Diputació Barcelona
Àrea de Territori i Sostenibilitat
Gerència de Serveis de Medi Ambient

Summary report: Energy consumption and greenhouse gases emissions in the province of Barcelona

July 2014

Oficina Tècnica de Canvi Climàtic i Sostenibilitat

Diputació Barcelona

Background

Diputació of Barcelona as a Covenant of Mayors coordinator gives support to municipalities to develop their Sustainable Energy Action Plan (SEAP). Till July 2014, 210 municipalities out of 311 have signed the Covenant and 200 SEAP have been already drafted. Diputació of Barcelona finances SEAP drafting (100%) and more than 3M€ have been spent. SEAP methodology is based on the Covenant of Mayors Office one; however we have some specificities that enrich it: we include waste management emissions (that is, emissions from waste treatment and transport), water cycle emissions and 10 energy assessment visits to municipal buildings or facilities

Data analysis

In order to carry out analysis on all SEAP we have created several databases, under an excel structure: data collection on yearly energy consumption by sources and by municipalities of the whole province of Barcelona, calculations on emissions of every municipality by sector and by source, data collection of energy consumption of municipal buildings and facilities and public lighting of all SEAPs drafted; another database includes all actions of each SEAP (title, description, emissions saved, estimated costs, energy savings or production and type of action); and finally we have developed another database that collects information on all energy assessments visits done that allow us to have realistic energy consumption rates by type of building or facilities. In this report we will present the results obtained in the emissions inventory of the municipalities of the province of Barcelona, from 2005 till 2012.

We must remark that some data are incomplete, so we have made some estimation based on past evolution of energy consumptions and energy consumption evolution from the whole province.

Electricity and natural gas (piped gas):

- The Catalan Institute on Energy (ICAEN- Catalan Governement) provides us with electricity consumption by municipality and by sector.

Gasoline, diesel, heating oil and LGP

- CORES (Corporación de Reservas Estratégicas de Productos Petrolíferos- Petroleum products Corporation) is the main source of data. However information cannot be at the municipal scale, so estimation at the municipal level has to be made.

- IDESCAT (Catalan Institute of Statistics-Catalan Government): basic data of each municipality like number of inhabitants and number of households using heating oil, LGP, piped gas...

- Dirección General de Trafico (Spanish Government): number of vehicles using diesel or gasoline by municipality.

Biofuel and biodiesel:

- ICAEN. However data end at 2009. It is very difficult to estimate data from 2009 till now since it is quite a new energy source and data series are short.

Renewable energy production

- ICAEN: Data series end at 2009. Since there are no data from 2009 we have extended data from 2009 till 2012. In some cases the municipality had its own data sources and we have made a better approach.

Water consumption:

- Catalan Agency of Water (ACA- Catalan Government). There is water consumption per year and per sector for each municipality.
- ATLL (Aigües Ter-Llobregat- Public company distributing water): energy consumption of each purification plant.
- Several sewage plants: energy consumption to treat waste water.

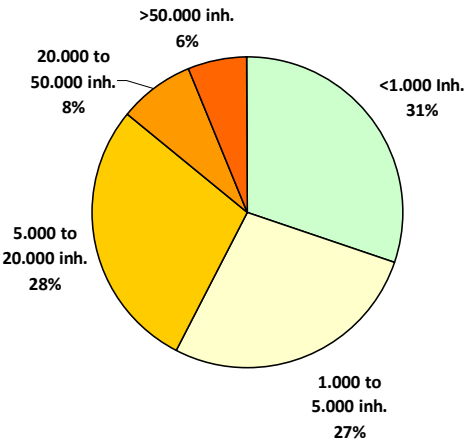
Waste management and production:

- Catalan Agency for Waste (ARC- Catalan Government). Waste production and disposal by municipality and by type of waste. They have also studies with specific emission factors for each waste treatment.
- Catalan Office of Climate Change (OCCC_Catalana Government): emission factor for waste disposal.

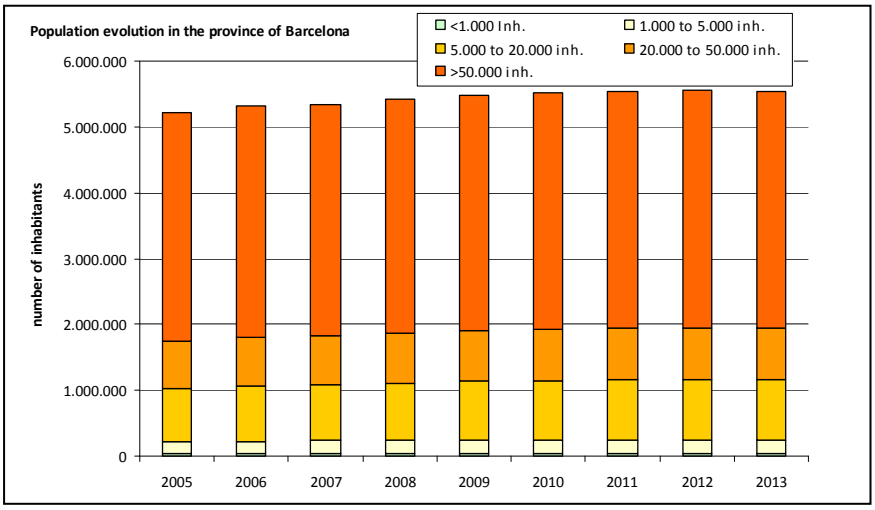
Municipalities' main characteristics

The province of Barcelona has 311 municipalities which are extremely diversified: from really small and rural villages to big towns within the Barcelona Metropolitan Area. Some municipalities are extremely touristy while other are really industrial towns.

Most municipalities can be considered medium or small since 84% have less than 20.000 inhabitants.



Total population of the province is above 5M people, and most live in big towns. There are 210 out of 311 municipalities that have signed the Covenant of mayors and they account for 96% of total population of the province.

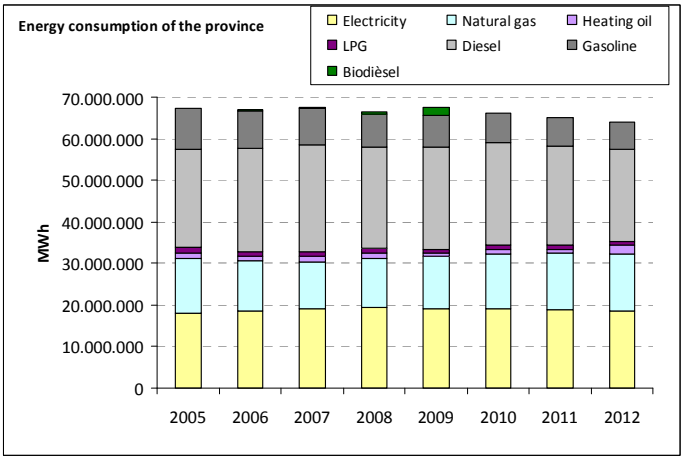


Energy consumption results

Energy consumption between 2005 and 2012 has decreased a 5%. Main reductions come from gasoline, diesel and LPG.

When energy consumption is analyzed in relative terms, per inhabitant, decrease is 11%. Energy consumption in 2005 was 12.9MWh/inhabitant while in 2012 was 11.5 MWh/inhabitant.

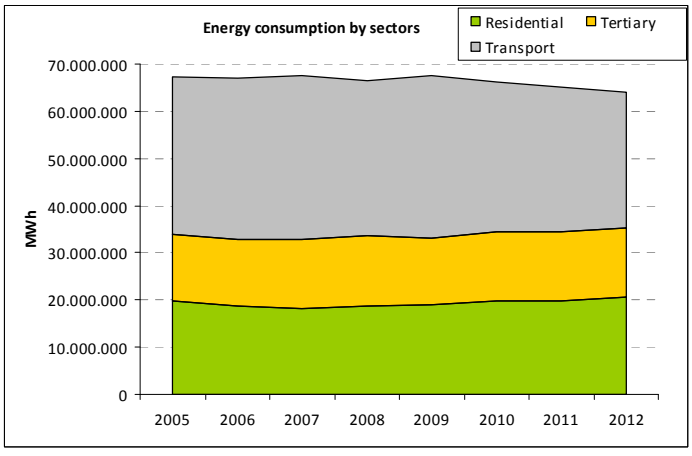
Natural gas and electricity consumption remains quite stable between those years.



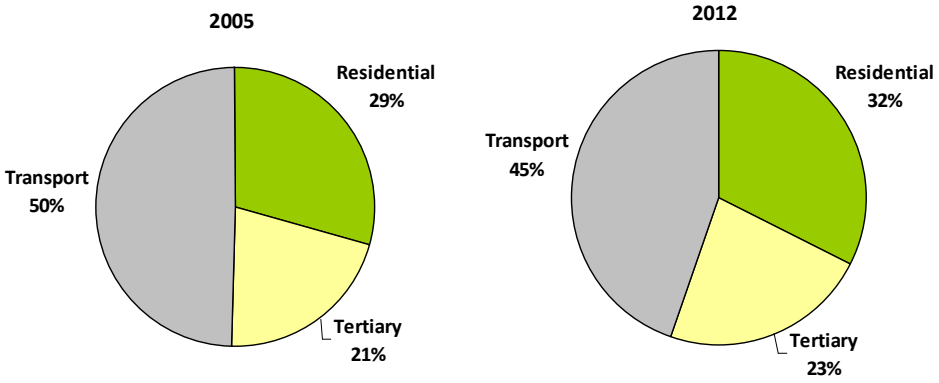
If energy consumption is assigned to different sectors (residential, tertiary and transport) most energy consumption accounts for transport.

It is also clear that transport is the main responsible for energy consumption reduction along these years, and that can be due to several causes:

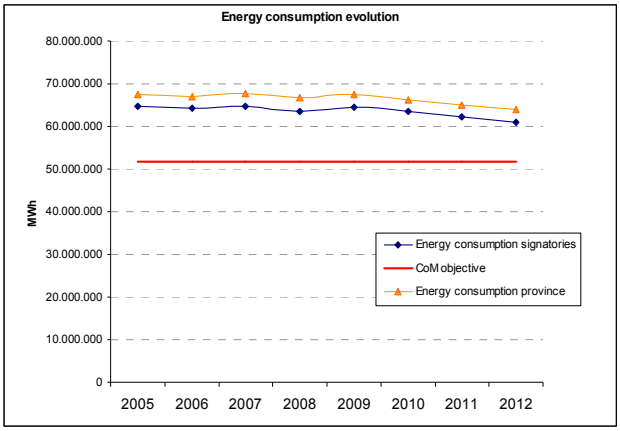
- economic crisis
- renewal of the private fleets

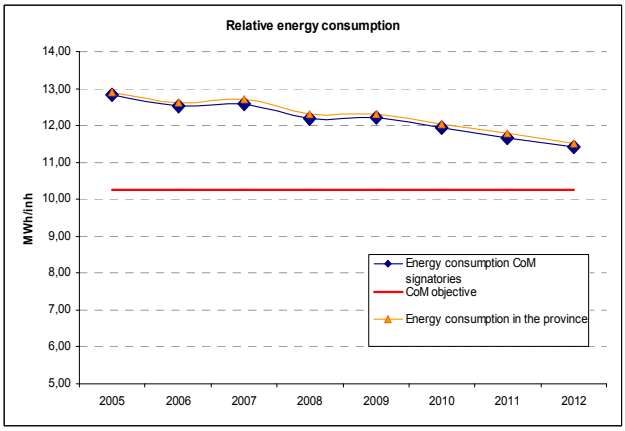


for more efficient cars



The tendency in energy consumption of the signatories of the Covenant of Mayors is similar to the general of the province. That is logical since signatories, 210 municipalities, account for more than 95% of total population.





When analyzed in relative terms, per inhabitant, signatories consume a little bit less than the average of the province, but it isn't really a significant difference. Energy consumption reduction for signatories is around 11% in relative terms (per inhabitant).

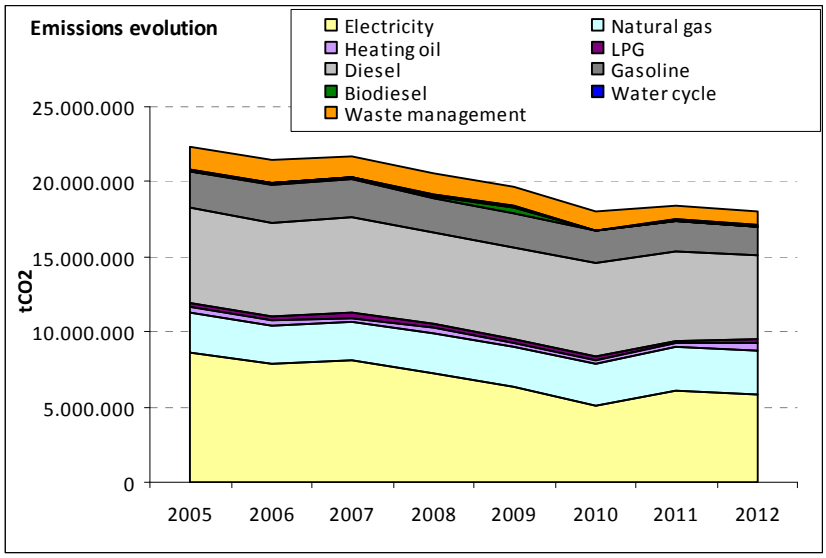
Emissions evolution in the province of Barcelona

Once energy consumption data have been collected, we could begin with the calculation of the emissions. According to the information on certified green energy procurement by municipalities and on local renewable electricity production, each municipality has its own electricity emission factor.

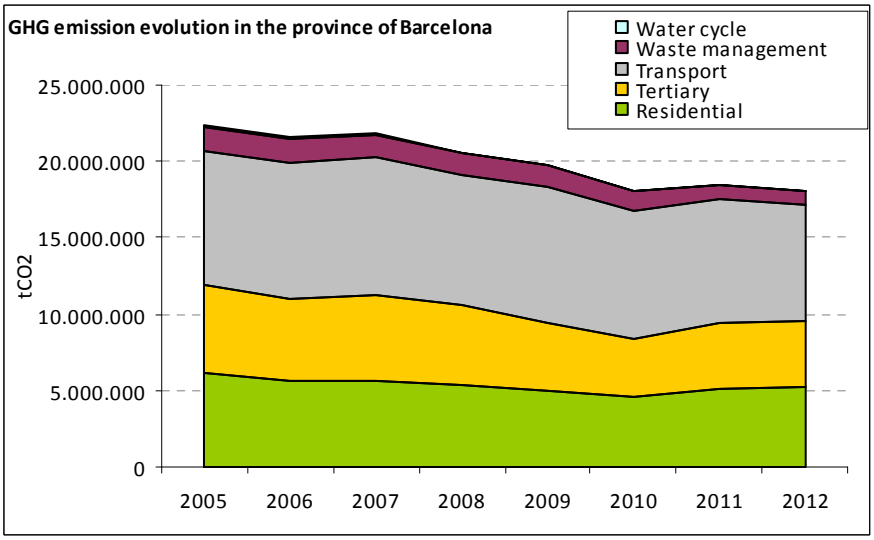
Emissions, logically, have also decreased since they depend directly on energy consumption. However some remarks have to be made on the evolution of the electricity emission factor. The national electricity emission factor has "improved" in GHG emission terms. The political commitment that used to be in Spain in the promotion of renewable sources is the main responsible for this.

Another interesting remark is that the methodology Diputació de Barcelona has developed includes water cycle and waste management emissions since those are fields where the

municipality can take action. Even though water cycle represents relatively few emissions, we must consider that we are in a Mediterranean area where water scarcity is a problem, which is foreseen to be worsened by the effects of climate change. Therefore water actions are welcomed and included, both as mitigation and adaptation actions, and that is the reason why we include this sector in the emission inventory.



Emission reduction between 2005 and 2020 is 19%, which is nearly 20% of the Covenant of Mayors goals. However it is important to remark that the economic crisis has played an important role too in that reduction.

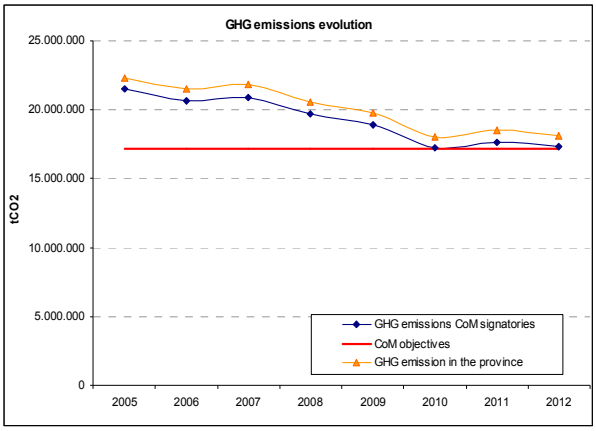


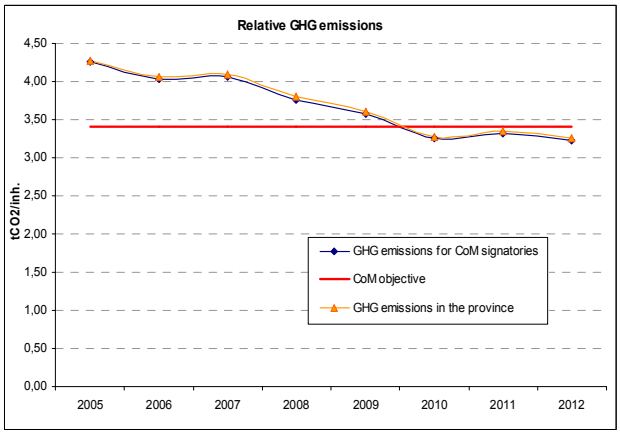
All sectors have reduced their emissions, both in absolute and relative terms (see table below).

In 2005 each inhabitant emitted 4.3tCO2, while in 2012 emissions per inhabitant were 3.3tCO2.

Difference 05-12	Absolute	Relative per inh.
Residential	-15%	-20%
Tertiary	-25%	-30%
Transport	-14%	-19%
Waste management	-38%	-42%
Water cycle	-53%	-55%
Total	-19%	-24%

When compared to total emission evolution, Covenant signatories there is no significant difference.





In fact emissions reduction among signatories per inhabitant is 24%, the same degree as the average of the province. Once again the main reason of this coincidence is the fact that signatories represent above 95% of total population of the province of Barcelona

Main conclusions

- Energy consumption has decreased from 2005 till 2012, both in absolute (5%) and relative (11% per inhabitant) terms. The Covenant of Mayors goal is reducing above 20% in 2020.
- Most energy decrease comes from transport, gasoline and diesel consumption reduction is the most important. This reduction might have several reasons: economic crisis which involves reduced mobility to go to work and less money to spend traveling, and renewal of the private fleet.
- Emissions have decreased due to several factors: reduced energy consumption and amelioration of the electricity emission factor.
- Emissions reduction per inhabitant are 24%, even though it seems that reached the Covenant of Mayors goal proactive measures are needed. Since already told, part of this reduction comes from economic crisis, so this means that an economic recovery might involve and increase in energy consumption and, thus, in emissions.
- The Spanish electricity emission factor has improved thanks to the strategy in favour of renewable electricity production that used to be. Nowadays, the strategy has changed and it could result in a worse electricity emission factor.