The Covenant of Mayors Initiative: An Assessment and Evaluation

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ABSTRACT

Local governments play a crucial role in mitigating the effects of climate change, all the more so when considering that 80% of energy consumption and carbon dioxide (CO_2) emissions is associated with urban activity.

The Covenant of Mayors (CoM) is the mainstream European movement involving local authorities voluntarily committing to meet and exceed the European Union 20% CO_2 reduction objective by 2020 by increasing energy efficiency and through the use of renewable energy sources on their territories.

In order to achieve its CO_2 reduction objective, a city that signs the CoM commits to a number of actions such as: to prepare a Baseline Emission Inventory; to submit a Sustainable Energy Action Plan (SEAP); to adapt city structures in order to undertake the necessary actions; and to mobilise civil society in their respective geographical areas to take part in implementing the Action Plan. Signatories of the CoM have to submit an implementation report at least every second year after the submission of the Action Plan and a Monitoring Emission Inventory at least every fourth year, in order to measure progress towards target (Bertoldi, 2010).

So far, almost 5500 signatories have signed up to participate in the CoM and over 3400 have submitted a SEAP.

This paper presents an evaluation of the CoM after 6 years, including the expansion of the scheme to Former Soviet Union Countries and North Africa.

Introduction

The CoM initiative was launched in 2008 by the European Commission to endorse and support local and regional authorities in the implementation of sustainable energy policies. It fits into a high level and EU-wide energy policy context represented by the Energy for a Changing World package.[1]

Several reasons justify the choice to encourage local authorities in implementing local sustainable energy policies:

- 74% of EU population lives in urban areas (Covenant of Mayors, 2009)
- Urban areas account for about 70% of the total primary energy demand of the EU;
- Under the IEA reference scenario, urban energy consumption is projected to increase twice the rate of the EU as a whole.

[1] The targets set by the Energy for a Changing World package for 2020 are:
- 20% reduction in EU Greenhouse Gas Emissions (GHG) of at least 20% below 1990 levels.
- 20% of EU final energy consumption to come from renewable resources.
- 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

Cities and towns are therefore recognized to have enormous potential for sustainable energy use, with a positive impact on local economy. Moreover, the idea that central governments alone cannot address properly the energy and climate change issues without engaging with the activity of sub-national and local action is widespread. Global environmental politics are not merely a matter of international negotiations and national policy development, but are also taking place locally (Betsill, 2006). Therefore, the Covenant proposes a new model of multi-level governance, where common objectives and support are fixed at EU level, but action takes place on the local level.

The main commitment taken by local authorities when joining the CoM is to reduce energy-related CO_2 emissions in their respective territories by at least 20% by 2020, compared to the levels of a base year (Edgar, 2011). Besides the main commitment, Signatories also commit to:

- prepare a baseline emission inventory (BEI), focusing on emissions associated with final energy consumption
- submit the Sustainable Energy Action Plan (SEAP) within the year following signing up to the Covenant
- adapt city structures
- mobilize the civil society
- submit an implementation report every second year after submission of the Action Plan

All signatory cities are free to set their target to 2020 either on an absolute or on a per capita basis. A third option is allowed only to signatories from former Soviet Union countries and from North Africa, i.e. to set the target based on a business-as-usual (BAU) scenario.

Almost six years after its launch, the Covenant of Mayors counts as many as 5500 signatory municipalities, of which around 3400 have submitted a SEAP (including a BEI).

The aim of this paper is to present an overall picture of the SEAPs received so far by the European Commission. We focus first on an analysis of the municipalities involved in the initiative by country and by population. Then we concentrate on an analysis of final energy consumption data extracted from the BEIs, to have an understanding of the most emitting sectors in the signatories' territories, and on the sectors in which signatories estimate to achieve the highest energy savings and local energy production in 2020 from SEAPs.

The Sustainable Energy Action Plan (SEAP)

The SEAP is a comprehensive document that defines the long-term vision of the local authority. Starting from the results of the BEI, it sets the target to 2020 and describes detailed measures aiming at improving energy efficiency and possibly increasing the use of local renewable energy, needed to reach the emission reduction objective. This document is also intended as a communication instrument, presenting to citizens and local stakeholders the policies implemented by the local authority in the field of sustainable energy (IEA, 2012).

Before starting the development of the SEAP, the local administration has to carry out some preliminary activities necessary to set the basis of its strategy.

First, the local authority needs to inform all the departments concerned by the SEAP and adapt its administrative structures, in order to ensure a good internal collaboration.

Secondly, the authority should identify the stakeholders to involve at different levels in the planning process: their participation in the definition of the long-term vision of the local authority and of the priority areas for action will also ensure support for the SEAP in the implementation phase.

Then, the local authority has to perform a detailed assessment of its starting point, through the elaboration of a BEI. The BEI is calculated based on final energy consumption data in the territory, generally gathered from the local suppliers and/or from regional databases. Data are detailed by energy carrier and by sector. Starting from activity data (i.e. final energy consumption) and multiplying them by appropriate emission factors, the corresponding CO_2 emission can be obtained. The calculation of the BEI allows identifying the major emitting sources in the territory. The assessment also consists of a baseline review, an evaluation of the existing and forecast trends in energy consumption and an analysis of legislation, policies, plans and other instruments tackling the energy issue.

This is the necessary information that will enable the local authority to define its strategy and translate it into concrete actions. All these elements extensively described will form the Sustainable Energy Action Plan.

The document has to be adopted and approved through the specific procedures of the local authority and submitted to the European Commission within the year following the formal adhesion to the initiative. The submission of SEAP is completed via the Signatory's restricted area on the CoM website by uploading the full SEAP document in national language and by filling in an online template. The online template allows signatories to summarize their strategy, to provide their BEI data and describe their actions in a structured and consistent manner. The data collected via this online template have been used for the analysis described in this paper.

Local Authorities Involved in the Covenant of Mayors (CoM)

Table 1. The signatories of Covenant of Mayors as of February 2014 with total number of inhabitants

Region	Country	No. of SEAPs	% no. SEAPs	CoM population by country	% EU28 CoM population	% Tot CoM population
EU-28	Italy	2690	53.46%	33,082,527	21.02%	18.35%
	Spain	1459	28.99%	25,343,427	16.10%	14.06%
	France	116	2.31%	15,596,553	9.91%	8.65%
	Greece	88	1.75%	3,226,964	2.05%	1.79%
	Portugal	76	1.51%	4,372,973	2.78%	2.43%
	Belgium	70	1.39%	3,591,694	2.28%	1.99%
	Croatia	58	1.15%	1,870,307	1.19%	1.04%
	Romania	56	1.11%	6,156,555	3.91%	3.42%
	Germany	53	1.05%	17,053,423	10.84%	9.46%
	Sweden	50	0.99%	4,082,547	2.59%	2.26%
	Poland	36	0.72%	3,592,912	2.28%	1.99%
	Denmark	36	0.72%	2,786,309	1.77%	1.55%
	Bulgaria	34	0.68%	2,624,367	1.67%	1.46%
	United Kingdom	33	0.66%	17,674,092	11.23%	9.80%
	Malta	25	0.50%	117,048	0.07%	0.06%
	Hungary	22	0.44%	2,472,475	1.57%	1.37%
	Cyprus	21	0.42%	452,906	0.29%	0.25%
	Slovenia	19	0.38%	562,172	0.36%	0.31%
	Netherlands	18	0.36%	3,804,493	2.42%	2.11%

Region	Country	No. of SEAPs	% no. SEAPs	CoM population by country	% EU28 CoM population	% Tot CoM population
EU 28	Latvia	17	0.26%	1,071,504	0.68%	0.59%
	Lithuania	14	0.28%	1,379,419	0.88%	0.77%
	Austria	12	0.24%	1,912,864	1.22%	1.06%
	Finland	7	0.14%	1,716,986	1.09%	0.95%
	Ireland	6	0.66%	1,404,659	0.89%	0.78%
	Czech Republic	6	0.12%	331,841	0.21%	0.18%
	Slovakia	5	0.10%	569,113	0.36%	0.32%
	Estonia	3	0.06%	432,860	0.28%	0.24%
	Luxembourg	2	0.04%	102,229	0.06%	0.06%
Total	EU 28	5032	100%	157,385,219	100%	87.30%

Region	No. of SEAPs	% number of SEAPs	Tot CoM population
European countries non EU	45	33.58%	8,578,190
Eastern Partnership & Central Asia countries	87	64.92%	13,052,115
Southern Mediterranean Countries	1	0.75%	903,485
Australia & New Zealand	1	0.75%	360,000
Total non EU	134	100%	22,893,790
TOTAL (EU and non EU)	**5166**	**100%**	**180,279,009**

Methodology

Construction of the Database

The database used for this analysis has been constructed starting from the data of all SEAPs submitted as of February 2014. Data have been collected via the online template that signatories fill-in when completing the SEAP submission process. The data taken into consideration are:

- Final energy consumption data by sector and energy carrier in the base year [MWh/year]
- Emission data by sector and energy carrier in the base year [t CO_2/year]
- Estimated energy savings and energy production in 2020 per planned measure in the sectors of activity [MWh/year]
- Estimated emissions reduction per planned measure per planned measure in the sectors of activity [t CO_2/year]

It is not compulsory for signatories to provide all this information, therefore the sample in this analysis was designed to remove the signatories that had not provided sufficiently detailed data in their BEI and SEAP templates.

Several signatories have provided an estimate of CO_2 reduction in 2020, but not energy savings. In those cases, a methodology has been applied to estimate the energy savings starting from the expected CO_2 reduction in 2020 (Em Red 2020). An overall emission factor (OEF) has been calculated for those cities starting from the total energy consumption (Tot EC) and total emissions (Tot Em) from the BEI (only energy related sectors are taken into account).

OEF [t CO_2/MWh] = Tot Em [t CO_2]/Tot EC [MWh]

It has been assumed that in 2020 the same overall emission factor will apply to the energy savings. Therefore an estimate of the energy savings Tot ES [*MWh]* has been made, dividing the expected CO_2 reduction by the overall EF:

Tot ES [MWh] = Em Red 2020 [t CO_2] / OEF [t CO_2/MWh]

Results

Data Analysis of by Sectors and Energy Carriers

The online template allows signatories to provide their BEI data and describe their actions in a structured and consistent manner. The data collected via this online template have been used for the analysis described in this paper. The sample used to analyze the data has been identified by removing those values that were considered out of range of energy saving procapita.

This paper is focused on the analyses of the final energy consumption. In the following table there is a summary of division of the subsectors.

Sector	Subsector		Description
BUILDINGS, EQUIPMENT, FACILITIES, INDUSTRIES	Municipal buildings and facilities		Buildings and facilities owned by the local authority. Facilities refer to energy consuming entities that are not buildings, such as wastewater treatment plants.
	Tertiary (non municipal) buildings, facilities		Buildings and facilities of the tertiary sector (services), for example offices of private companies, banks, commercial and retail activities, hospitals, etc.
	Residential buildings		Buildings that are primarily used as residential buildings. Social housing is included in this sector.
	Public lighting		Public lighting owned or operated by the local authority (e.g. street lighting and traffic lights). Non-municipal public lighting is included in the sector of "Tertiary buildings, equipment/facilities".
	Industries	Non-ETS	Refers to manufacturing and construction industries not involved in the EU Emissions Trading Scheme (EU-ETS).
		ETS	Refers to manufacturing and construction industries involved in the EU-ETS. Integrating them in your emission inventories is not recommended, unless such plants were included in previous energy plans and CO2 emission inventories of the local authority.

TRANSPORT	Municipal fleet	Vehicles owned and used by the local authority's administration.
	Public transport	Bus, tramway, metro, urban rail transportation and local ferries used for passenger transport.
	Private and commercial transport	Road, rail and boat transport in the territory of the local authority which refer to the transport of persons and goods not specified above (e.g. private passenger cars and freight transport).

Energy consumption. In the following Figure 1 the energy consumption from the Database of submitted SEAPs with a completed BEI as of February 2014 are reported with details on the sectors.

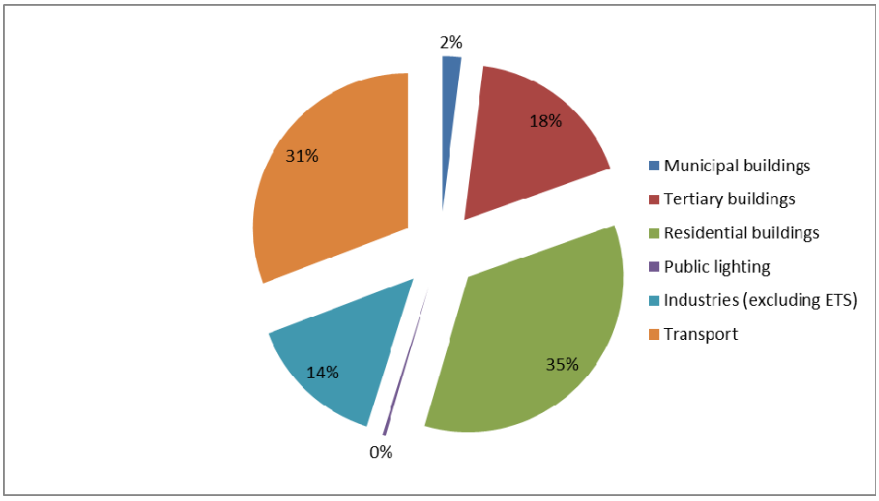

Figure 1. Energy consumption in total figure in CoM sectors reported in BEI.

According to figure 1 the building sector is responsible for 55% of the total energy consumption. In our previous report on the initiative it is shown that also the building sector is the largest CO_2 emitter in urban area, because about 75 % of CO_2 emissions are generated via combustion (Cerutti, 2013)

Despite the fact that municipal buildings represent only 2% of the final energy consumption reported in the inventories, according to the recast of the EPBD and the Energy efficiency directives, local administrations should lead as an example to citizens.

The main share of the energy consumption is due to the residential sector, therefore is crucial to devise efficient policies to reduce energy consumption and CO_2 emission in this sector. For example we suggest that local authorities take maximum advantage of the EPBD directive to improve the performance of the building stock and impose more stringent energy performance requirements than those applicable at national/regional level.

In the following section is reported the same data of energy consumption, with the details on the energy carriers. Figure 2.

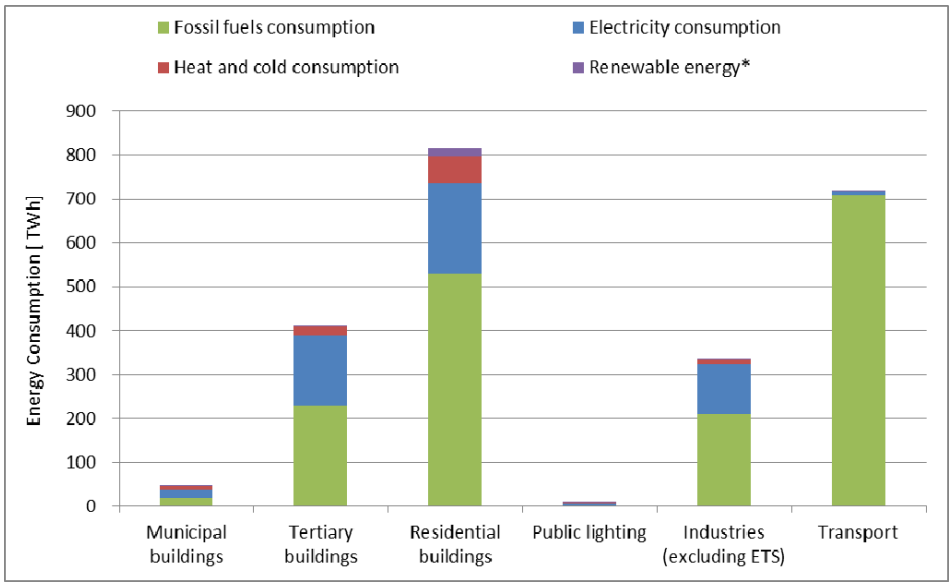

Figure 2. Energy consumption from electricity, heat and cold, fossil fuel and renewable energy locally produced.

One of the major overall conclusion from the analyses of these graph is that the majority of energy carriers used in urban context are the fossil fuels (mainly natural gas for buildings and gasoline for Transport) followed by electricity consumption and Heat from District Heating networks. The share of renewable sources is around 1.4% (the renewables refers only to heat production source).

Energy savings. Energy savings according to estimation for each sector in SEAPs by February 2014 are reported in the following figure 3, where the overall estimation in 2020 is 200 TWh/year.

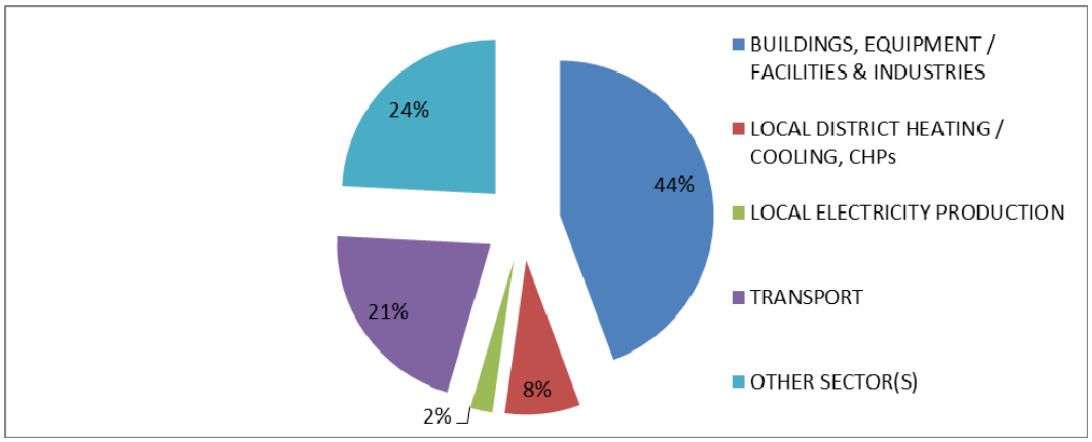

Figure 3. Estimated energy savings by sector and field of action.

As it can be seen from the figure 3, the building sector represents the most important sector for reaching European energy efficiency targets for 2020 with a figure of 44%. Also important is the transport sector mainly because there is estimation for 2020 from more efficient

vehicles. Furthermore the behavioral change will lead towards a more sustainable transport mode.

Other Sectors including Working with citizens and stakeholders, Land Use planning..etc provides a good share of energy savings, highlighting the importance of involving the citizens in this process.

The overall energy savings represents 8.5% of the overall energy consumption. This is mainly due to the fact that the CoM is a voluntary commitment and the only mandatory field is related to the estimation of CO_2 reduction per measure. This fact allows signatories to not provide a coherent Energy savings data related to the estimated CO_2 reduction measures.

In order to solve this lack of energy data we propose the methodology described above for the estimation of the energy savings in covering all the measures included in the CoM initiative. Applying this methodology, the overall energy savings is about 10% of the energy consumption.

This can be considered as a fair result, because all the statistics represent the effort declared by signatories, without being considered as a mitigation potential committed to by the European Commission.

Energy production. Energy production according to the estimation for each sector in SEAPs as of February 2014 are reported in the figure 4, where the overall estimation for 2020 is 138 TWh/year.

According to the Figure 4 the lion share is attributed to the Local Electricity production with a figure of 73% (mainly in CHP and waste management), while the District Heating represents only 12%.

The overall energy production represents 6 % of the overall energy consumption. Again this is mainly due to the fact that the CoM is a voluntary commitment and the only mandatory field is related to the estimation of CO_2 reduction per measure.

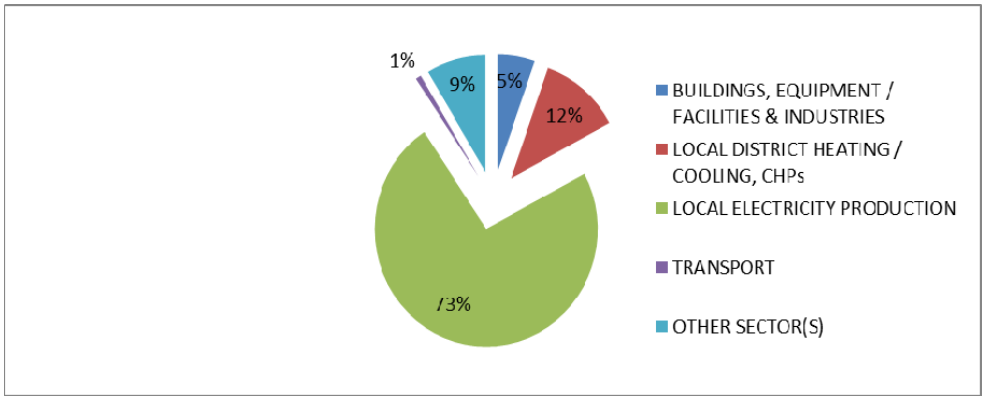

Figure 4. The estimated energy production by sectors.

Finally, having a now good understanding of the share of final energy consumption and the potential of energy savings and production, we will focus our analyses in the contribution of cities from different population ranges.

Data Analysis of by Population Range

As described earlier in this paper, out of 3433 SEAPs 88 % are represented by small municipalities (<10 000). This is due to the high administrative fragmentation in Europe, especially in countries like Italy and Spain, which are respectively the first and the second by

number of signatories. Providing adequate administrative and technical support to such a big and diversified community is requiring increasing resources from all the actors involved in the initiative, in particular the Covenant of Mayors Office (CoMO) and the European Commission - Joint Research Centre (EC-JRC). Having a now good understanding of the share of final energy consumption and of the potential represented by different groups of cities in terms of energy savings and production is very important to define the level of support that can realistically be offered by the structures made available to members of the CoM movement

In order to draw some conclusion which could allow the European Commission to better target the support offered to signatories, we have identified 4 population ranges as in table 2.

Table 2. Number of municipalities with a submitted SEAP and number of inhabitants covered by each population range

	Population range	Total no. SEAPs	Percentage of total SEAPs	Total no. inhabitants	Percentage of total inhabitants
1	<10 000 inh.	2001	64.7%	6 494 443	4.9%
2	10 0001 - 100 000 inh.	853	27.6%	26 321 844	20.0%
3	100 001 - 1 000 000 inh.	221	7.1%	64 615 149	49.2%
4	>1 000 000 inh.	17	0.5%	33 903 592	25.8%
	Grand total	3092		131 335 028	

In Table 2 we can see that even if around 2000 signatories are in the first population range, they only represent 5% of the total SEAP population. The highest share of SEAP population is covered by signatories in the third population range, i.e. 221 signatories cover almost a half of the SEAP population.

We have analysed the share each range represents in terms of:

- final energy consumption from the baseline emission inventories (Figure 5)
- expected energy savings in 2020 (Figure 6)
- expected energy production in 2020 (Figure 7)

In figure 5, we see that signatories with a population between 10 000 and 1 000 000 inhabitants (ranges 2 and 3) represent almost 80% of final energy consumption in the base year. As regards the first population range, we see that 2001 signatories represent a very low (around 4%) share of final energy consumption. Finally, we can see that 17% of final energy consumption occurs in cities above 1 million inhabitants (range 4).

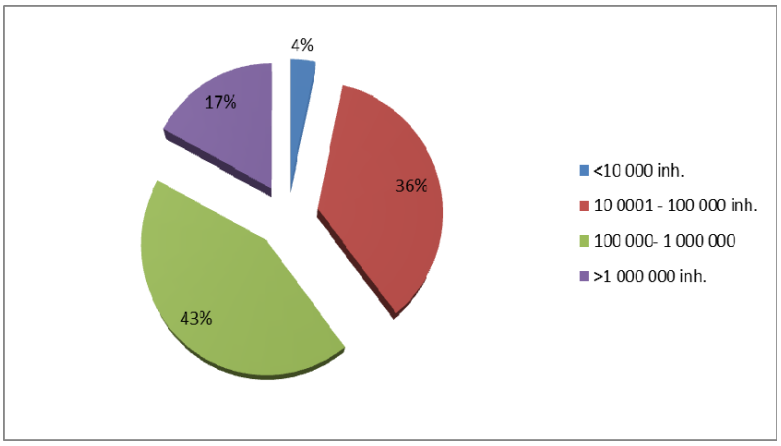

Figure 5. Final energy consumption in BEI by population range.

From figure 6 we can see that the greatest share of energy savings in 2020 is expected to be achieved by signatories in the range 3, which accounts for a total number of 64,6 million inhabitants. It is also worth noting that small municipalities, though representing only 4 % of final energy consumption (Figure 5), are expected to contribute with as much as 7% of energy savings in 2020 (Figure 6). This shows that small municipalities have a higher energy saving potential, probably because through the CoM they are starting for the first time to plan and implement energy savings measures and therefore have a larger room for improving their energy performance, compared to bigger municipalities.

Medium-sized municipalities (range 2) show a lower energy saving potential, compared to the other ranges (24% of expected energy savings as shown in Figure 6). In figure 7 we can however see that in these cities the share of expected energy production is higher if compared to other ranges.

In figure 7 we see that small municipalities expect to give a higher contribution to the overall energy production (21.4 TWh/year, corresponding to a share of 16%), compared to the share they represent in terms of final energy consumption or expected energy savings.

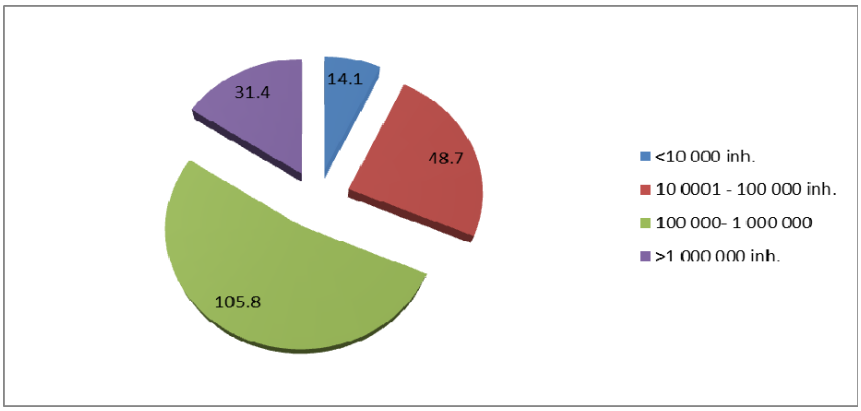

Figure 6. Expected energy savings [TWh/year] in 2020 by population range.

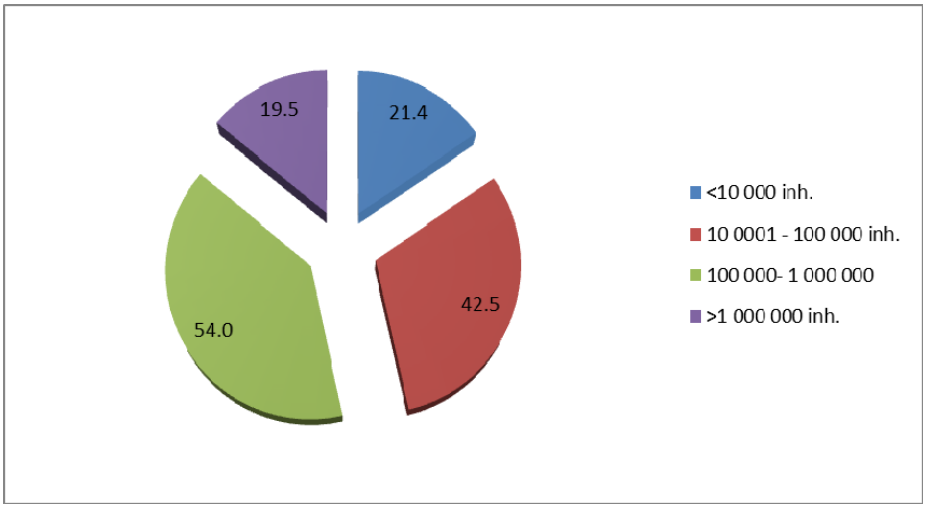

Figure 7. Expected energy production [TWh/year] in 2020 by population range

Conclusions

This paper provides an overview of the SEAPs submitted by CoM signatories to the European Commission as of February 2014. It highlights the share of energy consumption, expected energy savings and energy production, represented by different groups of municipalities. It demonstrates that despite small municipalities represent by far the majority of signatories having submitted a SEAP (~65%), they account for quite a limited share of energy consumption (as per the BEI) and potential energy savings and production in 2020 (as per the measures described in SEAPs).

The administrative and technical support needed by small municipalities from EC-JRC and CoMO to comply with their CoM commitment is very high compared to the results that can be achieved by these signatories in 2020 in those territories in terms of energy savings and production (and consequently CO_2 emissions). In order to maximise the potential represented by the CoM movement in the most efficient way, a possible approach would be to provide direct support to signatories in population ranges 2 and 3 (from 10 001 to 1 000 000 inhabitants), whereas the assistance to small municipalities should be conveyed through the involvement of intermediary government levels (e.g. Regions, Provinces, Counties, groupings of local authorities…). This study emphasizes the role of Covenant Territorial Coordinators (CTCs), public authorities at a higher territorial level that commit to provide guidance and support in SEAP development and implementation to small municipalities. The involvement of CTCs is also important in order to incorporate rural areas in territory-based sustainable development plans, taking into consideration the synergies between rural and urban areas in terms of supply of energy, products and services. Small local authorities should be encouraged to join the initiative in groups, committing to draft and implement a joint Action Plan.

References

Bertoldi P., D. Bornás Cayuela, S. Monni, R. Piers de Raveschoot. 2010. Guidebook: How to develop a sustainable energy action plan (SEAP). http://iet.jrc.ec.europa.eu/energyefficiency/publication/guidebook-how-develop-sustainable-energy-action-plan-seap

C40, 2012. Global Protocol for Community-Scale Greenhouse Gas Emissions. Tech. Rep. May, C40 Cities Climate Leadership Group and ICLEI Local Governments for Sustainability in collaboration with: World Resources Institute, World Bank, UNEP, and UN-HABITAT, Sao Paulo

Covenant of Mayors, 2009. Covenant official text. Available at: (http://www.covenantofmayors.eu/IMG/pdf/covenantofmayors_text_en.pdf)

Cerutti A., Iancu A., Janssens-Maenhout G., Melica G., Paina F., Bertoldi P. 2013. JRC Scientific Repor : Covenant of Mayors in figures 5 – Years Assessment.

Dall'O' G., Galante A., Pasetti G., 2012. A methodology for evaluating the potential energy savings of retrofitting residential building stocks. Sustainable Cities and Society, 4:12–21

Dall'O' G., Norese M.F., Galante A., Novello C., 2013. A Multi-Criteria Methodology to Support Pubblic Administration Decision Making Concerning Sustainable Energy Action Plans. Energies, 6:4308-4330

den Elzen M.G.J. , Olivier J.G. J., Höhne N., Janssens-Maenhout G., 2013. Countries' contributions to climate change: effect of accounting for all greenhouse gases, recent trends, basic needs and technological progress. Climatic Change 121:397–412

EDGAR, 2011. Global Emissions EDGAR version 4.2, released in November 2011. Available at: http://edgar.jrc.ec.europa.eu/

IEA, 2012. World Energy Outlook 2012. International Energy Agency Publications, Paris

IPCC, 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme. Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

IPCC, 2007. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

Janssens-Maenhout G, Dentener F, Van Aardenne J, Monni S, Pagliari V, Orlandini L, Klimont Z, Kurokawa J, Akimoto H, Ohara, T, Wankmueller R, Battye B, Grano D; Zuber A, Keating T. EDGAR-HTAP: a Harmonized Gridded Air Pollution Emission Dataset Based on National Inventories. Ispra (Italy): European Commission Publications Office; 2012. JRC68434, EUR report No EUR 25 299 - 2012, ISBN 978-92-79-23122-0, ISSN 1831-9424

Olivier J.G.J., Berdowski J.J.M., 2001. Global emissions sources and sinks. In: Berdowski, J., Guicherit, R. and B.J. Heij (eds.) "The Climate System", pp. 33-78. A.A. Balkema Publishers/Swets & Zeitlinger Publishers, Lisse, The Netherlands. ISBN 90 5809 255 0.

Betsill M. and Bulkeley H. 2006. "Cities and the Multilevel Governance of Global Climate Change, in Global Governance", 154.