%
Other	26.4817	15.00%
TOTAL	176.4875	

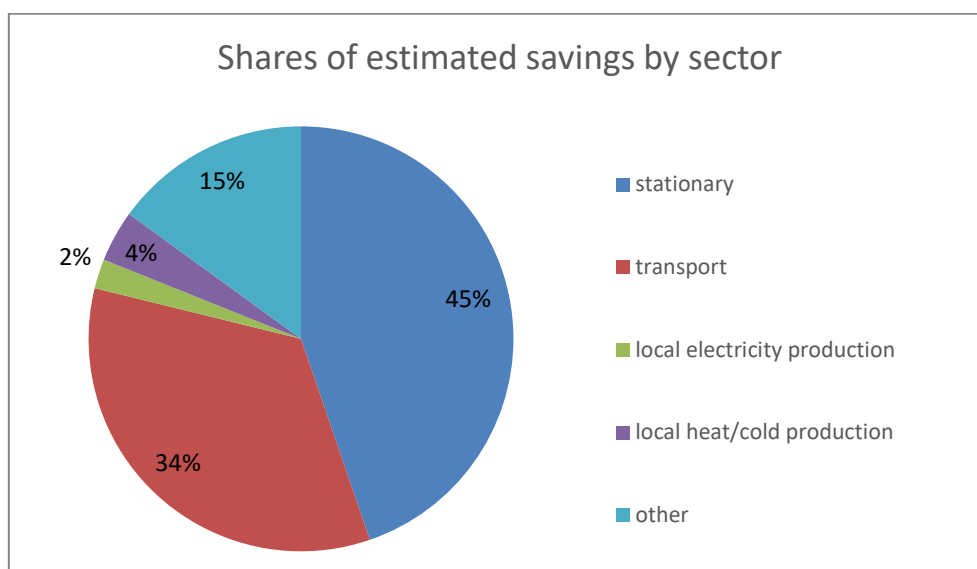
Source: JRC elaboration based on GCoM data

Table 9. Estimated energy savings by 2020 declared by signatories – EU-27 (units MWh/year per capita).

Sector	Estimated energy savings
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.8991
Transport	0.6852
Local electricity production	0.0450
Local heat/cold production	0.0788
Other	0.3015
TOTAL	2.0096

Source: JRC elaboration based on GCoM data

Figure 5. Shares of estimated savings by sector, reported in in BEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.3.2 Estimated renewable energy production

The highest share of renewable energy production corresponds to the local electricity production, with 48% of the total estimated renewable energy production. The details can be seen in Table 10. The total renewable energy production represents 4.2% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 11, signatories estimate that they will be able to produce, on average, 0.65 MWh/year of renewable energy per capita, by 2020. Figure 6 shows the shares of each activity sector in the total estimated renewable energy production.

Table 10. Estimated renewable energy production by 2020 declared by signatories – EU-27 (units TWh/year).

Sector	Estimated renewable energy production	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	8.0242	14.11%
Transport	1.9501	3.43%
Local electricity production	27.1972	47.84%

Sector	Estimated renewable energy production	SHARE
Local heat/cold production	11.6593	20.51%
Other	8.0241	14.11%
TOTAL	56.8549	

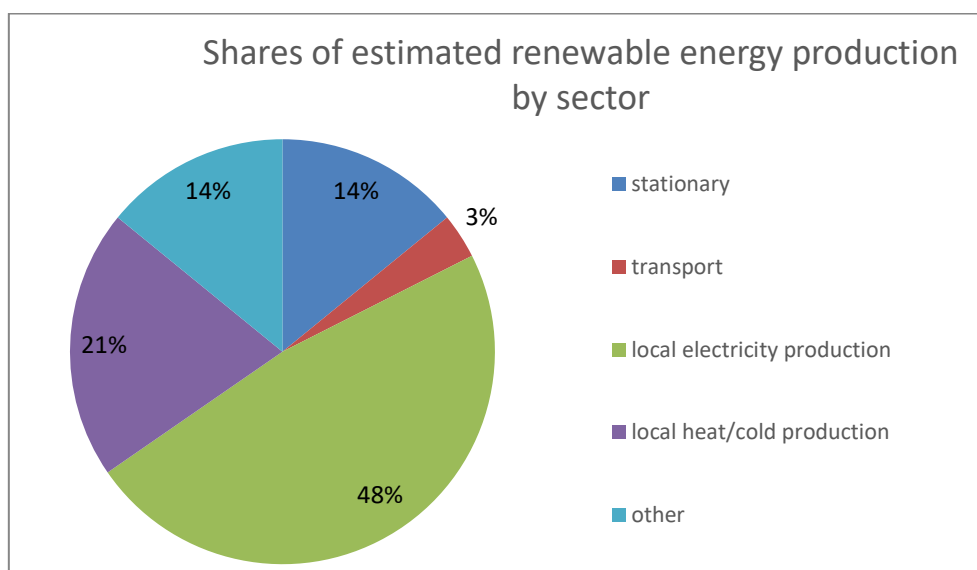
Source: JRC elaboration based on GCoM data

Table 11. Estimated renewable energy production by 2020 declared by signatories – EU-27 (units MWh/year per capita).

Sector	Estimated renewable energy production
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.0914
Transport	0.0222
Local electricity production	0.3097
Local heat/cold production	0.1328
Other	0.0914
TOTAL	0.6474

Source: JRC elaboration based on GCoM data

Figure 6. Shares of estimated renewable energy production by sector, reported in BEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.4 MEI energy consumption

Following the BEI, signatories should monitor the performance of their action plans in the subsequent years. Nonetheless, due to different reasons, not all of them comply with this requirement. Regarding EU-27 signatories with 2020 commitments, there are 1 775 signatories having reported a MEI, representing 83.9 million inhabitants. For monitoring reports, the type of fuel with the greatest total share of consumption is fossil fuels (62%), followed by electricity (26%). Thus, there is a slight decrease in terms of fossil fuels (-6%) and a slight increase in terms of electricity (+3%) consumption, when comparing the total MEI against the BEI. Additionally, the sector with the highest share is residential buildings (30%), followed by private and

commercial transport (22%). See Tables 12-14 for the absolute, percentage and per capita values, respectively, of the energy consumption reported in MEIs, and Figures 7-8 for the visualisation of the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it can be highlighted that fossil fuels represent the maximum consumption value, with 9.16 MWh/year per capita, around 2 MWh/year less than the consumption declared in the BEIs. On the other hand, renewable fuels have the lowest value, with 0.53 MWh/year per capita. Meanwhile, for the activity sectors, residential buildings have the highest consumption value, with 4.5 MWh/year per capita, followed by private and commercial transport, having 3.3 MWh/year per capita, as opposite to other sectors, such as municipal buildings, industry-ETS, municipal fleet, public transport, and agriculture, forestry and fisheries, having a minimal per capita consumption less than 1 MWh/year per capita. Overall, the situation depicted in the MEIs is very much in line with what was reported in the BEIs, with respect to both the shares for types of fuel and sectors, as well as for the per capita consumption, suggesting that the transition to a greener energy future still requires additional efforts to achieve EU targets.

Table 12. Energy consumption reported in MEIs related to 2020 commitments – EU-27 (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	14.7815	6.4616	7.3316	0.5932	29.1679	2.34%
Residential buildings	97.9526	47.9242	210.5103	21.1507	377.5378	30.32%
Tertiary (non-municipal) buildings, equipment/facilities	124.9936	15.4053	88.5046	1.8759	230.7794	18.53%
Industry Non-ETS	61.6292	10.4644	62.2858	2.5802	136.9595	11.00%
Industry-ETS	0.8035	0.1010	1.1175	4.5188	6.5407	0.53%
Buildings, equipment/facilities non-allocated	20.2477	25.5424	56.2393	5.4627	107.4921	8.63%
Subtotal - Stationary energy	320.4081	105.8988	425.9890	36.1815	888.4775	71.36%
Municipal fleet	0.0009		2.0999	0.0198	2.1206	0.17%
Public transport	3.1777		12.1554	0.3056	15.6387	1.26%
Private and commercial transport	0.8671		271.1516	5.4505	277.4693	22.28%
Transport non-allocated	1.0345		54.5066	2.4160	57.9571	4.65%
Subtotal - Transport	5.0803		339.9135	8.1919	353.1857	28.37%
Agriculture, Forestry, Fisheries	0.5570	0.1137	2.6281	0.0188	3.3177	0.27%
Other non-allocated	0.0404		0.0809	0.0000	0.1213	0.01%
Subtotal - Other	0.5974	0.1137	2.7090	0.0188	3.4390	0.28%
TOTAL	326.0858	106.0126	768.6116	44.3922	1245.102	
SHARE	26.19%	8.51%	61.73%	3.57%		

Source: JRC elaboration based on GCoM data

Table 13. Energy consumption reported in MEIs related to 2020 commitments – EU-27 (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	1.19%	0.52%	0.59%	0.05%	2.34%
Residential buildings	7.87%	3.85%	16.91%	1.70%	30.32%
Tertiary (non-municipal) buildings, equipment/facilities	10.04%	1.24%	7.11%	0.15%	18.53%
Industry Non-ETS	4.95%	0.84%	5.00%	0.21%	11.00%
Industry-ETS	0.06%	0.01%	0.09%	0.36%	0.53%
Buildings, equipment/facilities non-allocated	1.63%	2.05%	4.52%	0.44%	8.63%
Subtotal - Stationary energy	25.73%	8.51%	34.21%	2.91%	71.36%
Municipal fleet	0.00%		0.17%	0.00%	0.17%
Public transport	0.26%		0.98%	0.02%	1.26%
Private and commercial transport	0.07%		21.78%	0.44%	22.28%
Transport non-allocated	0.08%		4.38%	0.19%	4.65%
Subtotal - Transport	0.41%	0.00%	27.30%	0.66%	28.37%
Agriculture, Forestry, Fisheries	0.04%	0.01%	0.21%	0.00%	0.27%
Other non-allocated	0.00%		0.01%	0.00%	0.01%
Subtotal - Other	0.05%	0.01%	0.22%	0.00%	0.28%
TOTAL	26.19%	8.51%	61.73%	3.57%	

Source: JRC elaboration based on GCoM data

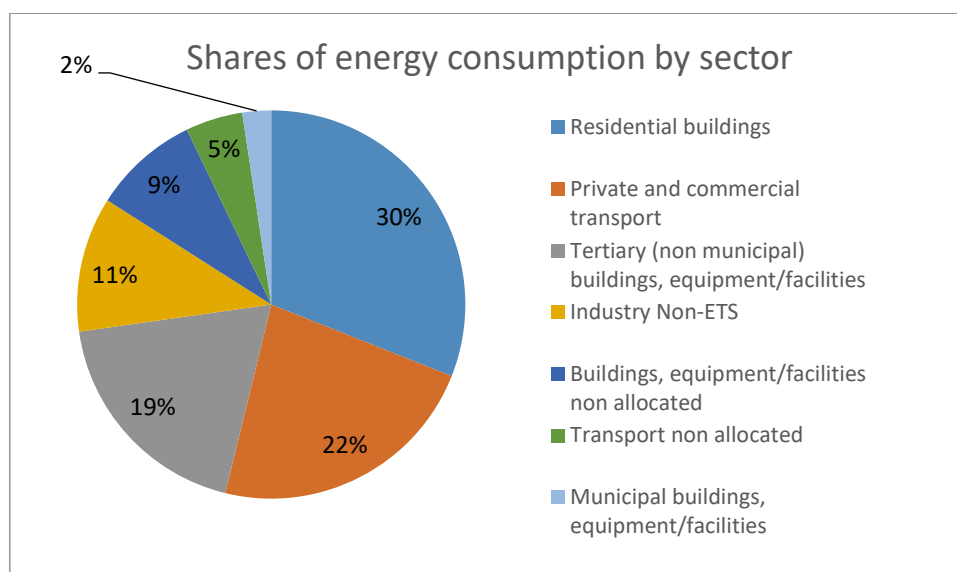
Table 14. Energy consumption reported in MEIs related to 2020 commitments – EU-27 (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1762	0.0770	0.0874	0.0071	0.3477
Residential buildings	1.1676	0.5713	2.5093	0.2521	4.5002
Tertiary (non-municipal) buildings, equipment/facilities	1.4899	0.1836	1.0550	0.0224	2.7509
Industry Non-ETS	0.7346	0.1247	0.7424	0.0308	1.6325
Industry-ETS	0.0096	0.0012	0.0133	0.0539	0.0780
Buildings, equipment/facilities non-allocated	0.2414	0.3045	0.6704	0.0651	1.2813
Subtotal - Stationary energy	3.8192	1.2623	5.0778	0.4313	10.5906
Municipal fleet	0.0000		0.0250	0.0002	0.0253
Public transport	0.0379		0.1449	0.0036	0.1864
Private and commercial transport	0.0103		3.2321	0.0650	3.3074

Transport non-allocated	0.0123		0.6497	0.0288	0.6908
Subtotal - Transport	0.0606	0.0000	4.0517	0.0976	4.2099
Agriculture, Forestry, Fisheries	0.0066	0.0014	0.0313	0.0002	0.0395
Other non-allocated	0.0005		0.0010	0.0000	0.0014
Subtotal - Other	0.0071	0.0014	0.0323	0.0002	0.0410
TOTAL	3.8869	1.2637	9.1618	0.5292	14.8415

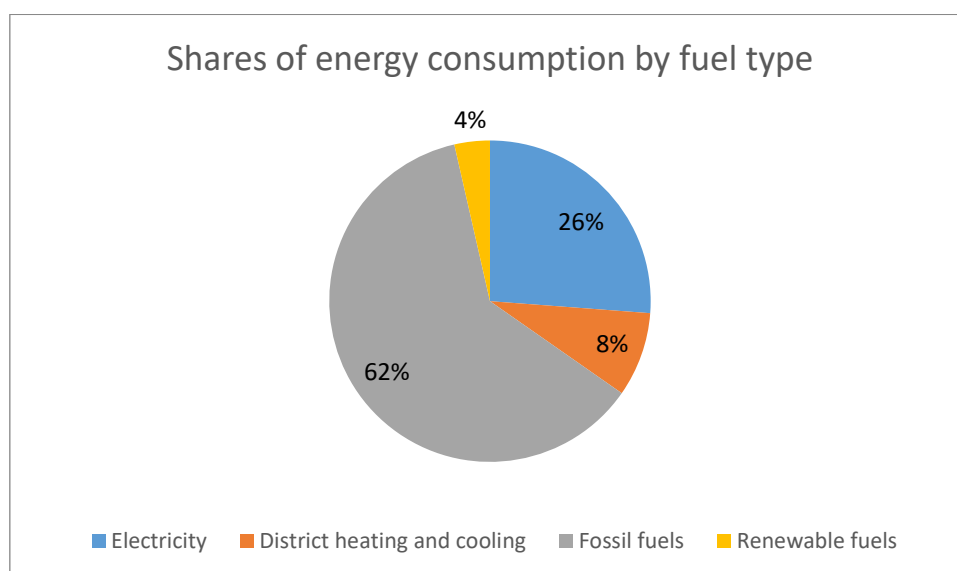
Source: JRC elaboration based on GCoM data

Figure 7. Shares of energy consumption by sector, reported in MEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

Figure 8. Shares of energy consumption by fuel type, reported in MEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

Examining the reported energy output from the 1 775 signatories having reported both BEI and MEI, there are 138 signatories having also reported some local heat/cold or electricity production.

2.1.5 MEI energy supply

2.1.5.1 Local electricity production and purchases of renewable energy certificates

The highest share of local electricity production corresponds to hydroelectric, with 29%, followed by CHP and wind, with around 23%, of the total reported local electricity production. This represents an important change with respect to the energy production declared in the BEI, where photovoltaics had the highest share (which could be partially explained by the extra degree north of the median latitude for this subset of signatories). See Table 15 for the complete description of the total production by technology. Furthermore, comparing non-renewable with renewable energy technologies, renewable energy has the highest share in total production, with 75%, representing 11% of the MEI electricity consumption for the cities reporting local electricity production. In per capita terms, see Table 16, the reported local electricity production amounts to 0.13 and 0.4 MWh/year for non-renewable and renewable technologies, respectively. Figure 9 shows the shares of the most representative electricity production sources and technologies.

Lastly, examining purchases of renewable energy certificates, there are 310 signatories reporting purchases (coming mainly from Italy (43%), Belgium (28%) and Spain (16%)), with a total of 4.98 TWh/year, representing 6.75% of their total MEI electricity consumption. In per capita terms, it amounts to 0.25 MWh/year per capita.

Table 15. Local electricity production in MEIs related to 2020 commitments - EU-27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		4.3688	4.3688	15.32%
Wind		6.4578	6.4578	22.65%
Hydroelectric		8.3231	8.3231	29.19%
Geothermal		0.0911	0.0911	0.32%
Local electricity production plants - Combined Heat and Power	6.7878	0.7631	7.5509	26.48%
Local electricity production plants - Other	0.338	1.3828	1.7209	6.04%
TOTAL	7.1258	21.3867	28.512	
SHARE OF TOTAL ELECTRICITY PRODUCTION	24.99%	75.01%		
SHARE OF TOTAL ELECTRICITY CONSUMPTION*	2.19% (3.6%)	6.56% (10.9%)		

*Compared to the total electricity consumption in MEI (only for cities reporting local electricity production)

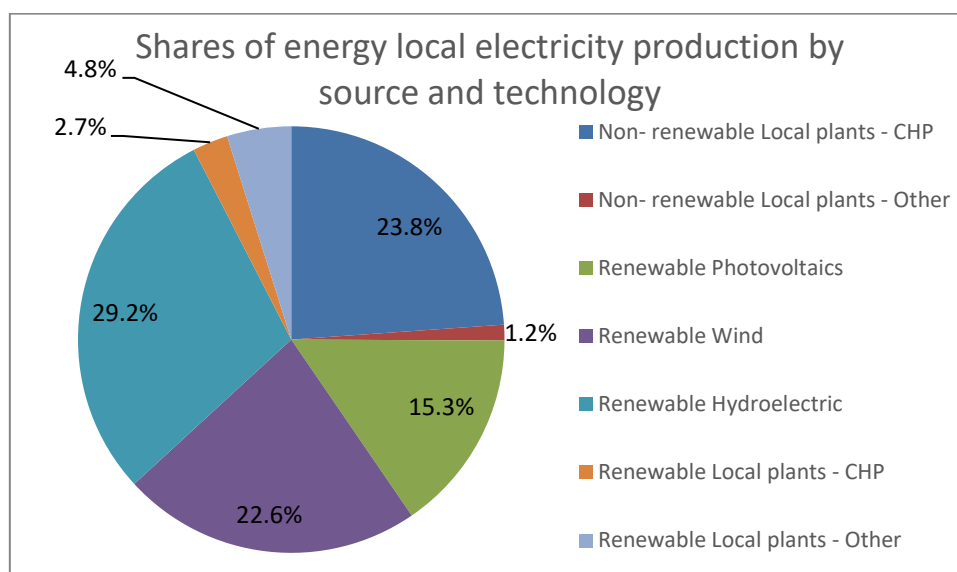
Source: JRC elaboration based on GCoM data

Table 16. Local electricity production in MEIs related to 2020 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.0832	0.0832
Wind		0.123	0.123
Hydroelectric		0.1585	0.1585
Geothermal		0.0017	0.0017
Local electricity production plants - Combined Heat and Power	0.1293	0.0145	0.1438
Local electricity production plants - Other	0.0064	0.0263	0.0328
TOTAL	0.1357	0.4073	0.5430

Source: JRC elaboration based on GCoM data

Figure 9. Shares of local electricity production by energy source and technology, reported in MEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.5.2 Local heat/cold production

Considering local heat/cold supply, the highest share of local heat/cold production corresponds to non-renewable CHP, with 54%. See Table 17 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 94%, representing a high share of the totality of the MEI heat/cold consumption for the cities reporting local heat/cold production. As shown in Table 18, the per capita production with non-renewable fuels amounts to 2.37 MWh/year. Figure 10 shows the shares of the most representative heat/cold production sources and technologies.

Table 17. Local heat/cold production in MEIs related to 2020 commitments - EU-27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Local heat/cold production plants - Combined Heat and Power	16.1073	1.583	17.6904	59.75%
Local heat/cold production plants - District heating (heat-only)	9.222	1.5836	10.8058	36.50%
Local heat/cold production plants – Other	1.095	0.015	1.11	3.75%
TOTAL	26.4245	3.1816	29.6061	
SHARE ON TOTAL HEAT/COLD PRODUCTION	89.25%	10.75%		
SHARE ON TOTAL HEAT/COLD CONSUMPTION*	24.93% (94.4%)	3% (11.4%)		

* Compared to the total heat/cold consumption in BEI (only for cities reporting local heat/cold production)

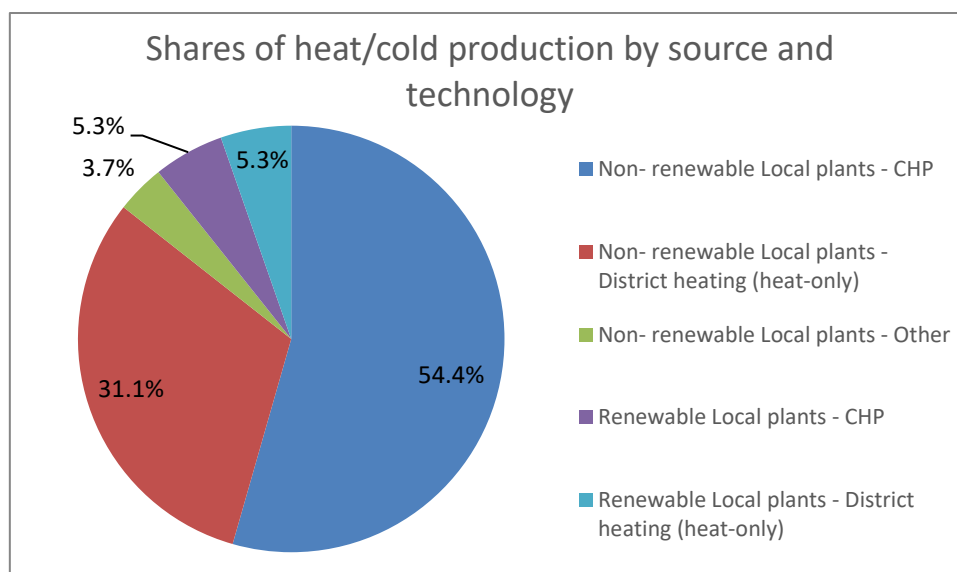
Source: JRC elaboration based on GCoM data

Table 18. Local heat/cold production in MEIs related to 2020 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non-renewable	Renewable	TOTAL
Local heat/cold production plants - Combined Heat and Power	1.4445	0.142	1.5864
Local heat/cold production plants - District heating (heat-only)	0.827	0.142	0.969
Local heat/cold production plants – Other	0.0982	0.0013	0.0995
TOTAL	2.3697	0.2853	2.655

Source: JRC elaboration based on GCoM data

Figure 10. Shares of local heat/cold production by energy source and technology, reported in MEIs related to 2020 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.1.6 Achievements in energy savings

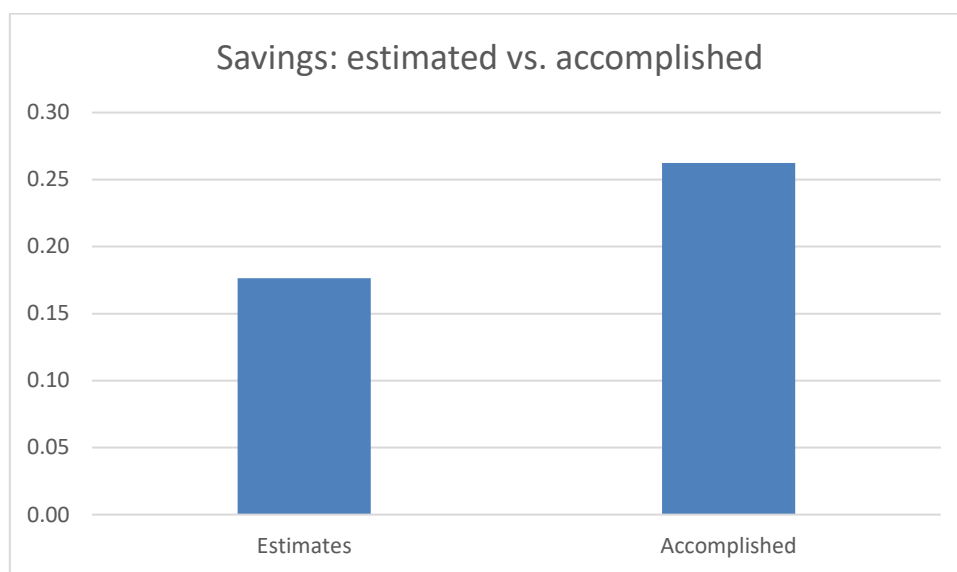
Once the reported estimated savings and the MEI consumption have been presented, it is possible to verify the actual savings for signatories holding a MEI. Thus, identifying the most successful signatories in accomplishing significant savings.

2.1.6.1 Accomplished savings

The total savings, when computing the difference between the BEI and the MEI consumption for the signatories holding a MEI, amounts to 117 TWh/year (1.45 MWh/year per capita). Overall, the total reduced consumption is 8% of the reported BEI, and 9% of the MEI consumption.

Considering only the signatories that reported estimates for energy savings and reported a MEI as well, a per capita savings yearly rate is computed between the per capita consumption in the BEI and in the last MEI. For this sample of signatories, they accomplished a mean annual rate of per capita energy savings of 0.26 MWh/year, exceeding the initially reported/estimated rate of 0.17 MWh/year (see Figure 11).

Figure 11. Mean yearly per capita energy savings, estimated vs. accomplished, related to 2020 commitments – EU-27 (units MWh/year per capita).



Source: JRC elaboration based on GCoM data

Examining the accomplished absolute savings, a yearly rate is computed between the absolute consumption in the BEI and in the last MEI. The highest rates correspond with Dortmund, Budapest and Marbella, saving 1.45, 0.85 and 0.72 TWh/year, respectively. The top-10 cities, regarding their yearly absolute savings rate, are presented in Table 19.

Table 19. Top-10 signatories with highest savings rates, related to 2020 commitments – EU-27 (units TWh/year).

CITY	COUNTRY	BASE YEAR	LAST MONITORING YEAR	ABSOLUTE SAVINGS	ABSOLUTE SAVINGS ANNUAL RATE	SAVINGS PER CAPITA (MWh/year)	SAVINGS PER CAPITA ANNUAL RATE (MWh/year)
Dortmund	Germany	1990	2008	26.18	1.45	44.8	2.4
Budapest	Hungary	2005	2013	6.83	0.85	3.94	0.55
Marbella	Spain	2012	2013	0.72	0.72	5.05	6.85
Koeln	Germany	1990	2007	10.59	0.62	10.39	0.61
Dublin City Council	Ireland	2006	2016	6.11	0.61	11.02	1.38
Granada	Spain	2007	2011	1.64	0.41	6.84	1.78
Ravenna	Italy	2007	2010	1.07	0.36	6.75	2.35
Valencia	Spain	2007	2012	1.59	0.32	2	0.39
Guldborgsund	Denmark	2009	2013	1.25	0.31	20.31	4.75
Hanau	Germany	2009	2014	1.46	0.29	15.76	3.71

Source: JRC elaboration based on GCoM data

2.2 2030 Commitments – EU-27

In this section, the analysis focuses on EU-27 signatories with a commitment for the target year of 2030.

2.2.1 BEI energy consumption

Regarding 2030 commitments in EU-27, MyCovenant holds the BEI of 1 082 signatories, with an approximate population of 45.2 million inhabitants. The type of fuel with the highest total share of consumption is associated to fossil fuels (68%), followed by electricity (24%). The sector with the highest share is residential

buildings (34%), followed by private and commercial transport (27%). See Tables 20-22 for the absolute, percentage and per capita values, respectively, and Figures 12-13 for the visualisation of the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it can be highlighted that fossil fuels represent the maximum consumption value, with 11.3 MWh/year per capita, while renewable fuels represent the minimum consumption of 0.44 MWh/year per capita. Addressing the activity sectors, residential buildings has the highest consumption of 5.6 MWh/year per capita, followed by private and commercial transport with 4.5 MWh/year per capita, as opposite to other sectors, such as municipal buildings, industry-ETS, municipal fleet, public transport, and agriculture, forestry and fisheries, having a minimal per capita consumption of less than 1 MWh/year.

Table 20. Energy consumption reported in BEIs related to 2030 commitments – EU-27 (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	8.7979	2.0532	6.3396	0.0545	17.2451	2.30%
Residential buildings	58.2857	23.2724	156.3040	13.9051	251.7671	33.54%
Tertiary (non-municipal) buildings, equipment/facilities	60.4777	10.1272	59.7707	2.4932	132.8689	17.70%
Industry Non-ETS	39.2543	4.3841	47.3275	1.1133	92.0792	12.27%
Industry-ETS	2.5367		9.1884	0.0040	11.7291	1.56%
Buildings, equipment/facilities non-allocated	4.7205	0.0694	0.8891	0.0241	5.7031	0.76%
Subtotal - Stationary energy	174.0728	39.9062	279.8192	17.5941	511.3924	68.12%
Municipal fleet	0.0001		2.8370	0.1029	2.9401	0.39%
Public transport	2.9152		9.1743	0.1835	12.2729	1.63%
Private and commercial transport	0.4469		202.6816	1.9229	205.0515	27.31%
Transport non-allocated	0.1880		11.5367	0.0188	11.7435	1.56%
Subtotal - Transport	3.5502		226.2296	2.2281	232.0079	30.91%
Agriculture, Forestry, Fisheries	0.9788	0.7335	4.6318	0.0487	6.3928	0.85%
Other non-allocated	0.2843	0.3986	0.2334	0.0007	0.9170	0.12%
Subtotal - Other	1.2631	1.1321	4.8652	0.0494	7.3098	0.97%
TOTAL	178.8861	41.0384	510.9141	19.8716	750.7102	
SHARE	23.83%	5.47%	68.06%	2.65%		

Source: JRC elaboration based on GCoM data

Table 21. Energy consumption reported in BEIs related to 2030 commitments – EU-27 (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	1.17%	0.27%	0.84%	0.01%	2.30%
Residential buildings	7.76%	3.10%	20.82%	1.85%	33.54%
Tertiary (non-municipal) buildings, equipment/facilities	8.06%	1.35%	7.96%	0.33%	17.70%
Industry Non-ETS	5.23%	0.58%	6.30%	0.15%	12.27%
Industry-ETS	0.34%		1.22%	0.00%	1.56%
Buildings, equipment/facilities non-allocated	0.63%	0.01%	0.12%	0.00%	0.76%
Subtotal - Stationary energy	23.19%	5.32%	37.27%	2.34%	68.12%
Municipal fleet	0.00%		0.38%	0.01%	0.39%
Public transport	0.39%		1.22%	0.02%	1.63%
Private and commercial transport	0.06%		27.00%	0.26%	27.31%
Transport non-allocated	0.03%		1.54%	0.00%	1.56%
Subtotal - Transport	0.47%	0.00%	30.14%	0.30%	30.91%
Agriculture, Forestry, Fisheries	0.13%	0.10%	0.62%	0.01%	0.85%
Other non-allocated	0.04%	0.05%	0.03%	0.00%	0.12%
Subtotal - Other	0.17%	0.15%	0.65%	0.01%	0.97%
TOTAL	23.83%	5.47%	68.06%	2.65%	

Source: JRC elaboration based on GCoM data

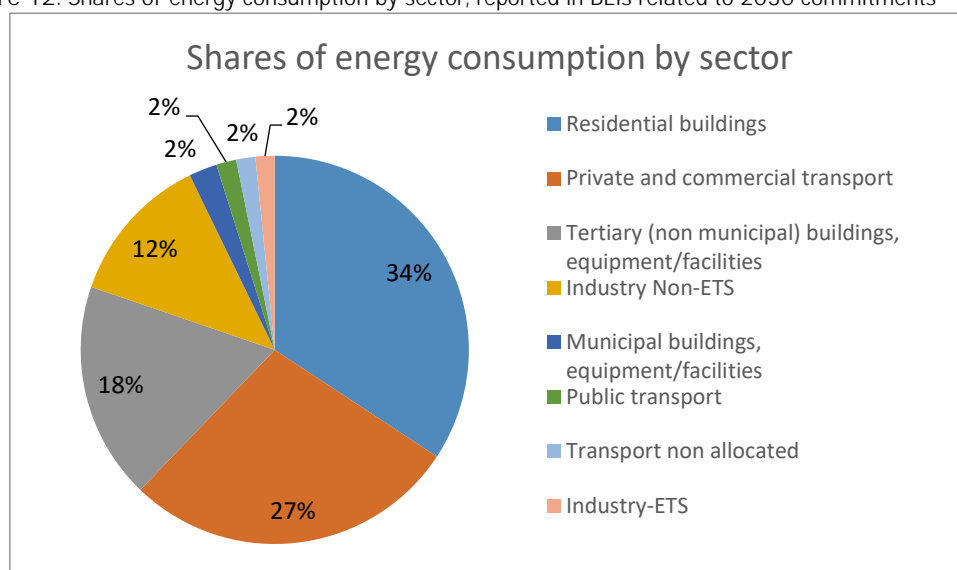
Table 22. Energy consumption reported in BEIs related to 2030 commitments – EU-27 (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1947	0.0454	0.1403	0.0012	0.3815
Residential buildings	1.2896	0.5149	3.4582	0.3076	5.5703
Tertiary (non-municipal) buildings, equipment/facilities	1.3381	0.2241	1.3224	0.0552	2.9397
Industry Non-ETS	0.8685	0.0970	1.0471	0.0246	2.0372
Industry-ETS	0.0561		0.2033	0.0001	0.2595
Buildings, equipment/facilities non-allocated	0.1044	0.0015	0.0197	0.0005	0.1262
Subtotal - Stationary energy	3.8513	0.8829	6.1909	0.3893	11.3144
Municipal fleet	0.0000		0.0628	0.0023	0.0650
Public transport	0.0645		0.2030	0.0041	0.2715
Private and commercial transport	0.0099		4.4843	0.0425	4.5367
Transport non-allocated	0.0042		0.2552	0.0004	0.2598

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Subtotal - Transport	0.0785	0.0000	5.0053	0.0493	5.1331
Agriculture, Forestry, Fisheries	0.0217	0.0162	0.1025	0.0011	0.1414
Other non-allocated	0.0063	0.0088	0.0052	0.0000	0.0203
Subtotal - Other	0.0279	0.0250	0.1076	0.0011	0.1617
TOTAL	3.9578	0.9080	11.3038	0.4397	16.6093

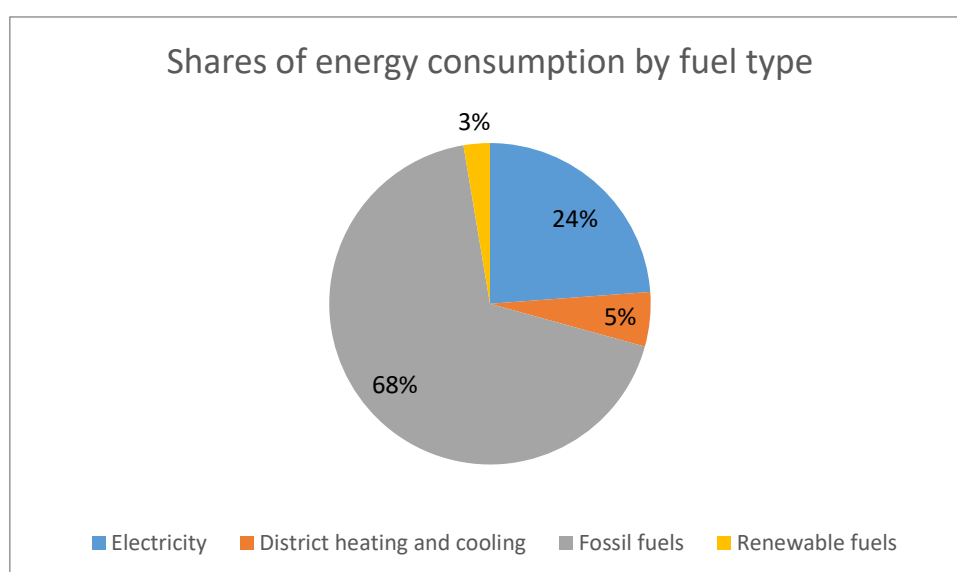
Source: JRC elaboration based on GCoM data

Figure 12. Shares of energy consumption by sector, reported in BEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

Figure 13. Shares of energy consumption by fuel type, reported in BEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.2.2 BEI energy supply

Examining the reported energy output from the signatories having reported a BEI, there are 383, out of the 1082, having also reported some local heat/cold or electricity production.

2.2.2.1 Local electricity production and purchases of renewable energy certificates

The highest shares of local electricity production correspond to photovoltaics (62.6%) and hydroelectric power (14%). See Table 23 for the complete description of the total production by technology. Additionally, comparing non-renewable with renewable energy technologies, renewable energy has the highest share, with 81%, representing 20% of the BEI electricity consumption for the cities reporting local electricity production. In per capita terms, Table 24, the reported local electricity production amounts to 0.20 and 0.9 MWh/year for non-renewable and renewable technologies, respectively. Figure 14 shows the shares of the most representative electricity production sources and technologies.

Lastly, examining purchases of renewable energy certificates, there are 97 signatories reporting purchases. These signatories come mainly from Belgium (76%) and Italy (14%). For these signatories, they report a total of 0.4 TWh/year, representing 2% of their total BEI electricity consumption. In per capita terms, it amounts to 0.13 MWh/year per capita.

Table 23. Local electricity production in BEIs related to 2030 commitments - EU-27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		13.3608	13.3608	62.58%
Wind		0.8449	0.8449	3.96%
Hydroelectric		2.9699	2.9699	13.91%
Geothermal		0.0000	0.0000	0.00%
Local electricity production plants - Combined Heat and Power	3.7269	0.1772	3.9042	18.29%
Local electricity production plants - Other	0.2658	0.0050	0.2708	1.27%
TOTAL	3.9927	17.3579	21.3506	
SHARE ON TOTAL ELECTRICITY PRODUCTION	18.70%	81.30%		
SHARE ON TOTAL ELECTRICITY CONSUMPTION*	2.23% (4.7%)	9.70% (20.4%)		

*Compared to the total electricity consumption in BEI (only for cities reporting energy supply)

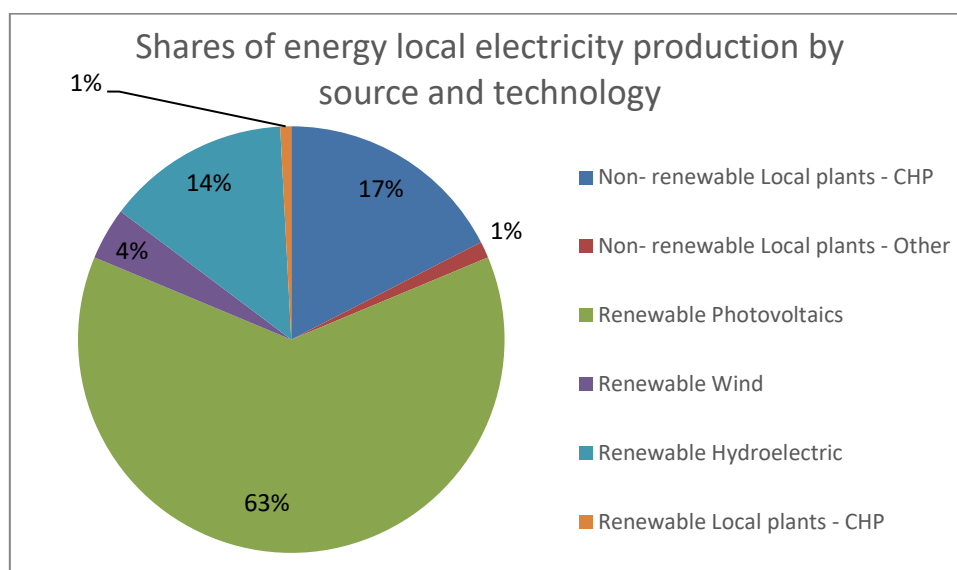
Source: JRC elaboration based on GCoM data

Table 24. Local electricity production in BEIs related to 2030 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.6908	0.6908
Wind		0.0437	0.0437
Hydroelectric		0.1535	0.1535
Geothermal		0.0000	0.0000
Local electricity production plants - Combined Heat and Power	0.1927	0.0092	0.2018
Local electricity production plants - Other	0.0137	0.0003	0.0140
TOTAL	0.2064	0.8974	1.1038

Source: JRC elaboration based on GCoM data

Figure 14. Shares of local electricity production by energy source and technology, reported in BEIs related to 2030 commitments – EU-27



Source: JRC elaboration based on GCoM data

2.2.2.2 Local heat/cold production

Considering local heat/cold supply, the highest shares of local heat/cold production correspond with district heating (heat only) (53%) and CHP (47%). See Table 25 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 99%, representing more than the BEI heat/cold consumption for the cities reporting local heat/cold production. As shown in Table 26, the per capita production with non-renewable fuels amounts to 2.25 MWh/year. Figure 15 shows the shares of the most representative heat/cold production sources and technologies.

Table 25. Local heat/cold production in BEIs related to 2030 commitments - EU 27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Local heat/cold production plants - Combined Heat and Power	6.6399		6.6399	47.21%
Local heat/cold production plants - District heating (heat-only)	7.2328	0.1731	7.4059	52.65%
Local heat/cold production plants – Other	0.0188	0.0003	0.0191	0.14%
TOTAL	13.8915	0.1734	14.0649	
SHARE ON TOTAL HEAT/COLD PRODUCTION	98.77%	1.23%		
SHARE ON TOTAL HEAT/COLD CONSUMPTION*	33.85% (108.2%)	0.42% (1.35%)		

* Compared to the total heat/cold consumption in BEI (only for cities reporting local heat/cold production)

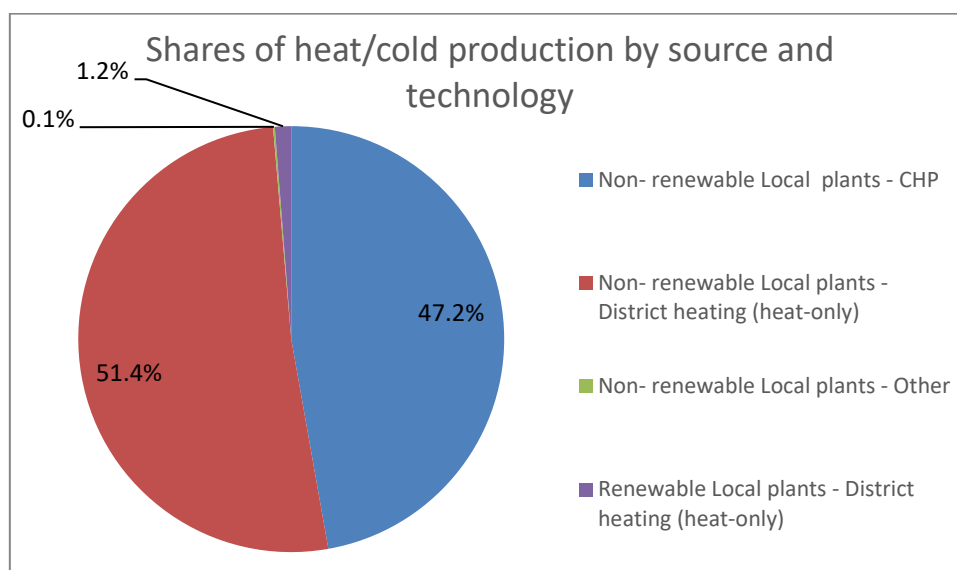
Source: JRC elaboration based on GCoM data

Table 26. Local heat/cold production in BEIs related to 2030 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Local heat/cold production plants - Combined Heat and Power	1.0756		1.0756
Local heat/cold production plants - District heating (heat-only)	1.1716	0.0280	1.1996
Local heat/cold production plants – Other	0.0030	0.0000	0.0031
TOTAL	2.2502	0.0281	2.2783

Source: JRC elaboration based on GCoM data

Figure 15. Shares of local heat/cold production by energy source and technology, reported in BEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.2.3 Estimated energy savings and renewable energy production

Focusing now on the reported estimated savings and renewable energy production from the signatories having reported a BEI with 2030 commitments, there are 911, out of the 1 082, having also reported some estimated savings or renewable energy production.

2.2.3.1 Estimated savings

The highest share of estimated savings corresponds to stationary energy, with 62% of the total estimated savings, followed by transport (34%). The details can be seen in Table 27. The total savings represent 22% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 28, signatories estimate that they will be able to save, on average, 3.8 MWh/year per capita, by 2030. Figure 16 shows the shares of each activity sector in the total estimated savings.

Table 27. Estimated energy savings by 2030 declared by signatories – EU-27 (units TWh/year).

Sector	Estimated energy savings	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	81.3928	61.64%
Transport	44.7081	33.86%
Local electricity production	1.6042	1.21%
Local heat/cold production	1.5589	1.18%
Other	2.7803	2.11%
TOTAL	132.0443	

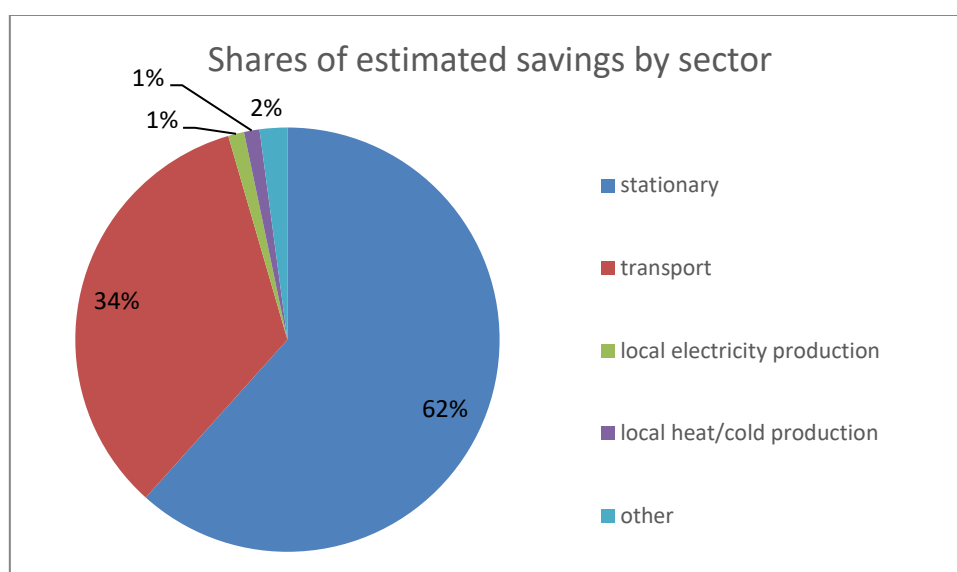
Source: JRC elaboration based on GCoM data

Table 28. Estimated energy savings by 2030 declared by signatories – EU-27 (units MWh/year per capita).

Sector	Estimated energy savings
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	2.3733
Transport	1.3036
Local electricity production	0.0468
Local heat/cold production	0.0455
Other	0.0811
TOTAL	3.8503

Source: JRC elaboration based on GCoM data

Figure 16. Shares of estimated savings by sector, reported in BEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.2.3.2 Estimated renewable energy production

The highest share of renewable energy production corresponds to the local electricity production, with 47% of the total estimated renewable energy production. The details can be seen in Table 29. The total renewable energy production represents 6% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 30, signatories estimate that by 2030, they will be able to produce, in average, 1 MWh/year per capita. Figure 17 shows the shares of each activity sector in the total estimated renewable energy production.

Table 29. Estimated renewable energy production by 2030 declared by signatories – EU-27 (units TWh/year).

Sector	Estimated renewable energy production	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	9.7081	26.99%
Transport	1.3615	3.79%
Local electricity production	16.8257	46.79%

Sector	Estimated renewable energy production	SHARE
Local heat/cold production	7.7064	21.43%
Other	0.3618	1.01%
TOTAL	35.9635	

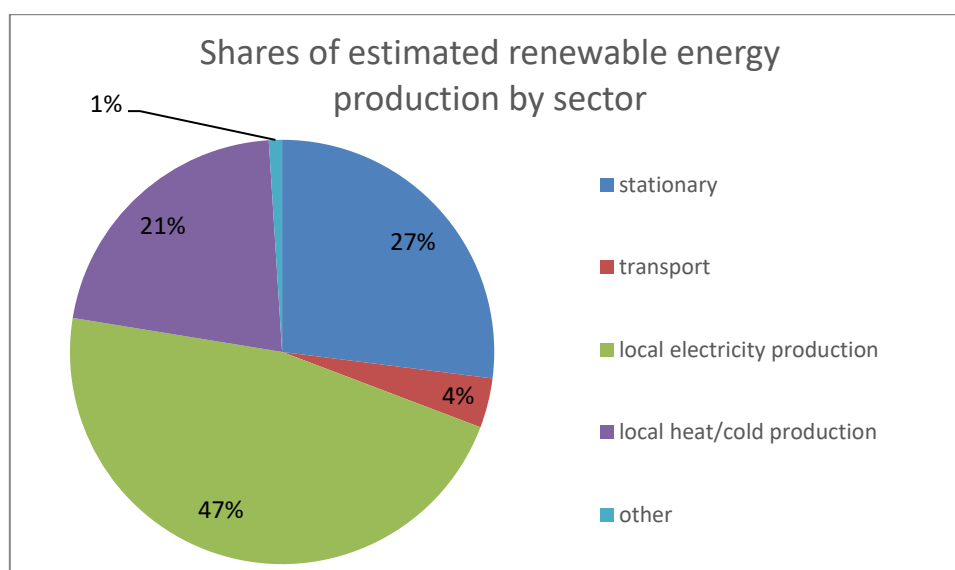
Source: JRC elaboration based on GCoM data

Table 30. Estimated renewable energy production by 2030 declared by signatories – EU-27 (units MWh/year per capita).

Sector	Estimated renewable energy production
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.2831
Transport	0.0397
Local electricity production	0.4906
Local heat/cold production	0.2247
Other	0.0106
TOTAL	1.0487

Source: JRC elaboration based on GCoM data

Figure 17. Shares of estimated renewable energy production by sector, reported in BEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.2.4 MEI energy consumption

Regarding EU-27 signatories with 2030 commitments, there are 400 signatories having reported a MEI, holding 23.6 million inhabitants. For monitoring reports, it can be seen that the type of fuel with the greatest total share of consumption is fossil fuels (66%), followed by electricity (25%). This is a slight decrease for fossils and a slight increase for electricity consumption, when comparing the total MEI against the BEI. The behaviour is also very similar when comparing with 2020 commitments. Additionally, the sector with the highest share is residential buildings (32%), followed by private and commercial transport (25%). See Tables

31-33 for the absolute, percentage and per capita values, respectively, of the energy consumption reported in MEIs, and Figures 18-19 for the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it is noted that fossil fuels represent the maximum consumption value, with 9.9 MWh/year per capita, while renewable fuels have the lowest value, with 0.45 MWh/year per capita. Focusing on the activity sectors, residential buildings has the highest consumption value, with 4.9 MWh/year per capita, followed by private and commercial transport, with 3.7 MWh/year per capita, revealing a small decrease with respect to the BEI consumption for both sector, of around 0.7 MWh/year per capita. Other sectors, such as municipal buildings, industry-ETS, municipal fleet, public transport, and agriculture, forestry and fisheries, have a minimal per capita consumption of less than 1 MWh/year per capita. Overall, the situation depicted in the MEIs is very much in line with what was reported in the BEIs, with respect to both the shares for types of fuel and sectors, as well as for the per capita consumption, confirming the initial insight (Section 2.1.4), suggesting that the transition to a greener energy future still requires additional efforts to achieve EU targets.

Table 31. Energy consumption reported in MEIs related to 2030 commitments – EU-27 (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	3.5607	1.4251	2.6926	0.1351	7.8135	2.18%
Residential buildings	28.5114	12.9022	68.6285	6.4617	116.504	32.45%
Tertiary (non-municipal) buildings,	33.7016	5.0256	26.1667	0.6707	65.5646	18.26%
Industry Non-ETS	20.6440	4.2392	24.3905	0.6705	49.9442	13.91%
Industry-ETS	0.7944		11.4762		12.2706	3.42%
Buildings, equipment/facilities non-allocated	0.0369	0.0353	0.1832	0.0344	0.2897	0.08%
Subtotal - Stationary energy	87.2490	23.6273	133.5377	7.9724	252.386	70.30%
Municipal fleet	0.0043		1.5958	0.0409	1.6410	0.46%
Public transport	1.3429		8.2899	0.2292	9.8620	2.75%
Private and commercial transport	0.0956		86.5576	2.2090	88.8622	24.75%
Transport non-allocated	0.1519		3.5359	0.2836	3.9714	1.11%
Subtotal - Transport	1.5948		99.9791	2.7627	104.337	29.06%
Agriculture, Forestry, Fisheries	0.2102	0.2135	1.6576	0.0384	2.1197	0.59%
Other non-allocated	0.0651		0.1308	0.0000	0.1959	0.05%
Subtotal - Other	0.2753	0.2135	1.7884	0.0385	2.3156	0.64%
TOTAL	89.1191	23.8408	235.3053	10.7735	359.039	
SHARE	24.82%	6.64%	65.54%	3.00%		

Source: JRC elaboration based on GCoM data

Table 32. Energy consumption reported in MEIs related to 2030 commitments – EU-27 (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.99%	0.40%	0.75%	0.04%	2.18%
Residential buildings	7.94%	3.59%	19.11%	1.80%	32.45%
Tertiary (non-municipal) buildings, equipment/facilities	9.39%	1.40%	7.29%	0.19%	18.26%
Industry Non-ETS	5.75%	1.18%	6.79%	0.19%	13.91%
Industry-ETS	0.22%		3.20%		3.42%
Buildings, equipment/facilities non-allocated	0.01%	0.01%	0.05%	0.01%	0.08%
Subtotal - Stationary energy	24.30%	6.58%	37.19%	2.22%	70.30%
Municipal fleet	0.00%		0.44%	0.01%	0.46%
Public transport	0.37%		2.31%	0.06%	2.75%
Private and commercial transport	0.03%		24.11%	0.62%	24.75%
Transport non-allocated	0.04%		0.98%	0.08%	1.11%
Subtotal - Transport	0.44%	0.00%	27.85%	0.77%	29.06%
Agriculture, Forestry, Fisheries	0.06%	0.06%	0.46%	0.01%	0.59%
Other non-allocated	0.02%		0.04%	0.00%	0.05%
Subtotal - Other	0.08%	0.06%	0.50%	0.01%	0.64%
TOTAL	24.82%	6.64%	65.54%	3.00%	

Source: JRC elaboration based on GCoM data

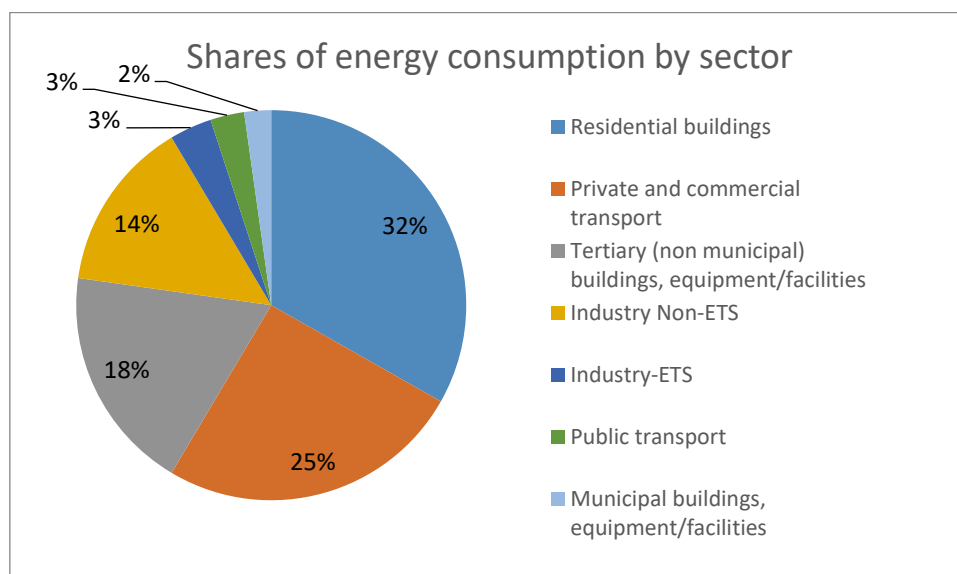
Table 33. Energy consumption reported in MEIs related to 2030 commitments – EU-27 (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1506	0.0603	0.1139	0.0057	0.3304
Residential buildings	1.2056	0.5456	2.9019	0.2732	4.9263
Tertiary (non-municipal) buildings, equipment/facilities	1.4250	0.2125	1.1064	0.0284	2.7724
Industry Non-ETS	0.8729	0.1793	1.0313	0.0284	2.1119
Industry-ETS	0.0336		0.4853		0.5189
Buildings, equipment/facilities non-allocated	0.0016	0.0015	0.0077	0.0015	0.0122
Subtotal - Stationary energy	3.6893	0.9991	5.6465	0.3371	10.6720
Municipal fleet	0.0002		0.0675	0.0017	0.0694
Public transport	0.0568		0.3505	0.0097	0.4170
Private and commercial transport	0.0040		3.6600	0.0934	3.7575
Transport non-allocated	0.0064		0.1495	0.0120	0.1679

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Subtotal - Transport	0.0674	0.0000	4.2275	0.1168	4.4118
Agriculture, Forestry, Fisheries	0.0089	0.0090	0.0701	0.0016	0.0896
Other non-allocated	0.0028		0.0055	0.0000	0.0083
Subtotal - Other	0.0116	0.0090	0.0756	0.0016	0.0979
TOTAL	3.7683	1.0081	9.9497	0.4556	15.1817

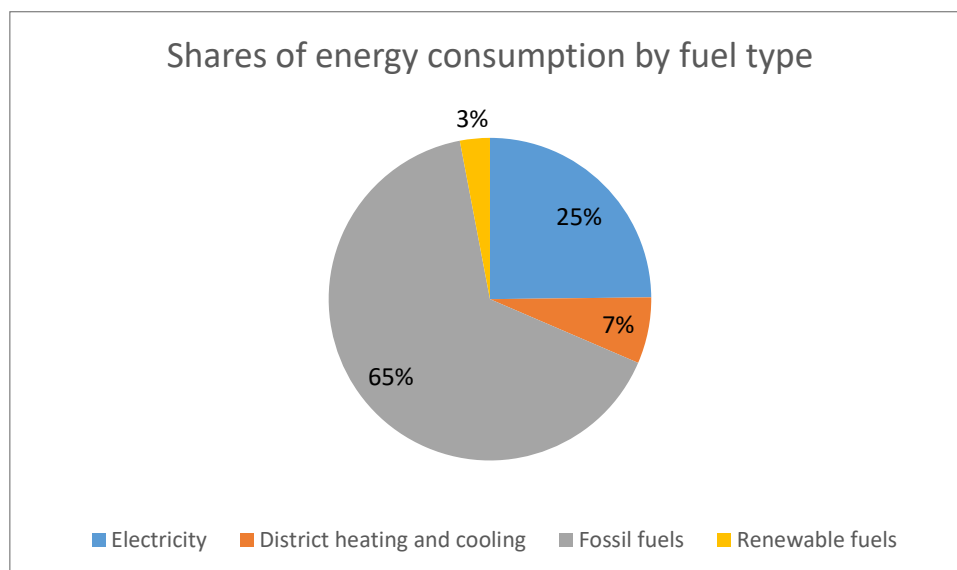
Source: JRC elaboration based on GCoM data

Figure 18. Shares of energy consumption by sector, reported in MEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

Figure 19. Shares of energy consumption by fuel type, reported in MEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.2.5 MEI energy supply

2.2.5.1 Local electricity production and purchases of renewable energy certificates

The highest shares of local electricity production correspond to hydroelectric power (44%) and photovoltaics (20%). See Table 34 for the complete description of the total production by technology. Additionally, comparing non-renewable with renewable energy technologies, renewable energy has the highest share, with 86%, representing 17% of the MEI electricity consumption for the cities reporting local electricity production. In per capita terms, Table 35, the reported local electricity production amounts to 0.09 and 0.58 MWh/year for non-renewable and renewable technologies, respectively. Figure 20 shows the shares of the most representative electricity production sources and technologies.

Lastly, examining purchases of renewable energy certificates, there are 102 signatories reporting purchases. These signatories come mainly from Belgium (59%) and Italy (27%). In total, they report 1.79 TWh/year, representing 6.8% of their total MEI electricity consumption. In per capita terms, it amounts to 0.21 MWh/year per capita.

Table 34. Local electricity production in MEIs related to 2030 commitments - EU-27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		2.1983	2.1983	19.89%
Wind		1.3939	1.3939	12.61%
Hydroelectric		4.909	4.909	44.41%
Geothermal		0.0137	0.0137	0.12%
Local electricity production plants - Combined Heat and Power	1.4771	0.8727	2.3498	21.26%
Local electricity production plants - Other	0.0892	0.1002	0.1894	1.71%
TOTAL	1.5663	9.4877	11.0541	
SHARE ON TOTAL ELECTRICITY PRODUCTION	14.17%	85.83%		
SHARE ON TOTAL ELECTRICITY CONSUMPTION*	1.76% (2.8%)	10.65% (17%)		

*Compared to the total electricity consumption in MEI (only for cities reporting energy supply)

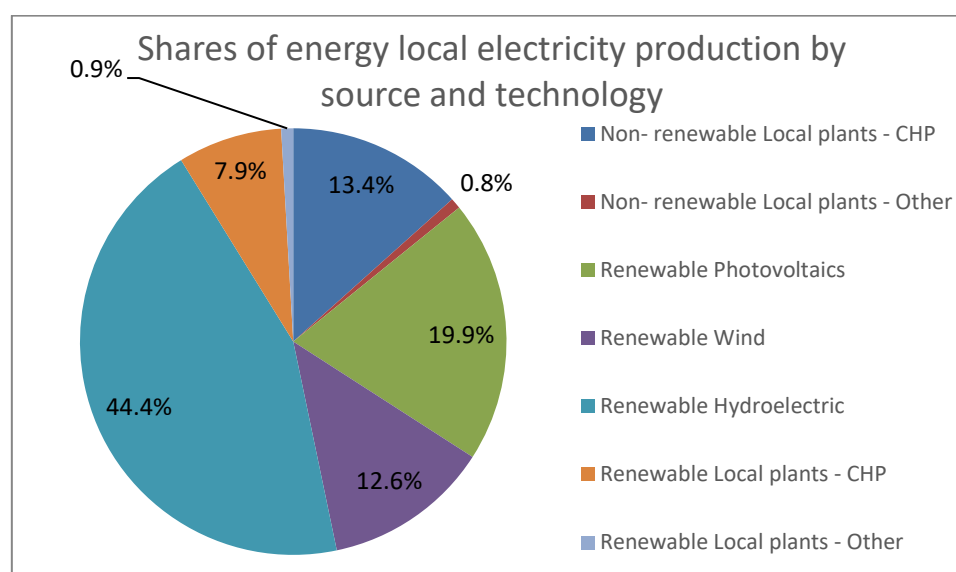
Source: JRC elaboration based on GCoM data

Table 35. Local electricity production in MEIs related to 2030 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.1363	0.1363
Wind		0.0864	0.0864
Hydroelectric		0.3045	0.3045
Geothermal		0.0008	0.0008
Local electricity production plants - Combined Heat and Power	0.0916	0.0541	0.1457
Local electricity production plants - Other	0.0055	0.0062	0.0117
TOTAL	0.0971	0.5884	0.6856

Source: JRC elaboration based on GCoM data

Figure 20. Shares of local electricity production by energy source and technology, reported in MEIs related to 2030 commitments – EU-27



Source: JRC elaboration based on GCoM data

2.2.5.2 Local heat/cold production

Considering local heat/cold supply, the highest shares of local heat/cold production correspond with non-renewable CHP (53%), followed by renewable CHP (19%). See Table 36 for the complete description of the total production by technology. Furthermore, comparing non-renewable with renewable energy technologies, the former (non-renewable) has a 70% share, against the 30% share of the latter (renewable). The 70% share of non-renewable technologies represents 77.5% of the MEI heat/cold consumption for the cities reporting local heat/cold production. This is an important change with respect to the BEI situation, where the 99% was taken from non-renewables. As shown in Table 37, the per capita production with non-renewable and renewable fuels amounts to 2.5 and 1 MWh/year, respectively. Figure 21 shows the shares of the most representative heat/cold production sources and technologies.

Table 36. Local heat/cold production in MEIs related to 2030 commitments - EU 27 (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Local heat/cold production plants - Combined Heat and Power	5.1257	1.8207	6.9464	71.66%
Local heat/cold production plants - District heating (heat-only)	1.345	0.9851	2.3301	24.04%
Local heat/cold production plants – Other	0.3097	0.1078	0.4175	4.31%
TOTAL	6.7804	2.9135	9.6939	
SHARE ON TOTAL HEAT/COLD PRODUCTION	69.94%	30.06%		
SHARE ON TOTAL HEAT/COLD CONSUMPTION*	28.44% (77.5%)	12.2% (33.3%)		

* Compared to the total heat/cold consumption in BEI (only for cities reporting local heat/cold production)

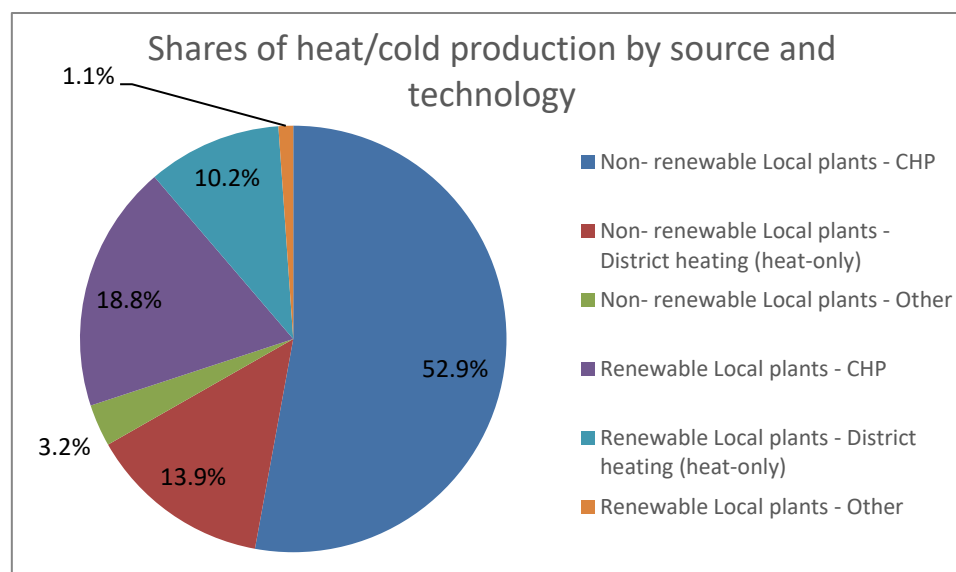
Source: JRC elaboration based on GCoM data

Table 37. Local heat/cold production in MEIs related to 2030 commitments - EU-27 (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Local heat/cold production plants - Combined Heat and Power	1.8759	0.6663	2.5422
Local heat/cold production plants - District heating (heat-only)	0.4922	0.3605	0.8528
Local heat/cold production plants – Other	0.1133	0.0394	0.1528
TOTAL	2.4815	1.0663	3.5477

Source: JRC elaboration based on GCoM data

Figure 21. Shares of local heat/cold production by energy source and technology, reported in MEIs related to 2030 commitments – EU-27.



Source: JRC elaboration based on GCoM data

2.2.6 Achievements in energy savings

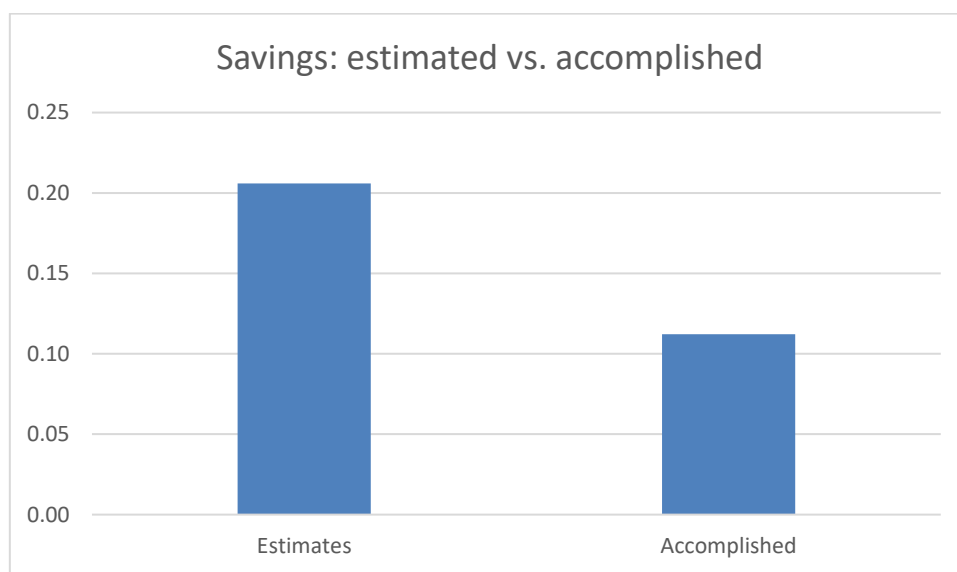
Focusing on the actual savings for signatories holding a MEI, the total savings are presented next, identifying the most successful signatories in accomplishing significant savings for 2030.

2.2.6.1 Accomplished savings

The total savings, when computing the difference between the BEI and the MEI consumption for the signatories holding a MEI, amounts to 27 TWh/year (1.17 MWh/year per capita). Overall, the total reduced consumption is 6.9% of the reported BEI, and 7.4% of the MEI consumption.

Considering only the signatories that reported estimates for energy savings and reported a MEI as well, they accomplished a mean annual rate of per capita energy savings of 0.11 MWh/year, falling short of the initially reported/estimated rate of 0.2 MWh/year (see Figure 22).

Figure 22. Mean yearly per capita energy savings, estimated vs. accomplished, related to 2030 commitments – EU-27 (units MWh/year per capita).



Source: JRC elaboration based on GCoM data

Examining the accomplished absolute savings, the cities achieving the highest savings annual rates are Dublin, Ravenna and Valencia, saving 0.61, 0.36 and 0.32 TWh/year, respectively. The top-10 cities, regarding their yearly absolute savings rates, are presented in Table 38.

Table 38. Top-10 signatories with highest savings rates, related to 2030 commitments – EU-27 (units TWh/year)

CITY	COUNTRY	BASE YEAR	LAST MONITORING YEAR	ABSOLUTE SAVINGS	ABSOLUTE SAVINGS ANNUAL RATE	SAVINGS PER CAPITA (MWh/year)	SAVINGS PER CAPITA ANNUAL RATE (MWh/year)
Dublin	City						
Council							
Ravenna	Italy	2007	2010	1.07	0.36	6.75	2.35
Valencia	Spain	2007	2012	1.59	0.32	2	0.39
Bruxelles/Brussel	Belgium	2008	2014	1.37	0.23	8.04	1.99
Amiens	France	2014	2016	0.34	0.17	2.58	1.29
Padova	Italy	2005	2017	2.05	0.17	9.75	0.78
Porto	Portugal	2004	2015	1.77	0.16	8.24	0.66
Genova	Italy	2005	2016	1.63	0.15	2.8	0.18
Berlin	Germany	1990	2012	2.89	0.13	0.83	0.04
Bologna	Italy	2005	2018	1.65	0.13	4.23	0.4

Source: JRC elaboration based on GCoM data

3 Energy consumption and savings in non-EU

3.1 2020 commitments – Europe, non-EU

In this section, the analysis focuses on Europe, non-EU signatories, with a commitment for the target year of 2020.

3.1.1 BEI energy consumption

Regarding signatories in non-EU with 2020 commitments, there are 193 signatories holding a BEI, representing 44.5 million inhabitants. For this subset of signatories, fossil fuels has the highest share in the total energy consumption (70%), followed by electricity (23%), while the sector with the highest share is residential buildings (40%), followed by industry non-ETS (20%). See Tables 39-41 for the absolute, percentage and per capita values, respectively, and Figures 23-24 for the visualisation of the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it can be highlighted that fossil fuels represent the maximum consumption value, with 9.75 MWh/year per capita, while renewable fuels represent the minimum consumption of 0.12 MWh/year per capita. Besides residential buildings (with a declared 5.5 MWh/year per capita), the activity sectors with greatest per capita consumption are industry non-ETS, private and commercial transport and buildings, equipment/facilities non-allocated, with 2.7, 2 and 1.5 MWh/year per capita, respectively; as opposite to other sectors, such as municipal buildings, industry-ETS, municipal fleet, public transport, and agriculture, forestry and fisheries, having a minimal per capita consumption of less than 1 MWh/year.

Table 39. Energy consumption reported in BEIs related to 2020 commitments –non-EU (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	4.7795	4.0484	6.6754	0.0521	15.5554	2.51%
Residential buildings	52.6764	27.6932	159.4847	4.4943	244.3486	39.42%
Tertiary (non-municipal) buildings, equipment/facilities	27.4450	2.8628	24.0841	0.1389	54.5308	8.80%
Industry Non-ETS	22.7404	0.4824	98.8475	0.1178	122.1880	19.71%
Industry-ETS	0.0438	0.0140	0.1065		0.1642	0.03%
Buildings, equipment/facilities non-allocated	34.0804	0.4700	31.9911	0.3296	66.8711	10.79%
Subtotal - Stationary energy	141.7654	35.5708	321.1893	5.1326	503.6581	81.26%
Municipal fleet	0.0125		0.7322	0.0023	0.7470	0.12%
Public transport	2.5723		8.9492	0.0008	11.5223	1.86%
Private and commercial transport	0.0566		91.2961	0.0009	91.3537	14.74%
Transport non-allocated			12.5019		12.5019	2.02%
Subtotal - Transport	2.6414		113.4794	0.0040	116.1249	18.73%
Agriculture, Forestry, Fisheries	0.0492		0.0008	0.0001	0.0501	0.01%

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Other non-allocated						
Subtotal - Other	0.0492	0.0000	0.0008	0.0001	0.0501	0.01%
TOTAL	144.4560	35.5708	434.6695	5.1367	619.8330	
SHARE	23.31%	5.74%	70.13%	0.83%		

Source: JRC elaboration based on GCoM data

Table 40. Energy consumption reported in BEIs related to 2020 commitments – non-EU (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.77%	0.65%	1.08%	0.01%	2.51%
Residential buildings	8.50%	4.47%	25.73%	0.73%	39.42%
Tertiary (non-municipal) buildings, equipment/facilities	4.43%	0.46%	3.89%	0.02%	8.80%
Industry Non-ETS	3.67%	0.08%	15.95%	0.02%	19.71%
Industry-ETS	0.01%	0.00%	0.02%		0.03%
Buildings, equipment/facilities non-allocated	5.50%	0.08%	5.16%	0.05%	10.79%
Subtotal - Stationary energy	22.87%	5.74%	51.82%	0.83%	81.26%
Municipal fleet	0.00%		0.12%	0.00%	0.12%
Public transport	0.41%		1.44%	0.00%	1.86%
Private and commercial transport	0.01%		14.73%	0.00%	14.74%
Transport non-allocated			2.02%		2.02%
Subtotal - Transport	0.43%	0.00%	18.31%	0.00%	18.73%
Agriculture, Forestry, Fisheries	0.01%		0.00%	0.00%	0.01%
Other non-allocated					
Subtotal - Other	0.01%	0.00%	0.00%	0.00%	0.01%
TOTAL	23.31%	5.74%	70.13%	0.83%	

Source: JRC elaboration based on GCoM data

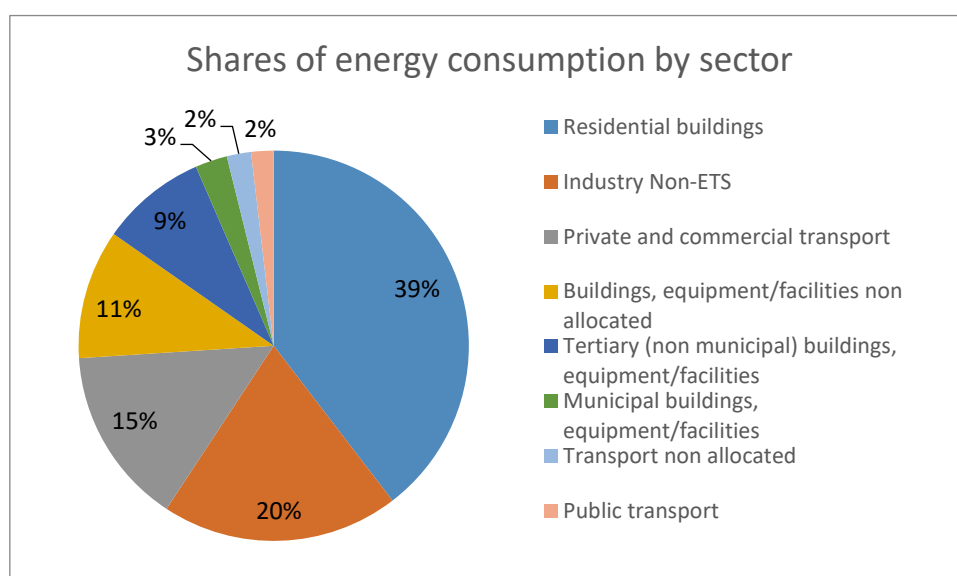
Table 41. Energy consumption reported in BEIs related to 2020 commitments – non-EU (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1073	0.0908	0.1498	0.0012	0.3491
Residential buildings	1.1821	0.6214	3.5789	0.1009	5.4833
Tertiary (non-municipal) buildings, equipment/facilities	0.6159	0.0642	0.5405	0.0031	1.2237
Industry Non-ETS	0.5103	0.0108	2.2182	0.0026	2.7419

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Industry-ETS	0.0010	0.0003	0.0024		0.0037
Buildings, equipment/facilities non-allocated	0.7648	0.0105	0.7179	0.0074	1.5006
Subtotal - Stationary energy	3.1813	0.7982	7.2076	0.1152	11.3022
Municipal fleet	0.0003		0.0164	0.0001	0.0168
Public transport	0.0577		0.2008	0.0000	0.2586
Private and commercial transport	0.0013		2.0487	0.0000	2.0500
Transport non-allocated			0.2805		0.2805
Subtotal - Transport	0.0593	0.0000	2.5465	0.0001	2.6059
Agriculture, Forestry, Fisheries	0.0011		0.0000	0.0000	0.0011
Other non-allocated					
Subtotal - Other	0.0011	0.0000	0.0000	0.0000	0.0011
TOTAL	3.2416	0.7982	9.7541	0.1153	13.9093

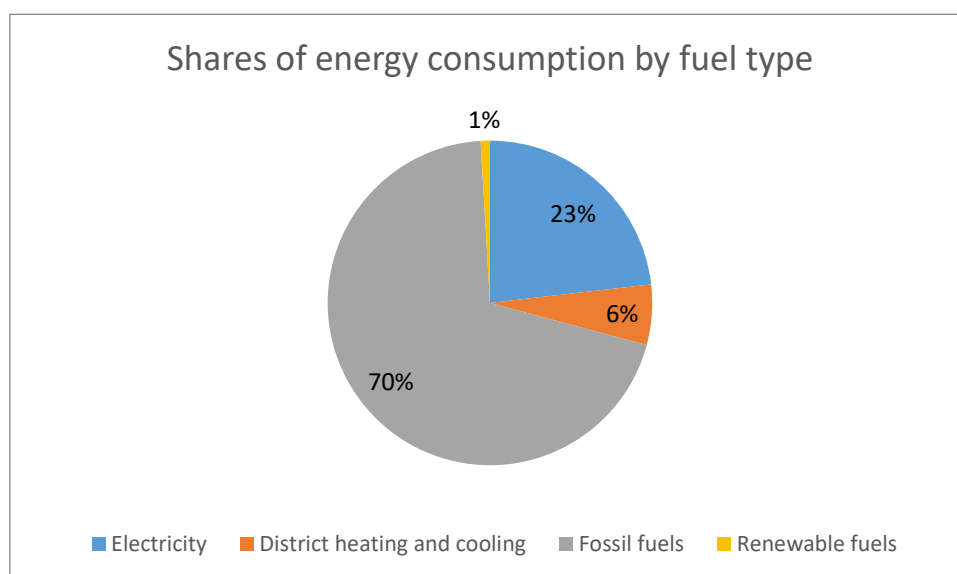
Source: JRC elaboration based on GCoM data

Figure 23. Shares of energy consumption by sector, reported in BEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

Figure 24. Shares of energy consumption by fuel type, reported in BEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.2 BEI Energy supply

Examining the reported energy output from this subset of signatories holding a BEI, there are 43 out of the 193, having also reported some local heat/cold or electricity production.

3.1.2.1 Local electricity production and purchases of renewable energy certificates

The highest share of local electricity production corresponds to CHP (55%), followed by hydroelectric (31%) and wind power (13%). See Table 42 for the complete description of the total production by technology. Furthermore, comparing non-renewable with renewable energy technologies, the share is 55% and 45%, respectively. The volume of production, for both renewables and non-renewables (considered jointly), represents 11% of the BEI electricity consumption for the cities reporting local electricity production.

Comparing with the (BEI) local electricity production declared by EU-27 signatories, the non-EU signatories do not rely on photovoltaics, but require other technologies such as CHP, hydroelectric or wind power. This could be explained according to their geographical location, as their median latitude is 49 degrees north, where solar irradiation is lower than the median of 42 degrees associated to EU-27 signatories.

In per capita terms, see Table 43, the total local electricity production amounts to 0.39 MWh/year. Figure 25 shows the shares of the most representative electricity production sources and technologies.

Examining the purchases of renewable energy certificates, there are 5 signatories reporting purchases (from Norway, United Kingdom, Switzerland and Iceland). Still taking these few observations as being indicative of the purchase behaviour of 2020 non-EU signatories, they report a total of 0.7 TWh/year, representing 8% of their total BEI electricity consumption. In per capita terms, it amounts to 0.86 MWh/year per capita.

Table 42. Local electricity production in BEIs related to 2020 commitments – non-EU (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		0.0007	0.0007	0.08%
Wind		0.1240	0.1240	13.36%
Hydroelectric		0.2889	0.2889	31.12%
Geothermal				
Local electricity production plants - Combined Heat and Power	0.5147		0.5147	55.44%
Local electricity production plants - Other				
TOTAL	0.5147	0.4137	0.9283	
SHARE ON TOTAL ELECTRICITY PRODUCTION	55.44%	44.56%		
SHARE ON TOTAL ELECTRICITY CONSUMPTION*	0.36% (6.3%)	0.29% (5%)		

*Compared to the total electricity consumption in BEI (only for cities reporting energy supply)

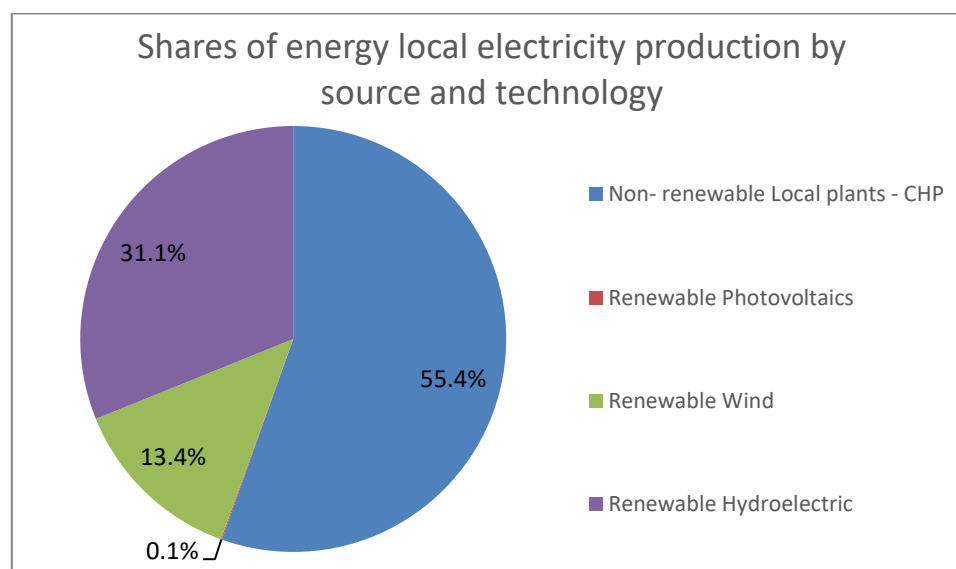
Source: JRC elaboration based on GCoM data

Table 43. Local electricity production in BEIs related to 2020 commitments – non-EU (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.0003	0.0003
Wind		0.0526	0.0526
Hydroelectric		0.1225	0.1225
Geothermal			
Local electricity production plants - Combined Heat and Power	0.2182		0.2182
Local electricity production plants - Other			0.0000
TOTAL	0.2182	0.1753	0.3935

Source: JRC elaboration based on GCoM data

Figure 25. Shares of local electricity production by energy source and technology, reported in BEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.2.2 Local heat/cold production

Considering local heat/cold supply, the highest share of local heat/cold production corresponds with district heating (heat only), with 93%. See Table 44 for the complete description of the total production by technology, where non-renewable energy sources has the complete share in the total local heat/cold production, covering the totality of their BEI heat/cold consumption. Table 45 shows the per capita production with non-renewable fuels, which amounts to 3.7 MWh/year. Figure 26 shows the shares of the most representative heat/cold production sources and technologies.

Table 44. Local heat/cold production in BEIs related to 2020 commitments – non-EU (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Local heat/cold production plants - Combined Heat and Power	1.0102		1.0102	5.79%
Local heat/cold production plants - District heating (heat-only)	16.2479		16.2479	93.14%
Local heat/cold production plants – Other	0.1857		0.1857	1.06%
TOTAL	17.4438	0.0000	17.4438	
SHARE ON TOTAL HEAT/COLD PRODUCTION	100.00%	0.00%		
SHARE ON TOTAL HEAT/COLD CONSUMPTION*	49.04% (125%)	0.00%		

* Compared to the total heat/cold consumption in BEI (only for cities reporting local heat/cold production)

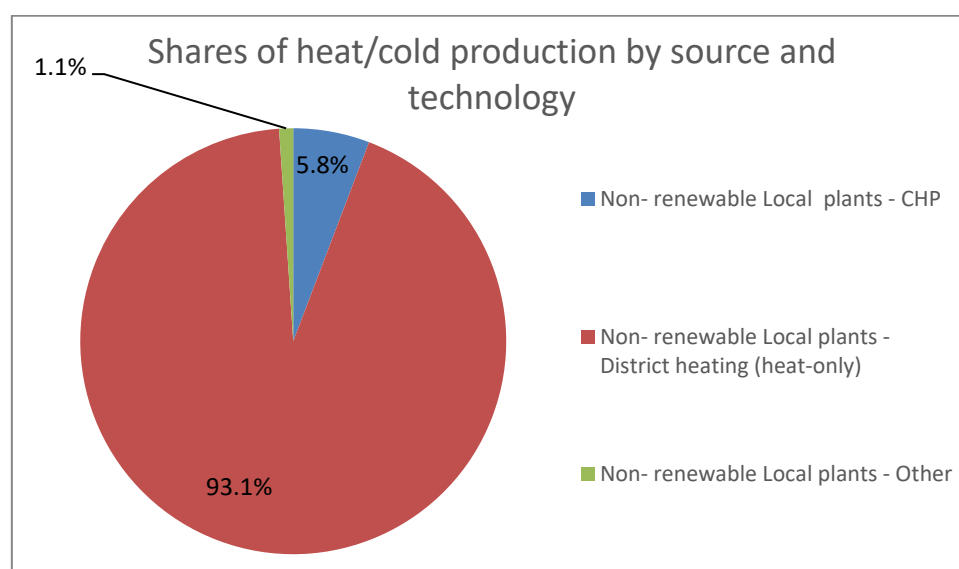
Source: JRC elaboration based on GCoM data

Table 45. Local heat/cold production in BEIs related to 2020 commitments – non-EU (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Local heat/cold production plants - Combined Heat and Power	0.2172		0.2172
Local heat/cold production plants - District heating (heat-only)	3.4933		3.4933
Local heat/cold production plants – Other	0.0399		0.0399
TOTAL	3.7504	0.0000	3.7504

Source: JRC elaboration based on GCoM data

Figure 26. Shares of local heat/cold production by energy source and technology, reported in BEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.3 Estimated energy savings and renewable energy production

Looking at the reported estimated savings and renewable energy production from the signatories having reported a BEI, there are 123, out of the 193, having also reported some estimated savings or renewable energy production.

3.1.3.1 Estimated savings

The highest share of estimated savings corresponds to stationary energy, with 48% of the total estimated savings, followed by transport (24%). The details can be seen in Table 46. The total savings represent 16% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 47, signatories estimate that they will be able to save, on average, 2 MWh/year per capita, by 2020. Figure 27 shows the shares of each activity sector in the total estimated savings.

Table 46. Estimated energy savings by 2020 declared by signatories – non-EU (units TWh/year).

Sector	Estimated energy savings	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	22.8497	47.95%
Transport	11.5361	24.21%
Local electricity production	1.3674	2.87%
Local heat/cold production	5.1550	10.82%
Other	6.7417	14.15%
TOTAL	47.6498	

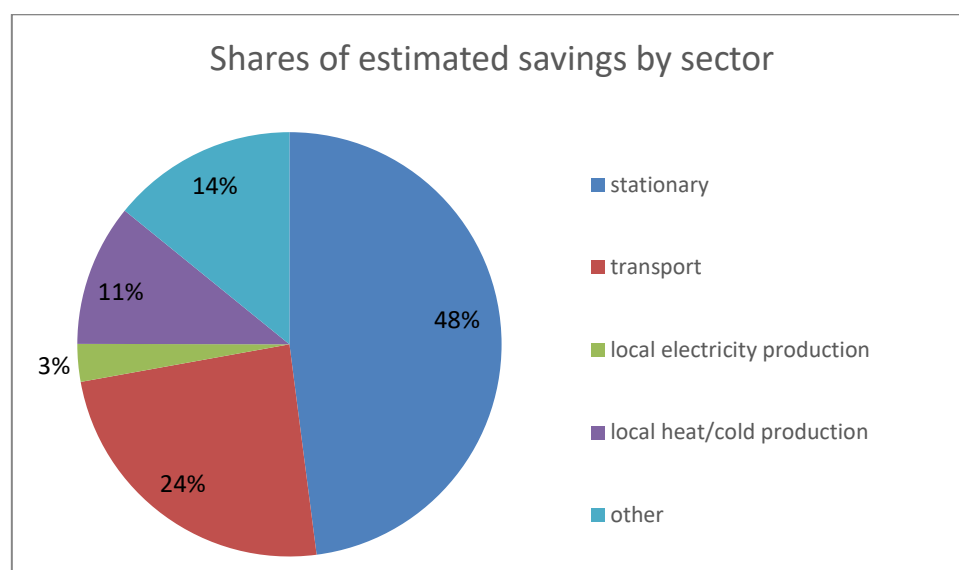
Source: JRC elaboration based on GCoM data

Table 47. Estimated energy savings by 2020 declared by signatories – non-EU (units MWh/year per capita).

Sector	Estimated energy savings
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.9605
Transport	0.4849
Local electricity production	0.0575
Local heat/cold production	0.2167
Other	0.2834
TOTAL	2.0029

Source: JRC elaboration based on GCoM data

Figure 27. Shares of estimated savings by sector, reported in BEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.3.2 Estimated renewable energy production

The highest shares of renewable energy production corresponds to the local electricity and heat/cold production, with 35% and 31%, respectively, of the total estimated renewable energy production. The details can be seen in

Table 48. The total renewable energy production represents 1.43% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 49, signatories estimate that they will be able to produce, in average, 0.18 MWh/year per capita, by 2020. Figure 28 shows the shares of each activity sector in the total estimated renewable energy production.

Table 48. Estimated renewable energy production by 2020 declared by signatories – non-EU (units TWh/year).

Sector	Estimated renewable energy production	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.9791	22.47%
Transport	0.3175	7.29%
Local electricity production	1.5453	35.47%
Local heat/cold production	1.3554	31.11%
Other	0.1592	3.65%
TOTAL	4.3565	

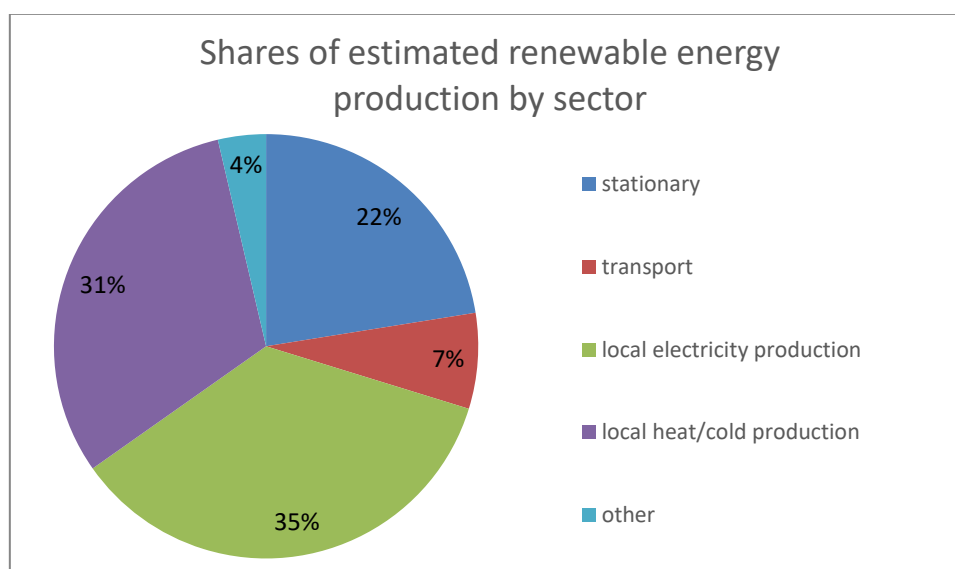
Source: JRC elaboration based on GCoM data

Table 49. Estimated renewable energy production by 2020 declared by signatories – non-EU (units MWh/year per capita).

Sector	Estimated renewable energy production
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.0412
Transport	0.0133
Local electricity production	0.0650
Local heat/cold production	0.0570
Other	0.0067
TOTAL	0.1831

Source: JRC elaboration based on GCoM data

Figure 28. Shares of estimated renewable energy production by sector, reported in BEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.4 MEI energy consumption

Considering non-EU signatories with 2020 commitments, there are 58 signatories having reported a MEI, representing 14.3 million inhabitants. For monitoring reports, it can be seen that the type of fuel with the greatest total share of consumption is fossil fuels (77%), followed by electricity (18%). Additionally, the sector with the highest share is industry non-ETS (33%), followed by residential buildings (29%) and private and commercial transport (22%). See Tables 50-52 for the absolute, percentage and per capita values, respectively, of the energy consumption reported in MEIs, and Figures 29-30 for the visualisation of the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it can be pointed out that fossil fuels represent the maximum consumption value, with 11 MWh/year per capita, 2 MWh/year per capita more with respect to the BEI fossils consumption, while renewable fuels have the lowest value, with 0.06 MWh/year, 0.06 MWh/year per capita less than the BEI renewables consumption. Focusing on the activity sectors, industry non-ETS has the highest consumption value, with 4.7 MWh/year per capita, followed by residential buildings and private and commercial transport, with 4.2 and 3.1 MWh/year per capita. Other sectors, such as municipal buildings, industry-ETS, municipal fleet, public transport, and agriculture, forestry and fisheries, have a minimal per capita consumption of less than 1 MWh/year per capita.

Overall, it is interesting to see that the consumption in the (non-ETS) industry and in private and commercial transport increased with respect to the declared BEI consumption, from 2.7 to 4.7 and from 2 to 3.1 MWh/year per capita, respectively. Meanwhile, the consumption in residential buildings decreased from 5.4 to 4.2 MWh/year per capita.

Table 50. Energy consumption reported in MEIs related to 2020 commitments – non-EU (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	1.6153	1.1487	2.1689	0.0094	4.9422	2.39%
Residential buildings	14.6890	5.0945	39.5297	0.5984	59.9117	28.96%
Tertiary (non-municipal) buildings, equipment/facilities	13.2486	0.5213	8.3889	0.2818	22.4407	10.85%
Industry Non-ETS	7.7323	1.0172	59.2100	0.0131	67.9726	32.86%
Industry-ETS						
Buildings, equipment/facilities non-allocated	0.0845		0.1534	0.0042	0.2420	0.12%
Subtotal - Stationary energy	37.3697	7.7816	109.451	0.9069	155.5092	75.18%
Municipal fleet			0.4052	0.0010	0.4062	0.20%
Public transport	0.5410		5.1809	0.0010	5.7229	2.77%
Private and commercial transport	0.0390		45.0745		45.1135	21.81%
Transport non-allocated			0.1050		0.1050	0.05%
Subtotal - Transport	0.5801		50.7656	0.0020	51.3476	24.82%
Agriculture, Forestry, Fisheries						
Other non-allocated						
Subtotal - Other						
TOTAL	37.9497	7.7816	160.216	0.9089	206.8568	
SHARE	18.35%	3.76%	77.45%	0.44%		

Source: JRC elaboration based on GCoM data

Table 51. Energy consumption reported in MEIs related to 2020 commitments – non-EU (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.78%	0.56%	1.05%	0.00%	2.39%
Residential buildings	7.10%	2.46%	19.11%	0.29%	28.96%
Tertiary (non-municipal) buildings, equipment/facilities	6.40%	0.25%	4.06%	0.14%	10.85%
Industry Non-ETS	3.74%	0.49%	28.62%	0.01%	32.86%

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Industry-ETS					
Buildings, equipment/facilities non-allocated	0.04%		0.07%	0.00%	0.12%
Subtotal - Stationary energy	18.07%	3.76%	52.91%	0.44%	75.18%
Municipal fleet			0.20%	0.00%	0.20%
Public transport	0.26%		2.50%	0.00%	2.77%
Private and commercial transport	0.02%		21.79%		21.81%
Transport non-allocated			0.05%		0.05%
Subtotal - Transport	0.28%	0.00%	24.54%	0.00%	24.82%
Agriculture, Forestry, Fisheries					
Other non-allocated					
Subtotal - Other					
TOTAL	18.35%	3.76%	77.45%	0.44%	

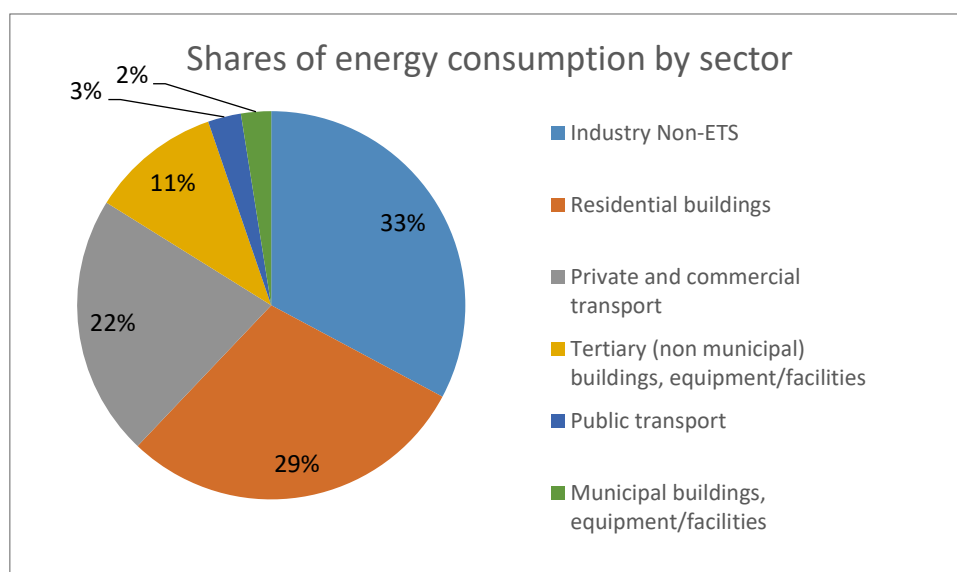
Source: JRC elaboration based on GCoM data

Table 52. Energy consumption reported in MEIs related to 2020 commitments – non-EU (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1130	0.0803	0.1517	0.0007	0.3456
Residential buildings	1.0272	0.3562	2.7643	0.0418	4.1895
Tertiary (non-municipal) buildings, equipment/facilities	0.9265	0.0365	0.5866	0.0197	1.5692
Industry Non-ETS	0.5407	0.0711	4.1405	0.0009	4.7532
Industry-ETS					
Buildings, equipment/facilities non-allocated	0.0059		0.0107	0.0003	0.0169
Subtotal - Stationary energy	2.6132	0.5442	7.6537	0.0634	10.8745
Municipal fleet			0.0283	0.0001	0.0284
Public transport	0.0378		0.3623	0.0001	0.4002
Private and commercial transport	0.0027		3.1520		3.1547
Transport non-allocated			0.0073		0.0073
Subtotal - Transport	0.0406	0.0000	3.5500	0.0001	3.5907
Agriculture, Forestry, Fisheries					
Other non-allocated					
Subtotal - Other					
TOTAL	2.6538	0.5442	11.2037	0.0636	14.4652

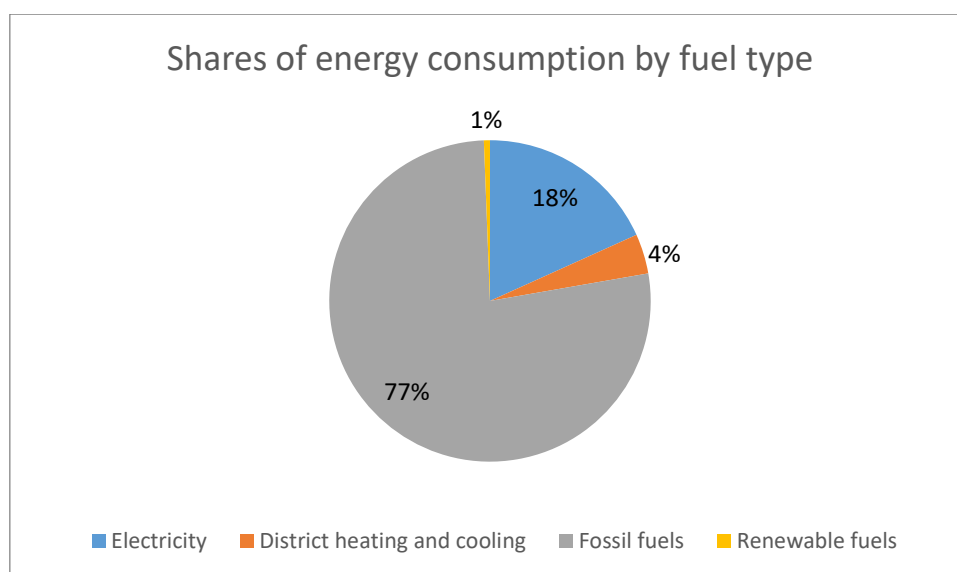
Source: JRC elaboration based on GCoM data

Figure 29. Shares of energy consumption by sector, reported in MEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

Figure 30. Shares of energy consumption by fuel type, reported in MEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.5 MEI energy supply

3.1.5.1 Local electricity production and purchases of renewable energy certificates

The highest share of local electricity production, out of 11 signatories reporting data, corresponds to hydroelectric (71.6%) and geothermal (27%) technologies. See Table 53 for the complete description of the total production by technology. Furthermore, only renewable energy sources are reported in the MEI for local electricity production, amounting to 2.3 MWh/year per capita (see Table 54). Figure 31 shows the shares of the most representative electricity production sources and technologies.

Lastly, examining purchases of renewable energy certificates, there are 7 signatories reporting purchases, reporting a total of 0.34 TWh/year, 0.21 MWh/year per capita (3.5% of their total MEI electricity consumption).

Table 53. Local electricity production in MEIs related to 2020 commitments – non-EU (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		0.0277	0.0277	0.48%
Wind		0.0315	0.0315	0.55%
Hydroelectric		4.1343	4.1343	71.67%
Geothermal		1.575	1.575	27.3%
Local electricity production plants - Combined Heat and Power				
Local electricity production plants - Other				
TOTAL		5.7684	5.7684	
SHARE OF TOTAL ELECTRICITY PRODUCTION		100%		
SHARE OF TOTAL ELECTRICITY CONSUMPTION*		15.2% (46%)		

*Compared to the total electricity consumption in MEI (only for cities reporting local electricity production)

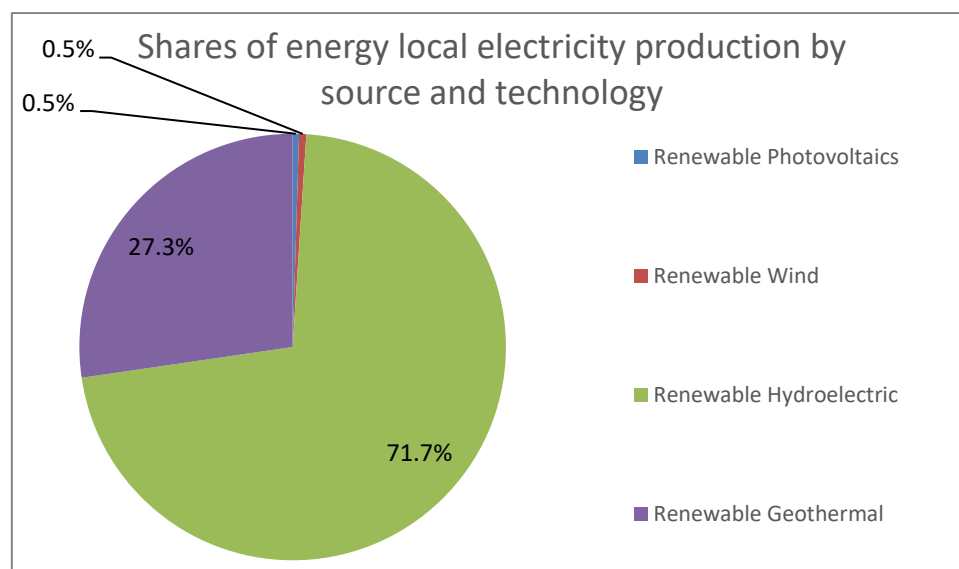
Source: JRC elaboration based on GCoM data

Table 54. Local electricity production in MEIs related to 2020 commitments – non-EU (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.0113	0.0113
Wind		0.0129	0.0129
Hydroelectric		1.6882	1.6882
Geothermal		0.6431	0.6431
Local electricity production plants - Combined Heat and Power			
Local electricity production plants - Other			
TOTAL		2.3554	2.3554

Source: JRC elaboration based on GCoM data

Figure 31. Shares of local electricity production by energy source and technology, reported in MEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.5.2 Local heat/cold production

Considering local heat/cold supply, the highest share of local heat/cold production correspond with non-renewable district heating (heat only), with almost 97%. See Table 55 for the complete description of the

total production by technology. Furthermore, 100% of the production relies on non-renewable sources, representing 91% of the MEI heat/cold consumption for the cities reporting local heat/cold production. As shown in

Table 56, the per capita production with non-renewable fuels amounts to 1.74 MWh/year. Figure 32 shows the shares of the most representative heat/cold production sources and technologies.

Table 55. Local heat/cold production in MEIs related to 2020 commitments – non-EU (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Local heat/cold production plants - Combined Heat and Power	0.0701		0.0701	3.22%
Local heat/cold production plants - District heating (heat-only)	2.1073		2.1073	96.78%
Local heat/cold production plants – Other				
TOTAL	2.1774		2.1774	
SHARE ON TOTAL HEAT/COLD PRODUCTION	100%			
SHARE ON TOTAL HEAT/COLD CONSUMPTION*	27.98% (91%)			

* Compared to the total heat/cold consumption in BEI (only for cities reporting local heat/cold production)

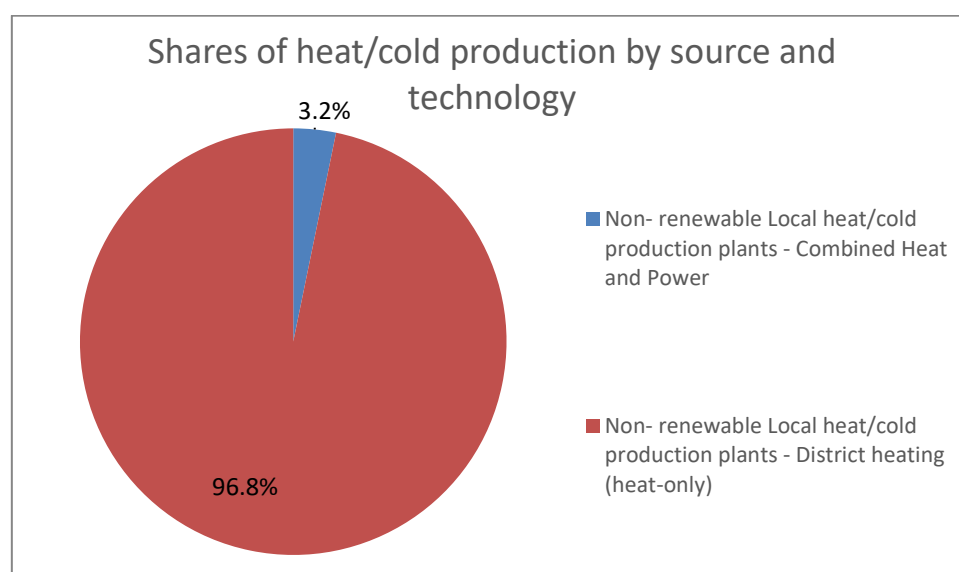
Source: JRC elaboration based on GCoM data

Table 56. Local heat/cold production in MEIs related to 2020 commitments – non-EU (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Local heat/cold production plants - Combined Heat and Power	0.056		0.056
Local heat/cold production plants - District heating (heat-only)	1.6841		1.6841
Local heat/cold production plants – Other			
TOTAL	1.7401		1.7401

Source: JRC elaboration based on GCoM data

Figure 32. Shares of local heat/cold production by energy source and technology, reported in MEIs related to 2020 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.1.6 Achievements in energy savings

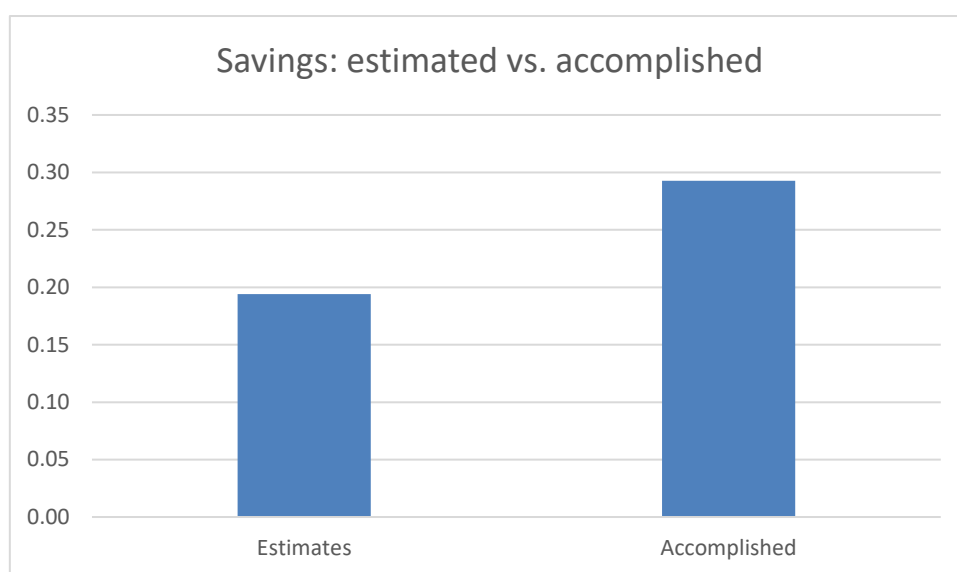
Now, in order to verify the actual savings for signatories holding a MEI, the total savings are examined below, identifying the most successful signatories in accomplishing significant savings.

3.1.6.1 Accomplished savings

After computing the difference between the BEI and the MEI consumption for the 2020 non-EU signatories holding a MEI, the total savings amount to 19.6 TWh/year (1.37 MWh/year per capita). The total savings amount to 8.6% of the reported BEI, and 9.5% of the MEI consumption.

Considering only the signatories that reported estimates for energy savings and reported a MEI as well, they accomplished a mean annual rate of per capita energy savings of 0.29 MWh/year, exceeding the estimated rate (reported by the cities) of 0.19 MWh/year (see Figure 33).

Figure 33. Mean yearly per capita energy savings, estimated vs. accomplished, related to 2020 commitments – non-EU (units MWh/year per capita).



Source: JRC elaboration based on GCoM data

Examining the accomplished absolute savings, the cities achieving the highest annual savings rates are Mariupol, Vinnytsia and Sunderland, saving 0.95, 0.46 and 0.28 TWh/year, respectively. The top-10 cities, regarding their yearly absolute and per capita savings rates, are presented in Table 57.

Table 57. Top-10 signatories with highest savings rates, related to 2020 commitments – non-EU (units TWh/year)

CITY	COUNTRY	BASE YEAR	LAST MONITORING YEAR	ABSOLUTE SAVINGS	ABSOLUTE SAVINGS ANNUAL RATE	SAVINGS PER CAPITA (MWh/year)	SAVINGS PER CAPITA ANNUAL RATE (MWh/year)
Mariupol	Ukraine	2010	2020	9.5	0.95	21.00757	0.84
Vinnytsia	Ukraine	2010	2018	3.67	0.459	9.922344	1.26
Sunderland	United Kingdom	2005	2007	0.56	0.278	1.981418	0.97
Cardiff	United Kingdom	2005	2015	2.36	0.236	6.609868	0.89
Leicester	United Kingdom	1990	2013	4.98	0.217	14.92538	0.9
Milton Keynes	United Kingdom	2005	2014	1.83	0.203	7.05603	1.23

CITY	COUNTRY	BASE YEAR	LAST MONITORING YEAR	ABSOLUTE SAVINGS	ABSOLUTE SAVINGS ANNUAL RATE	SAVINGS PER CAPITA (MWh/year)	SAVINGS PER CAPITA ANNUAL RATE (MWh/year)
Aberdeen	United Kingdom	2005	2012	1.42	0.203	6.198629	1.4
Kadikoy	Türkiye	2010	2016	1.18	0.196	2.599312	0.11
Bălți	Moldova	2015	2016	0.19	0.194	1.283365	2.51
Bristol	United Kingdom	2005	2013	1.45	0.181	3.30307	0.58

Source: JRC elaboration based on GCoM data

3.2 2030 Commitments – non-EU

In this section, the analysis focuses on non-EU signatories with a commitment for the target year of 2030.

3.2.1 BEI energy consumption

Considering signatories in non-EU with 2030 commitments, there are 140 signatories with a BEI, with an approximate population of 19 million inhabitants. It can be seen that the type of fuel with the greatest total share of consumption is fossil fuels (71%), followed by electricity (20%) and district heating and cooling (8%). The situation depicted here by the BEI of 2030 commitments is very much in line with the analogous one of 2020 commitments. Furthermore, the sector with the highest share is residential buildings (41%), followed by private and commercial transport (31%). Thus, for 2030 commitments, the Industry (non-ETS) sector does not have as much importance as for 2020 commitments, where it had a 20% share, it now has a 6%. See Tables 58-60 for the absolute, percentage and per capita values, respectively, and Figures 34-35 for the visualisation of the shares for the most significant sectors and fuel sources, respectively.

Examining the per capita consumption, it can be pointed out that the fossil fuels represent the maximum consumption value, with 7 MWh/year per capita, followed by electricity, with 2 MWh/year per capita. These values show a decrease with respect to 2020 signatories, from 9.6 to 7 and from 3.2 to 2 MWh/year per capita, for fossils and electricity, respectively. Meanwhile, renewable fuels represent the minimum consumption, with 0.14 MWh/year per capita. The sectors with highest consumption are residential buildings (4.1 MWh/year per capita) and private and commercial transport (3 MWh/year per capita), while all the other sectors, except tertiary buildings (1.2 MWh/year per capita), have a per capita consumption of less than 1 MWh/year.

Table 58. Energy consumption reported in BEIs related to 2030 commitments – non-EU (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	3.1434	2.5036	1.8989	0.0892	7.6351	4.03%
Residential buildings	18.3182	11.5760	45.4257	2.2754	77.5954	40.98%
Tertiary (non-municipal) buildings, equipment/facilities	12.4023	0.4430	10.9101	0.2248	23.9802	12.67%
Industry Non-ETS	1.8347	0.0021	10.0586	0.0044	11.8998	6.28%
Industry-ETS	2.4279		0.1983	0.0043	2.6304	1.39%
Buildings, equipment/facilities non-allocated	0.0337		2.1800		2.2136	1.17%

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Subtotal - Stationary energy	38.1601	14.5247	70.6717	2.5981	125.954	66.52%
Municipal fleet			0.4896		0.4896	0.26%
Public transport	0.4698		3.0854		3.5552	1.88%
Private and commercial transport	0.0002		58.8027		58.8029	31.06%
Transport non-allocated			0.0001		0.0001	0.00%
Subtotal - Transport	0.4700		62.3779	0.0000	62.8478	33.19%
Agriculture, Forestry, Fisheries	0.0003		0.5297	0.0051	0.5351	0.28%
Other non-allocated						
Subtotal - Other	0.0003	0.0000	0.5297	0.0051	0.5351	0.28%
TOTAL	38.6303	14.5247	133.5793	2.6032	189.337	
SHARE	20.40%	7.67%	70.55%	1.37%		

Source: JRC elaboration based on GCoM data

Table 59. Energy consumption reported in BEIs related to 2030 commitments – non-EU (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	1.66%	1.32%	1.00%	0.05%	4.03%
Residential buildings	9.67%	6.11%	23.99%	1.20%	40.98%
Tertiary (non-municipal) buildings, equipment/facilities	6.55%	0.23%	5.76%	0.12%	12.67%
Industry Non-ETS	0.97%	0.00%	5.31%	0.00%	6.28%
Industry-ETS	1.28%		0.10%	0.00%	1.39%
Buildings, equipment/facilities non-allocated	0.02%		1.15%		1.17%
Subtotal - Stationary energy	20.15%	7.67%	37.33%	1.37%	66.52%
Municipal fleet			0.26%		0.26%
Public transport	0.25%		1.63%		1.88%
Private and commercial transport	0.00%		31.06%		31.06%
Transport non-allocated			0.00%		0.00%
Subtotal - Transport	0.25%	0.00%	32.95%	0.00%	33.19%
Agriculture, Forestry, Fisheries	0.00%		0.28%	0.00%	0.28%
Other non-allocated					
Subtotal - Other	0.00%	0.00%	0.28%	0.00%	0.28%
TOTAL	20.40%	7.67%	70.55%	1.37%	

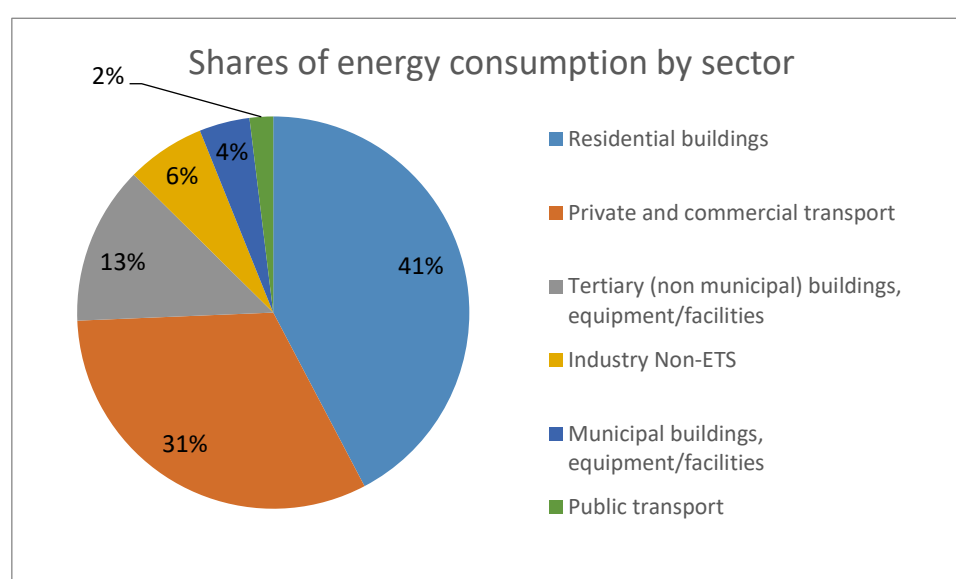
Source: JRC elaboration based on GCoM data

Table 60. Energy consumption reported in BEIs related to 2030 commitments – non-EU (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.1657	0.1320	0.1001	0.0047	0.4025
Residential buildings	0.9658	0.6103	2.3949	0.1200	4.0910
Tertiary (non-municipal) buildings, equipment/facilities	0.6539	0.0234	0.5752	0.0119	1.2643
Industry Non-ETS	0.0967	0.0001	0.5303	0.0002	0.6274
Industry-ETS	0.1280		0.0105	0.0002	0.1387
Buildings, equipment/facilities non-allocated	0.0018		0.1149		0.1167
Subtotal - Stationary energy	2.0119	0.7658	3.7259	0.1370	6.6406
Municipal fleet			0.0258		0.0258
Public transport	0.0248		0.1627		0.1874
Private and commercial transport	0.0000		3.1002		3.1002
Transport non-allocated			0.0000		0.0000
Subtotal - Transport	0.0248	0.0000	3.2887	0.0000	3.3135
Agriculture, Forestry, Fisheries	0.0000		0.0279	0.0003	0.0282
Other non-allocated					
Subtotal - Other	0.0000	0.0000	0.0279	0.0003	0.0282
TOTAL	2.0367	0.7658	7.0425	0.1372	9.9822

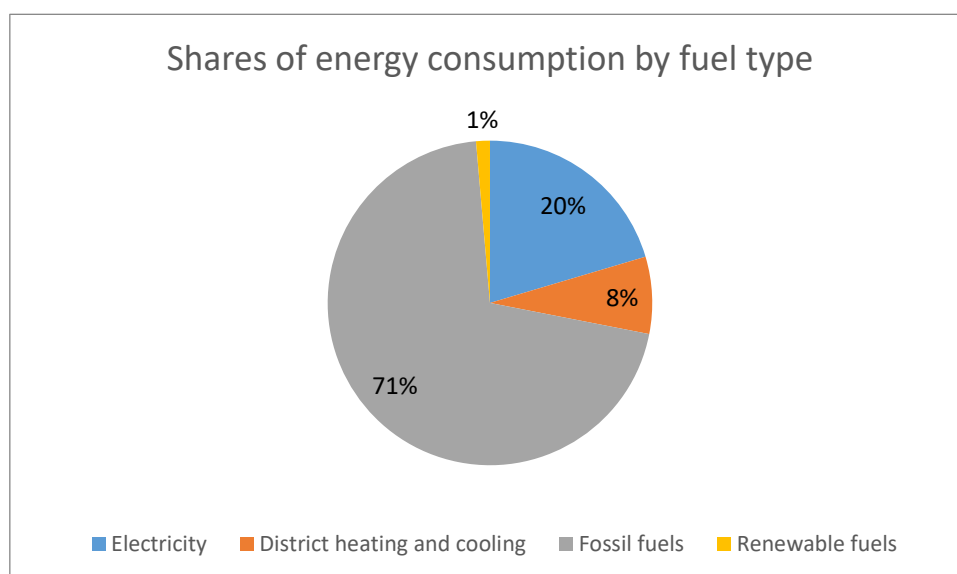
Source: JRC elaboration based on GCoM data

Figure 34. Shares of energy consumption by sector, reported in BEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

Figure 35. Shares of energy consumption by fuel type, reported in BEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.2.2 BEI Energy supply

Looking at the reported energy output from the signatories having reported a BEI, there are 18, out of the 140, having also reported some local heat/cold or electricity production.

3.2.2.1 Local electricity production and purchases of renewable energy certificates

The maximum share of local electricity production, out of 3 signatories reporting data, correspond with renewable hydroelectric power (88%) and non-renewable CHP (12.4%). Besides this, there is a small portion (0.02%) of wind power. See Table 61 for the complete description of the total production by technology. In this way, renewable energy, with an 88% share, represents 16% of the BEI electricity consumption for these cities. As presented in Table 62, the per capita production for hydroelectric and CHP amount to 0.2 and 0.03 MWh/year per capita, respectively. Figure 36 shows the shares of the most representative electricity production sources and technologies.

For 2030 commitments in non-EU, there is no information reported in the BEI on renewable energy purchases.

Table 61. Local electricity production in BEIs related to 2030 commitments – non-EU (units TWh/year).

Energy production technology	Non- renewable	Renewable	TOTAL	SHARE
Photovoltaics		0.0000	0.0000	0.00%
Wind		0.0001	0.0001	0.02%
Hydroelectric		0.7002	0.7002	87.60%
Geothermal				
Local electricity production plants - Combined Heat and Power	0.0989		0.0989	12.38%
Local electricity production plants - Other				
TOTAL	0.0989	0.7003	0.7992	
SHARE ON TOTAL ELECTRICITY PRODUCTION	12.38%	87.62%		
SHARE ON TOTAL ELECTRICITY CONSUMPTION*	0.26% (2.3%)	1.81% (16.3%)		

*Compared to the total electricity consumption in BEI (only for cities reporting energy supply)

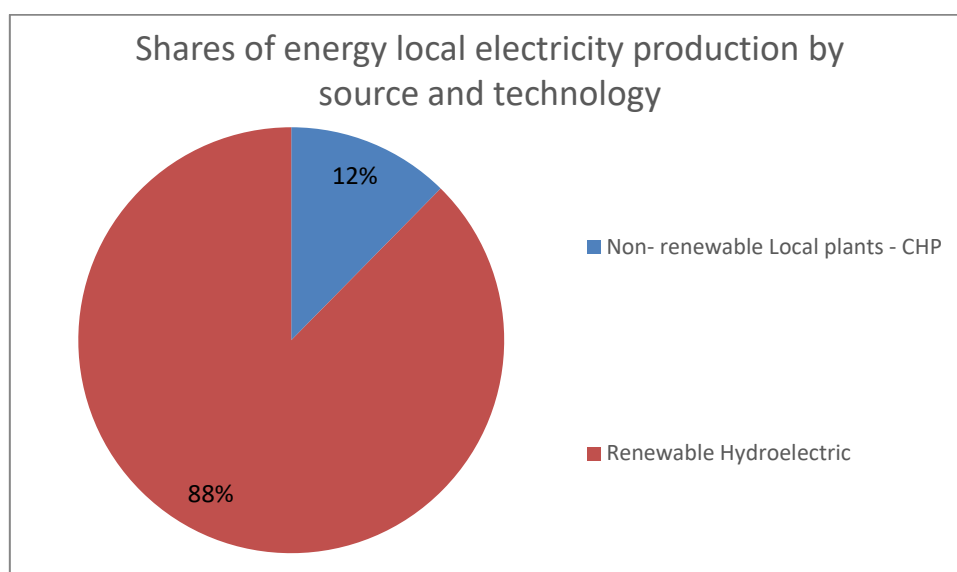
Source: JRC elaboration based on GCoM data

Table 62. Local electricity production in BEIs related to 2030 commitments – non-EU (units MWh/year per capita).

Energy production technology	Non- renewable	Renewable	TOTAL
Photovoltaics		0.0000	0.0000
Wind		0.0000	0.0000
Hydroelectric		0.2115	0.2115
Geothermal			
Local electricity production plants - Combined Heat and Power	0.0299		0.0299
Local electricity production plants - Other			
TOTAL	0.0299	0.2116	0.2415

Source: JRC elaboration based on GCoM data

Figure 36. Shares of local electricity production by energy source and technology, reported in BEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.2.2.2 Local heat/cold production

Considering local heat/cold supply, the 13 signatories reporting data have their total local heat/cold production assigned to non-renewable, district heating (heat only), representing 99% of their BEI heat/cold consumption. This amounts to a per capita production of 3 MWh/year.

3.2.3 Estimated energy savings and renewable energy production

Examining the reported estimated savings and renewable energy production from the 2030 non-EU signatories having reported a BEI, there are 117, out of the 140, having also reported some estimated savings or renewable energy production.

3.2.3.1 Estimated savings

The highest share of estimated savings corresponds with stationary energy, with 50% of the total estimated savings. The details can be seen in Table 63. The total savings represent 34% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 64, signatories estimate that they will be able to save, on average, 3.4 MWh/year per capita, by 2030. See Figure 37 for the shares of each activity sector in the total estimated savings.

Table 63. Estimated energy savings by 2030 declared by signatories – non-EU (units TWh/year).

Sector	Estimated energy savings	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	26.5405	50.24%
Transport	23.4916	44.47%
Local electricity production	1.5491	2.93%
Local heat/cold production	0.4767	0.90%
Other	0.7712	1.46%
TOTAL	52.8290	

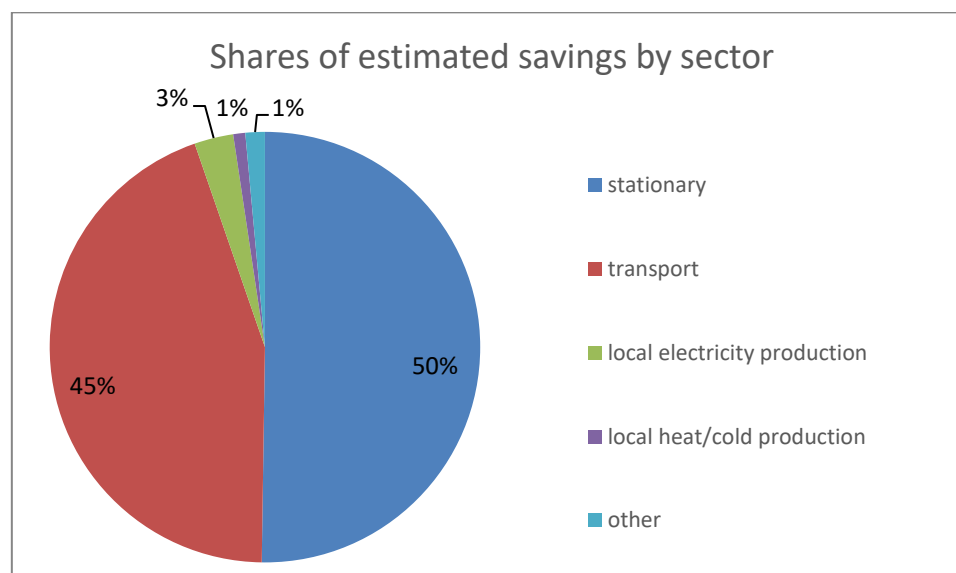
Source: JRC elaboration based on GCoM data

Table 64. Estimated energy savings by 2030 declared by signatories – non-EU (units MWh/year per capita).

Sector	Estimated energy savings
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	1.7220
Transport	1.5242
Local electricity production	0.1005
Local heat/cold production	0.0309
Other	0.0500
TOTAL	3.4277

Source: JRC elaboration based on GCoM data

Figure 37. Shares of estimated savings by sector, reported in BEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.2.3.2 Estimated renewable energy production

The highest share of renewable energy production corresponds to local electricity production (42%), followed by stationary energy (22%) and local heat/cold production (going from 30% to 12%, comparing with the

renewable energy production declared in the BEI of non-EU 2020 commitments). The details can be seen in Table 65. The total renewable energy production represents 2.3% of the reported consumption for these signatories (comparing the total consumption in BEI, only for cities having declared either energy savings or energy production by the target year). In total, as presented in Table 66, signatories estimate that by 2020, they will be able to produce, in average, 0.23 MWh/year per capita. Figure 38 shows the shares of each activity sector in the total estimated renewable energy production.

Table 65. Estimated renewable energy production by 2030 declared by signatories – non-EU (units TWh/year).

Sector	Estimated renewable energy production	SHARE
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.7920	22.03%
Transport	0.4844	13.47%
Local electricity production	1.5247	42.41%
Local heat/cold production	0.4331	12.04%
Other	0.3613	10.05%
TOTAL	3.5955	

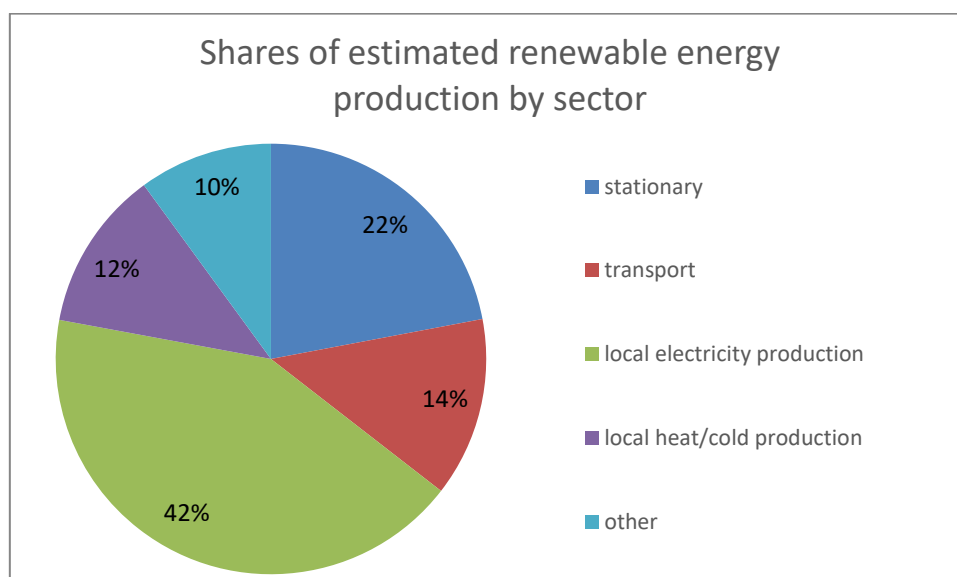
Source: JRC elaboration based on GCoM data

Table 66. Estimated renewable energy production by 2030 declared by signatories – non-EU (units MWh/year per capita).

Sector	Estimated renewable energy production
Stationary energy (includes, Municipal buildings, Lighting, Residential buildings, Tertiary buildings, Industry)	0.0514
Transport	0.0314
Local electricity production	0.0989
Local heat/cold production	0.0281
Other	0.0234
TOTAL	0.2333

Source: JRC elaboration based on GCoM data

Figure 38. Shares of estimated renewable energy production by sector, reported in BEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.2.4 MEI energy consumption

Regarding non-EU signatories with 2030 commitments, there are 21 signatories having reported a MEI, holding 3.6 million inhabitants. For these signatories, the type of fuel with the greatest total share of consumption is fossil fuels (83%), followed by electricity (14%). Comparing with the reported BEI consumption, the share of fossil fuels increased in 15%, but at the same time the district heating and cooling decreased in almost 9%, while the share on renewables slightly decreased in 0.7% (from 2% in 2020 to 1.35% in 2030 commitments).

Additionally, the consumption is mainly allocated in private and commercial transport (42%) and residential buildings (41%), with a declared 3.4 and 3.3 MWh/year per capita, respectively, followed by tertiary buildings (11%). See Tables 67-69 for the absolute, percentage and per capita values, respectively, of the energy consumption reported in MEIs, and Figures 39-40 for the visualisation of the shares for the most significant sectors and fuel sources, respectively. Examining the per capita consumption, it is relevant to point out that the consumption reported in the BEI for the different types of fuels remained rather stable, except for district heating and cooling and for renewables, decreasing from 1 to 0.09 and from 0.2 to 0.1 MWh/year per capita, respectively.

For 2030 commitments in non-EU, there is no information reported in the MEI on energy supply.

Table 67. Energy consumption reported in MEIs related to 2030 commitments – non-EU (units TWh/year).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
Municipal buildings, equipment/facilities	0.2553	0.0244	0.0690	0.0044	0.3531	1.17%
Residential buildings	2.0224	0.2831	9.5740	0.3982	12.278	40.64%
Tertiary (non-municipal) buildings, equipment/facilities	1.9197	0.0235	1.4028	0.0046	3.3505	11.09%
Industry Non-ETS	0.0001				0.0001	0.00%
Industry-ETS						
Buildings, equipment/facilities						

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL	SHARE
non-allocated						
Subtotal - Stationary energy	4.1976	0.3309	11.046	0.4072	15.981	52.89%
Municipal fleet			0.0521		0.0521	0.17%
Public transport	0.0588		1.5560		1.6148	5.34%
Private and commercial transport			12.566		12.566	41.59%
Transport non-allocated						
Subtotal - Transport	0.0588		14.174	0.0000	14.233	47.11%
Agriculture, Forestry, Fisheries	0.0001				0.0001	0.00%
Other non-allocated						
Subtotal - Other	0.0001	0.0000	0.0000	0.0000	0.0001	0.00%
TOTAL	4.2565	0.3309	25.22	0.4072	30.214	
SHARE	14.09%	1.10%	83.47%	1.35%		

Source: JRC elaboration based on GCoM data

Table 68. Energy consumption reported in MEIs related to 2030 commitments – non-EU (units %).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.85%	0.08%	0.23%	0.01%	1.17%
Residential buildings	6.69%	0.94%	31.69%	1.32%	40.64%
Tertiary (non-municipal) buildings, equipment/facilities	6.35%	0.08%	4.64%	0.02%	11.09%
Industry Non-ETS	0.00%				0.00%
Industry-ETS					
Buildings, equipment/facilities non-allocated					
Subtotal - Stationary energy	13.89%	1.10%	36.56%	1.35%	52.89%
Municipal fleet			0.17%		0.17%
Public transport	0.19%		5.15%		5.34%
Private and commercial transport			41.59%		41.59%
Transport non-allocated					
Subtotal - Transport	0.19%	0.00%	46.91%	0.00%	47.11%
Agriculture, Forestry, Fisheries	0.00%				0.00%
Other non-allocated					
Subtotal - Other	0.00%	0.00%	0.00%	0.00%	0.00%
TOTAL	14.09%	1.10%	83.47%	1.35%	

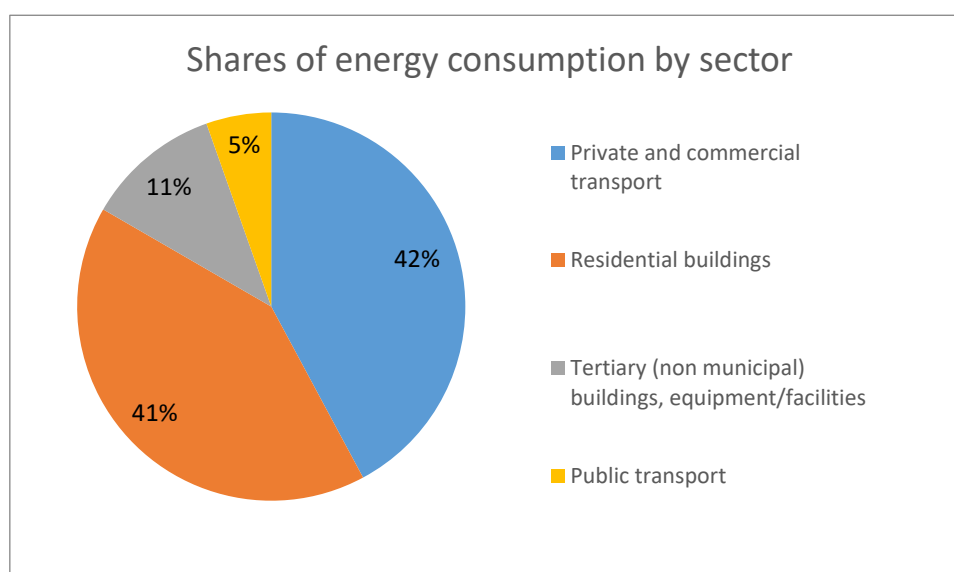
Source: JRC elaboration based on GCoM data

Table 69. Energy consumption reported in MEIs related to 2030 commitments – non-EU (units MWh/year per capita).

Sector / Sub-sector	Electricity	District heating and cooling	Fossil fuels	Renewable fuels	TOTAL
Municipal buildings, equipment/facilities	0.0696	0.0067	0.0188	0.0012	0.0963
Residential buildings	0.5514	0.0772	2.6102	0.1086	3.3473
Tertiary (non-municipal) buildings, equipment/facilities	0.5234	0.0064	0.3824	0.0013	0.9135
Industry Non-ETS	0.0000				0.0000
Industry-ETS					0.0000
Buildings, equipment/facilities non-allocated					0.0000
Subtotal - Stationary energy	1.1444	0.0902	3.0115	0.1110	4.3571
Municipal fleet			0.0142		0.0142
Public transport	0.0160		0.4242		0.4403
Private and commercial transport			3.4259		3.4259
Transport non-allocated					0.0000
Subtotal - Transport	0.0160	0.0000	3.8644	0.0000	3.8804
Agriculture, Forestry, Fisheries	0.0000				0.0000
Other non-allocated					0.0000
Subtotal - Other	0.0000	0.0000	0.0000	0.0000	0.0000
TOTAL	1.1605	0.0902	6.8758	0.1110	8.2375

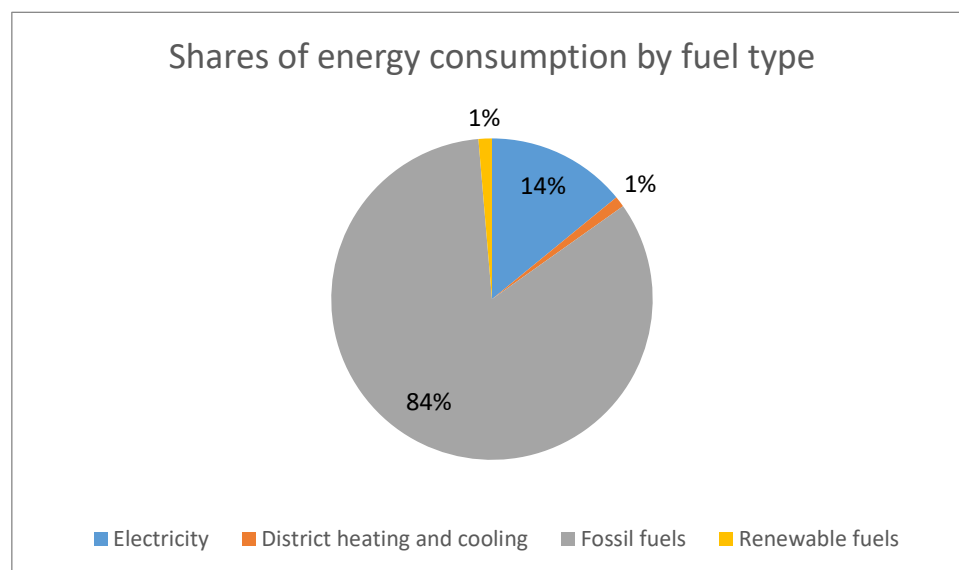
Source: JRC elaboration based on GCoM data

Figure 39. Shares of energy consumption by sector, reported in MEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

Figure 40. Shares of energy consumption by fuel type, reported in MEIs related to 2030 commitments – non-EU.



Source: JRC elaboration based on GCoM data

3.2.5 Achievements in energy savings

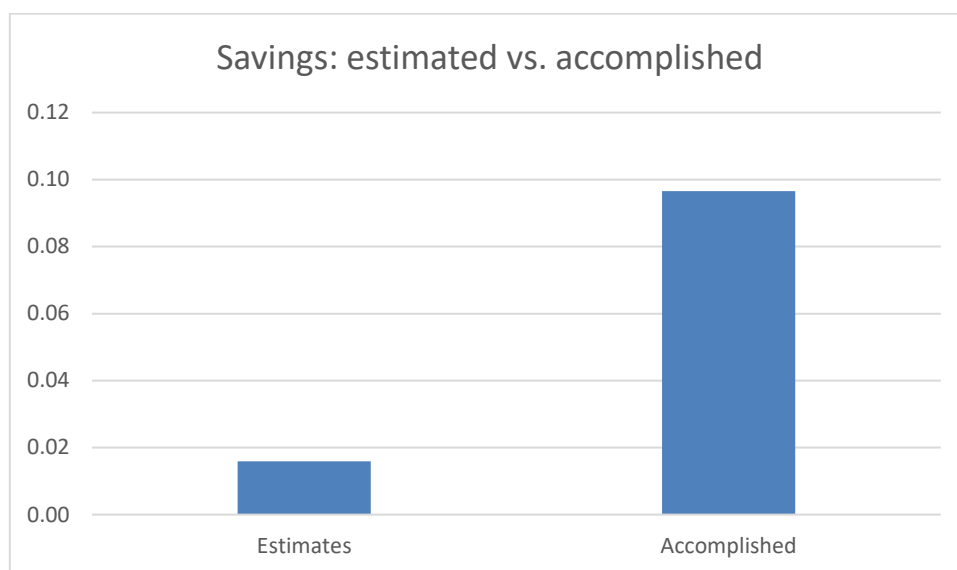
Focusing on the actual savings for signatories holding a MEI, the total savings are presented next, identifying the most successful signatories in accomplishing significant savings for 2030.

3.2.5.1 Accomplished savings

After computing the difference between the BEI and the MEI consumption for the 2020 non-EU signatories holding a MEI, there are no savings for these sample of Covenant cities (the negative savings amount to -1.9 TWh/year, representing -0.53 MWh/year per capita). This negative value is mainly due to the city of Bursa Metropolitan Municipality (holding almost 3 million inhabitants), which increased their energy consumption in 2.87 TWh/year from 2014 to 2016. The total (negative) savings amount to 6% of the reported BEI or MEI consumption.

Considering only the signatories that reported estimates for energy savings and reported a MEI as well, they accomplished a (positive) mean annual rate of per capita energy savings of 0.09 MWh/year, exceeding the reported/estimated rate of 0.016 MWh/year (see Figure 41).

Figure 41. Mean yearly per capita energy savings, estimated vs. accomplished, related to 2030 commitments – non-EU (units MWh/year per capita).



Source: JRC elaboration based on GCoM data

Examining the accomplished absolute savings, the cities achieving the highest yearly savings rates are Gradiška, Tuzla and Lukavac, saving 0.016, 0.01 and 0.009 TWh/year, respectively. The top-10 cities, regarding their yearly absolute and per capita savings rates, is given in Table 70.

Table 70. Complete ranking (top-10) of signatories with highest savings rates, related to 2030 commitments – non-EU (units TWh/year)

CITY	COUNTRY	BASE YEAR	LAST MONITORING YEAR	ABSOLUTE SAVINGS	ABSOLUTE SAVINGS ANNUAL RATE	SAVINGS PER CAPITA (MWh/year)	SAVINGS PER CAPITA ANNUAL RATE (MWh/year)
Gradiška	Bosnia and Herzegovina	2005	2017	0.19	0.016	3.66	0.2
Tuzla	Bosnia and Herzegovina	2002	2020	0.18	0.01	1.65	0.09
Lukavac	Bosnia and Herzegovina	2010	2020	0.09	0.009	2.2	0.18
Bijeljina	Bosnia and Herzegovina	2004	2020	0.11	0.007	1.1	0.07
Doboj	Bosnia and Herzegovina	2013	2020	0.05	0.007	0.78	0.07
Bihac	Bosnia and Herzegovina	2010	2020	0.05	0.005	0.86	0.08
Sanski Most	Bosnia and Herzegovina	2011	2020	0.03	0.004	0.85	0.08
Tešanj	Bosnia and Herzegovina	2008	2020	0.04	0.003	0.95	0.09
Zvornik	Bosnia and Herzegovina	2009	2020	0.03	0.003	0.65	0.05
Cazin	Bosnia and Herzegovina	2005	2020	0.04	0.003	0.65	0.04

Source: JRC elaboration based on GCoM data

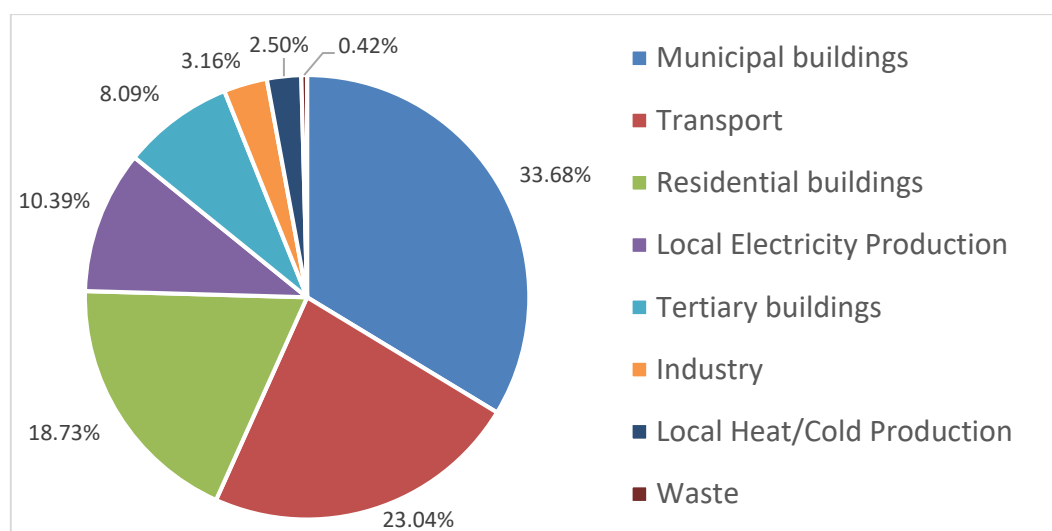
4 Policies accomplishing energy savings

Considering the actions and strategies that GCoM signatories plan and implement to achieve their ambitions, it is relevant to examine the general statistics on the sectors, areas and instruments reported in their SEAPs/SECAPs. In this section, an overview of the main policies is presented, focusing on the subset of signatories, for EU-27 and non-EU, achieving energy savings according to their submitted reports and inventories. In this way, the analysis only concerns the cities accomplishing a positive annual savings rate.

4.1 Overview of policies in EU-27

Concerning mitigation action sectors, the greatest share corresponds with buildings, where considering municipal, residential and tertiary buildings, it represents 61%. Transport also has an important share with 23%, as well as local electricity production (10%). This is coherent with the previous analysis on the BEI and MEI, where buildings (mainly residential) and transport are the two sectors with the highest relevance for the cities. Figure 42 presents the shares of sectors for the cities that reported actions, having a total of 49 693 individual actions, accomplishing savings in EU-27 (excluding missing and “other sectors”).

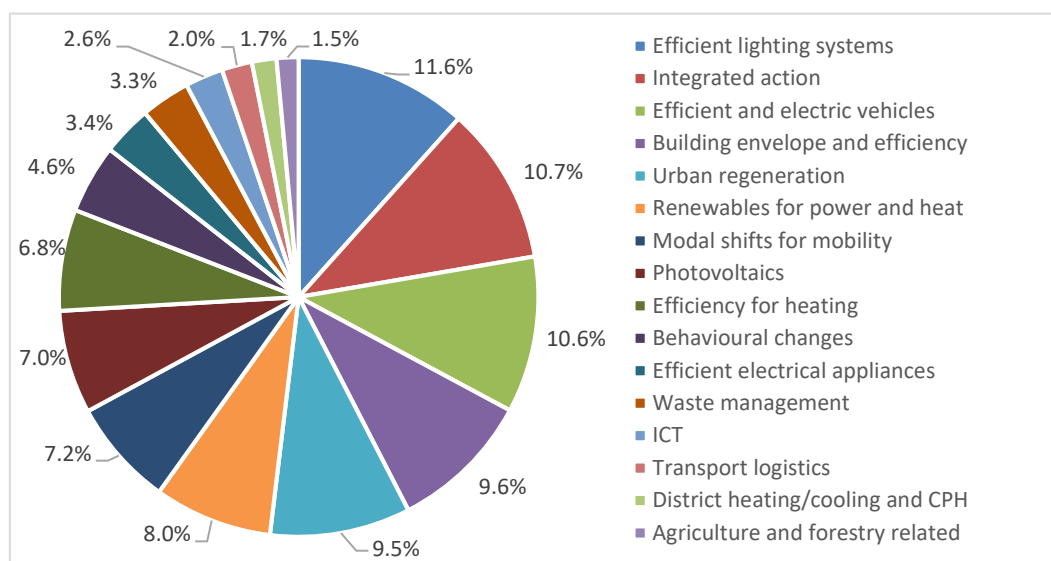
Figure 42. Main action sectors in EU-27. Tertiary buildings makes reference to Tertiary (non municipal) buildings, equipment/facilities.



Source: JRC elaboration based on GCoM data

Regarding the mitigation action areas, cities focused their attention on Efficiency in the lighting systems, Integrated action (tackling several energy/climate aspects), Efficient and electric vehicles, Building envelope and efficiency, and Urban regeneration (which includes tree planting in urban areas), each one of them with an approximate share of 10% to 12%. Figure 43 presents the complete shares for the areas, where Renewables for power and heat includes the sub-areas of Renewable energy for heating, Wind power, Hydroelectric power, Industry renewable energy and Biomass power plant; Modal mobility shifts includes Modal shift to walking and cycling, to public transport, and car sharing; Behavioural changes includes Eco-driving; Transport logistics include Road network optimization and Urban freight transport; and District heating/cooling and CHP includes District heating/cooling network, Combined heat and power (CHP) and District heating/cooling plants.

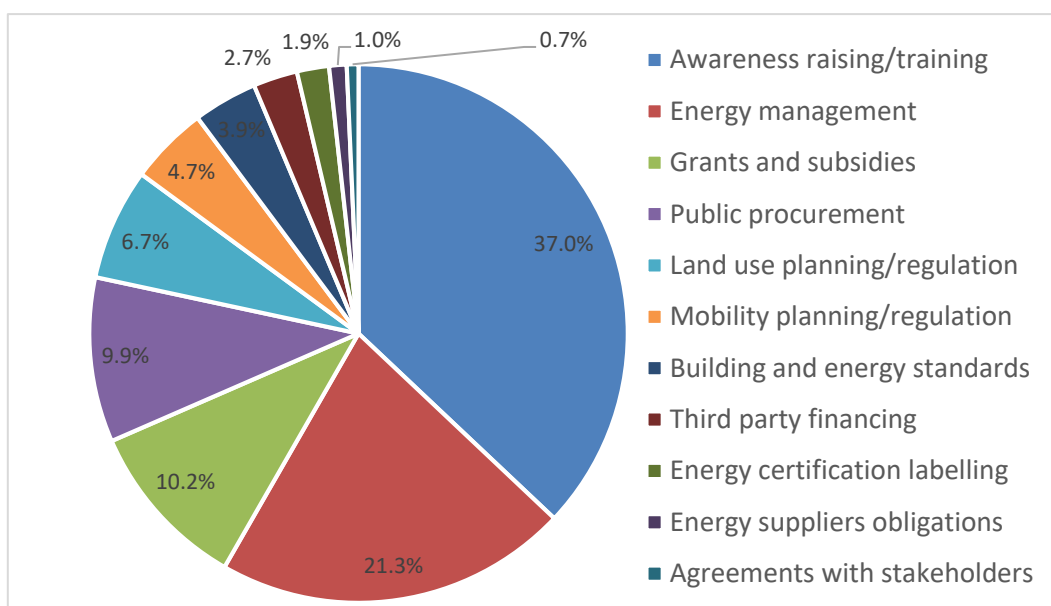
Figure 43. Main action areas in EU-27, excluding missing and “other areas”, as well as the less frequent Energy efficiency in industrial processes, Industry other, Mixed use development and sprawl containment and Smart grids.



Source: JRC elaboration based on GCoM data

Lastly, for the instruments being used by the cities, Awareness raising and training campaigns receive the highest share (37%), followed by Energy management (21%), Grants and subsidies (10%) and Public procurement (10%). The complete picture of the instruments taking part of the cities' actions can be seen in Figure 44.

Figure 44. Main action instruments in EU-27 (excluding missing, not applicable and “other instruments”, as well as the less frequent Integrated ticketing and charging, Energy carbon taxes and Road pricing).

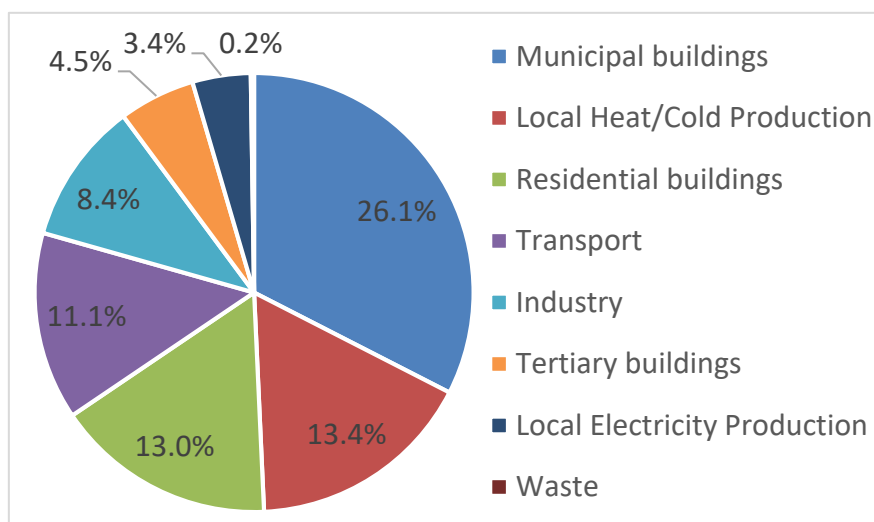


Source: JRC elaboration based on GCoM data

4.2 Overview of policies in non-EU

Turning the attention towards non-EU cities, there are a total of 2064 individual actions, most of them addressing (municipal, residential and tertiary) buildings (44%), followed by local heat/cold production (13%) and transport (11%). Comparing with the sectors included by EU-27 cities, this last sector for local heat/cold production has more importance for non-EU cities, and on the contrary, local electricity production has less importance. Recall that for EU-27, the local heat/cold production sector had a share of only 2.5% (against the 13% of non-EU), while the local electricity production one had a share of 10% (against the 3% of non-EU), pointing out the different energy needs that both regions have. Figure 45 presents the shares of sectors (excluding missing and “other sectors”).

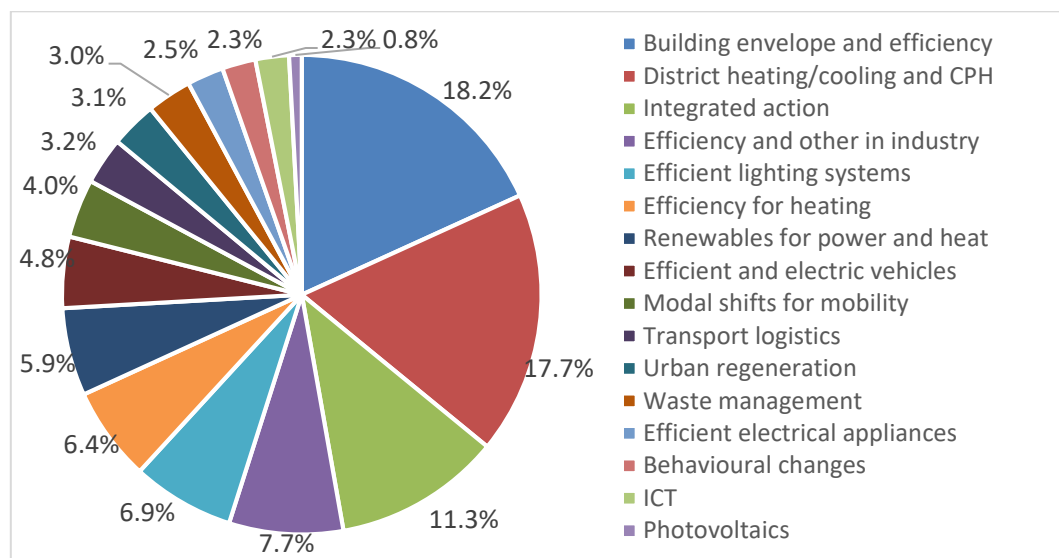
Figure 45. Main action sectors in non-EU. Tertiary buildings makes reference to Tertiary (non municipal) buildings, equipment/facilities.



Source: JRC elaboration based on GCoM data

Focusing on the mitigation action areas, the most relevant ones refer to Building envelope and efficiency and District heating/cooling and CPH, both of them with 18%, followed by Integrated action (11%) and Efficiency and other in industry (8%). Figure 46 shows the complete shares for the different action areas.

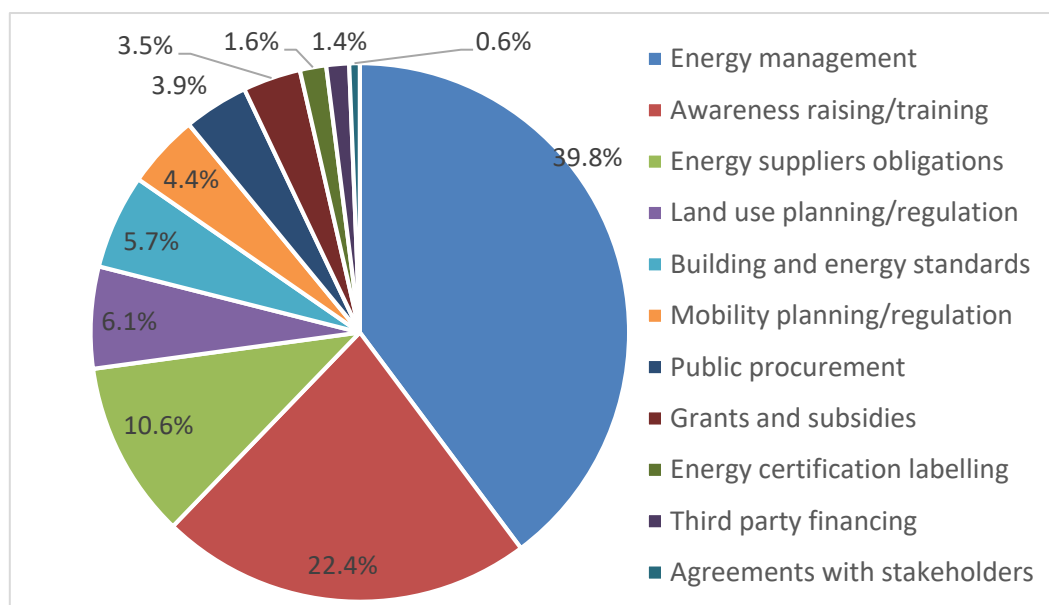
Figure 46. Main action areas in non-EU (excluding missing and “other areas”).



Source: JRC elaboration based on GCoM data

Lastly, the instruments that have more popularity for these subset of non-EU cities are Energy management (40%), Awareness raising and training campaigns (22%) and Energy suppliers obligations (11%). See Figure 47 for the complete picture of the participation of the different instruments in the actions for these non-EU cities.

Figure 47. Main action instruments in non-EU (excluding missing, not applicable and “other instruments”).



Source: JRC elaboration based on GCoM data

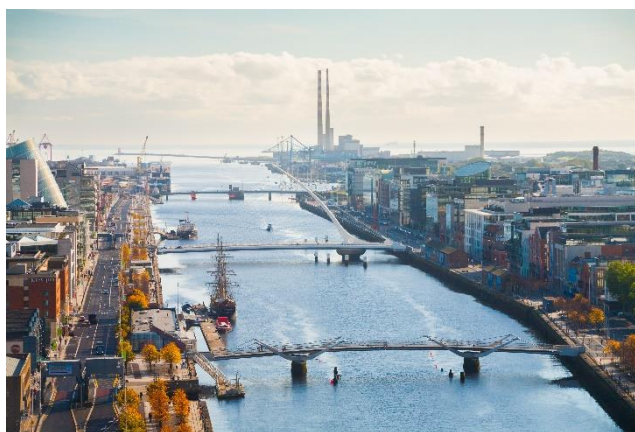
4.3 Illustration of the cities' actions

In this section, some successful projects are outlined for CoM cities accomplishing significant energy savings and local renewable energy production. Big cities like Dublin, Murcia or Mariupol, medium-sized cities like Gent, Padova and Tuzla, and smaller ones like Tipperary County and Sambir, are just a few examples of what cities can accomplish by engaging with stakeholders, gaining funding and planning and implementing a comprehensive set of actions fitted to their own context. From encouraging energy efficiency and sustainable mobility, to supporting the use of electricity from renewable energy sources and renewable energy generation, the following examples are just some snapshots of successful climate and energy plans already showing results for energy savings and renewable energy production.

4.3.1 Dublin (Ireland)

Dublin City Council, joined the CoM initiative in 2009 with an initial goal of reducing carbon dioxide emissions in 20%, from 2006 to 2020. Already in 2016, the city surpassed its initial goal, and achieved a 45% reduction. The transport sector had the major contribution on that achievement and reduced its emissions in 41%. More than half of the key actions presented on the SEAP focused on actions in that sector, encouraging the use of electric and efficient vehicles as well as cycling. It can be highlighted that almost all new cars registered in the last years were in an A band of efficiency, and that the numbers of journeys using bicycles increased more than 3 times between 2010 and 2016, mainly due to improved bicycle lanes.

Another sector that calls for attention is the buildings sector, which accounts for approximately 65% of the total energy consumed reported by the city. Some examples of mitigation actions in this sector focus on the smart use of energy and energy efficiency in households, new lighting systems and retrofitting opportunities. This sector contributed to an overall reduction of around 2 TWh/year within the period considered; representing a 34% reduction in the energy use and a 37% reduction in carbon emissions. According to the Monitoring and Progress Report of 2014 (2006-2011), and the BEI for 2016 (2011-2016), the residential sector had a significant contribution for those results, as total energy use per dwelling reduced from 31 MWh/year in 2006 to 21.8 MWh/year in 2011, and finally to 18.9 MWh/year in 2016. Additionally, from 2006 to 2016, the most common Building Energy Rating (BER) for a Dublin City dwelling changed from a 'G' rating to a 'D2' rating.



Dublin City Council (DCC) is the largest local authority in its country, leading by example with energy measures for its own buildings and facilities. Some of the actions proposed by the council focused on increasing energy efficiency on its buildings, also including green solutions (such as green roofs), accomplishing a 15% reduction of its own energy consumption, representing a decrease of 33% on its associated emissions.

4.3.2 Murcia (Spain)

The Spanish city of Murcia, with almost 500 000 inhabitants, enjoys the sunny Mediterranean weather with a



strong economic activity in the sectors of agriculture and tourism. Murcia's commitments, first for 2020 and then for 2030, propose a total of 172 actions, 26 of them targeting adaptation and 151 targeting mitigation. Overall, 142 actions aim at improving energy efficiency in the municipality. Aggregating the estimated outcome of those actions, the municipality expects to reduce 908 364 tCO₂, save 1 824 474 MWh/year, and produce 394 190 MWh/year of renewable energy. From 2007 to 2019, the city was already able to achieve a reduction of 167 732 tCO₂, savings of 447 130 MWh/year and to

produce 160 079 MWh/year of renewable energy.

Looking at the actions by sector, there are 41 actions targeting municipal buildings, 35 actions for transport, 18 actions dealing with local electricity or heat/cold production, and 15 actions on residential buildings. Concerning the funding of Murcia's project, the majority of actions are (co-)financed by the local authority (83 actions), whilst public bodies or instruments (e.g., national, regional and EU funds) co-finance the remaining actions.

Some of Murcia's most relevant actions are:

- Promote the Local Electric Vehicle Strategy. It includes measures and discounts that will be implemented to promote the use of electric vehicles, such as implementing a municipal network of charging stations.
- Creation of 30km/h zones and dissuasive parking lots, promotion of public transport, use of alternative fuels to diesel in public bus transport, extension of the tram, contingency of new licenses or transfers of taxis to be ecological vehicles (eco-taxis), installation of electric chargers for vehicles and parking spaces reserved for electric cars, and installation of biodiesel pumps at municipal gas stations.
- Improvement of the buildings thermal envelope with the objective of renewing at least 15% of the municipality's homes, and achieve savings of 28% in the residential consumption of air conditioning.
- Actions to improve energy efficiency in public lighting, including the replacement of 4 000 balloons for lighting with a 0% higher hemispheric flow, the conversion of 12 000 points of sodium vapor light (100W) for others of 50 W, a pilot project of photovoltaic solar streetlights at the *Plaza de la Sostenibilidad*, with an allocated budget of EUR 20 000, and the replacement of 79 points of sodium vapor by 89 of LED technology at the *Plaza Circular*.

4.3.3 Mariupol (Ukraine)

Mariupol joined the initiative in 2013 as a signatory of the Covenant of Mayors East Eastern Partnership (CoM East), an EU-funded project aimed at introducing the EU climate and energy initiative to the Eastern Partnership countries. It has been an active signatory in the region achieving remarkable success until the beginning of Russia invasion¹³.

According to the monitoring report submitted in 2022 including updated figures up to 31-12-2020, the city had reached a 16% reduction of emissions compared to year 2010. In some sectors, such as buildings and transport, the results outperformed the initial estimations included in the original SECAP. For instance, for the transport sector, about 3 000 MWh/year of energy savings and 700 tCO₂ of emissions reduction were originally expected. However, thanks to the implementation of the mitigation actions, the latest reported savings were calculated at 9 800 MWh/year, and emissions reduction of 5 600 tCO₂.

Among the planned transport actions, the renewal of municipal public transport was included as one of the key priorities, considering it serves 35% of the annual passenger turnover of 140 million passengers: Thanks also to the support of International Financial Institutions, Mariupol was able to:



- Renew the fleet by financing the acquisition of up to 72 modern, low-floor, energy efficient and environment friendly trolleybuses (replacing depleted vehicles and increasing the service levels to approximately 80 vehicles in daily service) and associated maintenance equipment.
- Renew the trolleybus infrastructure (including electrical sub-stations and cabling network).

¹³ During February 2022, the three-month-long Russian siege of Mariupol largely destroyed the city, including the public infrastructure, and in May 2022 the city fell to Russian control.

With an investment of EUR 16.21 million (with funding from the European Bank for Reconstruction and Development, the Eastern Europe Energy Efficiency and Environment Partnership, the Construction Training Fund and local contribution), the outcome of the project is estimated at EUR 1.35 million per year of monetary savings, 2 704 MWh/year reduction of energy consumption, and an emissions reduction of 1 369 tCO₂.

4.3.4 Gent (Belgium)

With a foreseen budget of EUR 289 million, Gent was the first Flemish city to join the CoM initiative. From 2007 to 2030, the city committed to achieving a 40% reduction on CO₂ emissions. In 2018, a reduction of 17% was already achieved.

Gent has a full commitment with energy use reduction and the increasing share of renewable energy sources in its local electricity production. This is reflected on the actions proposed in its SECAP. Most of the actions in the plan are related with the growth local production of electricity from renewable energy sources. Between 2007 and 2018, electricity from wind generation rose 146% and photovoltaic generation 130%, leading to a reduction in the local CO₂ emission factor of around 15%. Thus, the local emission factor of 0.226 tCO₂/MWh is now below the national average of 0.275 tCO₂/MWh. In addition, renewables sources increased the participation in 61% in the total production for local electricity, while the use of non-renewable sources reduced in 13%.



Regarding actions related to energy savings, most of the actions proposed by the city focused on the buildings sector, which accounted for more than 50% of the energy consumption. The actions are related with the energy management and behaviour changes for an efficient use of energy in the buildings, and most of the initiatives address the residential sector. As a result, a reduction of 13% was achieved for the whole buildings sector (17% if considering only the residential sector).

4.3.5 Padova (Italy)

In 2010, Padova joined the CoM initiative with a target of achieving a 21% CO₂ emissions reduction by 2020, compared with 2005. Until 2017, the commune decreased its emissions in 37%, and now it increasing its ambitions, setting a 55% target reduction by 2030. On its first phase of actions (2005-2020 plan), the



strategy of Padova focused on energy efficiency and energy use planning in public administration buildings and facilities, including municipal car fleets and local public transport, together with local production from renewable energy sources.

Foreseen energy efficiency actions in all sectors of the public administration resulted in a 37% energy demand reduction. For municipal buildings only, energy savings amounted to

53% due to a large number of actions focusing on more than 100 municipal buildings. Meanwhile, for public lighting only, an energy reduction annual rate of 1.6% was achieved, where the substitution of incandescent lighting for LED was one of the leading actions. For the transport sector, actions focused on municipal vehicles fleet renewal, aiming for efficient new vehicles.

Furthermore, Padova has put into place actions encouraging the use of electricity from renewable energy sources, not only increasing the direct installation of in site local photovoltaics but also from the purchase of electricity used in municipal installations, coming from certified renewable sources. Key actions refer to the installation of new photovoltaic plants on municipal builds and on parking tram terminals, installation of solar heating plants on municipal gyms and purchase of 36% of electric municipal consumption from certified renewables sources.

4.3.6 Tuzla (Bosnia-herzegovina)

The medium sized city of Tuzla, with about 110 thousand inhabitants, committed under the CoM initiative to reduce its CO₂ emissions in 20% by 2020, and in 40% by 2030. The efforts of the city went beyond the expectations already in 2020, accomplishing an emissions reduction of 33%.

Its main actions dealt with energy efficiency in the buildings sector, achieving savings of 34%. Specifically, addressing actions in reconstruction and buildings thermal efficiency. For individual residential buildings, energy savings went through the improvement of thermal-insulation features by reconstruction of outside envelopes, focusing on buildings with average heated surface of about 100 m². Concerning public buildings (municipal and non-municipal), actions looked into integrated energy reconstruction. That is, encouraging energy renovation of the external envelopes combined with a shift to cleaner energy fuel sources, which includes the replacement of existing fossil fuel boilers with high-energy efficiency ones, using biomass and more use of electricity.



4.3.7 Tipperary County (Ireland)

Tipperary County Council has set a 30% carbon reduction target by 2020 from 2005 levels. To reach this ambition, Tipperary County Council has encouraged energy efficiency and reduced the dependency on fossil fuel and imported energy, by boosting renewable energy development.

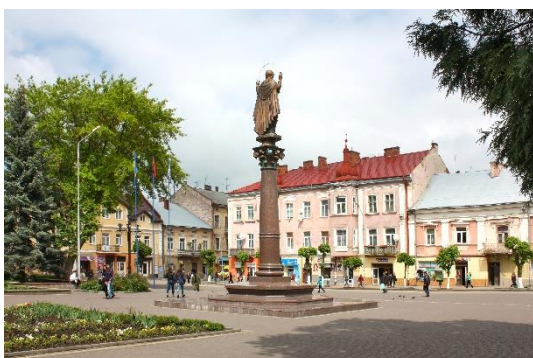
Tipperary has seized the potential of biomass, solar energy sector and wind energy. By 2017, 267.9 MW of wind energy capacity was installed, representing 8.6% of Ireland's total capacity. In 2014, the renewable energy produced from wind plants reached 477 168 MWh.



4.3.8 Sambir (Ukraine)

Sambir, with a population of 25 000 inhabitants, joined the Covenant in 2019, with the ambition of reducing the CO₂ emissions by 30% by 2030 compared to the base year of 2009. According to the latest inventory from 2017, a 14.5% emissions reduction had been already achieved, with savings of 177 430 MWh/year (53% of the baseline inventory consumption), thanks to the comprehensive set of mitigation actions planned and implemented.

Among the most impactful actions already completed, the modernization of the street lighting systems has been a demonstration project for the entire region. In fact, with a cost of about EUR 200k (80% EU-funded), the project has been able to achieve annual monetary savings of EUR 55k, with annual energy savings (electricity) of 366 MWh/year, thanks to the:



- Installation of 689 LED lamps with the capacity of 30 W
- Installation of 23 LED dimmable lamps with the capacity of 100 W
- Installation of 65 high-pressure sodium lamps (150 W capacity) and 56 decorative street luminaries with high-pressure sodium lamps (capacity 70-150 W)
- Installation of 56 poles and 28 km of cables, including 1 km underground cables
- Commissioning of one street lighting control

- system (real-time, internet-based) and 10 control cabinets
- Installation of 4 autonomous solar-powered street luminaries
- Architectural lighting for 5 historical buildings

Additionally, an estimated 20 000 of inhabitants directly benefit from the project thanks to the improved street lighting during night time, increasing comfort and safety of the neighbourhoods.

5 Conclusions

The evidence collected in this report suggests that, on average, fossil fuels hold the greatest share in the total energy consumption. For EU-27 signatories, it represents around 65% (in both BEI and MEI), while for non-EU signatories it is higher, with around 70% in BEI and 80% in MEI. The share of fossils is followed by electricity, with around 20% in BEI, but changing in the MEI, being higher for EU, with 25%, and lower for non-EU, with 15%. District heating and cooling is in third place, with around 6% in BEI and MEI (being lower for non-EU in MEI with 3%) and lastly, renewable energies (ranging from 1-5%). Although there is a slight increase in the use of renewable energies with respect to the first release of the GCoM 2021 first data release (as pointed out in Franco et al., 2022a), these findings suggest that still more effort is required to meet the EU targets for a successful transition to a greener energy system. Meanwhile, the sector with the highest share in the reported consumption is residential buildings (around 30% in EU-27, and 40% in non-EU), followed by private and commercial transport (with shares of around 20%-25% for EU, and 20%-40% for non-EU).

Furthermore, for EU-27 signatories, considering their 2020 and 2030 commitments, it has been established that the achieved savings amount to 1.45 and 1.17 MWh/year per capita, respectively. For 2020 commitments, and considering only the signatories with a monitoring history that also reported estimates for energy savings, they accomplished a mean annual rate of per capita savings of 0.26 MWh/year, exceeding their respective declared estimated annual rate of 0.17 MWh/year. The highest absolute savings yearly rates correspond to the cities of *Dortmund*, *Budapest* and *Marbella*, with 1.45, 0.85 and 0.72 TWh/year, respectively. On the contrary, for 2030 commitments, the accomplished mean annual rate of per capita savings amounts to 0.11 MWh/year, falling short of the declared estimated annual rate of 0.2 MWh/year. Here, the highest absolute savings yearly rates correspond to *Dublin*, *Ravenna* and *Valencia*, saving 0.61, 0.36 and 0.32 TWh/year, respectively.

Considering non-EU signatories, the achieved savings for 2020 and 2030 commitments amount to 1.37 and -0.53 MWh/year per capita, respectively. The negative value for 2030 commitments is due to the city of Bursa Metropolitan Municipality (holding almost 3 million inhabitants), which increased their energy consumption in 2.87 TWh/year from 2014 to 2016. For 2020 commitments (considering only the signatories with a monitoring history that also reported estimates for energy savings), the accomplished mean annual rate of per capita savings amounts to 0.29 MWh/year, exceeding the declared estimated annual rate of 0.19 MWh/year. The highest absolute savings yearly rates correspond to the cities of *Mariupol*, *Vinnitsia* and *Sunderland*, with 0.95, 0.46 and 0.28 TWh/year, respectively. As for 2030 commitments, the accomplished mean annual per capita rate amounts to 0.09 MWh/year, exceeding the declared estimated rate of 0.016 MWh/year. The highest absolute savings yearly rates correspond to *Gradiška*, *Tuzla* and *Lukavac*, saving 0.016, 0.01 and 0.009 TWh/year, respectively.

Regarding EU-27 signatories, the reported estimates for renewable energy production amounts to 0.65 and 1.05 MWh/year per capita, respectively for 2020 and 2030 commitments. The highest share of local electricity production reported in the BEI corresponds to photovoltaics (38% and 63% for 2020 and 2030 commitments, respectively), followed by hydroelectric power (25% and 14% for 2020 and 2030 commitments, respectively). The shares change according to the activity reported in the MEI, where the highest share corresponds to hydroelectric power (29% and 44% for 2020 and 2030 commitments, respectively), followed by CHP (27% and 21% for 2020 and 2030 commitments, respectively) and wind power, mainly for 2020 commitments, with a 23% share. Renewable energy has the highest share in the total local electricity production (ranging from 71% to 86%), representing around 20% of the BEI electricity consumption, and 11% and 17% of the MEI consumption for 2020 and 2030 commitments, respectively. Purchases of renewable energy certificates represent a small share of the reported electricity consumption (around 3% and 7% for the consumption in BEI and in MEI, respectively, for both 2020 and 2030 commitments). On the other hand, considering local heat/cold production, the highest shares correspond to combined heat and power (CHP) and district heating (heat only), using almost entirely non-renewable energy sources and covering approximately the entire heat/cold consumption (with the exception of 2030 commitments in the MEI, where renewables gain a 30% share, covering 33% of their respective consumption).

Focusing on non-EU signatories, the reported estimates for renewable energy production amounts to 0.18 and 0.23 MWh/year per capita, respectively for 2020 and 2030 commitments. The highest share of local electricity production in the BEI corresponds to CHP (55% and 12% for 2020 and 2030 commitments, respectively) and hydroelectric power (31% and 87% for 2020 and 2030 commitments, respectively). Meanwhile, for the supply reported by cities with 2020 commitments in their MEI, the highest shares

correspond to hydroelectric and geothermal power, with 71% and 27% respectively (no MEI information is available for 2030 commitments). For 2020 commitments, non-renewable and renewable energy have similar shares in the total local electricity production of their BEI (with a 10% difference in favour of non-renewables), each one representing around 5% of the BEI electricity consumption. For 2030 commitments, renewable sources have the highest share, reaching 88%, which represents 16% of the BEI electricity consumption. Purchases of renewable energy certificates (only available for 2020 commitments) have an 8% (3.5%) share of the total BEI (MEI) electricity consumption. Considering local heat/cold production, the highest shares correspond to district heating (heat only), mainly using non-renewable energy sources and covering approximately the entire BEI and MEI heat/cold consumption.

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List of abbreviations and definitions

BEI	Baseline Emission Inventory
CoM	Covenant of Mayors
CHP	Combined Heat and Power
CRF	Common Reporting Framework
EC	European Commission
EU	European Union
GCoM	Global Covenant of Mayors
GHG	Greenhouse Gas
JRC	Joint Research Centre
MEI	Monitoring Emission Inventory
NDC	Nationally Determined Contribution
SEAP	Sustainable Energy Action Plan
SECAP	Sustainable Energy and Climate Action Plan
TWG	Technical Working Group
UNFCCC	United Nations Framework Convention on Climate Change

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Annexes

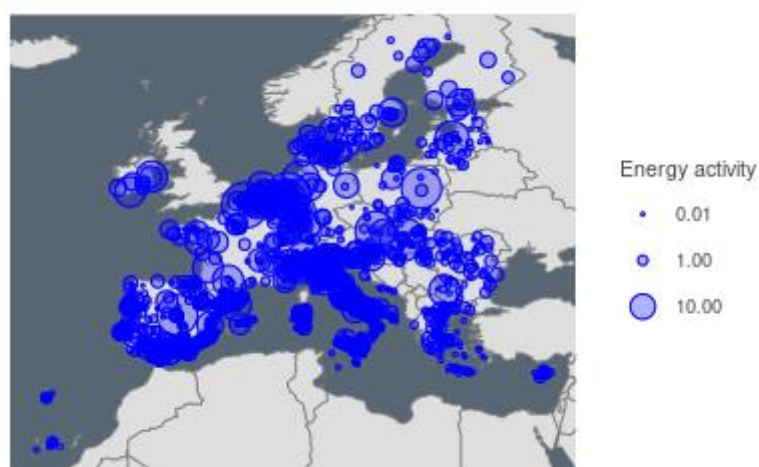
Annex 1. Proportion of signatories by commitment and country.

Table A1. Proportion of signatories with a BEI by country and commitment – EU-27 (units %)

Country	2020 commitment (%)	2030 commitment (%)
Italy	55.80	23.06
Spain	26.69	42.84
Belgium	3.34	18.14
Greece	2.07	3.01
Portugal	1.96	1.28
France	1.24	1.19
Croatia	1.01	1.46
Romania	1.10	1.00
Germany	0.99	0.46
Sweden	0.76	0.46
Poland	0.67	0.27
Denmark	0.58	0.00
Hungary	0.49	3.92
Slovenia	0.51	0.09
Cyprus	0.42	0.18
Bulgaria	0.41	0.09
Latvia	0.34	0.27
Malta	0.34	0.00
Netherlands	0.25	0.09
Austria	0.23	0.09
Lithuania	0.21	0.00
Finland	0.18	1.00
Ireland	0.14	0.55
Czech Republic	0.11	0.46
Estonia	0.09	0.00
Slovakia	0.07	0.09
Luxembourg	0.02	0.00

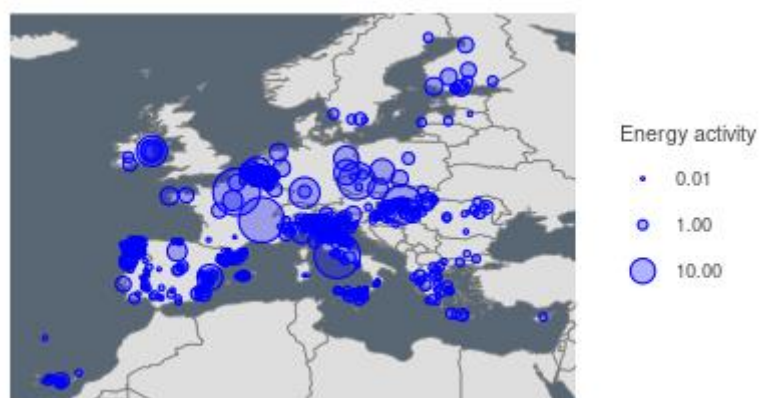
Source: JRC elaboration based on GCoM data

Figure A1. Map showing the proportion of signatories according to their baseline energy activity (TWh/year) for 2020 commitments – EU-27



Source: JRC elaboration based on GCoM data

Figure A2. Map showing the proportion of signatories according to their baseline energy activity (TWh/year) for 2030 commitments – EU-27



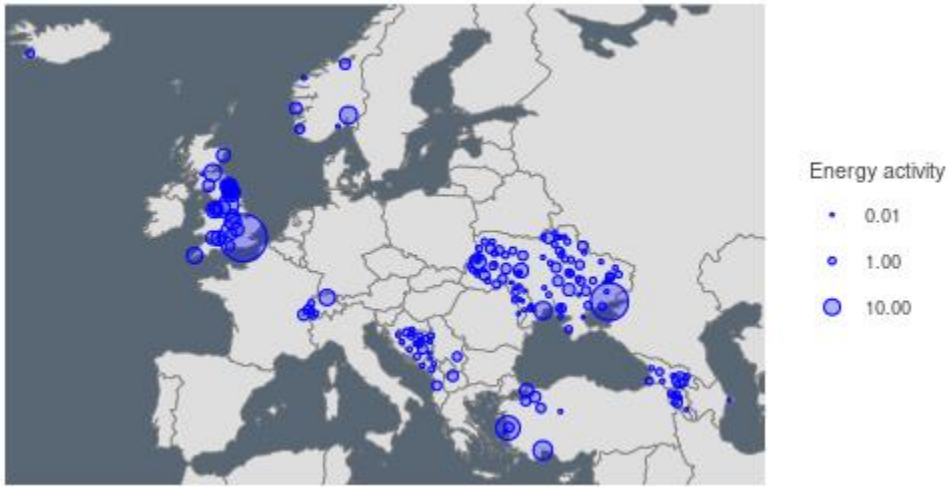
Source: JRC elaboration based on GCoM data

Table A2. Proportion of signatories with a BEI by country and commitment – non-EU (units %)

Country	2020 commitment (%)	2030 commitment (%)
Ukraine	41.33	60.99
United Kingdom	15.82	2.13
Bosnia and Herzegovina	9.69	17.73
Moldova	6.63	12.06
Armenia	5.10	0.71
Georgia	5.10	0.00
Türkiye	5.10	4.96
Switzerland	4.08	0.00
Norway	3.06	0.00
Montenegro	1.53	0.00
North Macedonia	0.51	0.00
Iceland	0.51	0.00
Serbia	0.51	0.71
Azerbaijan	0.51	0.71
Albania	0.51	0.00

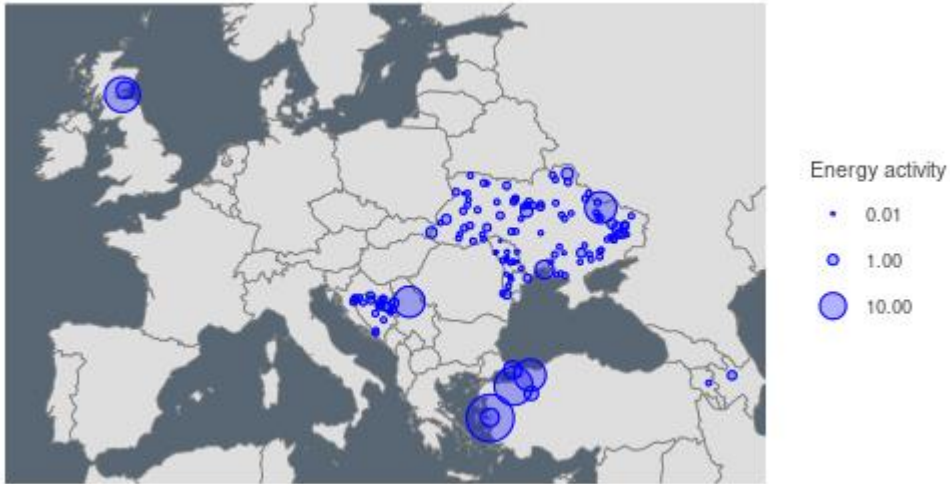
Source: JRC elaboration based on GCoM data

Figure A3. Map showing the proportion of signatories according to their baseline energy activity (TWh/year) for 2020 commitments – non-EU



Source: JRC elaboration based on GCoM data

Figure A4. Map showing the proportion of signatories according to their baseline energy activity (TWh/year) for 2030 commitments – non-EU



Source: JRC elaboration based on GCoM data

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