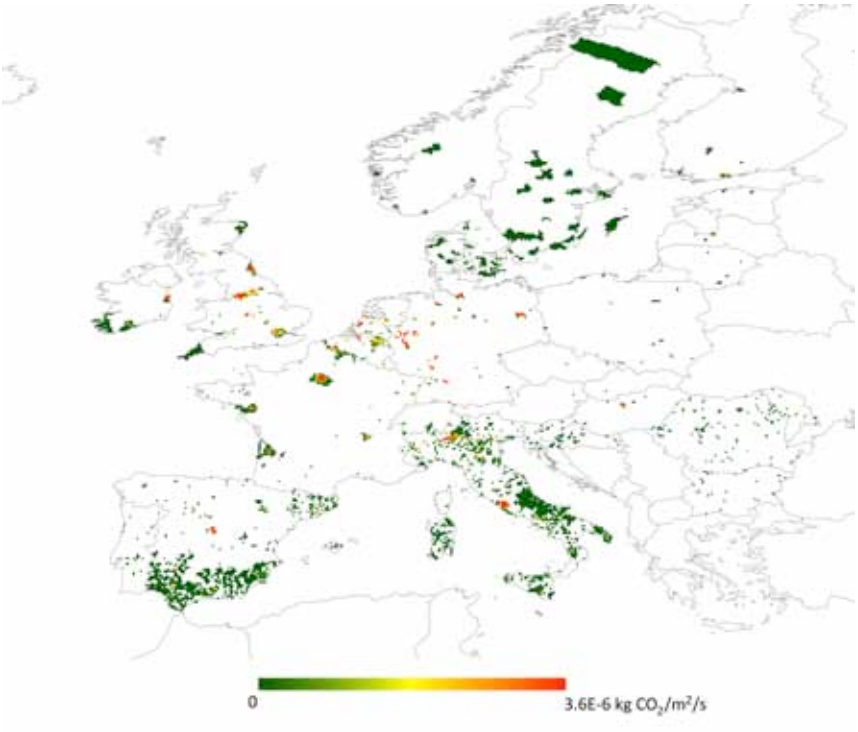
European Commission

JRC SCIENTIFIC AND POLICY REPORTS



The Covenant of Mayors in Figures 5-Year Assessment

Alessandro K. Cerutti, Andreea Iancu, Greet Janssens-Maenhout, Giulia Melica, Federica Paina, Paolo Bertoldi

2013

Report EUR 25992

Joint Research Centre

European Commission
Joint Research Centre
Institute for Environmental Sustainability

Contact information
Greet Janssens-Maenhout
Address: Joint Research Centre, Via E. Fermi, 2749, I-21027 Ispra (VA), Italy
E-mail: greet.maenhout@jrc.ec.europa.eu
Tel: +39 0332785831 or +39 0332789299

http://ies.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

This publication is a Scientific and Policy Report by the Joint Research Centre of the European Commission.

JRC81785

EUR 25992 EN

ISBN 978-92-79-30385-2

ISSN 1831-9424

doi: 10.2788/1062

Luxembourg: Publications Office of the European Union, 2013

Printed in Luxembourg

TABLE OF CONTENTS

ACRONYMS

BEI	Baseline Emission Inventory
CCS	carbon capture and storage
CH_4	methane (1 kg CH_4 ~ 21 kg CO_2)
CHP	combined heat and power
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-eq	CO_2-equivalents
CO_2LPE	CO_2 emissions due to the local production of electricity
CO_2LPH	CO_2 emissions due to the local production of heat
CoM	Covenant of Mayors
CTC	Covenant Territorial Coordinators
EDGAR	Emissions Database for Global Atmospheric Research
EFE	local emission factor for electricity
EFH	emission factor for heat
ELCD	European Reference Life Cycle Database
ETS	European Union Emissions Trading System
EU	European Union
GEP	green electricity purchases by the local authority
GHG	greenhouse gas
GWP	global warming potential
ICLEI	Local Governments for Sustainability
IEA	International Energy Agency
IEAP	International Local Government Greenhouse Gas Emissions Analysis Protocol
ILCD	International Reference Life Cycle Data System
IPCC	Intergovernmental Panel on Climate Change
LCA	life cycle assessment
LHP/LHC	local heat production/local heat consumption
LPE/LCE	local electricity production/ local electricity consumption
MEI	Monitoring Emission Inventory
N_2O	nitrous oxide (1 kg N_2O ~ 310 kg CO_2)
PV	photovoltaic
RES	Renewable Energy Sources
SEAP	Sustainable Energy Action Plan
TCE	total electricity consumption in the territory of the local authority
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
UNDP	United Nations Development Programme

1. INTRODUCTION

1.1 What is the Covenant of Mayors?

After the adoption, in 2008, of the EU Climate and Energy Package, the European Commission launched the Covenant of Mayors (CoM) to endorse and support the efforts deployed by local authorities in the implementation of sustainable energy policies. Indeed, 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 CoM is the mainstream European movement involving local and regional 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 (RES) on their territories ([1]). An extract of the CoM text is given in **Figure 1.1**.

WE, THE MAYORS, COMMIT TO:

Go beyond the objectives set by the EU for 2020, reducing the CO_2 emissions in our respective territories by at least 20%, through the implementation of a Sustainable Energy Action Plan for those areas of activity relevant to our mandates. The commitment and the Action Plan will be ratified through our respective procedures;

Prepare a baseline emission inventory as a basis for the Sustainable Energy Action Plan;

Submit the Sustainable Energy Action Plan within the year following each of us formally signing up to the Covenant of Mayors;

Figure 1.1. Extract of the legal Covenant of Mayors text, to which the signatories commit, as available on the CoM website (http://www.covenantofmayors.eu/about/covenant-of-mayors_en.html)

In order to achieve its CO_2 reduction objective, a city that signs the CoM commits to a number of related supportive actions.

- To prepare a **Baseline Emission Inventory (BEI)** as the basis for a Sustainable Energy Action Plan (SEAP). BEI is a prerequisite to SEAP elaboration, as it will provide knowledge on the nature of the entities emitting CO_2 on the municipality's territory, and thus help in the selection of appropriate actions. Inventories conducted in later years will make it possible to determine if the actions provide sufficient CO_2 reductions and whether further actions are necessary.

- To submit a **Sustainable Energy Action Plan (SEAP)**, officially approved by the local authority, within the year following the adhesion to the CoM. The SEAP is a key document that shows how the Covenant signatory will reach its commitment by 2020. It uses the results of the BEI to identify the best fields of action and opportunities for reaching the local authority's CO_2 reduction target. It defines concrete reduction measures, together with time frames and assigned responsibilities, which translate the long-term strategy into action. Signatories commit themselves to submitting their SEAPs within the year following adhesion.

- **To adapt city structures** in order to undertake the necessary actions, and **mobilise civil society** in their respective geographical areas to take part in developing the Action Plan.

- **To prepare regular Monitor Emission Inventories (MEIs) in which progress towards target is measured (will follow the same methods and principles as BEI).**

- To submit an **action report** at least every second year after submission of the Action Plan. The action report contains qualitative information about the implementation of the SEAP. It includes an analysis of the situation and qualitative, corrective and preventive measures. Every fourth year, the action report should be complemented by a MEI and by quantified information on measures implemented, their impacts on energy consumption and CO_2 emissions, and an analysis of the SEAP implementation process, including corrective and preventive

[1] The text of the Covenant signed by the municipalities is available at http://www.eumayors.eu/IMG/pdf/covenantofmayors_text_en.pdf online.

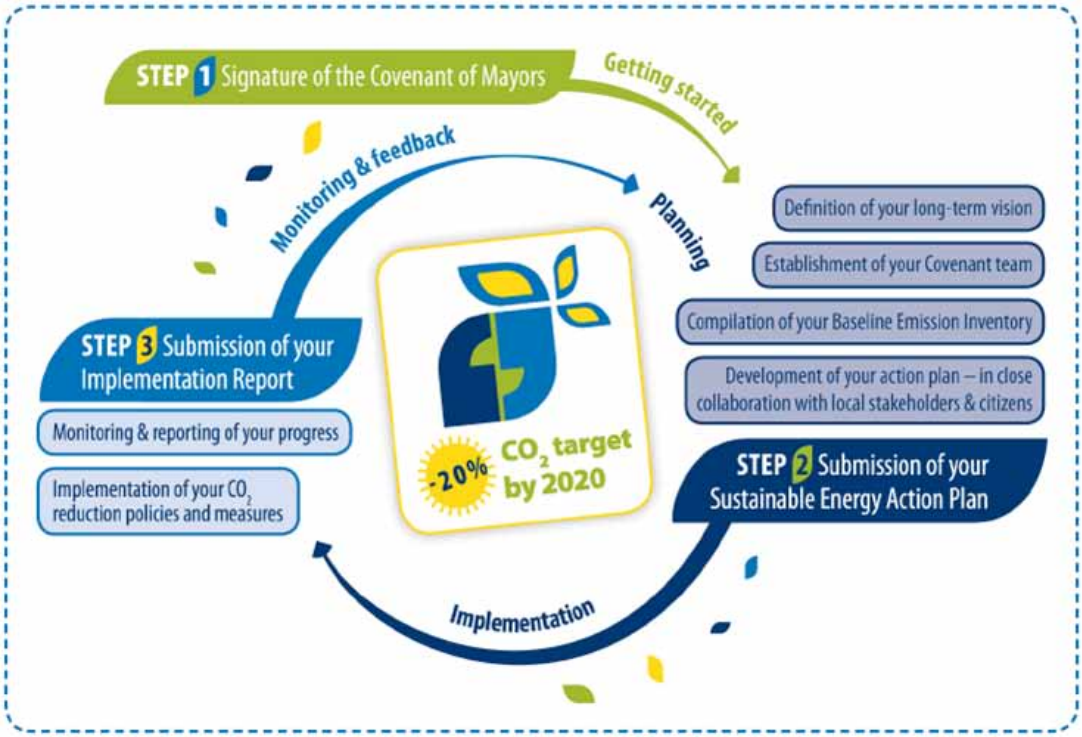


Figure 1.2. The process of SEAP elaboration and implementation. Modified from SEAP Guidebook, Part I - The SEAP process, step-by-step towards the -20 % target by 2020

measures when this is required. The action report, together with a MEI and relevant quantified information on the measures implemented, is called an **implementation report**.

The whole involvement of the signatories to the CoM project is summarised in **Figure 1.2**.

Up to March 2013, no action/implementation report has been submitted; therefore, all the statistics and the projections are based partially on the submitted SEAPs and partially on the accepted SEAPs.

1.2 The CoM and the multi-level governance of climate change

By signing the Covenant, local and regional authorities commit to meeting (and possibly exceeding) the European target in their respective territories. To attain this objective, they commit to take action in the policy areas relevant to their political mandates, focusing on more efficient energy use and on an increased exploitation of local RES.

The choice to promote the action at the level of local authorities is motivated by the fact that urban areas account for about 69 % of the total primary energy demand of the EU ([2]). Under the International Energy Agency (IEA) reference scenario, urban energy consumption is projected to increase at twice the rate of the EU as a whole. Cities and towns are therefore recognised to have enormous potential for driving sustainable energy use, with positive impact on the local economy.

Moreover, the idea that central governments alone cannot properly address the energy and climate change issues without engaging with the activity of sub-national and local action is widespread. Therefore, the Covenant proposes a new model of multi-level governance where common objectives and support are fixed at the EU level, but action takes place at the local level. Based on the subsidiarity principle, different institutional levels are invited to cooperate in order to locally address the global challenge of climate change.

The key role of local authorities is recognised in several Communications from the Commission:

- The Action Plan on Urban mobility (2009) ([3]);
- The Strategic Energy Technology (SET) Plan (2009) ([4]), which mentions the Smart Cities as an important initiative to trigger investments in energy efficiency in cities;
- Energy Strategy 2020 (2010): the need for strengthening initiatives like the Covenant is stressed, since cities and urban areas, consuming 'up to 80% of the energy, are

[2] International Energy Agency (IEA), World Energy Outlook 2008, Paris, 2010.

[3] COM(2009) 490.

[4] COM(2009) 519.

at the same time part of the problem and part of the solution to greater energy efficiency' ([5]);

- Energy Efficiency Plan (2011): the Commission insists on the importance of supporting the CoM, acknowledging 'the role of local and regional authorities in planning and implementing energy efficient and environmental friendly strategies' ([6]);

- Smart Cities and Communities European Innovation Partnership (2012) ([7]): the Commission aims at demonstrating how innovative solutions implemented by industry consortia at the intersection of energy, transport, and information and communication technologies (ICT) can support cities in meeting their targets of reducing greenhouse gas (GHG) emissions, by improving energy efficiency and deploying local RES.

Furthermore, cities are more and more considered as centres to enhance global sustainability and they are the target of several international projects, such as the C40 Cities Climate Leadership Group project ([8]) in which a network of the world's megacities has committed to addressing climate change, or the Local Governments for Sustainability project (ICLEI) ([9]). The latter is an international association of 12 megacities, 100 supercities and urban regions, and 450 large cities as well as 450 small and medium-sized cities and towns in 84 countries, with its world secretariat based in Bonn.

1.3 Geocoverage of the CoM

The CoM is mainly a European movement; therefore, the majority of the signatory cities come from Europe. Nevertheless, there are cities from various other regions. **Figure 1.3** below is a map with the geographical distribution of all cities whose mayors have signed the Covenant initiative so far (cut-off date 14 March 2013). Yet, based on the historical trend and the number of pending requests, there are estimates that the number of signatories is will still grow considerably. The numbers of signatories at the end of each year between 2008 and 2012 are an illustration of the current trend: in December 2008, 241 cities joined, in the same month of 2010, 1 322 cities, in 2011, 3 733 cities, and at the end of 2012, 4 654 cities. The most updated figure of CoM signatories can be found on the CoM website ([10]).

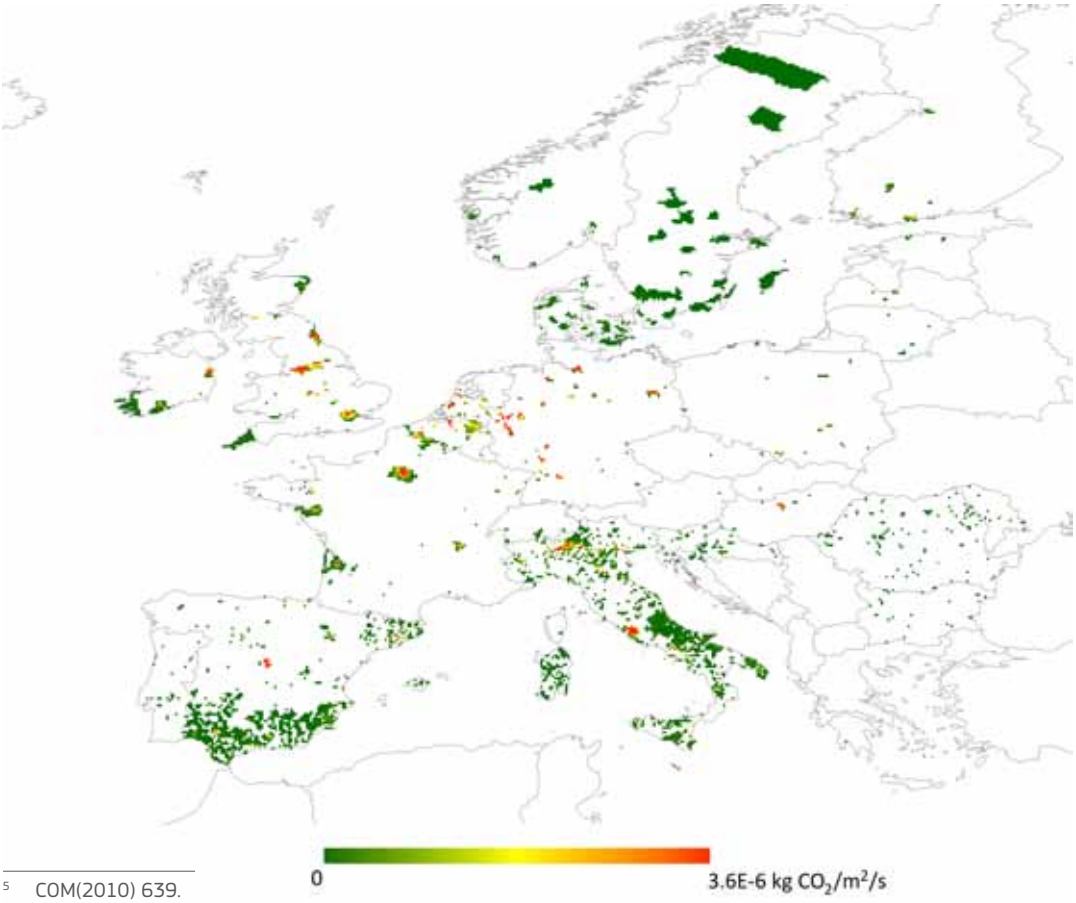


Figure 1.3. Graphical representation of the coverage of CoM signatories in Europe at 14 March 2013, scaled with GHG emissions of the residential sector from EDGARv4.2

[5] COM(2010) 639.

[6] COM(2011) 109.

[7] C(2012) 4701.

[8] See http://www.c40cities.org/home online.

[9] See http://www.iclei.org/ online.

[10] See http://www.covenantofmayors.eu/index_en.html online.

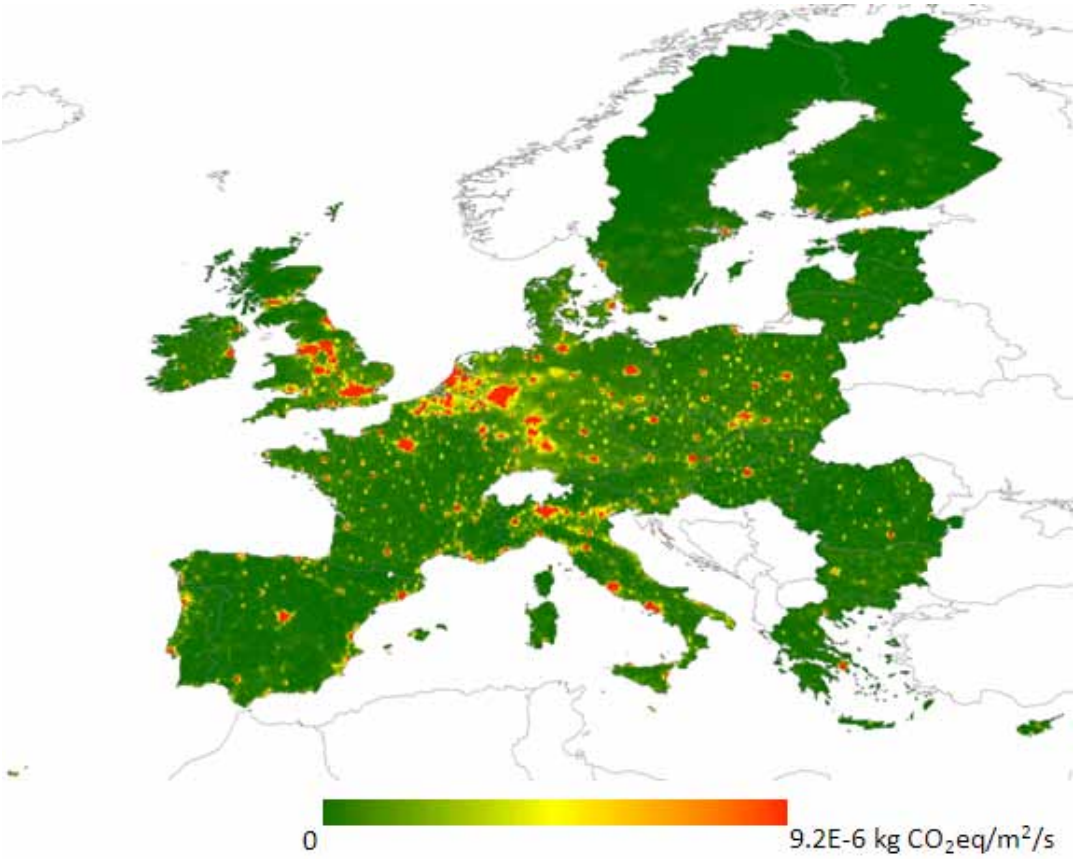


Figure 1.4. GHG emission gridmap of EDGARv4.2 for EU-27 including only three CoM sectors (buildings, transport and landfills), illustrating the large potential of CoM reduction measures in some larger cities

In mid-March 2013, from the total of 5 049 signatories, 2 600 had submitted a SEAP and corresponding BEI, which are then subject to the Joint Research Centre (JRC) review process. By mid-March 2013, 1 100 municipalities had received positive JRC feedback confirming compliance with the quality criteria as described in the CoM Guidebook of 2010 and acceptance of their SEAP and BEI.

The potential of the contributing CoM emission reduction for the EU-27 countries in relation to total emissions from three CoM sectors (heating of buildings, transport and landfills) is illustrated in **Figure 1.4**. The GHG emission estimates are taken from the EDGARv4.2 (Emissions Database for Global Atmospheric Research) emissions database of JRC/PBL (2011) (edgar.jrc.ec.europa.eu).

1.4 Citizens involved in the CoM

The total population covered by the signatories of the CoM, as of mid-March 2013, is 187 million inhabitants, representing 34 % of the total urban population of the 47 participating countries.

Started as an initiative of the European Commission, the CoM has signatories mainly from the EU-27 (160 million inhabitants covered, representing 86 % of the total population of the CoM and 43 % of the EU-27's total urban population).

However, the CoM is reaching out to other regions of the world and includes the participation of Argentina's Buenos Aires and Ushuaia cities as well as the city of Christchurch in New Zealand. Other regions covered by the CoM are European countries outside the EU-27 (Albania, Bosnia and Herzegovina, Croatia, former Yugoslav Republic of Macedonia, Iceland, Montenegro, Norway, Serbia, Switzerland and Turkey), eastern Europe and western Asia (ex-Soviet countries such as Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, Moldova and Ukraine), Africa, South America and Australia. Their proportion in the CoM action is relatively small but it is constantly growing, especially in western Asia. Recently, the CoM received particular attention from Chinese mayors and collaboration is envisaged.

The country with the biggest number of inhabitants involved in this action is Italy (30 million inhabitants), followed closely by Spain (24 million inhabitants). Other countries where the population covered by the CoM is higher than 15 million are, in decreasing order, the United Kingdom (UK), Germany and France. The country where the CoM covers a higher percentage from its urban population is Bosnia and Herzegovina (83.37 % from the country's total urban population).

Table 1.1. The signatories of the Covenant of Mayors as of 14.3.2013 by countries, with total number of inhabitants covered by the project

Region	Country	Number of signatories	Percentage from the number of signatories	CoM population by country 2008–2012 (thousands)	Percentage from CoM population	Percentage covered by CoM from the country urban population	Urban population (thousands) 2008–2012 ([11])
EU-27	Italy	2 582	51.14%	29 964	15.97%	72.67%	41 233
	Spain	1 323	26.20%	24 376	13.00%	68.79%	35 438
	France	151	2.99%	17 145	9.14%	32.24%	53 178
	Romania	110	2.18%	6 695	3.57%	54.43%	12 299
	Greece	104	2.06%	4 223	2.25%	60.74%	6 953
	Portugal	82	1.62%	4 526	2.41%	70.27%	6 441
	Germany	66	1.31%	17 707	9.44%	29.15%	60 744
	Belgium	65	1.29%	3 477	1.85%	33.42%	10 405
	Sweden	60	1.19%	5 551	2.96%	70.19%	7 908
	United Kingdom	44	0.87%	20 436	10.90%	41.53%	49 213
	Malta	37	0.73%	244	0.13%	62.16%	393
	Poland	37	0.73%	4 059	2.16%	17.39%	23 339
	Denmark	31	0.61%	2 804	1.49%	58.35%	4 806
	Netherlands	20	0.40%	4 013	2.14%	29.28%	13 704
	Hungary	22	0.44%	2 390	1.27%	35.20%	6 788
	Bulgaria	25	0.50%	2 874	1.53%	53.60%	5 362
	Latvia	19	0.38%	1 113	0.59%	72.80%	1 529
	Cyprus	15	0.30%	442	0.24%	57.38%	770
	Austria	14	0.28%	1 920	1.02%	33.97%	5 652
	Slovenia	15	0.30%	474	0.25%	47.15%	1 005
	Lithuania	13	0.26%	1 375	0.73%	61.59%	2 232
	Ireland	9	0.18%	1 509	0.80%	55.02%	2 743
	Slovakia	9	0.18%	574	0.31%	19.11%	3 004
	Finland	7	0.14%	1 717	0.92%	37.76%	4 546
	Czech Republic	6	0.12%	337	0.18%	4.38%	7 692
	Estonia	3	0.06%	446	0.24%	47.81%	932
	Luxembourg	2	0.04%	102	0.05%	23.95%	427

[11] Source: UNDP, calculated using each country's own criteria for urban population; the average of the period 2008–2012.

Region	Country	Number of signatories	Percentage from the number of signatories	CoM population by country 2008–2012 (thousands)	Percentage from CoM population	Percentage covered by CoM from the country urban population	Urban population (thousands) 2008–2012
European countries non EU-27	Croatia	45	0.89%	1 784	0.95%	70.29%	2 537
	Bosnia and Herzegovina	14	0.28%	1 515	0.81%	83.37%	1 818
	Switzerland	12	0.24%	906	0.48%	16.11%	5 621
	Turkey	8	0.16%	3 871	2.06%	7.72%	50 175
	Norway	7	0.14%	1 161	0.62%	30.19%	3 847
	Serbia	7	0.14%	570	0.30%	10.35%	5 507
	Montenegro	6	0.12%	276	0.15%	71.08%	388
	Macedonia	3	0.06%	714	0.38%	58.57%	1 220
	Albania	1	0.02%	133	0.07%	8.11%	1 644
	Iceland	1	0.02%	118	0.06%	39.93%	297
ex-Soviet countries	Ukraine	38	0.75%	8 121	4.33%	25.95%	31 294
	Moldova	17	0.34%	1 460	0.78%	87.34%	1 671
	Georgia	5	0.10%	1 738	0.93%	75.59%	2 299
	Belarus	6	0.12%	221	0.12%	3.09%	7 158
	Kyrgyzstan	2	0.04%	267	0.14%	14.59%	1 833
	Azerbaijan	1	0.02%	4	0.00%	0.08%	4 734
	Armenia	1	0.02%	2	0.00%	0.08%	1 982
South America	Argentina	2	0.04%	2 948	1.57%	7.94%	37 141
Africa	Morocco	1	0.02%	903	0.48%	4.91%	18 412
Australia and New Zealand	New Zealand	1	0.02%	360	0.19%	9.61%	3 745
	TOTAL EU-27	**4 871**	**96%**	**160.49 million**	**86%**	**43.53%**	**368 730**
TOTAL	**TOTAL**	**5 049**	**100%**	**187.56 million**	**100%**	**33.98%**	**552 050**

Data on 14.3.2013

These observations are not always reflected by the number of signatory cities. The country with the highest number of signatory cities is Italy (2 582 signatories), followed by Spain (1 323 signatories) and then France (151 signatories). **Table 1.1** gives a more detailed picture of the signatories of the CoM, grouped by region and arranged in decreasing order by the number of signatories. There is also information about the percentage covered by the CoM from the total urban population of the country (average of the period 2008–2012).

To foster a high involvement of citizens, the participation of densely populated cities is of highest relevance. As shown in **Table 1.2**, most of the signatories represent cities with less than 50 000 inhabitants; nevertheless, high shares of the population covered by the project are included in bigger cities (32.13 % of the CoM population live in cities housing between 100 000 and 500 000 inhabitants, and 27.26 % of the CoM population live in cities with more than 1 million inhabitants). Furthermore, up to 14 March 2013, there are 24 cities each with a population of over 1 million inhabitants involved in the CoM (listed in **Table 1.3**).

Table 1.2. Population distribution in Covenant of Mayors on 14.3.2013 according to the size of the municipality

Signatory size category	Number of signatories	Percentage from the total signatories	Total population	Percentage from the total population of CoM
< 50 000 inhabitants	4 453	88.18%	30 859 830	16.45%
50 001–100 000 inhabitants	252	4.99%	17 631 099	9.40%
100 001–500 000 inhabitants	277	5.49%	60 256 208	32.13%
500 001–1 000 000 inhabitants	44	0.87%	28 252 913	15.06%
> 1,000,001 inhabitants	24	0.50%	51 121 639	27.26%

Data on 14.3.2013

Table 1.3. Signatories as of 14.3.2013 with over 1 million inhabitants

No.	City name	Country code	Inhabitants (million)	No.	City name	Country code	Inhabitants (million)
1	London	UK	7.80	13	Sofia	BG	1.38
2	Berlin	DE	3.44	14	Munich	DE	1.36
3	Madrid	ES	3.27	15	Grand Lyon	FR	1.30
4	Buenos Aires	AR	2.89	16	Lancashire	UK	1.30
5	Kyiv	UA	2.82	17	Milan	IT	1.30
6	Rome	IT	2.70	18	Scania	SE	1.23
7	Paris	FR	2.23	19	Lille Metropole	FR	1.11
8	Budapest	HU	2.01	20	Tbilisi	GE	1.10
9	Bucharest	RO	1.94	21	Brussels-Capital	BE	1.05
10	Hamburg	DE	1.76	22	Birmingham	UK	1.03
11	Warsaw	PL	1.68	23	Cologne	DE	1.02
12	Barcelona	ES	1.63	24	Napoli	IT	1.00

Data on 14.3.2013

To facilitate the participation of small municipalities and help them to comply with the Covenant requirements, the initiative allows the preparation of a joint SEAP. Adjoining municipalities with limited financial and/or human resources can therefore join their efforts and prepare a single common SEAP. Not only does this approach reduce the costs for SEAP preparation and reporting, but it could also ease the identification of better opportunities for high-impact actions that go beyond the geographical boundaries of a single municipality.

Following this approach, some municipalities, such as Grand Lyon and Lille Metropole, have signed as metropolitan areas and committed to submitting a joint SEAP. Also, many small municipalities, especially in Spain and France, have chosen to sign as an association of municipalities and develop joint action plans. Examples are Communauté de Communes du Val D'Ille and some Mancomunidades in Spain.

The adhesion of a huge number of small municipalities has also been encouraged, particularly in Spain and Italy, through the support offered by public administrations such as regions or provinces that have signed up to the initiative as Covenant Territorial Coordinators (CTCs). These administrations have committed to offer strategic guidance, and financial and technical support to Covenant signatories, for example by:

- adapting the Covenant methodology to the specific circumstances in their territories;
- gathering the needed activity data and developing dedicated tools for the elaboration of emission inventories;
- identifying the most suitable actions to be implemented by municipalities, possibly identifying economies of scale for the actions' implementation, and searching for available funding sources or financing mechanisms;
- helping municipalities to calculate the potential impact of those actions on the level of emissions;
- drafting the SEAPs for their municipalities;
- taking care of organisational aspects to ensure a proper endorsement of the SEAP by local stakeholders.

As a result, SEAPs submitted by signatories coordinated by the same CTC turned out to be structured in a very similar way and they can be analysed in a special procedure (see Section 2.3).

2. THE SUSTAINABLE ENERGY ACTION PLAN (SEAP)

2.1 Definition

Key to the CoM methodology is the SEAP, in which signatories commit to a minimum CO_2 emission reduction target of 20 % by 2020 and define the actions they need to put in place to reach their commitment. A more specific overview on this procedure can be found in the CoM Guidelines ([12]) and it is briefly described underneath.

2.2 City inventory to monitor the effect of the SEAP

2.2.1 Baseline Emission Inventory (BEI)

As a commitment, when signing the Covenant, the municipality has to prepare a BEI as a basis for the SEAP.

Following the established framework of the United Nations Framework Convention on Climate Change (UNFCCC), we use the Intergovernmental Panel on Climate Change (IPCC) guidelines for definition and emission factors. Similar as for UNFCCC, the recommended baseline year for reporting is 1990, or the closest subsequent year for which the most comprehensive and reliable data can be provided. For those Annex I countries with economy in transition, we recommended choosing a year after 1990, but close to it and representative for the current situation, in order not to be penalised for the 1990–1991 economic breakdown.

The emission reduction target is specified as a ratio, of no less than 20 %, of the 2020 emissions to the baseline year emissions with either an absolute emission reduction or an emissions per capita reduction.

The signatories are given various options regarding the method of approach for the emission inventories. They can choose the IPCC approach or the life cycle assessment (LCA) approach.

In the first case, the standard emission factors are based on the carbon content of each fuel, like in national GHG inventories in the context of the UNFCCC and the Kyoto Protocol. The focus is set on CO_2, which is mandatory to be reported as the most important GHG. Optionally, signatories can choose to also report the emissions of methane (CH_4) and nitrous oxide (N_2O), converted into CO_2-equivalents (CO_2-eq.) according to their global warming potential (GWP). Furthermore, the CO_2 emissions from the sustainable use of biomass/biofuels, as well as emissions of certified green electricity, are considered to be zero. The standard emission factors given in the general guidelines are based on the IPCC 2006 Guidelines (IPCC, 2006). However, the local authority may decide to also use other emission factors that are in line with the IPCC definitions.

Using the LCA approach, the overall life cycle of the energy carrier is accounted. This approach includes not only the emissions of the final combustion, but also all emissions of the supply chain. It includes emissions from exploitation, transport and processing (e.g. refinery) steps, in addition to the final combustion. This hence also includes emissions that take place outside the location where the fuel is used. In this approach, GHG emissions from carbon-neutral fuels are also accounted because of the supply chain of the energy vector. In the case of this approach, GHGs other than CO_2 may play an important role. Therefore, the local authority that decides to use the LCA approach is encouraged to report emissions as CO_2-eq.

2.2.2 Key sectors

The BEI covers the CO_2 emissions that occur due to energy consumption in the territory of the local authority. The European countries report all anthropogenic GHG emissions to UNFCCC as completely as possible and cover the sectors in **Figure 2.1**. From these sectors, road transport and residential combustion are mainly responsible for emissions, and mostly by the urban population, and therefore key sectors for the CoM. In **Figure 2.2**, the 2008 GHG emissions of the CoM sectors for each of the

[12] The full guidebook can be downloaded from the library section of the Covenant, available at http://www.eumayors.eu//Library,84.html online.

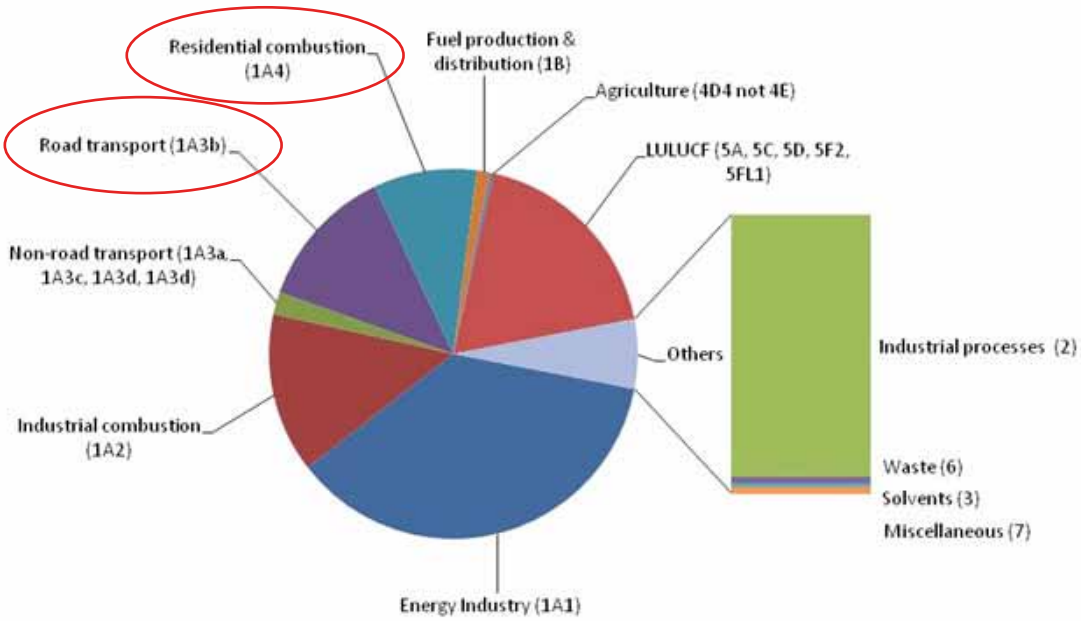


Figure 2.1. Composition for 2008 of the sectors contributing to global anthropogenic CO_2 emissions (conform UNFCCC definition), estimated by EC-JRC/PBL, EDGARv4.2 (http://edgar.jrc.ec.europa.eu)

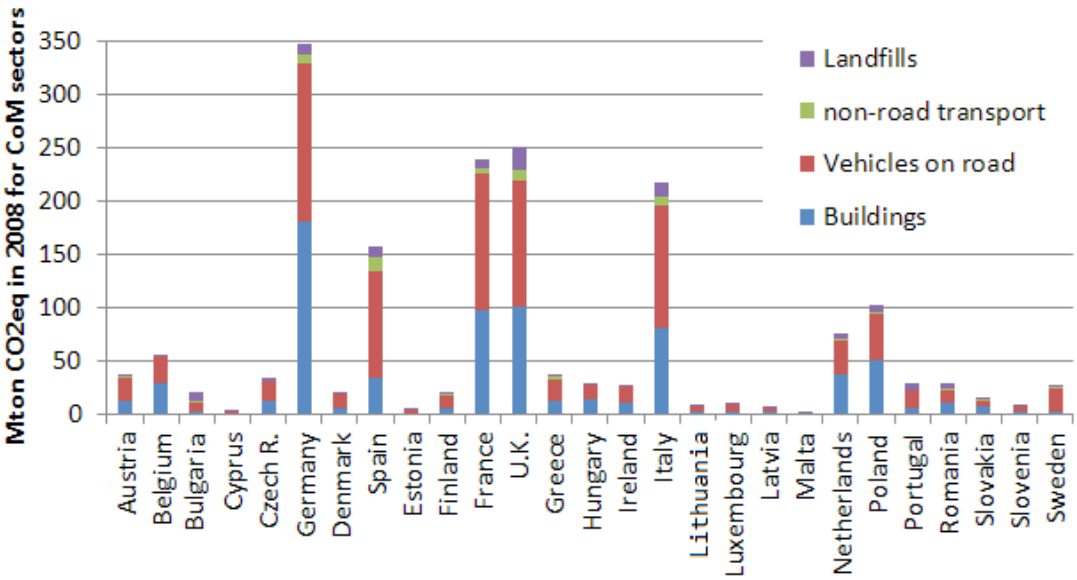


Figure 2.2. Country-specific GHG emissions for 2008 of only those sectors relevant to the Covenant of Mayors (CO_2 from buildings, CO_2 from road and rail transport, and CH_4 from landfills) for EU-27, estimated by EC-JRC/PBL, EDGARv4.2 (http://edgar.jrc.ec.europa.eu)

EU-27 countries are given. From the countries with the largest populations (Germany, Spain, France, Italy and the UK), the highest potential for contributing to the CoM reductions can be expected. The most southern countries (Spain and Italy) show in addition that the transport sector is emitting more significantly than the residential sector, because less heating of buildings is needed.

Among all the fields of action that signatories may adopt to reduce the emissions of their municipality, the following sectors are strongly recommended:

- municipal buildings, equipment and facilities, and municipal public lighting;
- tertiary (non-municipal buildings, equipment and facilities);
- residential buildings;
- urban transportation (including municipal fleet, public transport, private transport).

It is indeed recognised that these sectors are either the highest emitting in the urban environment or those whose energy consumption patterns can be better influenced by the local authority. Therefore, the sectors mentioned above are referred to throughout this report as the four key sectors of activity.

Optionally, besides the above-mentioned energy-related emissions sectors, the sector of industry can be included in the BEI, if the SEAP foresees measures for it. Whenever possible, signatories made a distinction between industry not under the European Union Emissions Trading System (ETS) and industry related to the ETS,

with only the first one being introduced in the city's inventory. Some emission sources not related to energy consumption might also be included in the BEI and in the SEAP, for example wastewater and solid waste treatment.

The local authority may wish to also include actions aiming to reduce CO_2 emissions on the supply side (e.g. development of the district heating network, wind farms and solar photovoltaic (PV) installation). In this case, local energy (electricity, heat/cold) production should also be accounted in the BEI.

It is important to keep in mind that CoM sectors are just a fraction of the whole socioeconomic structure of a city. Some sectors, which play important roles in the GHG emissions of a city, such as big industry or aviation, are deliberately excluded from the scope of the Covenant because the municipalities do not, in most cases, have sufficient influence over them. As a consequence, it is important to state that emission inventories calculated within the framework of the CoM may not be directly compared to inventories from other databases, which for example may include all sources of emission in a country.

2.3 SEAP evaluation criteria

In order to be accepted, a submitted SEAP has to pass thorough technical checks by the JRC. The analysis performed by the JRC consists of a verification of the following criteria:

1. *The SEAP must be approved by an official body (in principle the municipal council).*

Having a longer time horizon than the political mandate of a Mayor, the Covenant engages not only the present administration but possibly also the subsequent one. Therefore, it is essential that the SEAP is endorsed at the highest political level. For this reason, it is considered that the municipal council is the best suited to approve of and to follow up on the SEAP.

2. *The SEAP must clearly specify the overall CO_2 reduction objective by 2020 (20 % as a minimum).*

A quantified target has to be clearly mentioned in the SEAP document in order to allow transparent communication and adequate monitoring of the progress.

3. *The results of the Baseline Emission Inventory (BEI) must be provided and must cover the key sectors of activity.*

The JRC considers criterion 3 fulfilled if the BEI covers at least three out of four key sectors of activity. The municipality is, however, warmly advised to carry out a BEI that covers all the key sectors plus any other sector addressed by measures in the SEAP.

4. *The SEAP must include a set of actions in the key sectors of activity.*

This criterion is met if the municipal sector plus one other key sector is addressed by some actions. Nevertheless, the local authority is recommended to diversify its actions in order to cover as many key sectors as possible.

5. *The SEAP template must be correctly filled in.*

The online SEAP template is the main tool used by the JRC to perform the analysis of data. Moreover, the template will also be used by signatories to report on SEAP implementation. For these reasons, it is crucial that signatories compile it with a sufficient level of details.

6. *The data inserted in the SEAP template must be coherent and complete.*

By comparing the data in the inventories with national averages, the JRC can spot very significant deviations, which might highlight possible mistakes in the data provided by the signatory. In addition, the verification of the internal data coherence helps to demonstrate that SEAP data are accurately reported and ensures the scientific soundness of the approach for developing the SEAP.

An important support for signatories in the whole SEAP management process is given by CTCs. In particular, the procedure for analysis of these SEAPs is done as outlined below.

1. The CTC groups its SEAPs on the basis of population ranges proposed by the JRC and indicates one reference SEAP per group. However, signatories will be free to propose other suitable clusters on the basis of their local situation.

2. The JRC analyses the reference SEAP(s) and the methodology, and sends feedback to the CTC.

3. All the SEAPs in line with the reference one are accepted/not accepted accordingly.

The CTC makes sure that the recommendations made by the JRC on the methodology and/or on the reference SEAP will be transmitted and applied to all the other SEAPs.

Considering country breakdown (see **Table 2.1**), it is possible to highlight a high diversification of the number of SEAPs submitted up to 14 March 2013. Main contributors in terms of SEAPs submitted were Spain and Italy, which together cover almost 80 % of the total number of SEAPs submitted. Furthermore, countries where SEAPs cover the highest percentages of population were considered for more detailed analysis and comparisons.

Table 2.1. Country breakdown of submitted SEAPs as of 14 March 2013

Countries	Number of SEAPs submitted	% of submitted SEAPs	Population covered by SEAPs	% of the population from submitted SEAPs	% of the country urban population covered by the submitted SEAPs
Italy	1 217	46.83%	17 960 954	16.31%	43.56%
Spain	854	32.86%	17 726 379	16.10%	50.02%
France	66	2.54%	10 828 160	9.83%	20.36%
Portugal	51	1.96%	3 377 245	3.07%	52.43%
Germany	48	1.85%	15 021 766	13.64%	24.73%
Sweden	40	1.54%	4 086 681	3.71%	51.68%
Belgium	39	1.50%	2 460 089	2.23%	23.64%
Greece	35	1.35%	1 392 697	1.26%	20.03%
United Kingdom	26	1.00%	14 009 536	12.72%	28.47%
Poland	25	0.96%	2 838 533	2.58%	12.16%
Malta	22	0.85%	104 920	0.10%	26.68%
Romania	22	0.85%	2 046 555	1.86%	16.64%
Denmark	18	0.69%	1 543 642	1.40%	32.12%
Netherlands	12	0.46%	2 597 916	2.36%	18.96%
Bulgaria	7	0.27%	894 502	0.81%	16.68%
Lithuania	7	0.27%	521 077	0.47%	23.34%
Austria	6	0.23%	61 425	0.06%	1.09%
Finland	6	0.23%	1 286 270	1.17%	28.29%
Cyprus	6	0.23%	172 790	0.16%	22.43%
Slovenia	5	0.19%	177 726	0.16%	17.69%
Latvia	4	0.15%	1 024 258	0.93%	66.98%
Republic of Ireland	3	0.12%	968 630	0.88%	35.31%
Slovakia	3	0.12%	101 473	0.09%	3.38%
Hungary	2	0.08%	1 726 378	1.57%	25.43%
Czech Republic	2	0.08%	23 153	0.02%	0.30%
Estonia	1	0.04%	16 914	0.02%	1.82%
Luxembourg	1	0.04%	2 200	0.00%	0.52%
Others non EU-27	72	2.77%	7 178 927	6.52%	3.92%

Data on 14.3.2013

2.4 Status of reviewed SEAPs as a basis for the statistical analysis

Until the date of the report, there were 5 049 signatories, with 187.5 million inhabitants. Of these signatories, 2 600 have submitted a SEAP, and 1 340 SEAPs have been analysed with the following outcomes: 82 % were accepted, 8 % were not accepted and 10 % are on hold (more details in **Table 2.2**).

As accepted SEAPs guarantee both a minimum level of technical quality and political support for the implementation of the action, this report applies statistics on the SEAPs that have been accepted before 14 March 2013. This methodological choice has been adopted in order to give robust results about the current situation and the most reliable expectation from energy savings and emission reduction potential of the project.

Table 2.2. Status of SEAP analysis as of 14 March 2013

Status of the signatory/SEAP	Number as of 14.3.2013	Population covered as of 14.3.2013	% of the population from the total submitted SEAPs
SEAPs Received	2 600	110 905 102	100%
Analysed	1 340	63 311 280	57.09%
Accepted (inclusive eligible)	1 100	45 328 879	40.87%
Not accepted (inclusive non-eligible)	104	11 615 207	10.47%
On hold	136	6 367 194	5.74%

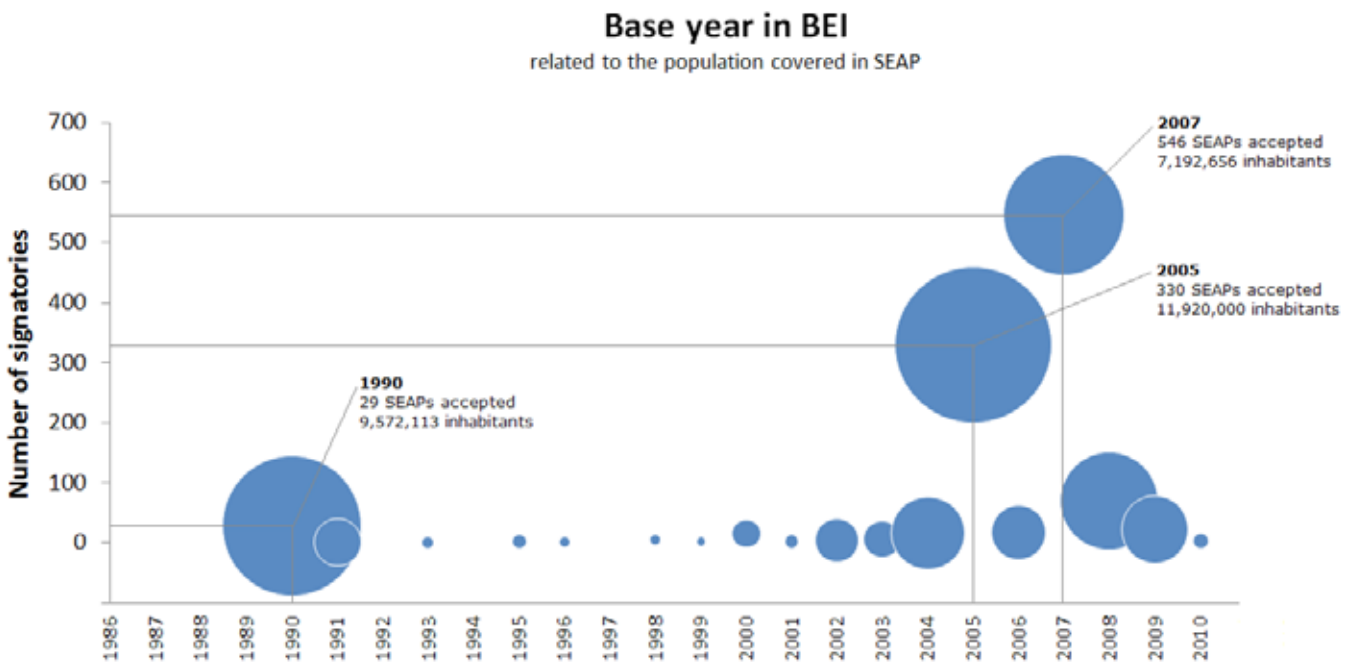
Data on 14.3.2013

3. COM INDICATORS FOR SEAPS' MAIN STATISTICS

3.1 General statistics from the BEI

In the reference guidebook *How to develop a Sustainable Energy Action Plan*, a general recommendation was made to use 1990 as the year for the BEI; nevertheless, freedom of choice was given to signatories to choose the closest subsequent year for which reliable data could be gathered. As a result, different years have been chosen in BEIs. Considering just accepted SEAPs as of 14 March 2013, most of the signatories (almost 85 % of the accepted SEAPs) decided to take 2005 or 2007 as their reference year (see **Figure 3.1** for details). Just 29 SEAPs adopted 1990 as reference year for BEI, as suggested in the guidelines; nevertheless, as these signatories include big municipalities such as Berlin, Munich and Brussels-Capital, about 22 % of the total population in the accepted SEAPs is included in that reference year.

Figure 3.1. The base year chosen in BEIs related to the population covered in the correspondent SEAPs (which is represented, in relative terms, by the size of bubbles).
Data considers only accepted SEAPs as of 14 March 2013



It is important to remark that figures of the chosen year for the BEI may change significantly from this point until the end of the project, both because several SEAPs have yet to be submitted and because of the role played by the CTC. Where a CTC takes care of the BEI elaboration for several municipalities (therefore adopting the same approach, including the choice of the BEI year, as in the case of Barcelona and Andalucia), the number of SEAPs adopting the same year for their BEI may vary significantly.

From country to country the share of population covered in the BEI year may be very different. For example, in Germany and Sweden about 85 % of the population from the accepted SEAPs is covered in the year 1990, for France 2004 is the most used reference year covering 66 % of the SEAP population. In Italy, 50 % of the SEAP population is contained in the BEI from 2005, and for Spain 54 % of the SEAP population is contained in the BEI from 2007.

As emission reduction targets are set according to the BEI, the reference year that has been chosen may play an important role in the whole project. Indeed, for several European countries, for example Germany and Sweden, a significant emission reduction trend can already be highlighted from the beginning of 1990 to nowadays (see EDGARv.4.2 ([13])). Setting the

[13] EDGARv4.2 can be accessed at http://edgar.jrc.ec.europa.eu online.

target based on reference years closer to the actual year would mean a higher effort for emission reduction.

Furthermore, several differences may be highlighted in the methodological approach chosen for the inventories. In most of the SEAPs, the IPCC approach was applied and emission inventory for the CoM sectors was reported in tonnes (t)CO_2 (see **Table 3.1**).

Table 3.1. Inhabitants, share of population covered and total emissions in accepted SEAPs as of 14 March 2013

	Emission unit for reporting	Number of SEAPs	Inhabitants covered by the BEI	Percentage from SEAPs accepted population	GHG emissions as reported in BEI (t)
IPCC approach	CO_2	382	20 579 818	47.55%	170 847 789
	CO_2-eq.	668	16 987 421	39.25%	111 242 634
LCA approach	CO_2	15	2 500 554	5.78%	28 579 298
	CO_2-eq.	10	3 212 780	7.42%	36 786 587

Data from accepted SEAPs as of 14.3.2013

Several reasons may be behind the decision to adopt one method rather than another. One of the most important aspects that must be considered is the availability of data for completing the BEI. As the LCA approach includes emissions from both the user and the producer's phase of each energy carrier, it may require a bigger effort than using the IPCC approach.

3.2 Methodologies for aggregated figures on GHG emissions

As signatories may decide to use two calculation methodologies and two reporting units (resulting in four different kinds of accounting), aggregating emissions for summarised reporting is not a straightforward process. Indeed, combining IPCC and LCA approaches with CO_2 and CO_2-eq. reporting units it is possible to obtain the following figures:

- CO_2 emissions related to direct use of all the energy carriers, adopting IPCC methodology and tCO_2 as reporting unit;
- CO_2, CH_4 and NO_2 emissions related to direct use of all the energy carriers and other non-energy–related sources, adopting IPCC methodology and tCO_2-eq. as reporting unit;
- CO_2 emissions related to direct use and whole supply chain of all the energy carriers, adopting LCA methodology and tCO_2 as reporting unit;
- GHG emissions related to direct use and whole supply chain of all the energy carriers and other non-energy–related sources, adopting LCA methodology and tCO_2 equivalent as reporting unit.

In the scientific literature it is usually highlighted that the two methodologies are related to different aims: the IPCC approach is related to country emission inventory reporting in the framework of policy application and international statistics, while the LCA approach is used for emission inventory at the level of products mainly for environmental product declarations. As a consequence, the two methodologies can be seen as complementary (see **Figure 3.2**) and no consensus can be found on the methodologies for aggregating figures obtained with both approaches.

Therefore, in order to give a single aggregated figure for the statistics of the project, an aggregation methodology has been developed and two steps were applied.

Step 1: transformation from supply chain-related emissions to direct emissions. As emissions accounted with IPCC and LCA refer to different components of the energetic system of a country, the simple sum of them will lead to meaningless figures. Although the IPCC approach considers just direct emissions, the LCA approach considers both direct and

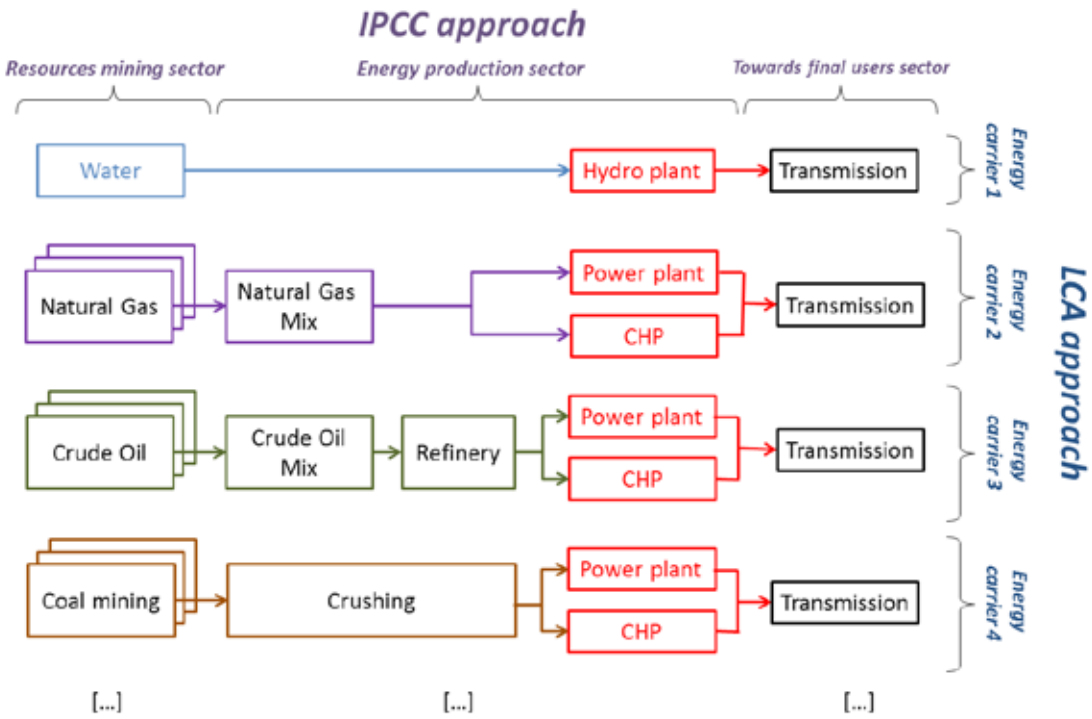


Figure 3.2. Graphical representation of the emission sources considered using the two approaches (IPCC and LCA) in the case of emission accounting from electricity consumption (Modified from ELCD, v.3.1, Electricity EU27 Life Cycle Inventory)

supply chain-related emissions and it can thus be considered to provide the same quantity of emissions using the IPCC approach plus a percentage given by the management of each energy carrier. As such, it is possible to state that, within most of the energy carriers, emission factors using IPCC are related to the direct use of the carrier and LCA emission factors are related to the direct use and the supply chain-related emissions. Therefore, comparing the two emission factors it is possible to obtain the share of direct emissions compared to the whole life cycle emissions of the carrier. For example, considering natural gas, the IPCC emission factor is 0.202 tCO_2-eq./MWh of electricity and the LCA emission factor is 0.237 tCO_2-eq./MWh of electricity. Therefore, in order to obtain 1 MWh of electricity from this carrier, 0.202 tCO_2 (85.28 % of the total) are emitted as a result of the direct use and 0.035 tCO_2 (14.72 % of the total) are emitted as a result of the processes involved in the supply chain of the vector.

Comparing the share of direct and indirect emissions for all the energy vectors with similar system processes (therefore excluding vectors that have null emission factors according to IPCC rules), it is possible to define the range of direct emissions from 81.49 % in gasoline, to 98.46 % in wood, with an average of 88.53 % across all vectors. This share has been assumed to be a representative average for the quantity of direct emissions in the figure calculated using the LCA approach. Therefore, the equivalence factor 0.885 has been set in order to add LCA results to IPCC results (within the same reporting unit). Furthermore, it has to be noted that GWP characterisation factors in LCA are taken directly from IPCC guidebooks, thus problems in consistency in the characterisation of the different emission inventories do not occur.

Step 2: transformation from tCO_2 to tCO_2-eq. Once the transformation to direct emissions is performed it is possible to proceed with just tCO_2 and tCO_2-eq., which refer to the same part of the process (the user phase). In line with the fact that the CO_2 emission is a subsystem of the total amount of emission types, it is possible to assess that the quantity of CO_2 is contained within the quantity of CO_2-eq. Furthermore, it has to be considered that at the urban level the major role in GWP is played by CO_2, which is responsible for an average of 85 % of GWP at the European scale ([14]), and that other GHG emissions are minor components. As a consequence, converting everything CO_2 and CO_2-eq. allows for addition and a comparison will lead to a total value that underestimates the quantity of non-CO_2 emissions, but gives a reliable idea of the dimension of the statistics of the project.

Adopting this procedure, it is possible to obtain the values of aggregated CO_2-eq., which represents only direct emissions of the most important GHGs, with an expected underestimation of non-CO_2 emissions. In the report, this figure is used in order to give a better idea of the statistics and the mitigation potential of the project; nevertheless, disaggregated figures are also given for more details.

[14] Data from EDGARv4.2 (http://edgar.jrc.ec.europa.eu).

3.3 GHG emissions in CoM sectors

The GHG emissions reported in the Covenant are related mainly to the final energy consumption occurring on the territory of the signatory from the sectors recommended by the Covenant. The recommended sectors are usually those which the municipality can influence, which is why there are many very high emitting sectors that are not recommended for inclusion in the city inventory.

In order to submit a SEAP for evaluation, the CoM technical team of each signatory has to compile an online template of the BEI that comprehends both mandatory and optional entries. The mandatory entries include the figure of total emissions in BEI and the subtotal emissions per macro-sector of activities:

- buildings, equipment/facilities and industry (small industry, not included in the EU ETS);
- transport;
- others, not related to energy consumption (non-mandatory sectors, that possibly may be included in one).

The BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES sector includes the following subsectors:

1. municipal buildings, equipment/facilities;
2. tertiary (non-municipal) buildings, equipment/facilities;
3. residential buildings;
4. municipal public lighting;
5. industries – small industries, not involved in ETS.

All these subsectors, with the exception of the industry, are recommended for inclusion in the BEI. The industry sector comprises only small industry, not included in the EU ETS and it is usually included in the BEI if the signatory has planned actions for it in the SEAP.

The TRANSPORT sector includes the following subsectors:

1. municipal fleet;
2. public transport;
3. private and commercial transport.

These sectors cover all transportation that occurs on the territory of the signatory and that is in the competence of the local authority, and include urban road transportation on the street network, urban rail transportation (tram, metro, local trains) and local ferries.

The OTHER EMISSIONS sector includes the not energy consumption-related emissions such as:

1. waste management;
2. wastewater management;
3. other sectors of activities such as agriculture.

It is not mandatory to report figures on emissions of each sector within each of the three macro-sectors. Neither is the inclusion of all the mentioned sectors. As a result, many signatories did not report disaggregated figures for all the key sectors in their template.

In order to give aggregate and robust statistics, only data for filled template entries has been considered for calculating total emissions of each macro-sector and the difference with the given total emission is reported in **Table 3.2** under the category 'Not-assigned emissions in the macro-sector'.

It is interesting to highlight that most of the emissions of the BEI are related to the building sector and, as expected, the emissions in the sectors referred to as 'Other sectors', which include mostly emissions not related to the energy consumption, play a minor role in the project.

Another important remark is the relatively high uncertainty adopted by signatories. Indeed, in total, about 25 % of emissions are not well attributed in the sector. This uncertainty could be related to several factors, including difficulties in the allocation of the total energy consumed by the building sector to a related sector of activities (e.g. due to the quality of

data provided by the energy suppliers in some countries, which does not precisely match the requested split in the template).

Emissions (total and per macro-sector) reported in BEI from signatories in different countries may vary considerably across the EU-27. **Table 3.3** presents emissions reported in BEIs from countries for which accepted SEAPs as of 14 March 2013 cover more than 3 % of the population from the total submitted SEAPs (see **Table 2.1**).

Table 3.2. GHG emissions in CoM sectors reported in BEIs in accepted SEAPs as of 14 March 2013

Sectors covered		IPCC approach (tCO_2-eq.)	LCA approach (tCO_2-eq.)	Aggregated values ($KtCO_2$-eq.)	%
BUILDINGS, EQUIPMENT / FACILITIES & INDUSTRIES	Municipal buildings, equipment/facilities	5 462 013	1 737 681	7 025±147	2.03%
	Tertiary (non municipal) buildings, equipment/facilities	38 662 942	11 276 322	48 809±957	14.10%
	Residential buildings	67 242 613	15 796 631	81 456±1 340	23.55%
	Public lighting	1 016 005	88 128	1 095±7	0.32%
	Industries (excluding ETS)	28 073 095	14 269 988	40 913±1 211	11.80%
	Not-assigned emissions in the macro-sector	60 764 640	141 691	60 892±12	17.66%
	Subtotal	201 221 308	43 310 442	240 190±3 675	69.46%
TRANSPORT	Municipal fleet	333 713	55 738	384±5	0.11%
	Public transport	3 097 322	1 085 741	4 074±92	1.18%
	Private and commercial transport	49 525 868	20 062 779	67 577±1 702	19.51%
	Not-assigned emissions in the macro-sector	24 558 774	72 431	24 624±6	7.14%
	Subtotal	77 515 677	21 276 689	96 659±1 805	27.94%
OTHER	Waste management	6 098 004	666 108	6 697±57	1.94%
	Other sectors of activities	1 181 516	26 467	1 205±2	0.35%
	Not-assigned emissions in the macro-sector	1 014 881	77 562	1 085±7	0.31%
	Subtotal	8 294 401	770 137	8 987±65	2.60%
	TOTAL	287 031 386	65 365 886	345 844±5 546	100%

Data from accepted SEAPs as of 14.3.2013

Table 3.3. GHG emissions in CoM sectors reported in BEIs (total and macro-sectors) for countries covering more than 3 % of the population from the total submitted SEAPs

		IPCC approach (tCO_2-eq.)	LCA approach (tCO_2-eq.)	Aggregated values ($KtCO_2$-eq.)	%
France	Building sector	3 719 905	9 347 771	12 131±793	39.84%
	Transport sector	2 009 001	13 106 285	13 801±1 112	45.21%
	Others	270 272	4 777 483	4 569±405	14.95%
	Total	*5 999 178*	*27 231 539*	30 501± 2 311	100%
Germany	Building sector	75 587 384	42 368 368	113 708±3 595	76.16%
	Transport sector	23 727 357	12 779 400	35 226±1 084	23.60%
	Others	0	413 709	372±35	0.25%
	Total	*99 314 741*	*55 561 478*	149 306±4 714	100%
Italy	Building sector	26 964 852	925 828	27 798±79	77.79%
	Transport sector	7 268 704	576 823	7 788±49	21.78%
	Others	147 261	6 604	153±1	0.43%
	Total	*34 380 817*	*1 509 254*	35 739±128	100%
Portugal	Building sector	6 465 107	0	6 465	55.97%
	Transport sector	5 015 621	0	5 016	43.42%
	Others	70 596	0	71	0.61%
	Total	*11 551 324*	*0*	11 55	100%
Spain	Building sector	31 588 515	2 243	31 591±0.2	53.82%
	Transport sector	23 110 344	1 717	23 112±0.1	39.37%
	Others	3 998 168	159	3 998±0.1	6.81%
	Total	*58 697 027*	*4 119*	58 701±0.3	100%
Sweden	Building sector	4 404 555	0	4 405	60.10%
	Transport sector	2 924 723	0	2 925	39.90%
	Others	0	0	-	0.00%
	Total	*7 329 278*	*0*	7 329	100%
United Kingdom	Building sector	24 118 760	2 602 000	26 460±221	77.40%
	Transport sector	6 992 015	818 000	7 728±69	22.60%
	Others	0	0	-	0.00%
	Total	*31 110 775*	*3 420 000*	34 188±290	100%

Data from accepted SEAPs as of 14.3.2013

Besides total emissions, interesting remarks may be obtained considering emission per capita within each sector. As some sectors are strictly related to the municipality and cannot be directly related to citizens (such as municipal buildings or municipal fleet), only in a few sectors can the relation between emissions and population be significant. Emission per capita may be relevant for the sectors of residential buildings, tertiary buildings, private and commercial transport, and the waste management sector. For these sectors, emissions per capita are reported and related to the same indicator obtained from the emission inventory database at the country level (EDGARv4.2). The 'per capita' values from EDGAR were obtained using data series on CO_2, CH_4 and N_2O emissions from 1990–2008. Because not all the years are equally represented as baseline years in the Covenant, the EDGAR average 'per capita' figure was calculated as a weighted average, the weight of each year given by the percentage of the population covered for that year in the Covenant.

Table 3.4. GHG emissions per capita in some CoM sectors reported in BEIs in accepted SEAPs as of 14 March 2013

Sectors covered	IPCC approach (tCO_2-eq./cap)	LCA approach (tCO_2-eq./cap)	Aggregated values (tCO_2-eq./cap)	EDGAR values** at EU-27 (tCO_2-eq./cap)
Tertiary (non-municipal) buildings, equipment/facilities	1.40	2.31	1.51	0.41
Residential buildings	2.29	2.91	2.34	1.33
Private and commercial transport	1.75	3.41	1.99	1.79
Waste management	0.37	0.27	0.35	0.32
TOTAL	***5.81***	***8.90***	***6.18***	***3.85***
TOTAL (including all the sectors in BEI)	**7.54***	**11.42***	**7.88***	**4.02 (10.99***)**

Data from accepted SEAPs as of 14.3.2012

** General Total as reported in the BEI table; please note that this value has no meaning in physical terms*

*** Weighted average for the period 1990–2008, weighting factor – percentage of the population covered by the year in the accepted SEAPs*

**** Figure including all the IPCC sectors at EU-27 level*

The national values from EDGAR contain only data related to the emissions of: CO_2, CH_4 and N_2O and the IPCC sectors covered are: residential combustion, road transport, solid waste management and domestic wastewater management.

Table 3.5. Country breakdown of GHG emissions per capita in some sectors reported in BEIs for partner countries with SEAPs covering more than 3 % of the population from the total submitted SEAPs as of 14 March 2013

		IPCC approach (tCO_2-eq./cap)	LCA approach (tCO_2-eq./cap)	Aggregated values (tCO_2-eq./cap)	EDGAR values at country level (*all sectors) (tCO_2-eq./cap)
France	Tertiary (non-municipal) buildings, equipment/facilities	1.25	1.56	1.34	0.52
	Residential buildings	1.92	2.47	2.10	1.76
	Private and commercial transport	1.99	5.57	4.10	2.20
	Waste management	0.73	0.16	0.21	0.27
	TOTAL (all the sectors in BEI)	***5.71***	***11.92***	***9.02***	***4.96 (8.99*)***
Germany	Tertiary (non-municipal) buildings, equipment/facilities	1.48	2.98	2.00	0.93
	Residential buildings	2.36	3.38	2.64	1.82
	Private and commercial transport	1.61	2.35	1.83	1.97
	Waste management	--	0.78	0.69	0.39
	TOTAL (all the sectors in BEI)	***15.05***	***12.31***	***13.30***	***5.21 (14.48*)***
Italy	Tertiary (non-municipal) buildings, equipment/facilities	1.32	0.57	1.29	0.29
	Residential buildings	2.61	1.84	2.56	1.14
	Private and commercial transport	1.36	2.31	1.40	1.96
	Waste management	0.32	0.11	0.32	0.32
	TOTAL (all the sectors in BEI)	***6.85***	***6.21***	***6.79***	***3.87 (8.36*)***

		IPCC approach (tCO_2-eq./cap)	LCA approach (tCO_2-eq./cap)	Aggregated values (tCO_2-eq./cap)	EDGAR values at country level (*all sectors) (tCO_2-eq./cap)
Portugal	Tertiary (non-municipal) buildings, equipment/facilities	0.95	--	0.95	0.23
	Residential buildings	0.86	--	0.86	0.78
	Private and commercial transport	1.75	--	1.75	1.79
	Waste management	0.19	--	0.19	0.63
	TOTAL (all the sectors in BEI)	***4.98***	***--***	***4.98***	***3.55 (9.13*)***
Spain	Tertiary (non-municipal) buildings, equipment/facilities	0.90	--	0.90	0.19
	Residential buildings	1.16	--	1.16	0.70
	Private and commercial transport	1.62	--	1.62	2.29
	Waste management	0.26	0.14	0.26	0.25
	TOTAL (all the sectors in BEI)	***4.80***	***4.90***	***4.80***	***3.61 (9.66*)***
Sweden	Tertiary (non-municipal) buildings, equipment/facilities	0.24	--	0.24	0.50
	Residential buildings	1.24	--	1.24	1.16
	Private and commercial transport	2.15	--	2.15	2.19
	Waste management	--	--	--	0.33
	TOTAL (all the sectors in BEI)	***7.37***	***--***	***7.37***	***4.36 (13.21*)***
United Kingdom	Tertiary (non-municipal) buildings, equipment/facilities	1.92	--	1.92	0.39
	Residential buildings	2.93	2.58	2.84	1.37
	Private and commercial transport	2.15	1.65	2.04	2.00
	Waste management	--	--	--	0.40
	TOTAL (all the sectors in BEI)	***9.14***	***6.90***	***8.75***	***4.18 (11.04*)***

Data from accepted SEAPs as of 14.3.2013
** Figure representing the GHG emissions for all IPCC sectors*

The EDGAR national GHG emissions for the CoM sectors just serve as orientation value for the values reported under the CoM. The following differences should be noted.

1. The definition of the energy consumption in the tertiary, residential and transport sectors in EDGAR covers only locally, in-situ emitting sources whereas the CoM defined these sectors for all energy carriers, including electricity and heat. Even though electricity and heat are non-emitting at the place of consumption, the CoM considers the users co-responsible for the production of the electricity and heat and therefore for its corresponding emissions at the place of production. This is important for those countries where electricity from fossil fuel and heat from district plants are used substantially (more in northern Europe).

2. Whereas small industrial combustion is in EDGAR defined as conform IPCC, under manufacturing industry, this can be defined in the CoM under small-scale installations for the tertiary sector. The per capita values of the CoM for the tertiary sector can therefore be larger than the ones in EDGAR and the total emissions for the tertiary sector in CoM can exceed the estimate of EDGAR.

3. Whereas EDGAR aims to have a complete accounting of each sector, the CoM only reports the sector or subsector on which reduction measures are defined, without the aim of providing a complete estimate of the emissions for that sector.

4. Whereas the CoM collects data bottom-up for the region of the city, EDGAR collects the data at national level. For those signatories with well-developed urban centres, attracting the population of the surrounding area for tertiary services, per-capita values can deviate.

Considering the above-mentioned limitations, in most of the cases analysed, it is possible to observe similar data at 'per capita' figures at the level of key sectors. A notable exception is the 'per capita' figure for the tertiary sector, which is constantly and considerably bigger for the emissions reported in the Covenant. This was expected given the fact that most of the signatories are urban centres where the tertiary sector is better developed and also serves the population of the surrounding area, and therefore it is better represented at 'per capita' level.

However, the total 'per capita' emissions reported in the Covenant inventories is, in some cases such as Germany, France and Italy, more similar to the 'per capita' national average for all the IPCC sectors and not only for the key sectors of the Covenant. This could be explained by the introduction, in many of the inventories, of the small industry sector, one which is not accounted for in the EDGAR national average.

3.4 Energy consumption in signatory cities

As the focus of the initiative is reducing emissions associated with energy consumption by end users, and because about 75 % of CO_2 emissions are generated via combustion ([15]), it is interesting to see which are the most energy-consuming sectors in Covenant cities. As in the case of emission accounting, general statistics may also be calculated for energy consumption from the signatories. According to the accepted SEAP as of 14 March 2013, the residential sector plays the most important role among the sectors covered by the project (See **Tables 3.6a** and **3.6b**). The municipal sector (including Municipal buildings, equipment/facilities, Public lighting, Municipal fleet) represents around 2 % of the final energy consumption reported in the inventories. Nevertheless, it is considered one of the key sectors of activity for the initiative due to the exemplary role that the local administration has to represent for its citizens.

Table 3.6a. Energy consumption, in total figures in CoM sectors reported in BEIs

	Sectors covered	Energy consumption (MWh)	%
BUILDINGS, EQUIPMENT/ FACILITIES & INDUSTRIES	Municipal buildings, equipment/facilities	23 661 473	1.57%
	Tertiary (non-municipal) buildings, equipment/facilities	226 279 812	15.02%
	Residential buildings	338 181 304	22.44%
	Public lighting	3 153 362	0.21%
	Industries (excluding ETS)	151 648 408	10.06%
	Energy consumption not attributed in the macro-sector	324 162 303	21.51%
	Subtotal	**1 067 086 661**	**70.81%**
TRANSPORT	Municipal fleet	1 625 389	0.11%
	Public transport	15 409 261	1.02%
	Private and commercial transport	245 960 078	16.32%
	Emission not attributed in the macro-sector	176 899 478	11.74%
	Subtotal	439 894 206	29.19%
	TOTAL	**1 506 980 867**	**100%**

Data from accepted SEAPs as of 14.3.2013

[15] Data from EDGARv4.2 (http://edgar.jrc.ec.europa.eu).

Table 3.6b. Final energy consumption from electricity, heat and cold, fossil fuel and renewable energy produced in situ, for CoM sectors reported in BEIs. Please note that electricity and heat and cold might contain a share from renewable sources according to the national and local power grid mix. Figures are obtained from non-mandatory fields in Table A of the SEAP template; as a result, totals may differ from mandatory values expressed in Table 3.6a.

Sectors covered		Electricity consumption (MWh)	Heat and cold consumption (MWh)	Fossil fuels consumption (MWh)	Renewable energy* (MWh)
BUILDINGS, EQUIPMENT/ FACILITIES & INDUSTRIES	Municipal buildings, equipment/facilities	7 121 323	7 304 085	6 096 523	65 166
	Tertiary (non-municipal) buildings, equipment/facilities	100 006 872	22 348 421	74 472 208	313 776
	Residential buildings	94 199 600	37 801 465	202 136 363	4 983 105
	Public lighting	3 177 503	-	-	-
	Industries (excluding ETS)	56 897 999	8 480 510	87 153 430	360 863
	Energy consumption not attributed in the macro-sector	76 047 572	38 185 525	23 334 267 564	7 341 555
	Subtotal	**337 450 868**	**114 120 006**	**23 334 755 367**	**7 341 569**
TRANSPORT	Municipal fleet	937 760	-	1 535 318	43 653
	Public transport	4 713 008	-	7 047 113	293 064
	Private and commercial transport	384 033	-	240 879 020	114 971
	Emission not attributed in the macro-sector	3 031 749	-	140 910 568	1 203 523
	Subtotal	**9 066 550**	**0**	**390 372 019**	**1 655 211**
	TOTAL	346 522 342	114 120 006	1 079 215 150	14 719 675

Data from accepted SEAPs as of 14.3.2013
Note: figures are obtained from non-mandatory fields in Table A of the SEAP template; totals may differ from mandatory values expressed in Table 3.6a
**Renewable energy (not electricity) produced by end users for their own usage*

From **Table 3.7** it is interesting to observe that, as can be expected, certain Mediterranean countries such as Spain and Portugal (and Italy, even if to a lesser extent) have lower per capita energy consumption in residential buildings compared to central and northern European countries, such as Germany, France, Sweden and the UK. In the transport sector, the per capita energy consumption ranges between 5.4 MWh/capita for Italy and 8.6 MWh/capita for Sweden, whereas the figure for France is sensibly higher (15.5 MWh/capita). The energy consumption per capita, in the transport sector, incorporates several technical parameters such as efficiency of vehicles and infrastructures, but also other social aspects such as the organisation of the

city, the average distance from house to work per capita and the attitude of using transport during leisure time. As a consequence, further in-depth analyses are required to explain these statistics.

Table 3.7. Country breakdown of energy consumption per capita in some sectors reported in BEIs for partner countries with SEAPs covering more than 3 % of the population from the total submitted SEAPs as of 14 March 2013

		Energy consumption (MWh)	Population covered by BEI	Energy consumption per capita (MWh)
France	Tertiary (non-municipal) buildings, equipment/facilities	40 295 396	3 316 427	12.15
	Residential buildings	40 156 816	3 316 427	12.11
	Private and commercial transport	48 837 922	3 159 781	15.46
	TOTAL (all the sectors in BEI)	**138 214 125**	**3 336 327**	**41.43**
Germany	Tertiary (non-municipal) buildings, equipment/facilities	42 034 979	6 392 827	6.58
	Residential buildings	67 650 241	6 467 168	10.46
	Private and commercial transport	49 077 289	7 276 763	6.74
	TOTAL (all the sectors in BEI)	**439 769 535**	**9 261 420**	**47.48**
Italy	Tertiary (non-municipal) buildings, equipment/facilities	17 847 429	4 759 755	3.75
	Residential buildings	47 137 920	4 825 397	9.77
	Private and commercial transport	25 554 089	4 723 039	5.41
	TOTAL (all the sectors in BEI)	**130 930 335**	**5 262 033**	**24.88**
Portugal	Tertiary (non-municipal) buildings, equipment/facilities	3 927 282	1 620 565	2.42
	Residential buildings	4 460 802	1 819 624	2.45
	Private and commercial transport	11 355 746	1 684 069	6.74
	TOTAL (all the sectors in BEI)	**34 024 672**	**2 219 372**	**15.33**
Spain	Tertiary (non-municipal) buildings, equipment/facilities	20 744 588	7 890 492	2.63
	Residential buildings	31 010 307	7 890 445	3.93
	Private and commercial transport	45 232 930	7 041 891	6.42
	TOTAL (all the sectors in BEI)	**192 380 978**	**12 201 666**	**15.77**
Sweden	Tertiary (non-municipal) buildings, equipment/facilities	1 084 806	243 422	4.46
	Residential buildings	7 143 435	676 464	10.56
	Private and commercial transport	679 901	79 043	8.60
	TOTAL (all the sectors in BEI)	**35 271 509**	**925 164**	**38.12**
United Kingdom	Tertiary (non-municipal) buildings, equipment/facilities	10 320 995	1 940 250	5.32
	Residential buildings	34 422 693	3 265 529	10.54
	Private and commercial transport	15 508 231	2 292 029	6.77
	TOTAL (all the sectors in BEI)	**109 194 680**	**3 405 029**	**32.07**

Data from accepted SEAPs as of 14.3.2013

3.5 Local production of electricity (LPE) in signatory cities

Besides reducing the emissions associated with their energy consumption, local authorities can also decide to take action on the supply side, for example by fostering the deployment of locally available RES to produce electricity. If a local authority wants to take action on the supply side and some production plants were already present in its territory during the baseline year, the signatory is requested to report the amount of locally produced electricity in a separate table of the online template. This means that signatories whose aim is only to reduce the amount of energy consumed in their territory are not obliged to report on LPE. Besides, it has to be underlined that the CoM methodology for the elaboration of emission inventories sets clear rules for considering a production plant as local; therefore, not all the production plants within the boundaries of the local authority are necessarily included in the table ([16]).

As can be seen in **Table 3.8**, only 128 inventories in the sample contain information on LPE through at least one technology. The data provided do not allow for discriminating between which amount of electricity comes from renewable sources and which from fossil sources.

It is interesting to observe that a very important share of electricity is produced through combined heat and power (CHP). The greatest share of LPE is reported under the 'Others' category, where signatories have inserted electricity produced through other combustion plants without combined heat production.

As a general remark, it can be seen that the share of LPE compared to the total consumption of electricity (TCE) as reported in the same inventories is lower than 3 % for Spain, France, Italy, Portugal and the UK, whereas Germany has the highest share of LPE on TCE, close to 14 % (see **Table 3.9**).

Table 3.8. Local production of electricity, in total figures and per capita, in CoM sectors reported in BEIs

	Number of BEIs including LPE	Population in BEIs including LPE	LPE (MWh)	LPE per capita (MWh/ capita)	Share of each technology on LPE	Share of each technology on TCE**
Wind power	17	3 254 415	631 983	0.19	2.99%	0.19%
Hydroelectric power	39	5 178 003	991 734	0.19	4.69%	0.30%
Photovoltaic	64	2 604 020	291 254	0.11	1.38%	0.09%
Combined heat and power	35	9 669 174	7 395 131	0.76	34.98%	2.23%
Others	26	13 716 926	11 828 187	0.86	55.96%	3.56%
of which from waste management	*16*	*9 282 165*	*6 846 757*	*0.74*	*32.39%*	*1.98%*
BEIs including at least one sector	***128****	***18 207 966***	***21 133 099***	***1.16***	***100%***	***6.36%***

Data from accepted SEAPs as of 14.3.2013
** Number of BEIs including at least one source*
*** TCE: total energy consumption, equal to 332 031 681 MWh*

[16] See the decision tree in the CoM Guidebook (Part II, section 3.4.2 Local electricity production) to see what is considered as local electricity production in the CoM.

Table 3.9. Local production of electricity (LPE), in total figures and per capita, in CoM sectors reported in BEIs for partner countries with SEAPs covering more than 3 % of the population from the total submitted SEAPs as of 14 March 2013

	Number of BEIs including LPE	Population in BEIs including LPE	LPE (MWh)	LPE per capita (MWh/capita)	Total consumption of electricity (TCE) (MWh)	Percentage of LPE compared to TCE
France	3	405 746	236 149	0.58	34 423 443	0.69%
Germany	15	7 880 670	9 982 156	1.27	72 054 118	13.85%
Italy	46	1 756 823	781 898	0.45	27 024 842	2.89%
Portugal	4	630 495	102 652	0.16	9 765 777	1.05%
Spain	36	1 446 141	329 711	0.23	58 841 221	0.56%
Sweden	8	737 471	825 780	1.12	13 136 804	6.29%
United Kingdom	2	1 309 479	156 518	0.12	22 414 808	0.70%

Data from accepted SEAPs as of 14.3.2013

3.6 Local heat/cold production in signatory cities

If local heat/cold production (LPH) plants (i.e. plants feeding a district heating/cooling network) are present in the territory of the local authority, the signatory has to list them in a dedicated table, providing information on the energy carrier input and heat/cold output. This will allow for the calculation of a local emission factor for heat/cold, to be used to calculate emissions associated with the heat/cold distributed as a commodity to the end users.

Table 3.10. Local heat/cold production (LPH), in total figures and per capita, reported in BEIs

	Number of BEIs including LPH	LPH (MWh)	LPH per capita (MWh/capita)	Share of each technology on the LPH	Share of production, from each vector, compared to LHC
Combined heat and power	1 113	51 441 860	1.07	51.16%	46.27%
District heating plants	1 113	34 574 273	0.72	34.39%	31.10%
Others	1 113	14 528 006	0.25	14.45%	13.07%
BEIs including at least one source	***1 113****	***100 544 139***	***2.10***	***100.00%***	***90.43%*****

Data from accepted SEAPs as of 14.3.2013
** Number of BEIs including at least one source*
*** Total heat and cold locally consumed 111 187 606 MWh. The amount of heat and cold locally consumed is higher than the amount locally produced. This can be due to the fact that signatories are not required to report the amount of heat and cold imported from a plant located outside municipal boundaries.*

Table 3.11. Local heat/cold production (LPH), in total figures and per capita, in CoM sectors reported in BEIs for partner countries with SEAPs covering more than 3 % of the population from the total submitted SEAPs as of 14 March 2013

	Number of BEIs including LPH	Population in BEIs including LPH	LPH (MWh)	LPH per capita (MWh/capita)
France	9	3 336 327	6 994 164	2.1
Germany	16	9 591 985	41 594 886	4.34
Italy	310	5 283 629	1 834 782	0.35
Portugal	31	2 433 166	12 990	0.01
Spain	659	12 246 082	83 167	0.01
Sweden	14	977 821	7 423 028	7.59
United Kingdom	14	4 922 569	1 552	0

Data from accepted SEAPs as of 14.3.2013

In order to better understand these results it is important to highlight that there is an infrastructural difference between countries of northern Europe needing lots of heating of houses, which is efficiency delivered by district heating plants, and the countries of southern Europe, which efficiently only heat locally and temporarily as needed.

4. CO_2 MITIGATION POTENTIAL BY COM SIGNATORIES

4.1 Use and limitation of the estimations

All signatories have to submit their official action plan following their own specific methodology and structure. Besides this official document, they also have to fill in a template, introducing the Sustainable Energy Actions (SEAs) included in the SEAP, together with project management information and certain impact estimations regarding each of them, such as:

1. responsible body;
2. implementation time frame;
3. estimated costs per measure;
4. expected energy saving per measure [MWh/a];
5. expected renewable energy production per measure [MWh/a];
6. expected CO_2 reduction per measure [t/a];
7. energy saving target per sector [MWh] in 2020;
8. local renewable energy production target per sector [MWh] in 2020;
9. CO_2 reduction estimation per sector [t] in 2020.

The only compulsory field in this template is the CO_2 reduction estimation per sector (9). Besides this field, most of the signatories chose to fill in information only for: implementation time frame (2), estimated costs per measure (3) and expected CO_2 reduction per measure (6).

As a consequence, the database shows different kinds of data that can be used for statistics in mitigation potential and for projections. The first kind of reduction potential is calculated considering the reduction target that has been set: in this case the quantity of emissions reduced is given as the CO_2 as a percentage of the total emission reported in BEI. The second and the third mitigation potentials are given by the sum of the expected reduction in each of the CoM sectors and in each of the actions described in the SEAP. As a result of the not mandatory request of CO_2 reduction estimation for all sectors and for all measures, several entries have been left open and in each plan (thus, in each signatory) the three total reduction potentials may not coincide. In the following paragraphs all the three kinds of reduction potentials (**Table 4.1**) are reported and described taking into account implications and limitations.

Another aspect of the limitation of the statistics is given by the inner nature of the project's voluntariness. Signatories declare their commitments ([17]) to CO_2 reduction in a voluntary framework and no control of the effective CO_2 reductions will be performed by the European Commission. Indeed, the European Commission is not a regulatory body or a regulatory authority and, in the framework of the subsidiarity principle ([18]), only monitoring actions (e.g. on air quality or energy efficiency) can be taken. As a result, all the statistics here represent the effort declared by signatories, but they cannot be taken as mitigation potential committed to by the European Commission.

[17] See Covenant of Mayors' core documents in the library section of the CoM website (http://www.eumayors.eu/Library,84.html).

[18] Article 5 of THE TREATY ON EUROPEAN UNION, Official Journal of the European Union, 30.3.2010.

Table 4.1. Summary description of the three figures on emission reduction potentials

Figure	Description	Location	Mandatory
CO_2 reduction by reduction target from BEI	The target of all the actions in the SEAP. It is given by signatories as a percentage of emissions in 2020 compared to the emissions in BEI	My Overall Strategy	yes
CO_2 reduction by estimated reduction in sectors	The estimation by signatories of emission reductions in each sector that could be achieved in 2020	Sustainable Energy Action Plan Template	yes, only for buildings and transport (also in local energy production if measures are reported)
CO_2 reduction by estimated reduction in actions	Calculated as the sum of all the emissions avoided by running the action. Figures for all the actions are not indicated because estimating the effect of an action is not always possible	Sustainable Energy Action Plan Template	no

4.2 Global targets from Sustainable Energy Action Plans (SEAPs)

The scope of the SEAP is to quantitatively define, describe and estimate energy-related GHG reduction measures. Signatories are free to decide on a reduction target in 2020 that has to be higher than the 20 % of the total emissions reported in BEI.

Considering SEAPs accepted as of 14 March 2013, a large number of the signatories (37 %) decided to adopt exactly the 20 % reduction target, but most of them committed to even increasing their efforts: 43 % of the signatories adopted a reduction target comprised of 20 % and 25 %, 9 % of the signatories targeted 25 % (included) to 30 % reduction, and 12 % of the signatories decided to target more than 30 % (included). **Figure 4.1** shows the emission reduction potential of each range of targeted reduction.

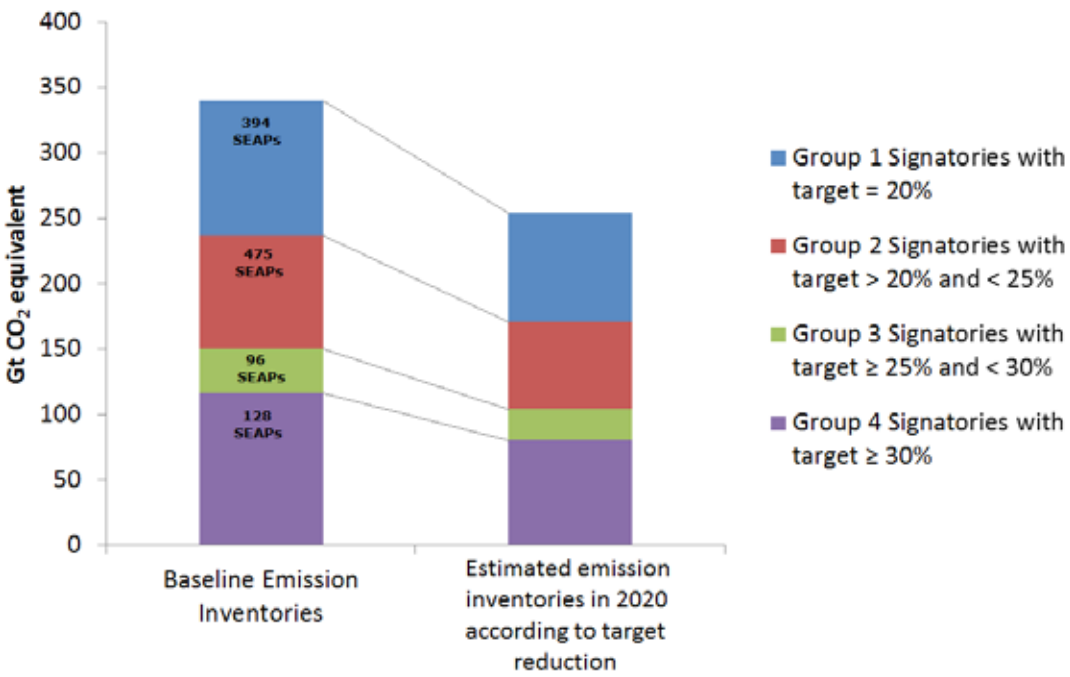


Figure 4.1. Graphical representation of the emission reductions according to the targets set in SEAPs accepted as of 14 March 2013

It is interesting to highlight that, in general terms, big cities decided to adopt higher reduction targets than small cities. As a result, the total emissions potentially reduced in 2020 by the 394 SEAPs that committed to exactly 20 % is lower than the quantity of total emissions committed to be reduced by the 128 SEAPs that committed to 30 % or more emission reductions (in the first case 20 Gt of CO_2-eq. and in the second case 34 Gt of CO_2-eq.). This result leads to the importance for big cities to commit for high percentages of emission reductions but also, on the other hand, for small cities to participate in high numbers in order to make a significant contribution at the country level.

As highlighted in Section 4.1, from each plan several figures of mitigation reduction potential may be obtained referring to different aspects of the SEAP. Those figures can be very different (see **Table 4.2**) and they can be reported or quoted according to the level of precision required by the context. Indeed, the figure of 96.88 $MtCO_2$-eq. represents the total reduction in 2020 committed to by signatories from accepted SEAPs as of 14 March 2013; but, up to now, just 23 % of this amount (22.35 Mt CO_2-eq.) is precisely calculated in SEAPs.

It is important to stress that figures of emission reduction potential reported in **Table 4.2** reflect the situation according to only the accepted SEAPs; for projection of the estimation in emission reduction potential for the project, please see Chapter 5.

Table 4.2. GHG emission reduction potential according to declared reduction target and methodological approach in SEAPs accepted as of 14 March 2013

Approach	Unit	CO_2 reduction estimation by target reduction percentage from BEI	CO_2 reduction estimation by estimated reduction in sectors	CO_2 reduction estimation by actions
IPCC - CO_2	tCO_2	52 807 147	32 717 985	8 003 060
IPCC - CO_2-eq.	tCO_2-eq.	25 347 446	18 429 435	13 480 461
LCA - CO_2	tCO_2	11 516 965	9 159 417	505 534
LCA - CO_2-eq.	tCO_2-eq.	9 647 463	8 531 030	483 108
Aggregated value	*$KtCO_2$-eq.*	*97 197±1 796*	*67 064±1 501*	*22 373±84*

Data from accepted SEAPs as of 14.3.2013

Considering the emissions reduction according to the methodological approach for inventories calculation, it is interesting to highlight that the biggest part (more than 80 %) of the aggregated value of reduced CO_2 is accounted according to the IPCC approach (see **Table 4.2**). Also, this aspect is a consequence of the choices made by big cities. Indeed, up to 14 March 2013, just five accepted SEAPs with more than 500 000 inhabitants considered the LCA approach (Paris, Munich, Frankfurt am Main, Durham and Nuremberg).

4.3 Sector-specific breakdown of emission reductions potential

Interesting observations may be made considering the breakdown of reduction potentials among CoM sectors. In the SEAPs accepted as of 14 March 2013 (see **Table 4.3**), the single macro-sector with the highest emission reduction is the building sector, with almost 45 % of emission reductions across all sectors. Also, the transport sector has an important role in emission reductions (almost 20 % of the total). An important aspect that has to be considered is that both committed and estimated emission reductions are obtained by signatories through their own models with specific calculations and forecasting

approaches. In some sectors like buildings or electricity production, the quantification of emission reduction is usually straightforward; but in other sectors (the ones more focused on social and behavioural aspects), a precise calculation could be impossible. In some cases, it is possible to make estimations according to agent-based models in order to forecast the effect of a municipal directive on the citizens, but all models have specific critical aspects and should be taken just as a general indication. As a consequence, several signatories decided to not insert an estimation of emission reduction for such actions, but to insert an overall reduction estimate for the sector, resulting in a big discrepancy between the estimates per sector and the estimates assigned to specific actions.

Table 4.3. GHG emission reductions according to estimations for each sector in SEAPs accepted as of 14 March 2013

Sectors		Emission reductions estimation (IPCC – tCO_2-eq.)	Emission reductions estimation (LCA – tCO_2-eq.)	Emission reductions estimation (total $KtCO_2$-eq.)	% of total emission reductions†
Buildings, equip./ facilities and industries	per sector	20 737 547	10 148 070	29 868±861	44.49%
	associated with specific measures	8 000 879	453 252	8 409±38	37.58%
Transport	per sector	9 179 214	4 645 262	13 359±394	19.89%
	associated with specific measures	3 348 968	164 780	3 497±14	15.63%
Local electricity production	per sector	5 015 264	344 196	5 325±29	7.96%
	associated with specific measures	1 778 564	87 519	1 857±7	8.30%
Local district heating/ cooling, CHPs	per sector	3 320 107	2 045 074	5 160±174	7.68%
	associated with specific measures	1 679 541	25 814	1 703±2	7.61%
Land-use planning	per sector	3 458 089	166 677	3 608±16	5.40%
	associated with specific measures	1 507 281	27 653	1 532±2	6.85%
Public procurement of products and services	per sector	486 171	41 644	524±3	0.78%
	associated with specific measures	97 734	2 909	100±0.25	0.45%
Working with the citizens and stakeholders	per sector	3 373 691	294 712	3 639±25	5.44%
	associated with specific measures	1 363 244	68 384	1 425±6	6.37%
Other sectors	per sector	5 569 406	12 743	5 582±4	8.35%
	associated with specific measures	3 707 311	158 331	3 850±13	17.21%
Total	**per sector**	**51 139 489**	**17 698 378**	**67 064±1 504**	**100%**
	associated with specific measures	**21 483 522**	**988 643**	**22 373±84**	**100%**

Data from accepted SEAPs as of 14.3.2013

† Percentages of emission reductions are calculated according to the different totals of committed and estimated reductions.

Besides buildings, transport and other CoM sectors, several actions were planned within the category 'Other sectors'. Considering SEAPs accepted as of 14 March 2013, the emission reductions potential in this category is relevant (about 17 % of committed emission reductions); therefore; further details are given in **Table 4.4**. The biggest share of emission reductions is estimated in actions related to waste management, including in this category all the actions regarding waste, from investments in the technological level of waste elaboration to increasing efficiency in recycling. Indeed, the emission reductions in actions focused on waste management are estimated to be bigger than other sectors such as land-use planning, public procurement and working with citizens.

Table 4.4. GHG emission reductions according to actions within the category 'Other sectors' according to SEAPs accepted as of 14 March 2013

Action groups in the category: 'Other sectors'	Number of SEAPs including the action	Aggregated direct emissions (tCO_2-eq.)	Percentage in sector: 'others'	Percentage in total emission reductions estimation
Waste management	142	1 468 887	38.18%	6.57%
Decarbonisation of power grid mix	41	111 181	2.89%	0.50%
Agriculture and rural land management	14	80 386	2.09%	0.36%
Water and wastewater management	43	694 750	18.06%	3.11%
Green areas and carbon storage	20	23 461	0.61%	0.10%
Biomass utilisation	36	166 843	4.34%	0.75%
Other actions	98	1 301 927	33.84%	5.82%
Total	***394***	***3 847 434***	***100%***	***17.21%***

Data from accepted SEAPs as of 14.3.2013

The interest in actions focused on waste management is high (142 accepted SEAPs include actions in this measure). Nevertheless, the effect on emission reductions is estimated to be lower than in other actions such as the decarbonisation of the grid mix. Although actions on water systems may not be strictly relevant to the CoM project, they can be very important at the city level in the broader framework of improving environmental sustainability.

In the case of energy savings in SEAPs, it is important to remember that neither the estimation at the level of sectors or actions is mandatory; therefore, results are presented exclusively as the sum of the energy saved from all the actions in a sector (see **Table 4.5**) according to the assumption that the estimation per action could be more reliable than the one performed at sector level.

Different results in the sector breakdown can be highlighted for energy saving compared to emission reductions. For energy saving, the building sector has the most important role, covering almost 80 % of potential energy savings. This result is an effect of the high number of actions aimed at increasing the energy efficiency of houses and service sector buildings (at different policy levels) from all the partner countries.

Table 4.5. Energy savings according to estimation for each sector in SEAPs accepted as of 14 March 2013

Sectors	Energy saving (MWh)	% of energy saving
Buildings, equip./facilities and industries	26 760 005	53.77%
Transport	9 046 131	18.18%
Local electricity production	1 249 912	2.51%
Local district heating/cooling, CHPs	1 603 380	3.22%
Land-use planning	3 744 538	7.52%
Public procurement of products and services	128 302	0.26%
Working with the citizens and stakeholders	3 367 548	6.77%
Other sectors	3 865 642	7.77%
Total	49 765 460	100%

Data from accepted SEAPs as of 14.3.2013

Table 4.6. Energy production from RES according to the estimation for each sector in SEAPs accepted as of 14 March 2013

Sectors	Energy production (MWh)	% of energy production
Buildings, equip./facilities and industries	1 796 042	17.35%
Transport	157 203	1.52%
Local electricity production	3 194 958	30.86%
Local district heating/cooling, CHPs	2 612 704	25.24%
Land-use planning	34 839	0.34%
Public procurement of products and services	42 212	0.41%
Working with the citizens and stakeholders	122 357	1.18%
Other sectors	2 391 765	23.10%
Total	10 352 079	100%

Data from accepted SEAPs as of 14.3.2013

4.4 Region-specific breakdown of emission reductions potential

Considering total emission reductions estimated in SEAPs, interesting differences among countries may be highlighted. **Figure 4.2** shows emission per capita in the most represented countries from accepted SEAPs up to 14 March 2013 (see **Table 2.1** and Chapter 3) according to BEIs and the estimated emission reductions in 2020 as the sum of emission reductions from all sectors and the emission reductions calculated from the overall reduction target. As expected, higher emission reductions in absolute terms can be found in countries with higher baseline emissions per capita (such as Germany and France).

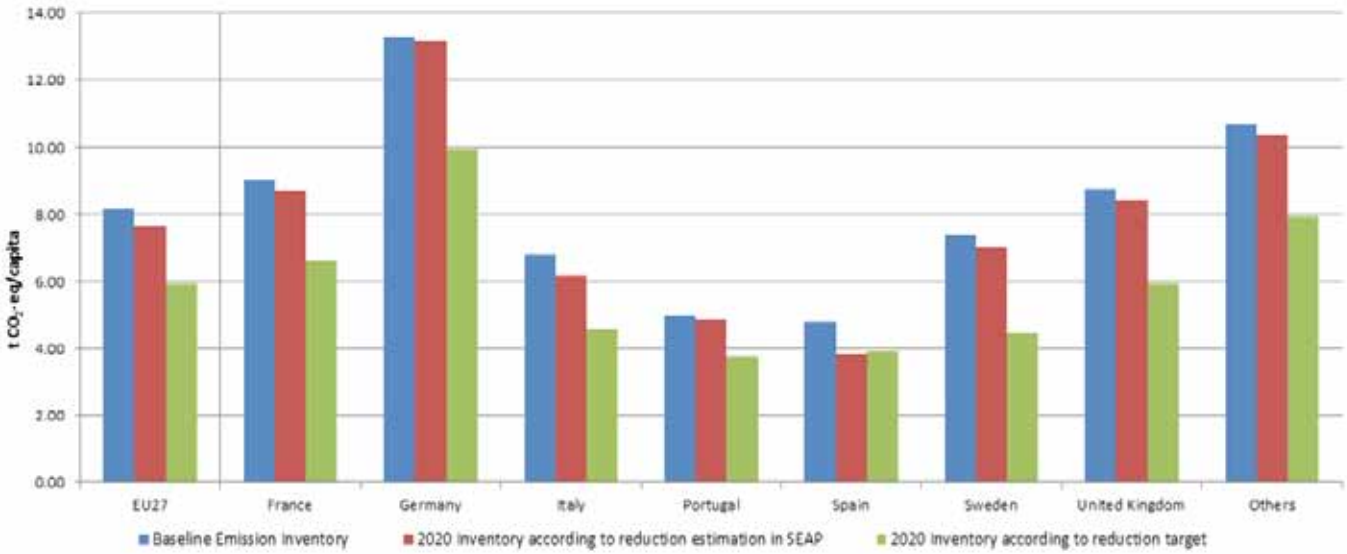


Figure 4.2. Country breakdown of emission reductions comparison in BEIs and 2020 estimation from SEAPs accepted as of 14 March 2013

4.5 Detailed analysis of the accepted actions

As defined previously, a SEAP can be seen as the strategic planning of actions that are forecast to be completed in order to reach the emission reductions target. Within each SEAP any number of actions can be planned according to the potentiality of the signatory. Taking into consideration that the number of actions forecasted is not related to the quantity of emissions reduced or the quality level of actions themselves, it is interesting to see different statistics from partner countries in the CoM project in SEAPs accepted as of 14 March 2013 (see **Table 4.7**). As expected, the biggest part of the actions at the EU-27 level (almost 30 %) are focused on the building sector; but surprisingly, a lot of actions have been planned at the citizen level, thus acknowledging the importance of behaviours and societal practices for increasing the environmental sustainability of cities.

Another important parameter associated with each measure is the estimation of the costs for its full completion. Also, this aspect is not mandatory in the online SEAP template; nevertheless, the estimation of the costs is a keystone in the preparation of the plan. Therefore, this kind of information may be considered reliable for significant statistics. For an estimation of the costs forecasted in the completion of the plans considering all the SEAPs submitted up to 14 March 2013 (therefore excluding just SEAPs that were not accepted and not eligible) see **Table 4.8**.

Table 4.7. Number of actions per sector in SEAPs accepted as of 14 March 2013

	Buildings, equip./ facilities, industries	Transport	Local electricity production	Local district heating/ cooling, CHP	Land-use planning	Public proc. of products/ services	Working with citizens and stakeholders	Others	*All actions*
Austria	-	-	-	-	-	-	-	-	-
Belgium	53	13	29	8	21	8	25	9	166
Bulgaria	-	-	-	-	-	-	-	-	-
Cyprus	17	7	9	4	6	4	8	4	59
Czech Rep.	22	3	4	2	3	2	5	-	41
Denmark	93	30	32	14	22	14	36	42	283
Estonia	5	3	4	2	3	2	4	-	23
Finland	33	11	24	6	13	6	17	4	114
France	72	54	48	20	33	21	50	12	310
Germany	183	122	90	41	66	38	132	77	749
Greece	31	13	21	8	12	9	18	2	114
Hungary	-	-	-	-	-	-	-	-	-
Ireland	5	3	4	2	3	2	4	-	23
Italy	2 842	1 102	1 273	600	1 051	607	1 606	504	9 585
Latvia	15	6	10	4	12	4	11	7	69
Luxembourg	-	-	-	-	-	-	-	-	-
Lithuania	51	34	18	10	13	9	20	14	169
Malta	18	11	9	4	7	4	17	-	70
Netherlands	-	-	-	-	16	8	28	-	52
Poland	58	19	24	12	18	12	25	3	171
Portugal	380	155	139	65	113	74	205	45	1 176
Romania	77	42	29	14	22	14	35	5	238
Slovakia	19	9	8	4	6	4	9	2	61
Slovenia	5	3	4	2	3	2	4	-	23
Spain	5 706	2 477	2 871	1 255	2 957	1 282	4 191	1 273	22 012
Sweden	131	62	63	28	44	28	76	33	465
UK	151	68	57	24	56	27	81	33	497
Total EU-27	9 967	4 247	4 770	2 129	4 500	2 181	6 607	2 069	36 470
	27.33%	11.65%	13.08%	5.84%	12.34%	5.98%	18.12%	5.67%	100%
Non EU-27	65	28	42	16	30	16	47	9	253
CoM project	10 032	4 275	4 812	2 145	4 530	2 197	6 654	2 078	36 723

Data from accepted SEAPs as of 14.3.2013

Figures comprehend all measures, even the ones without impacts or cost estimations.

By March 2013, the whole project mobilised more than EUR 50 billion, which is expected to double considering the number of signatories that have not already submitted the SEAP. Signatories obtain those funds from both public and private sources, in the direction of the sustainable development of cities and urban regions across Europe, making the CoM one of the most important movements through sustainable societies supported by the European Commission.

Table 4.8. Estimated cost of measures per sector in submitted SEAPs as of 14 March 2013, excluding not accepted SEAPs. Figures are expressed in thousands of euro.

	Buildings, equip./ facilities, industries	Transport	Local electricity production	Local district heating/ cooling, CHP	Land-use planning	Public proc. of products/ services	Working with citiz. and stakeholders	Others	*All measures*
Austria	44	570	-	-	-	-	36	-	650
Belgium	97 531	3 117	237 120	15 200	-	-	95 200	-	448 168
Bulgaria	201 687	367	56 900	-	564	20	3 308	10 280	273 126
Cyprus	2 726	1 025	2 265	-	42	-	210	-	6 267
Czech Rep.	24 040	1 085	3 240	120	140	-	116	-	28 741
Denmark	170 509	4 072	150	10 000	6 070	215	9 171	7 048	207 235
Estonia	-	-	-	-	-	-	-	-	-
Finland	550 298	211 180	-	-	-	50	1 680	139 950	903 158
France	2 886 712	2 930 952	166 109	517 540	189 197	1 870	16 490	163 246	6 872 116
Germany	598 592	113 800	762 965	38 252	5 937	10 731	38 079	111 240	1 679 595
Greece	133 775	26 249	75 490	-	34 726	486	1 470	4 317	276 513
Hungary	1 505 500	406 338	1 500	100 000	250 000	12 000	550 000	-	2 825 338
Ireland	-	-	-	-	-	-	-	-	-
Italy	4 730 081	6 002 709	2 373 254	369 595	1 410 191	80 649	25 805	191 962	15 184 246
Latvia	6 338	-	4 564	4 564	17 009	-	-	-	32 476
Luxembourg	-	-	-	-	-	-	-	-	-
Lithuania	118 010	285 200	340 000	676 146	6 030	-	1 000	63 595	1 489 980
Malta	6 749	1 256	6 377	35 000	72	-	200	-	49 653
Netherlands	140 216	36	23 656	151 240	90	-	8 638	40	323 916
Poland	3 091 697	1 091 450	1 470	319 536	2 623	1	1 787	50	4 508 615
Portugal	42 096	17 680	1 062	84	2 762	44	879	60	64 665
Romania	835 232	355 411	59 791	29 140	53 268	-	46	572 560	1 905 449
Slovakia	3 000	50 000	90 000	65 000	300 200	-	50 250	-	558 450
Slovenia	2 172	55	150	625	-	-	24	-	3 026
Spain	2 110 837	3 494 654	3 189 231	107 340	1 392 670	108 774	191 969	351 736	10 947 210
Sweden	30 710	79 266	52 815	12 805	20 608	10	7 318	-	203 532
UK	882 533	260 055	136 655	52 396	2 853	-	6 910	23 565	1 364 969
Total EU-27	***18 171 086***	***15 336 525***	***7 584 763***	***2 504 584***	***3 695 051***	***214 850***	***1 010 585***	***1 639 649***	***50 157 094***
	36.23%	***30.58%***	***15.12%***	***4.99%***	***7.37%***	***0.43%***	***2.01%***	***3.27%***	***100.00%***
Non EU-27	902 131	912 251	156 494	707 551	283 973	1 479	240 283	65 890	3 270 053
Total CoM	19 073 217	16 248 776	7 741 257	3 212 135	3 979 024	216 329	1 250 869	1 705 539	53 427 147

Data from submitted SEAPs as of 14 March 2013, excluding not accepted and not eligible SEAPs.

For countries representing a statistical significant coverage in SEAP population (see **Table 2.1** and Chapter 3), further statistics on economic performance are reported in **Table 4.9**. The average estimated cost per measure, in each sector, has been calculated excluding measures in which costs are not reported in order to have a reliable estimation of the costs of each measure.

In mid-March 2013, France was the country estimated to have the higher investment per

measure (even if it is not the country with the higher total investment). This effect is related to the higher relative weight of Paris on other French cities. On the contrary, in countries with a relatively high number of small municipalities (such as Spain and Portugal) it is possible to see the decrease in cost estimation at the national level.

It is interesting to note that the sectors of transport, electricity production and heating/cooling management are estimated to be the ones with the higher costs per measure. On the contrary, measures aimed at working in the social dimension are estimated to be the least expensive and they are planned in bigger numbers (see **Table 4.7**).

Table 4.9. Estimated average cost/measure of each sector in submitted SEAPs as of 14 March 2013 (excluding not accepted SEAPs) excluding measure without costs. Only countries covering a statistically significant population number are presented. Figures are expressed in thousands of euro.

	Buildings, equip./ facilities, industries	Transport	Local electricity production	Local district heating/ cooling, CHP	Land-use planning	Public proc. of products/ services	Working with citiz. and stakeholders	Others	*All measures*
France	20 768	48 849	6 152	27 239	5 565	187	270	13 604	18 984
Germany	6 651	3 161	28 258	3 477	457	1 192	508	27 810	6 338
Italy	1 723	5 926	2 866	1 857	2 626	524	31	3 147	2 384
Portugal	290	402	89	84	395	22	19	60	250
Spain	391	2 518	2 621	3 701	699	783	67	481	794
Sweden	1 059	13 211	10 563	3 201	5 152	5	1 045	0	3 571
UK	9 593	28 895	9 761	4 366	1 427	0	864	4 713	9 612
Average†	1 306	5 047	3 137	3 993	1 168	639	73	1 033	1 710

Data from submitted SEAPs as of 14.3.2013, excluding not accepted and not eligible SEAPs.
Figures exclude measures for which costs are not reported.
† Average calculated as the average estimated cost per measure of all the measures of the reference countries.

5. PROJECTIONS

5.1 Projections of the effects for the whole project

Most of the figures presented so far are related to an analysis performed on just the accepted SEAPs and therefore results reflect the situation on the day of the publication of the report. Nevertheless, 1 260 SEAPs submitted before 14 March 2013 are not included in the analysis and more than 1 950 SEAPs are expected to be submitted considering the current number of signatures and re-submissions; therefore, final results of the project may change significantly.

In order to give an estimation of project results in terms of energy savings and emission reductions, two projections have been calculated according to the data as of 14 March 2013.

The first projection is based on average energy savings estimation per capita and average emission reductions estimation per capita expected in 2020 within the accepted SEAPs, and multiplying these values for the total population currently covered by signatories (regardless of the analysis status of their SEAPs). **Table 5.1** shows results of the projection calculated according to an estimation of the population covered by signatories at the moment of adhesion of 187 566 369 inhabitants.

Table 5.1. Projected results of the project based on general reduction averages from accepted SEAPs as of 14 March 2013. For precautionary reasons, the CoM population in 2020 was taken as equal to total CoM population as of 14 March 2013 even if an increase in the number of signatories is expected.

	Average energy savings in 2020 (MWh/capita)	Average emission reductions in 2020 (tCO_2-eq./capita)	Total CoM population as of 14 March 2013 (inhabitants)	Projected energy savings in 2020 (TWh)	Projected emission reductions in 2020 ($MtCO_2$-eq.)
CoM project	1.17	2.24	187 566 369	213.69	419.87

Beyond this rough estimation, a more precise projection can be calculated using country averages instead of general averages (see **Table 5.2**). This projection is more reliable because inhabitants from different countries may have different reduction averages per capita. The estimation of the population in 2020 can be done only according to the population covered by signatories as of 14 March 2013, regardless if they have already submitted their SEAPs. As a consequence, this projection does not include the increase in signatories after the cut-off date, which is already occurring.

Table 5.2. Projected results of the project based on country-specific reduction averages from accepted SEAPs as of 14 March 2013. For precautionary reasons, the country-specific CoM population in 2020 was taken as equal to the CoM population as of 14 March 2013, even if an increase in the number of signatories is expected.

	Average* energy savings in 2020 (MWh/capita)	Average* emission reductions in 2020 (tCO_2-eq./capita)	Total CoM population as of 14 March 2013 (inhabitants)	Projected energy savings in 2020 (MWh)	Projected emission reductions in 2020 (tCO_2-eq.)
Austria	1.17*	2.24*	1 919 938	2 273 492	4 297 850
Belgium	0.13	3.10	3 477 413	449 196	10 787 453
Bulgaria	1.17*	2.24	2 874 272	3 403 565	6 434 161
Cyprus	0.08	1.62	441 991	35 555	715 679
Czech Rep.	0.01	1.25	336 876	2 505	419 619
Denmark	0.32	1.98	2 804 099	908 088	5 545 136
Estonia	1.17*	2.24*	445 567	527 618	997 418
Finland	0.01	3.43	1 716 602	7 738	5 886 729
France	0.03	2.25	17 144 811	520 429	38 514 474
Germany	0.23	5.21	17 707 329	4 134 008	92 301 130
Greece	0.01	1.95	4 222 900	7 009	8 233 069
Hungary	1.17*	2.24*	2 389 546	2 829 578	5 349 084
Ireland	0.00**	2.07	1 509 287	n.a	3 130 907
Italy	1.57	1.97	29 963 687	47 092 974	58 889 873
Latvia	0.19	0.37	1 113 150	206 017	406 878
Luxembourg	1.17*	2.24*	102 229	121 054	228 843
Lithuania	0.69	1.73	1 374 899	950 384	2 372 316
Malta	0.78	0.47	244 483	189 865	113 772
Netherlands	0.00**	4.00	4 013 028	n.a	16 035 174
Poland	0.85	2.63	4 058 565	3 442 193	10 674 428
Portugal	0.27	1.21	4 526 306	1 224 702	5 476 464
Romania	0.48	0.73	6 694 560	3 185 619	4 882 184
Slovakia	1.38	0.59	574 066	792 394	336 069
Slovenia	0.00**	1.10	473 740	n.a	521 345
Spain	2.65	1.06	24 376 489	64 518 750	25 831 612
Sweden	1.27	2.48	5 551 089	7 051 246	13 756 226
UK	0.59	2.48	20 436 425	12 000 978	50 638 813
Total EU-27	**1.17**	**2.33**	**160 493 347**	**168 401 374**	**372 776 704**
Non EU-27	0.62	0.73	27 073 022	16 701 907	19 703 265
CoM project	***1.14***	***2.24***	***187 566 369***	***185 103 281***	***392 479 969****

Data as of 14.3.2013

** Whenever the number of accepted SEAPS is not sufficient to allow for a statistically robust national average, the average from the accepted SEAPS from the whole CoM project is used.*

*** No estimation in energy savings from actions is provided*

**** This figure is obtained with a different projection method from the one used in Table 5.1*

In order to better understand the results of the projection, a comparison of the results with EDGARv4.2 is proposed for most European countries with SEAPs covering more than 3 % of the population from the total submitted SEAPs as of 14 March 2013 (see **Figure 5.3**).

The BEI data is represented by the total emissions reported in the BEI. In most cases, these emissions are the ones encountered in the key sectors of the Covenant, but not exclusively. Some cities choose to also include small industry in the BEI. That is how the case of Sweden can be explained, where we see that the emissions of the projected BEI are bigger than the total emissions per country of the Covenant sectors.

From **Figure 5.3** we can see that some countries still have a large potential for growth within the Covenant while some, such as Italy, Spain or Sweden have almost reached their full growing potential. At the EU-27 level, a growing potential for the CoM movement still remains. The potential of GHG emissions under the CoM reached 68 % of the national total for the CoM sectors and the citizen population covered under the CoM reached 45.8 % from the total population.

However, there are some limitations to the comparison of the full potential as estimated with EDGAR and the CoM projected emissions. Let us recall the differences between the CoM and the EDGAR emissions of Chapter 3, in particular accounting of the emissions from electricity and heat production under the energy sector in EDGAR and under the residential sector in the CoM (as indirect emissions). The GHG emissions at the national level of EDGAR used for comparison are only those coming from direct fuel combustion or other direct sources in the residential (including residential, commercial, agriculture, fishing and others), road transport, solid waste management and wastewater management sectors, and exclude the GHG emissions coming from the energy sector (electricity and heat production) and from industrial combustion. Therefore, a full comparison would require a calculation of the indirect emissions of the electricity and heat produced by the combustion of fossil fuel.

The BEI data in **Figure 5.3** represent the total emissions reported for all sectors of the CoM. For the tertiary sector these might also include small industrial combustion, which does not fall under the tertiary sector in EDGAR. This explains why the emissions of the projected BEI in Sweden are larger than the total Swedish emissions for the CoM sectors (residential, tertiary and transport).

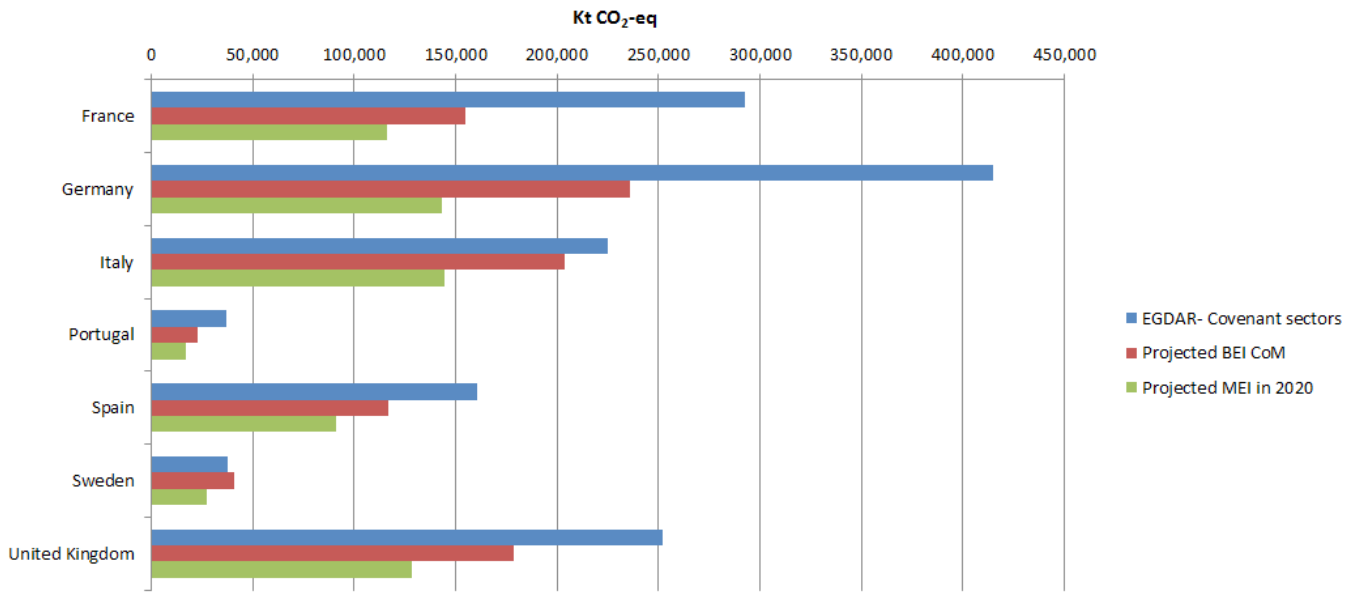


Figure 5.1. Projected potential GHG emission reductions of the Covenant at the representative countries' level according to their number of signatories as of 14 March 2013 (with current baseline emission inventory (BEI) and by 2020 with expected monitoring emission inventory (MEI)).

6. CONCLUSION

6.1 Main achievements

After almost five years of activity, preliminary results of the projects may be highlighted. Up to mid-March 2013, 5 049 municipalities signed the Covenant, for a total of 160.49 million inhabitants in the EU-27 (corresponding to more than 42 % of the EU-27 urban population) and a total of 187.56 million inhabitants in the whole project (corresponding to 34 % of the urban population of the participating countries). Furthermore, 24 municipalities with more than 1 million inhabitants signed the Covenant.

Among these signatories, 2 600 have already submitted a SEAP and a corresponding BEI, resulting in 1 100 accepted SEAPs, covering 45 328 879 inhabitants, and representing 82 % of the analysed SEAPs as of 14 March 2013. As accepted SEAPs guarantee both minimum level of technical quality and political support for the implementation of the action, this report applies statistics on the SEAPs that have been accepted before 14 March 2013. This methodological choice has been adopted in order to give robust results on the current situation and the most reliable expectation from energy savings and emission reductions potential of the project.

Although the minimum commitment was to reduce 20 % of the current emissions, 699 signatories committed to reduce more than the threshold, resulting in an estimated emission reduction in 2020 of 97 197 $KtCO_2$-eq. (which a calculation uncertainties of ± 1 796 $KtCO_2$-eq. due to the different approaches that signatories used to report their emission inventories). Energy saving in 2020 is estimated to be 49 764 GWh together with the increase of energy production from RES of 10 352 GWh.

These figures are already relevant considering that it is calculated on less than a quarter of the expected number of SEAPs, according to the number of signatories. Furthermore, these figures acquire even more value considering the 'bottom up' perspective of the project, in which no policies are forced to be applied, and that the reduction in climate change is a result of the voluntary decision of mayors and the empowering of citizens in developing climate resilience actions.

Table 6.1. EU-27 Covenant current and projected main statistics of the project at EU-27 level. Current statistics are based on accepted SEAPs as of 14 March 2013 and projections, for precautionary reasons, are based on the total EU-27 CoM population as of 14 March 2013, even if an increase in the number of signatories is expected.

	Unit	Estimations and targets from accepted SEAPs 14 March 2013	Projection according to number of signatories as of 14 March 2013
Population			
EU-27 Population covered by Covenant	million inhabitants	45.31	160.49
Total EU-27 population	million inhabitants	492.14	492.14
Total EU-27 urban population	million inhabitants	368.73	368.73
Population covered by Covenant from the EU total urban population		12.29%	43.53%
Final energy consumption			
Total annual final energy consumption covered by EU-27 Covenant	TWh	1 507	5 338
Total annual final energy consumption at EU-27 level*	TWh	14 276	14 276
Total annual final energy consumption at EU-27 level (only Covenant sectors)*,**	TWh	8 809	8 809
Percentage of annual final energy consumption covered by EU-27 Covenant from the total energy consumption at EU-27 level (only Covenant sectors)**		17%	61%
GHG emission inventories			
Total GHG emissions covered by EU-27 Covenant	$KtCO_2$-eq.	409 962	1 452 072
Total GHG emissions at EU-27 level*,***	$KtCO_2$-eq.	5 272 385	5 272 385
Total GHG emissions at EU-27 level (only Covenant sectors)*,**,***	$KtCO_2$-eq.	1 889 617	1 889 617
Percentage covered by Covenant from the total GHG emissions at EU-27 level (only Covenant sectors)**		22%	77%
GHG emission reductions potential			
Annual GHG emission reductions potential of the EU-27 Covenant for 2020 in accepted SEAPs	$KtCO_2$-eq.	97 197	372 777****
EU-27 Projected GHG emissions for 2020 for all sectors according to CIRCE	$KtCO_2$-eq.	4 937 903	4 937 903
EU-27 Projected emissions for 2020 for Covenant sectors according to CIRCE	$KtCO_2$-eq.	1 581 340	1 581 340
Potential annual GHG emission reductions for the EU-27 Covenant from the total GHG emission at EU-27 level (only Covenant sectors)**		6.15%	23.57%

** Weighted average with the population in BEI, accepted SEAPs for the period 1990–2008*
*** Covenant sectors covered: residential combustion, road transport, solid waste management and domestic wastewater management*
**** Only data on CO_2+CH_4+N_2O*
***** Figure for EU-27, obtained with the second projection method described for results in Table 5.2*
Sources:
Population data at EU-27 level, UNDP (UNDESA 2010)
Final Energy consumption data at EU-27 level, IEA 2011 database
GHG emissions at EU-27 level, EDGARv4.2 database

6.2 Perspective

The CoM kicked off very well, as shown in **Table 6.1**, with a substantial percentage of about 15 % of the total potential of CoM sectors for all EU-27 cities. Also, the targeted MEI of **Figure 6.1** shows a reduction of almost 24 %, which is really committing to the CoM target of minimum 20 %.

The CoM appeared very popular in the southern European countries. As such, the total CoM emissions of the signatories in Italy are approaching the national total of CoM sectors for Italy according to EDGAR estimates, as shown in **Figure 6.2**. Similar good geospatial coverage of cities participating in the CoM is observed for Spain. In northern European countries, the CoM could gain some more popularity.

Even though in some countries such as Spain and Italy publicity for the CoM paid off and many signatories were registered, real GHG reductions are only starting. Many efforts and much engagement will be needed by the mayors to realise the projected reductions. The implementation of several GHG reduction measures takes time, depending on the measure. However, with the extension of the CoM eastwards (into the Newly Independent States) and southwards (into the north African countries around the Mediterranean Sea) the EU-27 should be a representative example.

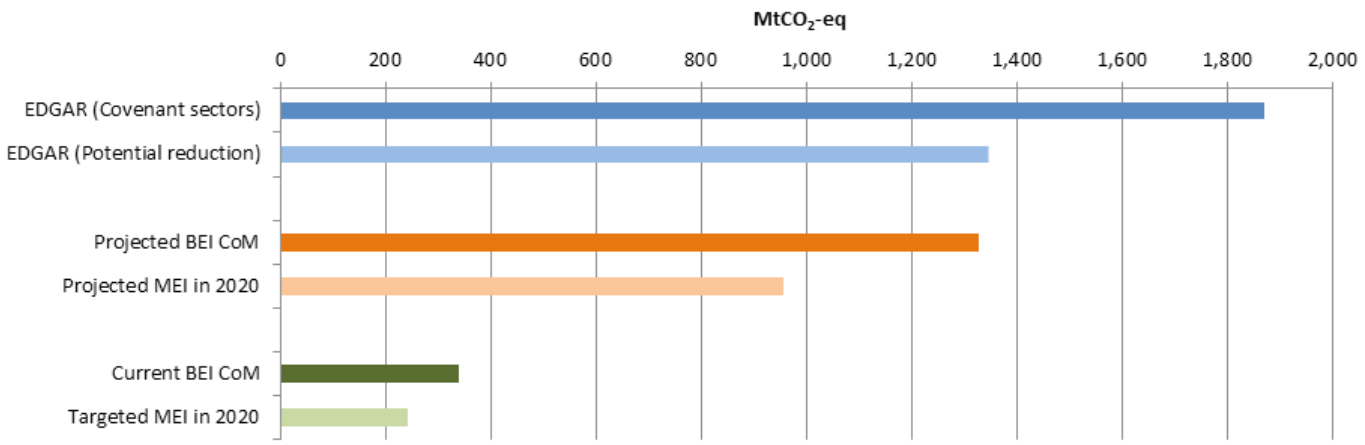


Figure 6.1. Current and projected potential GHG emission reductions of the Covenant in the EU-27 according to the number of signatories as of 14 March 2013, compared to data from EDGARv4.2

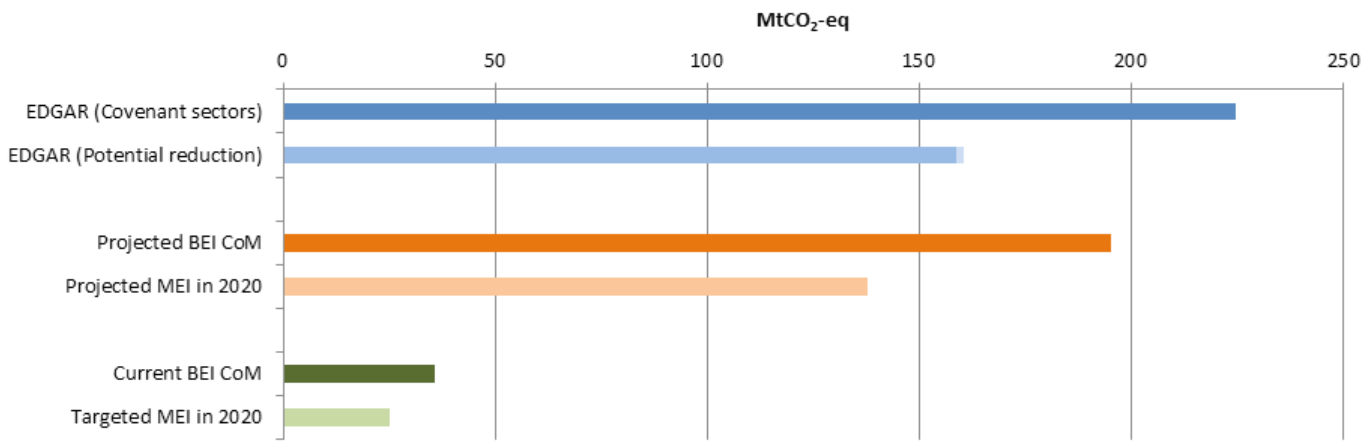


Figure 6.2. Current and projected potential GHG emission reductions of the Covenant in Italy according to the number of signatories as of 14 March 2013, compared to data from EDGARv4.2

ACKNOWLEDGEMENT

Authors thank Directorate-General for Energy (DG ENER) colleagues Pedro Ballesteros Torres for his enthusiastic launching of this initiative, and Adam Szolyak and Helisene Habart for their continuing support and presence. Contributions to the report have been received from the whole current Covenant of Mayors team of the JRC, which also includes, beyond the authors, Paolo Zancanella, Luca Castellazzi, Michel Quicheron, Irena Gabrielaitiene and Umberto Tromboni. We are grateful to Diego Guizzardi of the EDGAR team for help with the maps. Past efforts from Ronald Piers de Raveschoot, Ana Meyide-Orives, Damian Bornas Cayuela, Michele Canova and Suvi Monni are also acknowledged. Special thanks to our colleagues of the Covenant of Mayors Office in Brussels for managing, among others, relations with signatories and dissemination aspects.

MAIN REFERENCES

European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL), Emission Database for Global Atmospheric Research (EDGAR), release version 4.2, 2011. See http://edgar.jrc.ec.europa.eu

EEA, 'EMEP/EEA air pollutant emission inventory guidebook — 2009', European Environment Agency, Copenhagen, 2009. See http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009

Eurelectric, 'Statistics and prospects for the European electricity sector (1980-1990, 2000-2020)', EURPROG Network of Experts, 2005.

Evans, A., Strezov, V. and Evans T.J., 'Assessment of sustainability indicators for renewable energy technologies', *Renewable and Sustainable Energy Reviews*, Vol. 13(5), 2009, pp. 1082–1088.

ICLEI, *International Local Government GHG Emissions Analysis Protocol*, 2009. See http://www.iclei.org/ghgprotocol

IEA, 'World Energy Outlook 2010', International Energy Agency Publication, 2010. See http://www.iea.org/publications/freepublications/publication/weo2010-1.pdf

IPCC, *Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change*, Houghton, J.T., Meira Filho, L.G., Callender, B.A., Harris, N., Kattenberg, A. and Maskell, K. (Eds), Cambridge University Press, Cambridge, UK, 1995, p. 572.

IPCC, *Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., van der Linden, P.J., Dai, X., Maskell, K. and Johnson, C.A. (Eds), Cambridge University Press, Cambridge, UK and New York, NY, USA, 2001, p. 881.

IPCC, *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), IGES, Japan, 2006. See http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

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

Janssen-Maenhout, G., Meijide-Orive, A., Iancu, A., Guizzardi, D. and Pagliari, V., *An approach with a Business-as-Usual scenario projection to 2020 for the Covenant of Mayors from the Eastern Partnership*, Publications Office of the European Union, 2012. See http://publications.jrc.ec.europa.eu/repository/handle/11111111½5940

Janssens-Maenhout, G., Peters, J., Wilson, J., *Long Term Trend in Global CO2 Emissions*, The Hague (Netherlands): PBL Netherlands Environmental Assessment Agency and European Commission Publications Office, 2011. JRC65918

JRC, *European Reference Life Cycle Database (ELCD)*, LCA data sets of key energy carriers, materials, waste and transport services of European scope, 2009. See http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm

JRC et al., *International Reference Life Cycle Data System (ILCD)*, Guidance documents for consistent and quality-assured LCA data and methods for robust LCA based decision support in business and government, under development, 2009. See http://lct.jrc.ec.europa.eu/eplca/deliverables

Kennedy, C., Steinberger, J., Gasson, B., Hansen, Y., Hillman, T., Havranek, M., Pataki, D., Phdungsilp, A., Ramaswami, A., Villalba Mendez, G., 'Methodology for inventorying greenhouse gas emissions from global cities', *Energy Policy*, 2009. doi:10.1016/j.enpol.2009.08.050

Olivier, J. and Janssens-Maenhout, G., 'Part III: Greenhouse-Gas Emissions', in *CO2 emissions from fuel combustion*, Paris (France): International Energy Agency, 2011, p. III.1–III.57. JRC67519

Sala, S., Pant, R., Hauschild, M. and Pennington, D., 'Research needs and challenges from science to decision support. Lesson learnt from the development of the International References Life Cycle Data System (ILCD) Recommendation for Life Cycle Impact Assessment', *Sustainability*, Vol. 4, 2012, pp. 1412–1425.

UNFCCC, *Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories*, 2003. See http://unfccc.int

UNFCCC, *Updated UNFCCC reporting guidelines on annual inventories following incorporation of the provisions of decision 14/CP.11*, 2006. See http://unfccc.int

UNDP, *Human Development Report 2007/2008. Fighting Climate Change: human solidarity in a divided World*, United Nations Development Programme, 2007. See http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf

Vasilis, M., Fthenakis, V., Kim, H. and Alsema, E., 'Emissions from Photovoltaic Life Cycles', *Environmental Science & Technology*, Vol. 42, No. 6, 2008, pp. 2168–2174.

WRI/WBCSD, *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)*, World Resources Institute and World Business Council for Sustainable Development, 2004.

European Commission
EUR 25992– Joint Research Centre – Institute for Environment and Sustainability

Title: The Covenant of Mayors in Figures 5-Year Assessment

Author(s): Alessandro K. Cerutti, Andreea Iancu, Greet Janssens-Maenhout, Giulia Melica, Federica Paina, Paolo Bertoldi

Luxembourg: Publications Office of the European Union

2013 – 52 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1018-5593 (print), ISSN 1831-9424 (online)

ISBN 978-92-79-30386-9 (print)
ISBN 978-92-79-30385-2 (pdf)

doi: 10.2788/12203 (print), 10.2788/1062 (online)

Abstract

After almost five years of activity, preliminary results of the projects may be highlighted. Up to mid-March 2013, 5 049 municipalities signed the Covenant of Mayors (CoM), for a total of 160 million inhabitants in the EU-27 (corresponding to more than 43 % of the EU-27 urban population) and a total of 187 million inhabitants in the whole project (corresponding to 34 % of the urban population of the participating 47 countries). Furthermore, 24 municipalities with more than 1 million inhabitants signed the CoM. Among these signatories, 2 600 had already submitted a Sustainable Energy Action Plan and a corresponding Baseline Emission Inventory, resulting in 1 100 accepted Action Plans, covering 45 328 879 inhabitants. Although the minimum commitment was to reduce 20 % of the current emissions, 699 signatories committed to reduce more than the threshold, resulting in an estimated emission reduction in 2020 of 97±2 $KtCO_2$-eq.

The CoM appeared very popular in southern European countries. As such, the total CoM emissions of the signatories in Spain and Italy are approaching the national total of CoM sectors for Italy, according to EDGAR estimates. In northern European countries, the CoM could gain some more popularity. Even though in some countries, such as Spain and Italy, publicity for the CoM paid off and many signatories were registered, real greenhouse gas (GHG) reductions are only starting. Many efforts and more engagement will be needed by the mayors to realise the reduction targets. The implementation of several GHG reduction measures takes time, depending on the measure. However, with the extension of the CoM eastwards (into the Newly Independent States) and southwards (into the north African countries around the Mediterranean Sea) the EU-27 should be a representative example.

LB-NA-25992-EN-N

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing and transferring its know-how to the Member States, the scientific community and international partners.

Publications Office

ISBN 978-92-79-30385-2

9 789279 303852