The University of Manchester
MANCHESTER 1824
Centre for Urban and Regional Ecology
School of Environment and Development

grip
The Greenhouse Gas Regional Inventory Project

GREENHOUSE GAS EMISSIONS INVENTORIES FOR 18 EUROPEAN REGIONS

Athens | Bologna |Brussels | Frankfurt | Glasgow | Hamburg | Helsinki | Madrid | Napoli | Oslo
Ljubljana | Paris | Porto | Rotterdam | Stockholm | Stuttgart | Torino | Veneto

$EUCO_2$80/50 Project Stage 1: Inventory Formation
The Greenhouse Gas Regional Inventory Protocol (GRIP)

metropolregion hamburg

METREX
The network of
European Metropolitan Regions and Areas

Foreword

Christian Maaß

State Secretary in the Ministry for Urban Development and Environment of the Free and Hanseatic City of Hamburg

WITH project EUCO2 80/50, 18 European metropolitan regions have taken charge as regards climate protection. Their shared aim is to reduce their greenhouse gases emissions by 80 percent by the year 2050.

As fundamental first step, the regions have compiled inventories of their CO_2 emissions, using the GRIP - Greenhouse gas Regional Inventory Protocol data model. It complies with the guidelines of the United Nations Framework Convention on Climate Change UNFCCC and ensures a europewide and worldwide comparability of the inventories.

The results are presented in this brochure in overview and detail. By means of the inventories, we can now determine our positions in the individual regions; identify, based on the respective economical and geographical situation, priority fields of action; and realise in which areas we can learn from the successes of other regions.

The Hamburg Metropolitan Region is coordinating partner of EUCO_2 80/50. Already in november 2007, we hosted the METREX Conference on Climate Change. The City of Hamburg will be European Green Capital in 2011. This title is, amongst other things, an acknowledgment of our efforts in the fight against climate change, but we are aware in Hamburg that successes can only be achieved in cooperation with the whole region.

Many of our problems in the Hamburg Metropolitan Region are comparable to those in other regions. We too are looking for the best solutions and have by no means found all answers yet. The European cooperation can open up new vistas for us and inspire us in our efforts.

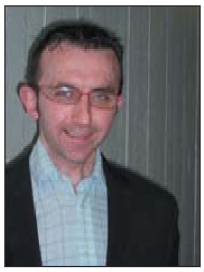
WE thank all regions which are our partners in this project for the trust they confided in us. Our thanks also go to the University of Manchester for the devoted scientific monitoring of the CO_2 inventory process and to the many colleagues in the participating regions who have contributed with their work to the project's success. On the basis of this cooperation, we can confidently approach the great challenges we have set ourselves.

Christian Maaß

State Secretary in the Ministry for Urban Development and Environment of the Free and Hanseatic City of Hamburg

Contents

Greenhouse Gas Inventories for 18 European Regions



Authors
Dr Sebastian Carney
Dr Nick Green
Dr Ruth Wood
University of Manchester

Roger Read
METREX

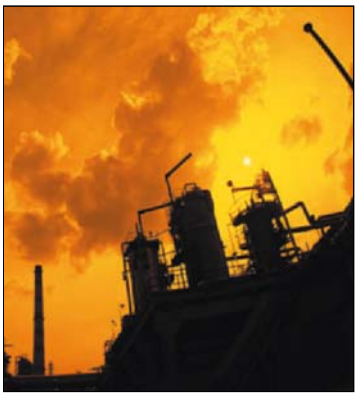
METREX and its focus on climate change

Roger Read, Secretary General
METREX
Lower Ground Floor, 125 West Regents Street
Glasgow
GP2334

Tel: +44 (0)129 231 7074

METREX was founded in 1996, at the Glasgow Metropolitan Regions Conference, to foster the exchange of knowledge and understanding between practitioners (politicians, officials and their advisers) on key strategic issues of metropolitan significance and common interest. The Network has now grown to 50 of Europe's 100+ major urban, or metropolitan, areas. It is highly representative all European urban conditions, circumstances and nationalities. The METREX web site at www.eurometrex.org gives information on the activities of the Network and its current agenda and programme.

At a METREX Meeting in Granada in 2005 the Network first considered the key issue of climate change. The Network took advice from the Tyndall Centre (UK) on the metropolitan dimension to climate change and the scale and significance of urban greenhouse gas (GHG) emissions. The Tyndall Centre brought to the attention of the Network the capacity of the GRIP (Greenhouse Gas Regional Inventory Protocol) model and process, devised and developed by Dr. Sebastian Carney now of Manchester University, to enable metropolitan areas to assess their GHG emissions and explore mitigation scenarios.



Metropolitan dimension of climate change

The population of the EU is some 490 million of which perhaps 60% live in its 100+ major urban, or metropolitan, areas. EU per capita GHG emissions are some 11 tonnes CO2 equivalent. On this basis EU metropolitan areas could be responsible for some 3234m tonnes of GHG emissions annually or 14% of the global total of 23000m tonnes.

The EU has set a target for an 80% reduction in GHG, over 1990 levels, by 2050. METREX has responded by taking steps to become informed about the most effective way in which Europe's 100+ metropolitan areas can reduce their emissions to meet this target.

The Stern Report has shown that the level of GHG in the atmosphere has to be stabilised at below 500ppm, from its present (2005) level of 430ppm, if the world is to have the prospect of holding average temperature rise to below 3ºC. This means that effective mitigation action has to be identified, initiated, committed and given momentum in the next 10 years. The forthcoming Copenhagen summit, in December 2009, will be the forum through which co-ordinated international mitigation action can be orchestrated.

The $EUCO_2$ 80/50 project, described below, aims to provide an effective response to mitigation at the level of Europe's metropolitan areas.

Metropolitan areas, energy security and competitiveness

It is clear that Europe will have to move quickly to a low carbon economy if it is to remain competitive. Carbon based economies will face more expensive and diminishing fuel supplies. Such supplies may also become less secure. In these circumstances it makes good sense for metropolitan areas to consider their own energy supplies and the extent to which these can become low carbon and more secure in the future.

The $EUCO_2$ 80/50 project also aims to identify ways in which, in taking effective mitigation action, Europe's metropolitan areas can also secure their low carbon energy futures.

InterMETREXplus

An existing EU Interreg IIIC project on effective metropolitan spatial planning practice, InterMETREX, was extended in 2007, as InterMETREXplus, to include consideration of climate change. InterMETREXplus involved four of the project partners in piloting the application of the GRIP model at the metropolitan level, to produce GHG inventories, and in the case of the project Lead Partner to explore mitigation scenarios. The InterMETREXplus pilot project brochure can be downloaded from the METREX web site.

The InterMETREXplus project received a 2008 Award from the Scottish Government and the Royal Town Planning Institute. The Judges remarks give support to the wider application of the GRIP model and process now being progressed through the $EUCO_2$ 80/50 project.

"The project identifies the key role the spatial planning system has in reducing greenhouse gas emissions. We recognise the importance of this innovative piece of work in providing a solid foundation for starting to develop and share spatial planning responses with partner organisations in Scotland and the wider European context to address climate change in advance of any statutory requirements emanating from the Climate Change Scotland Bill. The Judges wish GCVSPJC (the Lead Partner) and Partners every success in the future development of the project".

EUCO$_2$ 80/50

"The design of policies and the challenge of implementation is where economists, other social scientists and policy analysts should now be focusing their efforts." (*Blueprint for a safer planet. How to Manage Climate Change and Create a New Era of Progress and Prosperity*. Nicolas Stern. 2009).

The EUCO$_2$ 80/50 project is a METREX initiative to enable Europe's metropolitan areas to assess their GHG emissions, through inventories of the main energy sources and their use, and to explore effective mitigation measures, through scenarios of collective "stakeholder" action.

Eighteen partner metropolitan areas, from twelve EU countries, will take forward the application of the GRIP model and process, piloted through InterMETREXplus. The first stage of this work is summarised in this Report. In the autumn of 2009 it is intended to move to the mitigation scenario and preferred strategy stages. An Application has been made for support from the Interreg IVC programme by the Lead Partner, the Metropolregion Hamburg.

The EUCO$_2$ 80/50 project aims, as its outcome, to produce a Benchmark of Effective Metropolitan Mitigation Practice. This may take the form of a manual and a DVD addressed to the 100+ metropolitan areas of Europe and the 100+ plus metropolitan areas of the USA, which, as it happens, also represent about 60% of the American population. The 200 major metropolitan areas of Europe and America are together responsible for about 30% of global GHG emissions. Effective mitigation practice in these major global urban areas can be progressed through outcomes of the EUCO$_2$ 80/50 project.

This is the ambitious aim of the project in the period from 2009 to 2012.

Metropolitan GHG mitigation

The intention, at the end of the project, is to provide an effective political and technical response to the question that all European metropolitan Presidents, Mayors and Leaders will ask.

"So what should we do?"

The EUCO2 80/50 project assumes that by 2050 effective mitigation action will have been taken at the international, European, national and metropolitan levels. Some of the measures that are conceivable are set out in the box below. They and other measures appropriate to the varying climatic and urban circumstances across Europe's metropolitan areas will be explored and assessed as the EUCO2 80/50 project develops.

Roger Read, Secretary General

Measures for mitigation

European level

1 EU renewable energy grid

2 Low carbon energy supplies (all EU and adjoining renewables)

3 CCS for coal and gas

4 Electric cars (and related charging infrastructure)

5 Hydrogen and fuel cell trucks and buses (and related infrastructure)

6 High speed train network for short (450km) journeys

7 Few short haul flights (across seas) with hybrid and bio-fuel power

8 Long and medium haul flights with hybrid and bio-fuel power

9 Maritime hydrogen and fule cell power

10 Energy efficient appliances (EU standards)

11 Energy efficiency building management systems (EU standards)

National level

12 Road pricing (for GHG and air pollution, congestion, public transport capacity and environmental capacity)

13 Building regulations for high insulation (also EU standards)

Metropolitan level

14 Local renewable energy supplies

15 CHP locally and domestically

16 Electric car charging infrastructure

17 Hydrogen and fuel cell truck and bus infrastructure

18 Electric/fuel cell public transport

19 Integrated transportation (walking, park and ride, bus, tram. light rail, metro, interchanges) for local, regional, national, European travel

20 Integrated spatial planning and transportation (reducing the need to travel). Mixed use, higher density and transport related

21 New building and retro fitted building insulation programmes

22 CCS for cement, iron and steel industries etc.

23 Waste management and recycling

24 Local food economies and low carbon agricultural practice

25 Afforestation, water management and micro-climate management

The GRIP Inventory Methodology

About the GRIP approach

GREENHOUSE GASES, and their measurement using inventory techniques, involves a broad spectrum of organisations. This has led to a variety of methodologies being developed to calculate them. As a consequence making comparisons between the results of these inventories is convoluted. Some methods exclude certain emissions sources, others allocate emissions in differing ways. Some inventory methodologies use detailed data sets, whereas others use an entirely top down approach – where national data is disaggregated to the regional scale using scaling factors such as employee numbers or population. These differences are magnified by the different data sets available in different European regions as well as differences in the depth of understanding regarding emissions and their sources. The GRIP for Europe inventory approach had to recognise and embrace these issues, so that transparent methodology could be developed which would ensure that the resulting figures were trustworthy. Such an approach was also required to enable any resulting inventory to be comparable with both the respective national inventory and with those of other regions and years; these, along with visual clarity of the results, were all important considerations for the regions.

GRIP in Europe

To satisfy these requirements, the GRIP for Europe methodology adopted the same format as the original GRIP inventory methodology applied in the UK. This format comprises three different levels of methodology to calculate each emissions source. This is similar in format to the tiered approach provided by the IPCC for countries to form national inventories. Indeed, the methods chosen for use in GRIP for Europe are congruent with these international standards. This new methodology maintains the following five criteria of its predecessor:

1) It is timely in its approach
2) Adaptable to differing data sets
3) Transparent in nature
4) Easily replicable, and
5) It has a clear reporting structure.

The methodology provides a framework upon which a web based tool sits, that ensures no double

The GRIP tools and information are accessible over the internet.

The inventory tool itself is a series of forms to be completed with readily available statistics.

counting of emissions takes place, and that there is a concrete flexibility to enable comparisons between regions to be conducted without ambiguity. Each level of methodology relies on a different level of data availability.

The GRIP for Europe level 1 approaches are the most accurate, with level 3 approaches having the highest level of uncertainty associated with them. Level 1 data is derived from detailed and accurate data sets that are disaggregated. Level 2 data is estimated or inferred from other aggregated data sets which might themsleves be reasonably accurate. Level 3 data is estimated from large-scale demographic data sets, such as population or GDP data..

The key benefit of GRIP is that every emissions source identified in it has three methodological levels associated with estimating its significance. This means that whilst data may be limited for a given emissions source

in a region – information for dairy cattle, for example, might require a level 3 approach for a particular year – a region may also have detailed data for another source such as industrial fuel consumption, thereby enabling a more accurate level 1 approach to be employed. The GRIP for Europe tool presents these results in a colour coded format, to a high level of specificity.

This takes the following format: emissions estimated using a level 1 approach are presented in green, level 2 approaches in orange and finally level 3 approaches are presented in red. This means that a reader can immediately draw comparisons between the accuracy of an emissions source and make quick sensible comparisons of that source between not just regions and years, but also the respective country's national emissions inventory. The same colour coding applies to the inventory tool, where red boxes symbolise the data required for level 3 approaches, orange for level 2 and green for level 1.

In this document, each data set is presented using a pie chart to show the levels of emissions for a particular sector, along with an associated bar chart which shows the GRIP level achieved for different parts of that sector (see diagram).

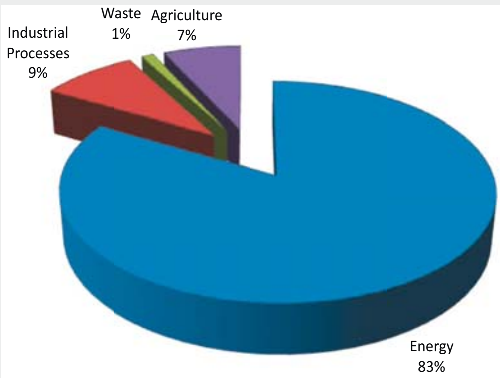
EUCO$_2$: the first step

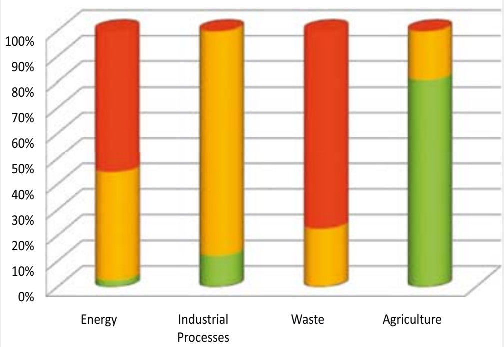
The basic structure

The GRIP approach was implemented in phases. Members of METREX were invited to join the EUCO$_2$ network, which had been set up specifically to implement the GRIP approach in a number of regions across Europe. In total, there are eighteen partners in the EUCO$_2$ network.

The first stage was to hold a partner meeting in Amsterdam in May 2008, at which potential partners could discuss their motives, aspirations and aims and ojectives for the network, and commit themselves to the project. The final list of partners was confirmed in December 2008.

The second stage, in January 2009, was to hold an inception meeting in Hamburg, the different partners recieved hands-on training in how to use the inventory tool, and were able to use it to make preliminary explorations of the data sets available.





GRIP 'levels' & the use of charts in this document

In this example, which shows totals for the four sectors of a region, we can see a pie chart showing the different percentages of greenhouse gas emissions (which are expressed as *Carbon Dioxide equivalent*, or CO_2e) that can be attributed to different sectors. Here we can see that most of the greenhouse gas emssions for this region come from energy.

The bar chart shows the data 'level,' where level 1 (green) is data about which we are most certain, and level 3 data (red) is data about which we are least certain. Level 2 (orange) lies between the two. The bar chart is presented as a percentage, so we can see that for energy, we are very certain about the quality of roughly 5% of the data, we are reasonably certain about the quality of 35% of the data, and we are uncertain about the quality of 50% of the data.

Allocating levels to the data in this way enables policy makers to quickly see the strengths and weaknesses of their data sets (see text for derivation of the different GRIP levels).

OVER a period of twelve weeks in early 2009, five workshops were held in Paris, Turin, Frankfurt, Athens and Stockholm. At each of these workshops, three or four groups of partners plus the project leaders were able to discuss the progress they had made on the inventory, and to put detailed questions to the lead partners about specific points and issues that they had come across in the course of their data collection activities.

The entire inventory is completed on-line, so that the project leader can access the raw data for collation and analysis (the results of which are set out in this document). The partners also have access to an off-line version, so that the inventory can be completed when no reliable network connection is available, and then uploaded to the central servers at a later date.

GRIP as a learning experience

One of the key aims of the EUCO$_2$ project is to empower city-regions not only by providing access to the final analysis of the emissions data, but also by encouraging dialogue between the EUCO$_2$ partners about how to use the inventory tool and to understand the data itself.

This is a crucial element of the project, because the key to properly understanding greenhouse gas emissions in general is to acquire an in-depth knowledge of the sources and nature of those emissions. So in the EUCO2 project, the partners have 'hands-on' experience of the data, and this enables them to see exactly which sectors in their region are emitting which greenhouse gases, and how much. This information provides a valuable overview of potential areas of intervention, and so enables the partner regions to develop policies that are better targetted, more efficient and more realistic than would be possible without this detailed knowledge.

The expert knowledge that is developed in the region as a consequence of this process does of course risk being undermined unless the tools necessary for its application continue to be available. The GRIP inventory tool will therefore continue to be freely available for use by the partners in perpetuity.

What this means in practice is that having once learned how to use it, and gained this valuable expertise (in the course of this project), partners are in a position to continue using it over the years. They can therefore update and develop their emissions inventories, and in so doing, strengthen the long-term foundations of their regional policies pertaining to greenhouse gas emissions.

THE EUCO$_2$ project does not, however, stop at inventory compilation, which is the first stage of three. The second stage is a scenario tool which will assist policy makers in developing their long-term visions for their regions, and in enhancing their greenhouse gas mitigation strategies. The data gathered for the inventory will be suitable for feeding into this scenario tool, which is discussed in the final chapter of this document. The third stage, is the planning process itself; putting strategy into practice.

Dr Sebastian Carney
University of Manchester
sebastian.carney@grip.org.uk
+44(0)161 306 6439

The GRIP main page can be reached at
http://www.grip.org.uk/Home.html

The inventory tool can be reached at
http://www.carboncaptured.org.uk

Technical Annex on the GRIP Approach

The Greenhouse Gas Regional Inventory Protocol (GRIP) has three methods to estimate emissions from each emitting sector. The method that is applied is dependent on the level of data available in each region.

The key calculation that runs throughout this methodology is:

$Emissions_{RGX} = R_{X,A} * EF_{GXy}$

Where: R is the Region
X is the activity under examination (measured or estimated)
EF is the emissions factor
G is the greenhouse gas
Y is the Regions nation.

The emissions of GhG (G) (CO_2, CH_4, N_2O) emanating from activity (X)in region (R) is equal to the level of activity (X) occurring in Region (R) multiplied by the Emissions Factor (EF) for GhG (G) for the activity (X) in Country (Y)

In GRIP we try to find out as much data about the activity within the region, whether this is energy consumption by sub-sector, farm yard animal numbers or fertiliser application to crops and so on.

When a measured amount of activity is known within a region a GRIP level 1 method is applied. When a measured amount of the activity is not available there needs to be a way of estimating it.

This is the main alternative when measured data is not available (the remaining one is to do nothing).

Therefore there needs to be a way of estimating the activity (X). This is the orange (level 2) and red data (level 3) inputted and outputted by the GRIP tool.

$Activity_{XR} = ((R_I * R_H) / (N_I * N_H)) * N_X$

Where: R is the Region
N is National
X is the activity under examination
I is the indicator *eg*
GDP per household
Expenditure on fuels
Waste incinerated / landfilled / recycled in tonnes
H is Households

The ESTIMATED level of activity of emissions source (X) in Region (R) is equal to a Regional Value (I) multiplied by the Emissions Factor (EF) for GhG (G) for the activity (X) multiplied by the National activity (N_X)

$Activity_{XR} = (R_I / N_I) * N_X$

Where: R is the Region
N is National
X is the activity under examination
I is the indicator *eg*
GVA (Gross Value Added)
Population

The ESTIMATED level of activity of emissions source (X) in Region (R) is equal to a Regional Value (I) divided by the national indicator (N_I) multiplied by the national activity

Regional Overview

A comparison of the regions using inventories from stage 1 of $EUCO_2$

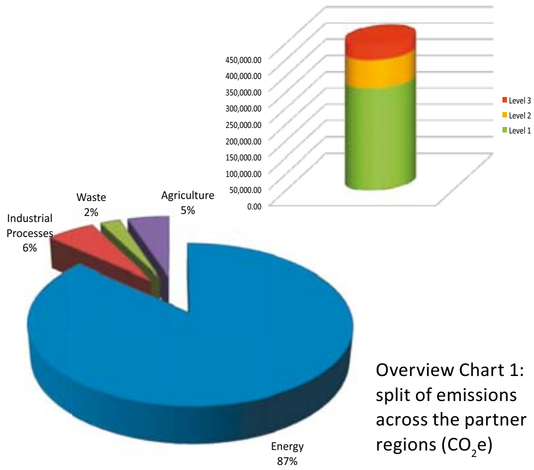
THE Regions considered in this brochure are collectively responsible for 11.5% of the European Community's Emissions. They are therefore a key part of delivering Europe's emissions reductions targets. They are taking the lead by operating at this level to explore how they can help deliver the changes necessary to help mitigate climate change.

This report presents the results of the first stage of the $EUCO_2$ project, inventory formation. In this section we present an overview of the greenhouse gas emissions from each partner region. Subsequently the results of the inventories are presented on a region-by-region basis in greater detail. The emissions inventories, in accordance with the GRIP learning focused approach, have all been compiled by regional representatives. This has been done to enable these representatives to gain a better insight into the emissions sources within their region, so that they are better placed to explain the results of the emissions inventories – within their region. All the data inputted on to the GRIP inventory tool has been done by these representatives.

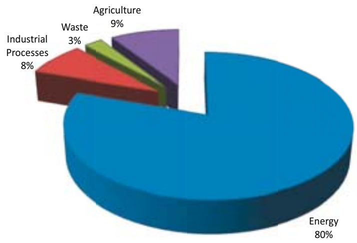
The results show that the EUCO2 project partners are responsible for 455,233kt CO_2e of emissions in 2005, this represented 11.5% of the emissions from the European Community (EC). The regions account for 52.5Million of the EC's 500million inhabitants. The amount of CO_2e released varied between partners, with this being a function of the nature and type of industry, the energy mix, the manner in which waste is treated and the size of the agricultural sector within each region. The overall split of emissions across the partner regions is presented in Overview Chart 1, the total for the European Community is presented in Overview Chart 2. This shows that the share of emissions from the partner regions is more dominated by energy emissions than the European Community as a whole. This is largely due to the lower amount of agricultural activity in the partner regions. The insert on Overview Chart 1 shows that 70% of the emissions estimated from the $EUCO_2$ partners were performed using level 1 methods, 20% with Level 2 methods and 10% with Level 3 methods.

Overview Chart 3 shows the overall emissions released in each region, together with the relative size of each emissions source. This chart shows the large difference in emissions between the partner regions. Part of this data can also be represented in another way, which is displayed in Overview Chart 4. This chart shows the contribution of each emissions source to overall emissions in each region.

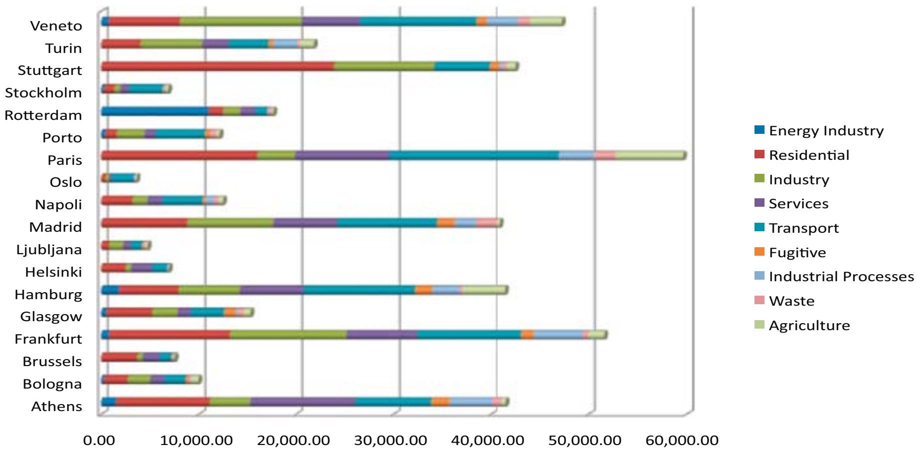
Due to the significant differences in terms of overall emissions between the regions there needs to be a way



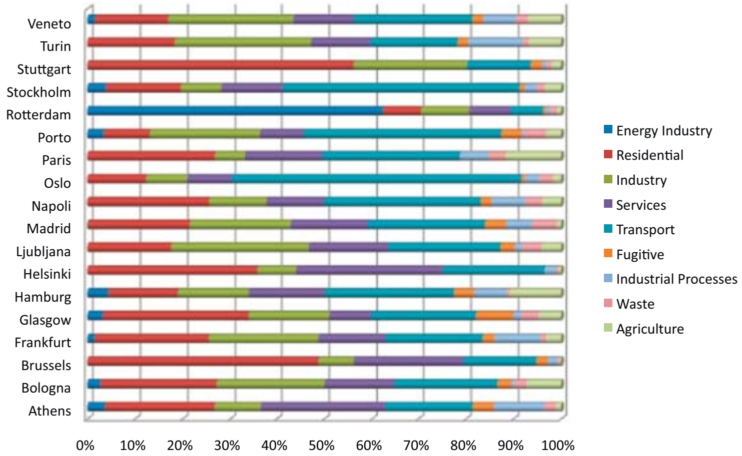
Overview Chart 1: split of emissions across the partner regions (CO_2e)



Overview Chart 2: emissions for the EC



Overview Chart 3: overall emissions released in each region, together with the relative size of each emissions source



Overview Chart 4: contribution of each emissions source to overall emissions in each region

of comparing the different regions. One of the mechanisms for doing this is to use per capita emissions, or emissions per person.

Of the 18 partner regions, the region that emitted the most CO_2e was Ille De France at 59,644kt CO_2e(although one of the lower emitting regions on a per capita basis (5.2TCO_2e)). The region emitting the least was Oslo 3,629kt CO_2e (Oslo also had the lowest emissions per capita at 3.5tCO_2e).

On average the emissions per capita across the partner regions was 9.65tCO_2e, which was below the national (of the partner regions) average of 10.2tCO_2e. However, this former figure is largely distorted by very high per capita emissions in Rotterdam, where there are four petroleum refineries (which are large CO_2e emitters). Therefore when considering the sum of emissions across the partner regions we discover that emissions per capita were 8.45tCO_2e, compared to a European Community average of 8.4tCO_2e per person. These figures can be seen on Overview Chart 5.

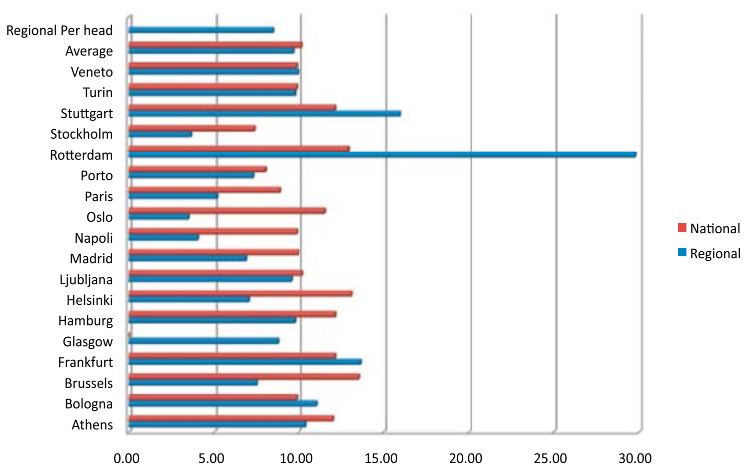
Overview Chart 5 shows that five of the eighteen partner regions had higher per capita emissions than those displayed in their host nations. This is mainly due to higher industrial activities to population ratios in the regions in comparison to the host nations. In three regions: Napoli, Oslo and Stockholm emissions were less than half of the per capita emissions displayed in their host countries. In the case of Stockholm this can be largely explained by the use of biomass for heat generation within their region in comparison to that nationally. In Oslo this can largely be explained by the lower amounts of agricultural and industrial activity in comparison to Norway as a whole. In Napoli this may be explained by the lower amounts of economic activity in both the service and industrial sectors to that displayed in Italy. In the remaining regions emissions are consistently lower than their nation's average, with this being explained by a lower industrial activity of the region, a higher household density and lower agricultural emissions. Furthermore, certain regions use more efficient mechanisms of energy production such as Combined (Cooling) Heat and Power (C(C)HP) – which reduce the overall load. Largely urbanised regions such as these also afford opportunities for lower energy lifestyles due to the location of services with respect to where people live.

A high- or a low-emissions-per-capita should not always be interpreted as a good or a bad thing. The key issue to consider is the activity that causes these emissions. The emissions that are presented in this document relate to the emissions that are emitted within the region, with the emissions associated with electricity being additional. A region may have low emissions per capita but be heavily reliant on goods and services from outside the region. Indeed a region may have high emissions but provide a range of goods and services to others , Rotterdam is a good example of this – having a series of petroleum refineries. The charts should not, therefore, be considered as a league table. Rather, lessons from partners should be transferred as to the reasons for their lower, or higher emissions. This is a function of the scale of Energy, Industrial Process, Agricultural and Waste activity in each region.

Energy

Overview Chart 6 displays the total emissions by energy sub-sector across the partner regions. It shows that emissions from fugitive sources contribute the least to overall emissions, with residential sector emissions contributing the most, closely followed by Transportation. Turning back to Overview Chart 4 we see that 8 of the regions identified that they did not have any energy industry activity within their region, so consequently no emissions allocated to them. It also shows the consistently high contribution that Transport makes to total emissions in each region – to the extent that it dominates emissions in Oslo and Stockholm.

The emissions from the energy sector are a function of the type of fuel combusted. This is usually considered in terms of a consistent unit of



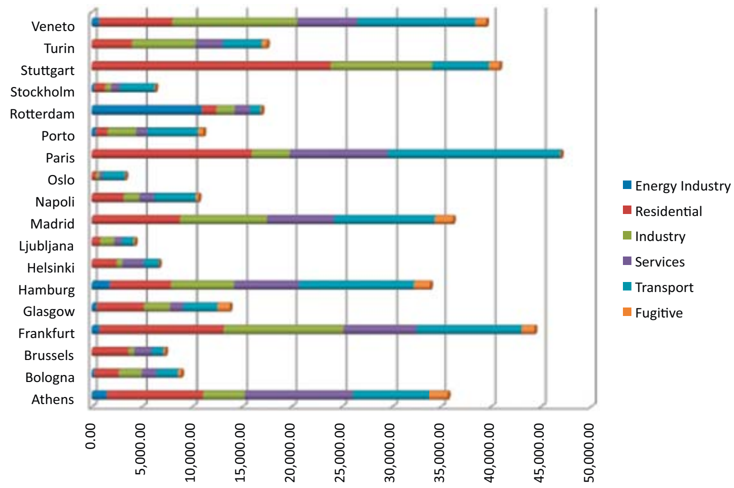
Overview Chart 5: Emissions per capita (tCO2e) energy: joules, watt-hours, tonnes of oil equivalent – in GRIP we use GWh. When combusted solid fuels emit the highest amount of CO2e per GWh. This is followed by liquid, gaseous and biomass fuels. This has additional implications for electricity generation – as electricity produced from coal is usually more carbon intensive than electricity produced by natural gas.

Therefore the emissions in the regions from energy are determined firstly by the type of fuels combusted by each sub-sector and, secondly by the technologies used to produce electricity and, heat/cooling for district heating/cooling. The remainder of the emissions in this sector are determined by the presence of Coal, Oil and Gas extraction activities.

The key reason for Stockholm's low emissions is its large heat distribution network powered by biomass and the low carbon intensity of Sweden's electricity system. The key reason for Oslo's lower emissions is due to Norway's very low carbon electricity grid – and its use of electricity as its main source of heating buildings. Turin, Veneto and Stuttgart all display higher emissions and this is largely due to the comparatively higher levels of industrial activity within their region. This is because industrial activity is generally more energy intensive then service based activity. When this energy is sourced from fossil fuels the emissions are going to be higher than when it is sourced from renewable energy sources. This poses a series of questions for the short-, medium- and long-term – including: where should industrial activity be based? Should it be near to renewably abundant areas? Should the decisions regarding where to produce goods be carbon-market driven, or should such decisions operate ahead of such market?

Industrial Processes

Overview Chart 7 shows the relative contribution of the four key emissions sectors to overall emissions. The chart shows that the majority of the regions had a small amount of industrial process emissions, which were largely caused by the maintenance of products such as air conditioning units. These emissions are particular to certain types of industrial sites and activities. The emissions from this category are released from non-energy sources, they are non-combustion chemical reactions and leakages of certain gases. The size of this sector is therefore, mostly dependent on the existence of the industry. The chart shows us that Veneto, Turin and Paris had the largest emissions from this sector, with this being due to the nature of industry within their region.



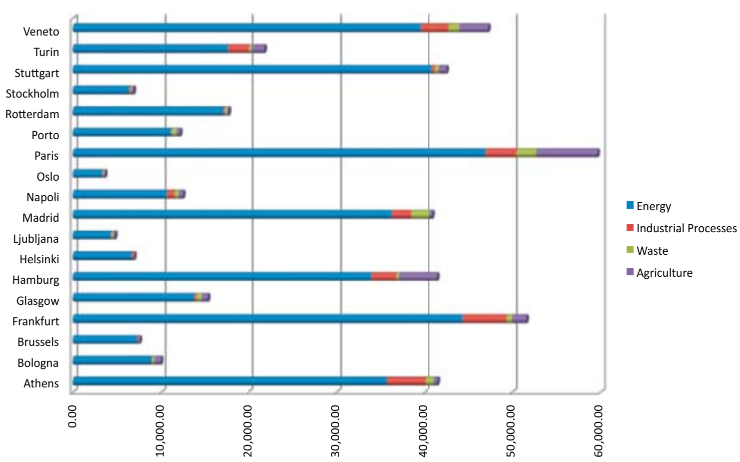
Overview Chart 6: total emissions by energy sub-sector across the partner regions (ktCO_2e)

Waste

Overview Chart 7 shows the relative contribution of Waste to the four key emissions sectors to overall emissions. The chart shows that every region emitted at least some GhG's from this sector. The emissions varied by region largely depending on the regions propensity to landfill, combust or recycle their waste. Waste emissions are a function of these, with emissions from land-filling waste generally being the highest, higher still if it is at un-managed landfill sites. The emissions per person varied considerably between the partner regions - with Brussels and Stockholm emitting the least, with this largely determined by the comparatively larger level of waste combustion and recycling in the region compared to other regions in this document

Agriculture

Overview Chart 7 shows the relative contribution of Agriculture to the four key emissions sectors to overall emissions. The chart shows that there were agricultural emissions released in every region. The emissions varied between the regions, the emissions in Brussels, Helsinki and Oslo were the lowest. With emissions being the highest in Ille de France, Hamburg and Veneto. These emissions statistics are purely a reflection of the level and nature of agricultural activity within each region. The emissions are largely determined by the amount of



Overview Chart 7: relative contribution of each sector to the four key emissions sectors to overall emissions (ktCO_2e) farm yard animals, the treatment of their waste and, the amount of fertilisers (both organic and in-organic) applied to the soil.

It should be noted that whilst the regions have greatly differing levels of emissions associated with them in this inventory, it is likely not to be symptomatic of the emissions that are caused to provide the food that their inhabitants eat. This means that the true impact will extend beyond the region.

What does this data tell us?

This data, together with the data presented over the next 72 pages tells us what GhGs were released in the partner regions in 2005. The figures provide us with a baseline upon which scenarios may be set and policy may be informed. The figures show us the differences between the partner regions emissions and the associated activities that drive them. It enables for the first time, these regions to compare themselves to each other in terms of their emissions released using a consistent methodology.

In order to plan for mitigating climate change, we need to be aware of the emissions that we release each year, so that we can control them downwards, which will help stabilise the atmospheric concentration of Greenhouse Gases (see table below). This requires us to understand the activities that cause emissions in our regions and cities. Furthermore, we need to develop our understanding of how to mitigate them by clarifying what needs to be done, and what powers cities and regions have now, and require, to make these goals a reality. Therefore, reductions in demand for energy and changes in how energy is supplied need to be considered urgently. Mitigating climate change requires substantial cuts in emissions in the short-, medium and, long-terms. We must therefore consider how and where the energy services that we rely upon are produced. So that by displacing/changing activity in one region does not lead to an overall increase in GhG globally.

This data tells us what activity is causing what emissions. The underlying data – available separately – tells us more detailed information regarding, for example, energy consumption, by type, by sector.

With a good understanding of activity, energy consumption and associated emissions policies can be considered that tackles the issues that are pertinent in each region. This represents the second and third stages of $EUCO_2$, which are discussed in the chapter *Next Steps*, towards the end of this document.

Classification of recent stabilisation scenarios according to different concetration targets
(Source: Climate Change Committee Report UK)

CO_2 concentration (ppm)	CO_2e concentration (ppm)	Global mean temperature increase above pre-industrial at equilibrium (°C), using "best estimate climate sensitivity"	Peaking year for CO_2 emissions	Change in global CO_2 emissions in 2050 (% of 2000 emissions)	No. of assessed scenarios
350-400	445-490	2.0-2.4	2000-2015	-85 to -50	6
400-440	490-535	2.4-2.8	2000-2020	-60 to -30	18
440-485	535-590	2.8-3.2	2010-2030	-30 to +5	21
485-570	590-710	3.2-4.0	2020-2060	+10 to +60	118
570-660	710-855	4.0-4.9	2050-2080	+25 to +85	9
660-790	855-1130	4.9-6.1	2060-2090	+90 to +140	5

Source: Adapted from IPPC Working Group III Fourth Assessment Table 3.5
Note: Equilibrium temperatures assume a climate sensitivity of 3°C and are different from expected global mean temperatures in 2100 due to the inertia in the climate system.

Attica

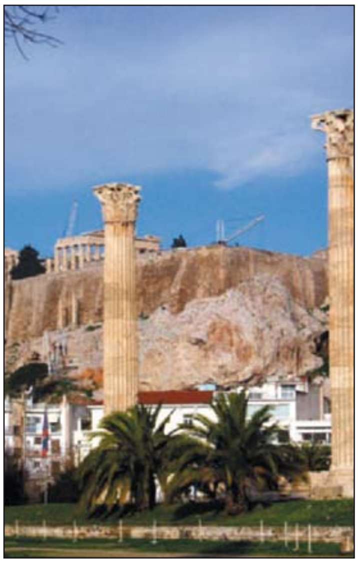
Dimitris Katsochis
Managing Consultant
Engineering Management Services Group
PLANET S.A.
Apollo Tower
64, Louise Reincourt St.
11523 Athens - GR

ORGANISATION for Planning and Environmental Protection OF ATHENS

ATTICA comprises one region, including the capital Athens, subdivided into four (4) prefectures,. Included in the region are the islands of Salamina, Egina, Poros, Hydra, Spetses and Kithira. 65 percent of the region is semi-mountainous, 30 percent lowland and 5 percent mountainous. The region has a temperate Mediterranean climate with 17.4 °C of mean annual temperature in Athens.

Despite its relatively small size (3 808 square kilometres), Attica is of great political, economic and historical importance, containing the national capital, Athens, which is the leading centre in terms of population, economy and culture. The region's economy is based on the development of industry and services. The boom in building activity has reduced the amount of agricultural land.

Attica has the highest concentration of manufacturing, commercial and banking activity and is home to 36 percent of the population of Greece.



It has both light and heavy industry. It is the main hub of communications in Greece, with facilities for the rapid transport of raw materials and finished products, principally through the port of Piraeus, which is linked directly to all the main ports of the Mediterranean, and also by road, rail and air. The region accounts for 40 percent of total national employment and has a plentiful supply of manpower, particularly skilled labour. It is the main educational centre of the country, with thousands of students attending its establishments of higher education. It also has a wealth of ancient monuments and sites (Parthenon, Arhaia Agora, etc.), which attract millions of visitors from all over the world.

The primary sector (agriculture, forestry and fisheries) is not enough developed and accounts for barely 2 percent of regional GDP. Attica is the largest industrial centre in the country, and the secondary sector (manufacturing, energy and construction) contributes 28 percent of the region's GDP. The region's heavy industry (oil refining, shipbuilding, mechanical engineering, etc.) and light industry (tobacco-processing, textiles, etc.) account for over 50 percent of the industrial goods produced in Greece.

The tertiary sector (transport, communications, distributive trades, banking and insurance) contributes 33 percent of regional GDP. Athens and Piraeus are the largest commercial centres in Greece, with large numbers of major foreign and Greek companies, both privately and publicly owned, and the largest retail establishments. The other sectors (housing, public administration, health, education and other services), basically belonging to the public sector, contribute 37 percent of regional GDP. Growth in regional GDP is higher than the national average.

The concentration of population in Athens has deteriorated the natural environment and the city has become one of the highly polluted capitals of Europe. Population showed some signs of stabilisation around mid-90's, but a new surge has been experienced since then due to a large number of people coming to live in Greece from poorer countries of Eastern Europe, Asia and Africa. The pressure on housing in Athens has resulted to the reduction of open spaces inside the city, while in the rest of Attica the forest areas are often being degraded not only by urban expansion but also by forest fires which are a rather common phenomenon of the summer months in the Mediterranean.

The constantly increasing number of cars, which brings average motorisation rate closer to Western European standards, narrow streets and insufficient parking facilities are creating major traffic problems. The vehicle exhaust fumes, factory chimneys and central heating plants are pouring out the chemical smog, which had become a permanent feature of the sky over Athens for more than 15 years since 1980. The situation is – only partly – reversed due to the implementation of a rather dense underground metro network and the increase of available off-street parking facilities. Despite the admission of each car into the centre of the city on alternate days only, the pollution levels occasionally exceed the safety limits, and emergency measures have to be taken.

The previous page contains an overview of the Athens Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Athens contains the largest industrial centre in Greece as well as hosting significant service sector.

The inventory for the Athens Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Athens Chart 1); secondly the emissions from industrial processes (Athens Chart 2); thirdly the emissions from agriculture (Athens Chart 3) and finally the emissions from waste (Athens Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Greece (Athens Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Athens area in 2005 was 35719 kt CO_2e. Athens Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Athens the emissions from the residential sector accounted for 27% of energy emissions, the service sector made up 30% of CO_2e emissions, the industrial sector 12% and the transport sector 22%. The energy industry of Athens represented 4% of emissions and finally fugitive emissions account for 5%. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Athens Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the fugitive emissions, level 2 methods were used to estimate emissions from the industrial sector, transport sector, energy industry and service sector emissions and level 3 data was used to estimate 100% of residential emissions. This means that there is a clear need for local energy information to be collected. This will enable year-on-year energy based emissions to be compiled for the Athens area in the future.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 4 383 kt CO_2e. The breakdown is presented in Athens Chart 2, and is comprised of 63% from mineral products, 20% from the production of halocarbons and SF6 and 17% from the consumption of halocarbons and SF_6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Athens has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from mineral products and the consumption of halocarbons and SF6 and level 2 methods were used to estimate the emissions from the production of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has clearly been done here. This relationship can be built upon to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

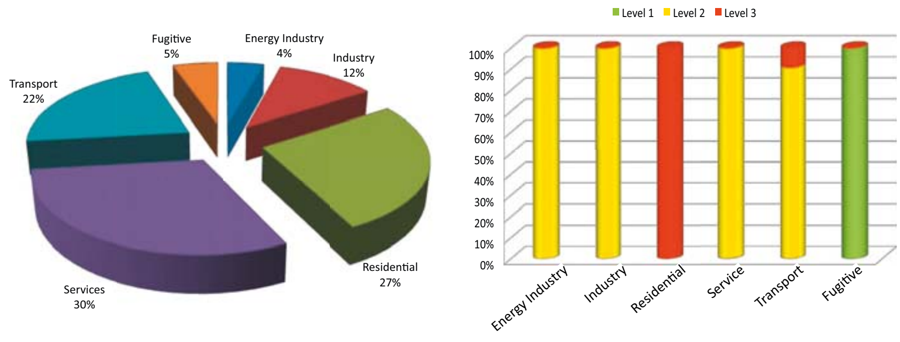
The inventory shows that 449 kt CO_2e were emitted from the agricultural sector within the region in 2005. Athens Chart 3 shows the total is made up of 7% from enteric fermentation, 6% from manure management, 87% from agricultural soils and, 0.5% from other sources. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation, manure management and other sources, level 2 methods have been used for 100% of the emissions from agricultural soils.

Waste

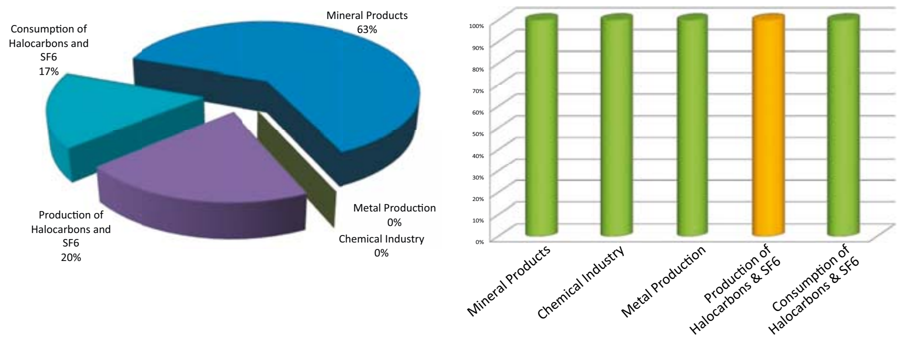
Waste emissions include CO_2, CH4 and, N2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 1 019 kt CO_2e were emitted from the waste sector in 2005. As shown in Athens Chart 4 the total is made up of 13% from managed waste disposal, 55% from unmanaged waste disposal, 32% from waste water and 0.2% from incineration.

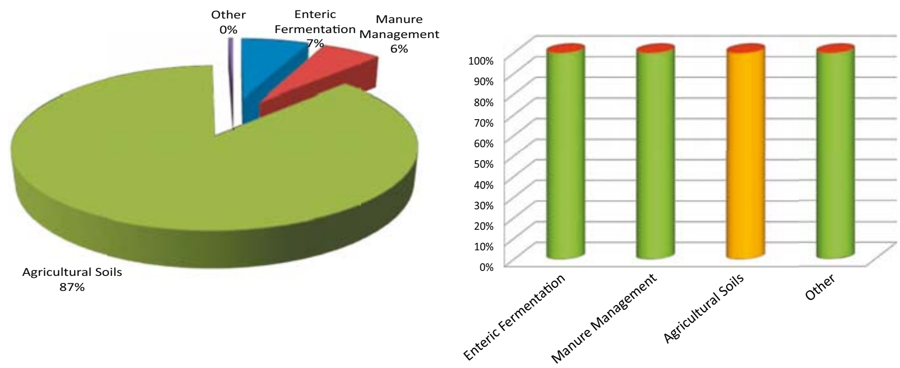
The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal, level 2 methods have been used to estimate 100% of unmanaged waste disposal, waste water and incineration emissions.



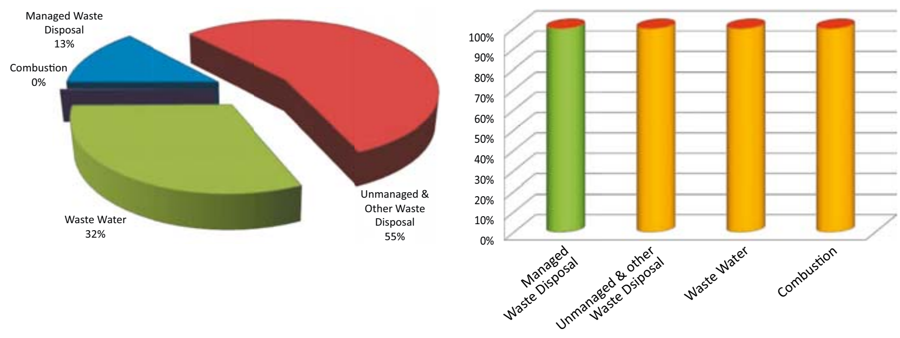
Athens Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e).
Right: GRIP level used (CO_2e)



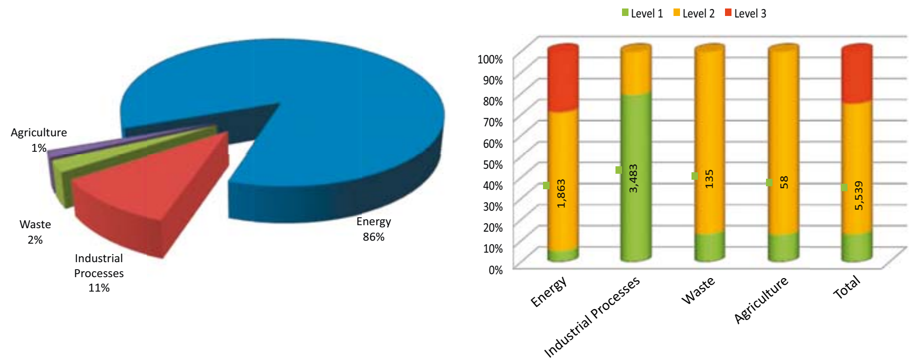
Athens Chart 2: Left: Emissions from industrial processes (CO_2e).
Right: GRIP level used (CO_2e)



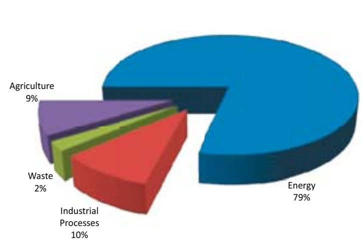
Athens Chart 3: Left: Emissions from agriculture (CO_2e).
Right: GRIP level used (CO_2e)



Athens Chart 4: Left: Emissions from waste (CO_2e).
Right: GRIP level used (CO_2e)



Athens Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)

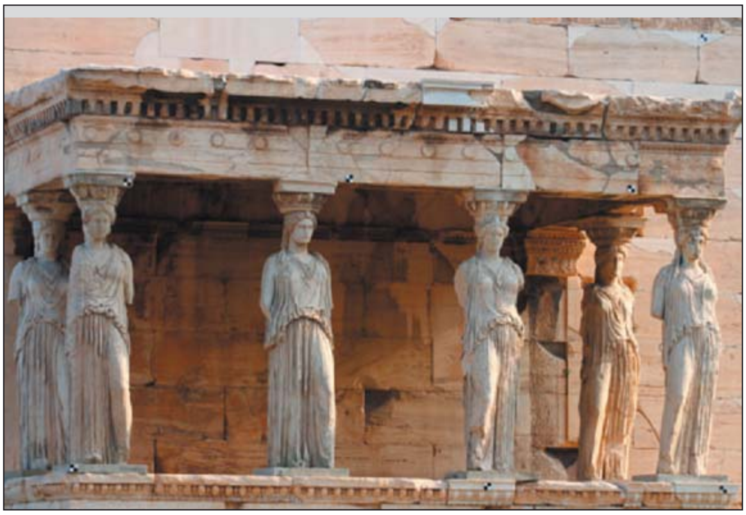


Athens Chart 6: Total national emissions by sector (CO_2e)

THE EMISSIONS for the whole of the Attica Region are displayed in Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions . These emissions represent the sum of the emissions presented on the previous two pages. The emissions for the country are displayed in chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a comparatively higher share of energy emissions to that displayed nationally and a substantially lower share of agricultural emissions. The emissions per-capita of the region are 10.4tCO_2e compared to 12tCO_2e nationally. This can be explained by the lower agricultural emissions of the region compared to that displayed nationally and also by the lower per capita energy consumption in the region compared to that of wider Greece. Regions with a similar per capita emissions include Turin, Veneto and Ljubljana. The emissions per capita are above the average of the regions and are also above the European average. They are similar in size to the emissions per capita of Italy. Although this needs to be considered in terms of the level of the methodology used, which in this case is largely level 2 and level 3 methods. Furthermore, the emissions are effected by the type of electricity generation in Greece that is more carbon intensive then those of other countries.

The table below displays the emissions for the whole of Attica on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 93% of CO_2 emissions and 85% of CO_2e emissions. This is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to look to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. This is the next step of the EUCO$_2$ project, and is explained in more detail at the end of this document.

The table below and Attica Chart 5 above show that the energy sector is responsible for 86% of emissions, Industrial Processes for 11%, Waste for 2% and Agriculture for 1% of emissions. This shows the clear need to focus on the energy system needed for Attica as a low-carbon region of the future.



	kt	kt	kt	CO_2e - GWP100		kt	kt	
Sector	CO2	CH_4	N_2O	HFC	PFC	SF_6	CO_2e - GWP100	GRIP % Level
Energy - Total	35282.60	4.45	1.11				35718.70	
Residential	9531.45	1.13	0.12				9592.72	
Services	10828.98	0.17	0.14				10876.79	
Industry	4088.56	0.18	0.14				4134.57	
Energy Industry	1515.26	0.05	0.01				1520.47	
Transport	7466.35	2.68	0.67				7730.93	
Fugitive	1852.00	0.23	0.02				1863.22	
Industrial Processes	2752.00	0.00	0.00	1629.49	0.00	0.00	4383.12	
Waste	1.59	42.09	0.43				1018.47	
Agriculture		1.90	1.32				449.09	
Total	38036.20	48.44	2.85	1629.49	0.00	0.00	41569.38	

Bologna Province

BOLOGNA PROVINCE covers an area of 140km^2 and sits within the region of Emilio-Romagna, Italy. It is home to 0.9m people accommodated in 0.46m households.

The Gross Domestic Product (GDP) of the region in the year 2004 (the year of the inventory) was valued at €29.4Bn. This level of economic activity equated to GDP per capita of €32,142, above the Italian average of €22,678. The level of economic activity within the region of Emillia Romagna is 25% above the Italian average and this is in part due to the Bologna Province.

Different industrial sectors and activities have differing levels and types of emissions associated with them. Some industries are highly carbon- and energy-intensive (iron and steel, for example) due to the amount and type of fuel they consume. Other industrial groups (such as cement and chemical manufacturing) are associated with high levels of "process emissions". Process emissions occur as a result of the nature and rate of a given activity and may result from, among other possibilities, chemical reactions or as a direct consequence of product use. The agricultural sector is also particularly important due to its contribution to both $CH_4$and N_2O emissions which arise both from the use of fertilisers and from animals.

The region houses a large amount of heavy and polluting industrial activity (34% GDP). In the year 2004, the region accounted for just under 10% of Italy's manufacturing output. The region's agricultural industry was responsible for 4% of the region's GDP in 2004.

The Bologna province holds both the most important motorway and rail interchanges in Italy. These carry the majority of traffic passing between north and south Italy. Of the 1,080 industrial areas within the region 85% of them are within 8km of the principal road network. The main railway line departing from the region is electrified, which results in lower direct emissions than a non-electrified route. Bologna Province also has two main airports, Bologna, and Bologna Forli.

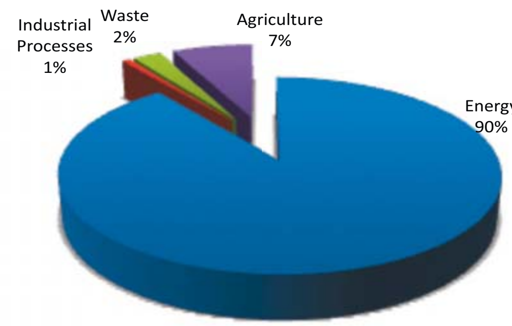
Emissions from Bologna

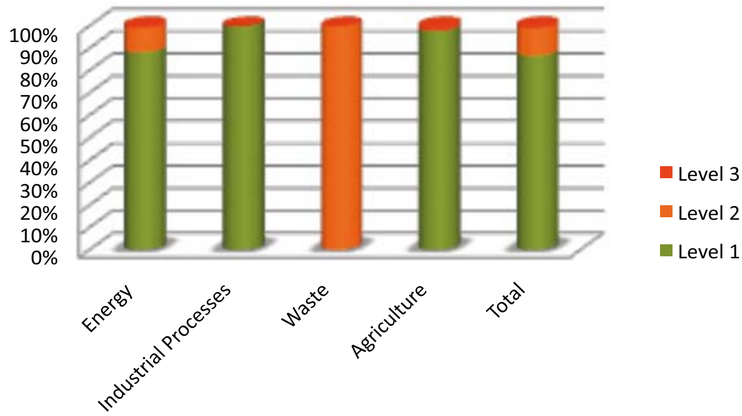
The energy sector, including domestic, industrial energy consumption, transport and fugitive emissions, accounts for 99.9% of regional CO_2 emissions (8,175kt CO_2), with CH_4 and N2O emissions adding an additional 742kt CO_2Eqv, making a total of 8,927kt CO_2Eqv for the year 2004. The chart above shows the breakdown of Bologna GHG emissions, from the energy sector in the year 2004.

Direct domestic emissions occur from the combustion of solid, liquid and gaseous fuels, burned in households across the region. Indirect emissions occur through the consumption of electricity. A home in the region may be heated by gas- or liquid-fired central heating, electric heating or indeed a combination of these. Emissions per household in Bologna Province are 4.9t CO_2 emissions per person are 2.47t CO_2. Total domestic emissions were 2,438kt CO_2Eqv.

Total emissions from the energy consumption by commercial, public administration and agricultural sectors in Bologna Province for the year 2004 were estimated to be 1,341kt CO_2. Total emissions from the energy consumption of the industrial sector were estimated to be 2033kt CO_2. There are no petroleum refineries, coke manufacturers, blast furnaces or oil and gas extraction taking place in this or any of the other pilot regions. Total emissions from other fugitive sources in the Bologna Province region for 2004 were estimated to be 270kt CO_2 Eqv.

Analysis of the emissions figures show that road transport is the largest contributor to transport emissions in Bologna Province emitting 2159kt CO_2 in 2004. However, it should be noted that emissions produced during the 'cruise' part of international flights from Bologna's air ports are not included in the analysis in accordance with IPCC emissions accounting guidance and may





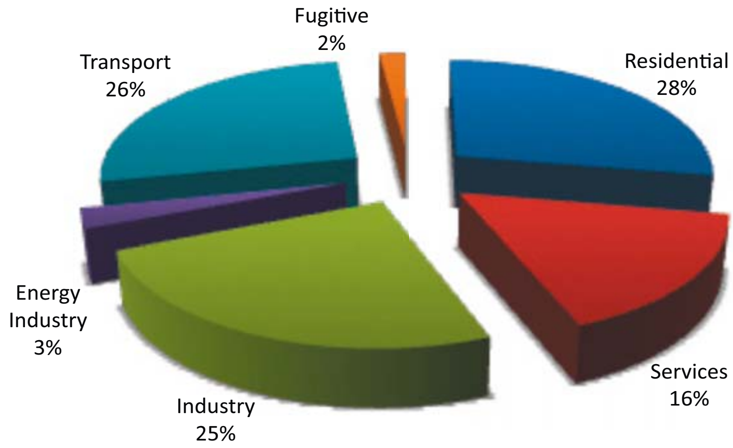
Overview of greenhouse gas emissions for Bologna region, showing percentage emissions, above left, and GRIP levels, above right.

therefore under- represent the contribution of this transport source.

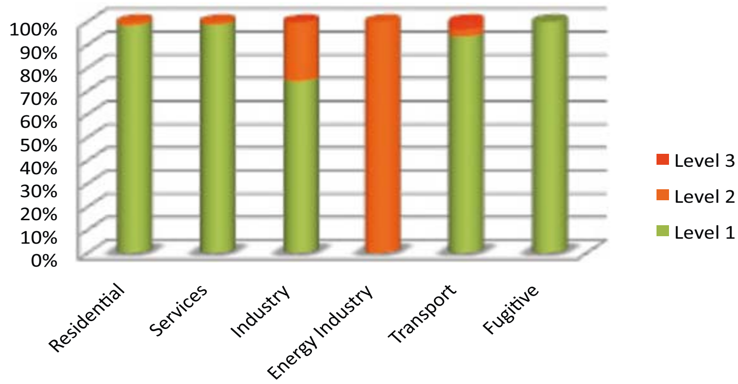
According to our communication with Bologna Province, there are no industrial process emissions released that are covered under international standards (such cement and chemical manufacturers).

The largest source of agricultural methane emissions arise from enteric fermentation followed by emissions from the management of animal waste. The levels of emissions are dependent on the number and type of farm animals, with dairy cattle being the most significant as well as the methods of waste management employed. The largest source of N_2O from agriculture is from agricultural soils resulting from the application of nitrogen fertilizers. The emissions in Bologna Province from the agricultural sector amount to 716kt CO_2Eqv.

The management of waste from Bologna Province was responsible for the emission of 253kt of CO_2 Eqv in 2004. Overall the emissions for the Bologna Province region are estimated at 10.9tCO_2Eqv per person, and 0.34ktCO_2Eqv per unit of GVA.



Greenhouse gas emissions for Bologna region from energy, broken down by sector; showing percentage emissions, above, and GRIP levels, below.



Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy	8175	5.84	2.03				8926.94	
Residential	2265	0.1	0.55				2437.6	
Services	1341	0.08	0.4				1466.68	
Industry	2033	0.13	0.8				2283.73	
Energy Industry	220	0.02	0.16				270.02	
Transport	2159	0.51	0.03				2179.01	
Fugitive	157	5	0.09				289.9	
Industrial Processes	0	0	0	69	3	0	72	
Waste	3	11	0.06				252.6	
Agriculture		13	1.43				716.3	
Total	8178	29.84	3.52	69	3	0	9967.84	

Brussels-Capital Region

Bram Lattré
ddv-aos@brucity.be
+32 (0)2.279.31.43

Tin Meylemans
Tin.Meylemans@brucity.be
+32 (0)2.279.30.41

FOUNDED in the tenth century in the valley of the river Zenne, the name Brussels, originally from an old Flemish word meaning marshland, refers to the river that is still part of the city, although it has been vaulted in the 19th and 20th century. The topography influences the further social evolution of the city: the bourgeoisie settles on the higher plateaux in the east and industries develop on the low-lying plains on the opposite riverbank. This social separation is still visible today; the luxury districts on the higher bank and the popular districts in the lower parts of town.

Since the independence of Belgium in 1830, Brussels is the capital of the country and houses the Belgian authorities. 1989 is a turning point in history with the formation of three regions with their own political authorities, for which the City of Brussels as well is the capital. From that moment on the 19 municipalities composing the Brussels-Capital region is physically and culturally encompassed by the Flemish and French speaking regions.

Brussels remains the economic capital of the country, although since the deindustrialisation process in the 1960s, the economy is above all service-based. Of the region's jobs 43% are concentrated in the City of Brussels, while no other single municipality has more than 7%. In 2005 the GDP of the Brussels-Capital region amounted to 58 000 million euros, or 19% of the country's total GDP. This is in contrast with the income of the region, because most of the working population lives outside the region. Per capita gross value added at basic prices in the same year came to 57.159 euros, compared wit a national figure of 28.831 euros. The region is known as one of the most green city regions in Europe, with its 8000 ha (+/- 50%) of green space.

Today Brussels is a cosmopolitan region, as people of various origins settle in the capital and count for 26 % of it's population. The migration of foreign workers in the 1960s had a centrifugal effect on the former Belgian population in the centre, which migrated to the periphery. The region's population varies around one tenth of the country's population and

was 1.006.749 in 2005; the City of Brussels counts 142.853 inhabitants. This population is spread out unequally over the area: the south-east of the region is characterized by 'garden cities' and important lots with free-standing villas. In contrast, in the north-west the rupture between urban and rural areas is more abrupt due to more densely populated areas with a predominantly unskilled working-class population.

From the 1960s on Brussels got the stature as the heart of Europe as in 1958 it became the headquarters of the European Economic Community (now the European Union), as well as NATO in 1967. The European institutions nowadays occupy an important place in the east of the city centre, Due to its international image, Brussels is an attractive place to international companies as location for their administrative seats.

The previous page contains an overview of the Brussels Metropolitan Region. This background offers a useful insight into the size and sources of GhG emissions that we expect to see in the region. The overview tells us that Brussels has a significantly higher amount of people working in the service sector than that displayed nationally. The energy that it consumes is mostly fossil based, with a relatively high amount of electricity being imported. It has a very small agricultural sector. The emissions from Brussels are similar to those from other regions.

The inventory for the Brussels Metropolitan Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Brussels Chart 1); secondly the emissions from industrial processes (Brussels Chart 2); thirdly the emissions from agriculture (Brussels Chart 3) and finally the emissions from waste (Brussels Chart 4). We then present total GhG emissions from the region and the breakdown of emissions sources from Belgium (Brussels Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Brussels Metropolitan area in 2005 were 7,341 kt CO_2e. Brussels Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that the emissions from the residential sector made up 50% of CO_2e emissions, the service sector 24%, the industrial sector 8% and the transport sector 16%. There are no petroleum refineries or solid fuel transformation plants etc in the region and therefore there are no emissions from the energy industry. Finally, fugitive emissions represent 2% of the emissions total from energy. This mix can be explained due to the high economic share of the service sector in the region compared to that displayed nationally, the somewhat higher population density of the region, the established transport links. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in relation to the GRIP methodological level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculation. The use of the GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Brussels Chart 1 shows the GRIP levels used, as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used for to estimate 100% of the emissions from the domestic sector, 100% of the service sector, 0% of the industrial sector, 15% of the transport sector, 100% of the energy industry and 100% of fugitive emissions. This means that much of the data entered by the team in Brussels was sourced from local measured data sets. This means that the inventory has been mostly produced using the highest level available data. However, it does identify gaps in the data that is available particularly in the industry and transport sectors. There is potential for improvement in future emissions inventories by improving the data quality of these sectors. By establishing and maintaining the demand for this data in future emissions inventories the organizations that hold it are more likely to release it, enabling more certain year-on-year energy based emissions to be compiled for the Brussels Metropolitan area in the future.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of certain products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 144 kt CO_2e presented in Brussels Chart 2, and is entirely from the consumption of halocarbons and SF_6. This reflects the nature and extent of the industry within the region. The data suggests that Brussels does not have any of the industrial sites that are responsible for emissions of GhGs. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from the consumption of halocarbons and SF_6.

Agriculture

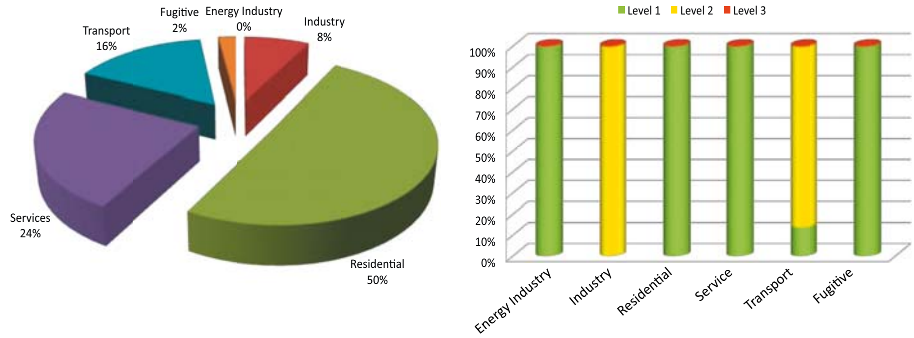
The agricultural emissions are very low, accounting for less that 0.1% of this region's emissions. They have largely been calculated using level 1 methods.

Waste

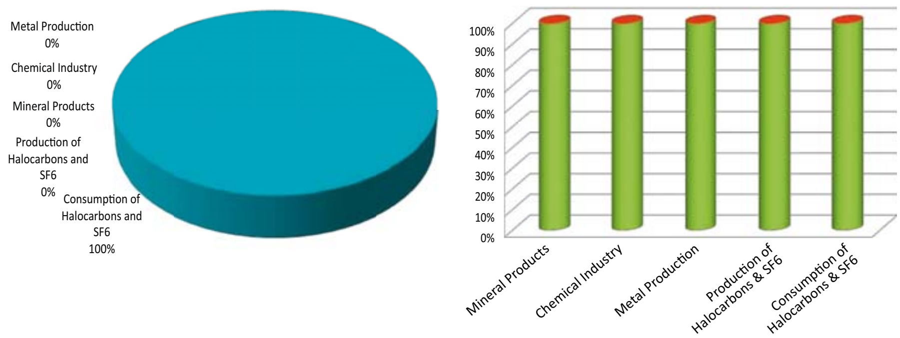
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and the amount of waste which is incinerated. The size of emissions reflect the volume of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

Brussels Chart 4 shows that 43 kt CO_2e were emitted from the waste sector in 2005. In the case of the region this was comprised of 90% from waste water and 10% incineration.

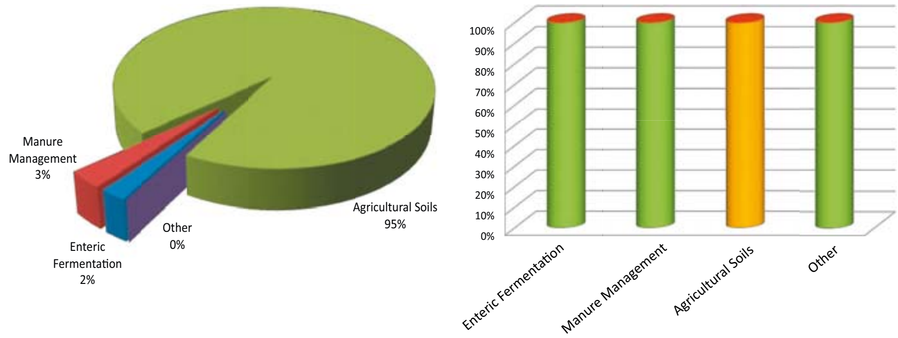
The reasons for the lower than average emissions from waste compared to Belgium is due to the data entered into the inventory tool regarding the region's propensity to recycle or incinerate their waste rather than landfill it. The emissions have been estimated using level 1 methods for 0% from managed waste disposal, 0% unmanaged waste disposal, 11% waste water and 0% incineration. These percentages may appear low, however, they are based upon statistics pertaining to waste management – and therefore provide greater confidence in their accuracy that would otherwise be warranted.



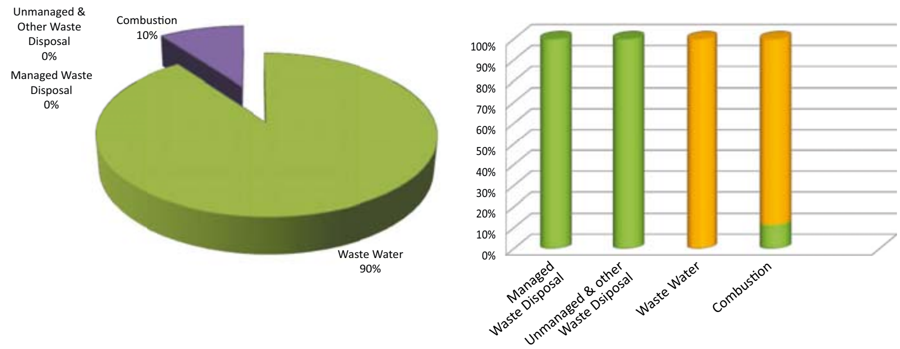
Brussels Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e).
Right: GRIP level used (CO_2e)



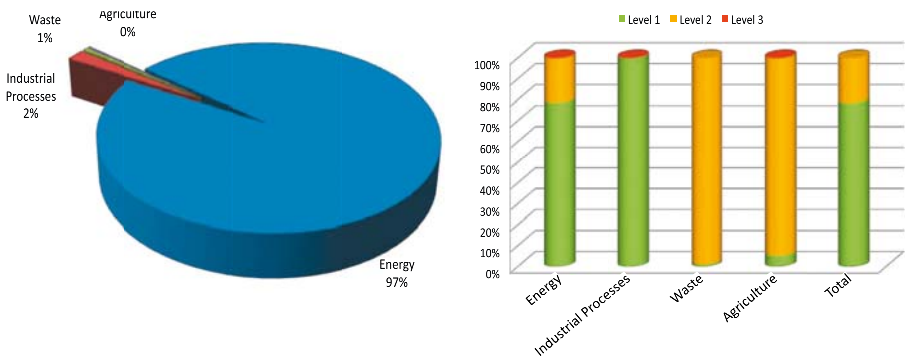
Brussels Chart 2: Left: Emissions from industrial processes (CO_2e).
Right: GRIP level used (CO_2e)



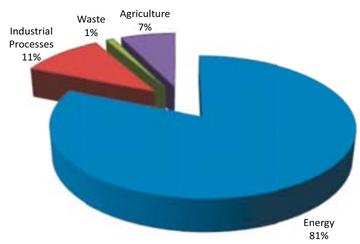
Brussels Chart 3: Left: Emissions from agriculture (CO_2e).
Right: GRIP level used (CO_2e)



Brussels Chart 4: Left: Emissions from waste (CO_2e).
Right: GRIP level used (CO_2e)



Brussels Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Brussels Chart 6: Total national emissions by sector (CO_2e)

THE EMISSIONS for the whole of the Brussels Region are displayed in Brussels Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions . These emissions represent the sum of the emissions presented on the previous two pages. The emissions for the Belgium are displayed in Brussels Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a substantially higher share of energy emissions to that displayed nationally and a lower share of agricultural and industrial process emissions. The emissions per-capita of the region are 7.5tCO_2e compared to 13.6tCO_2e in Belgium. This can be explained by the lower agricultural and industrial process emissions of the region compared to that displayed nationally and also by the lower per capita energy consumption in the region compared to that of wider Belgium. Regions with a similar per-capita emissions include Helsinki, Porto and Madrid. The emissions per-capita are below the average of the regions and are also below the European average. They are similar in size to the emissions per capita of Portugal and Swedem. Furthermore, the emissions are effected by the type of electricity generation in Belgium that is less carbon intensive then those of other countries and largely imported.

The table below displays the emissions for the whole of Brussels on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 96% of CO_2 emissions and 96% of CO_2e emissions. This is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next step of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Brussels Chart 5 above show that the energy sector is responsible for 97% emissions, Industrial Processes for 2%, Waste for 1% and Agriculture for less than 1% of emissions. This shows the clear need to focus on the energy system needed for Belgium to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Levels
Energy - Total	7252.24	2.25	0.13				7341.33	
Residential	3668.68	0.34	0.02				3682.00	
Services	1758.43	0.10	0.01				1763.75	
Industry	559.56	0.02	0.00				560.73	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	1116.57	0.11	0.10				1150.12	
Fugitive	149.00	1.69	0.00				184.72	
Industrial Processes	0.00	0.00	0.00	144.04	0.00	0.00	144.04	
Waste	0.49	0.79	0.08				43.34	
Agriculture		0.02	0.06				18.46	
Total	7252.73	3.06	0.28	144.04	0.00	0.00	7547.17	

Frankfurt/Rhein-Main

Dipl.-Ing. Reinhard Henke
Abteilung Regionale Kooperations- und Europaprojekte, Kommunalservice
Planungsverband Ballungsraum Frankfurt / Rhein-Main
Poststraße 16
60329 Frankfurt am Main

Planungsverband Ballungsraum Frankfurt/Rhein-Main

FRANKFURT RHEIN-MAIN is one of the 11 officially recognised metropolitan regions of Germany. For statistical purposes and European comparisons data for the Regierungsbezirk Südhessen (Darmstadt District, NUTS II DE71) are usually used. It lies in the southern portion of the Land Hessen with the kreisfreie Städte of Darmstadt, Frankfurt am Main, Offenbach am Main and Wiesbaden, together with 10 Landkreise. It is dominated by the northern and north-eastern portions of the upper Rhine trench and the adjoining hills of the Taunus, Odenwald and Spessart. The centre of the region is the Rhine-Main triangle that extends beyond the border of the Land to the south, east and west with the cities of Frankfurt and Offenbach am Main.

The Rhine-Main area is a major European transport hub. During peak periods, over 150 000 vehicles a day use the motorways around Frankfurt. Because of its central position in Germany and Europe, Frankfurt am Main is a major rail hub for both national and international services. Frankfurt's main railway station and, increasingly, the long-distance railway station at Frankfurt airport that began operating in 1999, are major rail hubs on the lines between Paris and Moscow, London and Budapest and Copenhagen and Rome. However, regional transport also plays an important role, with over 350 000 commuters travelling to Frankfurt's main railway station each day. Then there are the major waterways of the Rhine and the Main. Frankfurt airport is one of the largest in Europe. In and around this densely populated conurbation the Darmstadt district region also has a good deal of open countryside and extensive forests, e.g. in the Kreise of Rheingau-Taunus, Hochtaunus, Wetterau, Main-Kinzig, the Bergstraße and the Odenwald.

At the end of 2002, 3 761 700 people were living in the Darmstadt Regierungsbezirk - 6 percent more than in 1990. Almost a third of the population was living in the four kreisfreie Städte. At 505 inhabitants per square kilometre, the 2002 population density was well above the Land average (288), and the proportion of foreign nationals, at 14 percent, was also higher than for Hessen as a whole (13.6 percent).

Compared to the other two Regierungsbezirke, Darmstadt has relatively more people of employable age at 68 percent. Of these, 69 percent were actually in work. There are also well over 200 000 people from other parts of Hessen or other Länder working here. The Regierungsbezirk is one of Europe's most productive regions in economic terms. GDP per inhabitant is around 115 percent of that for Hessen as a whole, and in 2002 the adjusted unemployment rate was, at 5.6 percent, below that for Hessen (6.0 percent).

Multinationals have set up here alongside a wealth of SMEs and craft businesses. Pharmaceuticals from Höchst and Darmstadt enjoy a reputation that extends beyond the Land borders, as do cars from Rüsselsheim, leather goods from Offenbach, jewellery from Hanau and wines from the Rhinegau.

Innovative branches in the engineering (mechanical, electrical, environmental), biotechnology and computing industries are increasingly dominating the scene. The European Space Agency's European Operations Centre (ESOC) is also based in Darmstadt. However, it is the banking and services centre of Frankfurt that is the key to the economic strength of the region. Frankfurt is home not just to the European Central Bank and the Deutsche Bundesbank but also over 300 credit institutions and one of Europe's leading stock exchanges.

The conurbation also has its environmental problems - refuse, sewage, air pollution, traffic pollution and, last but by no means least, aircraft noise as a result of almost 460 000 take-offs and landings per year at Frankfurt airport. There is considerable demand for land for businesses, infrastructure and housing. The quality of the region's open space is increasingly acknowledged as an important locational factor.

The previous page contains an overview of the Frankfurt Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Frankfurt hosts major air and rail transport hubs and that the region contains both areas of countryside and of high population density. Frankfurt's economic income is made up of a mix of service sector and high-tech manufacturing industries.

The inventory for the Frankfurt Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Frankfurt Chart 1); secondly the emissions from industrial processes (Frankfurt Chart 2); thirdly the emissions from agriculture (Frankfurt Chart 3) and finally the emissions from waste (Frankfurt Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Germany.

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Frankfurt area in 2005 was 44400 kt CO_2e. Frankfurt Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Frankfurt the emissions from the residential sector accounted for 28% of energy emissions, the service sector made up 17% of CO_2e emissions, the industrial sector 27% and the transport sector 23%. The energy industry of Frankfurt represented 2% of emissions and finally fugitive emissions account for 3%. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Frankfurt Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to not used to estimate any of the residential sector, industrial sector, transport sector, energy industry or service sector emissions which instead rely on scaled down national data. Only the fugitive emissions were estimated using level 1 data. This means there is a large scope for improvement in future years, the data entered by the Frankfurt team is based on national data sets and has limited economic data on the sub sectors within the industry sector. Furthermore as Frankfurt hosts major rail and airport hubs, assuming national average emissions may lead to large uncertainty in the transport emissions reported here. By working with other agencies both in the region and nationally level 1 datasets may be obtained. By establishing such links and maintaining the demand for this data, future emissions inventories may be performed enabling reliable year-on-year energy based emissions to be compiled for the Frankfurt area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 4987 kt CO_2e. The breakdown is presented in Frankfurt Chart 2, and is comprised of 19% from mineral products, 28% from the chemical industry, 43% from metal production, 10% from the consumption of halocarbons and SF_6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Frankfurt has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were only used to estimate 100% consumption and production of halocarbons and SF_6

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has yet to be done in Frankfurt. This relationship can be built up to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

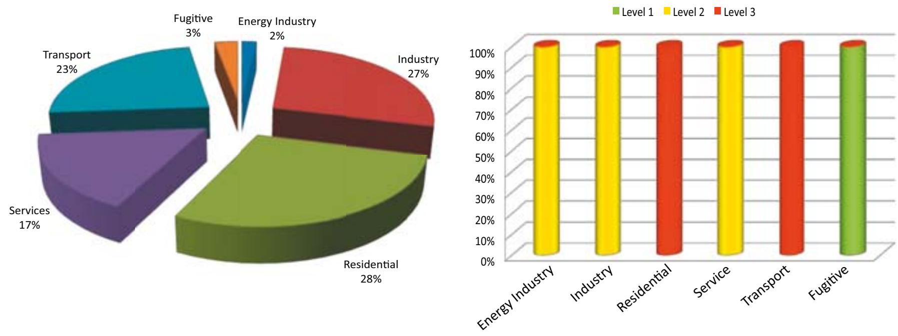
The inventory shows that 1614 kt CO_2e were emitted from the agricultural sector within the region in 2005. Frankfurt Chart 3 shows the total is made up of 43% from enteric fermentation, 11% from manure management and 47% from agricultural soils. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation and manure management, but 0% of the emissions from agricultural soils.

Waste

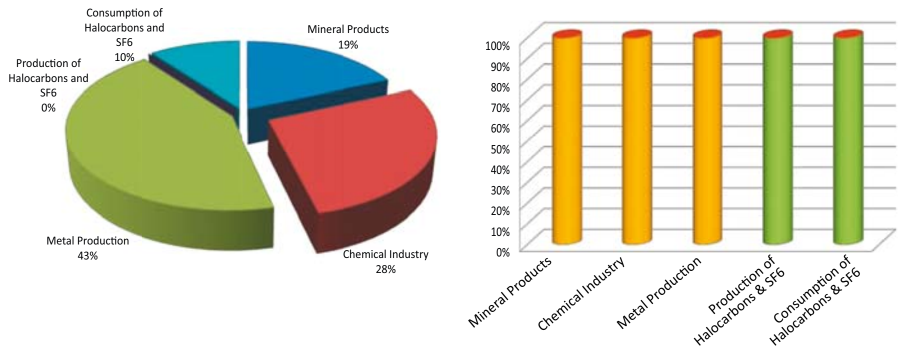
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 610 kt CO_2e were emitted from the waste sector in 2005. As shown in Frankfurt Chart 4 the total is made up of 77% from managed waste disposal, 19% from waste water and 4% from incineration.

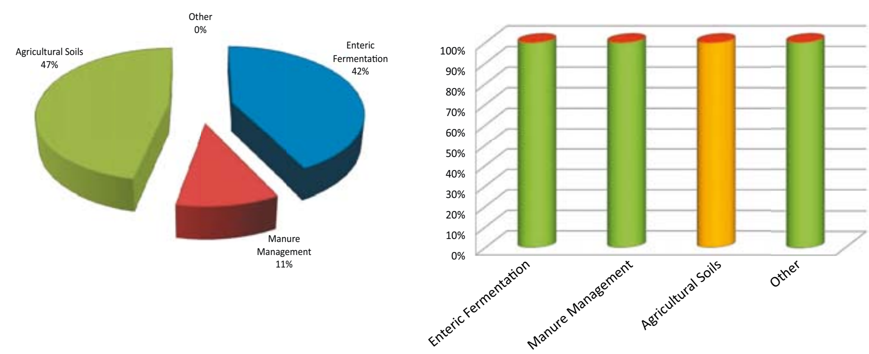
The reasons for these emissions are due to the Country's propensity to landfill its waste rather than to recycle or incinerate it, as this data has been based on national averages rather than locally collected data. The emissions have been estimated using level 3 methods for 100% of the emissions from managed waste disposal and incineration, and level 2 methods have been used to estimate waste water. With more locally collected information there is clear room for improvement in future inventories.



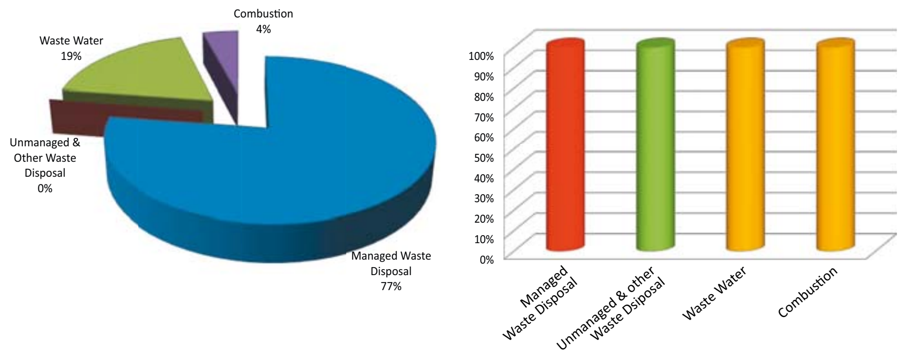
Frankfurt Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e).
Right: GRIP level used (CO_2e)



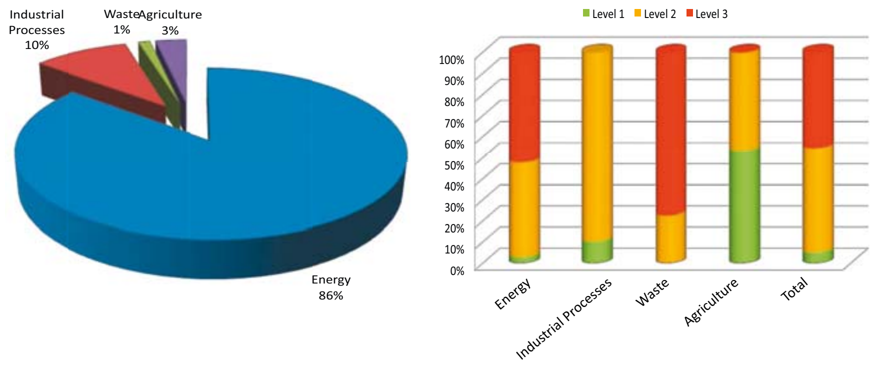
Frankfurt Chart 2: Left: Emissions from industrial processes (CO_2e).
Right: GRIP level used (CO_2e)



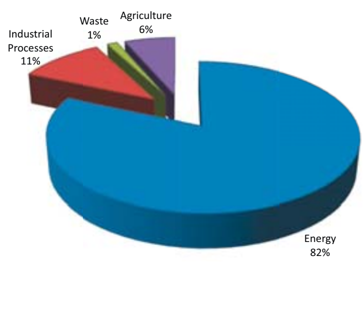
Frankfurt Chart 3: Left: Emissions from agriculture (CO_2e).
Right: GRIP level used (CO_2e)



Frankfurt Chart 4: Left: Emissions from waste (CO_2e).
Right: GRIP level used (CO_2e)



Frankfurt Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Frankfurt Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Frankfurt / Rhain Main Region are displayed in Frankfurt Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Germany are displayed in Frankfurt Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a slightly higher share of energy emissions to that displayed nationally and a lower share of agricultural emissions, industrial process and waste emissions are broadly in line. The emissions per-capita of the region are 13.7tCO_2e compared to 12.2tCO2e in Germany. This can be explained by the higher share of industry within Frankfurt to that displayed in wider Germany. This is because the majority of the emissions estimations have been performed using GRIP level 2 which largely aggregates emissions on the basis of economic activity. The two regions with a similar per-capita emissions are Stuttgart and Bologna. The emissions per-capita are above the average of the regions and are also above the European average. They are similar in size to the emissions per capita of Norway, Holland and Belgium. Although this needs to be considered in terms of the level of the methodology used, which in this case is largely level 2 and level 3 methods. Furthermore, the emissions are effected by the type of electricity generation in Germany that is more carbon intensive then those of other countries.

The table below displays the emissions for the whole of Frankfurt/ Rhain Main on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 92% of CO_2 emissions and 85% of CO_2e emissions. This is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next step of the EUCO2 project, and are explained in more detail at the end of this document.

The table below and Frankfurt Chart 5 above show that the energy sector is responsible for 86% emissions, Industrial Processes for 10%, Waste for 1% and Agriculture for 3% of emissions. This shows the clear need to focus on the energy system needed for Frankfurt to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	43900.81	6.64	1.16				44399.74	
Residential	12284.16	1.59	0.27				12402.49	
Services	7211.98	0.23	0.16				7267.33	
Industry	11892.61	0.37	0.37				12016.46	
Energy Industry	754.24	0.02	0.03				765.35	
Transport	10568.85	0.54	0.27				10664.52	
Fugitive	1188.97	3.89	0.04				1283.59	
Industrial Processes	3683.92	0.01	2.20	405.33	22.01	0.01	4986.93	
Waste	0.00	23.93	0.35				610.08	
Agriculture		40.80	2.44				1613.77	
Total	47584.73	71.38	6.15	405.33	22.01	0.01	51610.52	

Glasgow & the Clyde Valley

GLASGOW Region covers an area of 3,405 sq km - in Scotland, UK, and includes the City of Glasgow. It contains 0.79m households, just under half of which are located in the Glasgow City area. The population of the region in the year 2004 stood at 1.75m and it is one the most densely-populated regions in Scotland.

The Gross Domestic Product (GDP) of the region in 2004 was valued at £29.3Bn. This relatively low level of economic activity equated to GDP per capita of £16,791, below the UK average of £17,344.

The level of economic activity of Glasgow and the Clyde Valley (GCV) is heavily dominated by the Glasgow City area. The economy within Glasgow has changed greatly over recent years, from one that was dominated by ship building and imports to one that is dominated by the service industry. Elsewhere within the region there continues to be a contingent of heavy and polluting activity. The region also contains a large amount of coal mining. In 2004, the region accounted for 32% of Scotland's manufacturing output.

The region has an agricultural industry holding approximately 2% of the UK's animal population in 2004. The impact of events such as BSE and Foot and Mouth have led to changing farming practices in recent years, and these changes have had a subsequent effect on releases of methane (CH_4) and nitrous oxide (N_2O) from the agricultural sector.

The region has one airport, Glasgow International. It is the largest and busiest airport in Scotland, handling 8.5m passengers in 2004. Glasgow Prestwick Airport despite its name is located just outside the region it is much smaller than the international, but handles 2.2m passengers. It has experienced enormous expansion (from 0.7m passengers in 1999) and is expected to increase further with the activity of budget airlines.

The main railway line departing from the region is electrified, which presents less direct emissions than a non-electrified route. Despite the line being electrified, a small number of diesel trains continue to use the routes. On a smaller scale, there is the Glasgow City underground system. The road network joins up areas of habitation in the region. In 2004, approximately 593,500 cars were registered in the region.

Emissions from Glasgow

The energy sector, including transport and fugitive emissions, accounts for 99.9% of regional CO_2 emissions (12,827kt CO_2), with $CH_4$and N_2O emissions adding an additional 937kt CO2Eqv, making a total of 13,772kt CO2Eqv for the year 2004.

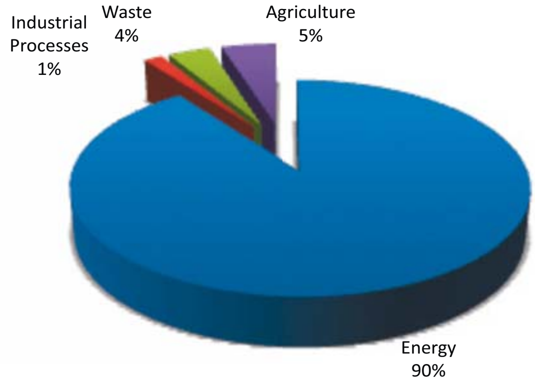
The Chart below shows the breakdown of GCV GHG emissions, from the energy sector in the year 2004.

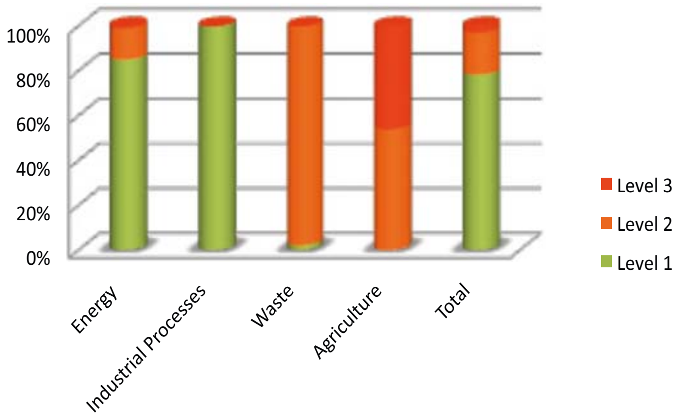
Households in the Glasgow region consume a slightly higher than average amount of energy due, possibly, to the weather and the level of insulation in homes among other factors. Domestic emissions per household are 5.93t CO_2, and per person are 2.67t CO_2.

Additional emissions reported within the energy sector include 1,346kt CO_2Eqv from the energy consumed by the commercial, public administration and agricultural sectors and 2,542 kt$CO_2$from the GCV region's industrial sector. Total Fugitive emissions from other energy sources in the GCV region for 2004 were estimated to be 1,210kt CO_2Eqv.

These figurative sources include Methane released from the gas distribution network, electricity losses from the grid and Methane leakage from coal mining.

The inventory shows that within the transport sector, road transport accounts for the largest proportion of emissions in the GCV with 3,395kt CO_2in 2004 cars. The GCV emissions

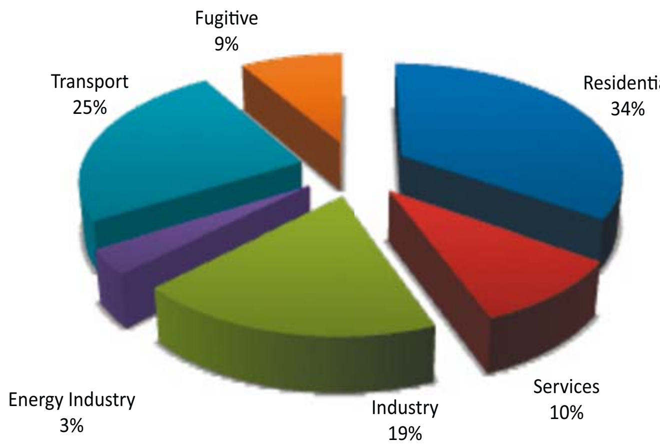




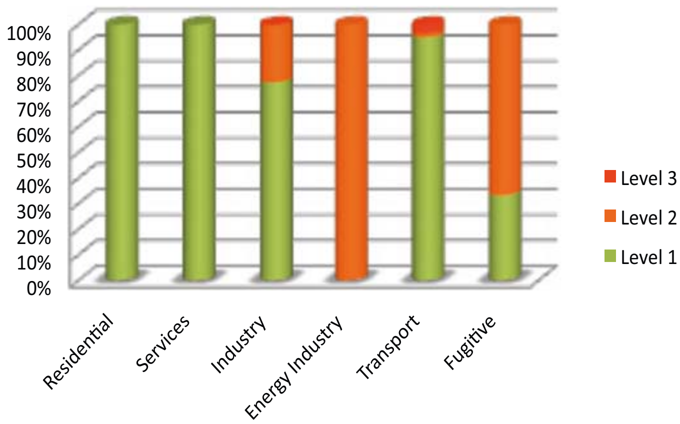
Overview of greenhouse gas emissions for Glasgow region, showing percentage emissions, above left, and GRIP levels, above right.

from transport sources accounted for 2.7% of total road transport emissions within the UK. This is higher then its population would indicate. Waste disposal in GCV emitted 559 ktCO_2Eqv and emissions from agriculture were estimated at 721 kt CO_2Eqv. There are no industries in the GVC regions which emit 'process emissions'.

Overall the emissions for the GCV region are estimated at 8.8 tCO_2Eqv per person, and 0.36 ktCO_2Eqv per unit of GVA.



Greenhouse gas emissions for Glasgow region from energy, broken down by sector; showing percentage emissions, above, and GRIP levels, below.



Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy	12825.00	40.50	0.31				13771.60	
Residential	4668.00	1.53	0.11				4734.23	
Services	1330.00	0.18	0.04				1346.18	
Industry	2542.00	0.26	0.11				2581.56	
Energy Industry	486.00	0.06	0.02				493.46	
Transport	3395.00	0.07	0.03				3405.77	
Fugitive	404.00	38.40	0.00				1210.40	
Industrial Processes	0.00	0.00	0.00	242.86	2.65	0.00	245.51	
Waste	12.53	24.10	0.13				558.93	
Agriculture		14.24	1.36				720.64	
Total	12837.53	78.84	1.80	242.86	2.65	0.00	15296.68	

Hamburg MR

Rainer Scheppelmann
Behörde für Stadtentwicklung und Umwelt
Leitstelle Klimaschutz
Stadthausbrücke 8
20355 Hamburg
Tel.: 0049 40 42840 2536

HAMBURG is Germany's second largest city, as well as a "Land" (State) of the Federal Republic. It is situated on the North German Plain, at the head of the Elbe estuary, around 100 km from the river's North Sea mouth. With 1.75 million inhabitants, Hamburg is number 10 among the european metropolises, covering an area of 755 km2.

The Hamburg Metropolitan Region, with its 4.3 million inhabitants, encompasses 14 districts of the neighbouring Federal States Schleswig-Holstein and Lower Saxony (Niedersachsen) and covers an area of 19.802 km2. The region has a maritime climate with mild winters and an annual average air temperature of 9.3 °C. Its GDP per capita is 32,440 €, per household 64,000 €.

Trading and transport services have a long tradition in Hamburg, reflecting the more than 800-year history of it's port, which today is the second largest in Europe. These activities have been complemented in more recent times by the growth of business services. The German unification gave back the natural „Hinterland" to Hamburg and boosted its function as a regional capital. The Hamburg Metropolitan Region has a legacy as Northern Europe's main transhipment centre for goods of all kinds, as key gateway for the overseas trade of the Baltic states and as a logistics hub for Eastern Europe.

The Hamburg Metropolitan Region is the world's third largest aviation industry centre, with 20,000 employees and 400 subcontracting firms in the surrounding districts. South of the river Elbe you find Europe's largest cohesive industrial area, with refineries, metal works and petrochemical works and the second largest copper plant in Europe – in direct neighbourship to Europe's biggest fruit-growing area. Agriculture is the dominating activity in most of the peripheral districts of the Hamburg Metropolitan Region, but in subcentres like Stade, Lüneburg and Elmshorn, small and middle sized logistics and technology enterprises contribute to the welfare of the region.

The Hamburg Metropolitan Region is home to large publishing houses of tradition, creative advertising, game producers, a stronghold of the movie industry and centre of high-quality televised information and entertainment, making it one of Europe's leading media centres with more than 100,000 people working in this sector. An additional strength of the regional economy is medical and mechanical engineering. The region is also an important location for the renewable energy industry, both in headquarters and in installations.

The region's public transport is one of the closest-knit in the world, with an integrated ticket system for the whole Hamburg Metropolitan Region. In the city itself, 98% of the population live closer than 300 meters to the next public transport station.

Hamburg is a city endowed with many green spaces and parks, even in the densely populated inner-city districts. Air pollution has been reduced by 50 percent, mainly by means of emissions-reducing upgrades of power stations and industrial combustion plants as well as the expansion of the district heating system that now services 45% of the households. Cleaner air has also improved the health of the city's trees, which number an estimated 2 million.

The previous page contains an overview of the Hamburg Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Hamburg has a large industrial area including energy production industries, a large agricultural area and benefits from mild winters, all of which can influence the emissions from the area. The energy that it consumes is mostly liquid and gas fossil fuels.

The inventory for the Hamburg Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Hamburg Chart 1); secondly the emissions from industrial processes (Hamburg Chart 2); thirdly the emissions from agriculture (Hamburg Chart 3) and finally the emissions from waste (Hamburg Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Germany.

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Hamburg area in 2005 was 33959 kt CO_2e. Hamburg Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Hamburg the emissions from the residential sector accounted for 18% of energy emissions, the service sector made up 20% of CO_2e emissions, the industrial sector 19% and the transport sector 33%. The energy industry of Hamburg represented 5% of emissions and finally fugitive emissions account for 5%. This mix reflects the economic activity of the region and the transport infrastructure of the region. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Hamburg Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the residential sector, industrial sector, transport sector, energy industry and fugitive emissions and 90% of service sector emissions. This means that nearly all the data entered by the team in Hamburg was sourced from local measured data sets. This will enable year-on-year energy based emissions to be compiled for the Hamburg area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 2 817 kt CO_2e. The breakdown is presented in Hamburg Chart 2, and is comprised of 14% from the chemical industry, 66% from metal production and 20% from the consumption of halocarbons and SF_6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Hamburg has a large metal production industry that is responsible for emissions. In terms of this sector, level 2 methods were used to estimate 100% of the emissions from the chemical industry and metal production and level 1 methods were used for 100% of the emissions from the consumption of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This is yet to be done here. This relationship can be built to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

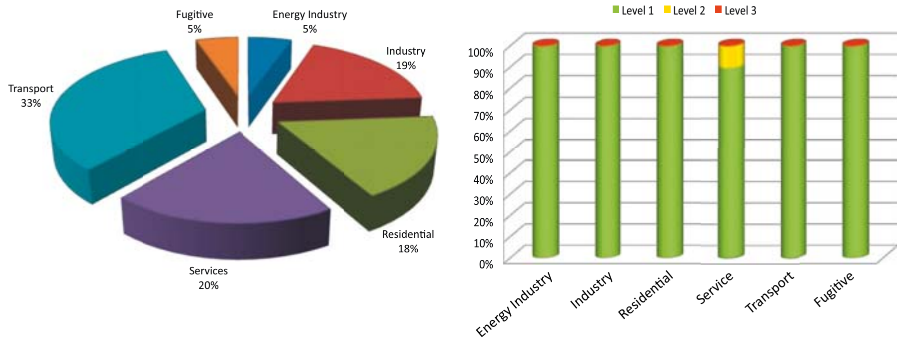
The inventory shows that 4 463 kt CO_2e were emitted from the agricultural sector within the region in 2005. Hamburg Chart 3 shows the total is made up of 34% from enteric fermentation, 10% from manure management and 56% from agricultural soils – reflecting the large fruit growing areas in the region. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation, manure management and other sources, level 2 methods were used to estimate the emissions from agricultural soils.

Waste

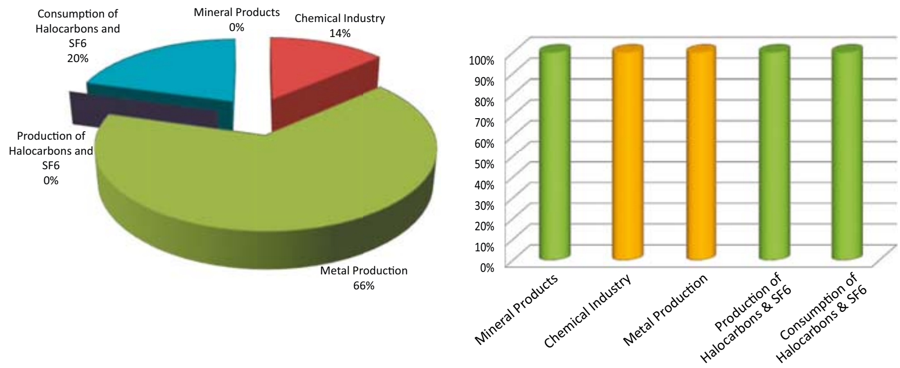
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 284 kt CO_2e were emitted from the waste sector in 2005. As shown in Hamburg Chart 4 the total is made up of 55% from managed waste disposal and 45% from waste water.

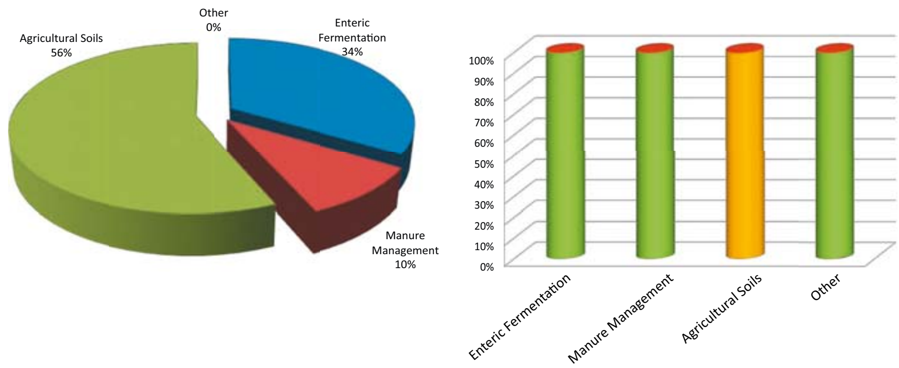
These emissions are low overall, and this is due to the region's propensity to burn its waste for electricity production (those emissions are considered under energy). Furthermore, the region has relatively higher recycling rates which reduce its emissions from the waste sector. The remaining emissions are due to the remaining waste that is landfilled. The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal and waste water.



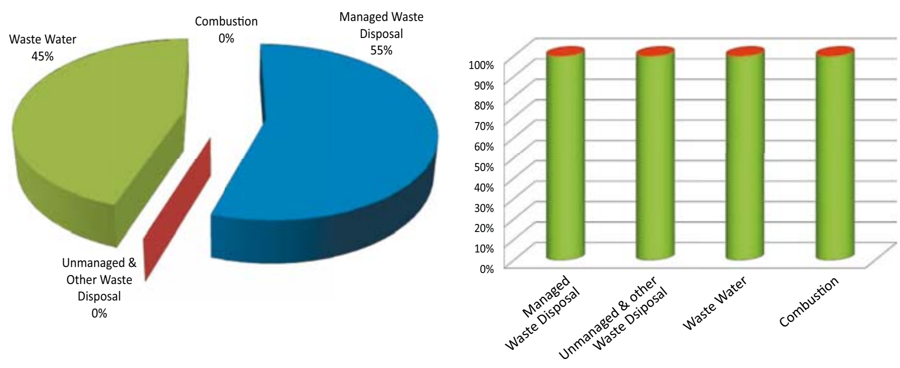
Hamburg Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



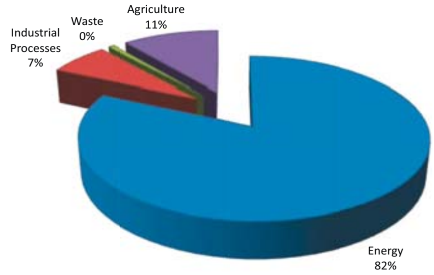
Hamburg Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)

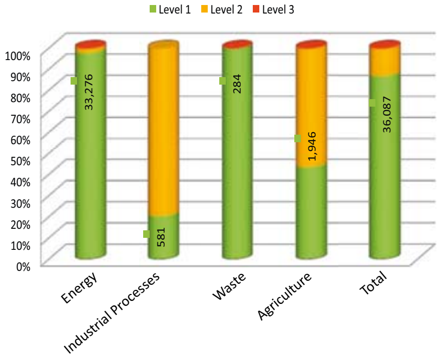


Hamburg Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)

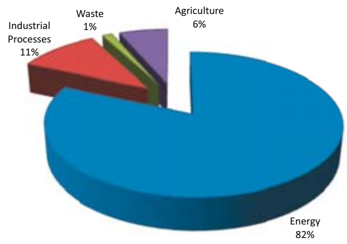


Hamburg Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)





Hamburg Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Hamburg Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Hamburg Metropolitan Region are displayed in Hamburg Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Germany are displayed in Hamburg Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has the same share of energy emissions to that displayed nationally, a lower share of Industrial process and waste emissions and a higher share of Agricultural emissions. The emissions per-capita of the region are 9.75tCO_2e compared to 12.2t$CO_2$2e in Germany. This can be explained by the nature of the economy within Hamburg to that displayed in wider Germany. Regions with a similar per-capita emissions include Turin, Veneto and Ljubljana. The emissions per-capita are above the average of the regions and are also above the European average. They are similar in size to the emissions per capita of Italy, France, Spain and Portugal. The data has been largely compiled using measured data and is therefore dependent on those datasets. Furthermore, the emissions are effected by the type of electricity generation in Germany that is more carbon intensive then those of other countries.

The table below displays the emissions for the whole of Hamburg Metropolitan Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 94% of CO_2 emissions and 79% of CO_2e emissions. Whilst this is a lower share than other regions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next step of the EUCO$_2$ project, and are explained in more detail at the end of this document.

The table below and Hamburg Chart 5 above show that the energy sector is responsible for 82% emissions, Industrial Processes for 7%, Waste for less than 1% and Agriculture for 11% of emissions. This shows the clear need to focus on the energy system needed for Hamburg to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	32911.63	36.28	0.92				33959.64	
Residential	6034.42	0.11	0.15				6082.51	
Services	6604.32	0.33	0.15				6656.90	
Industry	6211.07	0.16	0.19				6272.84	
Energy Industry	1805.70	0.03	0.03				1816.44	
Transport	11236.45	0.38	0.37				11359.55	
Fugitive	1019.66	35.27	0.04				1771.40	
Industrial Processes	2218.70	0.00	0.01	456.99	21.09	0.00	2816.59	
Waste	0.00	7.76	0.39				284.16	
Agriculture		92.64	8.12				4462.95	
Total	35130.32	136.69	9.44	456.99	21.09	0.00	41523.34	

Helsinki

Helsinki Metropolitan Area Council (YTV)
Regional and Environmental Information
Johannes Lounasheimo
Tel. +358 400 100 601, fax. +358 9 1561 334
johannes.lounasheimo@ytv.fi

Helsinki Metropolitan Area is located in the southern part of Finland on the coast of the Baltic Sea. The region covers 766 square kilometres, which represents 0.2 percent of Finland's total area. The population density is the highest in the country and, with 1330 inhabitants per square kilometre, is almost eighty times higher than the country's average. The moderate weather of Helsinki is influenced by both maritime and continental climate patterns. The annual mean temperature has been varying between 6 and 7 degrees in the past years, being around 5 °C in the 1950s.

The area comprises of Helsinki, the capital of the country, along with its neighbouring cities Espoo, Vantaa and Kauniainen. It had 988 500 inhabitants in December 2005 with an average annual growth rate of just under one per cent in the 21st century. Total increase in population by 2005 compared to 1990 has been 166 000. Demographically typical feature is high percentage of working population between 20 and 40 years of age, which makes the age distribution appear younger than in the rest of Finland.

Helsinki was founded in 1550 by the king Gustav I of Sweden. For a long time it remained a small coastal town but began to develop into a major city in the 19th century. Since then, traffic connections have been greatly extended, turning the region into a "Gateway to East". The railway from Helsinki to St. Petersburg was completed already in 1870.

Helsinki Metropolitan Area is the largest urbanized area in Finland and the centre for economy, culture and science. It has eight of Finland's twenty universities, the majority of the corporate headquarters and an international airport and harbours. The unemployment rate was 8.1 per cent in 2005 whereas the national figure was 11.1. The region is also richest in Finland in terms of Gross Domestic Product. In 2005 GDP per capita was roughly 40 000 euros compared to 30 000 for the whole of Finland.

In the cities of Helsinki, Espoo, Vantaa and Kauniainen agriculture is practically non-existent. The share of service sector in the gross value added is on the other hand almost 80 per cent. Industry corresponds to the rest, majority of which is from electronics. The most prominent businesses in the region include wholesale trade, finance and insurance services, and information-intensive business services.

The number of cars registered is somewhat lower (0.4 per citizen) than in the rest of the country (0.5). There is an integrated public transportation system with commuter trains, trams, buses and the underground. Pedestrian zones in the city centres are however fairly small and car traffic has been on the increase. The situation with cycling has improved greatly over the last decade. There are more than 2 500 kilometres of bicycle lanes in the Helsinki Metropolitan Area.

The number of households in the region was 512 000 in 2005. The average living area per capita was 34 m2. Approximately half of the houses are owner-occupied and half are rented. Almost eighty per cent are heated by district heating. A few large CHP power plants produce electricity and heat using natural gas and lignite as main fuels.

The previous page contains an overview of the Helsinki Metropolitan Region. This background offers a useful insight into the nature and type of emissions that we expect to see in the region. The overview tells us that Helsinki has a comparatively higher amount of people working in the service sector than that displayed nationally. The energy that it consumes is mostly fossil based, although it is used in a more efficient manner. As a consequence, despite their relatively low annual average temperatures, their emissions are lower then other regions.

We present the inventory for the Helsinki Metropolitan Region below. This is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Helsinki Chart 1); secondly the emissions from industrial processes (Helsinki Chart 2); thirdly the emissions from agriculture (Helsinki Chart 3) and finally in terms of the emissions from waste (Helsinki Chart 4). We then present total GhG emissions from the region and the breakdown of emissions from the whole of Finland (Helsinki Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The total emissions from the energy sector in Helsinki Metropolitan area in 2005 was 6,703 kt CO_2e. Helsinki Chart 1, on the opposite page presents the breakdown of the source of the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that the emissions from the residential sector made up 37% of CO_2e emissions, the service sector 32%, the industrial sector 9% and the transport sector 22%. There are no petroleum refineries or solid fuel transformation plants in the region and therefore there are no emissions from these sources. Finally, fugitive emissions account for 0.04% total energy emissions. This mix can be explained due to the high economic share of the service sector in the region compared to that displayed nationally, the somewhat higher population density of the region, the established transport links and a high amount of both CHP and heat networks in the region – which are more efficient and result in lower losses (fugitive emissions). Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Helsinki Chart 1 shows the GRIP levels used to estimate the emissions from each sub-sector as a percentage of those emissions estimated. This insert shows that level 1 methods were used to estimate 100% of the emissions from the domestic sector, 100% of the service sector, 100% of the industrial sector, 100% of the transport sector, 100% of the energy industry and 100% of the fugitive emissions. This means that all the data entered by the team in Helsinki was taken from local measured data sets and therefore that the inventory has been produced using the highest quality level available data. This shows a clear potential for additional emissions inventories to be compiled for years prior to 2005. Furthermore, by maintaining the demand for this data, future emissions inventories may be performed enabling reliable year-on-year energy based emissions to be compiled for the Helsinki area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of certain products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 168 kt CO_2e. This is presented in Helsinki chart 2, and is comprised entirely of the consumption of halocarbons and SF_6. The data reflects the fact that Helsinki does not have any other types of industrial sites responsible for other emissions. In terms of this sector, level 1 methods using local data were used to estimate 100% of mineral products emissions, 100% of chemical industry emissions, 100% of metal production emissions, 100% of production of halocarbons and SF6 and 100% of the emissions from the consumption of halocarbons and SF6. The emissions here are less reliable if they have not been estimated using level 1 approaches. In Helsinki's case links have been made with local regulatory bodies and industry and have established that no sites of the type relevant to this sector are in existence.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farm yard animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

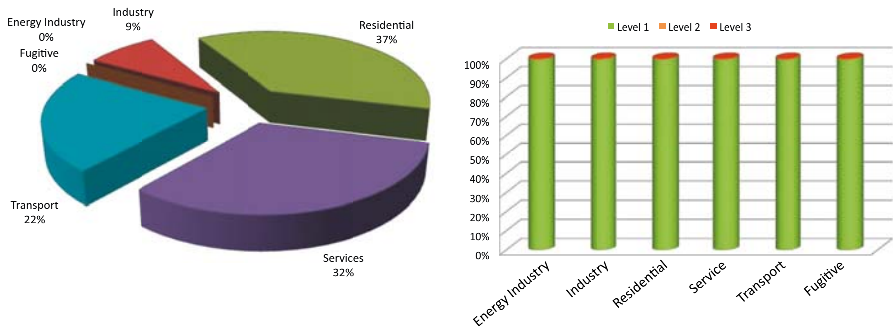
The inventory, illustrated in Helsinki Chart 3 shows that 28 kt CO_2e were emitted from the agricultural sector within the region in 2005. This total is comprised of 2% from enteric fermentation, 0% from manure management, 98% from agricultural soils and, 0% from other sources. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation, 100% from manure management, 0% from agricultural soils and, 100% of the emissions from other sources.

Waste

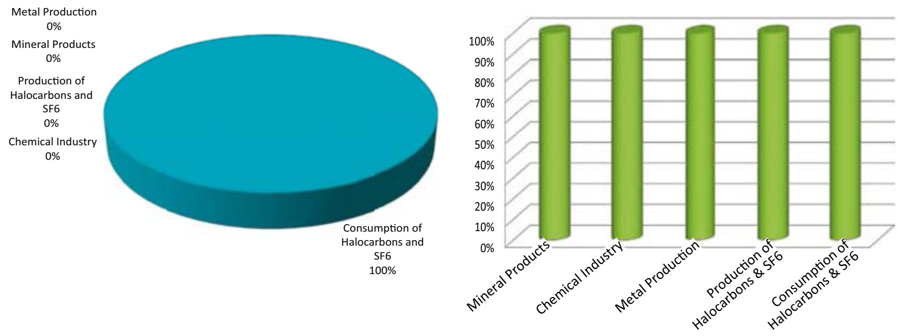
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and the amount of waste which is incinerated. The size of emissions reflect the volume of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

Helsinki Chart 4 shows that 42 kt CO_2e were emitted from the waste sector in 2005. In the case of the region this was comprised of 55% from managed waste disposal, 0% from unmanaged waste disposal, 18% from waste water and 27% from other sources, which in this case are from compost.

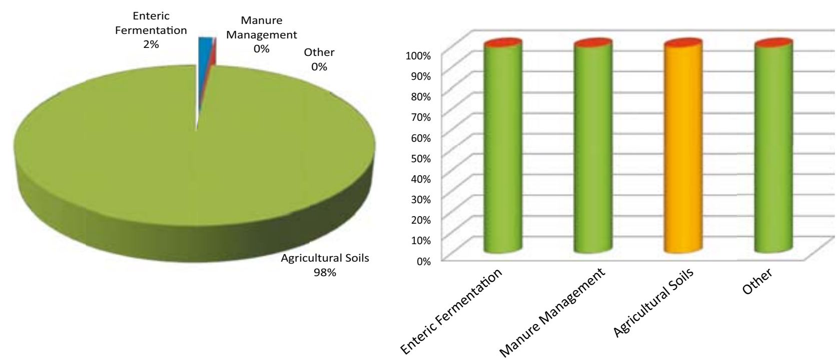
The emissions have been estimated using level 1 methods in 100% from managed waste disposal, 100% unmanaged waste disposal, 100% waste water and 100% incineration. This provides us with a high degree of confidence in the emissions estimations for this sector in the region.



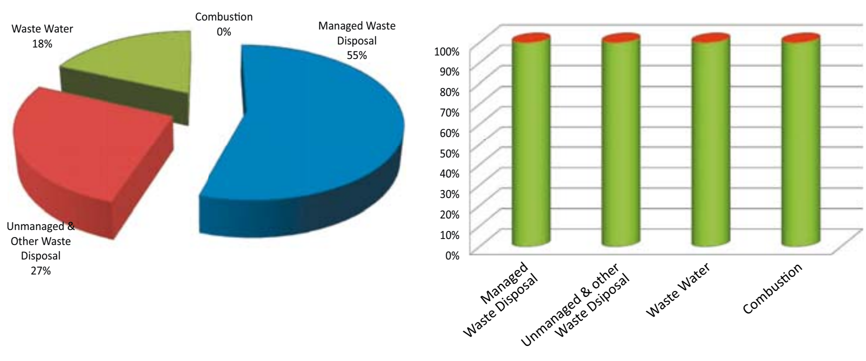
Helsinki Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



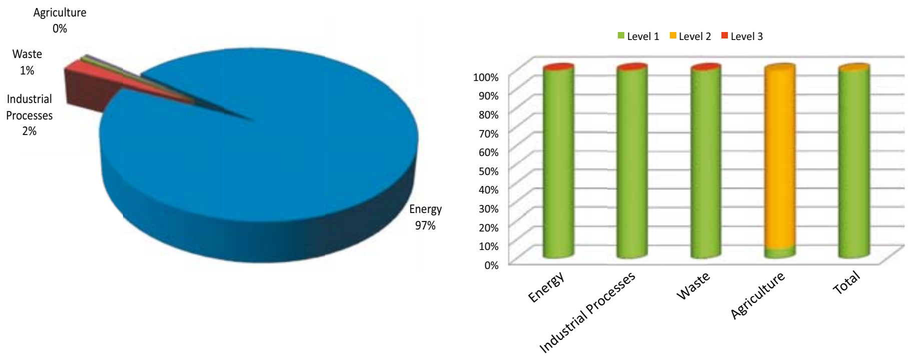
Helsinki Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



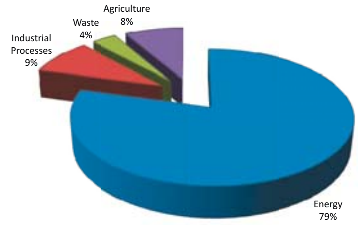
Helsinki Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Helsinki Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Helsinki Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Helsinki Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Helsinki Region are displayed in Helsinki Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Finland are displayed in Helsinki Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of energy emissions to that displayed nationally, a lower share of Industrial process and Agricultural emissions and a similar share of Waste emissions. The emissions per-capita of the region are 7tCO_2e compared to 13.1tCO_2e in Finland. This can be explained by the type of fuel combusted in Helsinki, its Transport system and its service sector base. Regions with a similar per-capita emissions include Porto, Madrid and Brussels. The emissions per-capita are below the average of the regions and are also below the European average. They are similar in size to the emissions per capita of Sweden. The data has been largely compiled using measured data and is therefore dependent on those datasets. Furthermore, the emissions are effected by the type of electricity generation in Finland that is less carbon intensive than those of other countries.

The table below displays the emissions for the whole of Helsinki Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 100% of CO_2 emissions and 95% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next step of the EUCO$_2$ project, and are explained in more detail at the end of this document.

The table below and Helsinki Chart 5 above show that the energy sector is responsible for 97% emissions, Industrial Processes for 2%, Waste for 1% and Agriculture under 1% of emissions. This shows the clear need to focus on the energy system needed for Helsinki to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	6594.38	0.59	0.31				6703.56	
Residential	2476.29	0.29	0.05				2498.17	
Services	2146.22	0.08	0.04				2161.18	
Industry	558.14	0.02	0.01				562.08	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	1411.17	0.19	0.21				1479.29	
Fugitive	2.55	0.01	0.00				2.83	
Industrial Processes	0.00	0.00	0.00	162.45	1.86	0.00	168.35	
Waste	0.00	1.78	0.01				41.72	
Agriculture		0.02	0.09				27.31	
Total	6594.38	2.39	0.41	162.45	1.86	0.00	6940.94	

Comunidad de Madrid

Alberto Leboreiro Amaro
Subdirector General de Planificación Regional
Dirección General de Urbanismo y Estrategia Territorial
Consejería de Medio Ambiente, Vivienda y Ordenación del Territorio
COMUNIDAD DE MADRID
Cl/ Maudes 17 - 28003 Madrid (Spain)

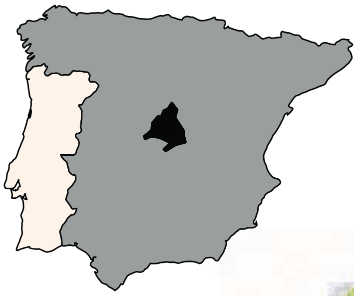
CONSEJERÍA DE MEDIO AMBIENTE, VIVIENDA Y ORDENACIÓN DEL TERRITORIO
Comunidad de Madrid

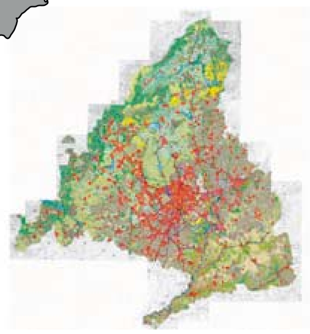
THE Community (Region) of Madrid is a single province of 8.028 square kilometres and includes the capital of the country. It has three distinct areas: the metropolitan area, which crosses nearly the whole region from northeast to southwest, including heavily dense industrial areas, residential areas and also a large number of commercial spots; the Sierra (mountains) in the north, a highly protected natural area; and the Campiña, a basically agricultural area, in the south. 84% of the land lies at an altitude of over 600 metres, giving rise to a dry, continental climate with major variations in seasonal temperatures. Nowadays we can speak about a larger connection of the metropolitan area with the surrounding regions, Guadalajara and Toledo of Castilla la Mancha, and Segovia of Castilla Leon.

The average annual population growth is mainly due to the natural increase, combined with an increasing net migration. The drop in the fertility rate, which is now amongst the lowest in the EU, and the unknown illegal immigration, meant small rises in numbers and the relative ageing of the population in the beginning of the 1990's. So we reached the lowest increase rate in the middle of the 90's. Since 2004, when the immigration was legalised, the total population increased significantly. In 2006, 13,22% of the resident had a foreign nationality. In the medium term, there will be a geographical redistribution of the population rather than any significant increases.

If we take a look to the demographic structure we observe also a progressive increase of the ageing, as in most European countries.

The pressure on today's labour market, a consequence of the 'baby boom' of the 1960s, will be reduced; in fact, there is already a spectacular decline in the numbers of children of pre-school age. This phenomenon was compensated, as mentioned, through the incorporation of the immigrants as cheap handworker, attracted by the economical boom special due to the explosive increase of the building sector.





The Madrid Region

Another indicator is density. 93% of the region's population is concentrated on only 24% of its surface area. This fact, which is common to all the capital regions in Europe, is particularly striking in Madrid, where the fall-off in population density is very pronounced.

The Madrid region is also attractive as the administrative centre of Spain, even if decentralisation, the consequence of the new autonomic state structure, allows a progressive dispersal of functions. The imbalances affect the sitting of businesses in relation to residential areas, which leads to a great deal of commuting. The specialization in the services sector of the so-called 'central core' has led to 45% of all jobs being concentrated in this area, the figure rising to 75% for financial services and 60% for public administration. So we can note that the GDP per inhabitant is the highest in Spain.

The previous page contains an overview of the Madrid Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Madrid has a far higher proportion of people employed in both the service sector and public sectors than the wider Spanish average, and is densely populated. The energy that it consumes is mostly fossil based.

We present the inventory for the Madrid Region below. This is displayed by sector: firstly we present the emissions from the combustion, distribution, transformation and extraction of energy (Madrid Chart 1); secondly the emissions from industrial processes (Madrid Chart 2); thirdly the emissions from agriculture (Madrid Chart 3) and finally in terms of the emissions from waste (Madrid Chart 4). We then present total GhG emissions from the region and also the breakdown of national emissions (Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Madrid area in 2005 was 36245 kt CO_2e. Madrid Chart 1, on the opposite page presents the emissions associated with energy from the region from different sectors. It shows that in Madrid the emissions from the residential sector accounted for 24% of energy emissions, the service sector made up 19% of CO_2e emissions, the industrial sector 24% and the transport sector 28%. The energy industry comprised 0%, as there are no petroleum refineries or solid fuel transformation plant etc in the region. Finally, fugitive emissions account for 5% of energy sector emissions. This mix may be explained due to the high population density in the Madrid Region. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Madrid Chart 1 shows the GRIP levels used for each sub-sector as a percentage of the emissions from that sub-sector. This insert shows that level 1 methods were used to estimate 100% of the emissions in the residential sector, 100% of the service sector, 64% of the industrial sector, 100% of the transport sector, 100% of the energy industry and, 100% of the fugitive emissions. This means that a large part of the data entered by the team in Madrid was sourced from locally measured data sets. There is potential for improvement in future emissions inventories from the service and industry sectors. By establishing and maintaining the demand for this data future emissions inventories like this one will be made possible. This will encourage organizations that hold it to collate and provide it. This will enable year-on-year energy based emissions to be compiled for the Madrid area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 2 228 kt CO_2e. This is presented in Madrid Chart 2, and is comprised of 65% from mineral products, 7% metal production and 28% consumption of halocarbons and SF6. This sector is usually a reflection of the nature and extent of the industry within the region, there is no chemical industry or producers of halogens or SF_6 in the area. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from mineral products, 83% of metal production and 100% of the emissions from the consumption of halocarbons and SF_6.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

The inventory shows that 358 CO_2e were emitted from the agricultural sector within the region in 2005. Madrid Chart 3 shows that this is comprised of 35% from enteric fermentation, 7% from manure management and 58% from agricultural soils.

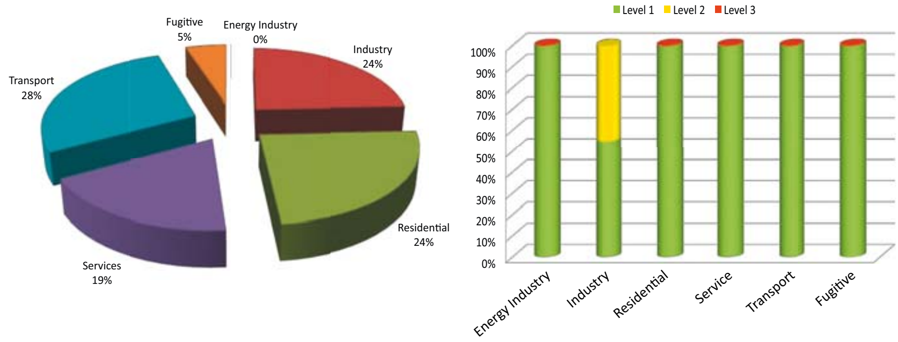
These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation and manure management and 0% of agricultural soil emissions.

Waste

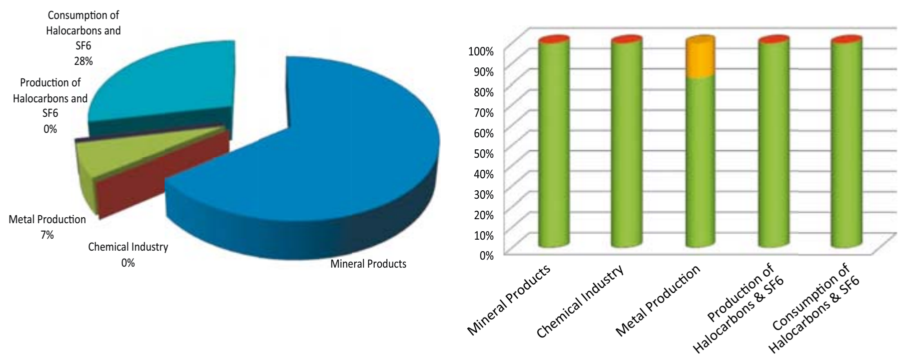
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount of waste that is recycled and the amount of waste that is incinerated without the production of electricity.

The inventory shows that 2 147 kt CO_2e were emitted from the waste sector in 2005. Madrid Chart 4 shows the total is comprised of 73% from managed waste disposal, 23% waste water and 4% from incineration.

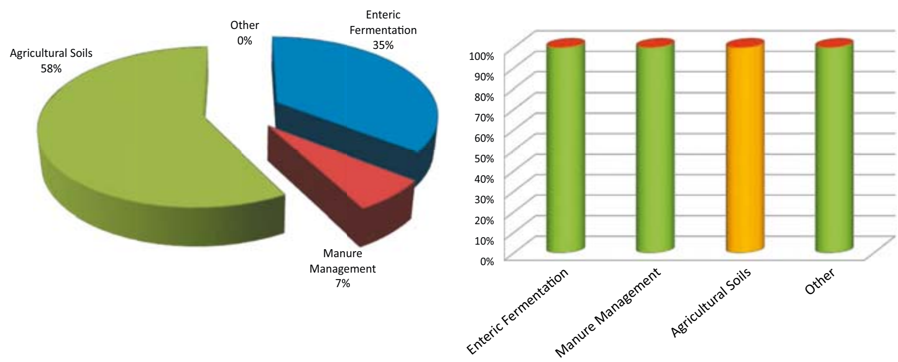
The reasons for these emissions are due to the regions propensity to landfill its waste rather than to recycle or incinerate it. The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal, 100% of waste water and 100% of emissions from incineration.



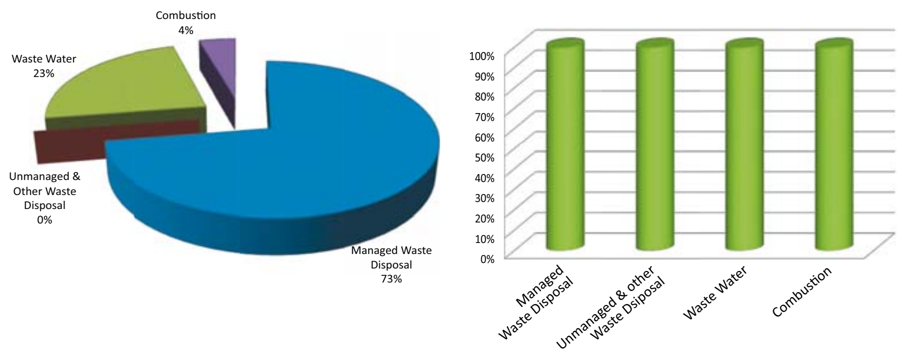
Madrid Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



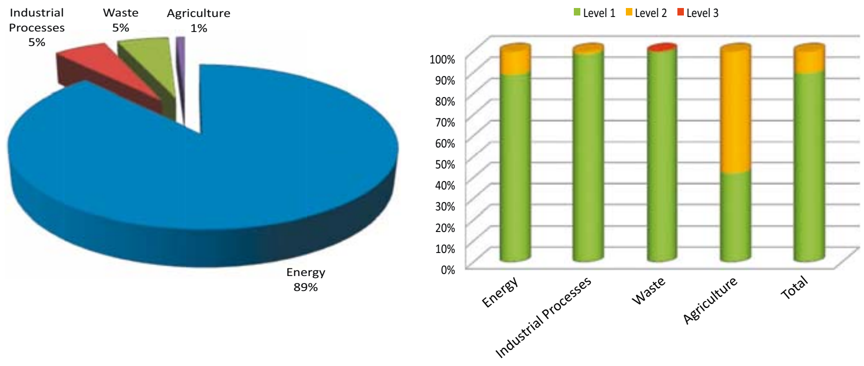
Madrid Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



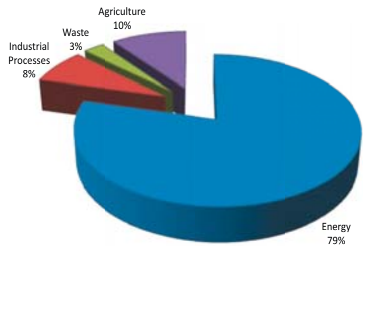
Madrid Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Madrid Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Madrid Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Madrid Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Madrid Region are displayed in Madrid Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Spain are displayed in Madrid Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of energy and waste emissions to that displayed nationally, a lower share of Industrial process and Agricultural emissions. The emissions per-capita of the region are 6.9tCO_2e compared to 10tCO_2e in Spain. This difference can be explained by the relatively higher share of the service sector within the region to that nationally. Regions with a similar per-capita emissions include Helsinki and Brussels. The emissions per-capita are below the average of the regions and are also below the European average. They are similar in size to the emissions per capita of Sweden. The data has been largely compiled using measured data sets and are therefore reliant on the accuracy of those data sets. The carbon intensity of electricity generation is also lower in Spain to that of other countries.

The table below displays the emissions for the whole of the Madrid Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 96% of CO_2 emissions and 87% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next step of the EUCO$_2$ project, and are explained in more detail at the end of this document.

The table below and Madrid Chart 5 above show that the energy sector is responsible for 89% emissions, Industrial Processes for 5%, Waste for 5% and Agriculture 1% of emissions. This shows the clear need to focus on the energy system needed for Madrid to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	35736.71	3.99	1.37				36245.28	
Residential	8706.53	0.52	0.16				8766.46	
Services	6605.24	0.27	0.13				6651.16	
Industry	8727.26	0.41	0.19				8794.23	
Energy Industry	45.11	0.00	0.00				45.39	
Transport	9898.18	0.87	0.86				10183.08	
Fugitive	1754.39	1.93	0.03				1804.96	
Industrial Processes	1580.76	0.76	0.00	584.83	13.69	0.00	2227.55	
Waste	0.09	94.13	0.55				2147.32	
Agriculture		7.33	0.66				358.28	
Total	37317.56	106.21	2.58	584.83	13.69	0.00	40978.43	

Napoli

Arch. Valeria Vanella / Mariarosaria Albano / Angelo Venezia
Provincia di Napoli
Direzione PTCP - Piani di settore - Progetti speciali
Via Don Bosco 4f - 80141 Napoli

vavanella@provincia.napoli.it
maalbano@provincia.napoli.it

Provincia di Napoli

THE province of Naples is one of the five provinces of Campania Region with 3,086,622 inhabitants and a surface of 1,171 km2: it is one of the most populated in Italy, with its 2,635 inhabitants per km2. The climate is typically Mediterranean except for the few inner zones where it is more continental. The territory is essentially flat with the exception of montainous part like Peninsula Sorrentina, Vesuvio and Monte Partenio.

The plain is characterized by two relevant volcanic areas, Vesuvio and Campi Flegrei: between them is concentrated the most densely populated center, where the city of Portici reaches 16,000 inhabitants per sq km, one of the highest on the planet. The province is divided in 92 municipalities, the biggest one is Naples, with more than 1,000,000 people and a high concentration of functions and services.

The population represents about 53.4% of the Region Campania while the surface is only 9% of the total area; it isn't growing since last years but has a young population growth. The employment rate in 2004 is 42.8 % while the unemployment rate is 18.9 %. There are 264,946 companies present on the territory most of them (54%) little-sized enterprises.

The coastal level grounds and a favourable climate represent the chief factors in the agricultural sector, characterized by vegetables fruit-trees, citrus fruits, olive-trees and vine. There are 51,000 agricultural enterprises whose production is worth over euro 500 million.

There are 30,398,000 crafts enterprises specialised in clothing and shoes (2,109); food products (2,877); furniture and wood objects (2,490); antique traditions of artistic handicraft (530).

There is a strong specialization in commercial brokerage for many product sectors. Mechanical and electromechanical sectors as well as the transport sector, are particularly important in the industry, as well as fashion with 7,600 enterprises of clothing, leather and shoes.

The natural resources as well as climate, culture, traditions and accommodation provide Naples and its surroundings with great touristic appeal: the islands of Capri, Procida and Ischia, the Sorrentine Peninsula, Vesuvius, the archaeological areas of Pompei and Herculaeum are very famous all over the world representing the fulcrum of the local economy with a large supply of accommodation.

Foreign trade involves about 2,500 enterprises that export goods for €4,213,000 and import goods for €4,457,000. The existing transportation network is strongly influenced by the main town Naples, that is well connected with the whole territory, as the centre of a radial system. The railways network is at moment in a big transformation: new railways lines are in work such as high speed ralways line.

The main rule of Naples City and a lot of areas characterized exclusively by residential or commercial functions influence the present road network structure that assures good connection inside the whole territory but with heavy problems in terms of traffic and pollution. Good connections with the exterior and the main hubs are also guaranteed by a good highway network.

In the port of Naples more than 20,8 million tons of goods are loaded and inloaded. Tourist traffic amounts to more than 9 million passengers and 370 enterprises offer different services such as naval reparations, port warehouses, furnishing and provisioning services, container services. It is destined to be qualified as an ever more important logistic platform in the Mediterranean. The berthing of cruise ships has increased by 7,2% over 2004 and tourists numbered 830,158. The international airport of Naples-Capodichino, the most important of the South of Italy with its 130 flights on a daily basis, is easily accessible and well-connected: it is the principal gateway for more than 4,500,000 passengers.

There are many universities and research activities, concerning the sectors of new materials, biotechnology, super-conductivity, and aero-space: 5 universities, 16 research Consortium, 22 institutes and 8 research centres of the National Research Council.

The previous page contains an overview of the Napoli Region. This background offers a useful insight into the size and sources of GhG emissions that we expect to see in the region. The overview tells us that Napoli has a higher proportion of the population employed in the agricultural sector and a lower proportion of people employed in the industrial sector compared to the Italian average. Campania also has a high level of employment in the public sector and is the most densely populated areas in Italy. The energy that it consumes is mostly fossil based.

The inventory for the Napoli Region is presented below. This is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Napoli Chart 1); secondly in terms of emissions from industrial processes (Napoli Chart 2); thirdly in terms of the emissions from agriculture (Napoli Chart 3) and lastly in terms of the emissions from waste (Napoli Chart 4). We then present total GhG emissions from the region and also the national emissions breakdown (Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Napoli area in 2005 were 10664 kt CO_2e. Napoli Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Napoli the emissions from the residential sector accounted for 30% of energy emissions, the service sector made up 14% of CO_2e emissions, the industrial sector 14%, the transport sector 39%. The energy industry comprised 0%, as there are no petroleum refineries or solid fuel transformation in the region. Finally, fugitive emissions account for 3%. This mix may be explained due to the high population density. It may also be explained by the lower than average employment levels in industry. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Napoli Chart 1 shows the GRIP levels used to estimate the emissions from each sub sector as a percentage of that sector's emission. This insert shows that level 1 methods were used to estimate 95% of the emissions from the residential sector, 74% of the service sector emissions, 64% of the industrial sector's emissions, 100% of the transport sector's and 97% of fugitive emissions. This means that a large part of the data entered by the team in Napoli was sourced from locally measured data sets. There is potential for improvement in future emissions inventories. However, by establishing and maintaining the demand for this data, future emissions inventories like this one will be made possible. This will encourage organizations that hold it to collate and provide it enabling year-on-year energy based emissions to be compiled for the Napoli area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of certain products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 874 kt CO_2e. This is presented in Napoli Chart 2, and is comprised of 60% from mineral products, 6% from chemical industry, 1% from metal production, 0.01% from the production of halocarbons and SF_6 and 33% from the consumption of halocarbons and SF_6. This sector is usually a reflection of the nature and extent of the industry within the region. The data suggests that Napoli has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were used to estimate 0% of the emissions from mineral products, from the chemical industry, from metal production and from the production of halocarbons and SF_6 and100% of the emissions from the consumption of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has not yet been done in Napoli. This relationship can be built to enable future versions of the emissions inventory to be populated with more level 1 data. Estimating emissions using level 2 and 3 approaches in this sector carry the greatest degree of uncertainty.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farm yard animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

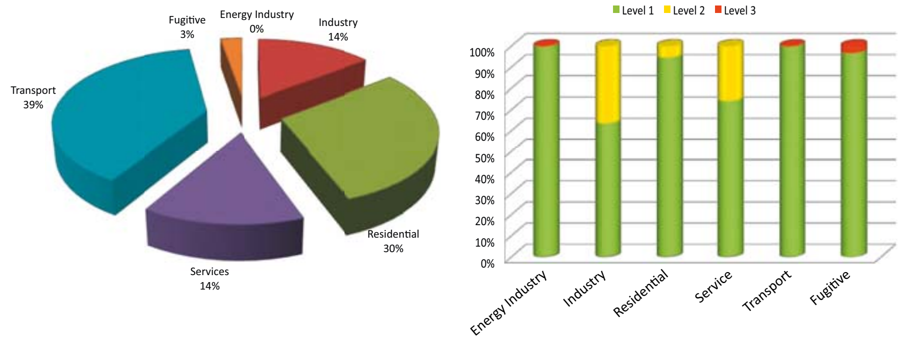
The inventory shows that 490 $ktCO_2e$ were emitted from the agricultural sector within the region in 2005. This is comprised of 24% from enteric fermentation, 5% from manure management, 71% from agricultural soils and, 0.06% from other sources. These emissions have been estimated using level 1 approaches for 27% of the emissions from enteric fermentation, 18% of emissions from manure management, 0% of agricultural soil emissions and 100% from other sources' emissions.

Waste

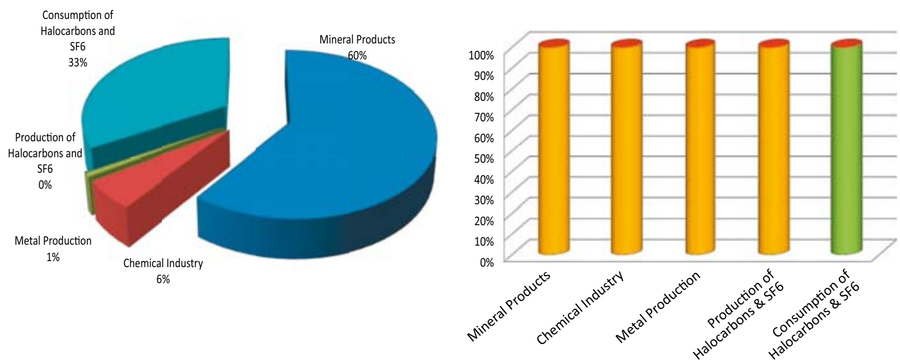
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial and the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated without the production of electricity.

The inventory shows that 458 kt CO_2e were emitted from the waste sector in 2005. In the case of the region this was comprised of 19% from managed waste disposal, 29% from unmanaged waste disposal, 39% from waste water and 14% from incineration.

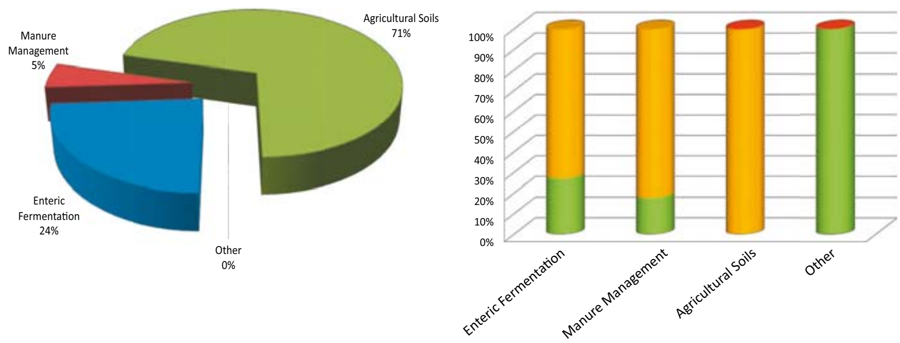
The reasons for these emissions are due to the regions propensity to landfill its waste rather than to recycle or incinerate it. The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal, 100% of unmanaged waste disposal, 100% of waste water emissions and 99% of the emissions from incineration.



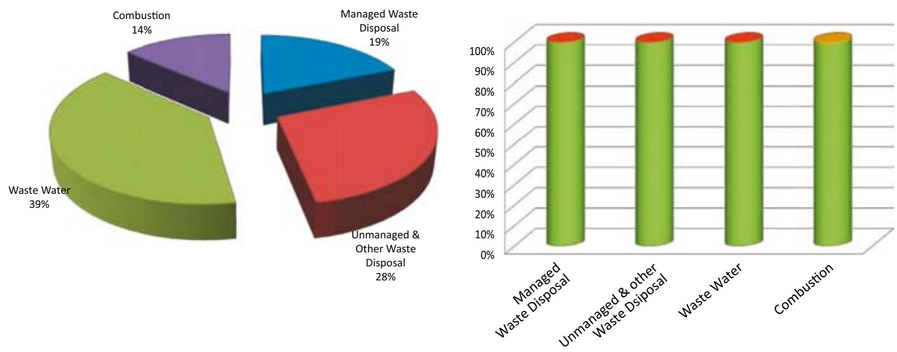
Naples Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



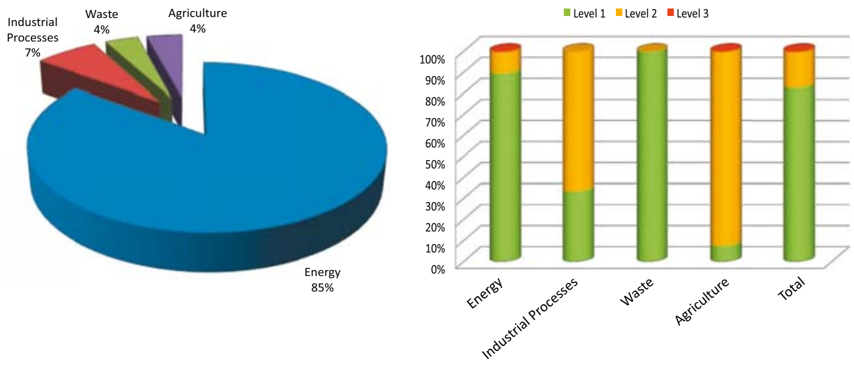
Naples Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



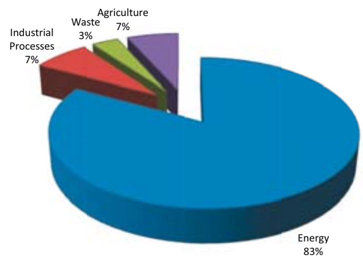
Naples Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Naples Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Naples Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Naples Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Napoli Region are displayed in Napoli Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Italy are displayed in Napoli Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a relatively similar share of emissions to that displayed in Italy. The emissions per-capita of the region are 4.05tCO_2e compared to 9.9tCO_2e in Italy. This difference may be explained by the comparatively low levels of employment in the region. Regions with a similar per-capita emissions include Stockholm and Oslo. The emissions per-capita are below the average of the regions and are also below the European average. They are below the emissions per capita of all the participating countries in this project. The data has been largely compiled using measured data sets and is therefore largely reliant on the accuracy of those data sets.

The table below displays the emissions for the whole of the Napoli Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 95% of CO_2 emissions and 83% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Napoli Chart 5 above show that the energy sector is responsible for 85% emissions, Industrial Processes for 7%, Waste for 4% and Agriculture 4% of emissions. This shows the clear need to focus on the energy system needed for Napoli to be an even lower-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	10376.17	4.78	0.61				10664.21	
Residential	3157.94	0.65	0.07				3193.49	
Services	1493.39	0.18	0.05				1512.23	
Industry	1510.42	0.06	0.09				1539.78	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	3995.07	0.85	0.39				4134.87	
Fugitive	219.35	3.04	0.00				283.84	
Industrial Processes	539.99	0.00	0.13	277.16	0.00	0.00	874.46	
Waste	19.53	14.17	0.46				458.28	
Agriculture		6.80	1.12				490.77	
Total	10935.68	25.75	2.32	277.16	0.00	0.00	12487.72	

Oslo

Peter Austin
Planning Advisor, Oslo City Council

Tel (office): +47 23461613
Tel (mobile): +47 45263688
peter.austin@radhuset.oslo.kommune.no

AKERSHUS FYLKESKOMMUNE

City of Oslo

OSLO metropolitan region as presented here is the City of Oslo and the surrounding county of Akershus. Both Oslo and Akershus are currently led by right wing majority councils. Oslo is a unitary authority and has both regional and local authority functions. Akershus has a two tier system of local government, with a directly elected regional authority, and 22 independent municipalities. The metropolitan region is a functional travel to work area. Mobility is high, with two thirds of the working population travelling to jobs outside the immediate areas where they live.

Although politically independent from each other, Oslo and Akershus work jointly in many key areas. These include:

- Regional energy and climate program, revised in 2008
- Oslo toll ring, run as a company since 1990 with a goal of raising revenue for transport investments and currently charging 3 Euros for motorised journeys into the city
- Joint public transport company with all services except local trains
- Structure planning, started 2009

The total population of the region was 1.1 million in January 2009. The City of Oslo has just over half the total population, living in a fairly compact area. The city-region is expanding rapidly. In 2008 the population grew by 24,000, or more than 2 percent in a single year. This growth is mostly driven by immigration, a young population with a high birth rate and net in-migration from peripheral parts of the country. The future is uncertain but strong growth is expected to continue over many years.

Unemployment in the Oslo metropolitan region is about 3 percent. Some 17,000 industrial jobs have been lost since the mid nineteen-eighties. Service sector jobs in the region have increased by more than 200,000 over the same period, nearly half of these new jobs being created in the public sector. In addition, the national airport is a key contributor to the region's economic success, providing vital links to Europe and the rest of Norway.

The Oslo area is one of the most expensive regions in Europe. Levels of pay are correspondingly high, so the relative cost of living is not especially burdensome. High levels of consumption in the region reflect this. Virtually all of the electric power used in the Oslo metropolitan region is provided from hydroelectric sources outside the metropolitan region, which supply the national grid. Oslo and many of the neighbouring municipalities also have district heating schemes based on sorting and incinerating waste. Oil-based central heating provides about 15 % of space heating. Since Norwegian industry is largely located outside the Oslo area, there is little energy used for manufacturing processes. Transport is the largest source of climate gas emissions in the Oslo metropolitan region. Road traffic has increased over many years until very recently. The national airport is also a major source of greenhouse gas emission.

The main efforts to reduce greenhouse gas emissions in the Oslo area are therefore focused on a) reducing convention car transport, and b) improving space heating in the service sector and residential buildings.

The previous page contains an overview of the Oslo Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The inventory data tells us that Oslo has a far higher level of travel by train rather than car when compared to the Norwegian average and its service sector is far larger than the industrial sector in economic terms. The energy that the region consumes includes much higher proportion of biomass particularly in the residential sector compared to the other regions in this study.

The inventory for the Oslo Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Oslo Chart 1); secondly the emissions from industrial processes (Oslo Chart 2); thirdly the emissions from agriculture (Oslo Chart 3) and finally the emissions from waste (Oslo Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Norway.

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Oslo area in 2005 was 3354 kt CO_2e. Oslo Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Oslo the emissions from the residential sector accounted for 14% of energy emissions, the service sector made up 10% of CO_2e emissions, the industrial sector 9% and the transport sector 66%. The fugitive emissions account for 1%. This mix may be explained due to the high use of biomass in the residential and service sector leaving transport as the main user of fossil based fuels and thus GhG emissions. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Oslo Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the residential sector, industrial sector and fugitive emissions and 99% of transport emissions and 95% of service sector emissions. This means that nearly all the data entered by the team in Oslo was sourced from local measured data sets. This will enable year-on-year energy based emissions to be compiled for the Oslo area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 108 kt CO_2e. The breakdown is presented in Oslo Chart 2, and is comprised entirely of emissions from the consumption of halocarbons and SF_6 all of which were estimated using a level 1 approach. This breakdown is largely a reflection of the type and size of industry within the region.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has clearly been done here. This relationship can be built upon to enable future versions of the emissions inventory to be populated with level 1 data too.

Agriculture

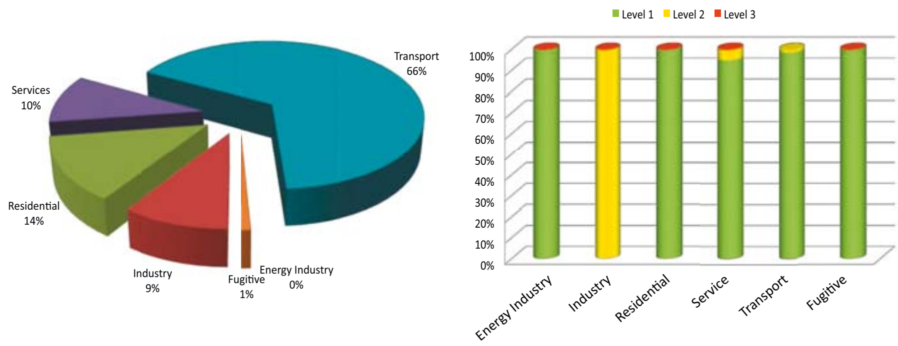
Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

The inventory shows that 60 kt CO_2e were emitted from the agricultural sector within the region in 2005. Oslo Chart 4 shows the total is made up of 83% from enteric fermentation, 17% from manure management and 0.27% from other sources. These emissions have been estimated using level 1 approaches for 98% of the emissions from enteric fermentation, 92% of the emissions from manure management and level 2 data was used for 100% of the emissions from other sources.

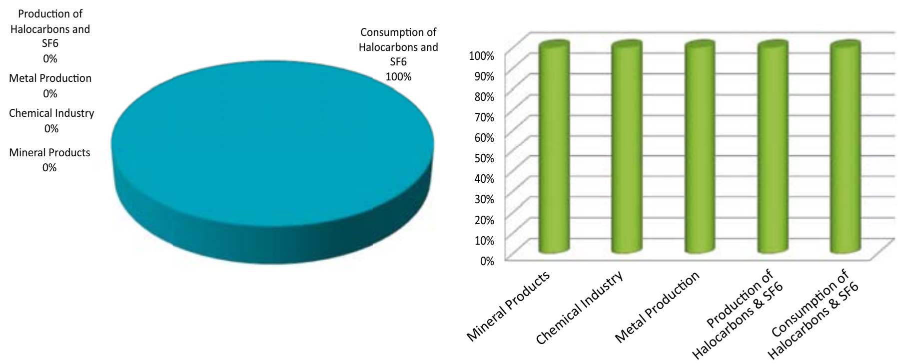
Waste

Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

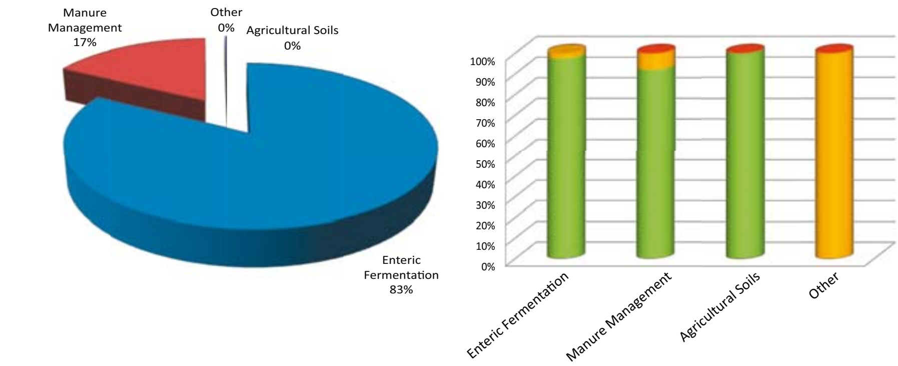
The inventory shows that 108 kt CO_2e were emitted from the waste sector in 2005. As shown in Oslo Chart 3 the total is made up of 71% from managed waste disposal and 29% from waste water. Although the region reports that a large proportion of waste (60%) is incinerated in the region these emissions are not captured in the inventory as the emissions from waste have been estimated using level 2 methods and national emissions from incineration were not available to the Oslo inventory team.



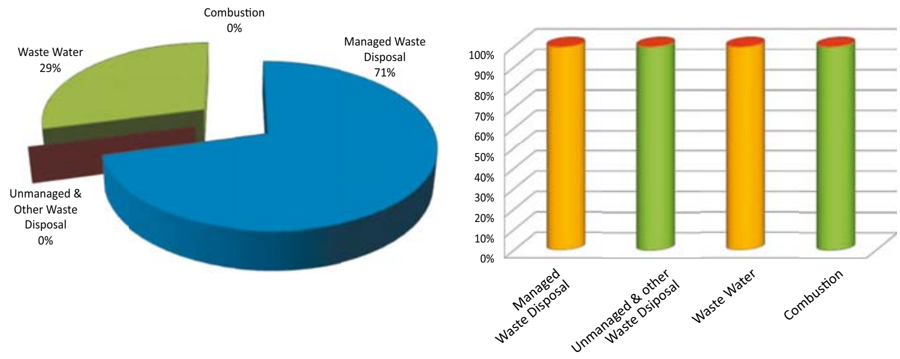
Oslo Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



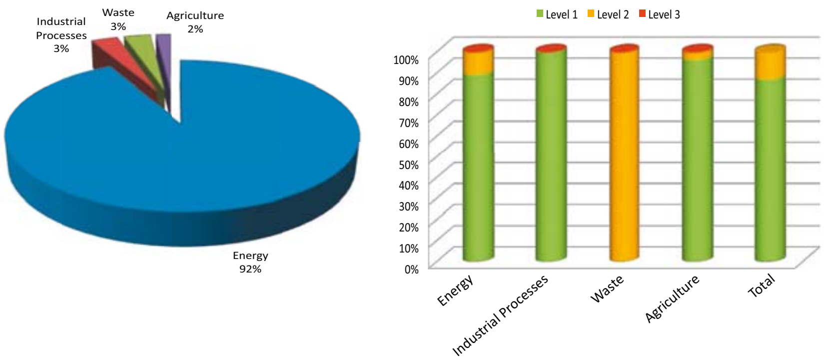
Oslo Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



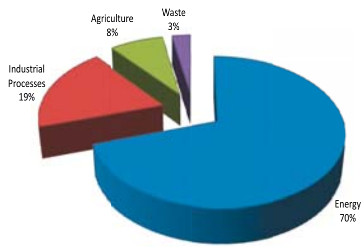
Oslo Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Oslo Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Oslo Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Oslo Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Oslo Region are displayed in Oslo Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Norway are displayed in Oslo Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a much higher share of emissions from energy then that displayed nationally, however this is largely due to the very small agricultural and industrial sectors. The emissions per-capita of the region are 3.5tCO_2e compared to 11.6tCO_2e in Norway. This difference can be explained by the larger than average use of electricity in the region, as it is very low carbon. Regions with a similar per-capita emissions include Stockholm and Napoli. The emissions per-capita are below the average of the regions and are also below the European average. They are below the emissions per capita of all the participating countries in this project. The data has been largely compiled using measured data sets and is therefore largely reliant on the accuracy of those data sets.

The table below displays the emissions for the whole of the Oslo Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 100% of CO_2 emissions and 90% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO$_2$ project, and are explained in more detail at the end of this document. In the case of Oslo a large part of their emissions are from Transport.

The table below and Oslo Chart 5 above show that the energy sector is responsible for 92% emissions, Industrial Processes for 3%, Waste for 3% and Agriculture 2% of emissions. This shows the need to focus on the energy system needed for Oslo to be an even lower-carbon region of the future. Perhaps it also shows how emissions may be reduced and is also an area where low carbon manufacturing could be located.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	3265.13	1.46	0.19				3353.90	
Residential	417.97	0.96	0.03				448.77	
Services	334.65	0.08	0.01				340.72	
Industry	310.82	0.03	0.01				313.74	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	2175.66	0.37	0.13				2223.48	
Fugitive	26.03	0.02	0.00				27.19	
Industrial Processes	0.00	0.00	0.00	107.91	0.01	0.00	107.92	
Waste	0.00	3.71	0.10				107.77	
Agriculture		2.86	0.00				60.03	
Total	3265.13	8.02	0.28	107.91	0.01	0.00	3629.61	

Osrednjeslovenska regija

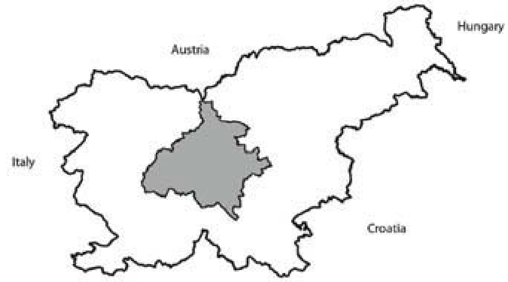
Ivan Stanič
Head of the administrative and general affairs office
Department of spatial planning
City administration
City of Ljubljana
Poljanska 28
SI 1000 Ljubljana, Slovenia

Osrednjeslovenska regija is the largest Slovenian region by population and second largest by size. As implied by its name, the region lies in the centre of the country. Ljubljana, the capital of Slovenia, is situated in the large Ljubljana Basin, and forms the economic and population nucleus of the country.

Covering 2 555 square kilometres, Osrednjeslovenska regija accounts for 12.6 percent of the national territory. In geographic terms, the region consists of several parts: the Ljubljana Basin, encircled by the pre-alpine Posavje and Polhograjci Hills to the northeast and west, high karst plateaus of Krim, Mokrc and part of Menišija to the southeast and south, and a narrow strip of Kamnik-Savinja Alps to the north. The climate is temperate continental: average annual temperature is 10.2°C (-0.1°C in January and 20.4°C in July). Precipitation is high in summer and low in winter.

The settlement system of the region consists of 1024 settlements. It is characterised by the strong centrality of the city of Ljubljana and by a star-shaped development of settlements along the main transportation corridors. The largest settlements in the region include Ljubljana (population 259 000), Kamnik (12 200), Domžale (11 600), Logatec (7 600), Vrhnika (7 500), Litija (6 400) and Grosuplje (6 000). A process of de-concentration has been taking place in the past two decades - about 20 000 inhabitants moved from Ljubljana into the neighbouring municipalities within the region. Still, the density of population remains high in and around Ljubljana, whereas the rest of the region is characterised by small settlements with low population density.

Nearly a quarter of the total Slovenian population (492 100) lived in the region in 2002, making it the most densely settled region in Slovenia (192.6 people per square kilometre). During the 1995-2006 period the population in the Osrednjeslovenska region grew moderately, growth being due in 60 percent to migration. Only 8 percent of the migrants came from the other Slovenian regions, the rest predominantly from the new Balkan states.



In economic terms, Osrednjeslovenska has the leading position among the Slovenian regions. In 2005 almost 36 percent of the Slovenian GVA has been created in the region, with the share constantly rising, more than 75 percent thereof in the service sector. GDP per capita was by 44.3 percent higher than the Slovenian average, and by 25.3 percent higher than the EU-27 average. Growth of GDP per capita in the region as compared with the average for Slovenia was high already in the second half of the 1990s, but even higher in the period 2000-2005 (6.5 index points).

The structure of economic activity is characterised by a predominance of the service sector (77 percent of all firms and commercial companies, 61.3 percent of total workforce in the region in 2005), followed by manufacturing (12.5 and 28.5) and construction (9.8 and 9.7). Agriculture and forestry play only a minor role, even though there are significant differences between municipalities in the region. As to manufacturing, the structure is very diversified, with food and beverages, paper, pulp and print, and chemical industry accounting for about 11 percent of regional employment. In the service sector, commerce is the strongest single branch (26.3 percent of workforce employed), followed by business services (16.1) and transport, storage and communication (12.1).

In terms of economic activity, the city and municipality of Ljubljana have always predominated. Growth of the tertiary and quaternary sectors has led to an even stronger concentration of workplaces: in 2002, 75 percent of all workplaces in the Osrednjeslovenska region were to be found in the city municipality of Ljubljana, their number exceeding the active population by almost 70 000. Commuting to work is mostly car-based, and includes people from neighbouring Slovenian regions. Other strong employment centres in the region are Domžale, Kamnik and Vrhnika.

The majority of the region's population and activities are concentrated in the Ljubljana Basin, where the environment is under strong pressure, while in outlaying parts of the region this pressure is considerably less. A major problem is air quality, which is deteriorating due mostly to growth in car-based transport. The main problems are high and growing concentrations of particulate matter, nitrogen oxides and ozone, whereas the concentrations of the "classical" pollutants such as sulphur dioxide have decreased under threshold values. The region has extensive areas of well preserved nature.

The previous page contains an overview of the Ljubljana Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Ljubljana has a large service sector, representing 75% of the economy and is the most densely populated region in Slovenia.

The inventory for Osrednjeslovenska regija is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Ljubljana Chart 1); secondly the emissions from industrial processes (Ljubljana Chart 2); thirdly the emissions from agriculture (Ljubljana Chart 3) and finally the emissions from waste (Ljubljana Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Slovenia.

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Ljubljana area in 2005 was 4305 kt CO_2e. Ljubljana Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Ljubljana the emissions from the residential sector accounted for 19% of energy emissions, the service sector made up 20% of CO_2e emissions, the industrial sector 32% and the transport sector 26%. Finally fugitive emissions account for 3%. This mix may be explained due to the high economic share of the industrial sector in the region compared to that displayed nationally. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Ljubljana Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 2 methods were used to estimate 100% of the residential sector, industrial sector, transport sector and service sector emissions. Level 1 methods were used to estimate 100% of fugitive emissions. This demonstrates a clear need for the collection of locally produced data. This will enable year-on-year energy based emissions to be compiled for the Ljubljana area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 73 kt CO_2e. The breakdown is presented in Ljubljana Chart 2, and is comprised of 46% from mineral products, 15% from chemical industry and 39% from the consumption of halocarbons and SF_6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Ljubljana has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from mineral products and the consumption of halocarbons and SF_6 and level 2 methods were used to estimate the chemical industry emissions.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has clearly been done here for most of the sources. This relationship can be built upon to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

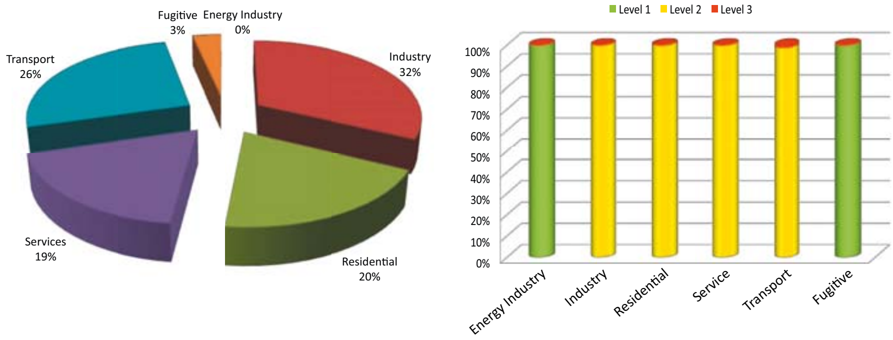
The inventory shows that 194 kt CO_2e were emitted from the agricultural sector within the region in 2005. Ljubljana Chart 4 shows the total is made up of 51% from enteric fermentation, 27% from manure management and 22% from agricultural soils. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation, manure management and other sources, level 2 approaches have been used to estimate the emissions from agricultural soils.

Waste

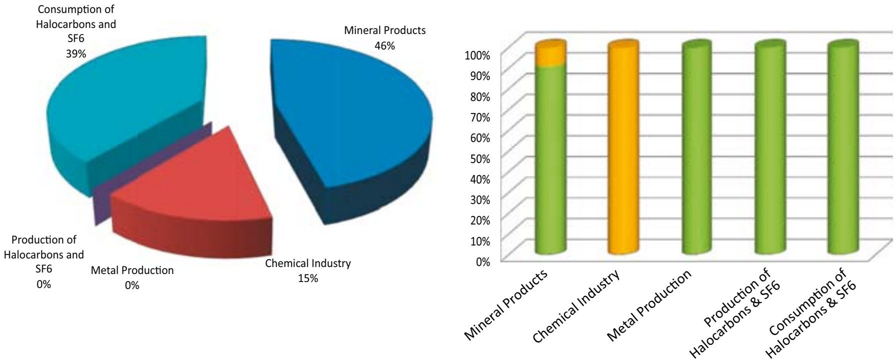
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 198 kt CO_2e were emitted from the waste sector in 2005. As shown in Ljubljana Chart 3 the total is made up of 79% from managed waste disposal and 21% from waste water.

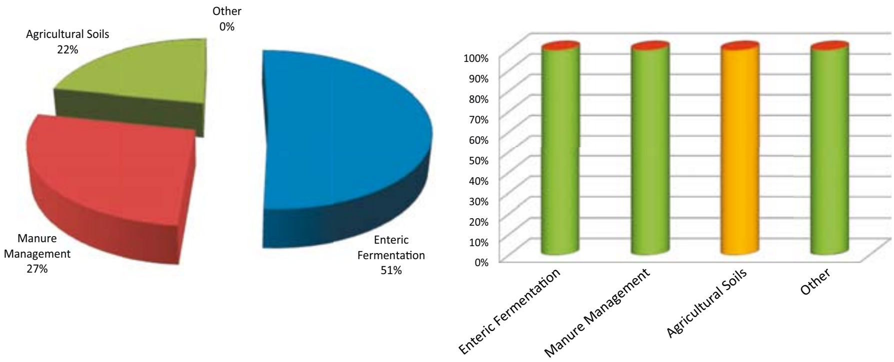
The reasons for these emissions are due to the region's propensity to landfill its waste rather than to recycle or incinerate it. The emissions have been estimated using level 2 methods for 100% of the emissions from managed waste disposal and waste water.



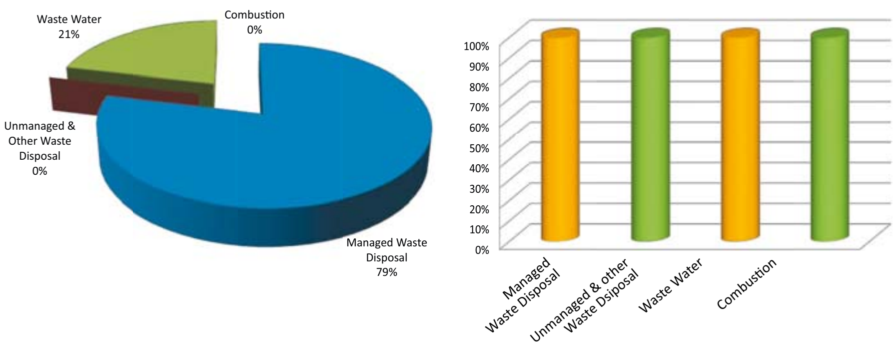
Ljubljana Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



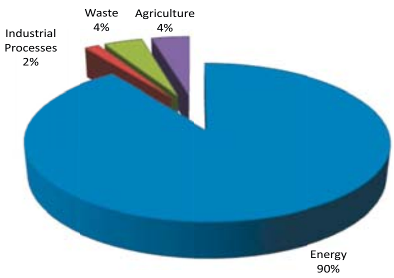
Ljubljana Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)

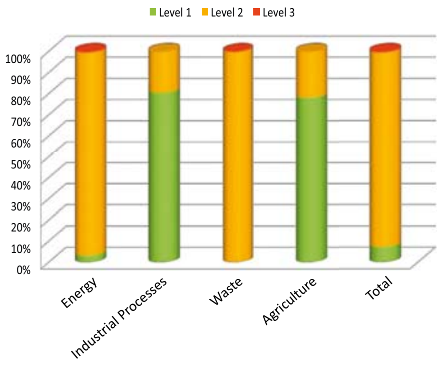


Ljubljana Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)

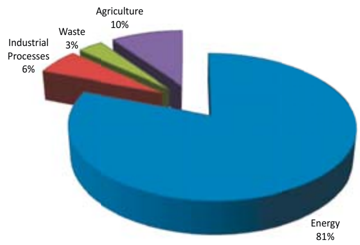


Ljubljana Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)





Ljubljana Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Ljubljana Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Ljubljana Region are displayed in Ljubljana Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Slovenia are displayed in Ljubljana Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of energy emissions to that displayed nationally, a lower share of Industrial process and Agricultural emissions and a similar share of Waste emissions. The emissions per-capita of the region are 9.5tCO_2e compared to 10.2tCO_2e in Slovenia. This can be explained by the difference in sectors within the region to that nationally. Regions with a similar per-capita emissions include Turin, Hamburg and Glasgow. The emissions per-capita are below the average of the regions and are also below the European average. They are similar in size to the emissions per capita of Italy. The data has been largely compiled using level 2 and level 3 methods and so carries a greater degree of uncertainty then the inventories of other regions in this brochure.

The table below displays the emissions for the whole of the Ljubljana Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 99% of CO_2 emissions and 90% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next step of the EUCO$_2$ project, and are explained in more detail at the end of this document.

The table below and Ljubljana Chart 5 above show that the energy sector is responsible for 90% emissions, Industrial Processes for 2%, Waste for 4% and Agriculture 4% of emissions. This shows the clear need to focus on the energy system needed for Ljubljana to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	4273.25	1.53	0.00				4305.39	
Residential	817.60	1.02	0.00				839.03	
Services	797.00	0.00	0.00				797.00	
Industry	1392.03	0.00	0.00				1392.03	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	1129.47	0.25	0.00				1134.73	
Fugitive	137.15	0.26	0.00				142.60	
Industrial Processes	44.64	0.00	0.00	23.53	0.00	0.00	72.88	
Waste	0.00	9.41	0.00				197.53	
Agriculture		7.23	0.14				194.15	
Total	4317.89	18.16	0.14	23.53	0.00	0.00	4769.95	

Ile de France

Erwan Cordeau
Chargé d'études Environnement
Département Environnement
urbain et rural (DEUR)
Tél. : 01.77.49.77.87
erwan.cordeau@iau-idf.fr
IAU île-de-France

Genevieve Danchin
Institut d'Aménagement et d'Urbanisme
(IAU île-de-France)
15, rue Falguière
75015 Paris

THE REGION ILE-DE-FRANCE, with Paris at its heart, is the political and economic capital of France. By far the most populous region in France, in January 2008 the region had 11 694 000 inhabitants; 19% of the population of metropolitan France on 2.2% of its national territory. The population density was 974 inhabitants per square kilometre, over two and a half times the population density of any other French region.

The Île-de-France is a region of contrasts, ranging from the highly urbanized central zone (Paris and the inner ring, with a density of 8500 habitants /ha) to its outer ring (215hab /ha in the outer most ring): 80% of the land is used for non urban purposes: more than half is devoted to agricultural purposes, mainly cereal crops; the outer ring , 24% is made up of several leisure parks and rich and varied natural habitats and forests (Rambouillet, Fontainebleau, the Seine valley and the Chevreuse valley). The basic development scheme for the region aims to keep this area free of pollution and to prevent any growth in urbanization along the transport axes.

Between 1990 and 2006 the population grew as quickly as that of France, at 0.7% per year, which puts it in 9th place among the regions of the metropolitan. By contrast the rate of growth in the inner ring, especially in Seine Saint Denis (North East) and Hauts de Seine (West). Even Paris itself has had an increase of 56 000, after decades of decline. The growth in the four départements in the outer ring continues, but more slowly than in the 1990s.

Although retired people are leaving the region,regional growth comes less and less from internal migrations, and more and more from natural increase. With 30.5% of its population between 20-39 years old, the Ile de France is, in demographic terms, the youngest region of France (26% are between 20 and 39 years old). Consequently, there are many children: 26% of the population under 19 (25% total France), and it still attracts young people of working age. In 1999 nearly a quarter of its population was under 20 years of age. Between 1990 and 1999 the proportion of this age group declined less in Île-de-France than in the other regions of France. Moreover, the increasing share of persons aged

60 or more, which grew from 15.8% in 1990 to 16.6% in 1999 in Île-de-France was less than in other region s. It remains the lowest share in metropolitan France.16%, against 21% in France

The Île-de-France tops the table of French regions for per capita GDP. In 2007 the GDP of Île-de-France amounted to 534 million euros; 28% of national GDP. GDP per inhabitant was 35 950 45 982 Euro in 20070; this is 52% higher than the average for metropolitan France.

The Ile-de-France has the highest value-added of all the French regions for each sector of economic activity with the exception of agriculture. The contribution of the agricultural production of the region to the national economy is falling, amounting to1,7% in 2007. Although industry has seen its share of regional value-added shrink, in 2000 2007 it still made up 19,8% of the national total. Construction contributed 18% of the national total. Market services place is increasing, with 38% in 2007 and non-market services (services publics and "services aux particuliers 26%.

The previous page contains an overview of the Paris Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that the Ile de France has areas which are densely populated, but also that half the area is agricultural land.

The inventory for the Paris Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Paris Chart 1); secondly the emissions from industrial processes (Paris Chart 2); thirdly the emissions from agriculture (Paris Chart 3) and finally the emissions from waste (Paris Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of France (Paris Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Paris area in 2005 was 47 009 kt CO_2e. Paris Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Paris the emissions from the residential sector accounted for 34% of energy emissions, the service sector made up 21% of CO_2e emissions, the industrial sector 8% and the transport sector 37%. There are no forms of energy industry in Paris. Finally fugitive emissions account for just 0.09%. This mix may be explained due to the high economic share of the service sector in the region. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Paris Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the residential sector, industrial sector, transport sector, energy industry, service sector and fugitive emissions. This means that all the data entered by the team in Paris was sourced from local measured data sets. This will enable year-on-year energy based emissions to be compiled for the Paris area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 3 526 kt CO_2e. The breakdown is presented in Paris Chart 2, and is comprised of 11% from mineral products, 14% from chemical industry, 6% from metal production, 3% from the production of halocarbons and SF_6 and 66% from the consumption of halocarbons and SF6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Paris has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from mineral products, the chemical industry, from metal production and from the production and consumption of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has clearly been done here. This relationship can be built upon to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

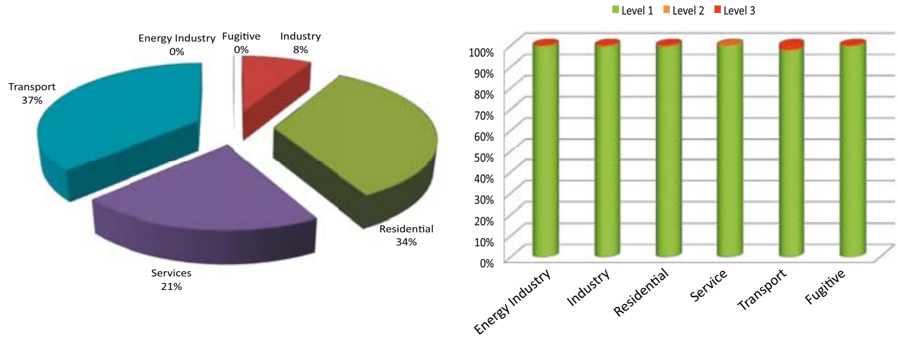
The inventory shows that 6 912 kt CO_2e were emitted from the agricultural sector within the region in 2005. Paris Chart 3 shows the total is made up of 1% from enteric fermentation, 86% from manure management and 13% from agricultural soils. The comparatively high levels of emissions from this sector reflect the large area of agricultural land in the Ile de France. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation, manure management and other sources, level 2 methods have been used to estimate 100% of the emissions from agricultural soils.

Waste

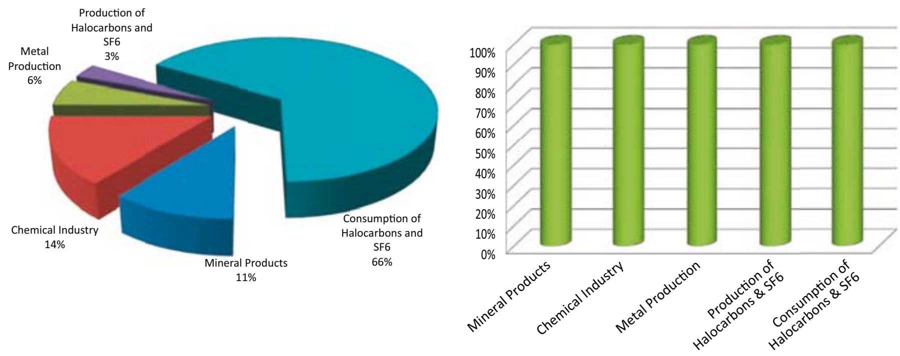
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 2 197 kt CO_2e were emitted from the waste sector in 2005. As shown in Paris Chart 4 the total is made up of 31% from managed waste disposal, 5% from waste water and 64% from incineration.

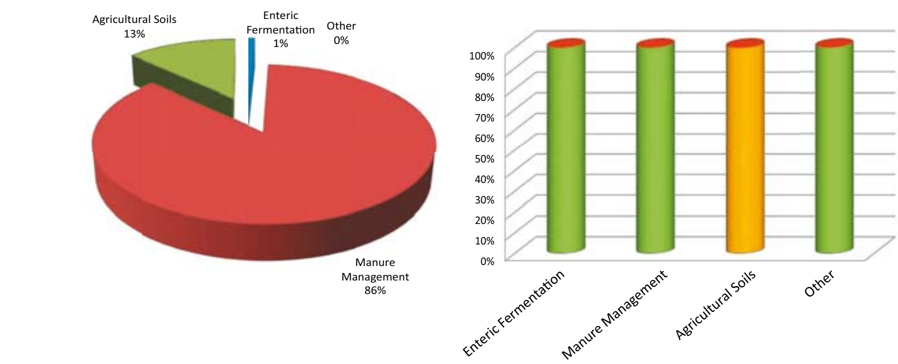
The reasons for these emissions are due to the region's propensity to combust its waste rather than to send it to landfill. The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal, waste water and incineration.



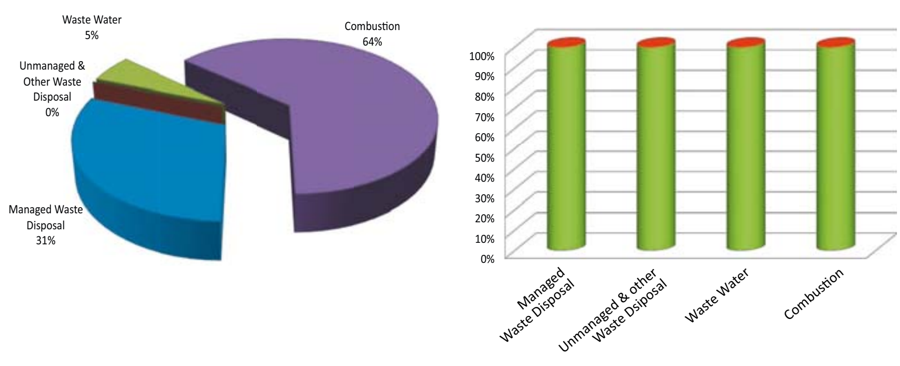
Paris Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e).
Right: GRIP level used (CO_2e)



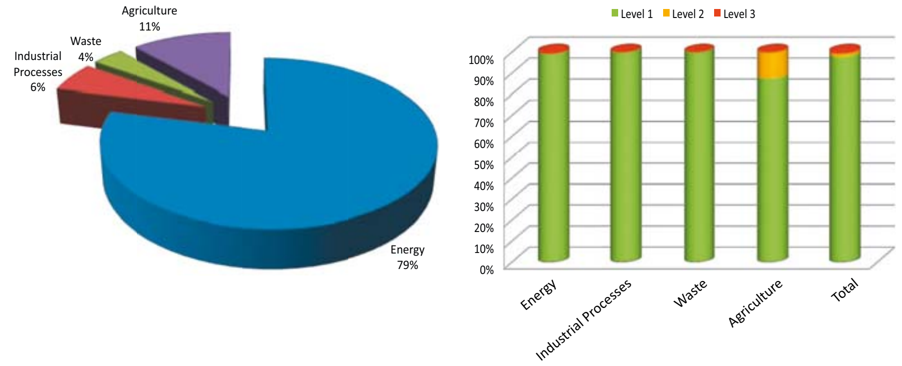
Paris Chart 2: Left: Emissions from industrial processes (CO_2e).
Right: GRIP level used (CO_2e)



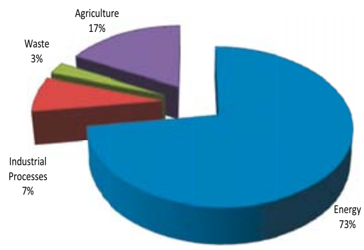
Paris Chart 3: Left: Emissions from agriculture (CO_2e).
Right: GRIP level used (CO_2e)



Paris Chart 4: Left: Emissions from waste (CO_2e).
Right: GRIP level used (CO_2e)



Paris Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Paris Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the ile De France Region are displayed in Paris Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for France are displayed in Paris Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of emissions from energy then that displayed nationally, however this is largely due to a comparatively smaller agricultural sector as both the Industrial Process and Waste sectors are similar. The emissions per-capita of the region are 5.2tCO_2e compared to 8.9tCO_2e in France. This difference can be explained by the type of industry in the region. Regions with a similar per-capita emissions Madrid and Napoli. The emissions per-capita are below the average of the regions and are also below the European average. They are below the emissions per capita of all the participating countries in this project. The data has been largely compiled using measured data sets and is therefore largely reliant on the accuracy of those data sets.

The table below displays the emissions for the whole of the ile De France Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 96% of CO_2 emissions and 78% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Paris Chart 5 above show that the energy sector is responsible for 79% emissions, Industrial Processes for 6%, Waste for 4% and Agriculture 11% of emissions. This shows the need to focus on the energy system needed for ile de France to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	46489.30	6.93	1.21				47009.13	
Residential	15699.32	5.04	0.54				15972.36	
Services	9677.67	0.37	0.21				9751.88	
Industry	3817.30	0.17	0.17				3872.13	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	17264.84	0.71	0.29				17369.23	
Fugitive	30.17	0.64	0.00				43.53	
Industrial Processes	617.28	0.02	1.50	2164.43	40.75	0.01	3526.06	
Waste	1367.63	39.47	0.00				2197.37	
Agriculture		3.49	22.06				6912.42	
Total	48474.21	49.91	24.77	2164.43	40.75	0.01	59644.98	

Porto

Área Metropolitana do Porto
Albano Carneiro
acarneiro@amp.pt

Euronatura
Sara Dourado
sara.dourado@euronatura.pt

The AMP – Metropolitan Area of Porto, located on the northern coast of Portugal, was formally constituted in 1992, structuring a region that has developed around the city of Oporto, the seafront and the major axis that the river Douro is. It currently consists of 16 municipalities that occupy a total area of 1,884 km2, has a population of approximately 1,647,000 inhabitants.

It is a territory that has been registering a decline over the last decade throughout the region. This downward trend in relative terms, however, does not undermine the status of a globally advanced sub-region that the metropolitan area of Porto still holds, nor the strong potential in human and technological resources and infrastructures of communication which are an effective support for a development based on innovation and knowledge economy.

The analysis of the productive structure in the region of Porto shows that there is a significant industrial base, consolidated and dynamic that gives the Metropolitan Area of Porto a specific vocation in national terms, which is to be at the centre of an economic system consisting predominantly of marketable and highly internationalized activities.

The University of Porto, of international prestige, is the Portuguese institution of higher education with more students, about 28,000 in 14 colleges, a business school and more than 70 structures of scientific research. There are also some companies within AMP with an organizational level and competitiveness of medium-sized European companies, in some cases with their own structures of R&D. Good examples can be found in the areas of health, with prestigious research facilities, in the food sector, with the commitment of the School of Biotechnology, the emerging engineering areas, with noticeable structures of R&D such as INEGI and INESC, companies with great investment in R&D, the sea sciences and economy related areas, with associated laboratories and an emerging shipping sector.

Even in more traditional industrial areas such as footwear, textiles, clothing and furniture, there are also firms with considerable dimension and, above all, innovative capacity.

Regardless other opinion, agriculture and agro-industries have continued to represent one of the largest and most modern means of production of AMP. The substantial growth of tourism is one of the most striking economic and social aspects of the last century, with an average growth higher than the world economy, which is expected to continue.

Oporto is one of the oldest cities in Portugal and its historical centre has been designated as World Heritage, with several monuments, from the Middle Ages, the Baroque to the contemporary architecture.

The AMP, in addition to its vast monumental heritage distributed by the 16 counties, has a magnificent coastline and waterways. Douro River offers cruises to the terraces of the Douro demarcated region, where the famous Port Wine is produced, which can be tasted in a visit to the Cellars, in Vila Nova de Gaia. A diverse gastronomic offer traditional and contemporary, complete a wide range of tourism programmes.

The previous page contains an overview of the Porto Region. This background offers a useful insight into the sources and size of GhG emissions that we could expect to see in the region. The overview tells us that Porto has a significant industrial base and growing tourism industry. The energy that it consumes is mostly liquid and gas fossil fuels.

The inventory for the Porto Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Porto Chart 1); secondly the emissions from industrial processes (Porto Chart 2); thirdly the emissions from agriculture (Porto Chart 3) and finally the emissions from waste (Porto Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Portugal.

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Porto area in 2005 was 11 142 kt CO_2e. Porto Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Porto the emissions from the residential sector accounted for 11% of energy emissions, the service sector made up 10% of CO_2e emissions, the industrial sector 25% and the transport sector 45%. The energy industry of Porto represented 4% of emissions and finally fugitive emissions account for 5%. This mix reflects the economic activity of the region, the transport emissions were estimated using level 3 data, more local data would show whether this figure was a true reflection of the emissions from transport in Porto. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Porto Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the residential sector and fugitive emissions, 94% of emissions from industry, 26% of those from the energy industry and 12% of service sector emissions. This means that there is a large scope for improving the inventory in future years by sourcing and collecting local energy data from Porto. This will enable year-on-year energy based emissions to be compiled for the Porto area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 66 kt CO_2e. The breakdown is presented in Porto Chart 2, and is comprised of 14% from metal production and 86% from the consumption of halocarbons and SF_6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Porto has few sources of these emissions. In terms of this sector, level 2 methods were used to estimate 100% of the emissions from metal production and level 1 methods were used for 100% of the emissions from the consumption of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This is yet to be done here. This relationship can be built to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

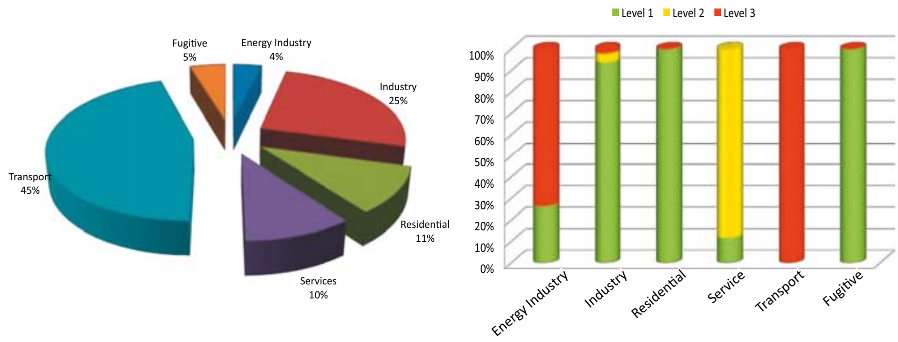
The inventory shows that 379 kt CO_2e were emitted from the agricultural sector within the region in 2005. Porto Chart 3 shows the total is made up of 39% from enteric fermentation, 15% from manure management and 43% from agricultural soils – reflecting the large fruit growing areas in the region. These emissions have been estimated using level 2 approaches for 100% of the emissions from enteric fermentation, manure management, other sources and agricultural soils.

Waste

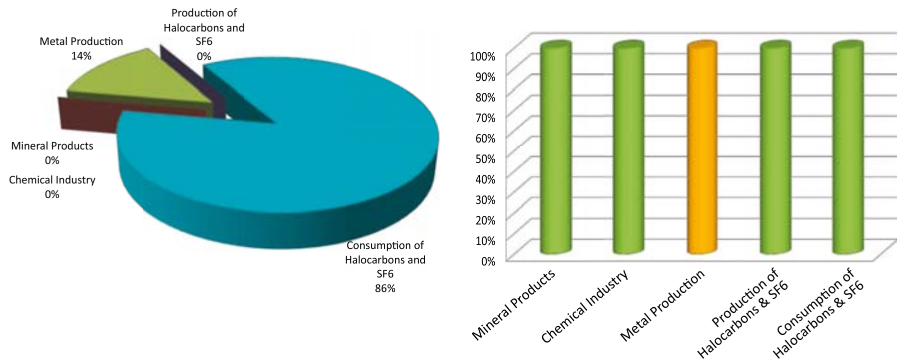
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 558 kt CO_2e were emitted from the waste sector in 2005. As shown in Porto Chart 4 the total is made up of 55% from managed waste disposal and 45% from waste water.

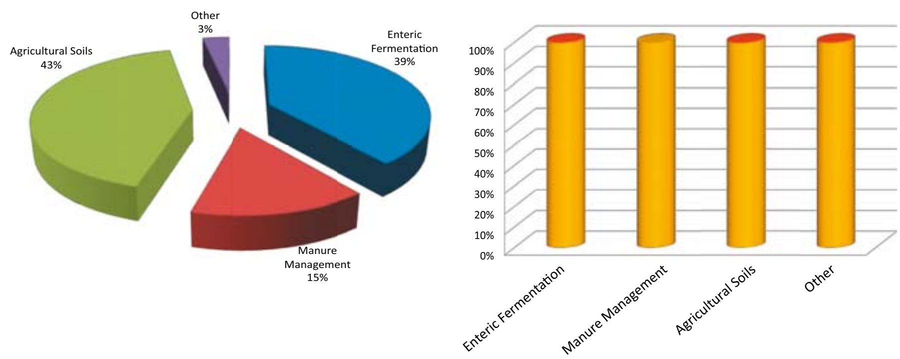
The reasons for these emissions are due to the region's propensity to landfill its waste rather than to incinerate it, more local data will provide further information on the recycling rates in the region. The emissions have been estimated using level 2 methods for 100% of the emissions from managed waste disposal and waste water.



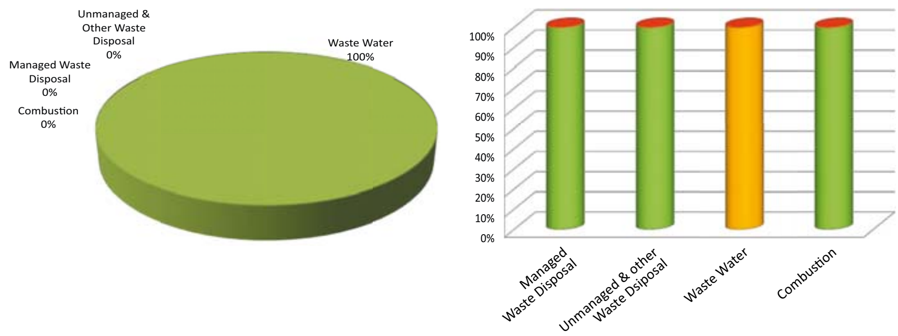
Porto Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



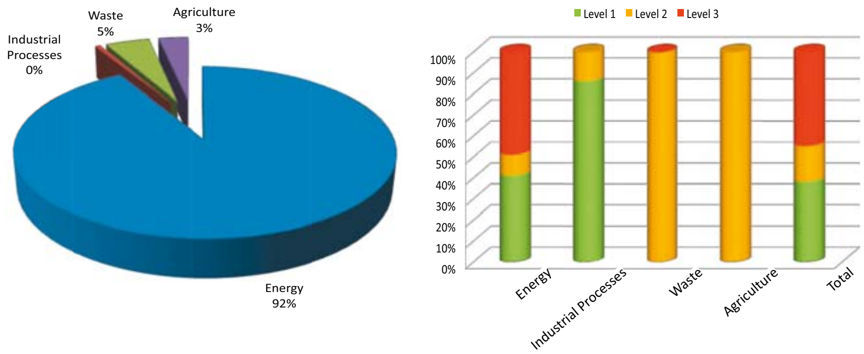
Porto Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



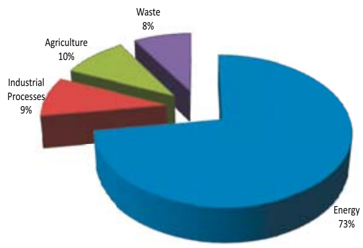
Porto Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Porto Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Porto Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)

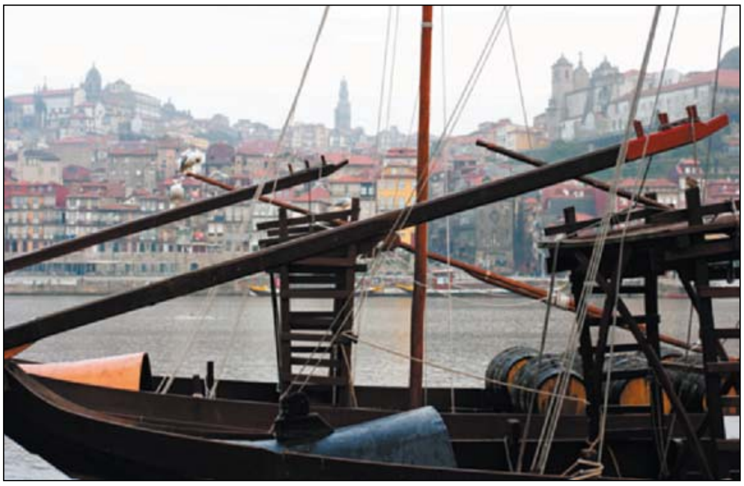


Porto Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Porto Region are displayed in Porto Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Portugal are displayed in Porto Chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of emissions from energy then that displayed nationally, this is largely due to a comparatively smaller agricultural sector – with emissions driven by Industry – albeit not of the form that generates industrial process emissions. The emissions per-capita of the region are 7.3tCO_2e compared to 8tCO_2e in Portugal. This difference can be explained by the lower share of agriculture in the region and the higher household density. Regions with a similar per-capita emissions Brussels, Helsinki and Madrid. The emissions per-capita are below the average of the regions and are also below the European average. They are similar to the per capita emissions of Sweden. The data has been largely compiled using GRIP level 2 and 3 and therefore carries a higher degree of uncertainty with it.

The table below displays the emissions for the whole of the Porto Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 99.9% of CO_2 emissions and 91% of CO_2e emissions. The dominance of CO_2emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Porto Chart 5 above show that the energy sector is responsible for 92% emissions, Industrial Processes for less than 1%, Waste for 5% and Agriculture 3% of emissions. This shows the need to focus on the energy system needed for Porto to be a low-carbon region of the future.



Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	11002.69	0.98	0.38				11141.74	
Residential	1165.74	0.02	0.02				1171.89	
Services	1117.63	0.03	0.02				1123.18	
Industry	2812.18	0.52	0.06				2843.11	
Energy Industry	415.51	0.01	0.01				417.49	
Transport	4974.05	0.39	0.27				5065.83	
Fugitive	517.58	0.01	0.01				520.22	
Industrial Processes	9.18	0.00	0.00	56.66	0.00	0.00	65.84	
Waste	0.00	22.17	0.30				557.91	
Agriculture		10.30	0.53				379.32	
Total	11011.87	33.45	1.21	56.66	0.00	0.00	12144.80	

Rotterdam

Nico Tillie
N.Tillie@dsv.rotterdam.nl

Koldo Verheij
koldo.verheij@dcmr.nl

ROTTERDAM is a modern city with wide boulevards, parks and waterways beautifully situated at the river Maas. It was established around 1100 and was the worlds largest port from the sixties until recently. It is now the largest port in Europe.. About 100 different nationalities live in Rotterdam, about 50% of the population is from non-Dutch origin or their parents are. Rotterdam is the Netherlands second city with 583.000 inhabitants and 1.2 million in the cityregion. It is situated in the western part of the Netherlands. It is part of the Randstad. This horseshoe shaped metropolis accounts for nearly half of the Netherlands population (16.5 million) and economic activity. The city including the port covers an area of 320 square km. In the port a number of oil companies operate giant storage tanks. This area plays a crucial role in western Europe in the landing, storage and refining of oil products. The transport and distribution sector is prominent. Enterprises in other sectors associated with international transport, such as banking, insurance and commerce have also become established in Rotterdam. Other important sectors next to the refineries include gas and chemical industries, shipping, transport and metal industries, the manufacture of instrumentation , the food and drink industry, building, architecture and design and medical.

In recent years air water and soil pollution (chemical) waste, noise exposure and external safety have commended greater attention in this densily populated region. Due to action the air and water has become cleaner. Several species of fish are returning to the waters including salmon. What's happening now and what are the goals for the nearby future? Rotterdam is constantly changing. The city is permanently working at it's future. After the successful period of the post-war reconstruction, Rotterdam continued enhancing it's status as an international city on the river The city centre witnessed the appearance of the Erasmus Bridge and the Kop van Zuid. Since then, the city has been boasting a skyline unique in the Netherlands. On the edges of the city beautiful residential districts have been built, like Prinsenland and Nesselande. New entertainment venues, restaurants and festivals have turned Rotterdam into a place with a young, trendsetting image. It is one of the cities with the youngest population in Europe about 40 % of the population is below 25. The coming years the city will grow further.

The city has chosen to grow in a sustainable way. The City of Rotterdam, The Port of Rotterdam NV, DCMR Environmental services Rijnmond and Deltalinqs work together in the The Rotterdam Climate Initiative to achieve significant reductions in CO_2 emissions and to prepare the city for climate change. By 2025 Rotterdam aims to have booked a 50% reduction in CO_2 emissions in the Rotterdam region-compared to the levels in 1990 for both the city and the port. At the same time the region must be able to adapt and cope with the consequences of climate change such as a rise in sea level Transformations of the city and port together with new developments should significantly contribute to achieving these targets over the coming years. This must go hand in hand with the creation of new economic opportunities.

Climate issues become an opportunity for the city. The ultimate aim is to create a city that is not only climate resistant and CO_2 neutral, but also prosperous and attractive. The climate programme is not autonomous. It must become an integral part of the day-to-day policies and practices. The programme is not only aimed at a few prominent green buildings, but especially targets existing neighbourhoods, districts and cities. A crucial aspect is the change in scale from the level of individual buildings to cluster level, district level and even to the level of the entire city and region.

The previous page contains an overview of the Rotterdam Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Rotterdam hosts the largest sea port in Europe and has a large associated energy transformation industry and transport distribution network. The energy that it consumes is mostly liquid and gas fossil fuels.

The inventory for the Rotterdam Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Rotterdam Chart 1); secondly the emissions from industrial processes (Rotterdam Chart 2); thirdly the emissions from agriculture (Rotterdam Chart 3) and finally the emissions from waste (Rotterdam Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of the Netherlands.

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Rotterdam area in 2005 was 17 081 kt CO_2e. Rotterdam Chart 1, on the opposite page presents the Emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Rotterdam the emissions from the residential sector accounted for 9% of energy emissions, the service sector made up 9% of CO_2e emissions, the industrial sector 10% and the transport sector 7%. The energy industry of Rotterdam represented 64% of emissions and finally fugitive emissions account for 1%. This mix may be explained due to the large numbers of oil refineries around Rotterdam's sea port which dominate the energy emissions. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Rotterdam Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the energy industry, transport and fugitive emissions, 27% of industry emissions were estimated using level 1 methods, level 3 methods were used to 100% of the residential and service sector emissions. This means that some of the data entered by the team in Rotterdam was sourced from locally measured data sets. The collection of energy consumption data for the industry, residential and service sectors presented here has since been improved, and this has improved the reliability of the inventory. However this was done on the day the document went to press, and so could not be included. Future applications of the inventory will enable year-on-year energy based emissions to be compiled for the Rotterdam area in the years ahead.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 148 kt CO_2e. The breakdown is presented in Rotterdam Chart 2, and is comprised of 30% from mineral products, 9% from chemical industry, 23% from the production of halocarbons and SF_6 and 38% from the consumption of halocarbons and SF6. This sector is largely a reflection of the nature and extent of these industries within the region. The data shows that Rotterdam has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from consumption of halocarbons and SF_6 and 16% of the emissions from the mineral product, level 3 data was used to estimate 100% of the chemical industry and the production of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This relationship can be built upon to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

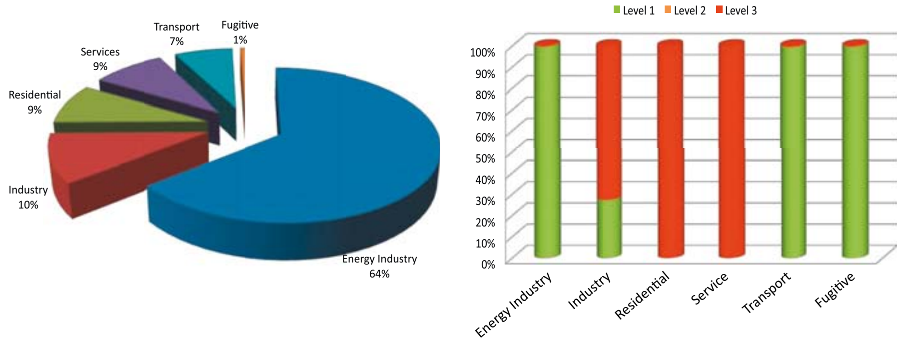
Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

The inventory shows that 132 kt CO_2e were emitted from the agricultural sector within the region in 2005. Rotterdam Chart 3 shows the total is made up of 40% from enteric fermentation and 60% from manure management. All these emissions have been estimated using level 3 approaches.

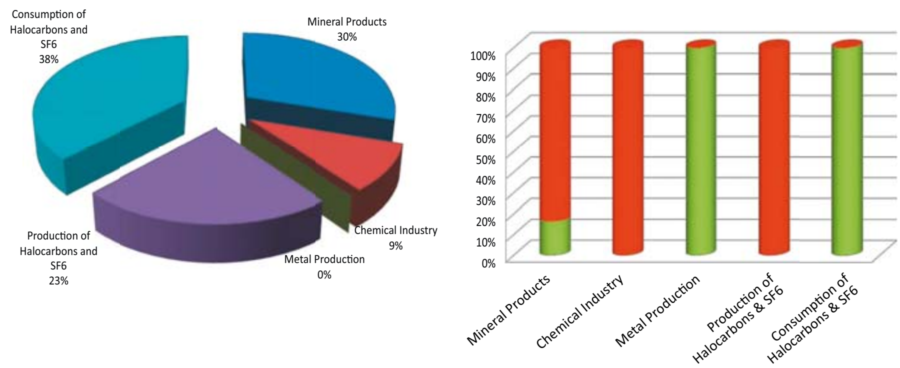
Waste

Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

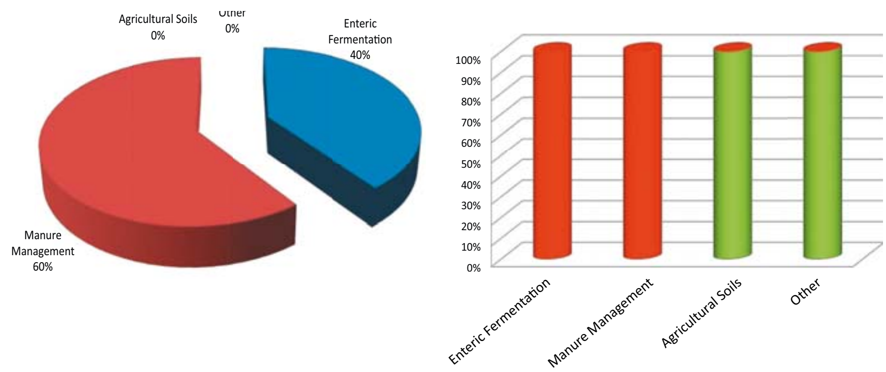
The inventory shows that 280 kt CO_2e were emitted from the waste sector in 2005. As shown in Rotterdam Chart 4 the total is made up of 91% from managed waste disposal, 8% from waste water and 1% from incineration. The emissions have been estimated using level 3 methods for 100% of the emissions from managed waste disposal and level 2 methods for 100% of the emissions from waste water and incineration.



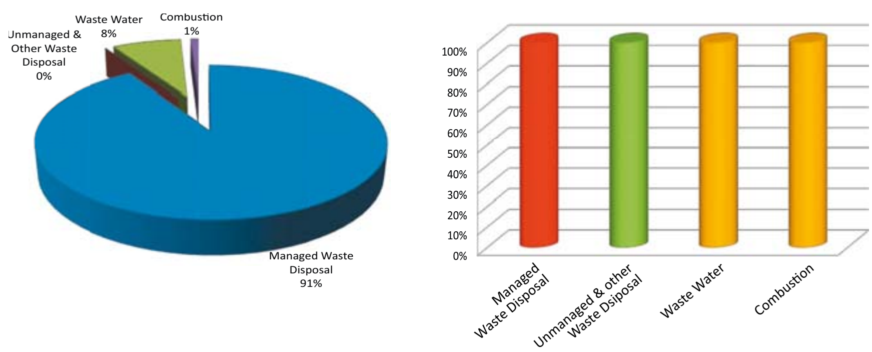
Rotterdam Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e)
Right: GRIP level used (CO_2e).



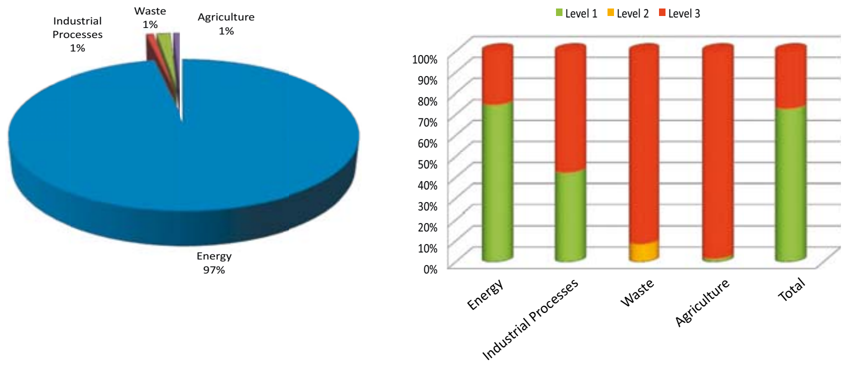
Rotterdam Chart 2: Left: Emissions from industrial processes (CO_2e).
Right: GRIP level used (CO_2e)



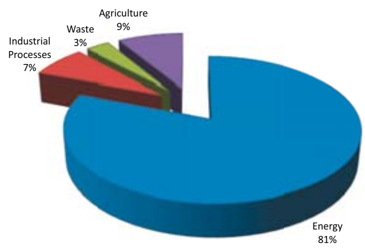
Rotterdam Chart 3: Left: Emissions from agriculture (CO_2e).
Right: GRIP level used (CO_2e)



Rotterdam Chart 4: Left: Emissions from waste (CO_2e).
Right: GRIP level used (CO_2e)



Rotterdam Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Rotterdam Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Rotterdam Region are displayed in Rotterdam Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Holland are displayed in Rotterdam chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a significantly higher share of emissions from energy then that displayed nationally, this is largely due to the petroleum refineries in the region. The emissions per-capita of the region are 29.8tCO_2e compared to 13tCO_2e in Holland. This difference can be explained by the substantial contribution that the petroleum refineries make to overall regional emissions. There are no other partner Regions with a similar per-capita emissions. The emissions per-capita are above the average of the regions and are above the European average. The data has been largely compiled using a mix of GRIP's methodological levels. Therefore there is some uncertainty. However, this anomaly is a good indication of the need for sector and sub-sector based reductions rather than overall reduction targets.

The table below displays the emissions for the whole of the Rotterdam Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 99.7% of CO_2 emissions and 96.2% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Rotterdam Chart 5 above show that the energy sector is responsible for 97% emissions, Industrial Processes for 1%, Waste for 1% and Agriculture 1% of emissions. This shows the need to focus on the energy system needed for Rotterdam to be a low-carbon region of the future.

Note: This inventory differs from a previous inventory conducted by Rotterdam themselves, due mostly to the allocation of electricity

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	16978.59	3.58	0.09				17080.67	
Residential	1434.63	1.24	0.01				1462.29	
Services	1538.26	0.16	0.00				1542.83	
Industry	1775.23	0.16	0.01				1780.98	
Energy Industry	10972.67	0.64	0.03				10995.62	
Transport	1185.76	0.07	0.04				1198.82	
Fugitive	72.06	1.32	0.00				100.12	
Industrial Processes	44.24	0.68	0.00	74.56	6.46	0.00	148.11	
Waste	0.00	12.66	0.05				280.13	
Agriculture		6.30	0.00				132.35	
Total	17022.83	23.22	0.13	74.56	6.46	0.00	17641.25	

Stockholm

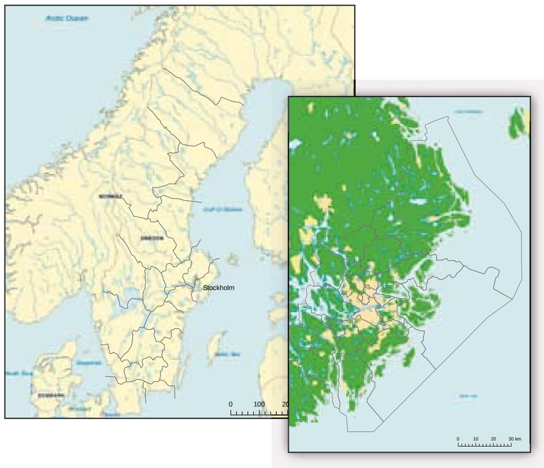
Michael Viehhauser
Office of Regional Planning
Stockholm
tel +46 70 737 44 99

Regionplane- och trafikkontoret
STOCKHOLMS LÄNS LANDSTING
Office of Regional Planning and Urban Transportation, Stockholm County Council

STOCKHOLM region (county's land area 6,500 sq km, 1.9 percent of the national territory) comprises 26 municipalities. 25 percent is covered by settlements and infrastructure and only 14 percent is arable land. The countryside is hilly with a great number of lakes. The coast is jagged, with an archipelago of thousands of islands offshore. Stockholm developed due to its strategic situation as a port and being the capital of Sweden.

The region has 1.95 million inhabitants (21 % of Sweden's population) whereof 0.8 m in the City of Stockholm. Population growth rates have been constant in the past (between 0,5 and 1% annually) and it is expected that the region will have 2,4 million inhabitants in 2030. Population densities are 285 inh./sq km for the County and 4 050 inh./sq km for the metropolitan area.

The region is one of the most successful metropolitan regions within the OECD. The region stands for almost 30 percent of Sweden's GDP. It comprises 1 million working places and has an advanced business, many logistical and financial services, few heavy industries, an established R&D strength, a solid housing stock and a very high share of public transport use. The region experienced large levels of growth during the last ten years particularly within the service sector which now stands for 85 percent of GDP. Its high educational attainment, low unemployment, small poverty levels and strong public health performance mean that it also ranks highly in terms of quality of life. Stockholm is also a major transport hub in Sweden and Norden with its big harbours and airports.



The Stockholm region's ambitious mitigation policies reach back into the early 1990s. Since that the total CO_2-emissions have been reduced by around 12 % despite economic growth and 300 000 new inhabitants. The energy use of the region is around 53 TWh whereof 18 TWh are oil products (2005). The use of oil products has decreased by 50% since 1980. Since 1990 the amount of using waste as energy source has risen by more than 400 %, the use of biomass by more than 500 %. Together these two energy sources stand for 15 % of primary energy use. The electricity used (ca. 22 TWh/year) stems from nuclear and hydro power as well as biomass power plants i.e. it is almost CO_2-neutral. The electricity used per unit GVA decreased from 90 kWh/1000 SEK in 1980 to 28 kWh/1000 SEK in 2005 which shows that economic growth is possible without using more energy. The nomination of Stockholm to be the first "Green Capital of Europe" proves this.

The biggest contributor to a clean and climate friendly environment in Stockholm is the widespread use of district heating which is one of the biggest systems in Europe. This system is also combined with district cooling which gives high economic and environmental benefits. There are 8 big district heating companies that have linked their systems into one growing system i.e. they use the most efficient and climate effective plants in the region for their base production. Also a big number of big heat pumps, partly fed by waste water, contribute to the clean district heating energy. In 2020, the district heating shall be completely independent of fossil fuels.

The region's holistic vision combines growth with sustainable development and includes the ambitious target of becoming independent of fossil fuels by 2050. The amount of GHG emissions per inhabitant (4.6 ton/year in 2005) is 50% lower than the national average. Road transport emissions are relatively high and make 45% of the county's direct CO_2-emissions. All public transport will run on renewable fuels and green electricity by 2020. Emissions per person have, since 1990, been reduced by 12% and shall be reduced to annually 3.5 ton/inhabitant in 2020 i.e. again by 25% compared to today.

The previous page contains an overview of the Stockholm Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Stockholm has a large service sectors and high tech light industry and contains major sea and air transport hubs. It also tells us that the region uses a high proportion of biomass compared to fossil fuels and benefits from a low carbon electricity supply. Only Stockholm's transport sector still uses significant amounts of fossil fuels.

The inventory for the Stockholm Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Stockholm Chart 1); secondly the emissions from industrial processes (Stockholm Chart 2); thirdly the emissions from agriculture (Stockholm Chart 3) and finally the emissions from waste (Stockholm Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Sweden (Stockholm Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Stockholm area in 2005 was 6355 kt CO_2e. Stockholm Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Stockholm the emissions from the residential sector accounted for 17% of energy emissions, the service sector made up 14% of CO_2e emissions, the industrial sector 9% and the transport sector 54%. The energy industry of Stockholm represented 4% of emissions and finally fugitive emissions account for 1%. This mix may be explained by the very low levels of fossil fuels used in sectors other than transport as well as the low carbon electricity supply. Stockholm hosts a number of air and sea ports using fossil fuels and furthermore private car transport is mainly reliant on fossil fuels too, this results in the high proportion of emissions associated with this sector. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Stockholm Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the service sector, industrial sector, transport sector and fugitive emissions, 99% of residential sector emissions and 47% of energy industry emissions. This means that nearly all the data entered by the team in Stockholm was sourced from local measured data sets. Further local information on the energy use by the local energy industry will enable year-on-year energy based emissions to be compiled for the Stockholm area in future years.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 172 kt CO_2e. The breakdown is presented in Stockholm Chart 2, and as can be seen in the chart it is made up entirely from the consumption of halocarbons and SF_6. This sector is largely a reflection of the type of the industry within the region. The data shows that Stockholm does not host the types of industrial sites that are responsible for these types of emissions. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from the consumption of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has clearly been done here to identify that no relevant sites exist. This relationship can be built upon to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

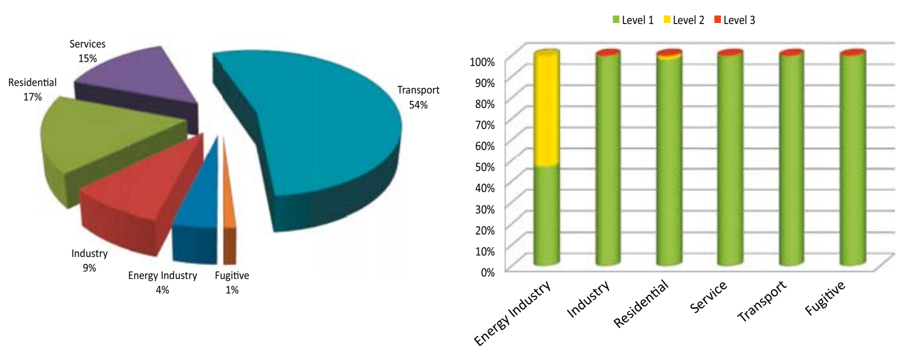
Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

The inventory shows that 236 kt CO_2e were emitted from the agricultural sector within the region in 2005. Stockholm Chart 3 shows the total is made up of 28% from enteric fermentation, 3% from manure management and 69% from agricultural soils. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation and manure management and level 2 approaches were used for 100% of the emissions from agricultural soils.

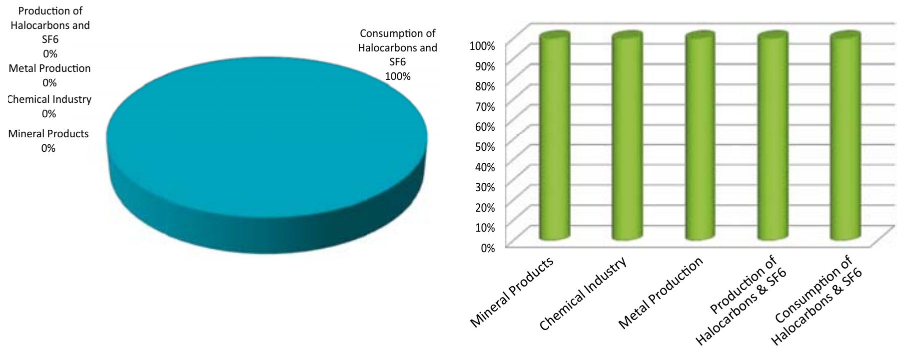
Waste

Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated without electricity production.

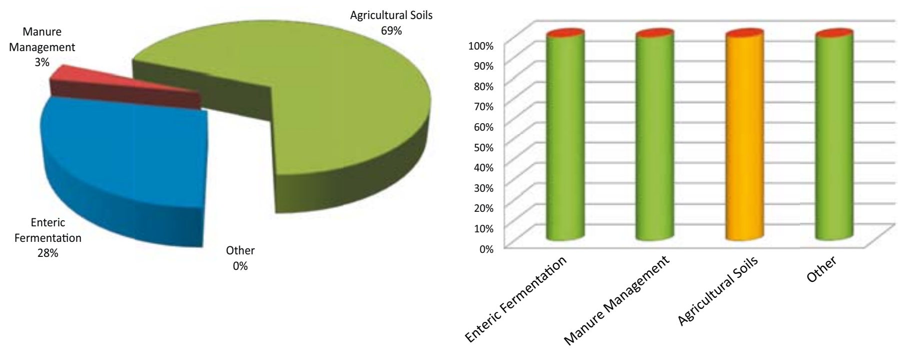
The inventory shows that 116 kt CO_2e were emitted from the waste sector in 2005. As shown in Stockholm Chart 4 the total is made up of 75% from managed waste disposal and 25% from waste water. The low levels of waste emissions reflect the large amount of waste that is used in electricity production in Stockholm. The emissions have been estimated using level 2 methods for 100% of the emissions from managed waste disposal and waste water.



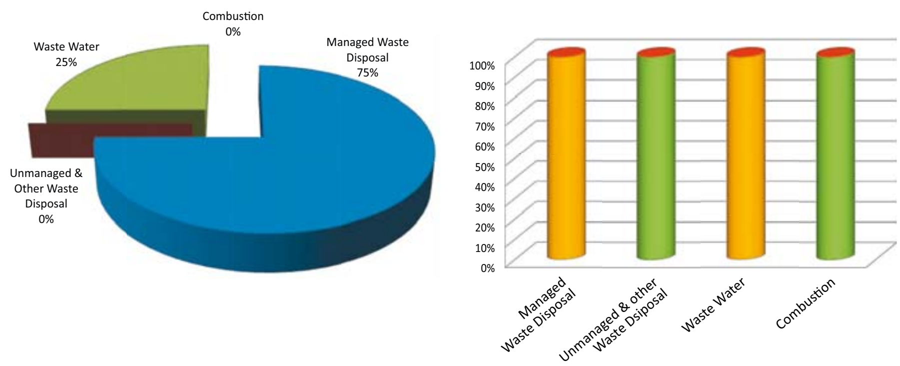
Stockholm Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



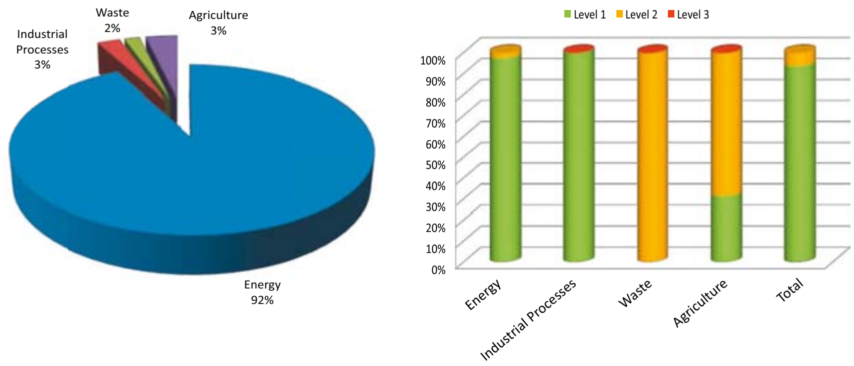
Stockholm Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



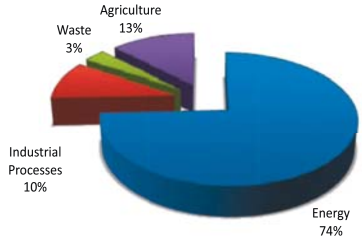
Stockholm Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Stockholm Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Stockholm Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Stockholm Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Stockholm County Region are displayed in Stockholm Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Sweden are displayed in Stockholm chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of emissions from energy then that displayed nationally, this is largely due to the low levels of agriculture in the region. The emissions per-capita of the region are 3.64tCO_2e compared to 7.4tCO_2e in Sweden. Regions with a similar per-capita emissions in this project include Oslo and Napoli. The emissions per-capita are below the average of the regions and are below the European average. The data has been largely compiled using measured data sets and therefore the results are reliant on the accuracy of these.

The table below displays the emissions for the whole of the Stockholm County Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 100% of CO_2 emissions and 90% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Stockholm Chart 5 above show that the energy sector is responsible for 92% emissions, Industrial Processes for 3%, Waste for 2% and Agriculture 3% of emissions. This shows the need to focus on the energy system needed for Stockholm to be a lower-carbon region of the future. It should be noted that Transport accounts for more than half of these emissions.

Note: This inventory differs from an existing inventory for Stockholm. This is mostly due to a different emissions factor being used for electricity consumption: GRIP uses a Sweden-specific one; the other inventory uses a Nordi-wide one.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	6189.58	1.54	0.43				6354.54	
Residential	1029.05	0.78	0.13				1085.35	
Services	871.02	0.27	0.11				909.91	
Industry	560.42	0.10	0.07				584.05	
Energy Industry	255.32	0.06	0.03				264.26	
Transport	3403.51	0.31	0.09				3436.96	
Fugitive	70.27	0.03	0.01				74.00	
Industrial Processes	0.00	0.00	0.00	166.14	0.37	0.00	171.50	
Waste	0.00	4.13	0.09				115.60	
Agriculture		3.48	0.53				236.05	
Total	6189.58	9.15	1.05	166.14	0.37	0.00	6877.68	

Stuttgart MR

Markus Siehr
Verband Region Stuttgart
Kronenstraße 25
70174 Stuttgart

Verband Region Stuttgart

The Stuttgart Region forms the core of the European Metropolitan Region of Stuttgart. With a population of over 2.7 million, the former is one of the most densely populated and most successful economic centres in the country. In this area intertwined in various ways, close collaboration between regional partners is imperative. The Verband Region Stuttgart was set up in 1994 as a political organisation with a directly elected Regional Assembly and autonomous authority as a stable foundation for regional co-operation. In particular, this includes being the body responsible of the S-Bahn commuter railway system and of parts of public local transport that have regional importance, of regional business and tourism promotion and regional planning, regional transport and infrastructure planning.

In addition to this formalised and politically legitimized co-operation, the Stuttgart Region works closely together with local authorities and regional associations surrounding the metropolitan region in a network-like, project-specific partnership. The "European Metropolitan Region of Stuttgart" co-ordinating committee was formed in 2007 as a platform for co-ordination on which the local authorities co- operate for the successful development of the entire metropolitan region.

Today the Stuttgart Region is the driving force in the greater regional context, and in a relatively small area covering 3,654 km2 achieves a similar annual gross value added to that of Portugal (about 92 billion euros in 2007). The main features of this market are the high export figures (58 %), the low level of unemployment (approx. 6%) compared to the national average, and a high concentration of jobs, with over one million gainfully employed in the region and subject to social insurance contributions. The average age of the local population (41.3 years of age) is comparable with the average of the federal state of Baden-Württemberg. The region's international character is evident in the population structure: some 16% of the region's inhabitants hold a foreign passport. The Stuttgart Region is present in key business metropolises, with a permanent representation in Brussels and an office in the USA.

Its expertise as a troubleshooter is respected worldwide. International delegations from the USA, for instance, follow the work of the Stuttgart Region and its successful approach to regional collaboration with great interest. Particular advantages are the central geographical location and ease of access via its international airport. The New Trade Fair Centre provides the region with a closely-watched shop window for the engineering skills and inventive spirit of Baden-Württemberg. This location benefit is exploited by research-based high-tech industries and numerous global players alike, such as Daimler, Bosch, IBM and others. There is also an agglomeration of highly inventive medium-sized companies, some of them world market leaders, e.g. Trumpf, Stihl and Mahle. Its position at the top of the national league for patent applications is due not just to the traditional sectors of automobile and mechanical engineering, but increasingly to eco-friendly technology as well. Leading firms in this sector are based in the Stuttgart Region.

For some years now, the Stuttgart Region has pursued sustainable regional development that also encompasses strategies and measures to combat climate change. In the METREX network the Stuttgart Region has initiated a transatlantic climate dialogue with its partner region Northern Virginia that is an example to the nation. The Stuttgart Region's involvement in the EU project EU CO2 80/50 signifies a further step towards its claim to position and establish itself as a model for climate change in metropolitan regions throughout Europe.

The previous page contains an overview of the Stuttgart Metropolitan Region. This background offers a useful insight into the sources and levels of GhG emissions that we expect to see in the region. The overview tells us that the Stuttgart region is very densely populated and has a very high economic output. The region's industry sector also consumes a disproportionately high amount of electricity.

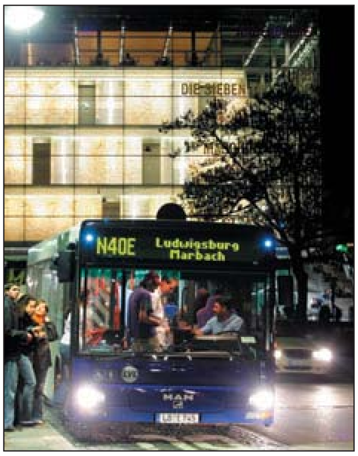
The inventory for the Stuttgart Metropolitan Region is presented below. This is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Stuttgart Chart 1); secondly in terms of emissions from industrial processes (Stuttgart Chart 2); thirdly in terms of the emissions from agriculture (Stuttgart Chart 3) and finally in terms of the emissions from waste (Stuttgart Chart 4). We then present total GhG emissions from the region, and the breakdown of emissions sources from Germany (Stuttgart Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2, methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Stuttgart Metropolitan area in 2005 was 40895 kt CO_2e. Stuttgart Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of



the energy sectors emissions in terms of CO_2e. It shows that the emissions from the residential and service sectors made up 58% of CO_2e emissions, the industrial sector 25%, the transport sector 14%. There are no petroleum refineries or solid fuel transformation plants etc in the region and therefore there are no emissions from the energy industry. Finally, fugitive emissions account for 2.5%. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Stuttgart Chart 1 shows the GRIP levels used for each sub-sector as a percentage of the emissions from that sub-sector. This insert shows that level 1 methods were used for 100% of domestic and service sector emissions, 50% industrial sector emissions, 100% of transport sector emissions and 100% of fugitive emissions. This means that all the data entered by the team in Stuttgart was largely sourced from local measured data sets. This means that the inventory has been mostly produced using the highest level available data. However, it does identify gaps in the data that is available, in particular the energy consumption data of the domestic and service sectors which were reported together need to be resolved. This shows a clear potential for improvement in future emissions inventories. By establishing and maintaining the demand for this data future emissions inventories the organizations that hold it are more likely to release it, enabling more certain year-on-year energy based emissions to be compiled for the Stuttgart Metropolitan area in the future.

Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of certain products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 364 kt CO_2e. The breakdown is presented in Stuttgart Chart 2, and is comprised solely of emissions from the consumption of halocarbons and SF_6. This sector is largely a reflection of the type and extent of the industry within the region. The data shows that Stuttgart does not have any of the industrial sites that are responsible for other emissions. Level 1 methods were used to estimate 100% of the emissions from consumption of halocarbons and SF_6.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it may require a relationship to be set-up with the regulatory body that monitors the large industrial units in the region, if they can set-up the data collection this will enable future versions of the emissions inventory to be populated with more level 1 data. In this case, these links have been made and established that no sites of the type relevant to this sector are in existence.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

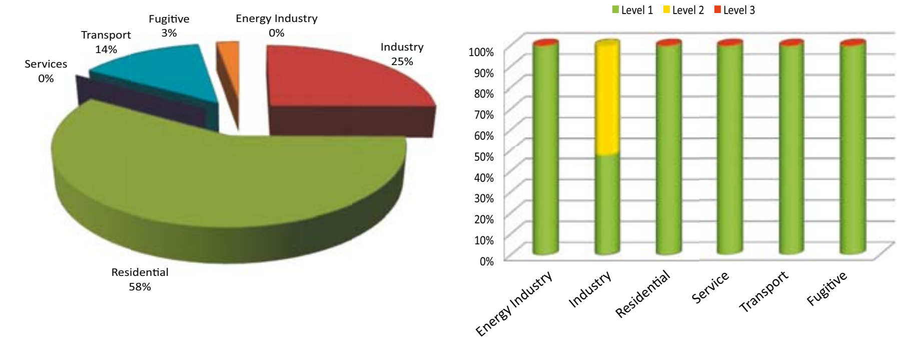
The inventory shows that 875 kt CO_2e were emitted from the agricultural sector within the region in 2005. The breakdown is shown in Stuttgart Chart 3 showing 15% are from enteric fermentation, 3% are from manure management and 82% are from agricultural soils and, 0% from other sources. These emissions have been estimated using level 1 approaches for 100% of enteric fermentation emissions, 100% of manure management and 0% of agricultural soil emissions. The comparatively higher share of emissions from agricultural soils within this sector may be due to the method used to estimate them – they do however only account for less than 2% of total regional emissions.

Waste

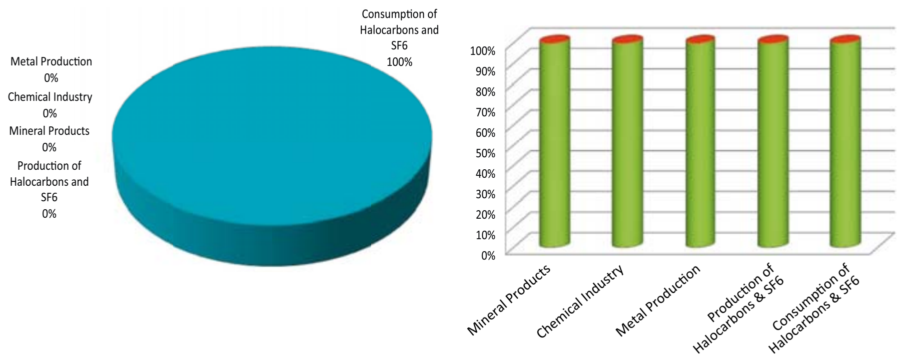
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited in landfill sites, the amount of waste water, whether it is domestic or industrial and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 435 kt CO_2e were emitted from the waste sector in 2005. Stuttgart Chart 4 shows that this total was comprised of 78% from managed waste disposal, 18% from waste water and 4% from incineration.

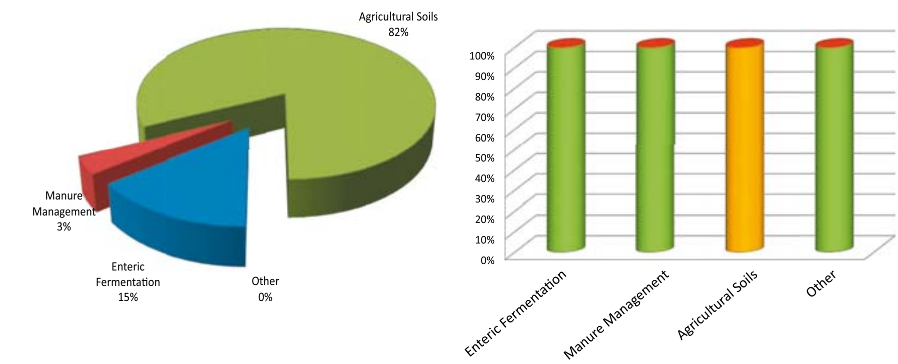
The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal, 100% of waste water emissions and 100% of emissions from incineration.



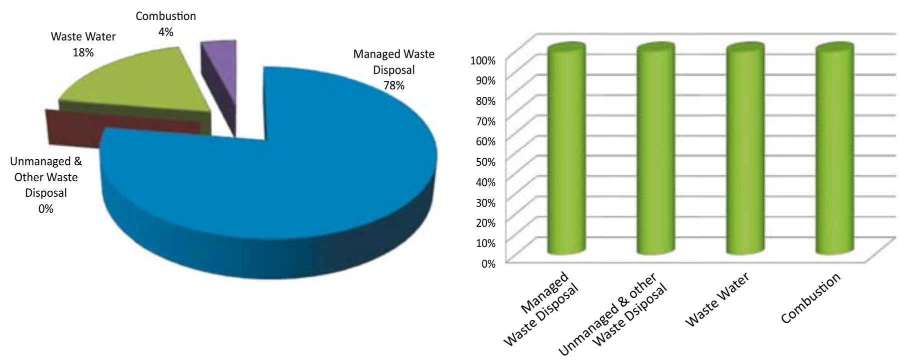
Stuttgart Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)



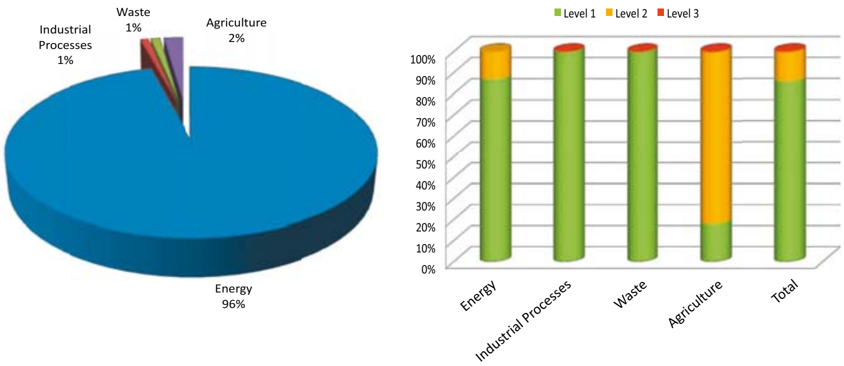
Stuttgart Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)



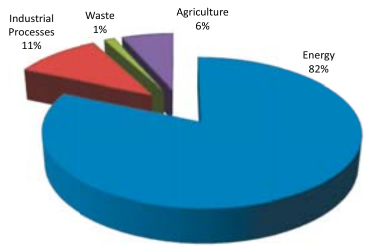
Stuttgart Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)



Stuttgart Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)



Stuttgart Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)

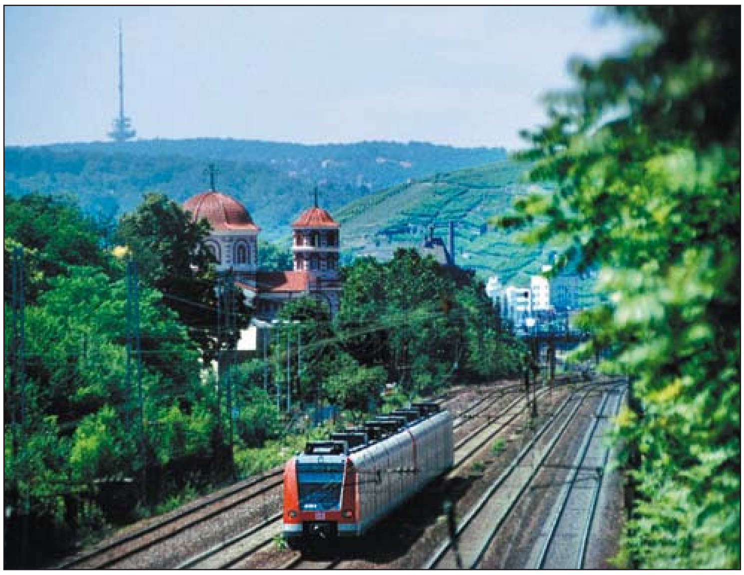


Stuttgart Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Stuttgart Region are displayed in Stuttgart Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Germany are displayed in Stuttgart chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a higher share of emissions from energy then that displayed nationally, this is largely due to the lower levels of agriculture in the region and a high level of industrial activity. The emissions per-capita of the region are $16tCO_2e$ compared to $12.2tCO_2e$ in Germany. There are no other regions with a similar per-capita emissions in this project. The emissions per-capita are above the average of the regions and are above the European average. The data has been largely compiled using measured data sets and therefore the results are reliant on the accuracy of these.

The table below displays the emissions for the whole of the Stuttgart Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 100% of CO_2 emissions and 95% of CO_2e emissions. The dominance of CO_2emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. It is this process that enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO$_2$ project, and are explained in more detail at the end of this document.

The table below and Stuttgart Chart 5 above show that the energy sector is responsible for 96% emissions, Industrial Processes for 1%, Waste for 1% and Agriculture 2% of emissions. This shows the need to focus on the energy system needed for Stuttgart to be a lower-carbon region of the future.



Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	40456.40	3.62	1.17				40894.52	
Residential & Services	23677.62	1.08	0.68				23912.29	
(Services row n/a)	*0.00*	*0.00*	*0.00*				*0.00*	
Industry	10178.71	0.36	0.30				10280.23	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	5611.28	0.29	0.15				5662.57	
Fugitive	988.78	1.90	0.03				1039.44	
Industrial Processes	0.00	0.00	0.00	286.21	4.27	0.00	363.95	
Waste	0.00	17.10	0.25				434.97	
Agriculture		7.51	2.31				874.51	
Total	40456.40	28.23	3.72	286.21	4.27	0.00	42567.95	

Torino

Gianfranco Fiora
fiorag@provincia.torino.it
+39 011 8613196

Cristian Villata
cristian.villata@csi.it
+39 011 8613076

THE PROVINCE OF TORINO dates back to the period when the Sabauda Dynasty settled down in the Sub-alps area. In fact, Savoia used to divide the territory under control in administrative units called "provinces", given to the administration of a reliable person.

Since then, the Province has performed different functions in different historical periods, though it has continued to carry out important activities in support of the municipalities, especially the small ones, within its territory. The Province is part of Piemonte region, situated in North–West Italy. It is at the upper end of the Po river basin area at the head of the Susa Valley. Together with the Bardonecchia area, it makes up the westernmost border of Italy.

It covers an area of 6,830 square km, more than a quarter of Piemonte and 2.26% of Italy. The physical feature of the region is about half mountains (Alps), a sixth hills and the remainder plains (Padan Plain). It includes 315 municipalities, the highest number of municipalities among Italian provinces.

Over the 50% of the population living in the Province is concentrated in Turin and in the surrounding urban area. The population density is higher than the national average. In 2005 it was equal to 328 inhabitants per square kilometre, compared to a national figure of 195. The variation of the population shows a growth between 1971 and 1981, fallowed by a gradual decline, according to 1991 and 2001 demographic surveys.

Since 2001 the resident population has returned to grow from 2,165,299 to 2,242,775 inhabitants in 2005, with a trend of steady growth. A significant contribution to this positive trend is represented by immigrants coming from European and not European countries. In ten years the percentage of foreign population rose from 1% in 1995 to almost 5% in 2005.

In 2005 the population older than sixty years exceeds 22% of the total. In the period 1991 - 2000 the old-age index increased by 25%, and there are ample reasons to assume that this value has continued to grow thanks to the continuous lengthening of life expectancy.

In January 2005 the value added was 55,105 million euros, equal to 4.3% of national value added. 70.6% was produced in services sector, 28.8% in manufactory, 5.2% in construction and 0.6% in agriculture. Enterprises in services were about 60% of total enterprises in the Province, of which about 27% worked in commerce and 24% in services to enterprises.

Though services sector has been increasing in importance, the Province keeps its tradition of being an important industrial centre. In addition to the traditional manufactory productions, such as food and wine, machinery and automobile (FIAT), it has developed new production specialisations in sectors such as information technology, automotive, aerospace, biotechnology, renewable energies sources.

However, transport equipment remains the main production exported (40% of total), followed by machinery and mechanical appliances (21%), and electrical - electronic equipment (10%).

The unemployment rate has been fluctuating around 6% and 4% in recent years (4.8% in 2005), influenced by national and international economic situation; it is higher for women than for men.

The previous page contains an overview of the Turin Region. This background offers a useful insight into the size and sources of GhG emissions that we expect to see in the region. The overview tells us that Turin has a comparatively higher amount of people working in industry than that displayed nationally and has a growing service sector. The energy that it consumes is largely fossil based.

The inventory for the Turin Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Turin Chart 1); secondly the emissions from industrial processes (Turin Chart 2); thirdly the emissions from agriculture (Turin Chart 3) and; finally the emissions from waste (Turin Chart 4). We then present total GhG emissions from the region and the breakdown of emissions from the whole of Italy (Turin Charts 5 and 6).

Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the levels potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in Turin in 2005 were 17604 kt CO_2e. Turin Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions, in terms of CO_2e. It shows that the emissions from the residential sector made up 23% of CO_2e emissions, the service sector 15%, the industrial sector 36%, and the transport sector 23%. There are no petroleum refineries or solid fuel transformation plants in the region and therefore there are no emissions from these sources. Finally, fugitive emissions account for 3%. This mix can be explained due to the higher amount of industry in the region compared to that displayed nationally, plus the somewhat lower population density of the region compared to the national average. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in relation to the GRIP methodological level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. Turin Chart 1 shows the GRIP levels used as a percentage for estimating the emissions from each sub-sector in the inventory. The Chart shows that level 1 methods were used to estimate 100% of the emissions from the domestic sector, 100% from the service sector, 100% from the industrial sector, 100% transport sector, 100% the energy industry and, 100% of fugitive emissions. This means that all the data entered by the team in Turin was taken from local measured data sets and that this section of the inventory was produced using the highest level available data in terms of that specific to the inventory area. This shows a clear potential for future emissions inventories to be compiled for Turin enabling reliable year-on-year comparisons to be made to assess the success of emission reduction measures from this sector.

Industrial Processes

Industrial Process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of certain products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 2 508 kt CO_2e. This is presented in Turin Chart 2, and is comprised of 52% mineral products, 23% chemical industry, 2% metal production, 0% production of halocarbons and SF_6 and 23% consumption of halocarbons and SF_6. The sectoral split reflects the nature and extent of the industry within the region. In terms of this sector, level 2 methods were used to estimate 98% of the emissions from mineral products, level 3 methods were used to estimate 100% of the emissions from the chemical industry, 72% of metal production emissions, 100% of the emissions from the consumption of halocarbons and SF_6.

The emissions here are less reliable if they have not been estimated using level 1 approaches. The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it may require a relationship to be set-up with the regulatory body that monitors the large industrial units in the region, if they can set-up the data collection this will enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and with the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

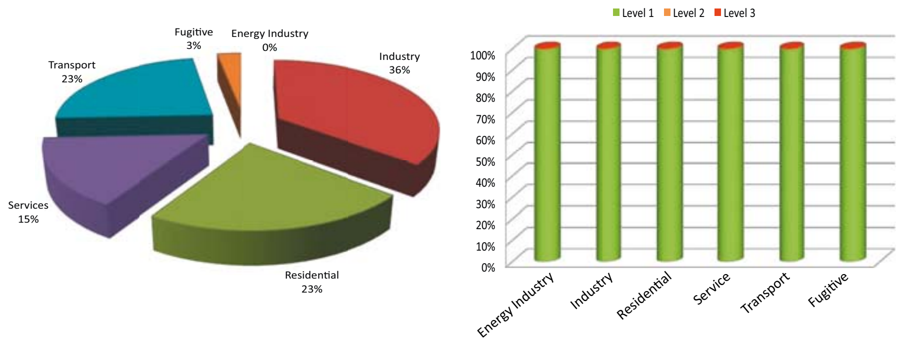
The inventory shows that 1 466 kt CO_2e were emitted from the agricultural sector within the region in 2005. This is comprised of 74% enteric fermentation, 12.5% manure management, 13.5% agricultural soils and, 0.15% from other sources. These emissions have been estimated using level 1 approaches for 100% of the emissions total given from enteric fermentation and other sources, 91% of manure management emissions, level 2 methods were used to estimate 100% of agricultural soil emissions.

Waste

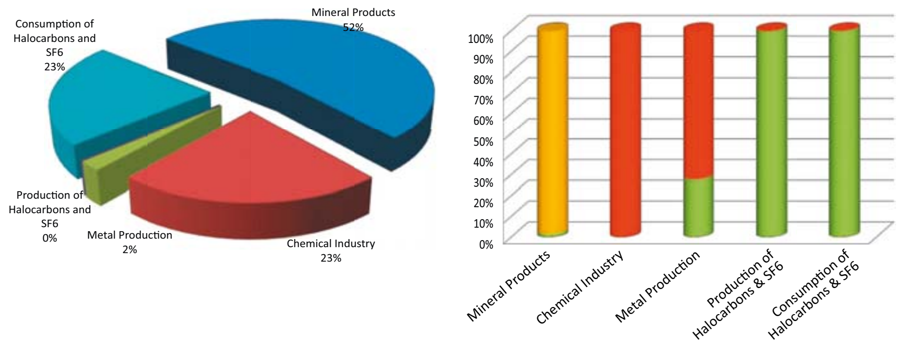
Waste emissions include CO_2, CH_4 and, N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to land-fill sites, the amount of wastewater, whether it is domestic or industrial and the amount of waste which is incinerated. The size of emissions reflect the volume of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 284 kt CO_2e were emitted from the waste sector in 2005. In the case of the region this was comprised of 38% from managed waste disposal, 30% unmanaged waste disposal, 32% waste water and 0.001% incineration.

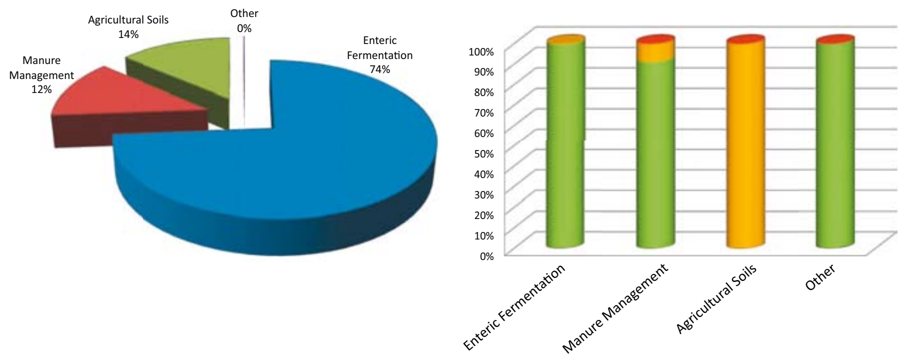
The reasons for the higher than average emissions from landfill sites is due to the region's assumed propensity to use landfill over incineration. The emissions have been estimated using level 1 methods accounting for 100% of the emissions presented from managed waste disposal and from waste water and level 2 methods were used for 100% of the emissions from unmanaged waste disposal and incineration. Thus, the amount of emissions from unmanaged waste disposal and incineration follow national averages, improvements to data collection in Turin could improve the quality of the estimates from these sources.



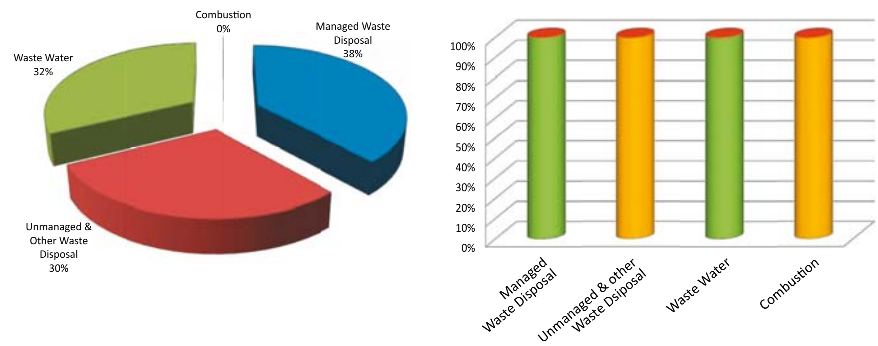
Turin Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e).
Right: GRIP level used (CO_2e)



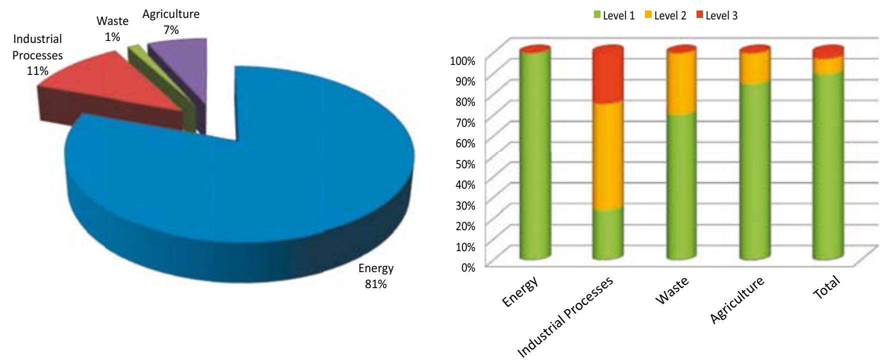
Turin Chart 2: Left: Emissions from industrial processes (CO_2e).
Right: GRIP level used (CO_2e)



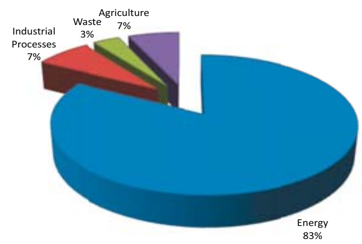
Turin Chart 3: Left: Emissions from agriculture (CO_2e).
Right: GRIP level used (CO_2e)



Turin Chart 4: Left: Emissions from waste (CO_2e).
Right: GRIP level used (CO_2e)



Turin Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)



Turin Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Turino Region are displayed in Turino Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Italy are displayed in Turino chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a similar share of emissions from energy to that displayed nationally. The emissions per-capita of the region are 9.8tCO_2e compared to 9.9tCO_2e in Italy. Regions with a similar per-capita emissions in this project include Hamburg, Ljubljana and, Veneto. The emissions per-capita are slightly above the average of the regions and are above the European Community average. The data has been largely compiled using measured data sets and therefore the results are reliant on the accuracy of these.

The table below displays the emissions for the whole of the Turino Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 92% of CO_2 emissions and 78% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Turino Chart 5 above show that the energy sector is responsible for 81% emissions, Industrial Processes for 11%, Waste for 1% and Agriculture 7% of emissions. This shows the need to focus on the energy system needed for Turin to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	17152.93	11.69	0.66				17604.24	
Residential	3986.21	0.19	0.07				4011.47	
Services	2719.22	0.15	0.07				2743.44	
Industry	6281.48	0.24	0.11				6320.78	
Energy Industry	0.00	0.00	0.00				0.00	
Transport	3893.98	0.87	0.41				4040.35	
Fugitive	272.04	10.25	0.00				488.20	
Industrial Processes	1443.10	0.02	1.57	490.57	23.11	0.00	2507.63	
Waste	0.00	9.74	0.26				284.29	
Agriculture		60.36	0.64				1466.18	
Total	18596.02	81.82	3.13	490.57	23.11	0.00	21862.33	

Veneto

Romeo Toffano
Regione del Veneto
Dirigente Direzione Pianificazione Territoriale e Parchi
romeo.toffano@regione.veneto.it

Laura Susanetti
lsusanetti@arpa.veneto.it

THE VENETO region covers 18.391 square kilometre and is divided into 7 provinces and 581 municipalities. Its capital, Venice, a city rich in art and culture, is built on small islands in the lagoon. Some 29 percent of the territory is mountainous with peaks rising to over 3.000 m in the extreme north, while approximately 56 percent lies in the eastern Po plain, where numerous alpine rivers provide abundant supply of water.

Veneto's population reached 4.738.313 inhabitants at the end of 2005, increasing by 100.000 units in the following two years. The demographic growth mainly occurred in the central part of the region while its northern mountainous areas and southern lands are being struck by depopulation. The increase of foreign population is slowing down the process of demographic ageing underway in Veneto as on the rest of Italy, but it is not enough. Padua, Venice and Treviso are the most densely populated provinces (with 300 inh/km2), while Belluno is the least one (with 57 inh/km2).

Unemployment rate is at standard levels (4.2% in 2005), reaching in 2008 the lowest rates in the last decades (3.5%). Agriculture employs 3.7 percent of the workforce, industry 39.2 percent, a figure far higher than the national average (30.7 percent), and belying a decline dating back to the 1970s. The services sector is growing (57.1 percent of the workforce), but it is still far below the national average (65 percent). The number of self-employed is falling in agriculture as a result of the gradual modernization of the sector, while the rise in self-employment in industry and services is an indication of a thriving small-business system.

In 2005 the Veneto GDP went over €134 billion (9.4% of the national GDP) and the positive trend consolidated up to 2007, when a 1.8% growth rate was achieved. Although between 2000 and 2005 the number of local units in the manufacturing sector decreased by 20.5%, the turnover and the international projection of this sector increased, making Veneto the second region in Italy for national export rate.

The high population density over much of the region's territory has jeopardised the survival of often unique ecosystems. This is especially true of plain and coastal areas where the land conservation situation is potentially critical. Approximately 20 percent of the plain surface area lies below the level of the watercourses and is thus exposed to the danger of flooding, which affected the province of Rovigo in the 1950s. The coastal area is also affected by the gradual subsidence of land, which until the 1980s threatened the city of Venice itself.

The biggest Italian rivers, the Po in particular, flow into the sea in the coasts of Veneto. The Po drains the industrial triangle, the most industrialised and built-up region in Italy, and flows through the area with the highest density of intensive livestock breeding, in which the use of agricultural chemicals is at its highest. Even the region's own watercourses, both surface and ground waters, are today in danger.

Air pollution, mainly caused by road traffic, is a problem in almost all the cities of the Region. Energy production as well as fuel transformation industries are responsible of high sulphur dioxide emissions which affect mainly the area of Porto Marghera, near Venice, and the Po river delta area. Other industrial districts, like tanning, cement and furniture manufacturing districts influence ambient air quality in Vicenza, Padua, Verona and Treviso provinces.

The previous page contains an overview of the Veneto Region. This background offers a useful insight into the sources and size of GhG emissions that we expect to see in the region. The overview tells us that Veneto has a far higher proportion of people employed in the industrial sector than the wider Italian average. The energy that it consumes is mostly fossil based.

The inventory for the Veneto Region is presented below. The inventory is displayed by sector: firstly the emissions from the combustion, distribution, transformation and extraction of energy (Veneto Chart 1); secondly the emissions from industrial processes (Veneto Chart 2); thirdly the emissions from agriculture (Veneto Chart 3) and finally the emissions from waste (Veneto Chart 4). We then present the total GhG emissions from the region and the breakdown of the emissions in the whole of Italy (Veneto Charts 5 and 6).

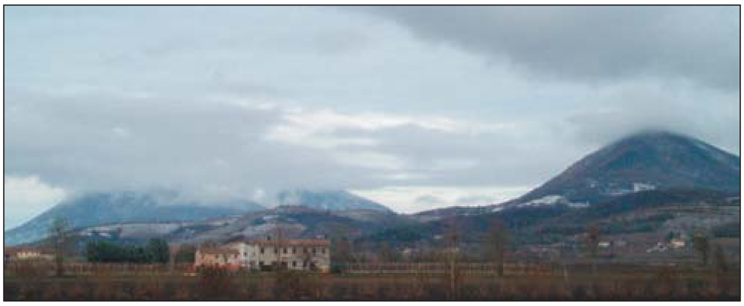
Emissions from the Energy Sector

Greenhouse gas emissions from the combustion, distribution, transformation and extraction of energy are of three types: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The levels of emissions vary depending on the manner in which energy is combusted/distributed/transformed/extracted, as well as the type of energy source (gas, solid, liquid, electricity etc).

The size of the emissions released from a region is determined by the type of energy combusted/distributed/transformed and extracted within it as well as how and where the electricity it consumes is produced. In this summary we present the overall data by sector, there are, depending on the GRIP level used potentially in excess of 1000 variables underpinning these figures. These are all available separately from the author.

The emissions from the energy sector in the Veneto area in 2005 was 39554 kt CO_2e. Veneto Chart 1, on the opposite page presents the emissions associated with energy from the region. It shows the relative size of the main components of the energy sectors emissions in terms of CO_2e. It shows that, in Veneto the emissions from the residential sector accounted for 18% of energy emissions, the service sector made up 15% of CO_2e emissions, the industrial sector 32% and the transport sector 30%. The energy industry of Veneto represented 2% of emissions and finally fugitive emissions account for 3%. This mix may be explained due to the high economic share of the industrial sector in the region compared to that displayed nationally. Underpinning all of these figures are sector specific amounts of energy consumed / combusted and their associated emissions, all considered in terms of the GRIP level used to estimate them.

In GRIP there are three different methodological levels associated with each emissions source, depending on the data available to carry out the emissions calculations. The use of GRIP level 1 methodology requires information collected locally on, in this case, energy consumption by type from different sectors, and is the level with which the highest confidence can be attached to the emissions reported. The insert in Veneto Chart 1 shows the GRIP levels used for each sub-sector as a percentage, for estimating the emissions from each sub-sector. This insert shows that level 1 methods were used to estimate 100% of the residential sector, industrial sector, transport sector, energy industry and fugitive emissions and 96% of service sector emissions. This means that nearly all the data entered by the team in Veneto was sourced from local measured data sets. This will enable year-on-year energy based emissions to be compiled for the Veneto area in future years.



Industrial Processes

Industrial process emissions include the GhG emissions that are released from non-combustion chemical reactions at certain industrial sites, in addition they include emissions that are released during the maintenance of products such as air conditioning units. This is the only sector in a GhG emissions inventory that includes all six Kyoto GhGs.

In the case of this region the emissions are 3 285 kt CO_2e. The breakdown is presented in Veneto Chart 2, and is comprised of 75% from mineral products, 0.1% from chemical industry, 8% from metal production, 3% from the production of halocarbons and SF6 and 14% from the consumption of halocarbons and SF_6. This sector is largely a reflection of the nature and extent of the industry within the region. The data shows that Veneto has a range of industrial sites that are responsible for these emissions. In terms of this sector, level 1 methods were used to estimate 100% of the emissions from mineral products, the chemical industry, the production and consumption of halocarbons and SF_6 and 81% of the emissions from metal production.

The industrial sites responsible for these emissions are nearly always subject to monitoring requirements and it requires a relationship to be set-up with the regulatory body that monitors the large industrial units in the region. This has clearly been done here. This relationship can be built upon to enable future versions of the emissions inventory to be populated with more level 1 data.

Agriculture

Agricultural emissions include CH_4 and N_2O, they are primarily associated with farmed animals and the use of organic and inorganic fertilizers. There are additional emissions associated with the combustion of agricultural produce on fields.

The inventory shows that 3 277 kt CO_2e were emitted from the agricultural sector within the region in 2005. Veneto Chart 3 shows the total is made up of 40% from enteric fermentation, 12% from manure management, 47% from agricultural soils and, 0.7% from other sources. These emissions have been estimated using level 1 approaches for 100% of the emissions from enteric fermentation, manure management and other sources, but 0% of the emissions from agricultural soils. Emissions from agricultural soils account for 3% of the region's total emissions.

Waste

Waste emissions include CO_2, CH_4 and N_2O. The emissions are mostly associated with the degradation of putrescible waste deposited to landfill sites, the amount of wastewater, whether it is domestic or industrial, and with the incineration of waste. The levels of emissions are reflected by the amount of waste that is deposited to landfill sites, the management of the site, the amount that is recycled and the amount of waste that is incinerated.

The inventory shows that 1 178 kt CO_2e were emitted from the waste sector in 2005. As shown in Veneto Chart 4 the total is made up of 52% from managed waste disposal, 9% from unmanaged waste disposal, 34% from waste water and 5% from incineration.

These emissions are quite low overall due to the region's recycling rate. The remainder of the emissions are due to the rest of the waste being landfilled or combusted. The emissions have been estimated using level 1 methods for 100% of the emissions from managed waste disposal, unmanaged waste disposal, waste water and incineration.

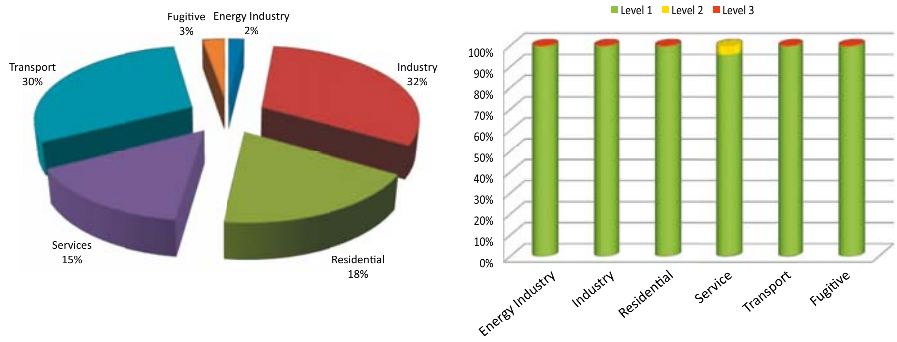


Chart 1: Left: Emissions from energy combustion, distribution, transformation & extraction (CO_2e). Right: GRIP level used (CO_2e)

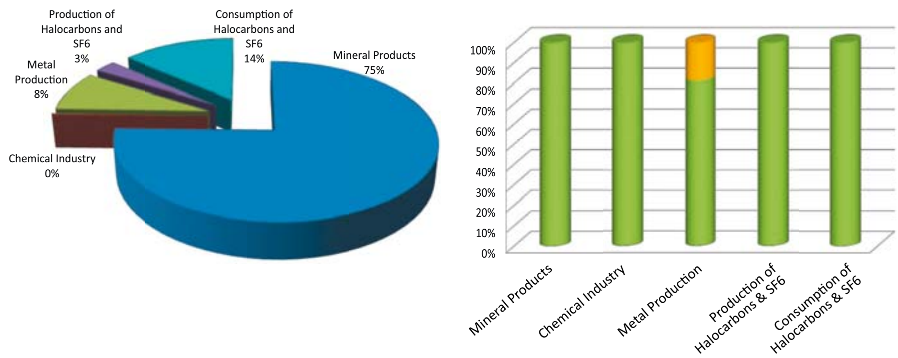


Chart 2: Left: Emissions from industrial processes (CO_2e). Right: GRIP level used (CO_2e)

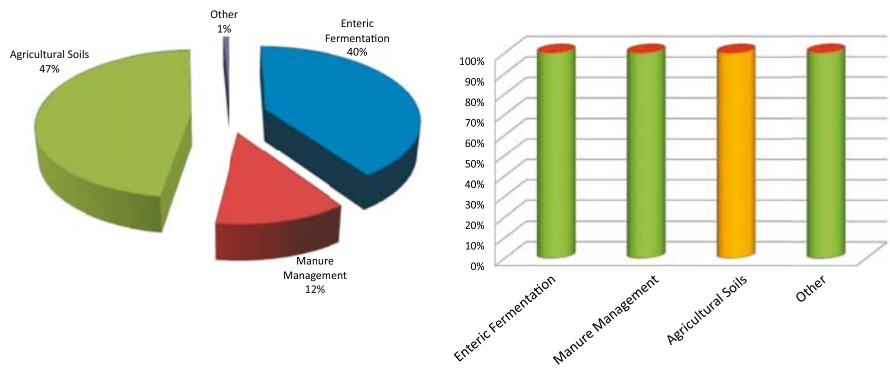


Chart 3: Left: Emissions from agriculture (CO_2e). Right: GRIP level used (CO_2e)

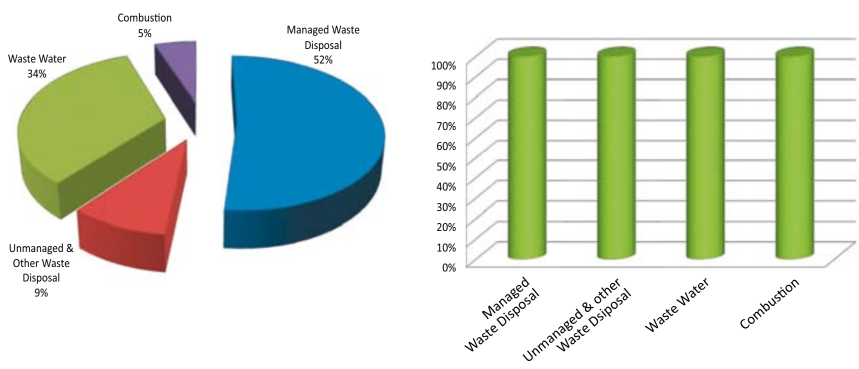


Chart 4: Left: Emissions from waste (CO_2e). Right: GRIP level used (CO_2e)

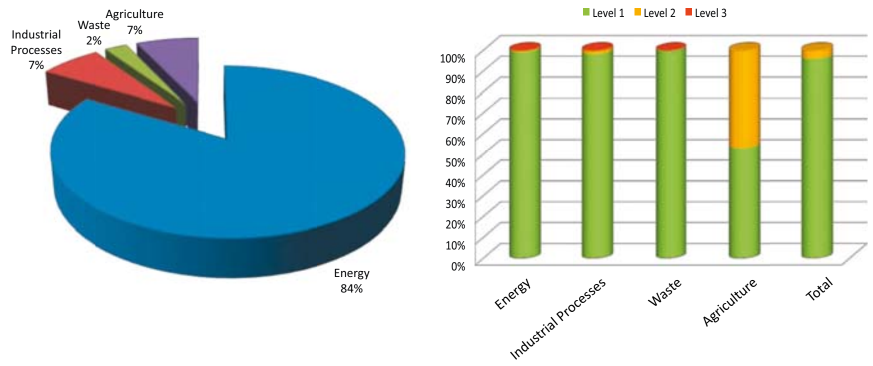


Chart 5: Left: Total regional emissions by sector (CO_2e); Right: GRIP level used (CO_2e)

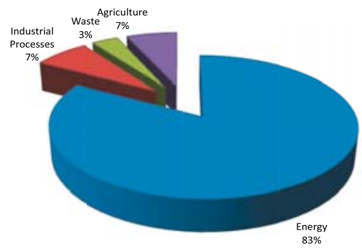


Chart 6: Total national emissions by sector (CO_2e)

THE emissions for the whole of the Veneto Region are displayed in Veneto Chart 5 above, the inset shows the percentage of GRIP levels that have been used to estimate the emissions. These emissions represent the sum of the emissions presented on the previous two pages. The emissions for Italy are displayed in Veneto chart 6 above. This shows the relative difference in the emissions in the region to that displayed nationally. The region has a similar share of emissions from energy to that displayed nationally. The emissions per-capita of the region are 10tCO_2e compared to 9.9tCO_2e in Italy. Regions with a similar per-capita emissions in this project include Hamburg, Ljubljana and, Turin. The emissions per-capita are above the average of the regions and are above the European Community average. The data has been largely compiled using measured data sets and therefore the results are reliant on the accuracy of these.

The table below displays the emissions for the whole of the Veneto Region on a sector-by-sector basis and the main sub-sectors of the energy sector. The results are displayed in terms of each of the six Kyoto greenhouse gases. The table shows the relative contributions that each gas makes from each source, with the CO_2e amount displayed also. This table clearly shows that CO_2 emissions from the energy sector dominate the emissions from this region. These account for 93% of CO_2 emissions and 81% of CO_2e emissions. The dominance of CO_2 emissions from the energy sector is a common feature to all the emissions inventories presented in this brochure. It is this data and the activity data underpinning it that drives the GRIP Scenario Tool, which is the platform of the GRIP Scenario process. This process enables regions to form scenarios of how they can reduce their energy emissions within their region. This can then be used to form preferred strategies on how the region may develop. These are the next steps of the EUCO_2 project, and are explained in more detail at the end of this document.

The table below and Veneto Chart 5 above show that the energy sector is responsible for 84% emissions, Industrial Processes for 7%, Waste for 2% and Agriculture 7% of emissions. This shows the need to focus on the energy system needed for Veneto to be a low-carbon region of the future.

Sector	kt CO_2	kt CH_4	kt N_2O	CO_2e - GWP100 HFC	PFC	kt SF_6	kt CO_2e - GWP100	GRIP % Level
Energy - Total	38304.59	19.75	2.69				39553.98	
Residential	7236.99	0.90	0.15				7301.68	
Services	5920.35	0.26	0.26				6005.43	
Industry	12282.22	0.56	0.80				12542.24	
Energy Industry	738.54	0.01	0.01				742.20	
Transport	11401.17	2.45	1.47				11908.09	
Fugitive	725.32	15.57	0.01				1054.33	
Industrial Processes	2746.52	0.31	0.00	508.18	0.00	0.00	3285.05	
Waste	61.32	45.36	0.53				1178.41	
Agriculture		82.49	4.98				3277.16	
Total	41112.43	147.91	8.21	508.18	0.00	0.00	47294.60	

Next Steps

THE NEXT STEPS FOR EUCO$_2$

The EUCO$_2$ 80/50 project will continue, after the Greenhouse gas (GHG) Emissions Inventory stage described in this Report, with further stages to,

1. **2009/2010** Explore metropolitan mitigation scenarios
2. **2009/2010** Identify and promote the adoption of Metropolitan Mitigation Strategies
3. **2010** Commit stakeholders to the Mitigation Action Plans to achieve the targets set out in the Strategy
4. **2010/2011** Monitor progress with Strategies and Action Plans
5. **2012** Disseminate evolving effective mitigation practice to the 100+ recognised metropolitan areas in Europe and the 100 metropolitan areas in the US

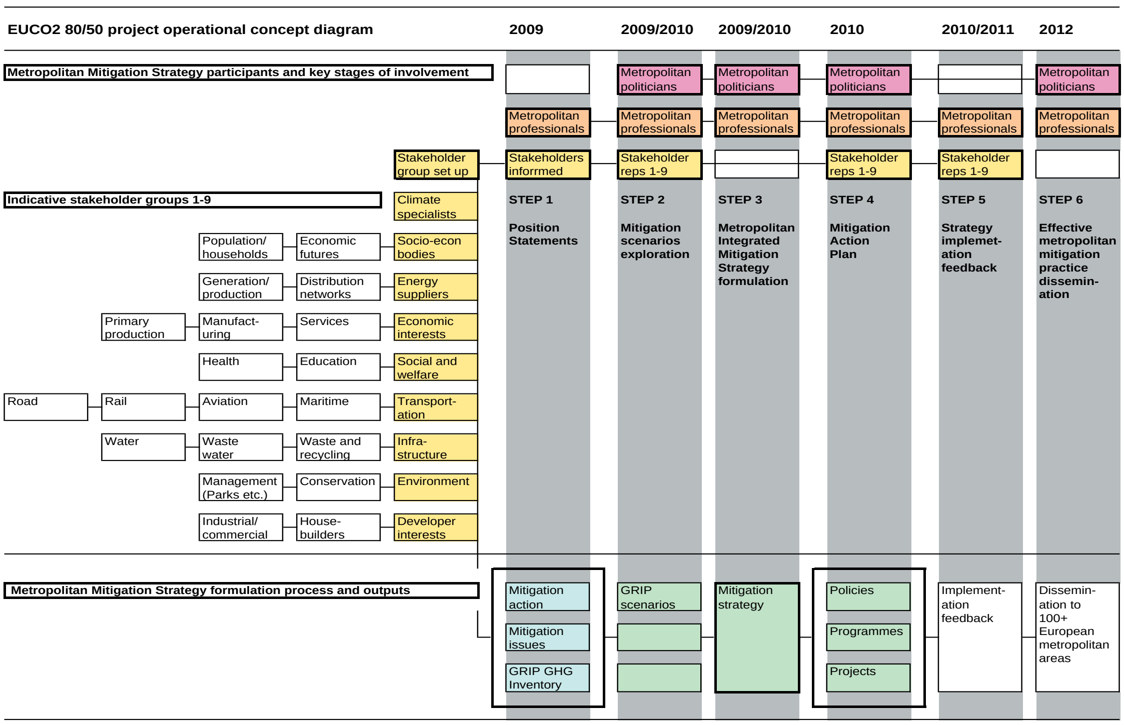
The diagram below illustrates these stages, within the overall metropolitan mitigation process, and the decision makers and stakeholders involved.

1. **Explore metropolitan mitigation scenarios**

An 80% reduction by 2050 (and the necessary emissions reductions in between now and then) in European metropolitan GHG emissions is the objective of the EUCO$_2$ 80/50 project. Such a reduction in emissions is associated with helping to stabilise atmospheric concentrations at a level which will likely lead to a global mean surface tempreature increase of between 2 and 3 degrees.

In the context of the knowledge of metropolitan GHG emissions gained from the GRIP Inventories, partners will use the GRIP scenario tool and process to explore mitigation options to achieve this objective. This will be done, collectively, by the key metropolitan social, economic and environmental interests because of the interrelated nature of the mitigation action required. For example, moving to a low carbon future will require action in the fields of energy, transport, planning and development and affect issues of energy supply and demand management. These factors must be considered together in order to deliver a low carbon energy system for our regions.

Key considerations will be the climate change in prospect in European metropolitan areas, north, east, south and west, and the wider European and national contexts of renewable energy supply.



2. **Identify and promote the adoption of Metropolitan Mitigation Strategies**

It is expected that all metropolitan areas will wish to review the security of their energy supplies, in the context of rising direct carbon fuel costs and taxes, and to move progressively to low carbon sources. They may wish to investigate their local urban potential energy generation, for example, from solar power and waste, and to then consider the potential renewable energy supplies in their wider regions. They might then consider the balance of their energy needs and the availability of renewable energy at national and European levels.

Within such a low carbon future they could then assess the scope for energy saving in the fields of, in particular, transport, infrastructure, housing, services and industry. Metropolitan low carbon futures will essentially be achieved through a combination of appropriate mitigation measures to "green" energy supply and reduce energy demand. The EUCO2 80/50 project has identified an initial list of 25 mitigation measures that might form part of such a package (see p.5).

3. **Commit stakeholders to the Mitigation Action Plans to achieve the Strategy's targets**

It will require a high level of political leadership at the metropolitan level to achieve the collective decision making required from the stakeholder interests and to ensure their commitment to the mitigation action required. The outcome might be an agreed Metropolitan Action Plan, setting out in detail the mitigation measures identified in the Strategy and the resources needed to realise and sustain them.

4. **Monitor progress with Strategies and Action Plans**

Stakeholders will then be expected to embody this action in their corporate plans, programmes and projects, to monitor the achievement of targets and to take such action as is necessary to keep the Metropolitan Action Plan on track and on target.

The monitoring, review and progressing of the Strategy and the Action Plan will require the setting up of a mechanism of metropolitan governance for this purpose. Such a mechanism might be expected to include a political and administrative dimension.

5. **Disseminate evolving effective mitigation practice to the 100+ recognised metropolitan areas in Europe and the 100 metropolitan areas in the US**

It is estimated that the combined populations of the 200+major urban, or metropolitan, areas in Europe and the US, with a combined population of perhaps 500+ million, may be responsible for 20% of global greenhouse gas emissions. Effective mitigation action in these key urban areas would not only make a major contribution to global GHG mitigation but would also provide practical experience and examples of the measures that work and can be achieved.

The dissemination, initially, of the outcome of the EUCO2 80/50 project, a Benchmark of effective Metropolitan Mitigation Practice (in published and DVD form), will be targeted at these 200+ European/US metropolitan areas and their governance structures. Thereafter, as commitment grows, their example can take on a growing international significance and influence.

The goals of the $EUCO_2$ 80/50 project are ambitious, but necessary.

Glossary

Agricultural Emissions
This is one of the four main categories of emissions. The emissions from this category include emissions from farmyard animals, the treatment of their waste, field burning of crops and the application of fertiliser to crops. There are two types of emissions associated with agriculture Methane (CH_4) and Nitrous Oxide (N_2O)

Bottom-up
Is an approach to estimating emissions based upon the measured activity level of the emitting activity. It may also result from the direct measurement of emissions at emitting sites. This is the best way to describe GRIP level 1 approaches.

Carbon Captured Ltd
The company that pays for the hosting of the GRIP web resources.

Carbon Dioxide
or CO_2 is the second most common absorber of long wave radiation behind water vapour and is currently the most dominant anthropogenic greenhouse gas. The atmospheric concentration of CO_2 is currently at about 387ppmv.

Carbon Dioxide Equivalent
Is considered in two parts. Firstly, the amount of CO_2 that would need to be released to cause the same level of time integrated radiative forcing. This is done by multiplying the amount of a GhG by its GWP (for the specified time period). Secondly, it is the atmospheric concentration of CO_2 that would cause the same amount of radiative forcing as a given mixture of CO_2 and other forcing components.

Carbon intensity
this is the amount of CO_2 or CO_2e that is released per unit of activity. This may be used to explain that electricity in one region is more carbon intensive than in another. This is due to it being produced by lower carbon means.

CHP
See Combined (Cooling) Heat and Power

C(C)HP
See Combined (Cooling) Heat and Power

CH4
see Methane

CO2
see Carbon Dioxide

CO2e
See Carbon Dioxide Equivalent.

Co-generation
See Combined (Cooling) Heat and Power

Combined (Cooling) Heat and Power (C (C) HP)
Is the use of a power station or heat engine to generate electricity and useful heat (and for tri-generation cooling). These can be small scale in peoples homes, at industrial sites or used on a district level.

Commercial & Institutional
See Services

Domestic
see residential.

Energy Industry
the emission associated with the energy industry include Petroleum Refineries and Solid Fuel Transformation. When crude oil is converted into the derivatives of petroleum energy is used an some emissions are released. Solid fuel transformation is similar in that it is a process that converts Coal into solid smokeless or patent fuels. This process requires the combustion of fuels.

Energy Intensity
This refers to the amount of energy consumed per unit of activity. This may be used to show the amount of energy consumed per unit of GVA in a given sector. By using energy intensity it is possible to show that different industries provide different levels of economic outputs for the energy they consume. It may also be used to show how different sizes and ages of housing stock consume energy.

Fugitive Emissions
are emissions that are released as a consequence or a by-product of another activity. For example when distributing natural gas along pipelines some of it leaks, which is a methane leakage. When coal is extracted methane is displaced. When oil and gas is extracted some of it is flared

releasing GhG's. In addition the distributed losses of electricity are considered a fugitive source in GRIP.

GWP
see Global Warming Potential

GWP100
see Global Warming Potential

Global Warming Potential
This is the measure of how much a given greenhouse gas is estimated to contribute to global warming. It is usually presented in terms of the reference gas CO_2. This is the value that a measure of a greenhouse gas is multiplied by to estimate its CO_2e

GRIP
The Grenhouse gas Regional Inventory Protocol. Is a three stage process that comprises forming an emissions inventory, forming energy emissions scenarios and, forming plans for mitigation.

The Greenhouse gas Regional Inventory Protocol
See GRIP

GRIP Level 1
A bottom up inventory approach to emissions estimation using measured data sets.

GRIP Level 2
A largely top-down approach to emissions estimation that uses detailed aggregating data sets.

GRIP Level 3
An entirely top-down approach to emissions estimation.

HFC
see Hydroflurocarons

Hydroflurocarbons (HFC)
Are non-flammable of low toxicity and are recyclable. They are however potent greenhouse gases, with a GWP100 that varies between 120 and 12,000. They are usually presented in terms of their CO2e value.

Industrial Process Emissions
This is one of the four main categories of emissions. It can be a confusing title. The emissions that are contained in this section refer to the greenhouse gas emissions released from non-combustion chemical reactions that take place at certain industrial sites. As a consequence regions may or may not have sites that utilise these chemical reactions as part of their process. In addition emissions associated with the maintenance of products such as air conditioning units are also considered here. It is the only category of emissions that includes all six GhG's.

Industry (including manufacturing)
Industrial emissions are of two types. The first is the emissions that are associated with the combustion and consumption of energy. The second is the emissions associated with non-combustion chemical reactions. In this document when emissions are referred to as industry or industrial they relate solely to the emissions from energy. They are always stated separately from Industrial Process emissions.

Methane (CH4)
Are mostly associated with anaerobic processes that occur in a variety of settings. It also includes emissions from fugitive sources and the combustion of fuels. The GWP100 of this gas is 21.

N2O
see Nitrous Oxide

Nitrous Oxide (N2O)
Anthropogenic sources of N2O are found predominantly in agriculture with the use of fertilisers. They also occur during the combustion of fuels. The GWP100 of this gas is 310.

Residential
for the purposes of GRIP the Residential sector includes emissions from the combustion of fuels on site for the buildings activities, together with the emissions associated with the electricity, distributed heat and cooling that are consumed. In some regions a component of the residential emissions may be small commercial outlets.

Services
for the purposes of GRIP thee Service sector includes emissions from the commercial and institutional sectors. In addition it includes the emissions associated with the energy consumed for agricultural purposes. This sector includes the fuels that are combusted on site for the buildings activities, together with the emissions associated with the electricity, distributed heat and cooling.

Top-Down
Is an approach to estimating emissions when the measured activity level of the emitting activity in the region is not known.

PFC
see Perflurocarbons

Perflurocarbons (PFC)
Perflurocarbons are a group of gases containing only fluorine and carbon atoms, they are often stored in a compressed liquid form. They are also potent greenhouse gases. They are usually presented in terms of their CO2e value.

Royal Town Planning Institute (RTPI)
RTPI
see Royal Town Planning Institute

Scenarios
A mechanism by which to form visions of how the future may unfold. They come in a variety of guises, including climatic scenarios, energy scenarios, social economic and so on. They may be performed to inform plans to prepare for different futures.

SF6
see Sulphur Hexaflouride

Sulphur Hexaflouride (SF6)
is an odourless, colourless, non-toxic, non-flammable greenhouse gas and is the most potent GhG with a GWP100 of 23,900.

Tri-generation
See Combined (Cooling) Heat and Power

Uncertainty
All Emissions inventories contain a degree of uncertainty. The uncertainty can come in a series of forms, this may include the emissions factors; the measurement of the activity data or the uncertainty used in employing a top down approach.

Waste Emissions
Emissions that result from the disposal of waste. These include CO2, CH4, N2O

Acknowledgements

Dr. Bernd Steinacher. 1956-2008
METREX President 2004-2008

The project partners would like to acknowledge the support given to the initiation and development of the EUCO2 80/50 project by METREX former President, Dr. Bernd Steinacher. It was during his Presidency that METREX developed its understanding of and concern for the issue of climate change and the urgent need for metropolitan mitigation.

We would like to thank the following for being the contact for the inventory:

Dimitris Katsochis
Bram Lattré
Reinhard Henke
Dieter Schmidt
Johannes Lounasheimo
Sergeja Praper
j.r.carlos zarzo hamma
Valeria Vanella
Peter Austin
Erwan Cordeau
Sara Dourado
Koldo Verheij
Annika Varnäs
Markus Siehr
Cristian Villata
Stefania De Vittori

We would also like to thank Roger Read and Tim Page of METREX for their support at the workshops.

We would like to thank the following for Hosting the Regional Workshops:

Hamburg - Rainer Scheppelmann
Genevieve Danchin - Paris
Gianfranco Fiora – Turin
Reinhard Henke - Frankfurt
Catherine Sykianaki-Kylikas - Athens
Michael Viehhauser - Stockholm

We would like to thank the following for their support at the School of Environment and Development @ Manchester University

Marta Fole
Kellie Gallagher
Lorraine Elphick
Jennifer Kilner

Authors

Dr Sebastian Carney
Dr Nick Green
Dr Ruth Wood
Roger Read

Dr Sebastian Carney
Research Fellow
Centre for Urban & Regional Ecology
School of Environment and Development
Humanities Bridgeford Street
University of Manchester
Oxford Road
M13 9PL

+44(0)161 306 6439
sebastian.carney@manchester.ac.uk

Further Information
http://www.euco2.org
http://www.grip.org.uk
http://www.eurometrex.org