Comparative Analytical Report

The common report on energy consumption, CO_2 emissions targeting 20 different European regions

Report 1 of ENESCOM - Project financed by IEE program

Editor and author of Analytical part:

The Czech Technical University in Prague

List of nations and partners

Italy
Union of Municipalities Samoggia Valley

Malta
Local Councils' Association

Hungary
Eastern-Hungarian European Initiations Foundation

Slovakia Progresit

Slovenia
Regional Development Agency Mura Ltd.

Poland
The Center of Education and Enterprise Support Association

Romania
Centru Regional Develepment Agency

France
Regional Federation of Center Initiatives to Valorize Agriculture and Rural area of Britanny

Croatia
INFORMO - Association for the employment support, professional education and training

Czech Republic
Czech Technical University in Prague

Greece
Municipal Enterprise for Planning and Development of Patras S.A.

Spain
Iniciativas Casmor S.L.

UK
Powys County Council

Portugal
Local Energy Agency Cascais

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1 Introduction

1.1 Objectives of report

1.1.1 General objectives

The common report on energy consumption, CO2 emissions targeting 20 different European regions is analytical material which can serve as a basis at the regional level for public administrators, urban planners, policy makers, technicians, entrepreneurs, citizens, transport operators and other regional institutions and as a guide and starting point for municipalities which are intent on entering into the Covenant of Mayors (CoM). The common report affords many interesting comparisons between regions of different countries as well as significant data assessment from 20 regions NUTS II. The common report has come out of the process of collecting information on each of the individual partners participating in the project ENESCOM. The Czech Technical University in Prague has put together the data into one consistent report and has carried out their evaluation and comparative analysis.

1.1.2 Specific objectives

This Common Report is a part of the task solution of the international project ENESCOM: European Network of Information Centers promoting Energy Sustainability and CO2 reduction among local Communities (the acronym of the project is ENESCOM).

The project is financed by community program IEE - The Intelligent Energy-Europe Program by the Contract N°: IEE/09/667/SI2.558230.

Coordinator of the Project is the Union of Municipalities Samoggia Valley.

The project ENESCOM intends to promote widespread information and dissemination activities targeting 14 different EU countries (Tab. 1) aiming at achieving the following main objectives:

- to increase the number of EU local communities engaged in the mitigation of climate change through the promotion of, and adhesion to the Covenant of Mayors' initiative
- to develop capacity building in energy sustainability and promote the adoption of intelligent local sustainable energy policies (creation and implementation of SEAPs)
- to promote the integration and institutionalization of energy efficiency, saving and use of renewable energy sources (energy-efficient behavior and lifestyles) within EU local communities, targeting all relevant stakeholders (public administration, businesses, citizens…)

The objective will be reached by means of a 30-months joint cooperation leading to the creation of a network of regional and local front offices with the main role of informing and advising users on energy matters based also on the analysis/assessment of the local situation, to promote and facilitate local authorities in the adhesion to the Covenant of Mayors and preparation of SEAPs/roadmaps, and to organize and run several training, dissemination and awareness-raising activities tailored to different target beneficiaries (students, citizens, stakeholders, policy-makers). This activity will be supported by the creation of specific information and communication tools (i.e. website), materials (i.e. brochure, e-newsletter) and actions involving also the media. The widespread involvement of

Pioneers of the Covenant of Mayors and disseminators/multipliers at local, regional, national and international levels will contribute to the achievement of the main project outputs and results, creating the basis for multiplying the effect-transferability-replication of actions and knowledge.

Table 1: Partners of the Project

Participant name	Participant short name	Country
Unione di Comuni Valle del Samoggia	Unione Samoggia	IT
Assocjazzjoni Kunsilli Lokali	LCA	MT
Kelet-magyarországi európai Kezdeményezések Alapitvány	KEK Foundation	HU
České vysoké učení technické v Praze	CTU in Prague	CZ
Anaptiksiaki Dimotiki Epichirisi Patras S.A.	A.D.E.P. S.A.	EL
Progresit, občianske združenie	Progresit	SK
Regionalna razvojna agencija Mura d.o.o.	RRA Mura d.o.o.	SI
Stowarzyszenie Centrum Wspierania Edukacji i Przedsiębiorczości	CEES	PL
Iniciativas Casmor S.L.	IC	ES
Powys County Council	PCC	UK
Agentia Pentru Dezvoltare Regionala Centru	CENTRU RDA	RO
Fédération Régionale des Centres d'Initiatives pour Valoriser l'Agriculture et le Milieu rural de Bretagne	FRCIVAM Bretagne	FR
INFORMO – Udruga za poticanje zapošljavanja, stručnog usavršavanja i obrazovanja	INFORMO	HR
Agência Cascais Energia	ACE	PT

1.2 EU policy context

The European Union (EU) faces serious energy challenges concerning sustainability and greenhouse gas emissions as well as security of supply, import dependence and the competitiveness and effective implementation of the internal energy market. **An European Energy Policy** is acknowledged as the most effective response to these challenges, which are faced by all Member States.

The project ENESCOM should contribute to solve the three aspects of the European Energy Policy[1].

- **Aspect of reducing greenhouse gas emissions**

Energy accounts for 80% of all greenhouse gas emissions in the EU. Determined to fight against climate change, the EU is committed to reducing its own emissions by at least 20% by 2020. Of course, reducing greenhouse gas emissions involves using less energy and using more clean energy.

[1] Source: An Energy Policy for Europe, Brussels, 10.1.2007 (COM) 2007

- **Aspect of energy efficiency**

Reducing its energy consumption by 20% by 2020 is the objective the EU has set itself in its Action Plan for Energy Efficiency (2007-2012). Concrete effort needs to be made to achieve this objective, in particular with respect to energy saving in the transport sector, the development of minimum efficiency requirements for energy-using appliances, awareness-raising amongst consumers about sensible and economic energy use, improving the efficiency of the production, transport and distribution of heating and electricity and also developing energy technologies and improving the energy performance of buildings.

- **Aspect of renewable energy**

The use of renewable energies (wind power, solar and photovoltaic energy, biomass and biofuels, geothermal energy and heat-pump systems) undeniably contributes to limiting climate change. Furthermore, it plays a part in securing energy supply and creating employment in Europe, thanks to the increase in the production and consumption of local energy. To increase the use of renewable energy sources, in its Renewable Energies Roadmap the EU has set itself the objective of increasing the proportion of renewable energies in its energy mix by 20% by 2020.

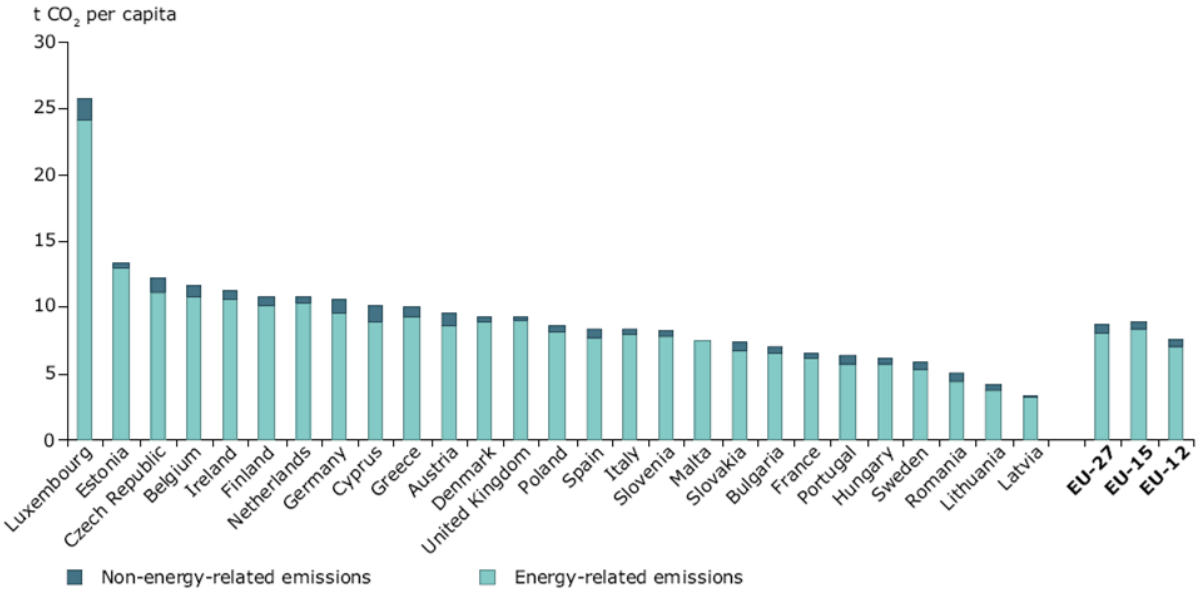
2 Analysis

2.1 Overview

2.1.1 Greenhouse gas emissions[2]

Energy related emissions continue to dominate emissions per capita across all Member States (see Figure 1). Total emissions per capita in Luxembourg are almost double what they are in Estonia and higher by a factor of six than in Latvia at the other end of the spectrum. The high level of emissions per capita in Luxembourg is linked to a high level of GDP in a country with a small population. However, it is caused, primarily, by the high cross-border sales of transport fuels (due to the tax differential with neighboring countries), with emissions allocated to the point of sale (IEA, 2000). Average emissions in the EU 15 are around 17.5 % higher than in the EU 12. A number of opposing trends drive the evolution of per capita emissions: higher levels of wealth (which tend to increase the overall levels of energy demand), higher levels of energy efficiency, climatic differences and differences in the structure of the energy supply system.

Figure 1: CO_2 emissions per capita by country (split by energy and non-energy related emissions), 2005

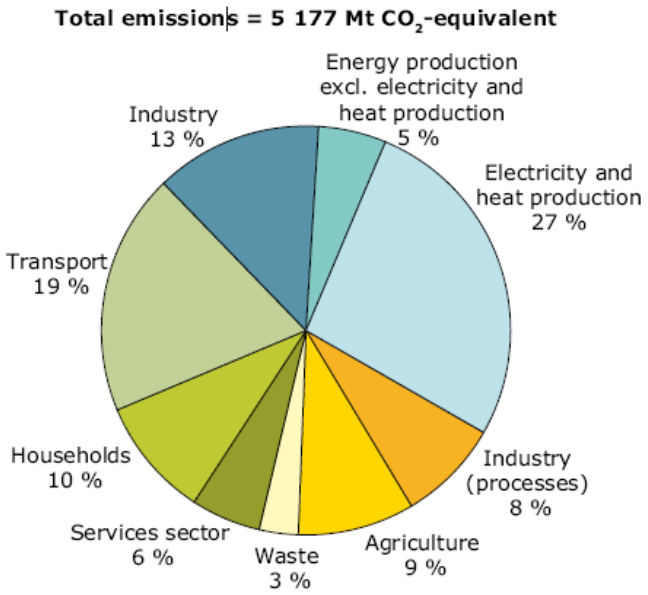


Source: EEA Report No 6/2008 Energy and environment report 2008

In 2005, the total greenhouse gas emissions in the EU 27 was 5 177 Mt CO2 equivalent comprising 82.5 % CO2; 8.1 % CH4; 8.0 % N2O, while the remaining 1.4 % corresponded to fluorinated gases. Energy related emissions continue to be dominant representing approximately 80 % of the total emissions (see Figure 2), with the largest emitting sectors being the production of electricity and heat, followed by transport.

[2] Energy and Environment Report 2008

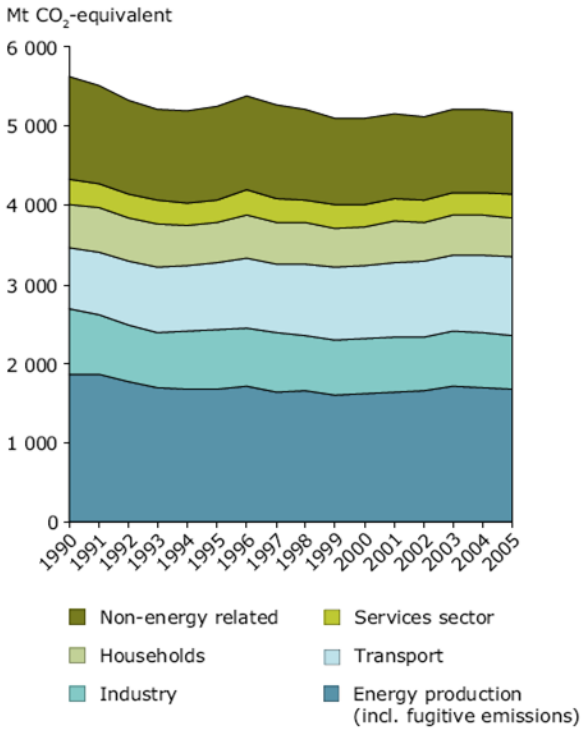
Figure 2: Structure of total greenhouse gas emissions by sector, EU-27



Source: EEA Report No 6/2008 Energy and environment report 2008

Sectors showing the largest decreases in greenhouse gas emissions are industry and that of the non- energy related (e.g. industrial processes) (see Figure 3). However, over the same period emissions from transport in the EU 27 increased significantly due to a continuous increase in road transport demand, thus offsetting much of the decrease in other sectors (see EEA, 2008a for further information on transport and the environment in the EU).

Figure 3: Trends in greenhouse gas emissions by sector, EU-27

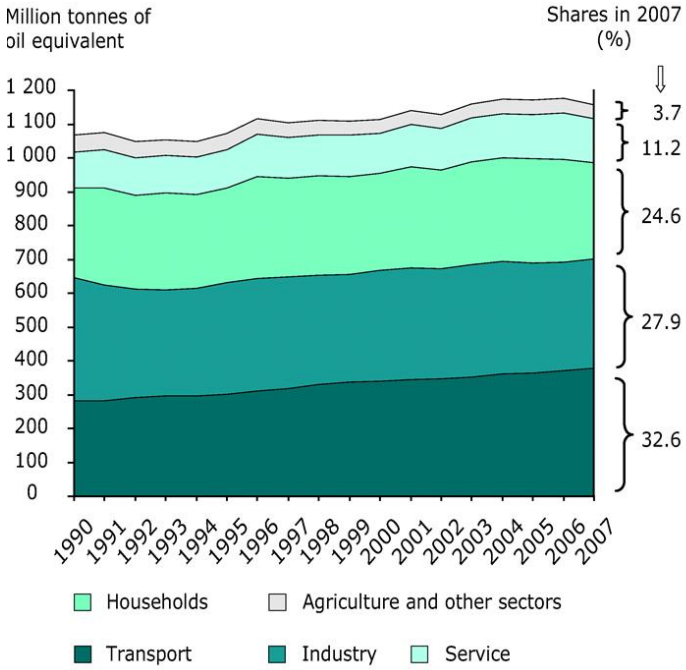


Source: EEA Report No 6/2008 Energy and environment report 2008

2.1.2 Energy consumption

Energy consumption related to sectors is shown in Figure 4.

Figure 4: Final energy consumption by sectors in the EU-27, 1990-2007



Source: Final energy consumption by sector (CSI 027/ENER 016)

Between 1990 and 2007, the final energy consumption in the EU-27 increased by 8.4% at an annual average rate of 0.5%. Transport remains the sector with the fastest growing energy consumption (34.4% over the period) followed by services (21.1% over the period). Over the same period, the household final energy consumption increased by about 8.0% while the final consumption in industry fell by 11.7 %. Between 2006 and 2007, the EU-27 final energy consumption decreased by 1.5 % mainly due to significant reductions in the households (6.6 %) and services (4.6%) sectors. In transport and industry final energy consumption actually increased between 2006 and 2007 by 1.6% and 1% respectively. On average, one person in the EU-27 used 2.3 tons of oil equivalent to meet energy needs in 2007.

Table 2 shows the share of renewable energy in gross final energy consumption (%) in the countries of EU-27 (2006 – 2008). The countries record big differences. A striking significance in values is recorded by Austria, Finland and Sweden. The smallest share of renewable energy is recorded by Malta with 0,2 share.

Table 2: Share of renewable energy in gross final energy consumption (%)

	2006	2007	2008	2020 target
EU-27	**8.8%**	**9.7%**	**10.3%**	**20.0%**
BE	2.7%	3.0%	3.3%	13.0%
BG	9.3%	9.1%	9.4%	16.0%
CZ	6.4%	7.3%	7.2%	13.0%
DK	16.8%	18.1%	18.8%	30.0%
DE	6.9%	9.0%	8.9%	18.0%
EE	16.1%	17.1%	19.1%	25.0%
IE	3.0%	3.4%	3.8%	16.0%
EL	7.2%	8.1%	8.0%	18.0%
ES	9.1%	9.6%	10.7%	20.0%
FR	9.6%	10.2%	11.0%	23.0%
IT	5.3%	5.2%	6.8%	17.0%
CY	2.5%	3.1%	4.1%	13.0%
LV	31.3%	29.7%	29.9%	40.0%
LT	14.7%	14.2%	15.3%	23.0%
LU	0.9%	2.0%	2.1%	11.0%
HU	5.1%	6.0%	6.6%	13.0%
MT	0.1%	0.2%	0.2%	10.0%
NL	2.5%	3.0%	3.2%	14.0%
AT	24.8%	26.6%	28.5%	34.0%
PL	7.4%	7.4%	7.9%	15.0%
PT	20.5%	22.2%	23.2%	31.0%
RO	17.5%	18.7%	20.4%	24.0%
SI	15.5%	15.6%	15.1%	25.0%
SK	6.2%	7.4%	8.4%	14.0%
FI	29.2%	28.9%	30.5%	38.0%
SE	42.7%	44.2%	44.4%	49.0%
UK	1.5%	1.7%	2.2%	15.0%

Source: Eurostat

2.2 Methodological note

2.2.1 Partners specification

The main objective was to develop a simple system for data and information collection (further referred to only as D&I), with their summary and evaluation intelligible and feasible for all project partners.

A considerable significance has been dedicated to the unity and comparability of D&I from the different regions and the possibility to communicate about the project issues at a distance with the partners (by e-mail and telephone). D&I of the same kind and units delivered by the project partners are of crucial importance for elaboration of the Common Report 1.

Collection of D&I in Target Regions was requested in the project proposal, but the regions have not been defined. To ensure comparability of the 20 Target Regions it was decided to use the NUTS 2 territorial unit

For compilation of Common Report 1 it was necessary to elaborate two Tables and two Analyses concerning the target Regions by each project partner.

2.2.1.1 Elaboration of Tables with D&I concerned with

- Energy Consumption in selected Branches in the Target Regions - Table 5
- Emissions in selected Branches in the Target Regions - Table 6

These Tables give an outline regarding the situation in the 20 Target Regions in the 14 countries participating in the project. There were prepared templates for the Tables (in Microsoft Office Excel format) and they are in Appendix 1.

Note: *Tables 1 to 4 concern municipalities considered as potential candidates for the CoM initiative. D&I from these tables have not been used in Common Report 1, but they had been for the project partners of crucial importance for understanding the local environment and will be useful for elaboration of the Baseline Energy Inventory (BEI) in the future.*

Data were defined as facts from which conclusions will be drawn (e.g. statistical data) and information defined as data presented within a context that gives them meaning and relevance and which lead to their better understanding.

2.2.1.1.1 D&I collection principles

- Collect proved and verified statements about Target Regions only (official statistics, research and analyses outputs, …),
- when no verified statements are available then ensure professionally qualified assessments,
- always mention the source,
- put the collected D&I into the attached templates.

The Tables contain cells for particular D&I as well space for relevant remarks, summaries, evaluations and indications about data sources. In some Tables are recommendations for their filling out more (e.g. optional data, detailed explanation such as sorts of waste etc.).

2.2.1.1.2 D&I summary and evaluation

The bare D&I, without their simple processing and comments at least, do not have generally the ability to give a clear survey. Therefore it was decided to summarize the collected D&I in such a way that they give an insight into the topic. It was recommended to compare the D&I from the Target Regions with the neighbouring regions or with the country´s average and thus inform about the trends.

2.2.1.1.3 Principles of D&I summary and evaluation

- Summarize important findings in a well-arranged graph or table and add some supporting information (explanatory sentences),
- evaluate briefly the situation by using simple and intelligible methods such as ranking according to priorities, data comparison, critical collation …,
- keep off general political or journalistic proclamations, giving clear statements and arguments,

- insert the summary and evaluation into the dedicated box in the Table**.**

2.2.1.2 Elaboration of Analyses concerned with

- Energy Consumptions of the Target Region - Analyses 1
- CO_2 Emissions in the Target Region - Analyses 2

These Analyses represent the process of breaking the complex topic into smaller parts to gain a better understanding completed with clear conclusions.

To ensure comparability of D&I from all involved Target Regions there have been drafted certain scopes for the required analyses and also defined the minimum number of pages. The templates for each required Analysis are in Appendix 2**.**

2.2.1.2.1 Principles for the Analyses processing

- Compile the Analyses according to the agreed contents and form,
- carry them out as briefly as possible with clear statements and arguments (tables, graphs, schemas …),
- mention the Tables from which the D&I have been taken,
- the minimum was recommended 15 Pages (font size 12, type Times New Roman, standard page with 1 800 characters which corresponds to 30 printed lines).

2.2.1.2.2 Guidelines for the Analyses

The guidelines contain the contents and additional explanation and recommendations concerning for example, references. There is in the footnotes of the templates the request for a minimum extent for the Analyses.

2.2.1.3 Data correction

Tables and analyses gathered were examined. Sometimes, data in tables needed to be sorted and deviations and differences had to be eliminated, so data could be directly compared. This concerns especially

- Recalculating percentage shares to eliminate mistakes.
- Redefining examined sectors, fuel types and contaminant types in case unusual data is provided by a partner.
- Removing redundancies and unnecessary data.

The results of these changes were new tables for all partners. These tables were directly comparable and were used for partners comparison (see chapter 2.2.2).

2.2.2 Partners comparison

The main objective of this part was to compare data provided by partners during the process described in chapter 2.2.1. The following data have been used:

- Energy Consumption in selected Branches in the Target Regions - Table 5
- Emissions in selected Branches in the Target Regions - Table 6

2.2.2.1 Support data (Eurostat)

Not all data required for comparison were provided by the partners. Some data needed as a data base had to be gathered from Eurostat. Eurostat's mission is *to provide the European Union with a high-quality statistical information source*[3]. Data used from this source were:

(Please note, sometimes it was not necessary to search for data on Eurostat, because some partners provided that information on their own. In this case, data provided by a partner were used instead of data from Eurostat).

:

- Population of region (2008)
- GDP of region (in PPS, 2008)
- Total area of region
- Total area distinguished by the Agricultural sector (2009)
- Total area distinguished by Services & Residential sectors (2009)

It is important to bear in mind that data for some of the partners was not available (see chapter 2.2.2.3).

2.2.2.2 Data comparison

Data were compared for the different areas: Energy consumption and Contaminants emissions. Each category was examined in a similar way. When interpreting results, we should have in mind that these two topics are interconnected.

For data analyses, spreadsheet software Microsoft Excel 2007 was used. Data were sorted, unified and directly compared in total numbers and in percentage shares for all participating partners. For the results presentation, charts were used as they were found to be the most descriptive way.

Data provided by this part of the project can be used for further and more complex analysis in the future, but for the purpose of this report, only simple comparison methods were used, as the reason was to point out basic differences, to directly compare participating partners and to show possible ways of extending the whole topic. More sophisticated analytical methods would overload this report with charts and tables and the length of this report would be highly exceeded. But it is important to understand that even deeper analysis of data is possible in case of need and the data gathered makes a strong foundation for future research.

2.2.2.2.1 Energy consumption

When dealing with energy consumption, the following aspects were considered for all participating partners whose regional data were provided and whose regional data were valid:

- Total energy consumption
- Total energy consumption per capita

[3] About Eurostat; available online: ec.europa.eu/eurostat; 19.3.2011

- Total energy consumption per total area
- Total energy consumption per GDP (in PPS)
- Total energy consumption per GDP per capita (in PPS)
- Percentage share of total consumption in the Industry sector
- Relative comparison of partners for the Industry sector by total sector consumption per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total consumption in the Agriculture sector
- Relative comparison of partners for the Agriculture sector by total sector consumption per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total consumption in the Tertiary Sphere sector
- Relative comparison of partners for the Tertiary Sphere sector by total sector consumption per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total consumption in the Transport sector
- Relative comparison of partners for the Transport sector by total sector consumption per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total consumption in the Housing sector
- Relative comparison of partners for the Housing sector by total sector consumption per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of solid fuels consumption
- Percentage share of liquid fuels consumption
- Percentage share of gaseous fuels consumption

2.2.2.2.2 Contaminants emissions

When dealing with contaminants emissions, the following aspects were considered for all participating partners whose data were provided and whose data were valid:

- Total CO_2 emissions
- Total CO_2 emissions per capita
- Total CO_2 emissions per total area
- Total CO_2 emissions per GDP (in PPS)
- Total CO_2 emissions per GDP per capita (in PPS)
- Total other contaminants dispersion
- Total other contaminants emissions
- Other contaminants dispersion
- Percentage share of total emissions in the Industry sector
- Relative comparison of partners for the Industry sector by total sector emissions per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total emissions in the Agriculture sector

- Relative comparison of partners for the Agriculture sector by total sector emissions per population, per total area, per GDP (in PPS), per GDP per capita (in PPS) and per agricultural area
- Percentage share of total emissions in the Tertiary Sphere sector
- Relative comparison of partners for the Tertiary Sphere sector by total sector emissions per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total emissions in the Transport sector
- Relative comparison of partners for the Transport sector by total sector emissions per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total emissions in the Housing sector
- Relative comparison of partners for the Housing sector by total sector emissions per population, per total area, per GDP (in PPS) and per GDP per capita (in PPS)
- Percentage share of total emissions sums for the Tertiary Sphere sector and the Housing sector
- Relative comparison of partners for the Tertiary Sphere sector and the Housing sector by total sector emissions sums per population, per total area, per GDP (in PPS), per GDP per capita (in PPS) and per Services & Residential area

2.2.2.2.3 Consumption and emission combination

Because of data interconnection, there is crossover comparison of contaminants emission per energy consumption for all participating partners, whose data were provided and whose data were valid:

- Total contaminants emissions per total energy consumption
- Total contaminants emissions per total energy consumption for the Industry sector
- Total contaminants emissions per total energy consumption for the Agriculture sector
- Total contaminants emissions per total energy consumption for the Tertiary Sphere sector
- Total contaminants emissions per total energy consumption for the Transport sector
- Total contaminants emissions per total energy consumption for the Housing sector
- Total contaminants emissions per total energy consumption for sums of the Tertiary Sphere sector and the Housing sector

2.2.2.3 Obstacles Encountered

There were two main obstacles during the data comparison process.

The first main obstacles were connected with regional unit differences. Firstly, each of the participating regions is different in size, economic strength etc. Therefore comparison in total numbers was mostly just informative and no deductions could be made based upon it. That's why the data base described in chapter 2.2.2.1 was used. Secondly, although each partner was asked to provide data for NUTS 2 level regions, they were often not able to gather corresponding data for this region level and a different region level had to be used instead. This was a better solution than if no data could be compared at all. By using the data

base described in chapter 2.2.2.1, major mistakes emerging from this obstacle were eliminated, although results may vary a little bit because of this inaccuracy. Moreover, data for other than NUTS 2 region levels were often not available and therefore it was impossible to include a partner into a comparison even though consumption or emissions data were provided.

The second main obstacle was the lack of data. Firstly, partners encountered many obstacles during the data gathering process and data were provided in inconsistent form. Some differences could be dealt with; some resulted in eliminating a partner from that specific comparison where data were missing. Secondly, because of the different level of regional units used for comparison, not all data bases (as for different sectors, GDP etc.) were available through accessible sources.

Data reliability is the most disputable issue and should be taken in consideration when interpreting the presented results.

2.3 Partners specification

This chapter is based on the following data provided (see chapter 2.2.1) by partners:

- Energy Consumption in selected Branches in the Target Regions - Table 5
- Emissions in selected Branches in the Target Regions - Table 6
- Energy Consumption of the Target Region - Analyses 1
- CO_2 Emissions in the Target Region - Analyses 2

The chapter is divided into 14 sections, a section for every participating partner. In every partner section, there are three subchapters. The first two subchapters are oriented towards examining the data provided by each partner. The first one deals with energy consumption, the second one deals with contaminants emission. The last subchapter summarises and corrects these data, showing them in simple charts and tables. Here it is possible to see comprehensively what data we are going to compare in the chapter 2.4.

2.3.1 Italy

Italy participated through one target NUTS 2 region, which is called Emilia Romagna. Emilia Romagna is one of the 20 regions which administratively form the Italian Republic. It is located in the north-eastern part of Italy and it consists of 341 municipalities and 9 provinces. At the present time, Emilia Romagna has 4,395,569 inhabitants, more than 7% of national population.

Emilia Romagna should be considered within the 15 macro sub-regions of the European Union where the higher economic development levels are recognized. With reference to the national frame, Emilia Romagna takes the first position when the pro-capita income is taken into account; this performance calls for a highly competitive productive system at both Industry and Agriculture level. The Emilia Romagna Region economy is mainly based on a significant presence of Small and Medium sized Enterprises. In this context the commitment of the regional government has always been oriented toward the promotion of a sustainable form of development of the regional economy and society within the environmental and social context.

2.3.1.1 Energy consumption

Having in mind this positive and dynamic development of both economy and the research/ technological culture, it appears logic the increasing attention of the Region to the Energy and Environment related aspects, coherently with the different institutional duties given to the Regions by the National Laws. Since many years local Administrations have shown a specific attention towards the Sustainable Development policies and the related energetic systems, more and more considered as a priority aspects for Institutions and Organizations at both international and national level. Within this general frame, a major importance should be recognized to the interventions focused to provide safer, cleaner and more economic energy sources. Emilia Romagna Region is fully committed to the identification of a proper merging between the Energy supply requirements (safety, reliability, supply continuity, economics) and the Environment related objectives in terms of both protection and recovery of the natural heritage.

The following Table 3 shows energy consumption in the selected region.

Table 3: Energy consumption in Emilia Romagna (Italy)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	18,203,000	1,192,000	8,761,000	694,000	6,541,000	**35,391,000**
Liquid fuels	29,330,000	16,170,000	12,918,000	169,037,000	24,855,000	**252,310,000**
Gaseous fuels	190,325,000	3,922,000	65,205,000	6,509,000	111,694,000	**377,656,000**
Others fossil fuels	6,090,000	406,000	2,987,000	236,000	2,227,000	**11,946,000**
Renewables	9,610,000	962,000	4,903,000	365,000	4,275,000	**20,115,000**
Total [GJ/year]	**253,558,000**	**22,652,000**	**94,774,000**	**176,841,000**	**149,592,000**	**697,417,000**
Total [percent]	**36,36%**	**3,25%**	**13,59%**	**25,36%**	**21,45%**	**100,00%**

As we can see, the sector with the biggest energy consumption is Industry (36,36%), followed by Transport (25,36%) and Housing (21,45%). The Tertiary Sphere is the fourth (13,59%) and the Agriculture sector is the last (3,25%). Considering fuel types, the most used fuel type are Gaseous fuels (especially because of Industry, Housing and Tertiary Sphere consumptions), followed by Liquid fuels (generated mostly by the Transport sector). Other fuels are in minor use.

Emilia-Romagna Region developed Regional Energy Law (26/2004) which rules the regional strategic plan for the energy sector in 2004, and approved Regional Energy Plan (REP) at the end of 2007.

2.3.1.2 Emissions

As we can see in the following Table 4, most data for contaminants emissions in Emilia Romagna were not available. Regardless, the most important information about CO_2 can be found there and shows us that the biggest share of contaminants emissions goes to the Industry sector (34,91%), followed by the Transport sector (29,49%). The third is the Housing sector (20,52%) and the fourth is the Tertiary Sphere (11,92%). The last is the Agriculture sector, with only a 3,16% share.

Table 4: Contaminants emissions in Emilia Romagna (Italy)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	14,671,000	1,328,000	5,007,000	12,393,000	8,621,000	**42,018,000**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**14,671,000**	**1,328,000**	**5,007,000**	**12,393,000**	**8,621,000**	**42,018,000**
Total [percent]	**34,91%**	**3,16%**	**11,92%**	**29,49%**	**20,52%**	**100,00%**

Taking full responsibility of greenhouse gas emission limitations, according to national objectives and European Policies, the Emilia-Romagna Region made a strong choice by signing the KYOTO protocol and therefore sets this objective as basis of the regional energy policy. Due to this voluntary adherence and participation to national objectives protecting global environment, Regional Energy Plan has as strategic objective the 6,5% reduction of the emissions registered in the 1990 by 2010.

2.3.1.3 Final data

In the following tables, there are all the data used for analyses in chapter 2.4.

Table 5: Final data for energy consumption in Emilia Romagna (Italy)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	18,203,000	1,192,000	8,761,000	694,000	6,541,000	**35,391,000**	**5.32%**
Liquid fuels	29,330,000	16,170,000	12,918,000	169,037,000	24,855,000	**252,310,000**	**37.92%**
Gaseous fuels	190,325,000	3,922,000	65,205,000	6,509,000	111,694,000	**377,655,000**	**56.76%**
Total [GJ/year]	**237,858,000**	**21,284,000**	**86,884,000**	**176,240,000**	**143,090,000**	**665,356,000**	**100.00%**
Total share	**35.75%**	**3.20%**	**13.06%**	**26.49%**	**21.51%**	**100.00%**	

Table 6: Final data for contaminants emissions in Emilia Romagna (Italy)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	14,671,000	1,328,000	5,007,000	12,393,000	8,621,000	**42,020,000**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**14,671,000**	**1,328,000**	**5,007,000**	**12,393,000**	**8,621,000**	**42,020,000**
Total share	**34.91%**	**3.16%**	**11.92%**	**29.49%**	**20.52%**	**100.00%**

The following figures show the share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 5: Energy consumption sectors share in Emilia Romagna (Italy)

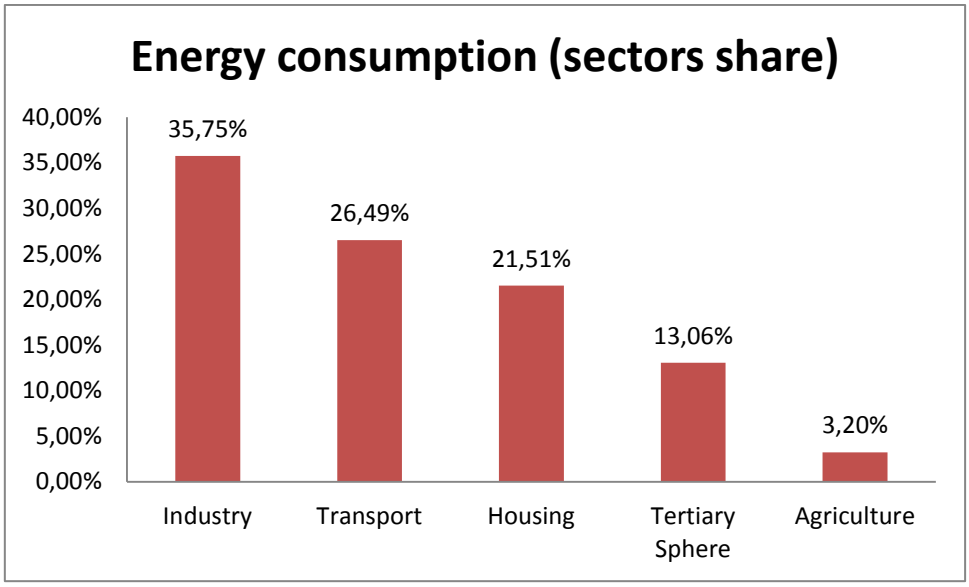


Figure 6: Energy consumption fuel types share in Emilia Romagna (Italy)

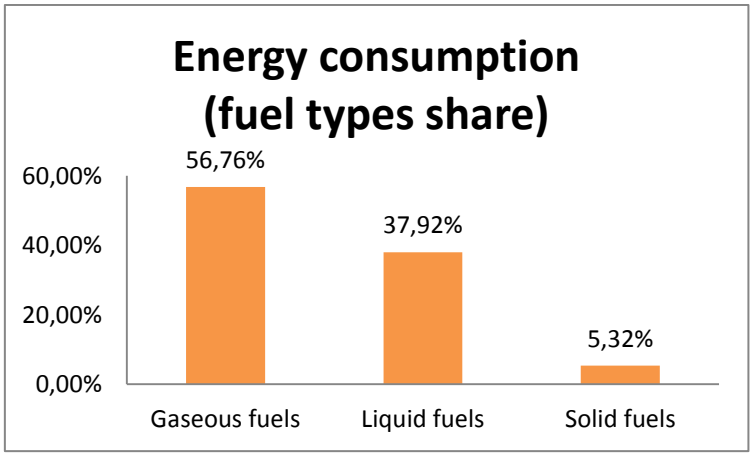
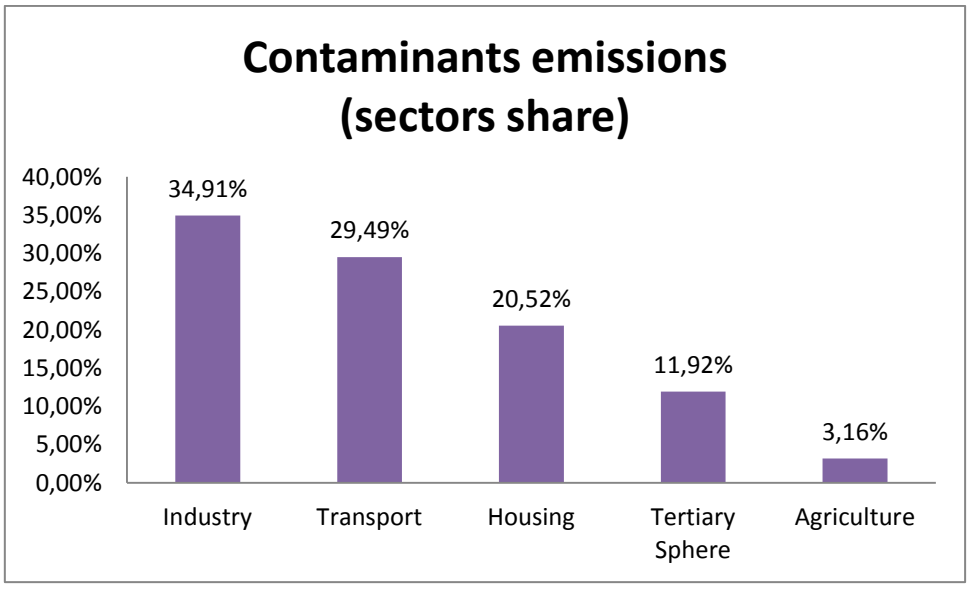


Figure 7: Contaminants emissions sector share in Emilia Romagna (Italy)



2.3.2 Malta

In Malta there are five administrative regions, namely Gozo region which is the “sister island” of Malta, Northwest, Southeast, South and Central regions. For the purpose of this analysis, Malta participated through three different regions: Gozo region (which is a NUTS 3 level region as well), Northwest region and South region.

Gozo Region, which includes the island of Comino, and which is composed of 14 localities, is spread out over an area of circa 60.70 km^2 and has 31,483 inhabitants. The energy generation is from the two power stations which cater for the whole island. The characteristic of the Gozo region, especially when compared to the other regions in Malta, is more rural and therefore the population density is relatively low, which stands at 518 inhabitants/km^2, which is relatively low when compared to the national population density of 1,308 inhabitants/km^2.

Northwest Region is composed of 12 localities, over an area of circa 112.90 km2 and with 84,270 inhabitants. The energy generation is from the two power stations and which cater for the whole island. The characteristic of the Northwest region especially when compared to the other regions in Malta (excluding Gozo) is more rural and therefore the population density is relatively low and which stands at 746 inhabitants/km^2, which is relatively low when compared to the national population density.

South Region is composed of 14 localities, over an area of circa 78.90 km2 and with 89,974 inhabitants. The energy generation is from the two power stations which cater for the whole island. The characteristic of the South region especially when compared to the other regions in Malta is more urban with a population density of 1,140 inhabitants/km^2, which is nearly identical to the national population density.

Because of the different character of these regions, the coming subchapter will be divided and every region will be examined individually.

There are no regional energy policies in Malta but there is a national energy policy which has been issued by the central Government. The Ministry for Resources and Rural Affairs has presented the National Strategy for Policy and Abatement Measures relating to the reduction of Greenhouse Gas emissions in September 2009. The same national strategy underlines that a number of proposed actions require further study as it was not deemed possible or realistic that the published strategy document would be comprehensive in terms of the details and impacts of each policy or abatement measure considered. Furthermore, it was emphasized that the proposed strategy is not absolute and immutable. As new challenges emerge and unforeseen opportunities arise, the strategy should be reviewed and reconsidered.

2.3.2.1 Energy consumption

In Malta, more than 94% of the fuels used are liquid fuels, whilst no solid ones are consumed. This statement is valid for every analyzed region as well. Data used for analysis were obtained from the national statistics office. Therefore a level of proportioning of national data has been inevitable. On the other hand, proportioning models were used very carefully and should represent true situation in regions.

Solid fuels (coke, black coal, brown coal, briquettes, wood, wood wastes, other solid fuels, special waste, granules) are not used in Malta and therefore in none of the regions.

The two types of fuels used are liquid fuels and gaseous fuels and the highest percentage of use is in the transport sector.

2.3.2.1.1 Gozo Region

The following Table 7 shows the energy consumption of the main economic branches in MWh/year where the transport sector is consuming the major part of the energy in the Gozo Region (54.53%) followed by industry (25.93%), housing (18.08%) and finally agriculture (1.46%).

Table 7: Energy consumption in Gozo Region (Malta)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**0**
Liquid fuels	313,279	17,348	n.a.	682,081	163,807	**1,176,515**
Gaseous fuels	11,045	936	n.a.	n.a.	62,327	**74,308**
Total [GJ/year]	**324,324**	**18,284**	**n.a.**	**682,081**	**226,134**	**1,250,823**
Total [percent]	**25,93**	**1,46**	**n.a.**	**54,53**	**18,08**	**100,00**

2.3.2.1.2 Northwest Region

The following

Table 8 shows the energy consumption of the main economic branches in MWh/year where the transport sector is consuming the major part of the energy in the Northwest Region (46.72%) followed by industry (36%), housing (15.79%) and finally agriculture (1.49%).

Table 8: Energy consumption in Northwest Region (Malta)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**0**
Liquid fuels	1,253,920	52,009	n.a.	1,672,751	436,975	**3,415,655**
Gaseous fuels	34,999	1,516	n.a.	n.a.	128,207	**164,722**
Total [GJ/year]	**1,288,919**	**53,525**	**n.a.**	**1,672,751**	**565,182**	**3,580,376**
Total [percent]	**36,00**	**1,49**	**n.a.**	**46,72**	**15,79**	**100,00**

2.3.2.1.3 South Region

The following Table 9 shows the energy consumption of the main economic branches in MWh/year where the transport sector is consuming the major part of the energy in the South Region (48.23%) followed by industry (33.21%), housing (17.52%) and finally agriculture (1%).

Table 9: Energy consumption in South Region (Malta)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**0**
Liquid fuels	1,089,637	33,390	n.a.	1,592,662	443,790	**3,159,479**
Gaseous fuels	6,797	824	n.a.	n.a.	134,874	**142,495**
Total [GJ/year]	**1,096,434**	**34,214**	**n.a.**	**1,592,662**	**578,664**	**3,301,974**
Total [percent]	**33,21**	**1,04**	**n.a.**	**48,23**	**17,52**	**100,00**

2.3.2.1.4 Comprehensive summary

Given that the main fuels used are liquid fuels there is risk of pollution which tends to increase as the traffic is on the increase in Malta. This risk is amplified for the Gozo region as the main transportation route is by sea from the mainland. The pollution risks are higher given that liquid fuels are considered as dangerous / hazardous / flammable goods. Although the frequency of the danger is not so high, the dimension could be catastrophic if an explosion occurs.

The local councils in all regions should consider conducting an energy audit of their facilities in order to identify possibilities of reducing energy consumption. Installation of renewable energy systems such as (but not limited to) a photovoltaic system could be considered. Promotional material should be provided to help the implementation of energy audits for non-municipal public buildings. It should be also considered to enter into an agreement with suppliers of renewable energy systems with the aim to purchase renewable energy at reduced prices.

Although all regions are different and were treated separately, the conclusion is the same for all of them. The largest sector in energy consumption is the Transport sector, followed by Industry, Housing and Agriculture. When added together, the following Table 10 shows comprehensive data.

Table 10: Total energy consumption in all analysed regions (Malta)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**0**
Liquid fuels	2,656,832	102,748	n.a.	3,947,494	1,044,572	**7,751,646**
Gaseous fuels	52,841	3,276	n.a.	n.a.	325,408	**381,524**
Total [GJ/year]	**2,709,673**	**106,024**	**n.a.**	**3,947,494**	**1,369,980**	**8,133,170**
Total [percent]	**33,32%**	**1,30%**	**n.a.**	**48,54%**	**16,84%**	**100,00%**

2.3.2.2 Emissions

In the case of all examined regions, only CO_2 emissions data were available. The following subchapters will therefore give the details of the CO_2 emissions subdivided by the main economic branch. Values are based on the quantity reported in the National Greenhouse Gas Emission Inventory for Malta and the values therein have been calculated using standard emission factors in line with IPPC principles.

2.3.2.2.1 Gozo Region

The following Table 11 shows CO_2 emissions in the region.

Table 11: Contaminants emissions in Gozo Region (Malta)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	70,169	3,737	n.a.	40,500	43,258	**157,664**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**70,169**	**3,737**	**n.a.**	**40,500**	**43,258**	**157,664**
Total [percent]	**44,51**	**2,37**	**n.a.**	**25,69**	**27,44**	**100,00**

As can be seen, the largest sector with the greatest emissions is industry with 44,51% of the CO_2 emissions. The second and third largest sectors are Housing and Transport sectors, with 27,44% and 25,69%. The Tertiary Sphere sector was not identified. The Agriculture sector plays only a minor role in the case of CO_2 emissions.

2.3.2.2.2 Northwest Region

The following Table 12 shows CO_2 emissions in the region.

Table 12: Contaminants emissions in Northwest Region (Malta)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	285,235	11,801	n.a.	124,156	113,067	**534,259**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**285,235**	**11,801**	**n.a.**	**124,156**	**113,067**	**534,259**
Total [percent]	**53,39**	**2,21**	**n.a.**	**23,24**	**21,16**	**100,00**

As can be seen, the largest sector with the greatest emissions is industry with 53,4% of the CO_2 emissions. The second and third largest sectors are the Transport and Housing sectors, with 23,2% and 21,2%. The Tertiary Sphere sector was not identified. The Agriculture sector plays only a minor role in the case of CO_2 emissions.

2.3.2.2.3 South Region

The following Table 13 shows CO_2 emissions in the region.

Table 13: Contaminants emissions in South Region (Malta)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	265,254	7,651	n.a.	112,946	115,115	**500,966**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**265,254**	**7,651**	**n.a.**	**112,946**	**115,115**	**500,966**
Total [percent]	**52,95**	**1,53**	**n.a.**	**22,55**	**22,98**	**100,00**

As can be seen, the largest sector with the greatest emissions is industry with 52,95% of the CO_2 emissions. The second and third largest sectors are the Housing and Transport sectors, with 22,98% and 22,55%. The Tertiary Sphere sector was not identified. The Agriculture sector plays only a minor role in the case of CO_2 emissions.

2.3.2.2.4 Comprehensive summary

In Malta the energy is mainly generated by means of the two power stations which make use of liquid fuel and hence we have high greenhouse gas emissions. Unless the heavy fuel oil is replaced by a cleaner fuel such as gas, the risk of CO_2 emissions will rather increase and not decrease.

Since electricity production is the major source of CO_2 emissions, it is envisaged that any improvement in this regard shall contribute to an improvement in the National Emission Factor and as a result reduce the locality's portion of CO_2 emissions.

Educational strategy may be implemented to explain the energy consumption and contaminants emissions problematic, based on principles of accessibility of information, good practice and targeting specific consumer sectors. The two power stations in Malta should preferably operate on natural gas rather than on heavy fuel oil as the former is a much cleaner technology. Renewable energy systems should be installed.

Although all regions are different and were treated separately, the conclusion is the same for all of them. The greatest emissions sector is the Industry sector, followed by the Housing and Transport sectors, which are in the case of CO_2 emissions, similar. When added together, the following Table 14 shows comprehensive data.

Table 14: Total contaminants emissions in all analysed regions (Malta)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	620,658	23,189	n.a.	277,602	271,440	**1,192,889**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**620,658**	**23,189**	**n.a.**	**277,602**	**271,440**	**1,192,889**
Total [percent]	**52,03%**	**1,94%**	**n.a.**	**23,27%**	**22,75%**	**100,00%**

2.3.2.3 Final data

In the following tables, there are all the data as used for analyses in chapter 2.4.

Table 15: Final data for energy consumption in Malta aggregated regions

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**0**	**0,00%**
Liquid fuels	2,656,832	102,748	n.a.	3,947,494	1,044,572	**7,751,646**	**95,31%**
Gaseous fuels	52,841	3,276	n.a.	n.a.	325,408	**381,525**	**4,69%**
Total [GJ/year]	**2,709,673**	**106,024**	**0**	**3,947,494**	**1,369,980**	**8,133,171**	**100,00%**
Total share	**33,32%**	**1,30%**	**0,00%**	**48,54%**	**16,84%**	**100,00%**	

Table 16: Final data for contaminants emissions in Malta aggregated regions

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	620,658	23,189	n.a.	277,602	271,440	**1,192,889**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**620,658**	**23,189**	**n.a.**	**277,602**	**271,440**	**1,192,889**
Total share	**52,03%**	**1,94%**	**n.a.**	**23,27%**	**22,75%**	**100,00%**

The following figures show the share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 8: Energy consumption sectors share in Malta aggregated regions

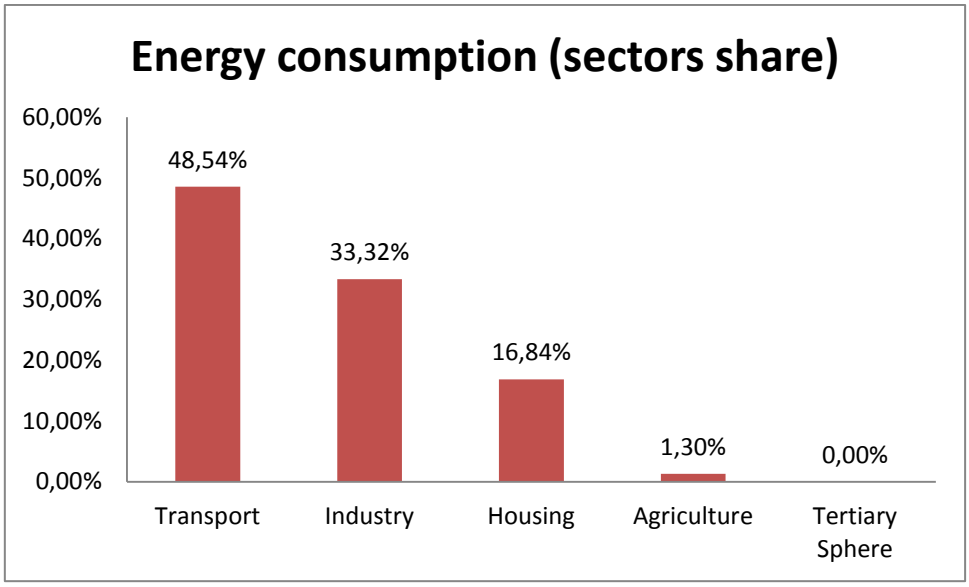


Figure 9: Energy consumption fuel types share in Malta aggregated regions

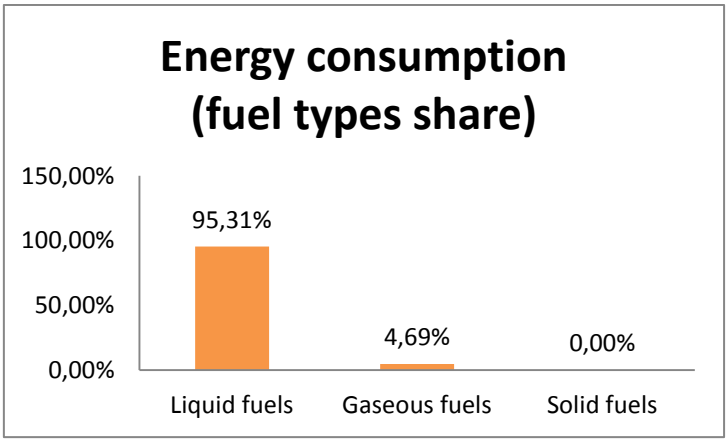
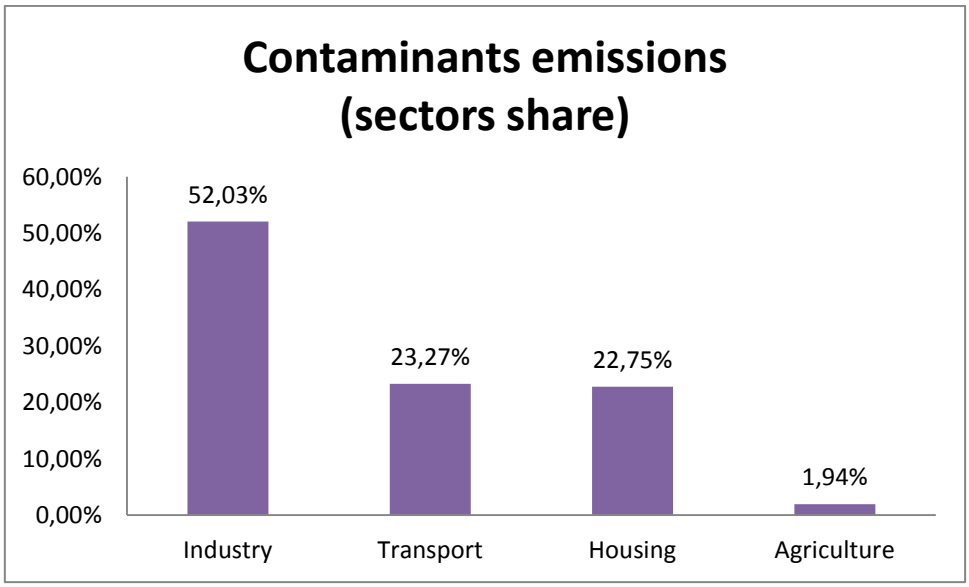


Figure 10: Contaminants emissions sector share in Malta aggregated regions



2.3.3 Hungary

Hungary participated through one target region, which is called the Northern Great Plain. This NUTS 2 region includes 3 different NUTS 3 counties and 28 NUTS 4 micro regions. The majority of them are less developed and underprivileged. The total territory of the region 17 729 km^2, the population 1 519 577 inhabitants, and the population density is 97 person/km^2. The number of settlements is 389, and 64 of them is urban. The Northern Great Plain Region produces 10.2% of Hungary's gross domestic product. The value of the 1 person /GDP (1591 thousand, 2007) rate was 1/3 of the highest.

The most important statistical data about the labor market is the following: the activity rate 55%, the employed rate 50,8% and the unemployment rate 10,7% (2009). In the region there were 130,505 unemployed people, which was 17,2% higher than one year earlier.

The majority of employed people are involved the tertiary sector, but due to the good agriculture conditions there are lots of people working in that sphere as well. The land used for agriculture is 12537 km2, which is one of the biggest in the whole country. In the business sector, the number of enterprises and entrepreneurship is less than the national average in the rural areas. Micro-enterprises are predominant in the entrepreneurial structure. The ratio of individual (self-employed) enterprises in the rural areas is 67%, in contrast to the national figure of 52%.

The living and working conditions and the opportunities for employment and education are disgraceful in the rural regions.

2.3.3.1 Energy consumption

The total energy consumption of the country was 527 487 TJ in 2007, which means that the Northern Great Plain region ranks 4th from Hungarian's regions. During the recent years (because of the political changes) energy consumption has shown a large decrease (20%).

As can be seen in Table 17, the total share of the Northern Great Plain region is 12,4% with 65 154 TJ.

Table 17: Energy consumption in Northern Great Plain (Hungary)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	4 203 000	**n.a.**
Liquid fuels	893,000	1,987,000	n.a.	n.a.	n.a.	**n.a.**
Gaseous fuels	n.a.	n.a.	10,951,000	n.a.	18,669,000	**47,316,000**
Total [GJ/year]	**12,550,000**	**4,985,000**	**15,999,000**	**n.a.**	**31,620,000**	**65,154,000**
Total [percent]	**19,26%**	**7,65%**	**24,56%**	**n.a.**	**48,53%**	**100,00%**

The biggest share in the case of different sectors for gas is the housing sector (48,53%), followed by the Tertiary Sphere (24,56%) and the Industry sector (19,26%). The last is the Agriculture sector with 7,65%, which is above average for this sector. The structure of regional energy consumption is not different from the national average.

Natural gas is the dominant fuel type, since Hungary is dependent on natural gas imports, and the gas system is implemented everywhere.

Hungary does not have regional energy standards or policies. The most important authority is the North-Plain Regional Energy Agency. The mission of the agency is to promote energy efficiency, to support the rational usage of energy resources, to foster the usage of new and renewable energy resources and to support energy diversification. They have made a regional strategy, which aims to provide a concept for the utilization of new and renewable energy resources in the region, to foster the usage of renewable technologies and to increase the efficiency of these technologies.

Energy consumption in Hungary has a big environmental impact in general and there are other impacts such as economic and social impacts. Therefore raising environmental awareness and education is suggested in the private and public spheres, even though consumption is decreasing and is lower than in past years

2.3.3.2 Emissions

The total emissions of greenhouse gases in Hungary were 73.1 million tons carbon dioxide equivalents. It is lower than it was in the last years due to the economic recession and other changes. The most important greenhouse gas is carbon dioxide accounting for 76.9% of total emissions. According to the National Inventory Report for 1985-2008 it must be emphasized that the energy sector was responsible for 76.9% of total GHG emissions among the sectors. The share of energy emissions are: 35% energy industries, 30% other (residential, agriculture etc.) 23% transport, 13% manufacturing and construction.

Unfortunately, most of the data were not available for the Northern Great Plain territory and only total numbers of contaminants emissions were provided, with the exception of Carbon dioxide. The results can be seen in the following Table 18.

Table 18: Contaminants emissions in Northern Great Plain (Hungary)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	n.a.	n.a.	n.a.	n.a.	2 478	**n.a.**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**4,089**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**2,251**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**19,261**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**66,177**
other	n.a.	n.a.	n.a.	n.a.	n.a.	**9,780**
Total [tons/year]	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**101,558**
Total [percent]	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

According to national shares of contaminants emissions, the CO_2 emission should be around 76,9% of total emissions and therefore it should be around 338 087 tons/year and in the future part of this report this number can be used only as an expert estimate. This number can differ because of the agricultural predominance of the region.

Since Hungarian accession to EU, regulations according to climate changes and emissions were affected towards cleaner energy usage and many specific plans and projects are being implemented. The new government is working on the national energy policy.

There is a lack of environmental awareness in public and private spheres, due to the heritage of the communist regime, the comfortable life style, and the different generations growing up without environmental knowledge. One of the serious problems is the lack of a holistic approach for developing long-term management strategies. The role of leaders and decision makers is decisive in Hungary because of the "top-down" social habitat. The Hungarian population is committed to environment consciousness less than west-European citizens. In the economic environment, one of the most important facts is investment, by which subsidy's requirements are more and more environmentally conscious.

The region is predominantly characterised by agricultural activity. Agricultural air pollution has a determining role: animal husbandry, compost producing, fertilizer, leaves and waste burning etc. A further impact is the CO_2 emission of agricultural machinery and the transport of agricultural goods.

In the future, it is important to calculate and assess CO_2 balance for the region and if needed biomass plants should be produced in the region in a bigger volume. It is advisable mainly in those arable lands that are not suitable for classic agricultural production. Due to the industrial activity, technological development is needed in thermal and electricity production to decrease CO_2 emissions. It is recommended to use more the existing railway system in the region when addressing transportation.

2.3.3.3 Final data

In the following tables, there are all the data as used for analyses in chapter 2.4.

Table 19: Final data for energy consumption in Northern Great Plains (Hungary)

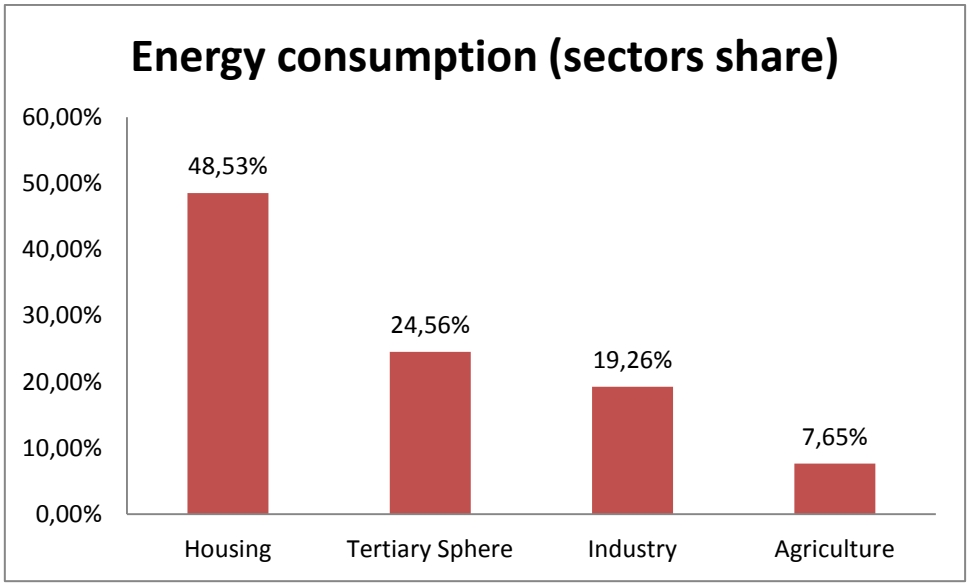
Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	n.a.	n.a.	n.a.	n.a.	4 203 000	**n.a.**	**n.a.**
Liquid fuels	893 000	1 987 000	n.a.	n.a.	n.a.	**n.a.**	**n.a.**
Gaseous fuels	n.a.	n.a.	10 951 000	n.a.	18 669 000	**47 316 000**	**72,62%**
Total [GJ/year]	**12 550 000**	**4 985 000**	**15 999 000**	**n.a.**	**31 620 000**	**65 154 000**	**100,00%**
Total share	**19,26%**	**7,65%**	**24,56%**	**n.a.**	**48,53%**	**100,00%**	

Table 20: Final data for contaminants emissions in Northern Great Plains (Hungary)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**4089**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**2251**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**19261**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**66177**
Total [tons/year]	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**101 558**
Total share	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

The following figures show share of specific sectors in contaminants emissions based on data provided by the partner.

Figure 11: Energy consumption sectors share in Northern Great Plains (Hungary)



2.3.4 Czech Republic

The Czech Republic participated through two NUTS 2 level regions: Middle Bohemia region and Prague region. These regions are quite different and therefore they will be treated separately.

Prague is the capital city of the Czech Republic and at the same time it is the largest city in the country by area (496 km2) and by population (1.23 million inhabitants in 2008). Concerning quality of the environment the city of Prague must solve similar issues as other large cities in the world. These are especially automotive traffic impacts, water and energy management, waste management, yet also sustainable use of land, care for cleanliness, greenery, and valuable nature localities on the city territory. In recent years numerous issues, which were putting a burden on the city environment arising from the past decades,(mostly from the former regime era), were managed to be solved. Other issues are, on the contrary, a challenge to new measures. Due to the current conditions further intentions in environmental management and care for the environment of the capital city of Prague are formulated in the Strategic Plan and in numerous conceptual documents aiming at particular thematic fields.

2.3.4.1 Energy consumption

In the Czech Republic, the main source of electric energy is brown coal (66%) and nuclear energy (30%). There are no oil or coal mines in the considered regions; therefore they are completely dependent on their imports. Sectors are using energy especially in the form of electricity, gaseous fuels, solid fuels and liquid fuels.

2.3.4.1.1 Middle Bohemia

The following Table 21 shows energy consumption in the Middle Bohemia region. The biggest share of energy consumption goes to the Housing sector (46,02%), followed by the Industry sector (45,07). The last three sectors are the Tertiary Sphere (7,32%), Transport (0,85%) and Agriculture (0,56%).

Table 21: Energy consumption in Middle Bohemia (Czech Republic)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	51 398 220	642 478	8 352 211	963 717	52 683 175	**114 039 800**
Liquid fuels	2 775 707	34 696	451 052	52 045	2 845 100	**6 158 600**
Gaseous fuels	10 034 073	125 426	1 630 537	188 139	10 284 925	**22 263 100**
Total [GJ/year]	**64 208 000**	**802 600**	**10 433 800**	**1 203 900**	**65 813 200**	**142 461 500**
Total [percent]	**45,07%**	**0,56%**	**7,32%**	**0,85%**	**46,20%**	**100,00%**

The priority of Middle Bohemia region should be in lowering dependency on energy imports, lowering energy usage, concentration on renewable energy and adjusting to safety management of energies.

2.3.4.1.2 Prague

Prague is the capital city of the Czech Republic. Its number of inhabitants and area makes it the largest city in the Czech Republic. Its role in the country as the natural centre of politics, international affairs, education, cultural life, and economy just follows from these factors. Prague is not merely a centre of employment opportunities for the Central Bohemia Region, but also for the whole country; here the international companies and firms doing business in progressive sectors of economy get concentrated. This determines its high economic performance, high average pay, and low unemployment rate. The number of Prague inhabitants has been growing namely due to economically motivated foreign migration.

The city of Prague has been systematically active in the fields of information dissemination, awareness, and education of the public with the objective to bring unbiased environmental information and the effect on raised public awareness and environmentally friendly behavior of the public. The Prague Environmental Information System, which presents data on-line as well as in the form of publications, has already a long tradition. The field of environmental education and awareness has been developed in a conceptual manner, especially in cooperation with schools. Thematic information campaigns focused on energy savings and other topics (for instance, waste management, nature conservation, and support to healthy life style, including bicycle transport) are also organised. Companies cooperating with the city have also been active in information and awareness activities.

Table 22: Energy consumption in Prague (Czech Republic)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	5 737 178	3 554	1 929 043	2 924	1 780 191	**9 452 890**
Liquid fuels	565 086	703	148 826	24 117	32 754	**771 486**
Gaseous fuels	11 771 649	39 202	10 613 009	892 892	13 020 071	**36 336 823**
Total [GJ/year]	**18 073 913**	**43 459**	**12 690 878**	**919 933**	**14 833 016**	**46 561 199**
Total [percent]	**38,82%**	**0,09%**	**27,26%**	**1,98%**	**31,86%**	**100,00%**

Table 22 shows us energy consumption in Prague. As we can see, the biggest share goes to the Industry sector with 38,82%, followed by Housing (31,86%). The third is the Tertiary Sphere (27,26%) . The last are Transport (1,98%) and Agriculture (0,09%).

In the target region NUTS II Prague gaseous fuels (especially natural gas) represent the largest energy source in all economic branches. The dependence of the Czech Republic on natural gas imports from abroad - especially Russia brings one of the strategic disadvantages of the Czech economy (there are only very limited own natural gas sources available in the country). Solid fuels represent the second largest source, because they represent the main energy source for production of electricity and heat. In Prague this concerns power, heat and refuse incinerating plants. The Czech Republic has large deposits of black and brown coal which represent a low cost source of energy. On the other hand coal is the most significant polluter. Industry and housing are the largest energy consumers from all branches. Attention with high priority is paid to energy saving in the housing branch (nearly 32% of the total consumption).

The city of Prague has been dealing with systematic prevention of risks in energy and fuel supply. The basis is the study of .Security Policy of the Capital City of Prague in energy supply. The study assessed strategic security of supplies of respective forms of energy and fuel; recommendations were made in the fields of both strategic and operational reliability and to development of their respective systems.

Prague, in the same way as other European and world cities, has been aware of climate change, the saving of different energy sources and use of diversified ones and has been implementing a number of measures.

Prague strives to be a prudent manager, behaving in an environmentally friendly way and sound in the field of sustainable energy.

2.3.4.2 Emissions

Industrial pollution decreased (2008 – 2009) due to the recession last year, but air in small towns is not better, as households again burn solid fuel to cut their costs, according to the Report on the State of the Environment in the Czech Republic. The annual growth in the number of households reverting to solid fuel for heating and a growing sale of coal briquettes is one of the most negative findings of the report.

2.3.4.2.1 Middle Bohemia

As can be seen in following Table 23, most contaminants are produced by the Industry sector (44,48%), followed by the Housing sector (39,30%), the Tertiary Sphere (14,54%), Transport (1,35%) and Agriculture (0,33%).

Table 23: Contaminants emissions in Middle Bohemia (Czech Republic)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	8 286 311	61 201	2 708 982	251 137	7 322 370	**18 630 000**
Solids	4 941	36	1 615	150	4 366	**11 108,20**
Sulphur dioxide (SO_2)	10 216	75	3 340	310	9 028	**22 969,20**
Nitrogen oxides (NO_x)	17 754	131	5 804	538	15 688	**39 915,30**
Carbon monoxide (CO)	26 770	198	8 752	811	23 656	**60 186,10**
Total [tons/year]	**8 345 991**	**61 642**	**2 728 493**	**252 946**	**7 375 108**	**18 764 179**
Total [percent]	**44,48%**	**0,33%**	**14,54%**	**1,35%**	**39,30%**	**100,0%**

Reducing contaminants emissions is one of the priorities of Middle Bohemia and there are special programs for implementing this task.

2.3.4.2.2 Prague

In recent years numerous issues, which were putting a burden on the City environment from the past decades,(mostly from the former regime era), were managed to be solved. Other issues are, on the contrary, a challenge to new measures.

Emissions of basic pollutants into the air from stationary sources were successfully reduced by many times. For instance, sulphur dioxide emissions were reduced by more than twenty times within the period since 1990. The effect of solid fuel reduction and installation of efficient technologies at larger air pollution sources have brought their benefits.

The issue of automotive traffic-generated air pollution still persists. Traffic load on the City territory has been significantly growing; over the last twenty years it has roughly doubled. The effects of this increase on air quality and noise are partly compensated by replacement in fleet by vehicles having better emission parameters, construction of new ring roads outside the developed areas, limited entry to the City centre, as well as support to public transport. The support to bicycle transport and building of cycling routes is also a traffic measure in the interest of high quality environment and healthy life style of the inhabitants. It can be stated, on the basis of data from measurements, that air quality is satisfactory for the majority of year. In recent years, no smog conditions were signaled and no regulating measures were applied.

In the suburban areas of the city environmental quality is substantially better than in the central section and in the vicinity of traffic-loaded roads. Due to the current conditions further intentions in environmental management and care for the environment of the Capital City of Prague are formulated in the Strategic Plan and in numerous conceptual documents aiming at particular thematic fields.

The following Table 24 shows contaminants emissions in Prague, divided by sectors share.

Table 24: Contaminants emissions in Prague (Czech Republic)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	1 228 566	2 621	610 026	51 955	904 289	**2 797 457**
Solids	296,79	1,10	74,99	4,10	653,96	**1 030,94**
Sulphur dioxide (SO_2)	1 531,01	1,26	116,80	3,94	1 126,96	**2 779,97**
Nitrogen oxides (NO_x)	2 263,67	2,45	769,28	52,48	870,05	**3 957,93**
Carbon monoxide (CO)	904,67	6,13	590,58	12,12	4 079,91	**5 593,41**
Total [tons/year]	**1 233 562**	**2 632**	**611 578**	**52 028**	**911 020**	**2 810 819**
Total [percent]	**43,89%**	**0,09%**	**21,76%**	**1,85%**	**32,41%**	**100,00%**

As can be seen, most emissions of basic contaminants in Prague is caused by the sector of Industry (43,89%) and Housing (32,41%), followed by the Tertiary Sphere (21,76%), Transport (1,85%) and Agriculture (0,9%). There has been an immense reduction of emissions in the recent decade. This is due legislative measures (e.g. after EU accession), heavy industry decline, current economy drives and global trends. There is a continuous conversion process to cleaner fuels, new production technologies, energy conservation, cost savings and new cleaning technologies for pollutants. Only the Transportation branch shows a growing trend in Prague.

In the future, solid fuels consumption and emissions from stationary to reduction should be aimed for, especially reduction of emissions from transport. The increasing share of renewable energy sources is quit important as well, together with the construction of energy saving buildings by Prague.

2.3.4.3 Final data

In the following tables, there are all data as used for analyses in chapter 2.4.

Table 25: Final data for energy consumption in Middle Bohemia (Czech Republic)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	51 398 220	642 478	8 352 211	963 717	52 683 175	**114 039 801**	**80,05%**
Liquid fuels	2 775 707	34 696	451 052	52 045	2 845 100	**6 158 600**	**4,32%**
Gaseous fuels	10 034 073	125 426	1 630 537	188 139	10 284 925	**22 263 100**	**15,63%**
Total [GJ/year]	**64 208 000**	**802 600**	**10 433 800**	**1 203 901**	**65 813 200**	**142 461 501**	**100,00%**
Total share	**45,07%**	**0,56%**	**7,32%**	**0,85%**	**46,20%**	**100,00%**	

Table 26: Final data for energy consumption in Prague (Czech Republic)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	5 737 178	3 554	1 929 043	2 924	1 780 191	**9 452 890**	**20,30%**
Liquid fuels	565 086	703	148 826	24 117	32 754	**771 486**	**1,66%**
Gaseous fuels	11 771 649	39 202	10 613 009	892 892	13 020 071	**36 336 823**	**78,04%**
Total [GJ/year]	**18 073 913**	**43 459**	**12 690 878**	**919 933**	**14 833 016**	**46 561 199**	**100,00%**
Total share	**38,82%**	**0,09%**	**27,26%**	**1,98%**	**31,86%**	**100,00%**	

Table 27: Final data for contaminants emissions in Middle Bohemia (Czech Republic)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	8 286 311	61 201	2 708 982	251 137	7 322 370	**18 630 001**
Solids	4941	36	1615	150	4366	**11108**
Sulphur dioxide (SO_2)	10216	75	3340	310	9028	**22969**
Nitrogen oxides (NO_x)	17754	131	5804	538	15688	**39915**
Carbon monoxide (CO)	26770	198	8752	811	23656	**60187**
Total [tons/year]	**8 345 992**	**61 641**	**2 728 493**	**252 946**	**7 375 108**	**18 764 180**
Total share	**44,48%**	**0,33%**	**14,54%**	**1,35%**	**39,30%**	**100,00%**

Table 28: Final data for contaminants emissions in Prague (Czech Republic)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	1 228 566	2 621	610 026	51 955	904 289	**2 797 457**
Solids	296,79	1,1	74,99	4,1	653,96	**1030,94**
Sulphur dioxide (SO_2)	1531,01	1,26	116,8	3,94	1126,96	**2779,97**
Nitrogen oxides (NO_x)	2263,67	2,45	769,28	52,48	870,05	**3957,93**
Carbon monoxide (CO)	904,67	6,13	590,58	12,12	4079,91	**5593,41**
Total [tons/year]	**1 233 562**	**2 632**	**611 578**	**52 028**	**911 020**	**2 810 819**
Total share	**43,89%**	**0,09%**	**21,76%**	**1,85%**	**32,41%**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 12: Energy consumption sectors share in Middle Bohemia (Czech Republic)

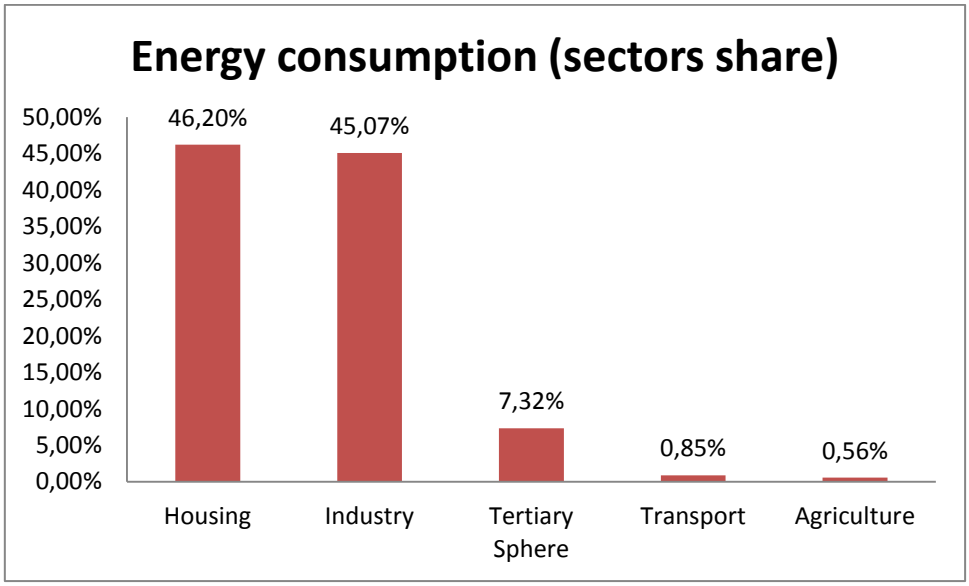


Figure 13: Energy consumption sectors share in Prague (Czech Republic)

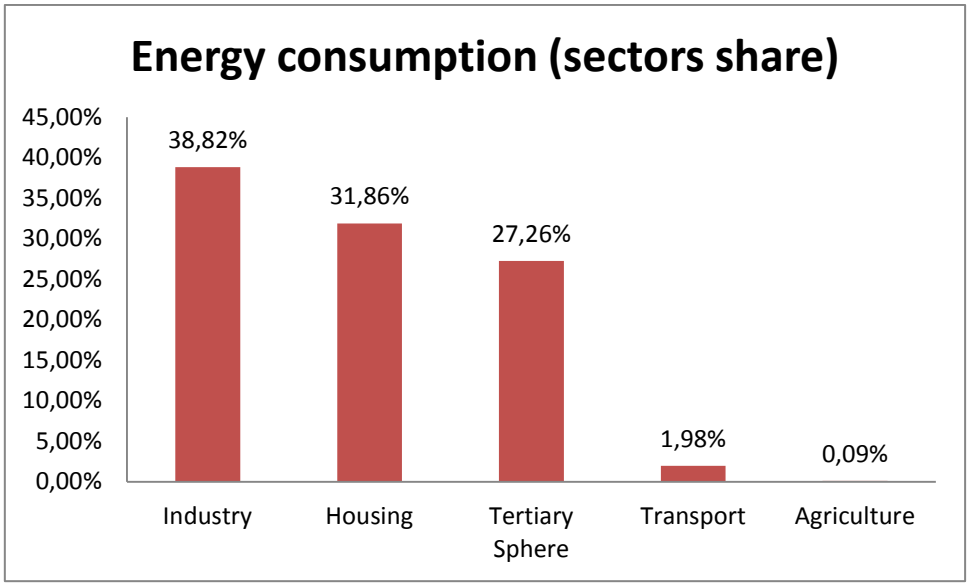


Figure 14: Energy consumption fuel types share in Middle Bohemia (Czech Republic)

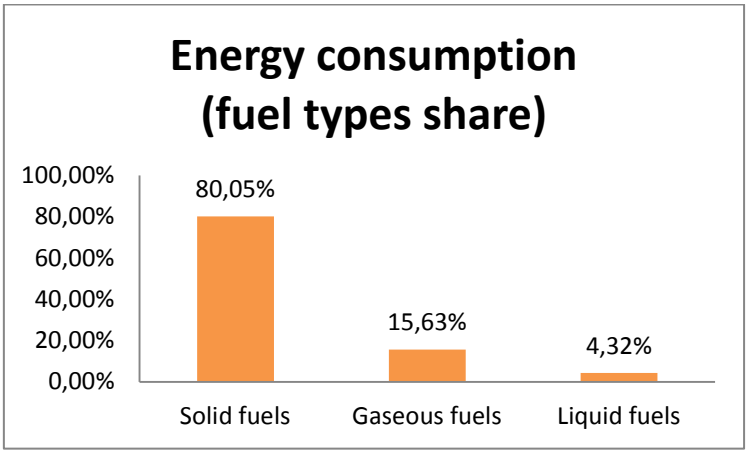


Figure 15: Energy consumption fuel types share in Prague (Czech Republic)

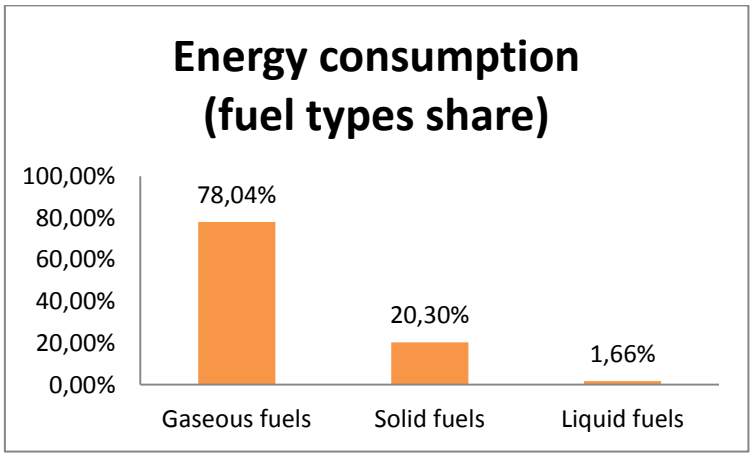


Figure 16: Contaminants emissions sector share in Middle Bohemia (Czech Republic)

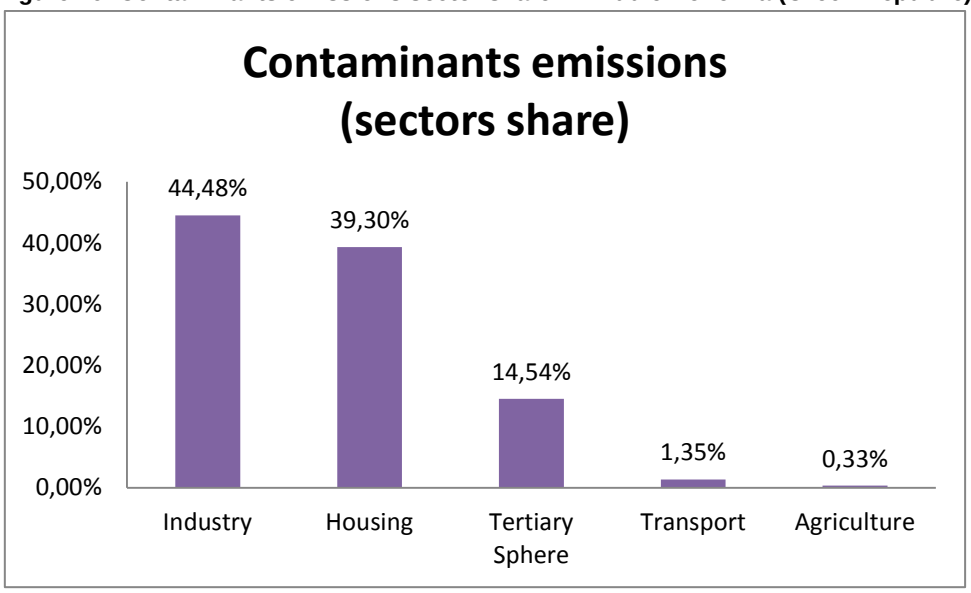
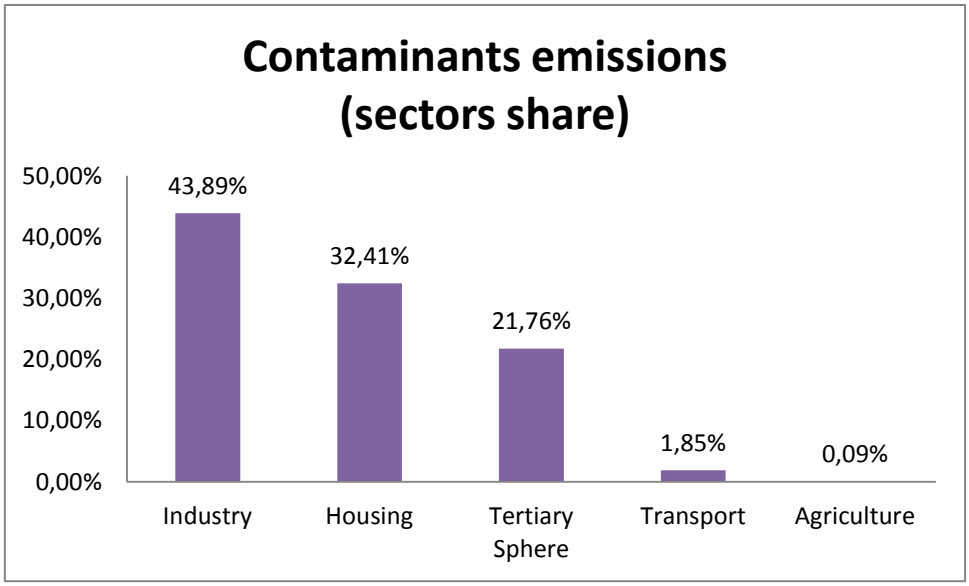


Figure 17: Contaminants emissions sector share in Prague (Czech Republic)



2.3.5 Greece

Greece participated through one target NUTS 2 region – Western Greece (Sterea Ellada). Due to the lack of analyses and missing data, deep comparison and assessment were not possible.

2.3.5.1 Energy consumption

As can be seen in the following Table 29, most data were not available and the table is not suitable for further analysis, mainly due to the lack of data and data imperfection.

Table 29: Energy consumption in Western Greece

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Liquid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Gaseous fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [GJ/year]	**16 726**	**846**	**3 519**	**n.a.**	**3 688**	**9 725**
Total [percent]	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

2.3.5.2 Emissions

As for contaminants emissions, the situation with data is better than with energy consumption, because at least data for the whole country was available, as can be seen in the following Table 30.

Table 30: Contaminants emissions in Greece

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	77 552 836	2 568 320	1 501 060	23 371 330	8 596 760	**113 565 830**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	521 870,00	n.a.	n.a.	28 960,00	n.a.	**550 830,00**
Nitrogen oxides (NO_x)	226 390,00	1 210,00	n.a.	150 400,00	n.a.	**378 000,00**
Carbon monoxide (CO)	308 960,00	26 940,00	n.a.	499 770,00	n.a.	**835 670,00**
Total [tons/year]	**78 610 056**	**2 596 470**	**1 501 060**	**24 050 460**	**8 596 760**	**115 330 330**
Total [percent]	**68,16%**	**2,25%**	**1,30%**	**20,84%**	**7,45%**	**100,00%**

The biggest share of contaminants emissions goes to Industry with 68,16%. This sector is followed by Transport with 20,84%, Housing (7,45%) and Agriculture (2,25%). The last is surprisingly the Tertiary Sphere with only 1,30%.

2.3.5.3 Final data

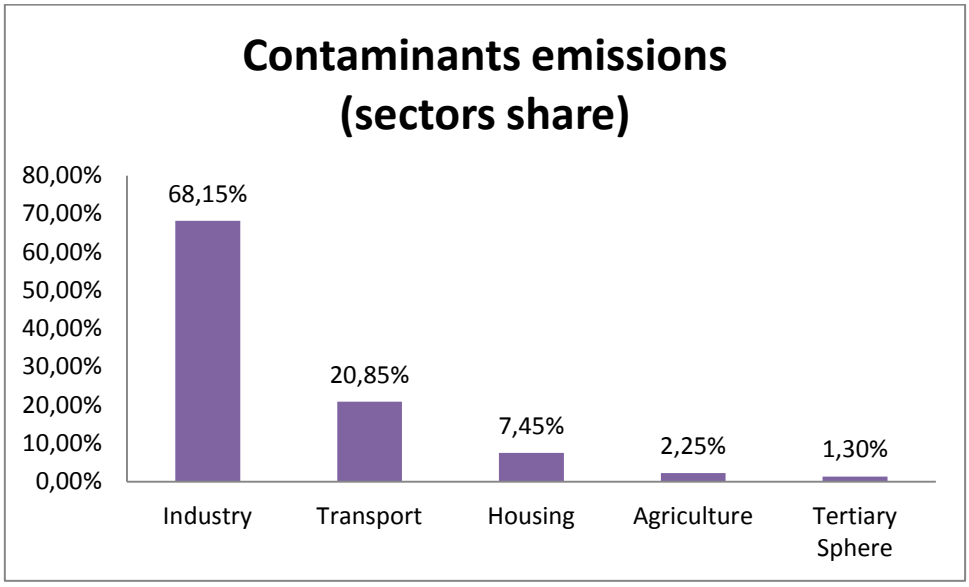
In the following table, there are all the data as used for analyses in chapter 2.4.

Table 31: Final data for contaminants emissions in Greece

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	77 552 836	2 568 320	1 501 060	23 371 330	8 596 760	**113 590 306**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	521870	n.a.	n.a.	28960	n.a.	**550830**
Nitrogen oxides (NO_x)	226390	1210	n.a.	150400	n.a.	**378000**
Carbon monoxide (CO)	308960	26940	n.a.	499770	n.a.	**835670**
Total [tons/year]	**78 610 056**	**2 596 470**	**1 501 060**	**24 050 460**	**8 596 760**	**115 354 806**
Total share	**68,15%**	**2,25%**	**1,30%**	**20,85%**	**7,45%**	**100,00%**

The following figure shows sector share in contaminants emissions based on data provided by the partner.

Figure 18: Contaminants emissions sector share in Western Greece



2.3.6 Slovakia

Slovakia participated through two NUTS 3 regions: Trnava and Trenčín. These regions are similar and are treated together in this report, because both regions are located in the west part of the Slovakia, they dispose of a quite good road network, and from an investment point of view those are very attractive regions. In each region there live more than 500 000 inhabitants. Unemployment is one of the lowest from the whole of Slovakia and incomes are on the level of the national average.

Unfortunately, there were no hard data available, so comparison tables for Slovakia could not be filled at all.

2.3.6.1 Energy consumption

In the region of Trenčín and Trnava in the past years there is a significant increase in the development of industry, what brought also immigration, construction of new houses and an increase in transport. The regional energy policy is in both regions being elaborated in line with this, but in any case will reflect national energy policy, which is focused on decreasing of emissions of CO_2 and at the same time supporting use of renewable energy sources.

With the increase of prosperity requirements for comfort in the cities and villages many investments went into construction of new flats and houses. Thus requirements on consumption were increased, but new construction materials have better insulating attributes as well.

In the future, new technologies should be developed and implemented and vehicles energy efficiency should be improved. Heating is essential for all houses in Slovakia and transport is essential to the mobility of the population, therefore special attention should be paid to these categories.

2.3.6.2 Emissions

In the region of Trnava and Trenčín the biggest consumer of energy and CO_2 emissions is the transport sector and heating. The main factor that contributes to CO_2 emission in Trnava and Trenčín region is transport, the heating of houses and industry.

Slovakia uses many different energy and environmental plans which aim to decrease contaminants emissions in future years.

2.3.6.3 Final data

No data which could be used for analyses in chapter 2.4 were provided by this partner.

2.3.7 Slovenia

Slovenia participated through one target NUTS 3 level region, which is called Pomurje and which is part of NUTS 2 level region – Eastern Slovenia. Pomurje region is a region in the northeast of Slovenia with a central watercourse, the river Mur, and bordering Austria, Hungary and Croatia. The relatively limited land area is 1337 km^2 large (6.6% of the entire territory of Slovenia) and there are about 120,875 inhabitants, representing approximately 6.3% of the total population of Slovenia. In the region are important economic activities of industry, agriculture and forestry, construction, commerce, manufacturing and service craft, and many others. A relatively clean and well- maintained environment is the basis for a nature-friendly development.

Important economic activities in the region are industry, agriculture and forestry, wholesale, retail, manufacturing and service craft, and many others. Pomurje region municipalities have a developed intellectual infrastructure such as primary education, childcare, sports, health, and social and physical infrastructure such as roads, railways, telecommunications, electricity and water supply.

Use of renewable energy in Pomurje is slowly but steadily pursued. Under the current situation for heating and heat technology the region uses 44% renewable energy sources, ie. wood, geothermal energy, solar energy and energy derived from heat pumps.

Analyses, which were provided by the Slovenian partner, deal with NUTS 3 Pomurje region. On the other hand, tables, which were used for comparison in chapter 2.4, were adjusted for NUTS 2 region – Eastern Slovenia. Therefore it should be noted, that tables in chapters 2.3.7.1 and 2.3.7.2 are concerning Eastern Slovenia, although data were, for the purpose of analyses, treated as if they are concerning Pomurje region.

2.3.7.1 Energy consumption

In comparison to Slovenia, the Pomurje region per capita on average consumes 23% more energy for heating and heat technology. For electricity consumption, a resident of Pomurje consumes 45% less energy than the average in Slovenia. Also the traffic in Pomurje region (in average per capita) spent 22% less energy.

As can be seen in the following Table 32, the highest consumption is still on liquid fuels, followed by electricity, gas fuel and solid fuel. The largest consumer sector is transportation (36,03%), mainly due to the large consumption of liquid fuels. The Transportation sector is followed by Industry (23,45%) and Housing (19,51%), which together

reach a slightly higher consumption than transport. The last two sectors are Agriculture (11,47%) and the Tertiary Sphere (9,54%).

Table 32: Energy consumption in Pomurje (Slovenia)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	5 568 444	0	83 736	1 172 304	13 565 232	**20 389 716**
Liquid fuels	6 405 804	13 032 000	8 792 280	76 241 628	12 392 928	**116 864 640**
Gaseous fuels	20 892 132	1 569 600	837 360	n.a.	4 940 424	**28 239 516**
Electricity*	17 877 636	10 220 400	10 927 548	544 284	11 304 360	**50 874 228**
Total [GJ/year]	**50 744 016**	**24 822 000**	**20 640 924**	**77 958 216**	**42 202 944**	**216 368 100**
Total [percent]	**23,45%**	**11,47%**	**9,54%**	**36,03%**	**19,51%**	**100,00%**

* Electricity will not be considered in chapter 2.4.

Most of the produced primary energy for heating and heat technology is derived from wood (39.3%), followed by fuel oil with 38.4%, then natural gas with 15.9%, geothermal energy by 3.7%, coal and liquefied petroleum gas, each about one percent. An almost negligible share of energy in the region derives from heat pumps (0.38%) and solar energy (0.03%). In transport, per year Pomurje is spending around 81 million litres of liquid fuel. Of that about 68% is gasoline and 32% is diesel fuel. Wood as an energy source in the region is mainly used for individual stores, that is, in households.

The National Assembly adopted the Resolution on the National Energy Program in 2004, which is currently in force and is a document that sets goals and provides mechanisms for the transition from the provision of energy supply and electricity to a reliable, competitive and environmentally friendly supply of energy services. It sets out objectives and mechanisms to change the understanding of the role and importance of energy in raising welfare. Individual municipalities independently perform local matters of public interest to be determined by a general act of the municipality, or they are defined by law. Among other things, they are engaged in tasks of spatial development planning. As part of its governing responsibilities, they manage and care for local public services (distribution of gas and heat), protection of air, soil, water sources, collection and disposal of waste, regulate and maintain water and energy utility facilities. Individual municipalities and the region as a whole take into account their specific conditions and goals and seek solutions that must be reconciled with the resolution.

Most municipalities in Pomurje region have already realised that energy has to enter into the basic instruments of local policies. This fact is confirmed by a commissioned and partially designed Energy base of municipalities. Challenges for sustainable development, conservation and radical climate change mitigation are also possible to find in the field of local energy. Municipality programs are addressing the fundamentals of improving energy efficiency and reducing fossil fuels while increasing renewable energy sources.

Care must be taken before deciding which deserves priority- EE or RES, and to consider all the advantages and disadvantages. Renewable energy sources can meet the core coexistence between human beings and nature itself on the basis of comprehensive regional resource planning, taking into account the protection of nature and the environment.

Increasing the efficient use of energy in a region must become a continuous process in the context of long-term strategy on energy development. At the regional level, an active approach to implementation of energy efficiency programs is needed: Promotion of information and promotional projects, continuous education and the awareness of energy consumers in a region, promoting private and entrepreneurial initiatives for the deployment of RES and RUE measures, promoting the production of energy audits in both public and private buildings and energy-consuming inspections of all high buildings and larger consumers, as well as the energy rehabilitation of buildings etc.

2.3.7.2 Emissions

Emissions of CO_2 in Pomurje have, as in Slovenia, increased over recent years.

As can be seen in the following Table 33, most CO_2 in Pomurje region comes from industry with 41,97%, followed by transport with 24,75%, agriculture at 13,24% and the tertiary sector with 13,04%. Households contribute around 7%.

Table 33: Contaminants emissions in Pomurje (Slovenia)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	9 395 000	3 201 000	4 034 000	5 395 000	1 898 000	**23 923 000**
Solids	3 072	1 240	1 652	2 828	717	**9 509**
Sulphur dioxide (SO_2)	3 885	636	148	27,5	180	**4 876**
Nitrogen oxides (NO_x)	2 418	843	0	2 821	336	**6 418**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**18 770 000**	**5 920 000**	**5 834 000**	**11 071 500**	**3 131 000**	**44 726 500**
Total [percent]	**41,97%**	**13,24%**	**13,04%**	**24,75%**	**7,00%**	**100,00%**

It is possible to see that the largest share of emissions are of carbon dioxide, other gases being much less present. Data for CO emissions could not be collected. In Pomurje a large amount of ammonia emissions are also present, which is not listed in the table.

In Slovenia, contaminants emissions are being dealt with by some regional development plans and national legislation, but at the level of the region there is no legal act providing for the operation of companies, groups and individuals in the field of energy. The Local Energy Agency operates, but it is not so widely known that the municipalities would follow their recommendations.

The largest share of emissions is contributed by solid fuel fired plants, representing just over 95% of CO_2 emissions of the sector. Emissions growth on the one hand, generates an increasing use of electricity, but on the other hand, there was in the past many missed opportunities for technological modernisation of existing power plants or building new, energy-and emission-efficient ones. The majority of greenhouse gas emissions from transport are due to road traffic, which represents almost 90% of all greenhouse gas emissions from transport and more than 20% of total CO_2 emissions.

Lately, the movement in the area of issuing energy performance certificates for buildings has been enabled. With the pilot project introducing energy certificates for buildings, Slovenia will among others realise one of the commitments of the European

directive, which aims to reduce CO_2 emissions by increasing the energy efficiency of buildings.

Recently there are more and more reports that in the future CO_2 could be stored underground. As a storage facility unused coal veins and depleted oil and gas fields could be used. Also Pomurje region has abandoned oil fields, so they can be used as storage for CO_2. However, technology is not developed yet, so it will take some more time before it could begin to be exploited.

2.3.7.3 Final data

In the following tables, there are all the data used for analyses in chapter 2.4. Data were adjusted to match the target NUTS 2 region.

Table 34: Final data for energy consumption in Eastern Slovenia

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	5 568 444	0	83 736	1 172 304	13 565 232	**20 389 716**	**12,32%**
Liquid fuels	6 405 804	13 032 000	8 792 280	76 241 628	12 392 928	**116 864 640**	**70,62%**
Gaseous fuels	20 892 132	1 569 600	837 360	n.a.	4 940 424	**28 239 516**	**17,06%**
Total [GJ/year]	**32 866 380**	**14 601 600**	**9 713 376**	**77 413 932**	**30 898 584**	**165 493 872**	**100,00%**
Total share	**19,86%**	**8,82%**	**5,87%**	**46,78%**	**18,67%**	**100,00%**	

Table 35: Final data for contaminants emissions in Eastern Slovenia

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	9 395 000	3 201 000	4 034 000	5 395 000	1 898 000	**23 923 000**
Solids	3072	1240	1652	2828	717	**9509**
Sulphur dioxide (SO_2)	3885	636	148	27,5	180	**4876,5**
Nitrogen oxides (NO_x)	2418	843	0	2821	336	**6418**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**9 404 375**	**3 203 719**	**4 035 800**	**5 400 677**	**1 899 233**	**23 943 804**
Total share	**39,28%**	**13,38%**	**16,86%**	**22,56%**	**7,93%**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 19: Energy consumption sectors share in Eastern Slovenia

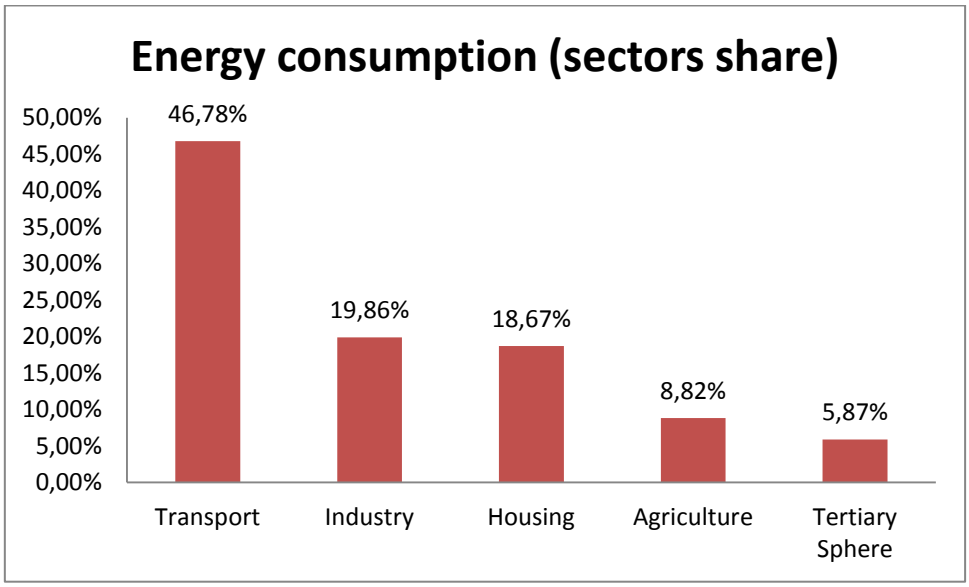


Figure 20: Energy consumption fuel types share in Eastern Slovenia

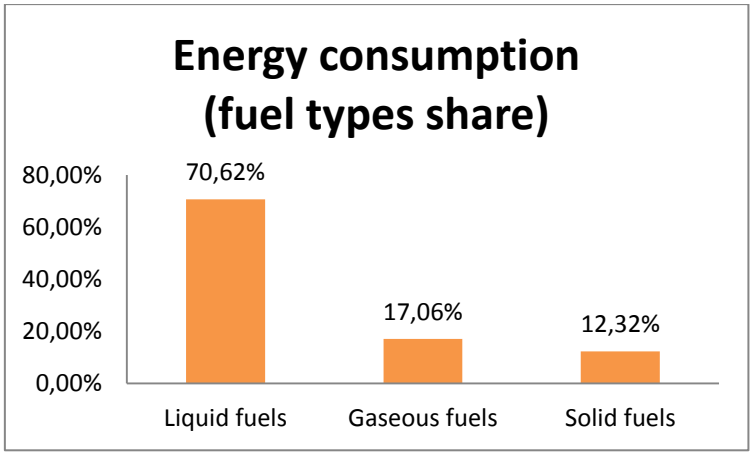
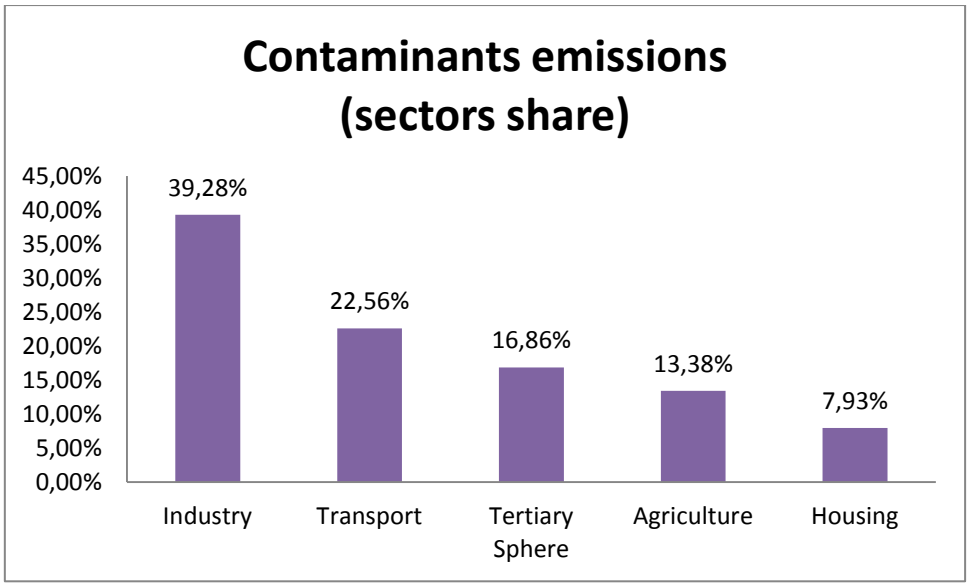


Figure 21: Contaminants emissions sector share in Eastern Slovenia



2.3.8 Poland

Poland participated through one target NUTS 2 region – Podkarpackie province, which is to the south of the country.

The Podkarpackie power system is characterized by good development and meets the current needs of individual customers and industry for energy. In Podkarpackie region there are also other very important elements of the national electricity system, such as the reducing station located in the municipality Boguchwała.

2.3.8.1 Energy consumption

Electricity and heat are mainly used in the industry and construction sectors. Significant consumption occurs in housing and other small receivers.

The final consumption of the energy carriers was over 102 000 TJ which is equal to 3,5mln t p.u. (coal with the highest calorie) or 2,4mln t o.e. (crude oil). Three components play the key role in the final consumption equation. These are: coal, natural gas and car fuel.

As far as car fuel is concerned, it was stated (according to the statistical data) that one equivalent vehicle consumes about 0,6 t o.e. (about 25 GJ). Propellants and natural gas are the most consumed energy carriers.

The biggest consumers of coal (45%) are power plants and CHPs. Large amounts of solid fuel are consumed by housing in the voivodeship (~30%). Heating plants and industry & construction sector consume ~8% each. Natural gas has three main consumers, i.e. industry and construction (~33%), power plants and CHPs (~28%) and housing (~23%). LPG and fuel oil, which are not consumed in sophisticated amounts within the Podkarpackie voivodeship, have diverse consumers. Electricity consumption in Poland is one of the lowest compared to other EU member states. Details can be examined in following Table 36.

Table 36: Energy consumption in Podkarpakcie voivodeschip (Poland)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	4 106 000	2 229 000	26 221 000	29 000	16 689 000	**49 274 000**
Liquid fuels	462 000	252 000	294 000	42 000	840 000	**1 890 000**
Gaseous fuels	9 569 000	86 000	10 538 000	105 000	12 877 000	**33 175 000**
Total [GJ/year]	**14 137 000**	**2 567 000**	**37 053 000**	**176 000**	**30 406 000**	**84 339 000**
Total [percent]	**16,70%**	**3,10%**	**43,90%**	**0,20%**	**36,10%**	**100,00%**

Energy heating is the most energy-intensive economic branch in Podkarpackie voivodeship. Households and others are in second place. Solid fuels, such as coal, are 56% of energy sources, whereas gaseous fuels are 39%. Almost 3% of energy comes from liquid fuels. Total energy consumption in Podkarpackie vovoideship is 84 300 TJ/year, which is 2,8% of the national consumption. The largest energy consumption sector is in the Tertiary Sphere with 43,9%, followed by the Housing sector with 36,1%. The third largest sector is Industry with 16,7% and the last energy consumption sectors are the Agriculture and Transport sectors with 3,1% and 0,2%.

Development of renewable energy sources is one of the most important aims that need to be achieved by Polish power engineering. Energy security should not by treated as a condition, but as a process that needs to be continually improved and updated according to the changing circumstances. It is also necessary to increase the capacities because of the forecasts regarding increased energy demands. The region has only a weakly developed industry. Development of RES has positive socio-economic effects due to job creation, sustainable development support of agricultural and rural areas, facilitation in meeting the high environmental standards by Poland and optimization of the geographic potential of Podkarpackie voivodeship, which will contribute to the local energy security growth that includes climatic challenges.

2.3.8.2 Emissions

From among the emitted greenhouse gases into the atmosphere, carbon dioxide (CO_2) is the most harmful. There are 82 industries which are particularly oppressive for clean air in the Podkarpackie voivodeship (31.12.2007). This indicates a declining number of these plants, which at the end of 2006 was 88. There is improvement in the manner of the dust pollution and gaseous pollutants reduction systems that are used as well.

The biggest emissions are connected with the coal power sector, which was responsible for issuing 212.4 million tons of CO_2, the burning oil mainly in transport contributed to the emission of 62.7 million tons of CO_2, and natural gas 27.1 million tons of CO_2.

Table 37: Contaminants emissions in Podkarpakcie voivodeschip (Poland)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	3 411 500	n.a.	n.a.	n.a.	n.a.	**3 411 500**
Solids	2 300	n.a.	n.a.	n.a.	n.a.	**2 300**
Sulphur dioxide (SO_2)	10 400	n.a.	n.a.	n.a.	n.a.	**10 400**
Nitrogen oxides (NO_x)	1 800	n.a.	n.a.	n.a.	n.a.	**1 800**
Carbon monoxide (CO)	3 400	n.a.	n.a.	n.a.	n.a.	**3 400**
Total [tons/year]	**3 434 600**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Total [percent]	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

According to Table 37, the biggest gas pollution comes from carbon dioxide (CO_2). The percentage share of this type of pollution is 99.3% of all impurities. Emissions of gaseous pollutants come from plants which are particularly onerous in energy and heat. Statistics do not provide information on emissions from agriculture, non-production areas, transportation and housing.

One of the main strategic objectives of podkarpackie voivodeship is to improve the quality of the environment under sustainable development. These actions aim to protect unique species as well as maintaining the landscape values of the environment. According to the strategic objective, the podkarpackie voivodeship should constantly reduce negative effects on the environment of the power engineering sector. Moreover, it should develop renewable energy.

2.3.8.3 Final data

In the following tables, there are all data as used for analyses in chapter 2.4.

Table 38: Final data for energy consumption in Podkarpakcie (Poland)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	4 106 000	2 229 000	26 221 000	29 000	16 689 000	**49 274 000**	**58,42%**
Liquid fuels	462 000	252 000	294 000	42 000	840 000	**1 890 000**	**2,24%**
Gaseous fuels	9 569 000	86 000	10 538 000	105 000	12 877 000	**33 175 000**	**39,34%**
Total [GJ/year]	**14 137 000**	**2 567 000**	**37 053 000**	**176 000**	**30 406 000**	**84 339 000**	**100,00%**
Total share	**16,76%**	**3,04%**	**43,93%**	**0,21%**	**36,05%**	**100,00%**	

Table 39: Final data for contaminants emissions in Podkarpakcie (Poland)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	3 411 500	n.a.	n.a.	n.a.	n.a.	**n.a.**
Solids	2300	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	10400	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	1800	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	3400	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**3 429 400**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Total share	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 22: Energy consumption sectors share in Podkarpakcie (Poland)

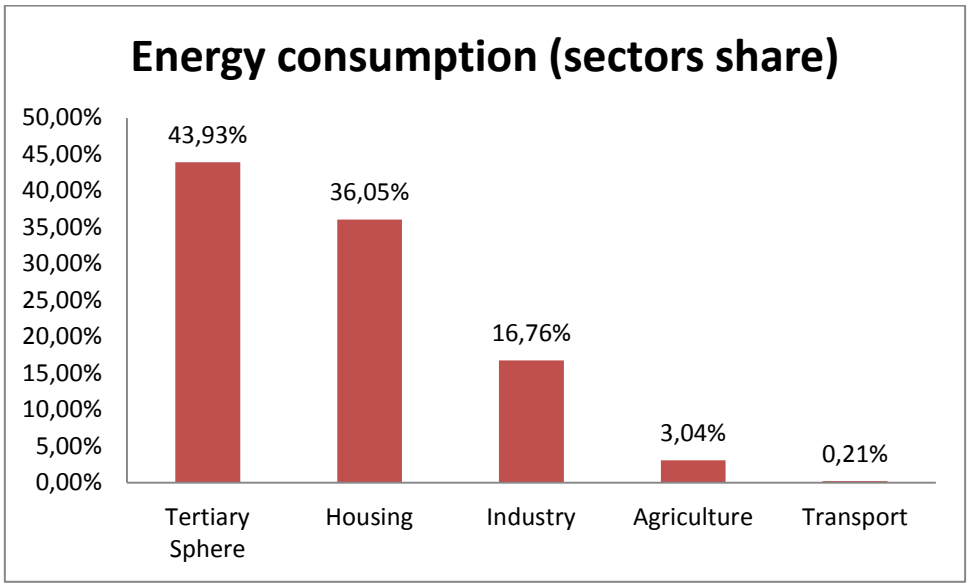
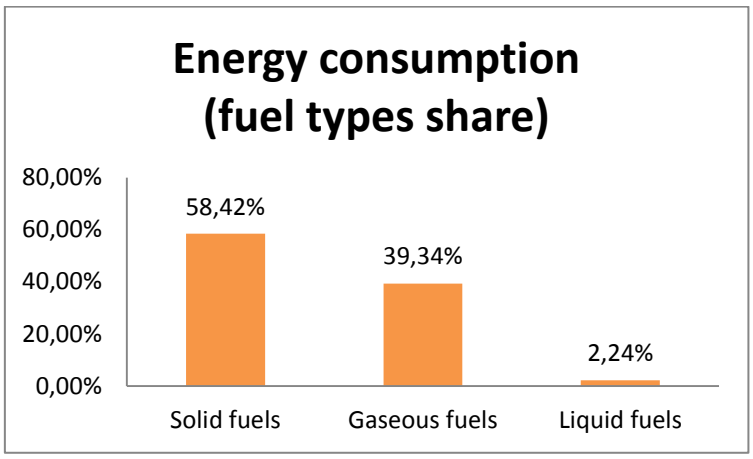


Figure 23: Energy consumption fuel types share in Podkarpakcie (Poland)



2.3.9 Spain

Spain participated through three target NUTS 2 regions. Unfortunately, only for one of the regions called Aragon, was data available. Moreover, there were no deep analysis available for Spain, therefore only the table data are presented.

2.3.9.1 Energy consumption

The following Table 40 shows energy consumption in the target region. Unfortunately, data were available only in percentages.

Table 40: Energy consumption in Aragon (Spain)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [percents]
Solid fuels	1,494	0,000	0,000	0,000	0,000	**1,48%**
Liquid fuels	5,999	14,891	0,000	53,008	3,156	**76,30%**
Gaseous fuels	12,643	0,163	0,000	0,000	9,628	**22,22%**
Total [percent]	**19,94%**	**14,91%**	**0,00%**	**52,49%**	**12,66%**	**100,00%**

We can see, that the most energy consuming sector is Transport with 52,49%, followed by Industry (19,94%), Agriculture (14,91%) and Housing (12,66%). The Tertiary Sphere is included in the Housing sector.

2.3.9.2 Emissions

In the following Table 41, contaminants emissions in Aragon can be examined.

Table 41: Contaminants emissions in Aragon (Spain)

Contaminants	Industry	Agriculture	Energy Trasnformation	Transport	Housing and Tertiary Sphere	Total [tons/year]
Carbon dioxide (CO_2)	3 456 810	329 220	5 432 130	5 267 520	1 975 320	**16 461 000**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	11 861,22	1 129,64	18 639,06	18 074,24	6 777,84	**56 482**
Nitrogen oxides (NO_x)	15 433,74	1 469,88	24 253,02	23 518,08	8 819,28	**73 494**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**3 484 105**	**331 820**	**5 475 022**	**5 309 112**	**1 990 917**	**16 590 976**
Total [percent]	**21,00%**	**2,00%**	**33,00%**	**32,00%**	**12,00%**	**100,00%**

As can be seen, the most contributing sector is Energy Transformation, which will not be included in chapter 2.4 and will be redistributed to all other sectors proportionally. Besides Energy Transformation, there is the Transport sector with 32,00%, followed by the Industry sector with 21,00%. After that is the Housing and Tertiary Sphere with 12,00% – these sectors were aggregated because of the lack of data. The last is Agriculture with 2,00%. Because of the lack of regional data, data distribution for Spain was used to evaluate distribution in the Aragon region.

2.3.9.3 Final data

In the following tables, there are all data as used for analyses in chapter 2.4.

Table 42: Final data for energy consumption in Aragon (Spain)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	1	0	0	0	0	**n.a.**	**1,48%**
Liquid fuels	6	15	0	53	3	**n.a.**	**76,30%**
Gaseous fuels	13	0	0	0	10	**n.a.**	**22,22%**
Total [GJ/year]	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**100,00%**
Total share	**19,94%**	**14,91%**	**0,00%**	**52,49%**	**12,66%**	**100,00%**	

Table 43: Final data for contaminants emissions in Aragon (Spain)

Contaminants	Industry	Agriculture	Tertiary Sphere + Housing	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	3 456 810	329 220	1 975 320	5 267 520	n.a.	**16 461 000**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	11861,22	1129,64	6777,84	18074,24	n.a.	**56482**
Nitrogen oxides (NO_x)	15433,74	1469,88	8819,28	23518,08	n.a.	**73494**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**3 484 105**	**331 820**	**1 990 917**	**5 309 112**	**n.a.**	**11 115 954**
Total share	**31,34%**	**2,99%**	**17,91%**	**47,76%**	**n.a.**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 24: Energy consumption sectors share in Aragon (Spain)

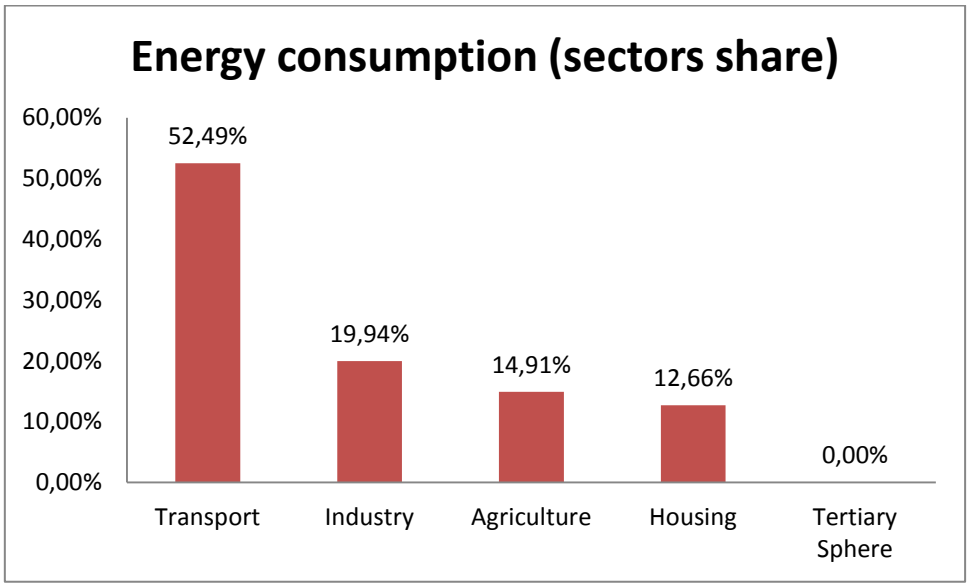


Figure 25: Energy consumption fuel types share in Aragon (Spain)

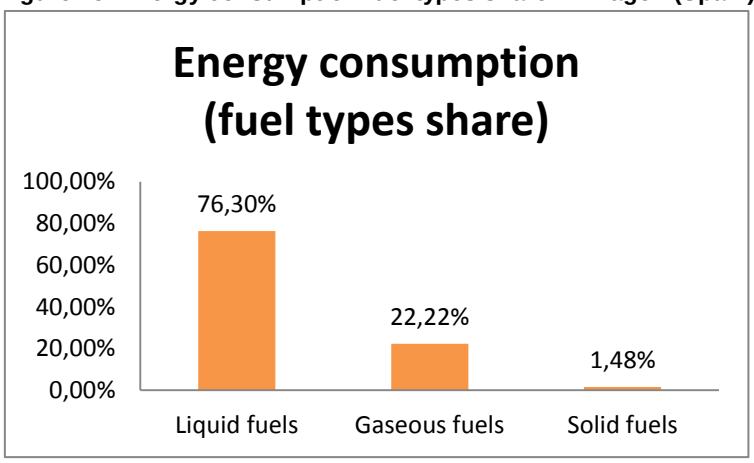
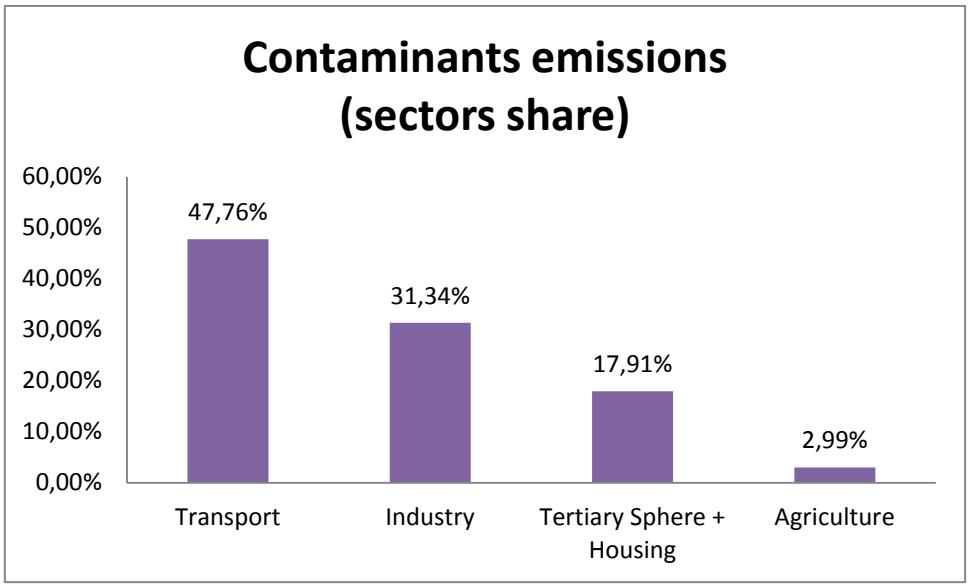


Figure 26: Contaminants emissions sector share in Aragon (Spain)



2.3.10 United Kingdom

The United Kingdom participated through one target NUTS 3 region, which is Powys. It is the largest local authority in Wales with about a quarter of the geographical area but only 132 thousand people making it the most sparsely populated local authority in England and Wales. The rural nature of the local authority brings many challenges and 54% of residents in Powys live in the worst 10% areas in Wales for access to services on foot or by bus.

Powys is a large landlocked and upland territory covering a total 5181 square kilometers, a quarter of the land area of Wales(see map below), and is by far the largest in extent of the twenty two Welsh Local Authorities. It is also the most sparsely populated county in England and Wales with a population of only 132 thousand or one person per four hectares.

2.3.10.1 Energy consumption

Energy policies have been developed by the Welsh Assembly Government which has objectives for housing efficiency and renewable energy generation.

Data gathered indicates that transport is the largest energy consumer in the area with 34,7% of all energy consumption coming from transport. In contrast the public sector and agriculture contribute only a 9,3% of energy consumption and the Public Sector only with 2,26%, which is an unusually low share. The rest of the data can be examined in the following Table 44, where we can see that the second and the third biggest share in consumption goes to the Housing (30,45%) and Industry sectors (23,36).

Table 44: Energy consumption in Powys (Wales, UK)

Fuel Type	Industry	Agriculture	Public Sector	Transport	Housing	Total [GJ/year]
Solid fuels	43 000	n.a.	n.a.	n.a.	269 300	**312 300**
Liquid fuels	950 500	1 189 300	7 500	4 443 800	1 011 400	**7 602 500**
Gaseous fuels	737 196	n.a.	185 125	n.a.	1 599 395	**2 521 716**
Electricity*	1 264 548	n.a.	97 024	n.a.	1 024 898	**2 386 470**
Total [GJ/year]	**2 995 244**	**1 189 300**	**289 649**	**4 443 800**	**3 904 993**	**12 822 986**
Total [percent]	**23,36%**	**9,27%**	**2,26%**	**34,65%**	**30,45%**	**100,00%**

* Grid Electricity, which will not be considered in chapter 2.4.

The most common fuel type used in Powys is Liquid fuels this is mainly due to the use of Liquid Fuels within the transport sector. In addition to the Solid, liquid and gaseous fuels an additional line for Electricity has been included. This has been included to take into account the energy consumed within Powys but actually generated outside of the local authority area.

The Welsh Assembly Government has introduced various Energy/Climate Change and Sustainability policies that influence the energy objectives of the targeted local authority. One of the aims is to encourage renewable heat production and will support target areas in financing renewable energies. The impact of the energy consumption in the target area will of course impact on the environment.

The largest energy contributor to energy consumption is transport, which indicates the rural nature of the county and poor development of public transport. Transport emissions are also increasing and therefore the environmental impact is greater. In contrast to this energy consumption is decreasing in the following areas; housing; agriculture; the public sector and industry, and therefore the environmental impact is decreasing. In addition to this the level of renewable energy generation is increasing-this in long term will see the environmental impact of the target area getting less.

Housing, renewable energy generation and transport should be focused on in order to reduce the energy consumption of the region. The number of households has increased dramatically since 1991, and therefore it is assumed that a lot of the new households live in relatively new housing that is more energy efficient than older/traditional housing. With future energy price rises, renewable energy generation will help alleviate fuel poverty and allow residents to heat their homes. Targeting fuel poverty by increasing energy efficiency in areas where incomes are low will be essential in helping lowering energy consumption.

2.3.10.2 Emissions

As shown in the following Table 45, only data for CO_2 emissions were available, but hopefully these data are the most important in the manner of contaminants emissions. No data to separate the Industry and Service (Tertiary) sectors was available. The Public sector emissions are for Buildings only.

Table 45: Contaminants emissions in Powys (Wales, UK)

Contaminants	Industry	Agriculture	Public Sector	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	287 109	94 000	25 891	358 000	336 000	**1 101 000**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**287 109**	**94 000**	**25 891**	**358 000**	**336 000**	**1 101 000**
Total [percent]	**26,08%**	**8,54%**	**2,35%**	**32,52%**	**30,52%**	**100,00%**

Three main sectors emit the majority of Carbon Emissions- Housing (31%), Transport (32%) and Industry (28%). Agriculture emits 9% of the local authority's emissions, which is low compared to other sectors, but fairly high relatively. This shows us that Powys is a highly agriculture-oriented region.

The level of CO_2 emissions in Powys is low compared to Regional and National emissions. Powys CO_2 emissions are 61% of the Wales Average. Powys has higher emissions per capita than Wales in the following areas: Agriculture, Transport and Housing. This can lead us to the evaluations- that agriculture is more prominent in Powys than the Wales Average, Transport is used more than the Wales average, due to the sparse population and the possibility that Powys homes are less energy efficient than the Wales average. In the same manner we could state that Industry is not prevalent in Powys, because this sector generates only around 37% of the Wales average.

No specific regional Energy Policy or commitment specific to the target region exists. There is a Energy/Carbon policy, which governs the whole area.

The data analysis indicates that the areas of Housing (31%), Transport (32%) and Industry (28%) contribute a similar amount of emissions in Powys. These are most important factors and should be targeted as areas of priority.

In relation to the regional and national average, Transport and Housing are higher factors in Powys, and this therefore indicates that there may be increased CO_2 saving potential in these areas. This would be supported by the social and economic make up of Powys as it is mainly a rural area with limited industry.

2.3.10.3 Final data

In the following tables, there are all data as used for analyses in chapter 2.4.

Table 46: Final data for energy consumption in Powys (Wales, UK)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	43 000	n.a.	n.a.	n.a.	269 300	**312 300**	**2,99%**
Liquid fuels	950 500	1 189 300	7 500	4 443 800	1 011 400	**7 602 500**	**72,85%**
Gaseous fuels	737 196	n.a.	185 125	n.a.	1 599 395	**2 521 716**	**24,16%**
Total [GJ/year]	**1 730 696**	**1 189 300**	**192 625**	**4 443 800**	**2 880 095**	**10 436 516**	**100,00%**
Total share	**16,58%**	**11,40%**	**1,85%**	**42,58%**	**27,60%**	**100,00%**	

Table 47: Final data for contaminants emissions in Powys (Wales, UK)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	287 109	94 000	25 891	358 000	336 000	**1 101 000**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Nitrogen oxides (NO_x)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**287 109**	**94 000**	**25 891**	**358 000**	**336 000**	**1 101 000**
Total share	**26,08%**	**8,54%**	**2,35%**	**32,52%**	**30,52%**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 27: Energy consumption sectors share in Powys (Wales, UK)

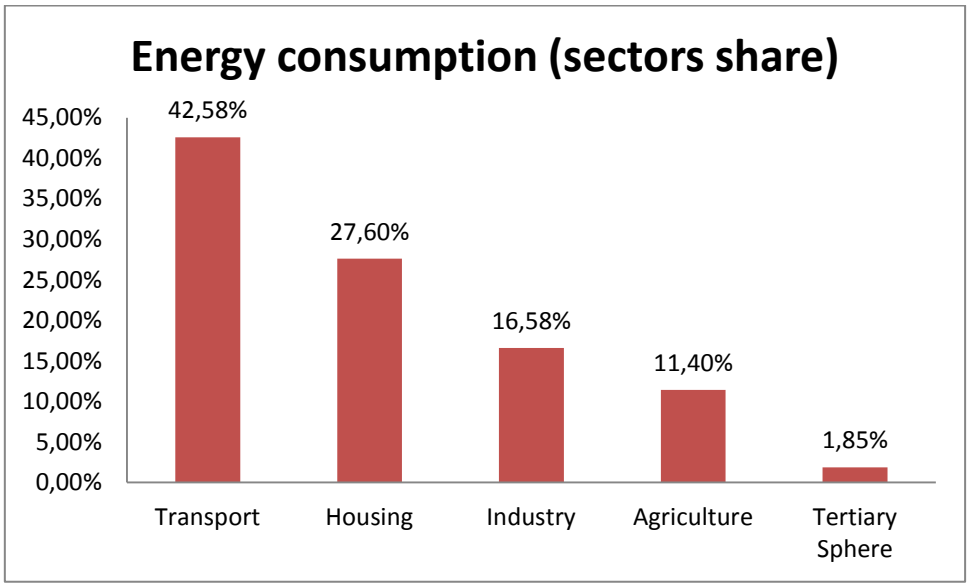


Figure 28: Energy consumption fuel types share in Powys (Wales, UK)

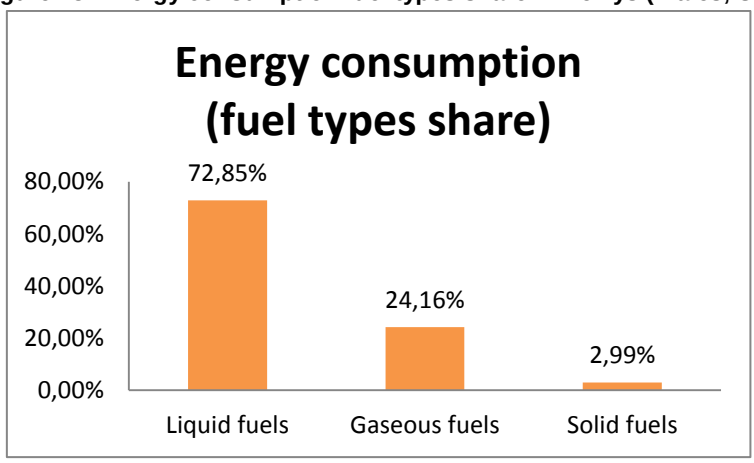
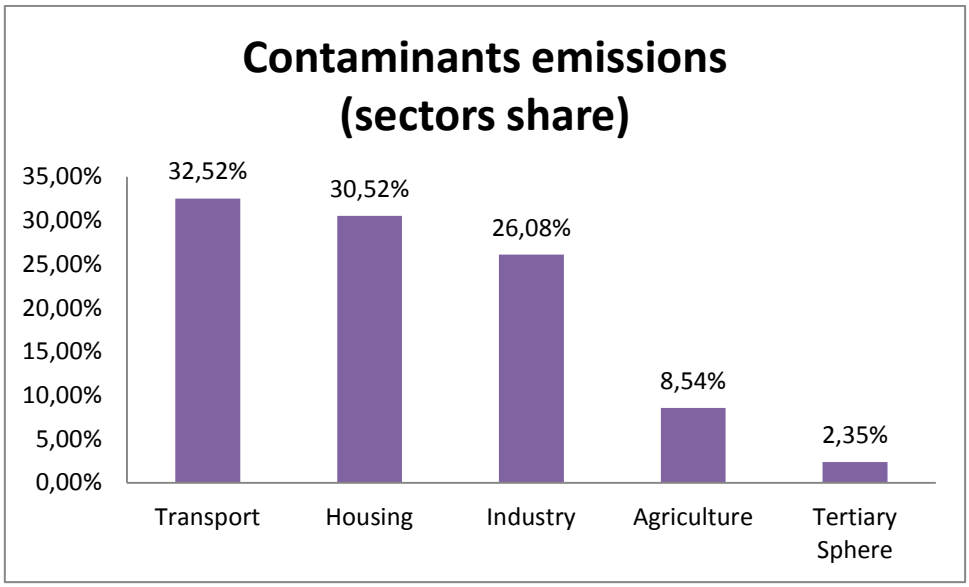


Figure 29: Contaminants emissions sectors share in Powys (Wales, UK)



2.3.11 Romania

For the purpose of this analysis, Romania participated through the Centru region, which lies in the centre of the republic and is NUTS 2 level. Romania has a wide range of primary energy resources, but in small amounts. The Romanian Energy Strategy for the period 2007-2020 shows that the non-renewable resources potential, excluding Uranium, is estimated at 929 tons. The most important resources are represented by coal deposits, ensuring energy stability for the long term. It is estimated that the hydrocarbon reserves (gas and oil) will be exhausted by the end of 2020.

Centru Region has a significant energy potential, which is partially capitalised through the two fossil fuelled power plants and through hydropower plants. The total installed power at regional level is approx 1660 MW (8% of the installed power at national level) out of which 30% is hydroelectric energy. Energy production of Centru Region totals about 4200GWh (7% of the national production), with a 27% share for hydroenergy.

There are the rich deposits of methane gas, largely spread in the Transylvanian Plateau (situated mainly in Centru Region). As of 2006, the total amount of exploited natural gas amounted to 5100 mil. cubic metres, representing over 40% of the national production.

Compared to 1990, the regional production of natural gas suffered a massive fall of almost 70 pp. Coal remains one of the most important energy resources in Romania and it is still used on a large scale for energy production at national level, but in Centru Region the only lignite pits of the region are due to be closed by 2011.

2.3.11.1 Energy consumption

Data required for energy consumption analysis for Table 48 in Centru region were not available, but since the breakdown of the energy consumption by fuel type and by economic sector at regional level is pretty similar to that at national level, data from national-level were used.

Table 48: Energy consumption in Romania

Fuel Type	Industry	Agriculture, Forestry and fishery	Transport	Households	Tertiary Sphere	Total [GJ]
Solid fuels	52 701 740	334 880	0	145 254 200	418 600	**198 709 420**
Liquid fuels	53 873 820	6 655 740	214 197 620	12 013 820	14 692 860	**301 433 860**
Gaseous fuels	172 044 600	2 009 280	0	91 631 540	33 822 880	**299 508 300**
Renewable energy	24 153 220	1 130 220	0	50 859 900	15 655 640	**91 798 980**
Electrical energy	82 757 220	2 009 280	5 023 200	37 422 840	23 148 580	**150 361 120**
Total [GJ]	**385 530 600**	**12 139 400**	**219 220 820**	**337 182 300**	**87 738 560**	**1 041 811 680**
Total [percent]	**37,01**	**1,17**	**21,04**	**32,36**	**8,42**	**100,00**

As can be seen in Table 48, there are three main energy consumer sectors: Industry which accounts for 37% of the total energy consumption, Households which makes almost one third of the total consumption and Transport with a 21% share of consumption. Almost 98% of the fuels used in transport are liquid fuels. Within residential consumption, solid fuels have the biggest share (43%), followed by gas (27%). The liquid fuels and the gaseous fuels have the most significant shares in the total amount of fuels used for energy production (28.9% and 28.7% respectively).

Whereas the Households and Transport share of energy consumption is considered average, Industry consumption is above average, compared to other counties, because Centru region has an industry-based economy, despite the fact that many large companies (active in big energy consumer industries such as metallurgy, chemical industry, industry of construction materials and so on) have been closed or have reduced their activity during the past 15 years, which has resulted in significant diminution of pollution levels and the greenhouse effect.

Although agriculture has only minor energy consumption (1,2%), the whole region has big agricultural potential, including the biomass, and the prospect of becoming in a short time a net contributor to the energy balance of the region with a biomass potential of 20277 TJ, out of which 4559 TJ is energy wood potential.

Regarding Households, their consumption of solid fuels should be mentioned, which is 43% of total consumption, followed by gaseous fuels, which is 27%.

Due to the rapid exhausting of the fossil fuels reserves, if the transition towards large scale use of renewable energy is delayed, the energy dependency of Centru Region on imports will increase significantly. Insufficient information and low level of awareness among the general public about the benefits of using renewable energy could lead to misunderstanding and low interest among consumers as regards the use of renewable sources. Relatively high initial costs are an additional factor that could discourage the use of alternative sources of energy.

Despite the positive developments in recent years, Centru Region is still lagging behind other European regions as regards the reduction of energy consumption. Industry and transport are among the most energy- intensive economic sectors, which along with residences make 90% of national energy consumption. Therefore projects to reduce energy consumption are very important for this region, together with tighter regulations applicable to newly-constructed buildings as regards the introduction of energy efficiency standards, together with financial support for the companies which invest in green technologies.

2.3.11.2 Emissions

According to data gathered in 2009, more than half (52.44%) of the amount of CO_2 and other contaminants emitted into the atmosphere, with negative impact on the environment, is produced by the industry sector, followed by the residential sector with 35.90% for CO_2 (36,90% for all contaminants). Another factor contributing to air pollution at regional level is represented by the emissions resulting from domestic and transit traffic, which is 9.53% for CO_2 and 10,53% for all contaminants. The smallest amount of CO_2 and other contaminants emitted into the atmosphere belongs to the agricultural sector, only 0.02%. These results can be seen in the following Table 49. The analysis did not take into consideration the emissions of carbon monoxide, because there are no centralised data per activity sector.

Table 49: Contaminants emissions in Centru Region (Romania)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	5 722 840	59	228 913	1 030 072	3 916 321	**10 898 204**
Solids	10 575	664	311	661	13 571	**25 782**
Sulphur dioxide (SO_2)	4 569	89	52	2 771	356	**7 838**
Nitrogen oxides (NO_x)	8 333	1 588	1 813	10 599	3 204	**25 537**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**5 746 316**	**2 400**	**231 089**	**1 044 103**	**3 933 452**	**10 957 361**
Total [percent]	**52,44**	**0,02**	**2,11**	**10,53**	**36,90**	**100,00**

In the past years, an increasingly big attention has been devoted to the quality of air. In order to consolidate the strategies of pollution reduction, in 2005 atmospheric pollutants in the ambient air have been monitored in the Centru Region with automated equipment. As a result of applying the legislation that deals with greenhouse gases, it can be observed that such gas emissions were reduced in 2005 and have been continuously decreasing during 2006-2009 in the Centru Region. According to analyses, the biggest share of greenhouse gas emissions is represented by CO_2.

As stated before, the biggest contaminants emitting sector is Industry. That is because of the industry-oriented economy of Centru region. There are a lot of industries (iron and steel industries, extractive industry, chemical industry, wood industry, salt industry and glass industry), which carry a major risk for the quality of the environment and the climatic equilibrium. Moreover, the influence of housing and transport should be considered as well, even though the values for this sector are average.

The quality of the ambient air in Centru Region must be evaluated according to the dynamics of the statistical indicators of air quality and their evolution in time and space, and referring it to the areas with problems, but also to the successful investments, with major effects on the protection of the atmosphere. Industrial activities represent an important part of the economy, but they contribute to environmental pollution, waste generation, and massive energy resources consumption. Despite the emissions reduction of the last decades, industrial activities remain a major source of pollution.

Greenhouse gas emissions can be reduced considerably if a set of measures and actions can be taken into account by the local authorities. These actions should cover granting subsidies and facilities for the public institutions, owners associations and inhabitants for implementing measures aimed at increasing the energy efficiency of public and private buildings, as well as supporting the development and implementation of innovative technological solutions for reducing greenhouse gas emissions. Information campaigns for energy consumers should be implemented too.

2.3.11.3 Final data

In the following tables, there are all data as used for analyses in chapter 2.4.

Table 50: Final data for energy consumption in Romania

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Households	Total [GJ/year]	Total share
Solid fuels	52 701 740	334 880	418 600	0	145 254 200	**198 709 420**	**24,85%**
Liquid fuels	53 873 820	6 655 740	14 692 860	214 197 620	12 013 820	**301 433 860**	**37,70%**
Gaseous fuels	172 044 600	2 009 280	33 822 880	0	91 631 540	**299 508 300**	**37,45%**
Total [GJ/year]	**278 620 160**	**8 999 900**	**48 934 340**	**214 197 620**	**248 899 560**	**799 651 580**	**100,00%**
Total share	**34,84%**	**1,13%**	**6,12%**	**26,79%**	**31,13%**	**100,00%**	

Table 51: Final data for contaminants emissions in Centru Region (Romania)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	5 722 840	59	228 913	1 030 072	3 916 321	**10 898 205**
Solids	10575	664	311	661	13571	**25782**
Sulphur dioxide (SO_2)	4569	89	52	2771	356	**7837**
Nitrogen oxides (NO_x)	8333	1588	1813	10599	3204	**25537**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**5 746 317**	**2 400**	**231 089**	**1 044 103**	**3 933 452**	**10 957 361**
Total share	**52,44%**	**0,02%**	**2,11%**	**9,53%**	**35,90%**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumptions and sector share in contaminants emissions based on data provided by the partner.

Figure 30: Energy consumption sectors share in Romania

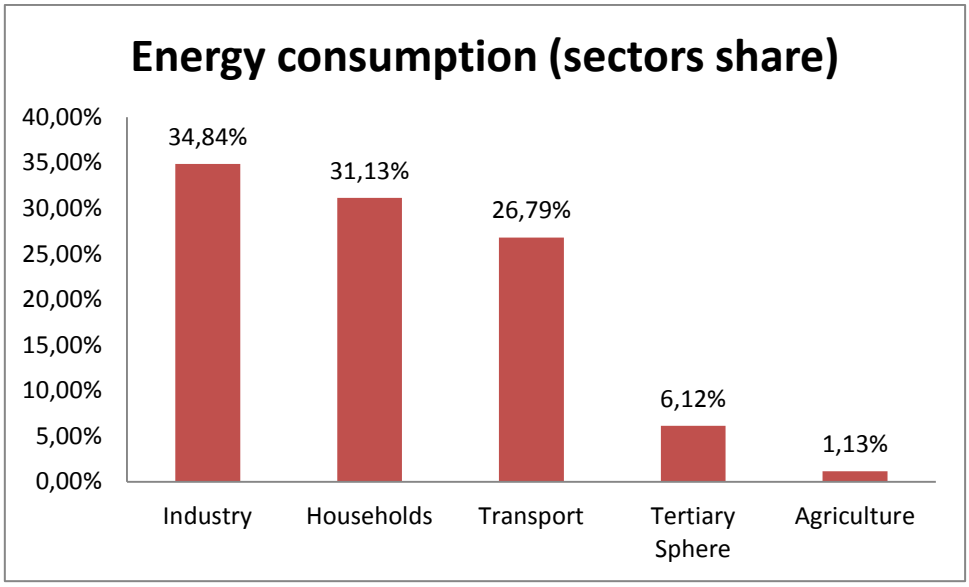


Figure 31: Energy consumption fuel types share in Romania

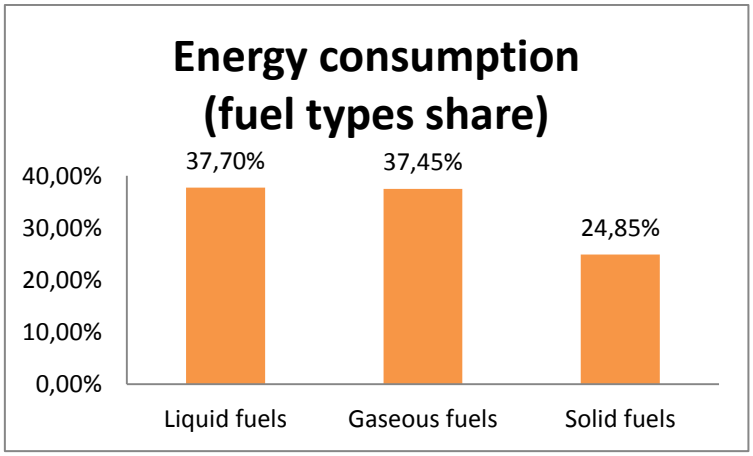
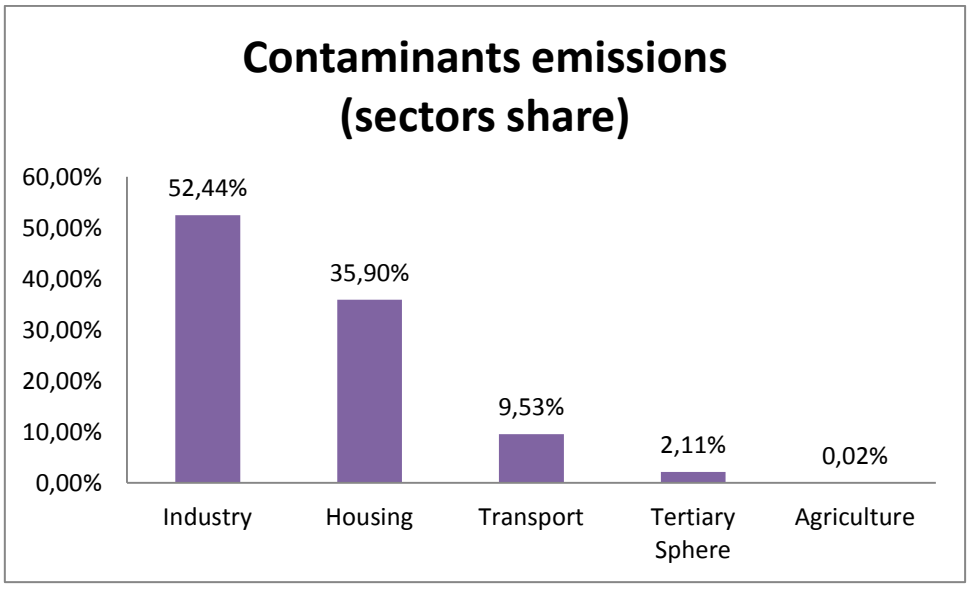


Figure 32: Contaminants emissions sector share in Centru Region (Romania)



2.3.12 France

France participated through the one target NUTS 2 region – Brittany(Bretagne), which occupies a large peninsula in the north-west of France. This region produces very little energy relative to its consumption - the region imports more than 92% of its needs and therefore there is strong energy dependence. Moreover, its distribution system is also fragile. The regional production is mainly electric, from water power, and represents 6% of the regional consumption of electricity.

2.3.12.1 Energy consumption

In 2008, the final energy consumption of Brittany reached 7 090 ktep which represents 4,4% of the national consumption for 5% of the national population. The average energy consumption of a person living in Brittany is averaged at 2,26 tep whereas the average energy consumption per person in France is 2,43 tep (2008). As can be seen in Table 52, the two principal sectors of consumption are Housing & Services (43%), and Transport (37%). The weighting of industry is lower than the average of France, whereas the weighting of agriculture is higher, due to intensive livestock production and greenhouses. Compared to Housing and Transport sectors, the Industry and Agriculture sectors seem to be not so significant in the case of energy consumption.

Table 52: Energy consumption in Brittany (France)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	753	1 542	532	0	1 184	**4 011**
Electricity	19 142	5 154	15 063	74	33 528	**72 961**
Liquid fuels	4 626	9 244	15 585	107 361	34 689	**171 505**
Gaseous fuels	16 319	2 798	8 528	0	18 981	**46 626**
Total [GJ/year]	**41 545**	**17 805**	**39 557**	**109 798**	**88 046**	**296 751**
Total [percent]	**14,00**	**6,00**	**13,33**	**37,00**	**29,67**	**100,00%**

Regarding Housing & Services, electricity is the first energy used, with 37% of the consumption of the sector (+8% since 1990). Then fuels , which represent 29% and are still much higher than the national level, due to the fact that the natural gas is less developed in the region.

The second principal sector, Transport represents 37% of the final consumption in Brittany and 5,1% of the sector on the national scale. The main energies used are liquid fuels with almost 98% of the consumption of the sector.

Agriculture represents 6% of final regional consumption and 11,1% of the national agriculture consumption. It has increased 51% since 1990. With 54% of fuels, but also 28% of electricity and 16% of natural gas, the energy structure of the regional agriculture is really special.

About 1000 ktep in 2007 have been consumed by the regional industry, which represent 14% of the final regional consumption and 3% of the total consumption of the national industry. It has increased 17% since 1990 - this tendency is opposite to the rest of France where it is decreasing.

It is important to underline that the growth of energy consumption in Brittany has been higher than in France for 40 years, which is to link it with a process of economic adjustment and industrialization. It has increased 27% since 1990 (final energy) against 13% in the case of France. Even if in recent years the increase rate is tending to reduce (it is stable), regarding the demographic perspective, one of the regional objectives should be in priority to reduce this growth including in absolute values.

Total energy consumption of Brittany is average, compared to the national average level. The main part of energy consumption comes from housing and the tertiary sphere, together with the transport sector. Brittany's energy consumption largely exceeds its production and therefore looking for a production boost is an important issue in this region nowadays. An Eco-Energy Program has been defined in Brittany to manage better the future of energy in the region. The objectives are to facilitate the control of consumption, with a priority on sectors which consume the most, to develop renewable energies (particularly wind and solar energies), to increase knowledge about energy and to create a dynamic in all the local territories.

2.3.12.2 Emissions

Between 1990 and 2008, energy consumption in Brittany has increased 27%. At the same time, the emissions of CO_2 linked to that consumption have increased from 11,8 million tons to 14,3 Mt (+22%).The major emission has been reached in 2001 with 15,5 Mt. Since then, the volumes of CO_2 emitted have decreased 7%. This decrease is linked to the recent development of agro-fuels and to the increase of the use of electricity – which is produced more than 90% outside the region. Sectors of transport and housing + services are the major emitters. Among all the sources of energy producing CO_2, petroleum produces the major contribution.

As can be seen in Table 53, the biggest sector emitting contaminants is the Transport sector, followed by the Tertiary Sphere + Housing sector. The Industry sector, which (in France) usually generates a large amount of emissions, has a low representation in Brittany, because the region has been more lately industrialized, and its principal industries are food, agriculture and building.

Table 53: Contaminants emissions in Brittany (France)

Contaminants	Industry	Agriculture	Tertiary Sphere + Housing	Transport	Energy	Total [tons/year]
Carbon dioxide (CO_2)	1 305 000	861 000	3 887 000	7 719 000	533 000	**14 305 000**
Solids	0	0	0	0	0	**0**
Sulphur dioxide (SO_2)	4 471,00	731,00	1 738,00	1 049,00	402,00	**8 391**
Nitrogen oxides (NO_x)	2 784,00	13 523,00	4 466,00	49 244,00	1 303,00	**71 320**
Carbon monoxide (CO)	12 756,00	21 084,00	89 205,00	167 919,00	777,00	**291 741**
Total [tons/year]	**1 325 011**	**896 338**	**3 982 409**	**7 937 212**	**535 482**	**14 676 452**
Total [percent]	**9,03**	**6,11**	**27,13**	**54,08**	**3,65**	**100,00**

Regarding the Housing and Tertiary Sphere Sectors, housing in Brittany is marked by a higher share of individual houses (74% against 57% in France) which impacts the

consumption of energy and CO_2 emissions due to the higher needs of heating (72% of consumption). Besides, the predicted increase in demographic pressure makes housing a central point in the politics of energy and CO_2 emissions.

The biggest contaminant emitter is the Transport sector. Since 1975, the distance between work and house has doubled, and transport for pleasure or shopping has also greatly increased. It is important to underline that the persons having more distance between work and house make most often for a more fragile socio-economic class. This is due to the high price of housing in the cities. Another issue is high territorial area specialization for different sectors (industrial, commercial, residential etc.). Regarding the increase of population predicted, the control of transport appears as a priority, most of all for big cities and the coast. More than 90% of the energy of this sector is consumed by road transport and the transport of goods (162.5 millions of tons in 2005) is also dominated by roads to 90%. Trains are very little used (half the national average).

Transport and housing are two priorities for reducing the emissions of CO_2. They are closely linked to the organization of the territory, the politics of urbanism, and the way of life of people. It is necessary to develop a global approach away from the more local level, to rethink this organization while also having a special attention to the more fragile socio-economic classes.

2.3.12.3 Final data

In the following tables, there are all the data as used for analyses in chapter 2.4.

Table 54: Final data for energy consumption in Brittany (France)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	753 000	1 542 000	532 000	0	1 184 000	**4 011 000**	**1,84%**
Liquid fuels	4 626 000	9 244 000	15 585 000	107 361 000	34 689 000	**171 505 000**	**78,62%**
Gaseous fuels	16 319 000	2 798 000	8 528 000	0	18 981 000	**46 626 000**	**21,38%**
Total [GJ/year]	**20 945 000**	**12 042 000**	**24 113 000**	**107 361 000**	**53 670 000**	**218 131 000**	**100,00%**
Total share	**9,60%**	**5,52%**	**11,05%**	**49,22%**	**24,60%**	**100,00%**	

Data in Table 54 were adjusted in scale against data in Table 52, because the data provided were clearly in TJ instead of GJ, which was a common mistake.

Table 55: Final data for contaminants emissions in Brittany (France)

Contaminants	Industry	Agriculture	Tertiary Sphere + Housing	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	1 305 000	861 000	3 887 000	7 719 000	n.a.	**14 305 000**
Solids	0	0	0	0	n.a.	**0**
Sulphur dioxide (SO_2)	4471	731	1738	1049	n.a.	**8391**
Nitrogen oxides (NO_x)	2784	13523	4466	49244	n.a.	**71320**
Carbon monoxide (CO)	12756	21084	89205	167919	n.a.	**291741**
Total [tons/year]	**1 325 011**	**896 338**	**3 982 409**	**7 937 212**	**n.a.**	**14 140 970**
Total share	**9,37%**	**6,34%**	**28,16%**	**56,13%**	**n.a.**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 33: Energy consumption sectors share in Brittany (France)

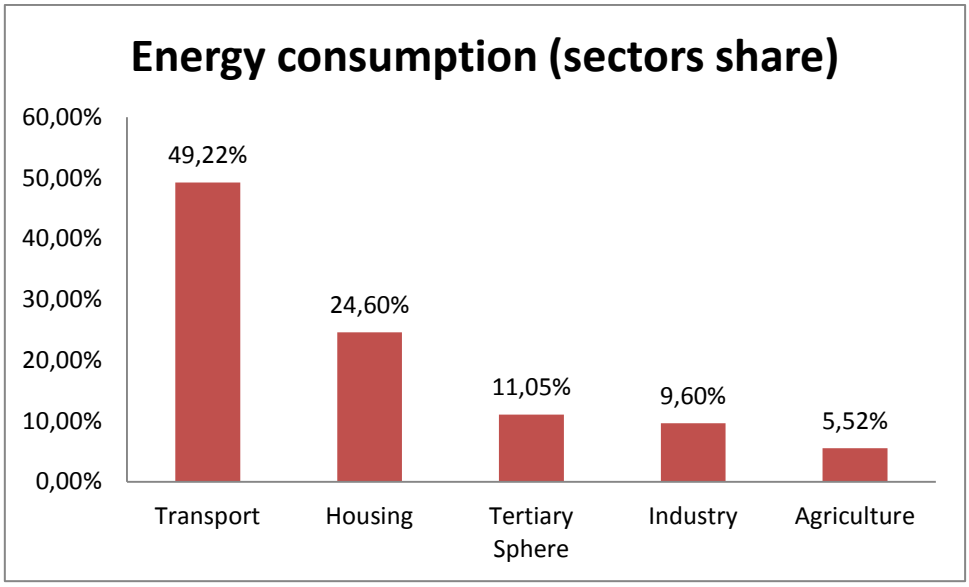


Figure 34: Energy consumption fuel types share in Brittany (France)

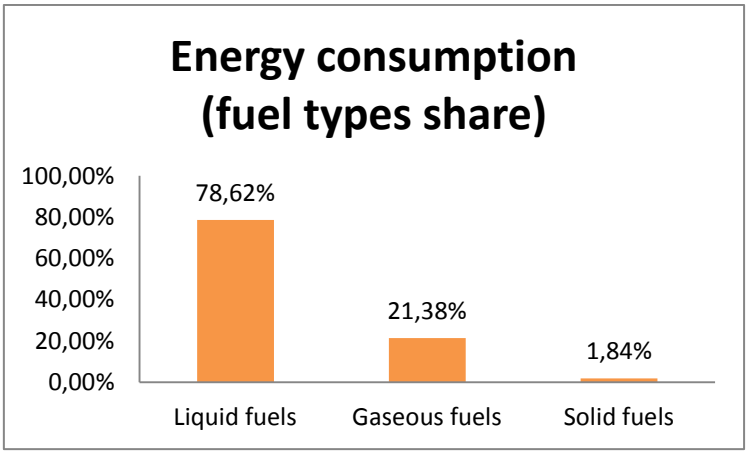
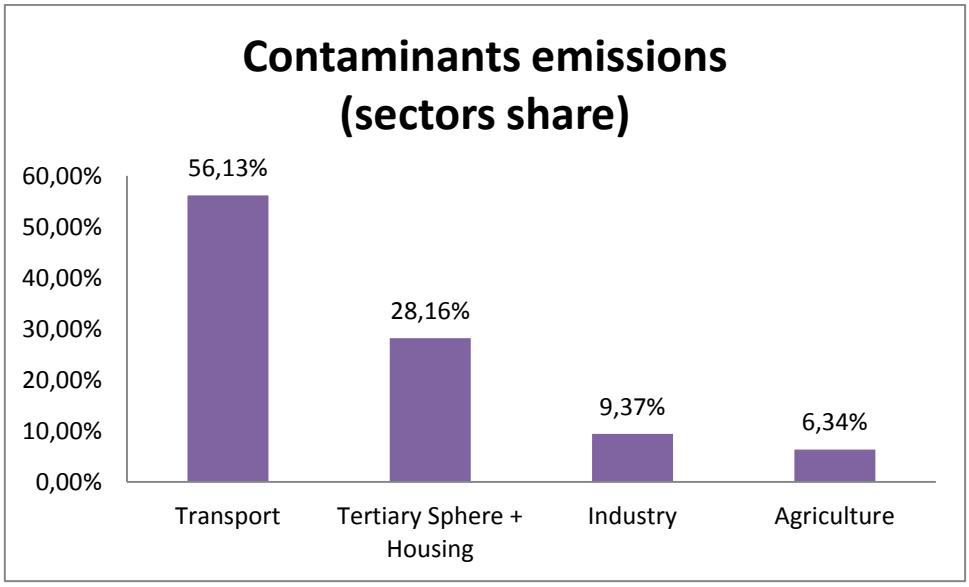


Figure 35: Contaminants emissions sector share in Brittany (France)



2.3.13 Croatia

Since Croatia is not part of the European Union yet, it participated through the NUTS 1 region equivalent – all Croatia. Croatian data are gathered from different tables from EUROSTAT or the Ministry of Economy L&E sources. The development of the energy market in Croatia formally began in July 2000. Later acts then helped the regulation of relations on the Croatian energy market according to the EU directives for the field of energy valid in that period. Energy efficiency and use of renewable sources of energy are becoming a more and more important initiator of Croatia's economic development. Increased funds such as the introduction of the Environmental Protection and Energy Efficiency Fund will bring more renewable energy and energy efficiency projects in the future.

2.3.13.1 Energy consumption

The following Table 56 shows energy consumption in the main economic branches in Croatia. The total energy consumption in the transport sector records the highest amount in relation to other economic sectors. There follows the housing and the industry sector respectively, while the agriculture sector has the lowest amount of energy consumption for the year 2008. The most used fuel is the liquid fuel with the highest value for the transport sector, although from the report (Energy in Croatia 2008) it emerges that the use of liquid fuels had a decrease compared to the previous year due to the increased use of natural gas.

Table 56: Energy consumption in Croatia

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]*
Solid fuels	11 560 000	n.a.	n.a.	n.a.	205 153	**29 684 412**
Liquid fuels	6 440 000	9 838 980	n.a.	80 780 000	6 677 946	**187 024 356**
Gaseous fuels	15 250 000	837 360	n.a.	3 220 000	26 808 080	**107 893 836**
Total [GJ/year]	**60 750 000**	**10 930 000**	**29 710 000**	**90 130 000**	**74 980 000**	**381 166 272**
Total [percent]	**13,32***	**3,06***	**4,21***	**24,67***	**15,40***	**100,0%***

* The total of each economic sector and the total of each fuel type are NOT the sum of the data described in the table, but are specific data found in different tables from EUROSTAT or the Ministry of economy L&E sources. Therefore total sum of different economic sectors partial shares does not fit with total sum (100%). Real percentage values may differ as well, because of "n.a." values in some fields.

Energy demand in industry has increased by 0.4% in 2008 compared to 2007. Such an increase resulted from an increased consumption of natural gas by 11.7%, while the consumption of all other energy forms in industry actually decreased. In 2008 the final energy demand in the transport sector decreased by 0.8% in relation to the previous year. The decrease was recorded in the consumption of motor gasoline, diesel fuel, and liquid biofuels, while the consumption of LPG, jet fuel, and electricity increased. The final energy demand in the other sectors (households, public services, agriculture and construction industry) increased by 5.5% from the previous year, with increasing consumption of all energy forms. The final energy demand in 2008 has increased by 2.2% in relation to 2007. The increase was recorded in the consumption of natural gas, electricity, and fuel wood. The biggest increase, described in percentage, occurred in consumption of natural gas and was 9.9%. The use of electricity in 2008 increased by 4.9%. The consumption of coal and coke dropped by 1.4%, the consumption of steam and hot water by 1.3% and the consumption of liquid fuels by 0.5%.

In Croatia, economic subjects are being encouraged to make their own investments that not only contribute to environmental protection and improvement of energy efficiency, but, using new, modern technologies, make higher profits, improve competitiveness and win a better position in the market. But it is not enough, so that increased funds for innovation and technology are needed to develop and improve energy efficiency and the production of own renewable energy source products. It is also important to promote environmental sustainability management in the different economic sectors and to raise awareness of environmental problems by promoting the best practice in energy efficiency and environmental sustainability.

2.3.13.2 Emissions

CO_2 emission in Croatia is considered to be relatively low, which is due to the abundance of hydro-energy, the widespread use of firewood and the lack of coal. Croatia has always been aware of the need to protect the environment and thus decrease CO_2 emissions; in 1992, it ratified the Vienna Convention and the Montreal Protocol on the protection of the ozone layer. In 1996, Croatia ratified the United Nations Framework Convention on Climate Change (UNFCCC) and in that way joined a global network for fighting climate changes with the primary focus of decreasing the level of CO_2 emissions. Furthermore, Croatia also endorsed the Kyoto protocol which is now the primary guideline when it comes to regional environmental and energy policies.

Carbon dioxide is the main contaminant polluting the atmosphere in Croatia. As can be seen in Table 57, the Transport sector is responsible for the highest carbon dioxide emissions in relation to other sectors. Unfortunately there is lack of data for emissions from the agriculture, housing and tertiary sphere sectors.

Table 57: Contaminants emissions in Croatia

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]*
Carbon dioxide (CO_2)	3 950 000	n.a.	n.a.	6 175 000	n.a.	**20 298 000**
Solids	2 245	n.a.	n.a.	6 299	n.a.	**13 266**
Sulphur dioxide (SO_2)	6 297	n.a.	n.a.	8 262	n.a.	**49 898**
Nitrogen oxides (NO_x)	5 919	n.a.	n.a.	50 428	n.a.	**71 142**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**14 637 000**	**3 349 000**	**n.a.**	**6 242 000**	**n.a.**	**31 132 000**
Total [percent]	**47,00**	**10,75**	**n.a.***	**20,00**	**n.a.***	**100,00***

* The total of each economic sector and the total of each contaminant are NOT the sum of the data described in the table, but are specific data found in different tables from EUROSTAT or the Ministry of economy L&E sources. The total percentages were calculated assuming that 100% is equal to the total of totals (31132000), therefore the total percentage for the tertiary sphere and the housing sector is assumed to be the remaining 22,25%.

The main source of CO_2 emissions is fuel combustion. Stationary energy sources emitted 67% of CO_2, 33% of CO_2 were emitted from energy production and transformation plants, 19% from manufacturing industries and construction and 17% from non-industrial combustion furnaces. Road transport contributed to total energy emissions with 28%, while other mobile sources contributed 2%.

The bigger cities and business districts of Croatia are, of course, the highest CO_2 emitters. In addition, there is not a lot of effort being put into educating people about ways to save energy and in that way contribute to the decrease of CO_2 emissions, even though after ratifying the Kyoto protocol, Croatia created a number of formal and legal frameworks in order to enforce measures and actions for protecting and improving the quality of the air in Croatia, especially in transport. In addition, there is a lot of support offered by the government of Croatia to entrepreneurs offering electricity produced with renewable energy sources. But still the public is unaware and misinformed, which definitely slows down the desired changes.

The potential of renewable energy sources in Croatia is above average in comparison with other European countries. In order to lower CO_2 emissions and achieve a cleaner, less polluted environment, Croatia should turn to the renewable energy sources which are abundant there. More support for the producers of energy by means of the renewable energy sources should be considered as well. Green building regulations and requalification of out - dated and high energy consuming buildings should be considered, together with support for hybrid and electrical cars.

2.3.13.3 Final data

In the following tables, there are all the data as used for analyses in chapter 2.4.

Table 58: Final data for energy consumption in Croatia

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	11 560 000	n.a.	n.a.	n.a.	205 153	**29 684 412**	**7,79%**
Liquid fuels	6 440 000	9 838 980	n.a.	80 780 000	6 677 946	**187 024 356**	**49,07%**
Gaseous fuels	15 250 000	837 360	n.a.	3 220 000	26 808 080	**107 893 836**	**28,31%**
Total [GJ/year]	**60 750 000**	**10 930 000**	**29 710 000**	**90 130 000**	**74 980 000**	**381 166 272**	**100,00%**
Total share	**15,94%**	**2,87%**	**7,79%**	**23,65%**	**19,67%**	**100,00%**	

Table 59: Final data for contaminants emissions in Croatia

Contaminants	Industry	Agriculture	Tertiary Sphere + Housing	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	3 950 000	n.a.	n.a.	6 175 000	n.a.	**20 298 000**
Solids	2245	n.a.	n.a.	6299	n.a.	**13266**
Sulphur dioxide (SO_2)	6297	n.a.	n.a.	8262	n.a.	**49898**
Nitrogen oxides (NO_x)	5919	n.a.	n.a.	50428	n.a.	**71142**
Carbon monoxide (CO)	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Total [tons/year]	**14 637 000**	**3 349 000**	**6 904 000**	**6 242 000**	**n.a.**	**31 132 000**
Total share	**47,02%**	**10,76%**	**22,18%**	**20,05%**	**n.a.**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 36: Energy consumption sectors share in Croatia

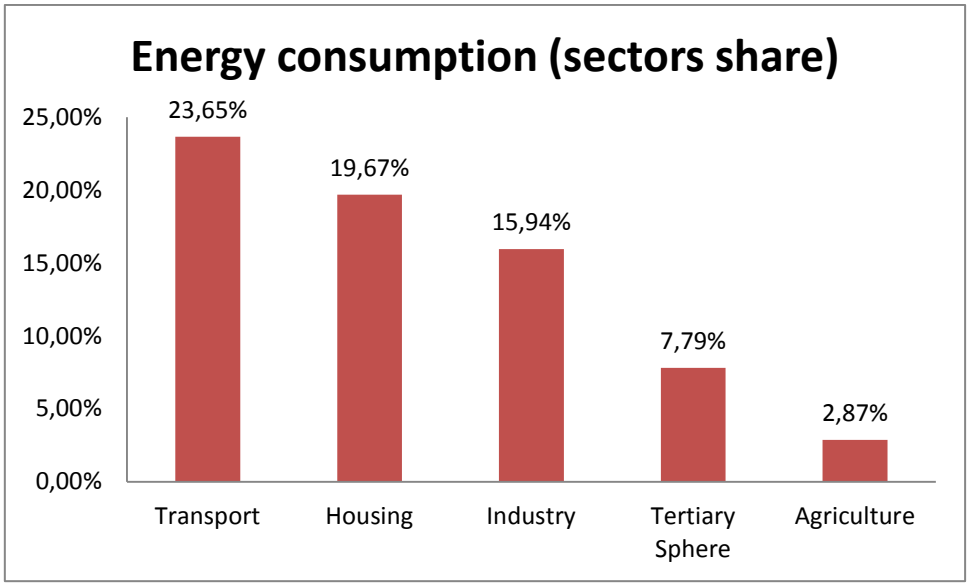


Figure 37: Energy consumption fuel types share in Croatia

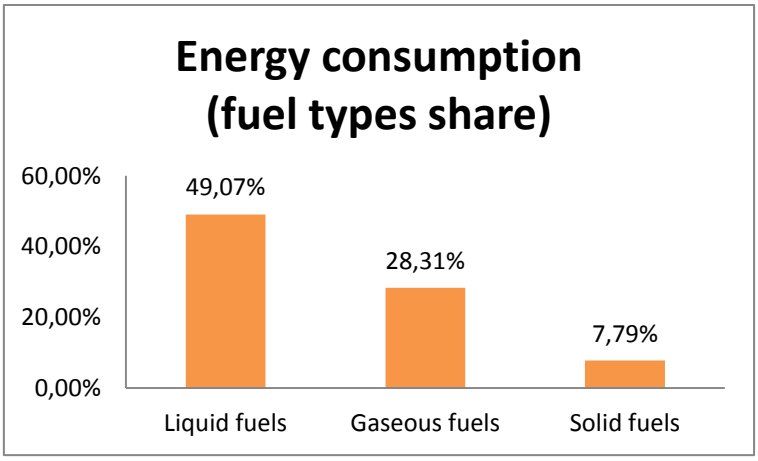
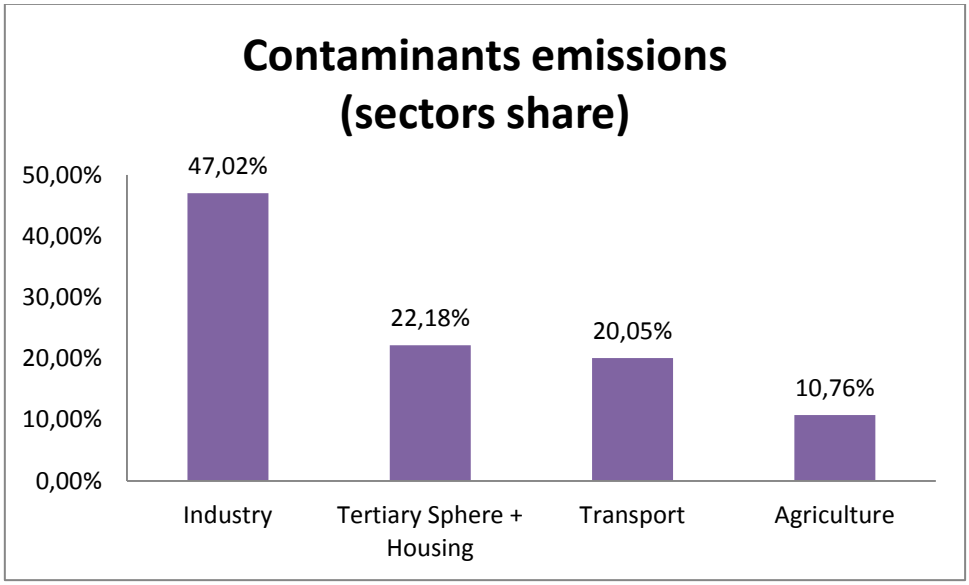


Figure 38: Contaminants emissions sector share in Croatia



2.3.14 Portugal

Portugal participated with one NUTS 2 region – Lisboa. This Lisboa region consists of many districts and in some cases, there were no required data available for the whole Lisboa region. In these cases, data for Lisboa district, which is one part of the Lisboa region, were used instead.

Lisboa is a region in constant change, gaining centers of innovation and technological development, the growth of competitive industries, the growth of a tertiary sphere - capable of responding to new challenges, the modernization of its two harbors, logistics platforms, deployment of the new international airport, connecting to European high-speed network.

Portugal (and Lisboa region) is highly energy dependent. In a context of increasingly expensive energy, this is one of the most serious problems Portugal is currently facing and it is also one of the causes of the general crisis that has shaken the Portuguese economy and society.

2.3.14.1 Energy consumption

As can be seen in Table 60, the Transport sector is the leading sector in Lisboa District region with 80,96% of energy consumption. It is followed by the Housing and Tertiary Sphere sectors, which in total, are only 16,27%. Energy consumption for the Agriculture and Industry sectors are only minor Lisboa District, about 1-2% each.

Table 60: Energy consumption in Lisboa District (Portugal)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Liquid fuels	815 786	1 063 790	4 963 506	54 910 452	5 984 294	**67 737 826**
Gaseous fuels	1 092	989	9 385	189 529	115 862	**316 857**
Total [GJ/year]	**816 878**	**1 064 778**	**4 972 891**	**55 099 980**	**6 100 156**	**68 054 683**
Total [percent]	**1,20**	**1,56**	**7,31**	**80,96**	**8,96**	**100,00**

In Lisboa Region the increasing economic importance of the services sector (transport) is in line with the phenomena of dematerialization of the economy, outsourcing and logistics, together with increasing intensity of gross value added of energy services. The final energy consumption mainly depends on fossil fuels, especially those derived from petrol consumed by the transport and energy sectors. The growing dependence on private transport and the number of passenger trip increases has caused serious social, economic and environmental problems, including inefficient consumption of energy in the transport sector.

The energy consumption by the Housing and Tertiary Sphere sectors are related especially to heating, cooler home facilities, kitchen facilities and electronics.

Together with the high energy dependence of the country, high transport energy consumption is the biggest problem, which should be dealt with. This should be done especially by promoting and developing clean energy and more energy efficient vehicles and by developing and enhancing service policies like public transport. Renewable energies should be introduced and energy management should be implemented. Very important is

citizen awareness and education, which should result in more sustainable behavior in every sector. Special attention should be paid to externalities as well.

2.3.14.2 Emissions

According to Table 61, in Portugal, and particularly in Lisboa, the biggest consumer of energy and CO_2 emissions is the transport sector. The main factor that contributes to CO_2 emission in Lisboa is Transport, representing 39,08%, Industry – 33,12% and the Tertiary sphere – 16%. Agriculture contains a very small number of CO_2 emissions and carbon dioxide, because Lisboa is a consolidated urban area with low agriculture expression at the present time. The main contaminant in the housing sector is carbond dioxide with 11,80% of total contaminant emissions for this sector.

Table 61: Contaminants emissions in Lisboa District (Portugal)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	4 357 453	436	2 106 162	5 145 460	1 553 747	**13 163 259**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	186	0	65	65	0	**317**
Nitrogen oxides (NO_x)	982	0	24	24	0	**1 029**
Carbon monoxide (CO)	3 003	537	2	2	0	**3 544**
Total [tons/year]	**4 361 625**	**973**	**2 106 253**	**5 145 551**	**1 553 747**	**13 168 150**
Total [percent]	**33,12**	**0,01**	**16,00**	**39,08**	**11,80**	**100,00**

Energy consumption in Lisboa district is higher. Lisboa is a district with a high density population, where many services, commerce and network offices in the country are located and where the transport network is denser.

Lisboa is a large dynamic business city with a consolidated road rail network. The development of net rail is increasingly, which results in using electricity instead of diesel. The carbon dioxide emission from burning fossil fuels is one that contributes to this phenomenon.

It is important to decrease investment policies on the non-sustainable road transport sector and to reduce European Commerce of Allowance Emissions in the transport sector in Lisboa. Investment into integrated sustainable public transport might be needed. It is important to analyse citizens' needs, to define public policies, to integrate central and local administration and to revise the funding system model. Hybrid and electric cars should be supported. Climate strategies should be implemented into companies and consistent and thorough review of municipal regulations should be considered, together with a planning instrument and environmental forecast integration.

2.3.14.3 Final data

In the following tables, there are all the data as used for analyses in chapter 2.4.

Table 62: Final data for energy consumption in Lisboa District (Portugal)

Fuel Type	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [GJ/year]	Total share
Solid fuels	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**	**n.a.**
Liquid fuels	815 786	1 063 790	4 963 506	54 910 452	5 984 294	**67 737 826**	**99,53%**
Gaseous fuels	1 092	989	9 385	189 529	115 862	**316 857**	**0,47%**
Total [GJ/year]	**816 878**	**1 064 779**	**4 972 891**	**55 099 981**	**6 100 156**	**68 054 683**	**100,00%**
Total share	**1,20%**	**1,56%**	**7,31%**	**80,96%**	**8,96%**	**100,00%**	

Table 63: Final data for contaminants emissions in Lisboa District (Portugal)

Contaminants	Industry	Agriculture	Tertiary Sphere	Transport	Housing	Total [tons/year]
Carbon dioxide (CO_2)	4 357 453	436	2 106 162	5 145 460	1 553 747	**13 163 258**
Solids	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**
Sulphur dioxide (SO_2)	186	0	65	65	0	**316**
Nitrogen oxides (NO_x)	982	0	24	24	0	**1030**
Carbon monoxide (CO)	3003	537	2	2	0	**3544**
Total [tons/year]	**4 361 624**	**973**	**2 106 253**	**5 145 551**	**1 553 747**	**13 168 148**
Total share	**33,12%**	**0,01%**	**16,00%**	**39,08%**	**11,80%**	**100,00%**

The following figures show share of specific sectors and fuel types in energy consumption and sector share in contaminants emissions based on data provided by the partner.

Figure 39: Energy consumption sectors share in Lisboa District (Portugal)

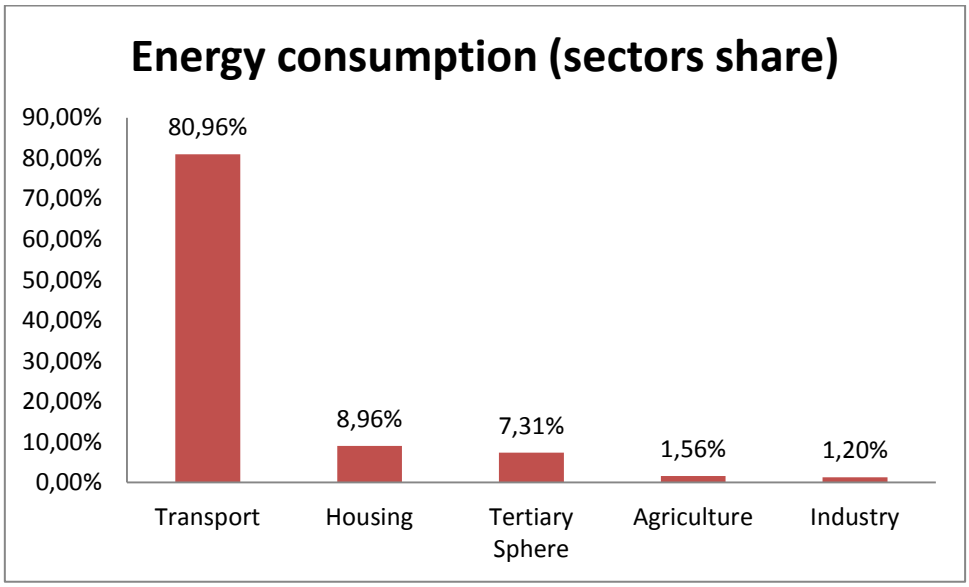


Figure 40: Energy consumption fuel types share in Lisboa District (Portugal)

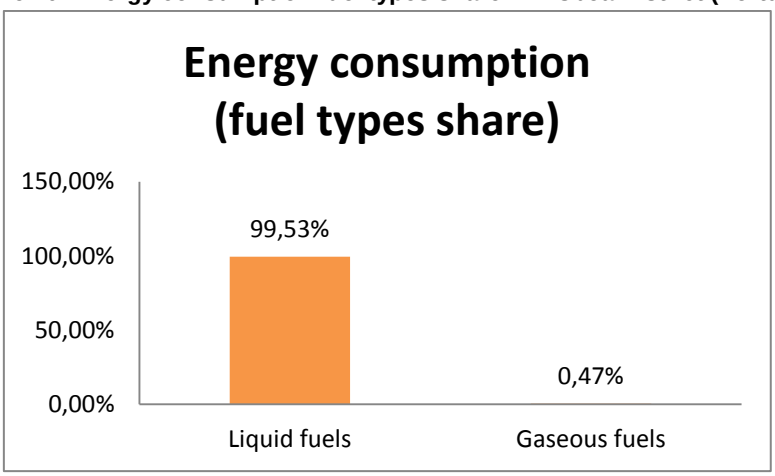
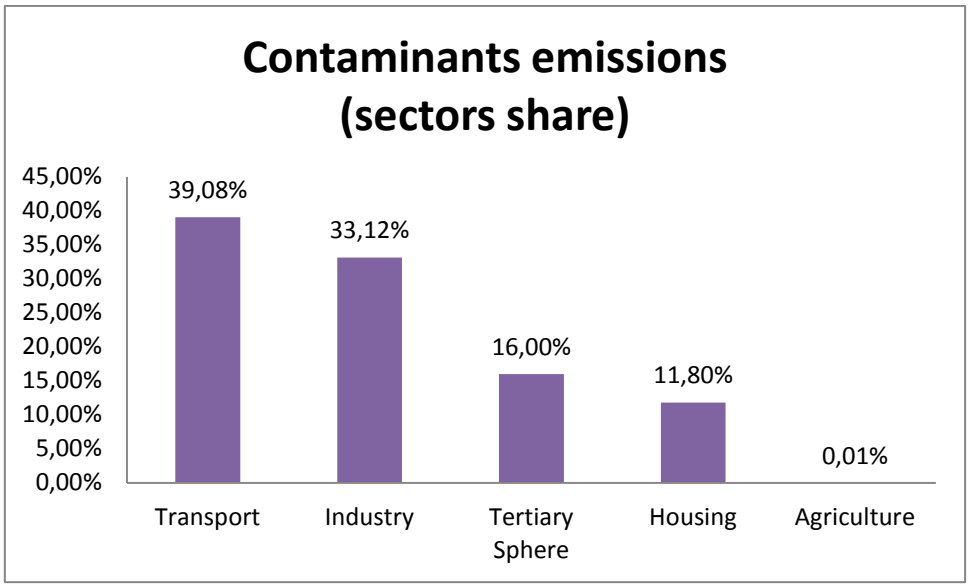


Figure 41: Contaminants emissions sector share in Lisboa District (Portugal)



2.4 Partners comparison

Partners were compared according to the methodological note described in chapter 2.2.2.

Because of huge problems during the data gathering process, not every partner participated in each comparison. Only partners whose specific data were available, could participate. Problems with some missing data were encountered with 13 of 14 partners. Some partners had missing even crucial parts of data, so they could not be covered in comparison at all. Although data completeness can be fully examined in chapter 2.3 of this report, here is a brief recapitulation:

- **Italy**: Only CO_2 emissions were available in contaminants emissions.
- **Malta**: Regions were not of NUTS 2 level; therefore they have been aggregated into one comprehensive region. Eurostat data for GDP and sector areas were not available. Solid fuels were not available in energy consumption. Only CO_2 emissions were available in contaminants emissions. Data for the tertiary sphere were available neither for energy consumption nor for contaminants emissions.

- **Hungary**: Some solid and gaseous fuels information was missing in energy consumption, as well as all data for the transport sector (please note, that shares of energy consumption for other sectors were used in this case - this may generate tolerable mistakes on the safe side). Only total numbers for contaminants emissions were available.
- **Czech Republic**: No problems at all.
- **Greece**: Energy consumption data were not available at all; contaminants emissions were missing on most information for the Tertiary Sphere and all information about solids. Contaminants emission was available only at national level. Eurostat data for sector areas were not available for Greece.
- **Slovakia**: No data available at all, Slovakia could not participate in the comparison.
- **Slovenia**: Pomurje region had to be adjusted to NUTS 2 region level. Data for gaseous fuels in transport sector were missing in energy consumption. In contaminants emissions, data for carbon monoxide were not available. Eurostat data for sector areas were not available.
- **Poland**: In contaminants emissions, only data for the industry sector were available.
- **Spain**: Only percentage shares were available for contaminants emissions. In contaminants emissions, data for solids, carbon monoxide were missing. Data for the tertiary sphere and housing sector were joined in contaminants emissions.
- **Wales, UK**: Data were provided for NUTS 3 level region, instead of NUTS 2 level region. In energy consumption, some data for solid and gaseous fuels were missing. Only CO_2 emissions were available in contaminants emissions. Eurostat data for GDP and sector areas were not available.
- **Romania**: Data for energy consumption were available only on the national level. In contaminant emissions, no data for carbon monoxide were available. Eurostat data for GDP and sectors area were not available.
- **France**: Data for the tertiary sphere and housing sector were joined in contaminants emissions.
- **Croatia**: Since Croatia is not part of the European Union, all relevant data were available only for national level. Eurostat data for GDP and sector areas were not available. Data for the tertiary sphere and housing sector were joined in contaminant emissions; moreover no data for the agriculture sector were available in contaminants emission and some data for the agriculture sector were not available in energy consumption.
- **Portugal**: No data for solid fuels in energy consumption were available and no data for solids in contaminants emissions were available.

2.4.1 Energy consumption

In this chapter, all partners have been compared in energy consumption. The research was based on data provided by participating partners and on the methodological note explained in chapter 2.2.2. This chapter was made according to partners comparison notes in introduction chapter 2.4.

2.4.1.1 Total energy consumption

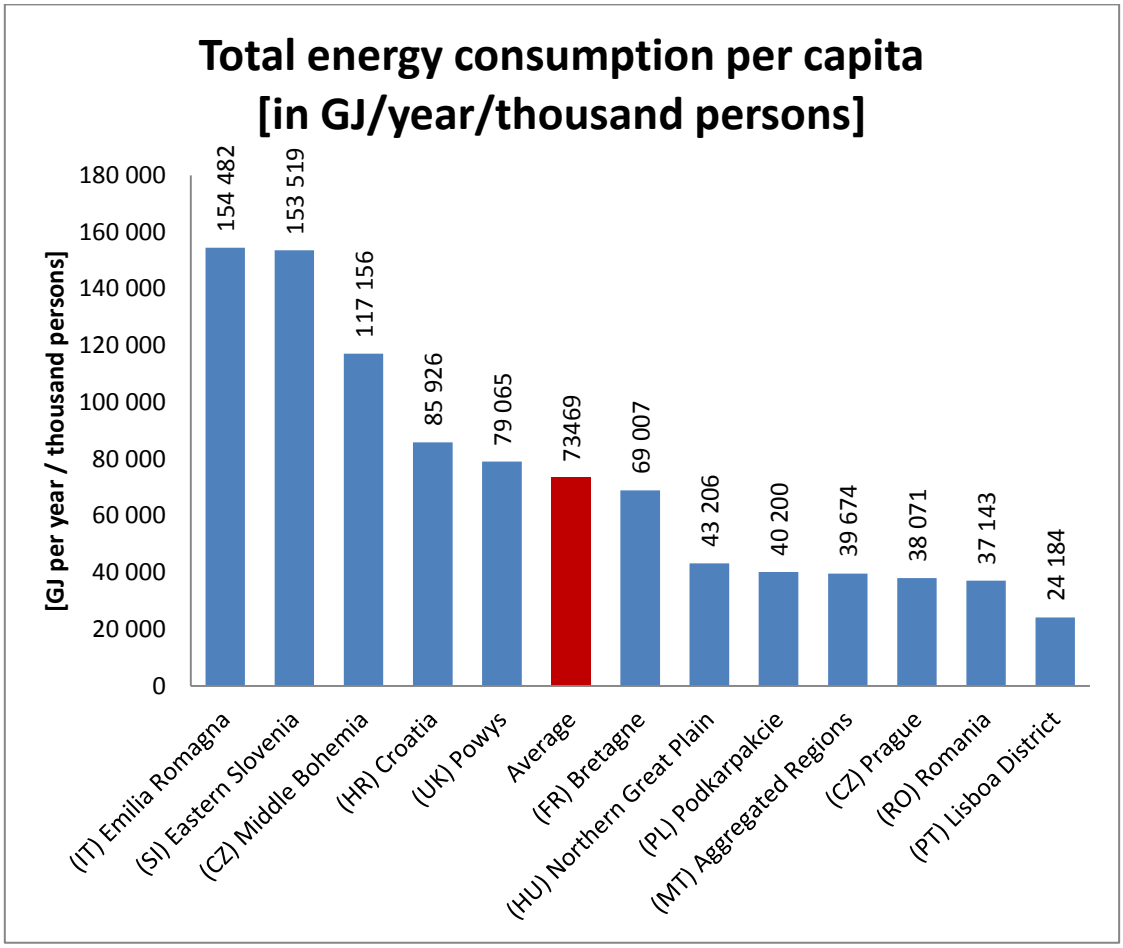
In the following figure, we can examine total energy consumption of all participating partners. We have to bear in mind that partners participated through different size regions, therefore the chart is mainly informative.

Figure 42: Total energy consumption

We can see that in the total, the highest energy-consuming region is the Northern Great Plain (HU), followed by Emilia Romagna (IT) and Croatia (HR).

To eliminate region size differences, we can examine the following chart, which shows us participating partners comparison in total energy consumption per capita.

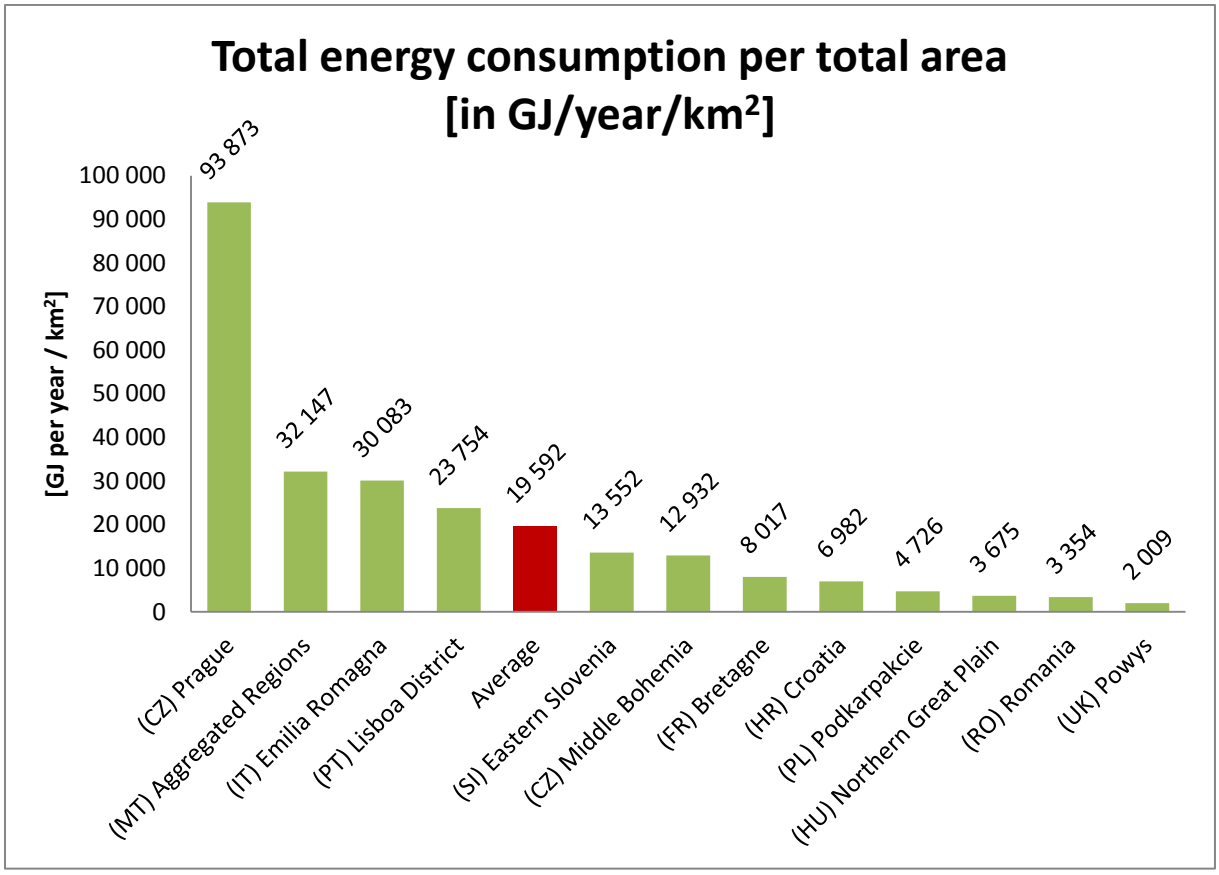
Figure 43: Total energy consumption per capita in target regions



As we can see, the highest energy per capita is consumed in Emilia Romagna (IT), followed by Eastern Slovenia (SI) and Middle Bohemia (CZ). On the other hand, the least consumption is in the Lisboa District (PT), Romania (RO) and Prague (CZ).

The following chart shows us a similar statistic – total energy consumption per total region area.

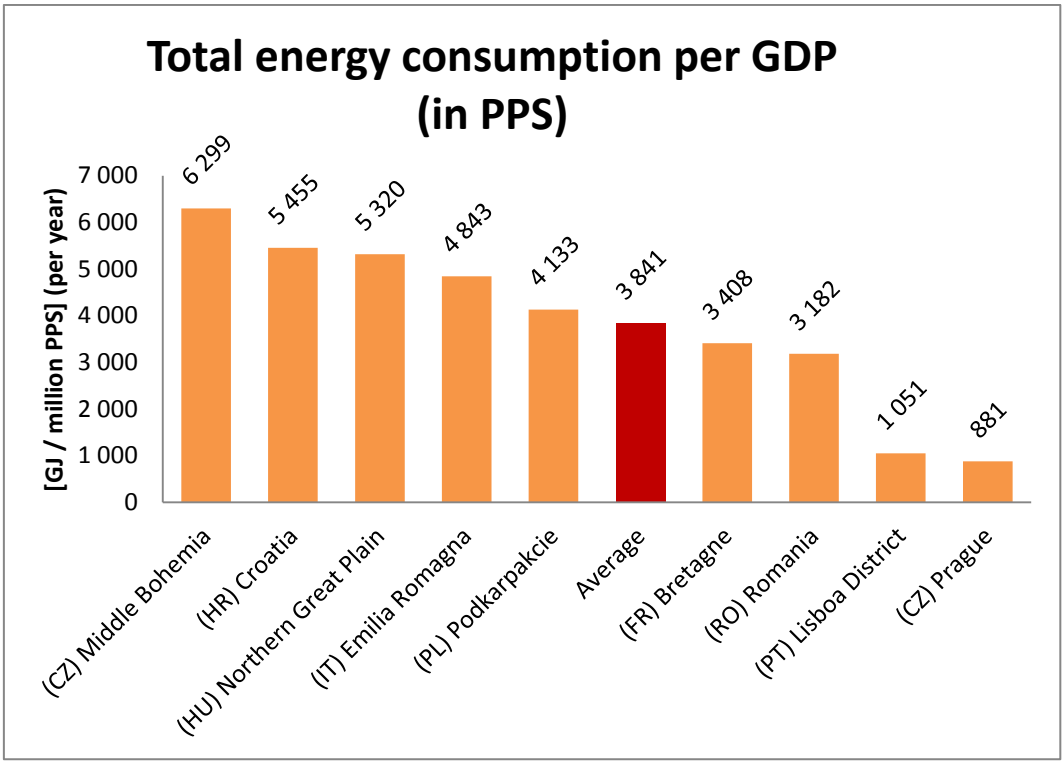
Figure 44: Total energy consumption per total area in target regions



As we can see, Prague (CZ) seems to be extremely high in consumption in comparison to other regions and indeed regions like Powys (UK) and Romania (RO) are quite efficient with very low consumption. It is given by high concentration of industry, transport and households per km^2 in Prague.

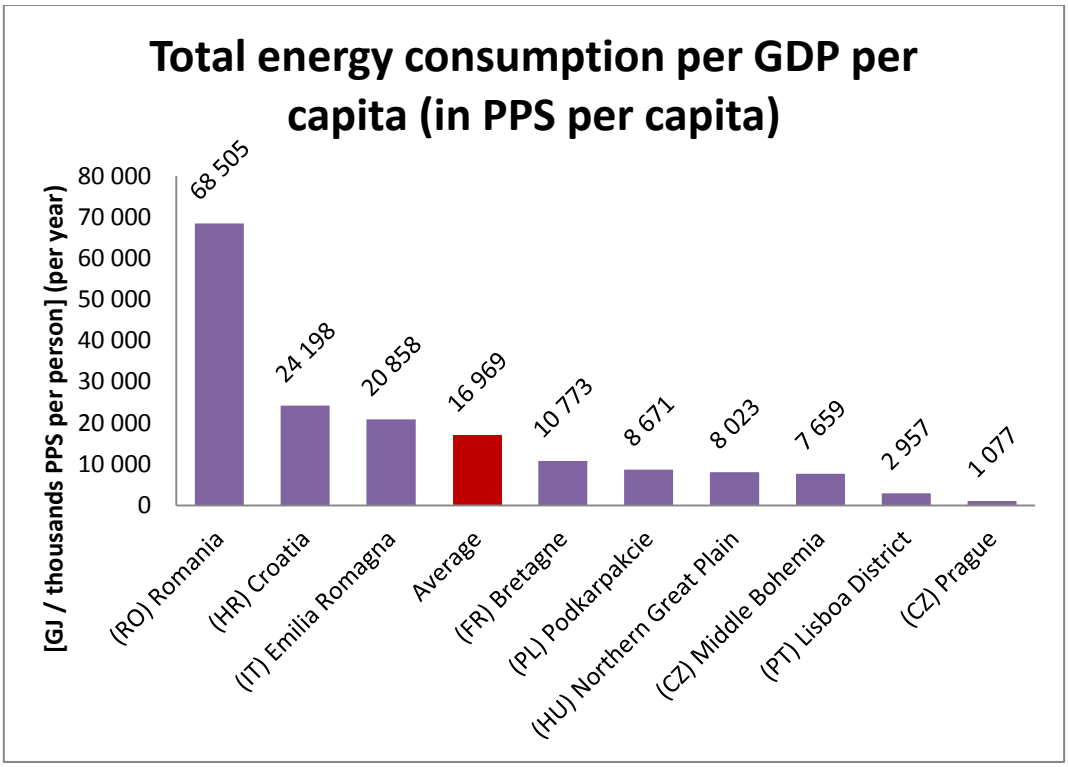
The next chart shows us a participating partners comparison when energy consumption is quantified against a region's GDP.

Figure 45: Total energy consumption per GDP in target regions



As we can see, almost all regions are above average, which is because of the very low relative consumption of Prague (CZ) and Lisboa District (PT) regions. This may be related to the population density of these two regions, which is examined in the following figure.

Figure 46: Total energy consumption per GDP per capita in target regions



Here we can see that all examined regions are around the average, with Lisboa District (PT) and Prague (CZ) still fairly well below others. Only Romania (RO) is high above average. It is given by low level of GDP per capita in the region.

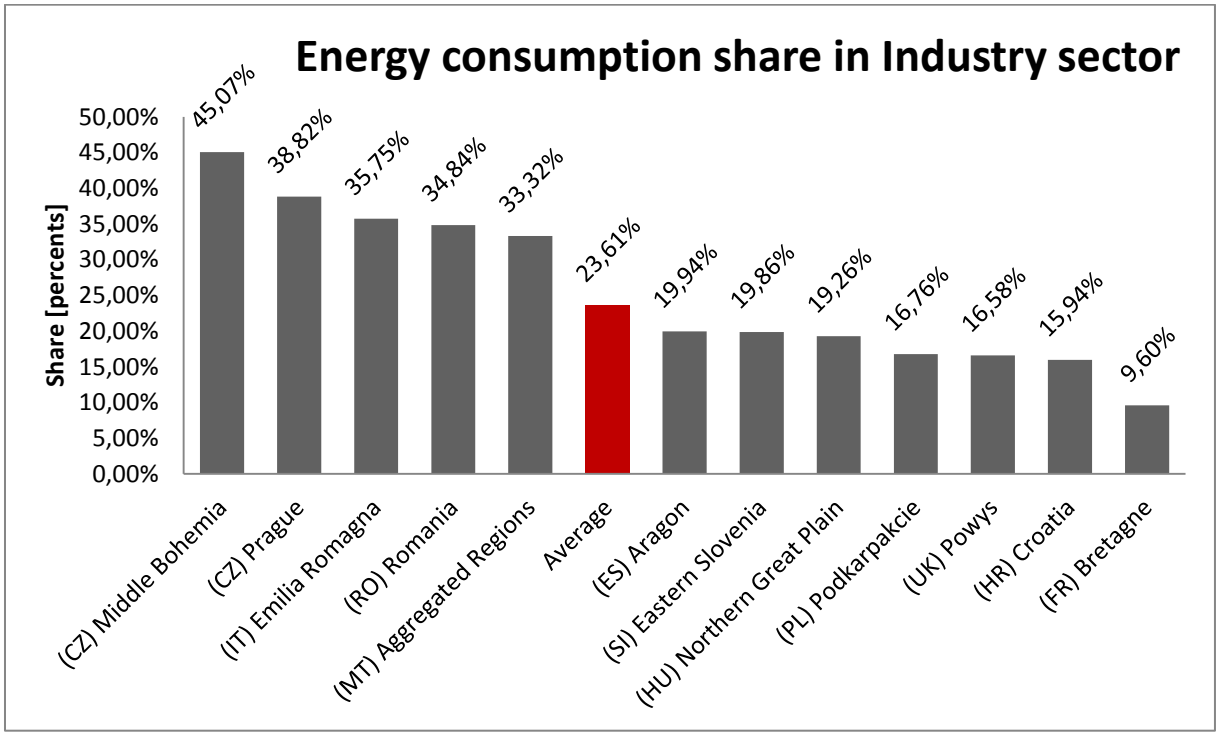
2.4.1.2 Sectors comparison

In this section, participating partners are examined from the point of view of different sectors, which are: Industry, Agriculture, Tertiary Sphere, Transport and Housing. For each sector, two charts were made. The first one shows an energy consumption share comparison, i.e. what share the examined sector takes from the total energy consumption in the examined region. The second chart examines total consumption of a sector from different point of views in the same manner, like the way total consumption was examined in chapter 2.4.1.1. The weighted average of all four examined values was used for sorting regions from the highest consuming to the lowest consuming. Energy consumption is expressed in percent values, relative to average value (which is 100%). This has been done to allow examining all values in one table and to allow direct comparison. When a region has less than 100% value, it means it consumes less energy in a specific sector than what is the average consumption.

2.4.1.2.1 Industry sector

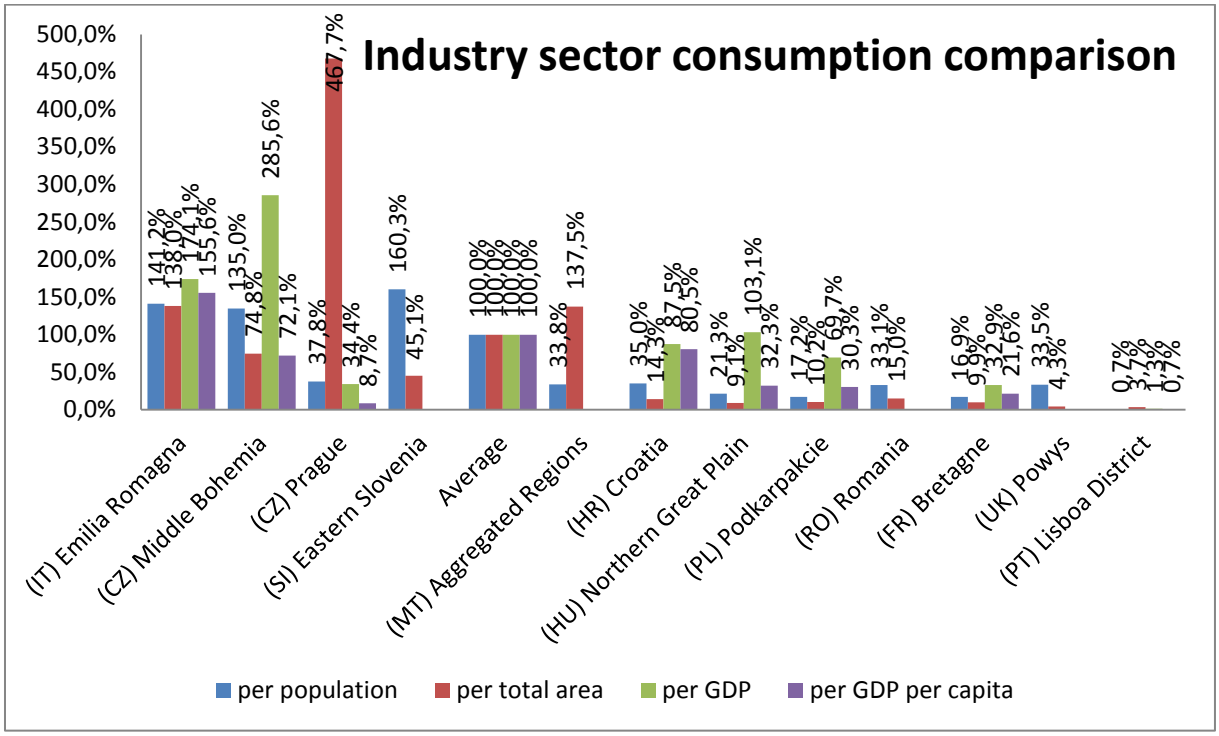
The following figure shows us energy consumption share in the Industry sector for all participating regions. We can see that Bretagne (FR) has the least share in Industry and Czech Republic regions (Middle Bohemia, Prague) has the biggest share of energy consumption in the Industry sector.

Figure 47: Energy consumption share in Industry sector in target regions



The following figure shows us the highest consuming regions in the Industry sector in total numbers.

Figure 48: Industry sector consumption comparison in target regions

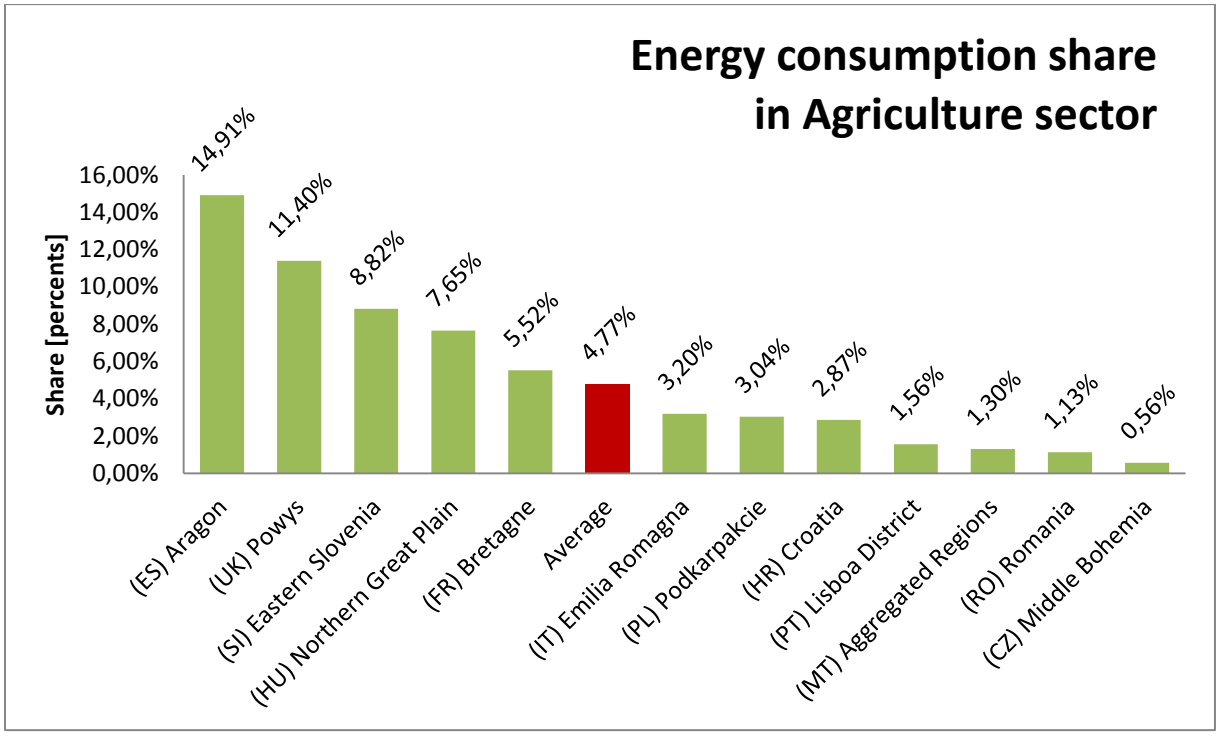


We can see that Emilia Romagna (IT), Middle Bohemia (CZ), Prague (CZ) and Eastern Slovenia (SI) are above average. All other regions are below (Bretagne, Powys, Lisboa District) or around average.

2.4.1.2.2 Agriculture sector

We can examine energy consumption share in the Agriculture sector in the following figure.

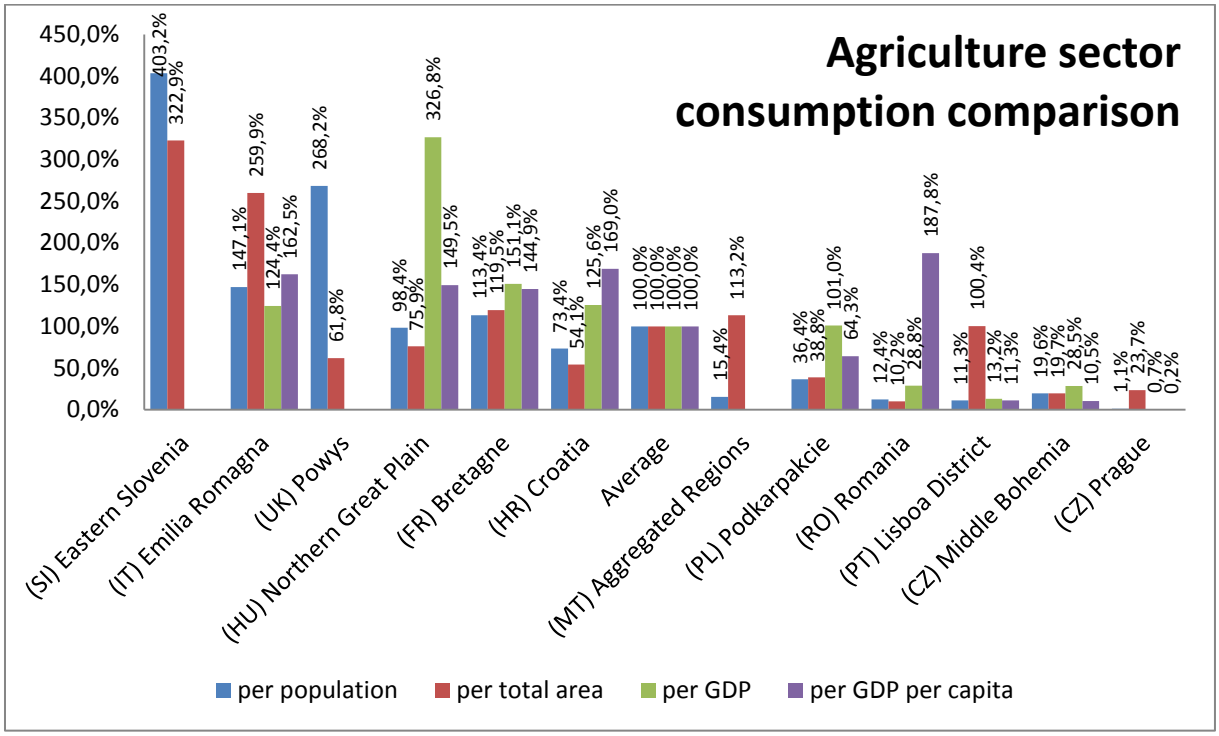
Figure 49: Energy consumption share in Agriculture sector in target regions



As we can see, Aragon (ES) has the biggest share in the agriculture sector, compared to other regions, followed by Powys (UK). The lowest share is in the Maltese regions, Romania and Middle Bohemia (CZ).

The following chart shows us the Agriculture sector consumption comparison in total numbers.

Figure 50: Agriculture sector consumption comparison in target regions

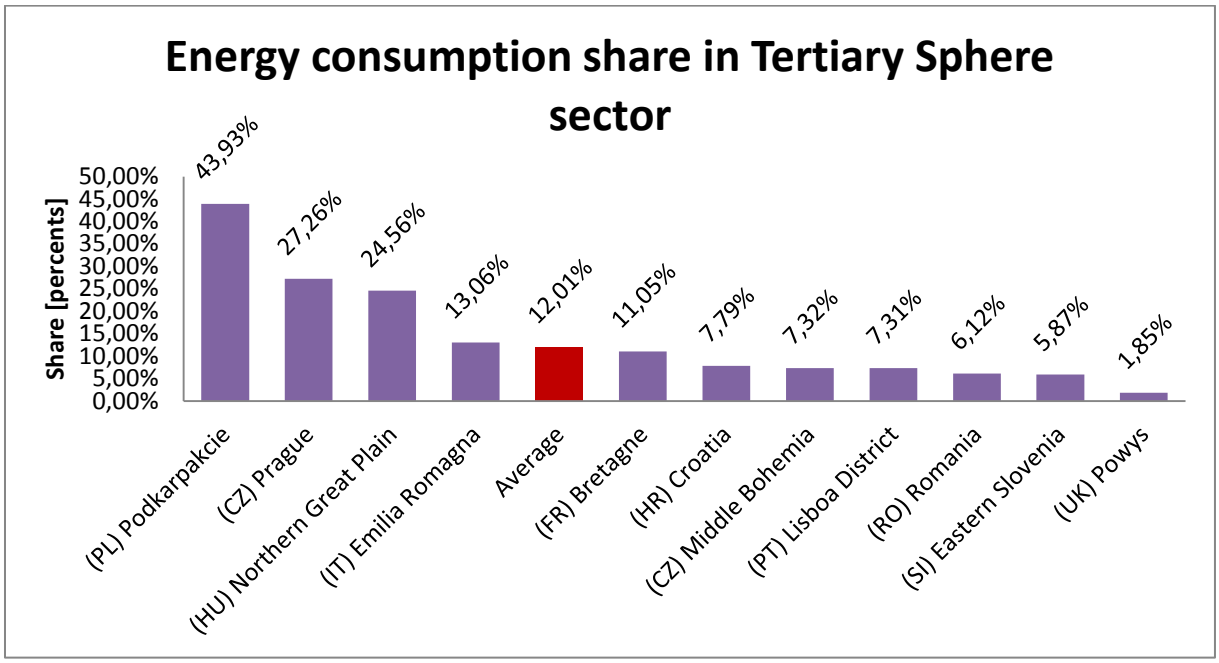


The highest consuming regions in the agriculture sector are Eastern Slovenia (SI), Emilia Romagna (IT) and Powys (UK). The least on the other hand are the Czech Republic regions (Prague, Middle Bohemia) and Lisboa District.

2.4.1.2.3 Tertiary Sphere sector

Energy consumption share in the Tertiary Sphere is examined in the following figure.

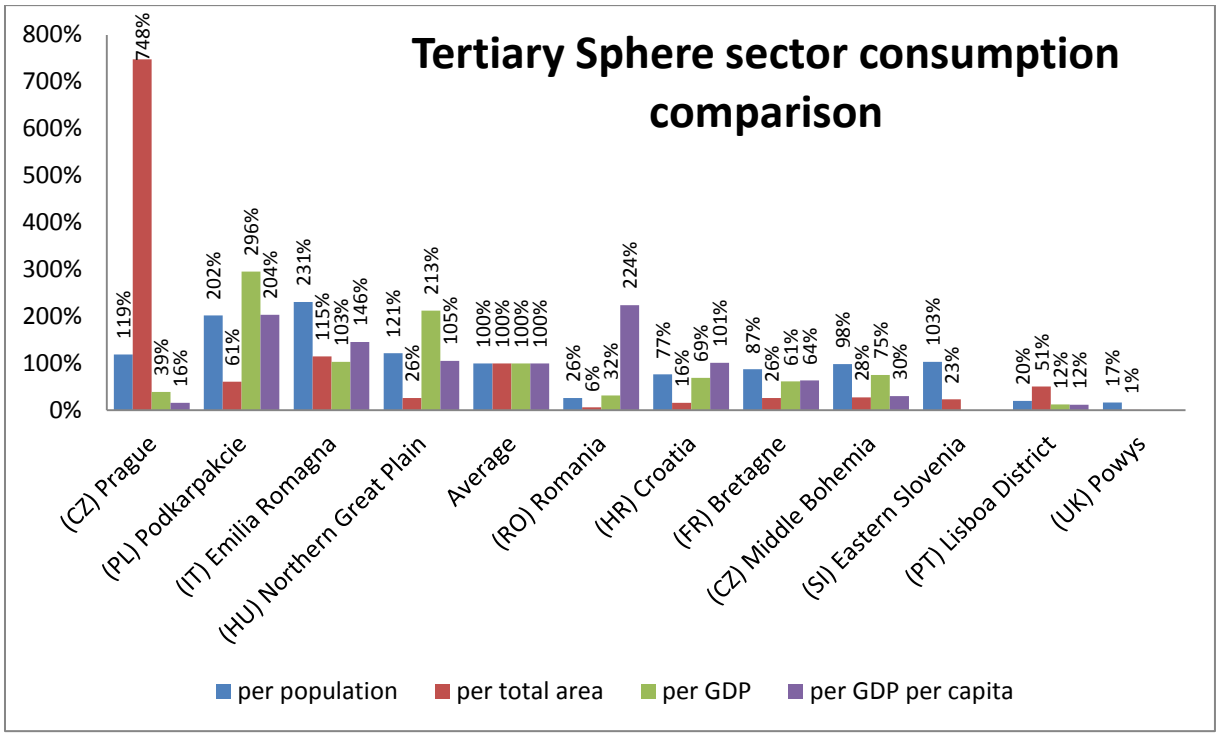
Figure 51: Energy consumption share in the Tertiary Sphere sector in target regions



Here we can see that Podkarpakcie (PL), followed by Prague (CZ) and Northern Great Plain (HU), has the biggest share in the Tertiary Sphere. Powys, on the other hand, has the lowest share.

In the following table, we can examine the Tertiary Sphere in total consumption.

Figure 52: Tertiary Sphere sector consumption comparison in target regions

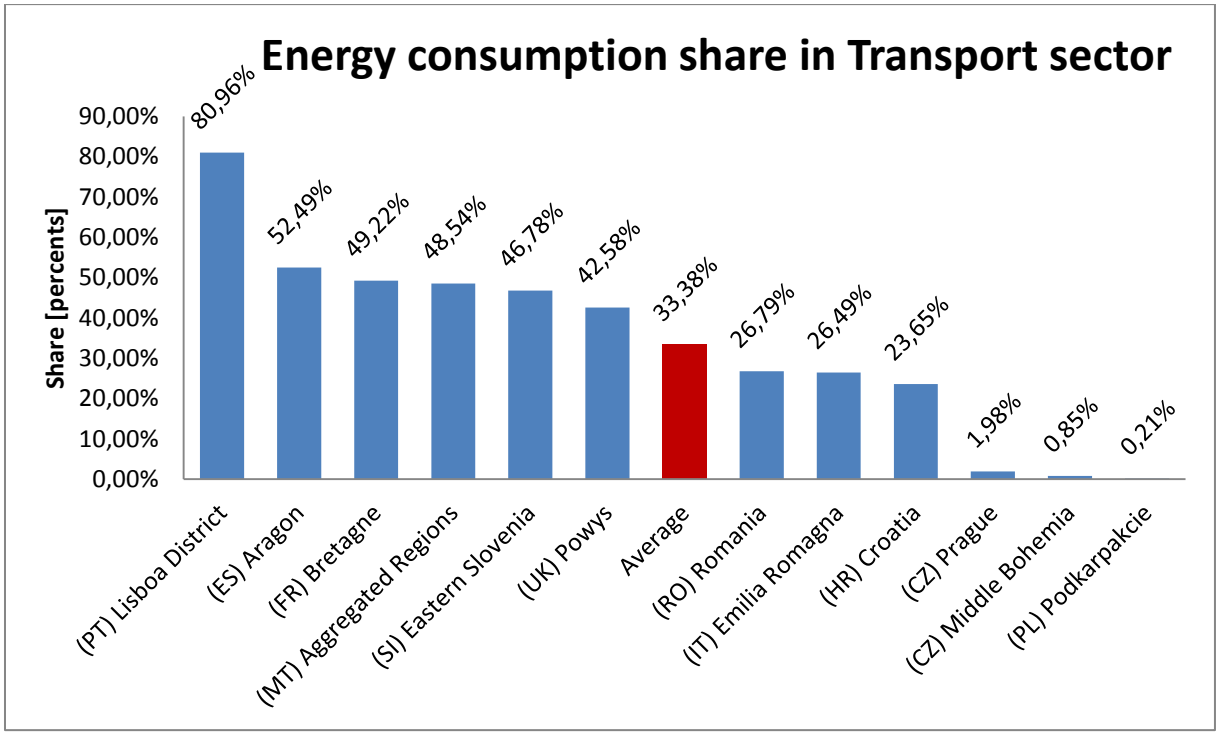


We can mention the extremely high consumption of Prague (CZ) per total area. On the other hand, we can see tiny energy consumption for this sector in Powys.

2.4.1.2.4 Transport sector

The transport sector has been examined in the same manner as preceding sectors. In the following figure, we can examine energy consumption share.

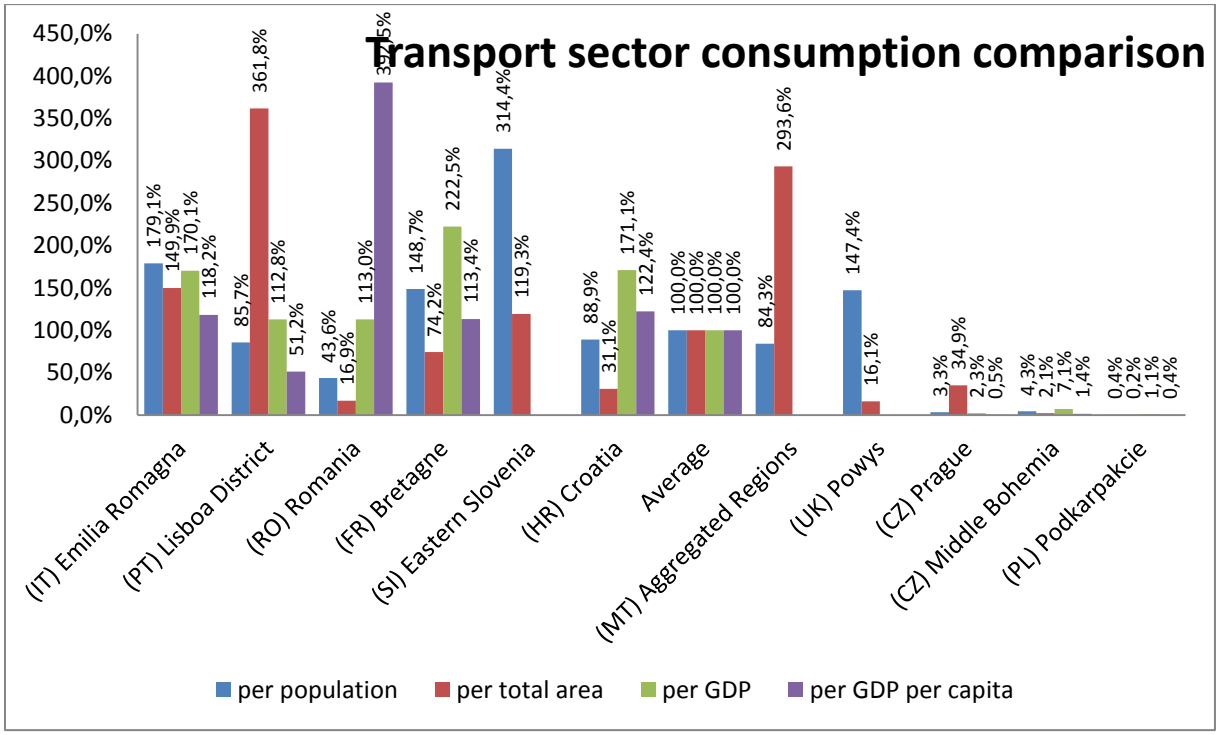
Figure 53: Energy consumption share in Transport sector in target regions



As we can see, all regions are quite average, with the exception of Lisboa District (PT), where the share for the Transport sector is fairly high, and Prague (CZ), Middle Bohemia (CZ) and Podkarpacie (PL), where the share is extremely low. This might be caused by wrong data interpretation, where some partners might have included personal transport and some partners included only public transport.

The following figure shows us transport sector comparison in total numbers.

Figure 54: Transport sector consumption comparison in target regions

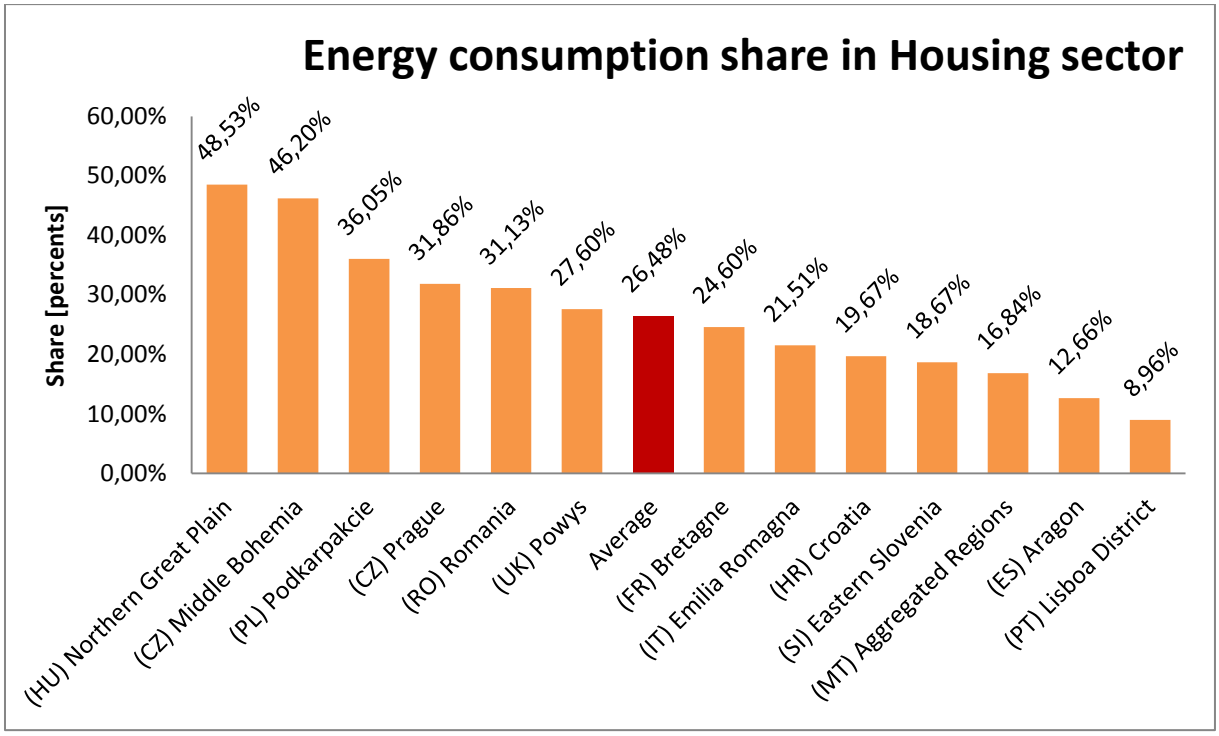


We can point out a lot of exceptionalities in this sector, where there are regions with high (Emilia Romagna) and low (Middle Bohemia, Podkarpakcie) energy consumption, as well as regions with extreme differences when using a different data base for comparison.

2.4.1.2.5 Housing sector

When examining the housing sector, all regions are quite average in comparison of sector share, as we can see in the following figure.

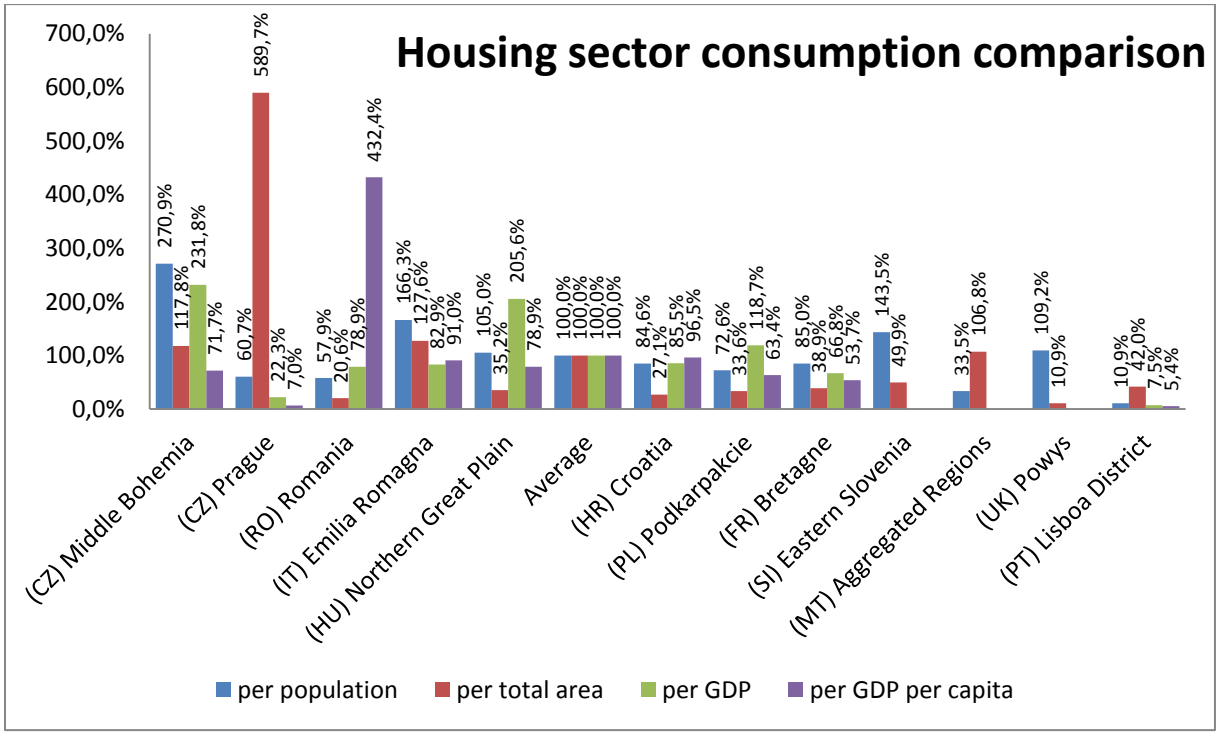
Figure 55: Energy consumption share in the Housing sector in target regions



Northern Great Plain (HU) has the biggest share, followed by Middle Bohemia (CZ), whereas Aragon (PT) and Lisboa District (PT) have the lowest share.

The following chart shows us the Housing sector comparison in total numbers. Here we can see extremely high consumption in Prague (CZ) per total area and in Romania per GDP per capita. The highest consuming sector is Middle Bohemia (CZ).

Figure 56: Housing sector consumption comparison in target regions



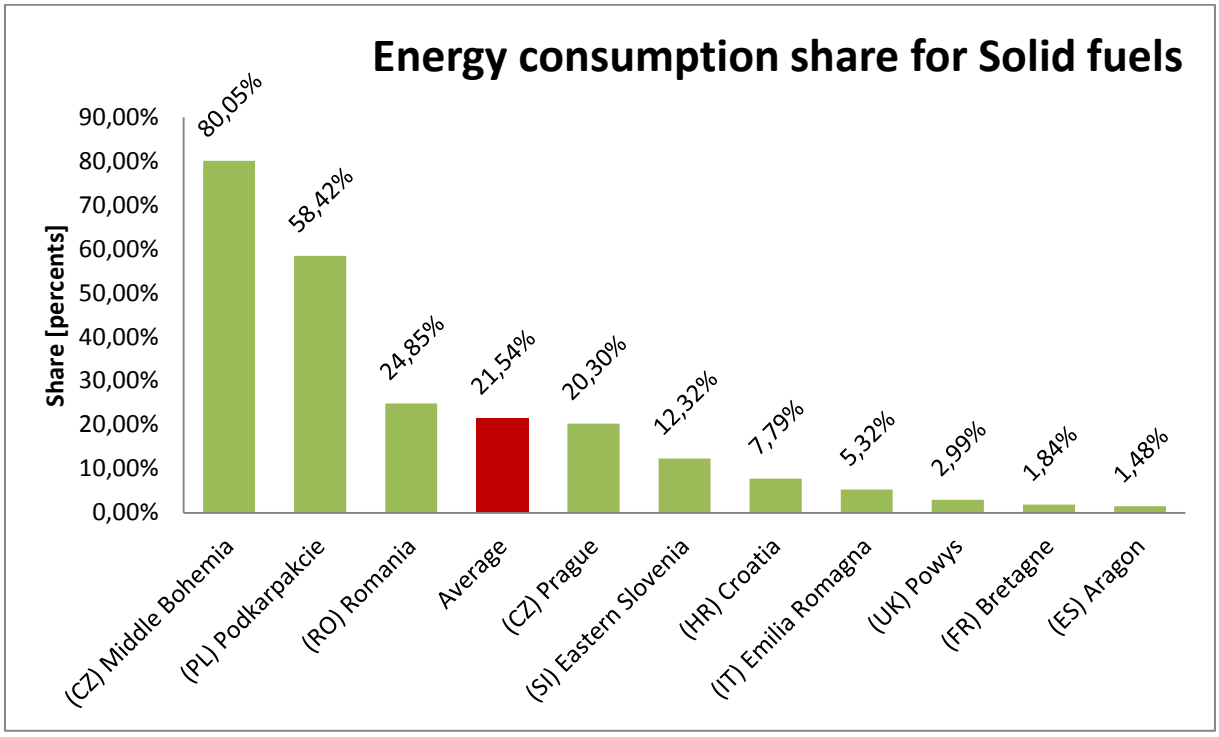
2.4.1.3 Fuel types share

In this chapter, fuel types shares of total consumption provided by participating partners are examined.

2.4.1.3.1 Solid fuels

The following figure shows us energy consumption share for Solid fuels. As we can see, almost all regions are below average, which is because of a fairly high share of Solid fuels in Podkarpakcie (PL) and an extremely high share in Middle Bohemia (CZ). Solid fuels share in Croatia, Emilia Romagna (IT), Powys (UK), Bretagne (FR) and Aragon (ES) is very low.

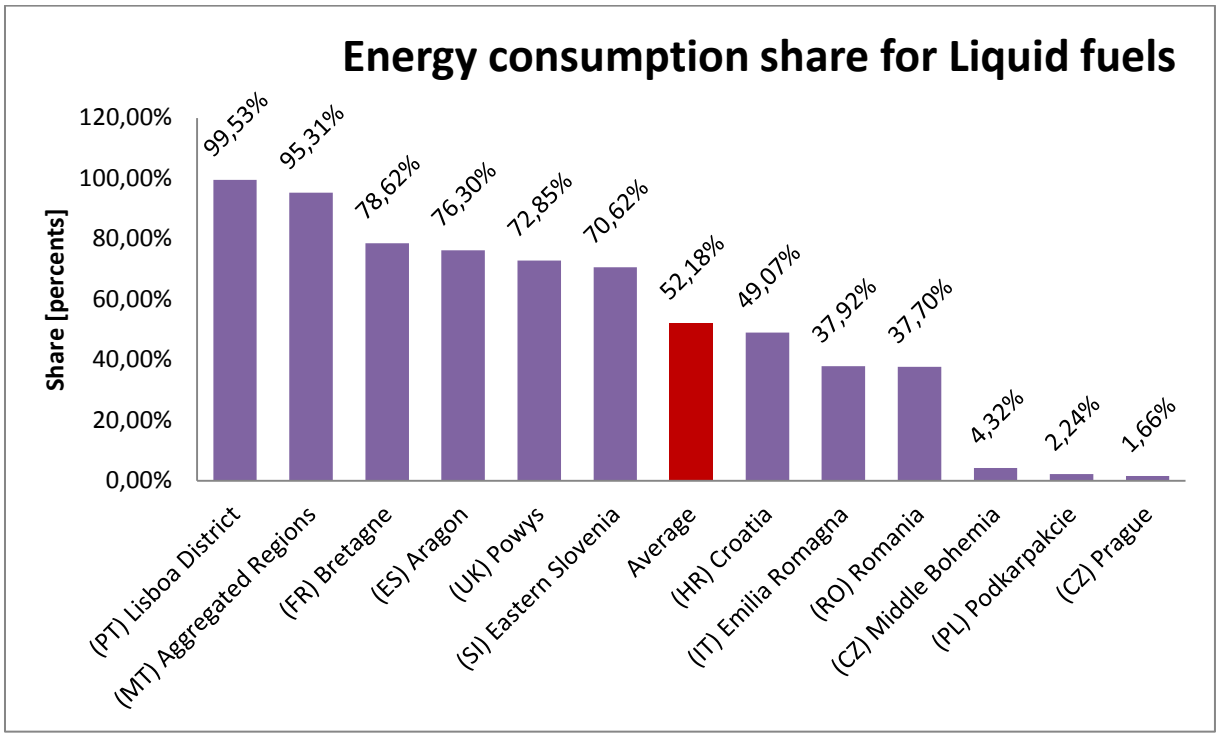
Figure 57: Energy consumption share for Solid fuels in target regions



2.4.1.3.2 Liquid fuels

We can examine Liquid fuels share of energy consumption in the following chart.

Figure 58: Energy consumption share for Liquid fuels in target regions

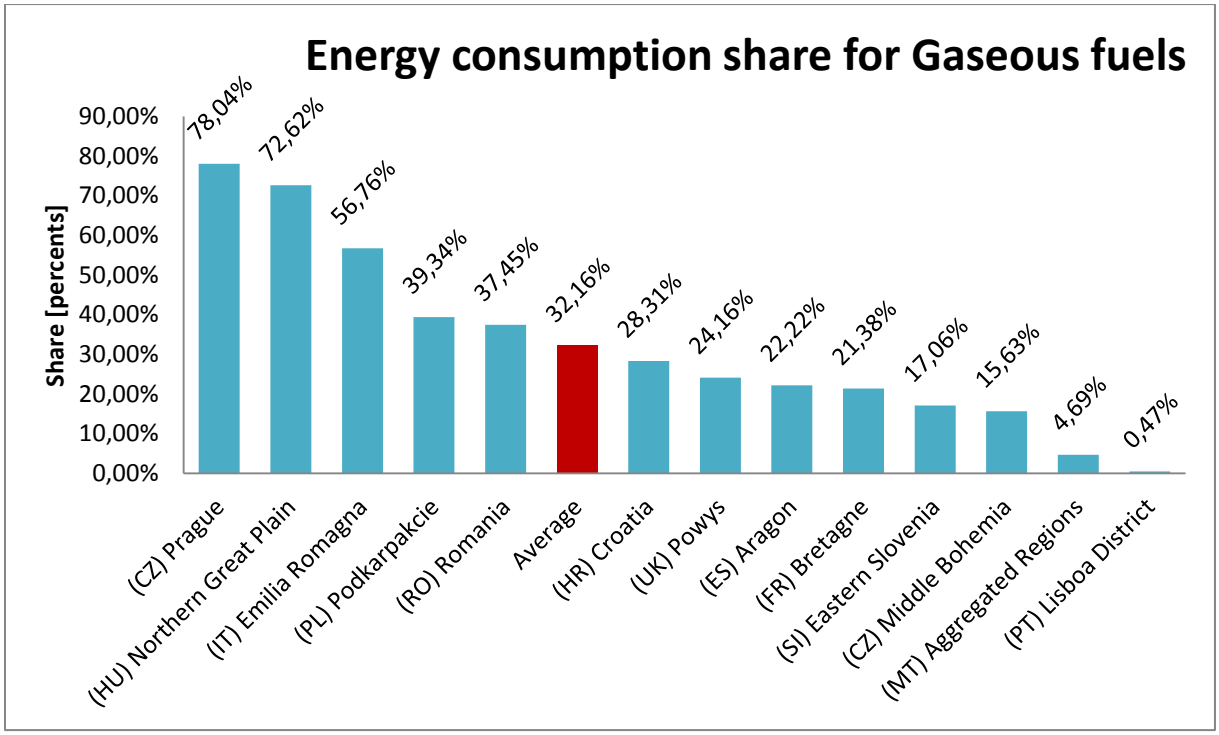


As we can see, Middle Bohemia (CZ), Podkarpakcie (CZ) and Prague (CZ) all have a very small share of liquid fuels, which might be connected to a very low share of the Transport sector in these regions (see chapter 2.4.1.2.4). On the other hand, there is extremely high share in Lisboa District (PT) and the Maltese regions.

2.4.1.3.3 Gaseous fuels

Gaseous fuels are the last fuel type which has been examined and compared. As we can see in the following chart, the highest share of gaseous fuels is in Prague (CZ), Northern Great Plain (HU) and Emilia Romagna (IT). The lowest share is in Lisboa District (PT) and Maltese regions. Other regions are around average.

Figure 59: Energy consumption share for Gaseous fuels in target regions



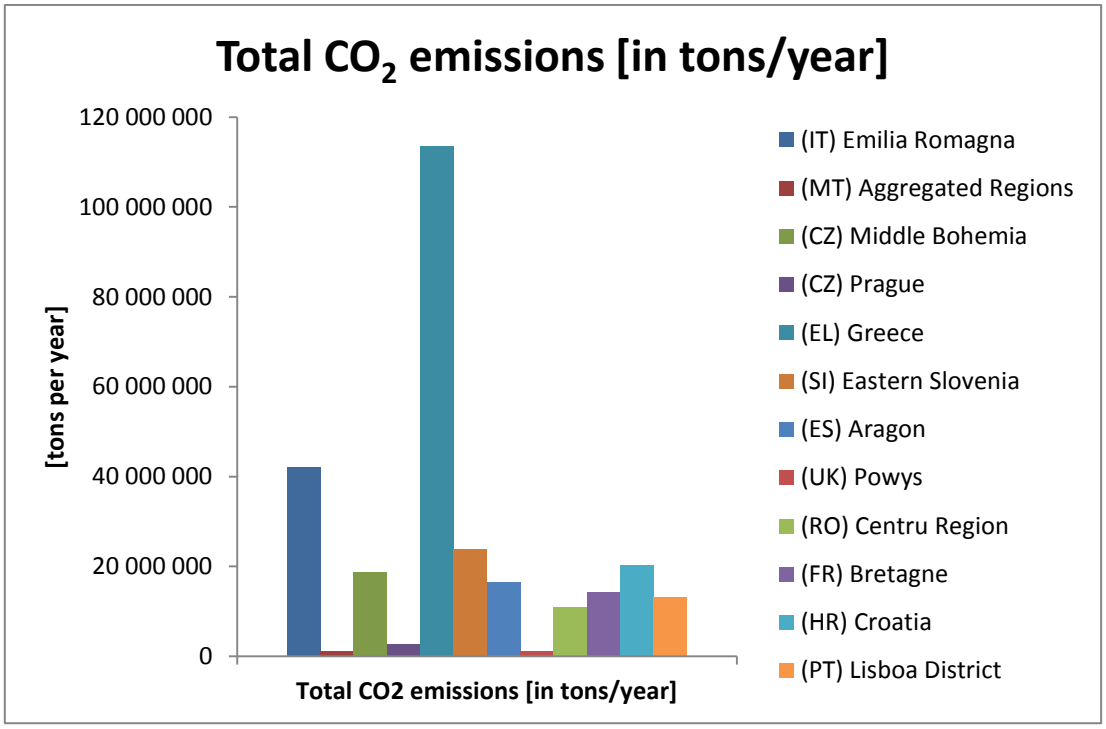
2.4.2 Contaminants emissions

In this chapter, all partners have been compared in contaminants emissions. The research was based on data provided by participating partners and on the methodological note explained in chapter 2.2.2. This chapter was made according to partners comparison notes in the introduction chapter 2.4.

2.4.2.1 Total CO_2 emissions

The following chapter compares participating partners in total CO_2 emissions. Total CO_2 emissions were used instead of total emissions, because this number was available for more of the partners. On the other hand, because of the amount of total CO_2 contaminants compared to other contaminants (there is a scale difference), the mistake generated by substituting total emissions by CO_2 emissions is equal to statistical discrepancy. This is especially important in case that some partner accidentally confused these data (data are sometimes added together purposely in some sources). For the purpose of this report and for the purpose of partners comparison, total CO_2 emissions could be therefore understood as total emissions as well.

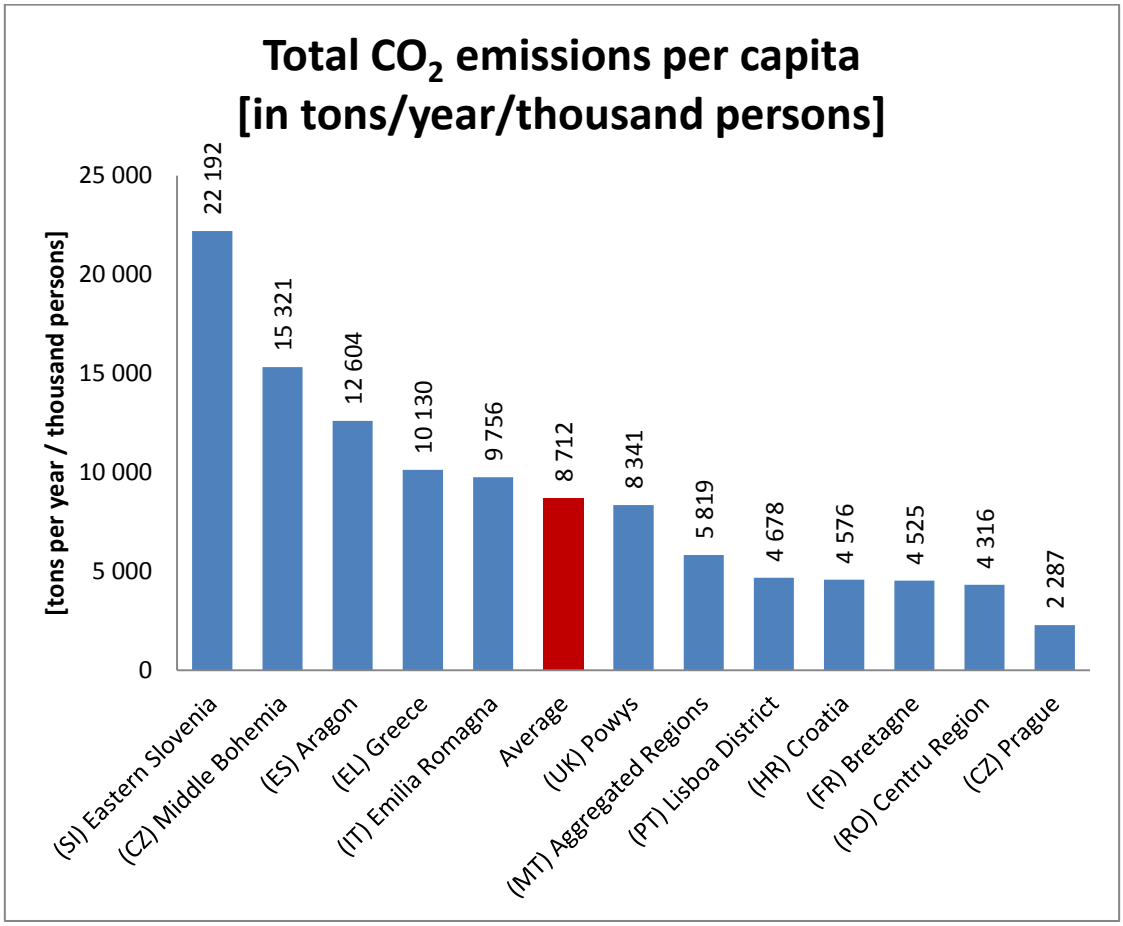
Figure 60: Total CO_2 emissions in target regions



In the figure above, there is a total CO_2 emission comparison for all participating partners. We have to bear in mind that partners participated through different size regions, therefore the chart is mainly informative. We can see that the most emission is generated by Greece, but this is because these data are for the whole country (which is the same for Croatia). The most emissions among NUTS 2 level regions are in Emilia Romagna (IT), followed by Eastern Slovenia (SI).

To make data directly comparable, data bases from Eurostat statistical office were used. The following chart shows us partners comparison in total CO_2 emissions per capita.

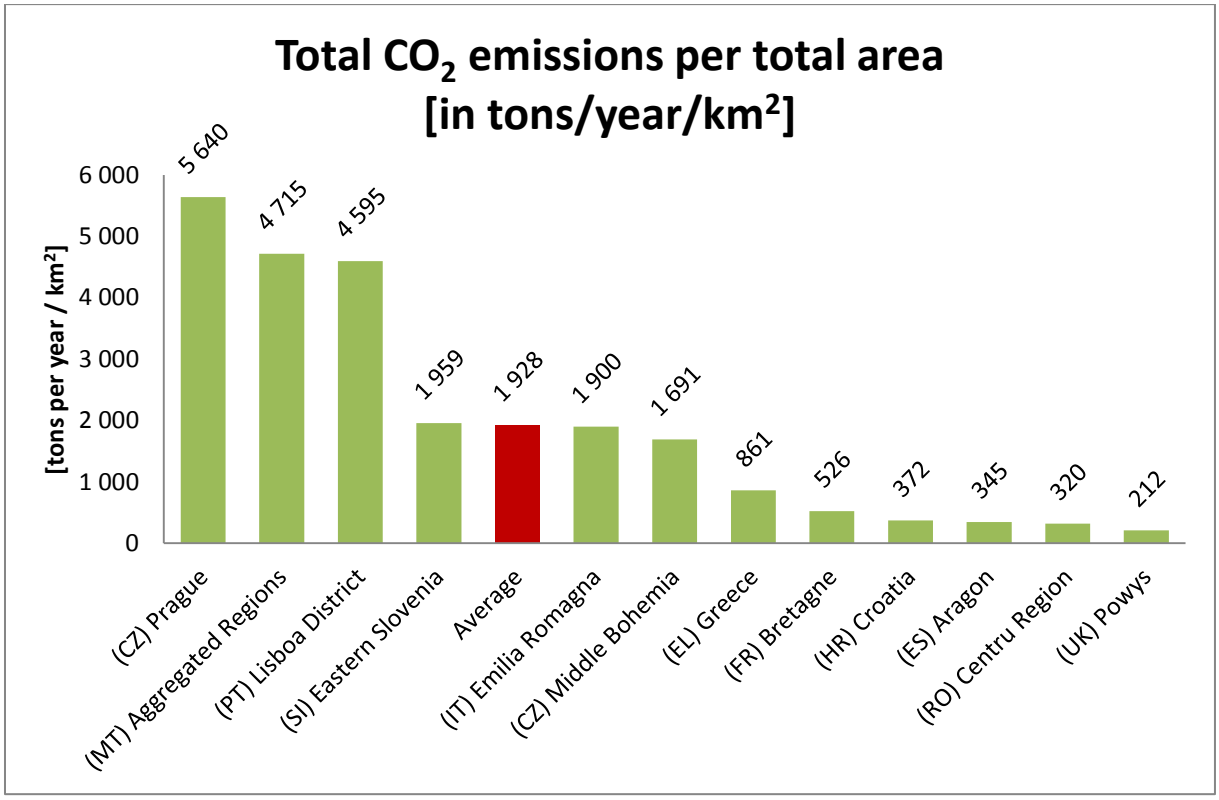
Figure 61: Total CO_2 emissions per capita in target regions



As we can see, the most emissions per capita are in Eastern Slovenia (SI - it is given by low population density in the region), followed by Middle Bohemia (CZ). The lowest emissions are in Prague (CZ - it is given by high population density in the region) and remaining regions are fairly average.

The next figure shows us CO_2 emissions per total area.

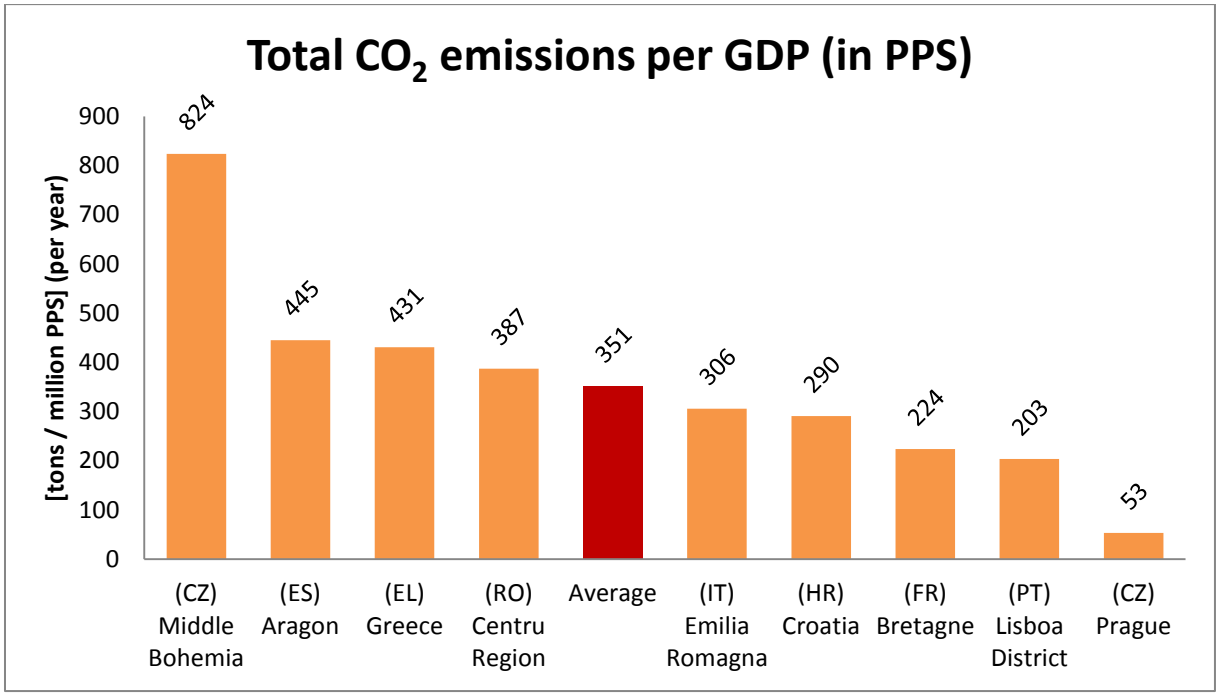
Figure 62: Total CO_2 emissions per total area in target regions



Here we can see three categories. In the first one, there are regions with fairly high emissions (Prague, Maltese regions, Lisboa District), the second one represents average regions (Eastern Slovenia, Emilia Romagna, Middle Bohemia) and the third one represents regions with low consumption with the rest of the regions and Greece somewhere in the middle between the second and the third group.

We can examine total CO_2 emissions per GDP in the next chart.

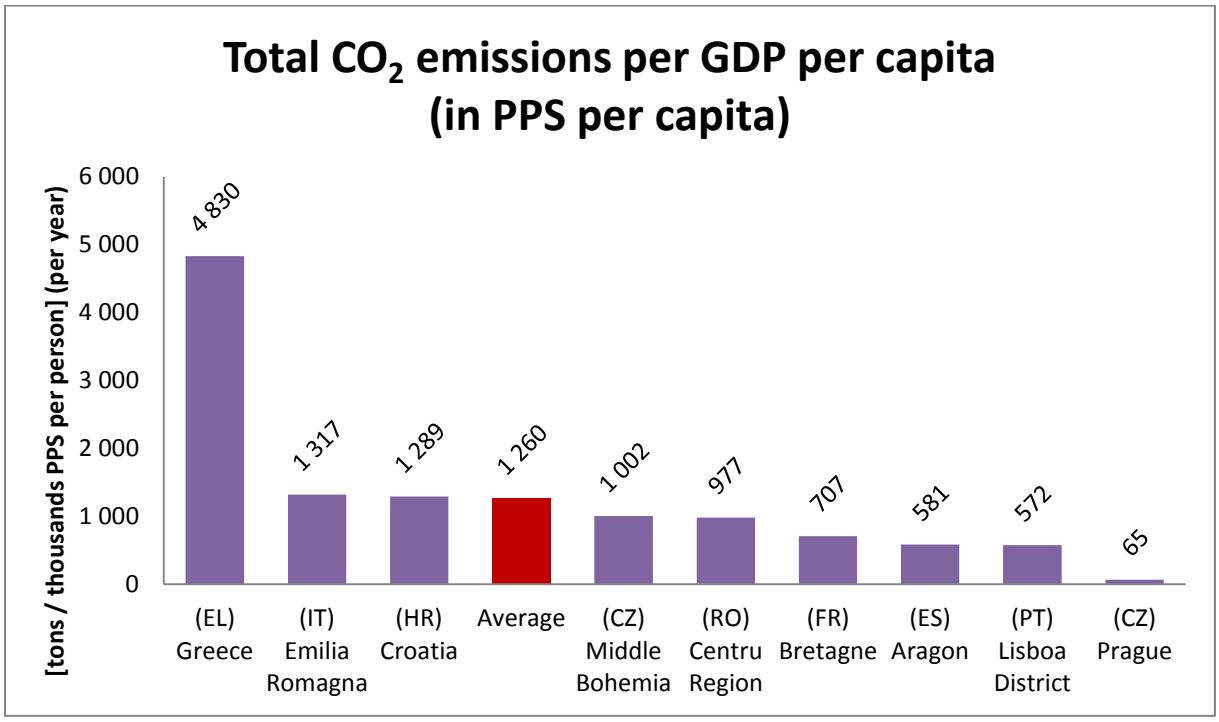
Figure 63: Total CO_2 emissions per GDP in target regions



As we can see, there is extremely high emission in Middle Bohemia (CZ) and extremely low emission in Prague (CZ). The rest of regions are around average.

The last chart shows us total CO_2 emissions per GDP per capita.

Figure 64: Total CO_2 emissions per GDP per capita in target regions



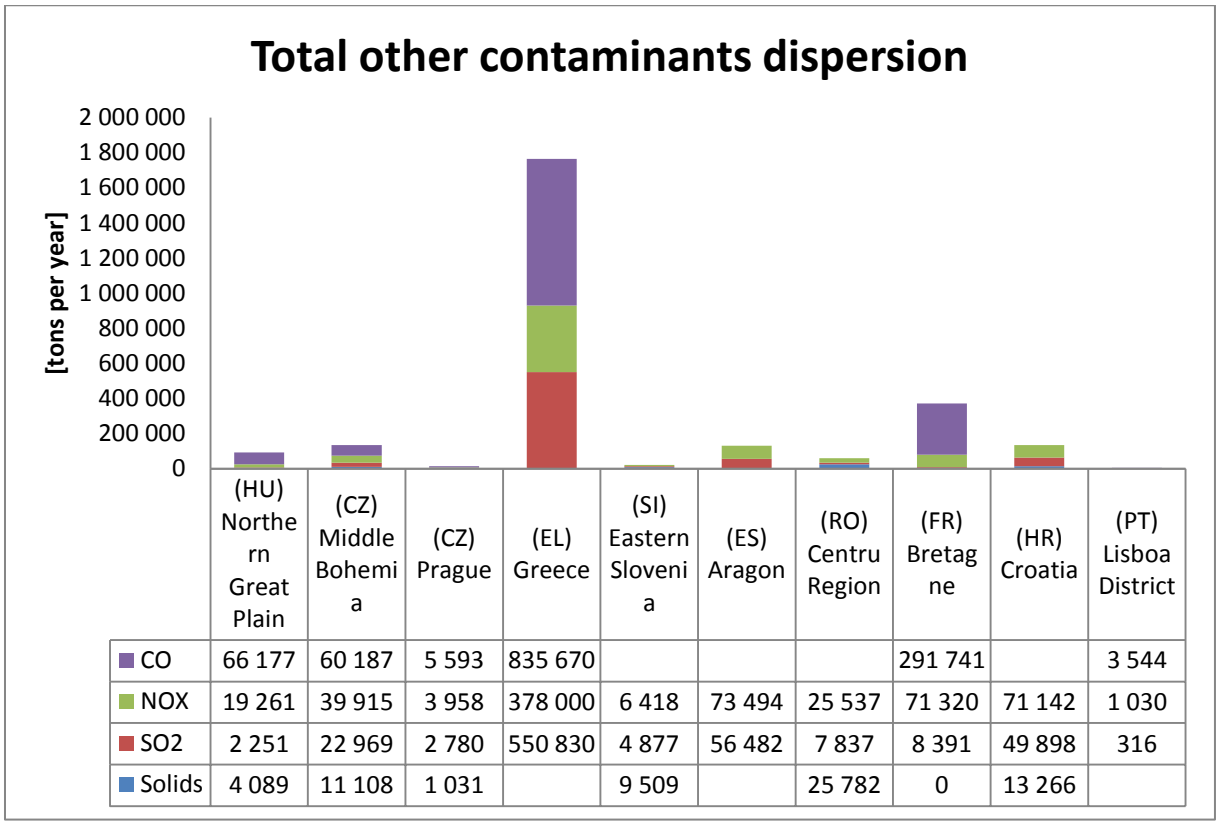
Here we can see extremely high emissions in Greece. It is given by low level of GDP per capita in the region. Extremely low emissions in Prague (CZ) is given by very high level of GDP per capita in the region.. The rest of the regions are around average.

2.4.2.2 Other contaminants

Regardless of their amount, other (i.e. not CO_2) contaminants could be examined as well. There were not much data available for other contaminants and providing them was optional.

In the following chart, we can see total emissions of other contaminants. This chart is basically just informative, because region size and economic strength is not distinguished here.

Figure 65: Total other contaminants dispersion in target regions

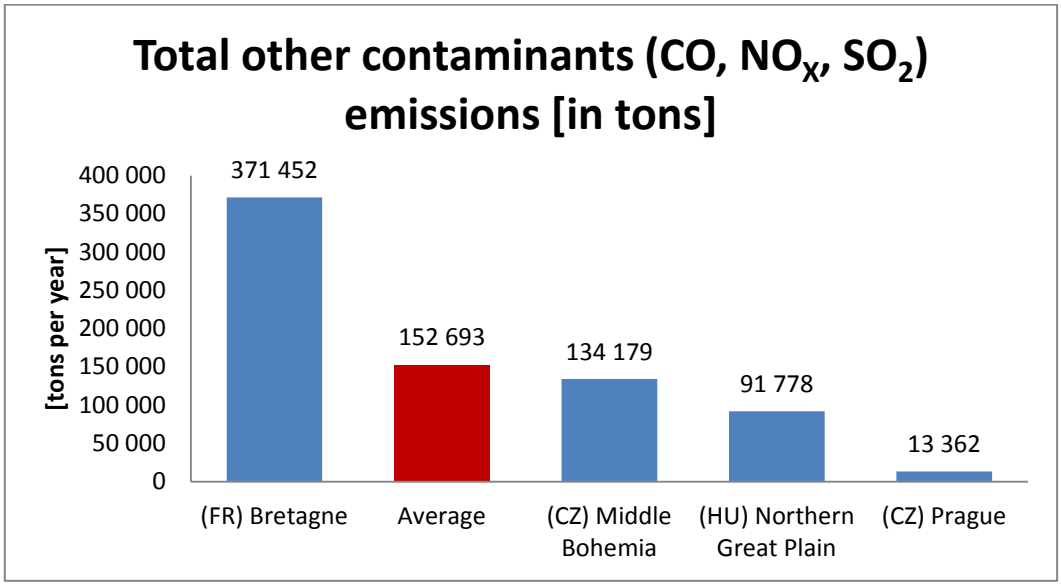


	(HU) Northern Great Plain	(CZ) Middle Bohemia	(CZ) Prague	(EL) Greece	(SI) Eastern Slovenia	(ES) Aragon	(RO) Centru Region	(FR) Bretagne	(HR) Croatia	(PT) Lisboa District
CO	66 177	60 187	5 593	835 670				291 741		3 544
NOX	19 261	39 915	3 958	378 000	6 418	73 494	25 537	71 320	71 142	1 030
SO2	2 251	22 969	2 780	550 830	4 877	56 482	7 837	8 391	49 898	316
Solids	4 089	11 108	1 031		9 509		25 782	0	13 266	

As we can see, the biggest amount of other pollutants is in Greece (because it's a NUTS 1 level unit), followed surprisingly by Bretagne (FR) and Croatia. It should be noted that some contaminants are missing (see table which is part of the figure).

In the next chart, the total sum of other contaminants is presented. Only partners with all information about other contaminants could participate.

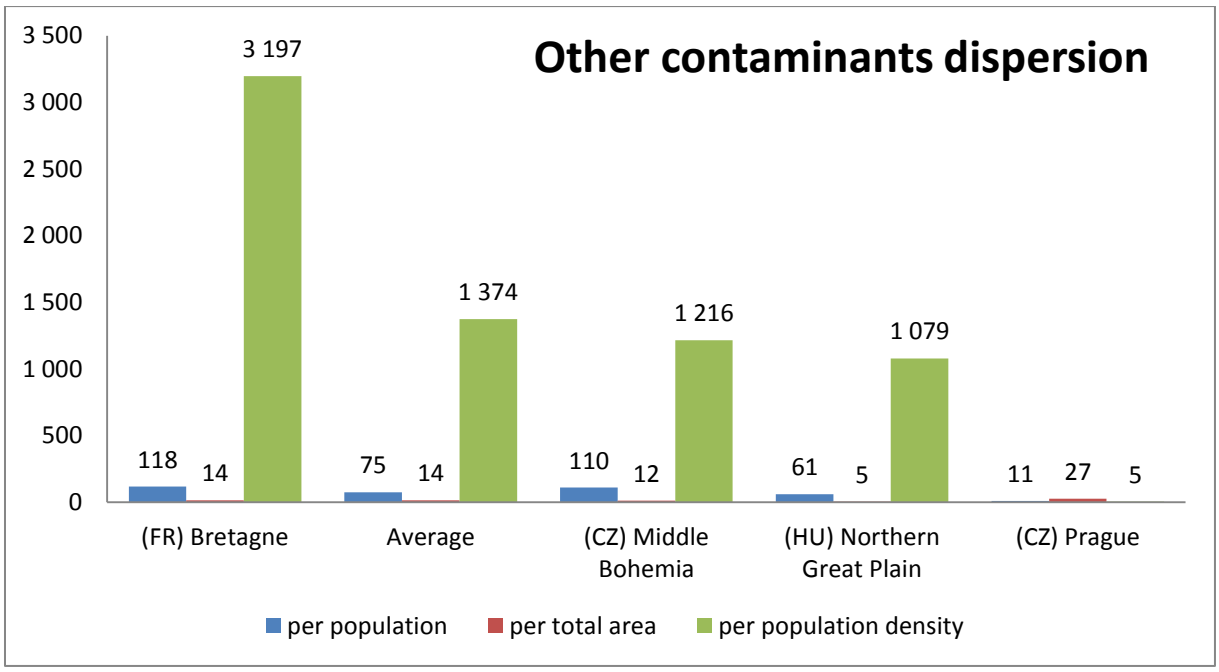
Figure 66: Total other contaminants emissions in target regions



Here we can see that Bretagne (FR) has the most other contaminants and Prague (CZ) has the least contaminants from four examined partners.

The following figure shows us other contaminants dispersion, i.e. amounts of contaminants per specific Eurostat data. This chart is more or less informative and the results are the same as in the preceding figure.

Figure 67: Other contaminants dispersion in target regions



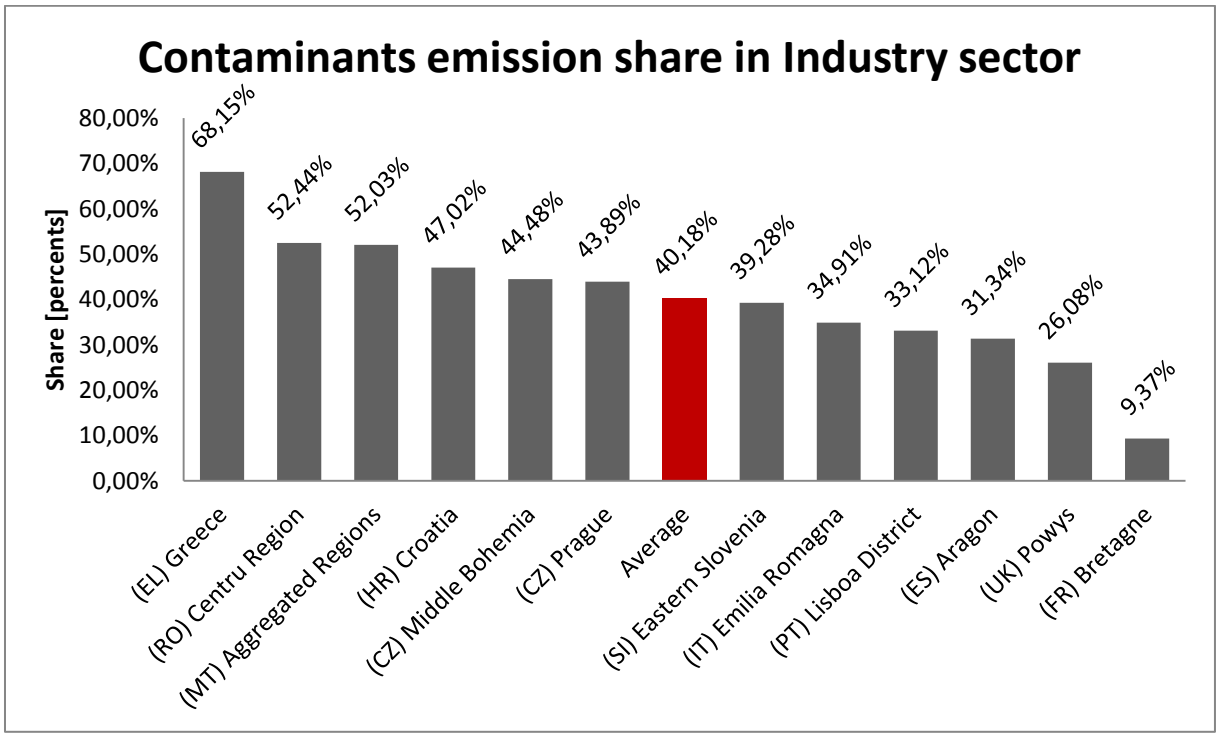
2.4.2.3 Sectors comparison

In this section, participating partners are examined from the point of view of different sectors, which are: Industry, Agriculture, Tertiary Sphere, Transport and Housing. Moreover, the sum of Tertiary Sphere and Housing sector were added as the sixth sector, because some partners only had these aggregated data available. Two charts were made for each sector. The first one shows contaminants emission share comparison, i.e. what share does the examined sector takes from the total contaminants emission in the examined region. The second chart examines total contaminants emission of the sector from different point of views in the same manner, like total CO_2 emission was examined in chapter 2.4.2.1. The weighted average of all three (four, in some cases) examined values were used for sorting regions from the most emitting to the least emitting. Contaminants emission is expressed in percent values, relative to average value (which is 100%). This has been done to allow examining all values in one table and to allow direct comparison. When a region has less than 100% value, it means it emits less energy in the specific sector than what is average emission.

2.4.2.3.1 Industry sector

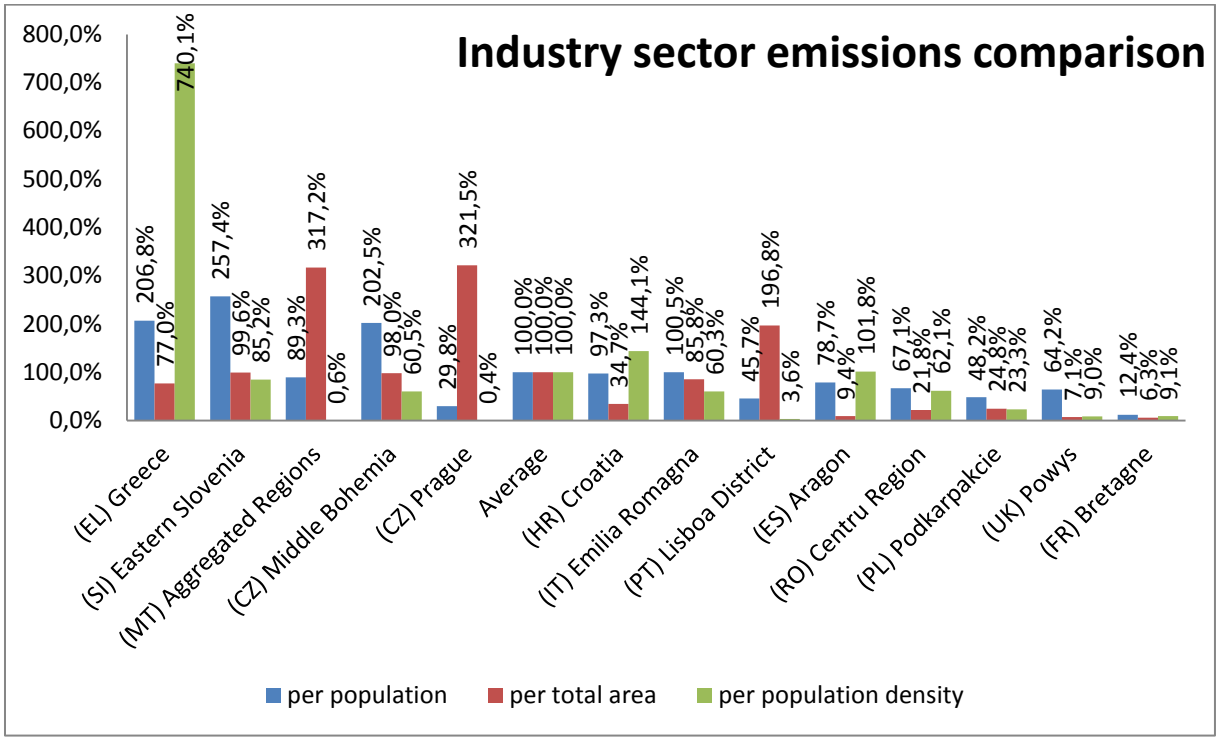
The following figure shows us contaminants emission share in the Industry sector from the total contaminants emission. As we can see, all regions have similar share around average with the exception of Greece with a high share and Bretagne (FR) with a low share.

Figure 68: Contaminants emission share in the Industry sector from the total contaminants emission in target regions



The most emitting regions in the Industry sector can be examined in the following chart.

Figure 69: Industry sector emissions comparison in target regions

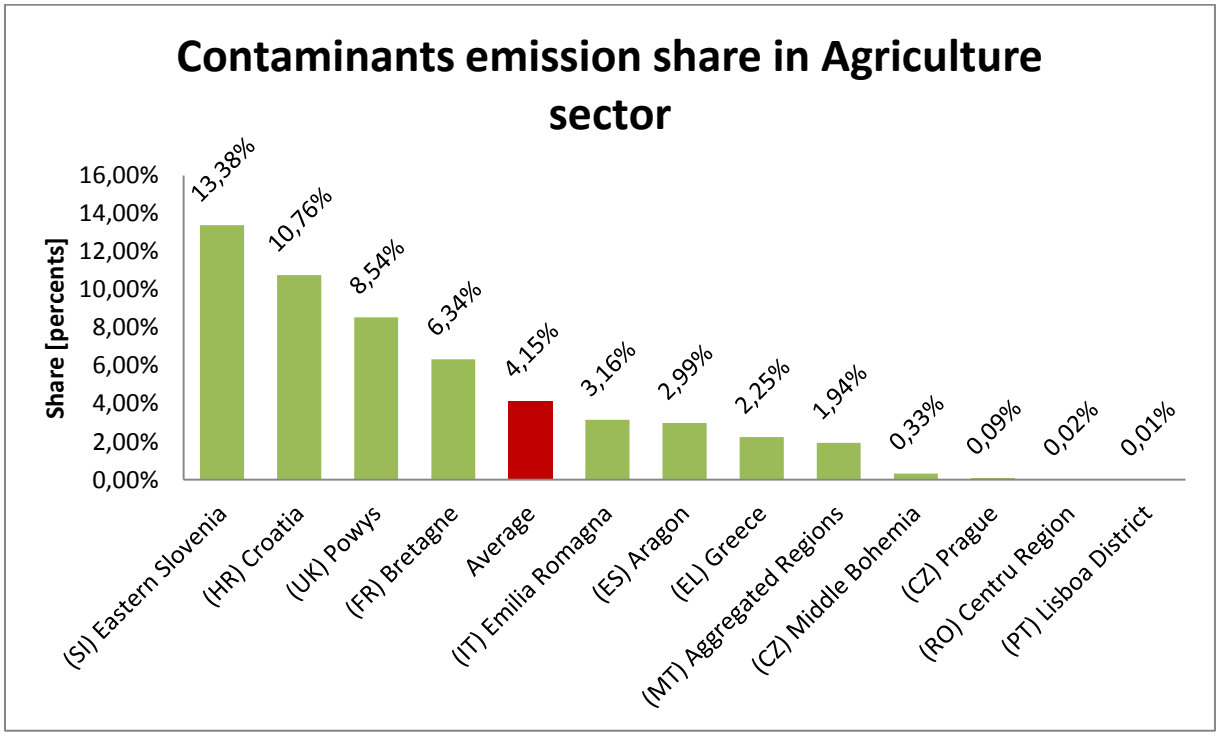


As we can see, the results are quite similar to the results from the preceding figure, with Greece having the highest emissions and Bretagne (FR) having the lowest emissions. We can see extremes in Maltese regions, Prague (CZ) and Lisboa District (PT) per total area of region.

2.4.2.3.2 Agriculture sector

In the next figure, we can examine contaminants emission share in the Agriculture sector from the total contaminants emission.

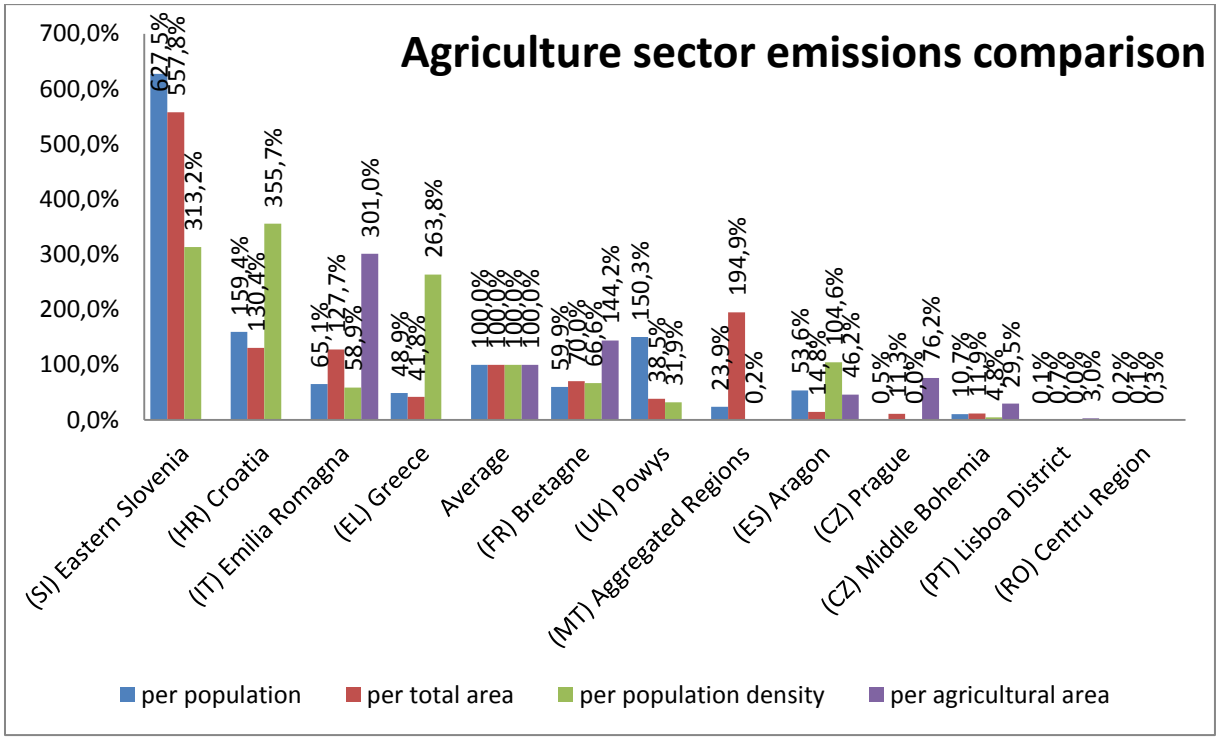
Figure 70: Contaminants emission share in the Agriculture sector from the total contaminants emission in target regions



We can see differences between the agricultural orientations of examined regions. Where Eastern Slovenia (SI), Croatia and Powys (UK) have a high share, Prague (CZ), Centru Region (RO) and Lisboa District (PT) have a low share with other regions somewhere between.

The next figure shows us agricultural sector emissions compared in total numbers.

Figure 71: Agriculture sector emissions comparison in target regions

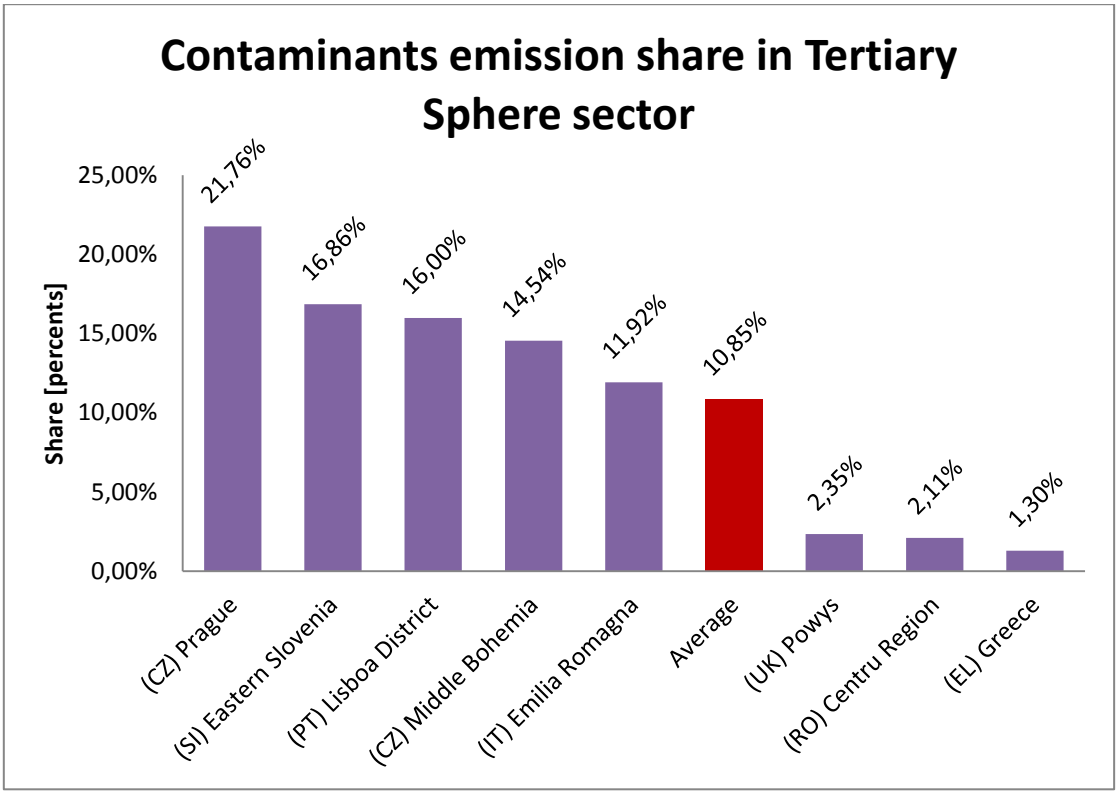


We can see similar results as in the preceding figure here, with some extremes in comparison per population density in Croatia and Greece and with extremes in comparison per area in Maltese regions, Emilia Romagna (IT), Bretagne (FR) Prague (CZ) and Middle Bohemia (CZ). Powys (UK) is an extreme in comparison per population. It should be noted, that comparison per agricultural area has been added into this chart.

2.4.2.3.3 Tertiary Sphere sector

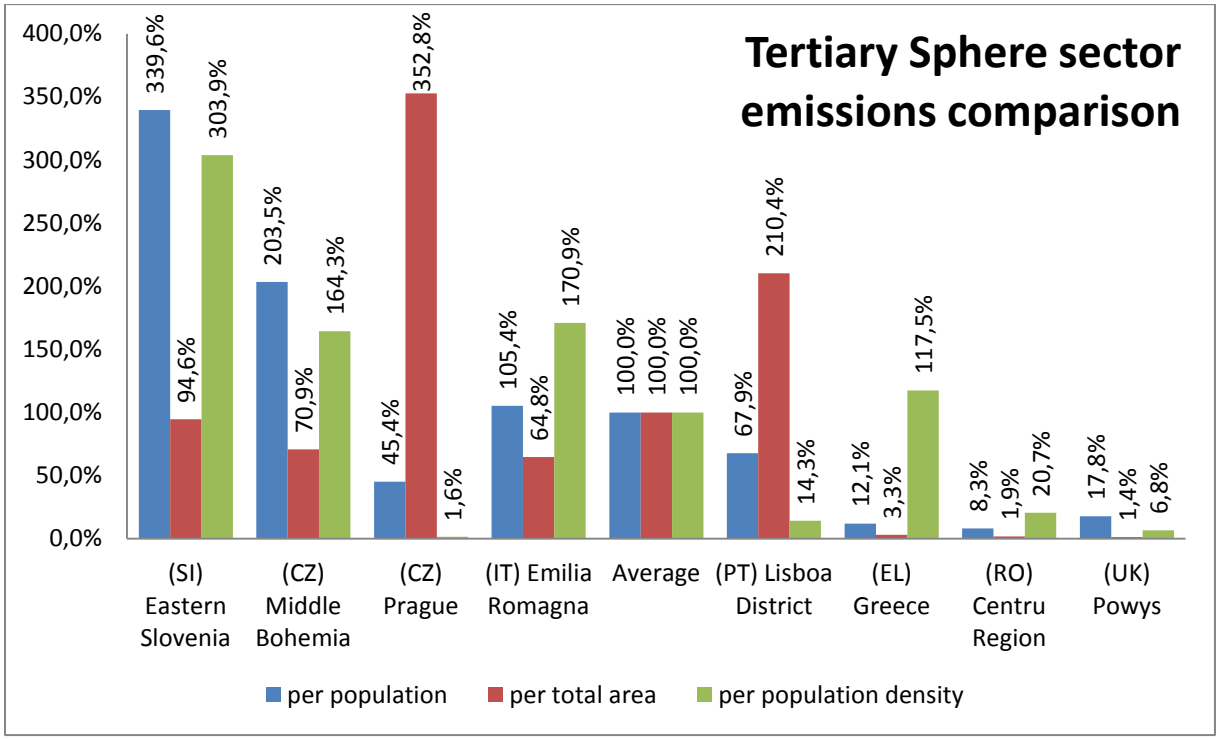
Tertiary Sphere share is examined in this chapter. The following chart shows shares for this sector from the total contaminants emission. Here we can see a strangely low share in Powys (UK), Centru Region (RO) and Greece. Other sectors are around average.

Figure 72: Contaminants emission share in Tertiary Sphere sector from the total contaminants emission in target regions



The next chart shows us Tertiary Sphere sector comparison in total numbers.

Figure 73: Tertiary Sphere sector emissions comparison in target regions

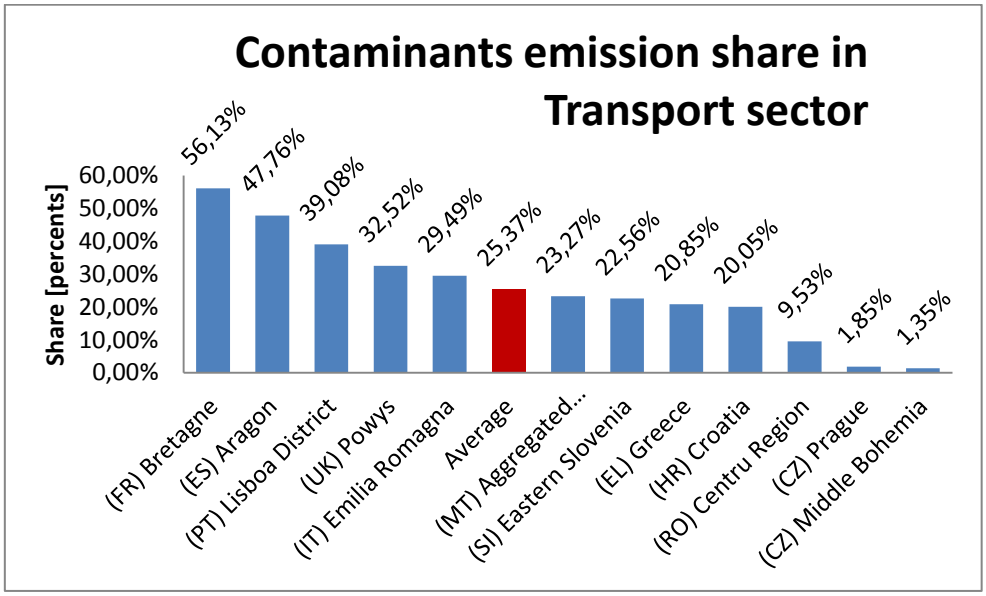


Here we can see extremes in comparison per total area, where there are regions with high above their average values (Prague, Lisboa District) and regions with high below their average (Eastern Slovenia, Middle Bohemia, Emilia Romagna). Besides , Centru Region (RO), Powys (UK) and Greece show the lowest emissions in this sector and Eastern Slovenia (SI) and Middle Bohemia (CZ) the highest emissions.

2.4.2.3.4 Transport sector

The following figure examines contaminants emission shares from the total contaminants emission in the Transport sector.

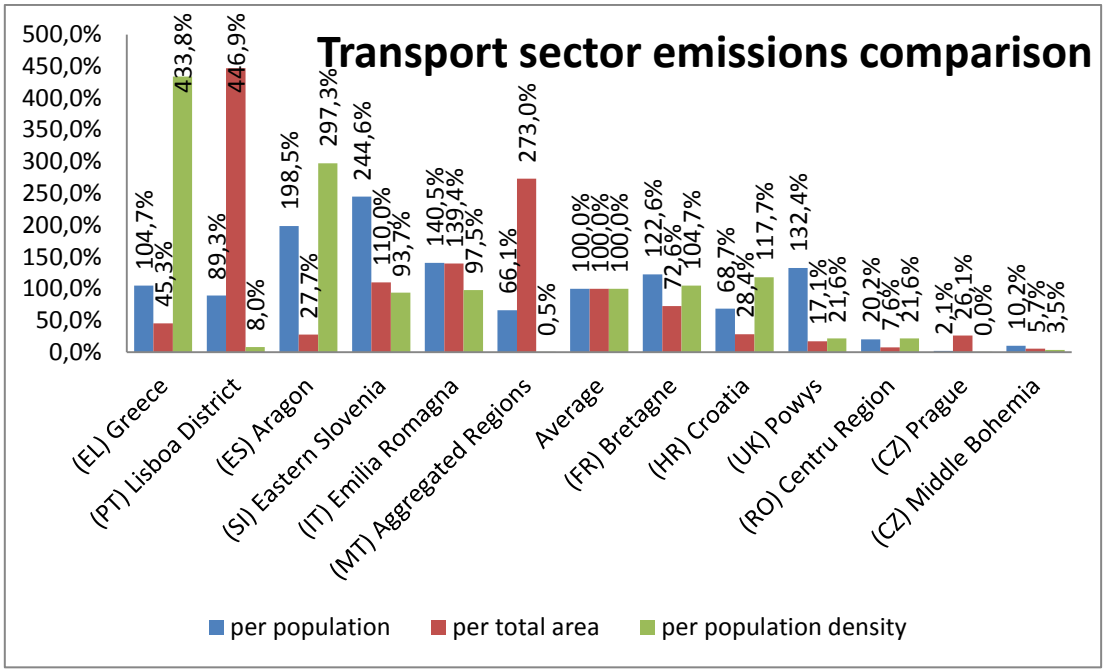
Figure 74: Contaminants emission share from the total contaminants emission in the Transport sector in target regions



Here we can see linear data spread with Bretagne (FR) having the highest share and Czech Republic regions having the lowest share. This high jump might be caused by wrong data interpretation, where some partners might include personal transport and some partners have included only public transport.

The following chart shows data in total numbers. With the exception of Czech Republic regions being a lot below average, other regions are around average with some oddities at extremes especially in comparison per population and comparison per population density.

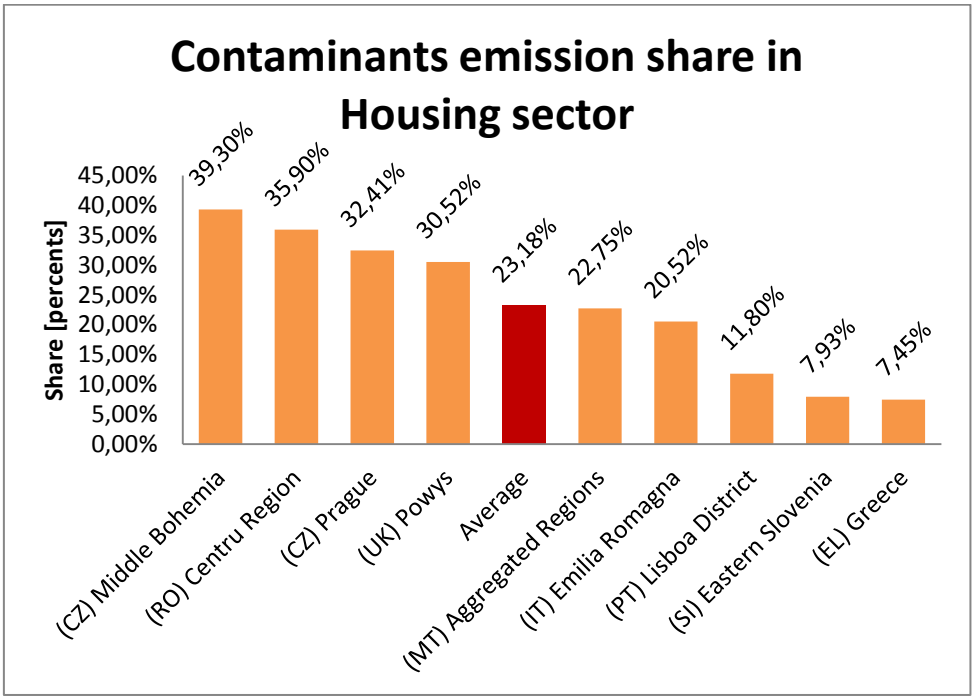
Figure 75: Transport sector emissions comparison in target regions



2.4.2.3.5 Housing sector

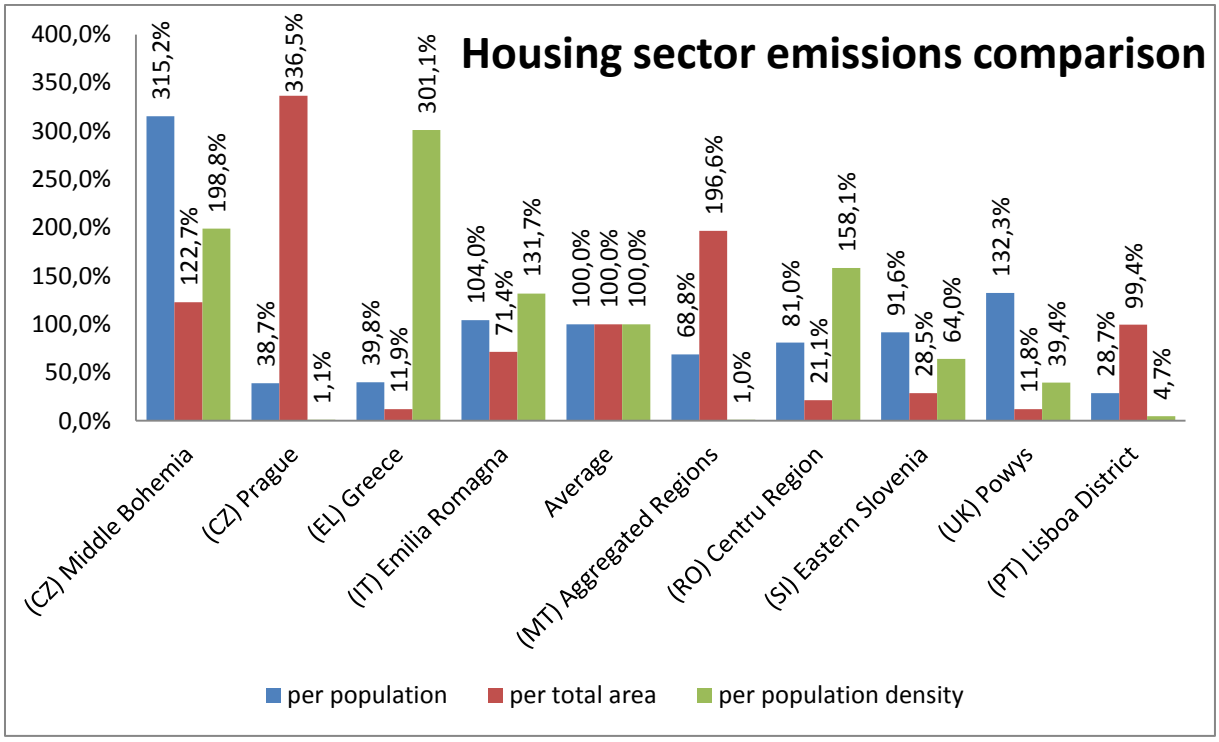
The next figure shows contaminants emissions share from the total contaminants emission in the Housing sector.

Figure 76: Contaminants emission share from the total contaminants emission in the Housing sector in target regions



Here we can see data are spread linearly with Middle Bohemia (CZ), Centru Region (RO) and Prague (CZ) having the biggest share in the Housing sector and Lisboa District (PT), Eastern Slovenia (SI) and Greece having the lowest share in the Housing sector.

Figure 77: Housing sector emissions comparison in target regions

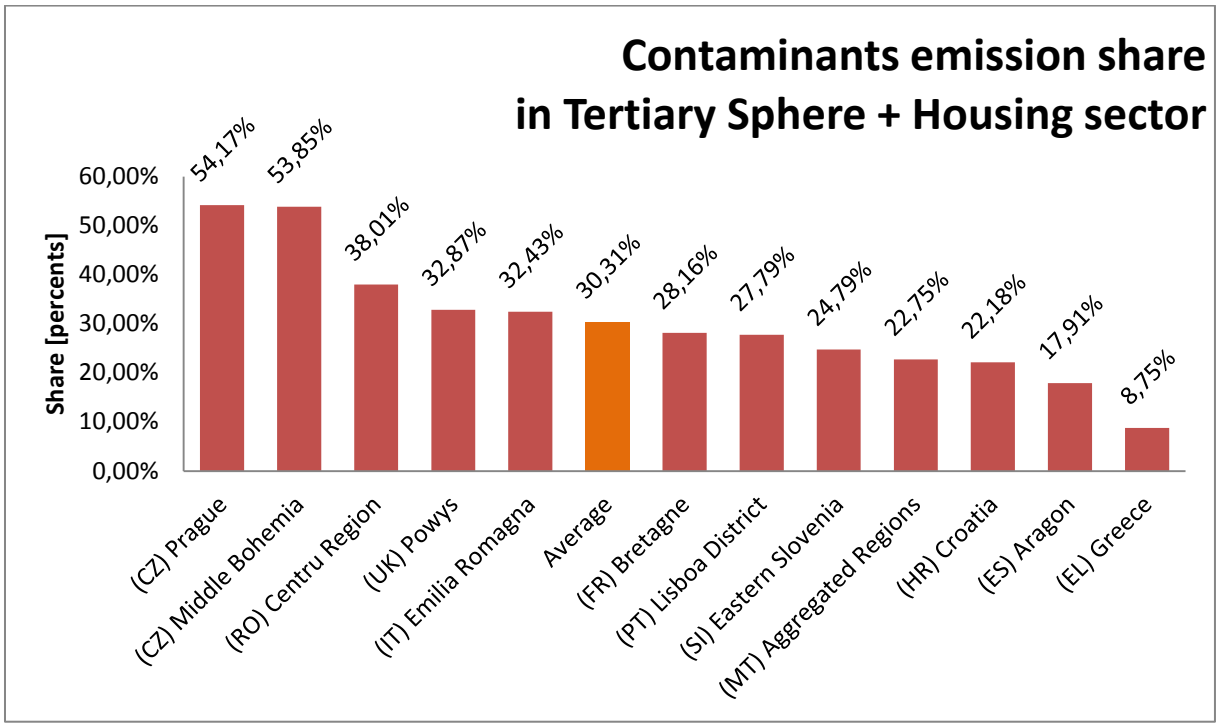


When data for the Housing sector were compared in total numbers, many oddities were encountered, as can be examined in the chart above. Emissions per population density are extremely high for Greece and Centru Region (RO), emissions per population are extremely high for Middle Bohemia (CZ) and Powys (UK) and emissions per total area are extreme for Prague (CZ), Maltese regions and Lisboa District (PT).

2.4.2.3.6 Tertiary Sphere + Housing sector

Finally, combination of Tertiary Sphere and Housing sector was examined. Following figure shows contaminants emission share from the total contaminants emission in this aggregated sector.

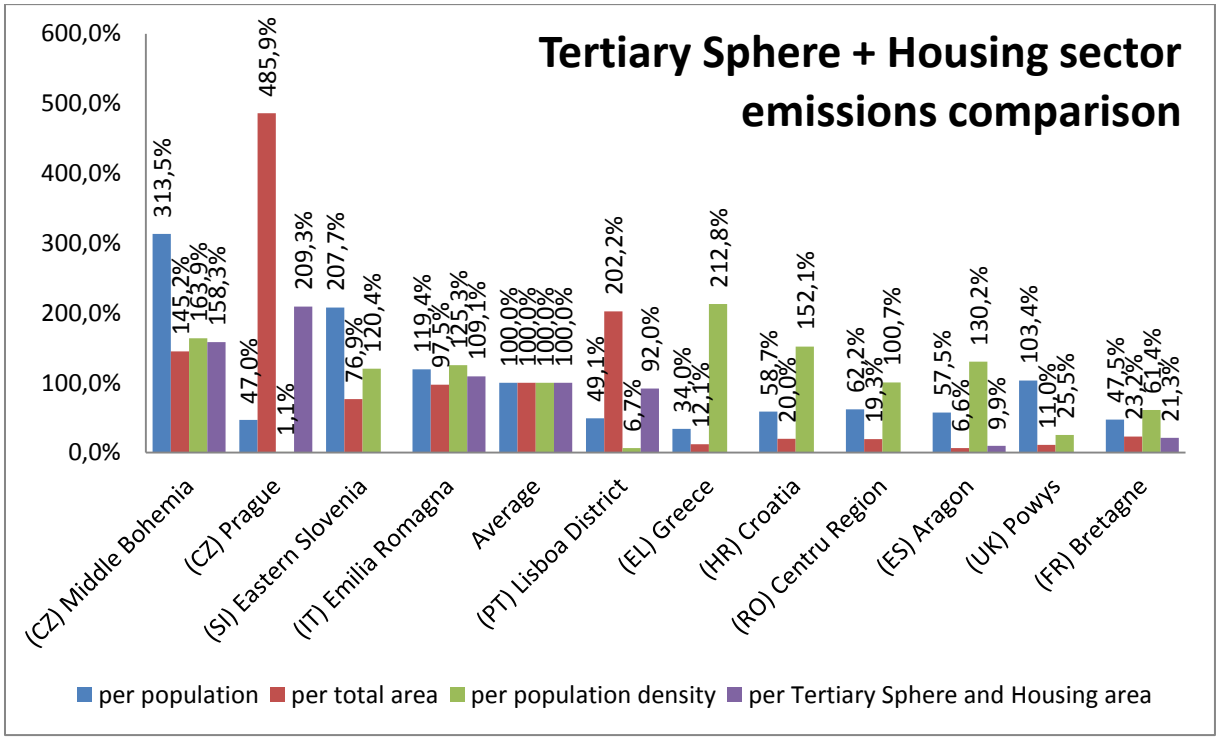
Figure 78: Contaminants emission share from the total contaminants emission in Tertiary Sphere + Housing sector in target regions



We can see that all regions are fairly average with the exception of Czech Republic regions (Prague, Middle Bohemia), which have a slightly higher share, and Greece with a lower share.

The next figure shows emissions comparison in total numbers.

Figure 79: Tertiary Sphere + Housing sector emissions comparison in target regions



Here it is possible to conclude that all regions have a similar average amount of emissions, but there are some extremes present, especially in comparison per population and population density. Please note that comparison per sum of Tertiary Sphere and Housing area is present.

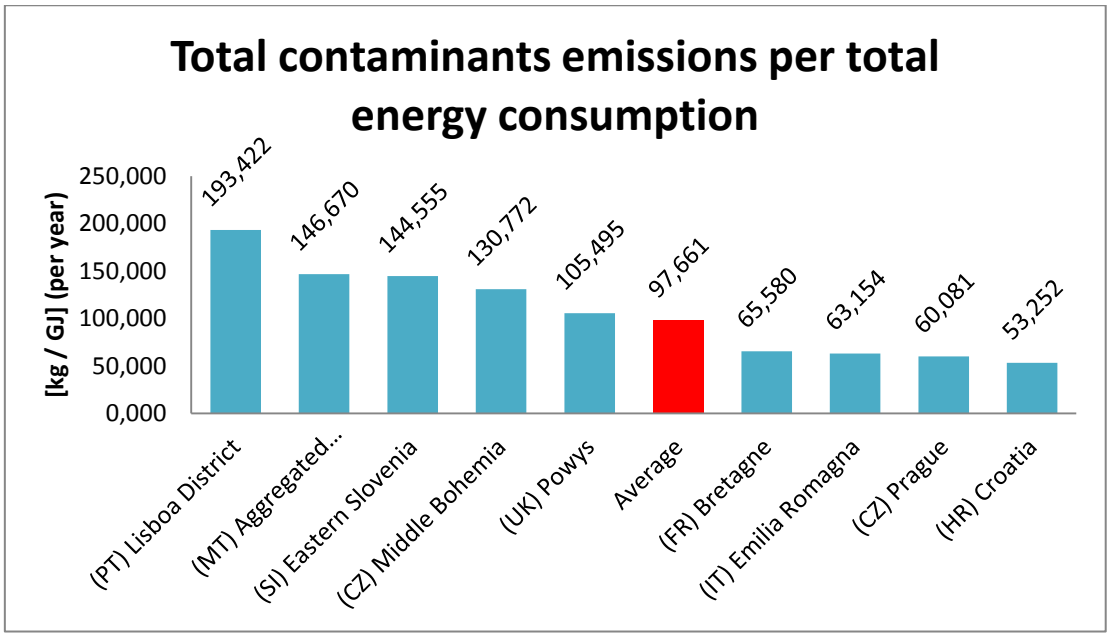
2.4.3 Consumption and emissions combination

The last chapter of partners comparison dealt with the combination of energy consumption and contaminants emission. Charts in this chapter show how many kilograms of contaminants are emitted for every GJ of energy consumed.

2.4.3.1 Total sum of sectors

The following figure shows us participating partners comparison of contaminants produced per energy used. We can see that Lisboa District (PT) emits the most contaminants for every GJ and other regions are around average.

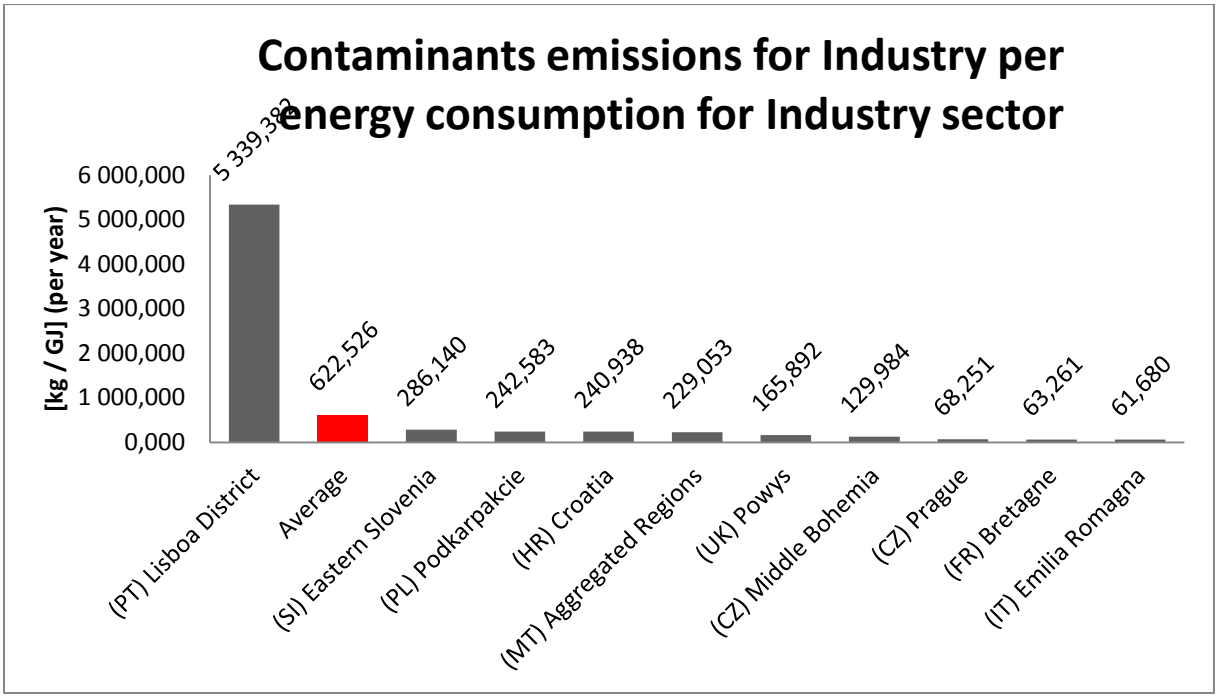
Figure 80: Total contaminants emissions per total energy consumption in target regions



2.4.3.2 Industry sector

Contaminants emissions for Industry per energy consumption for the Industry sector are presented in the following chart.

Figure 81: Contaminants emissions for Industry per energy consumption for the Industry sector in target regions

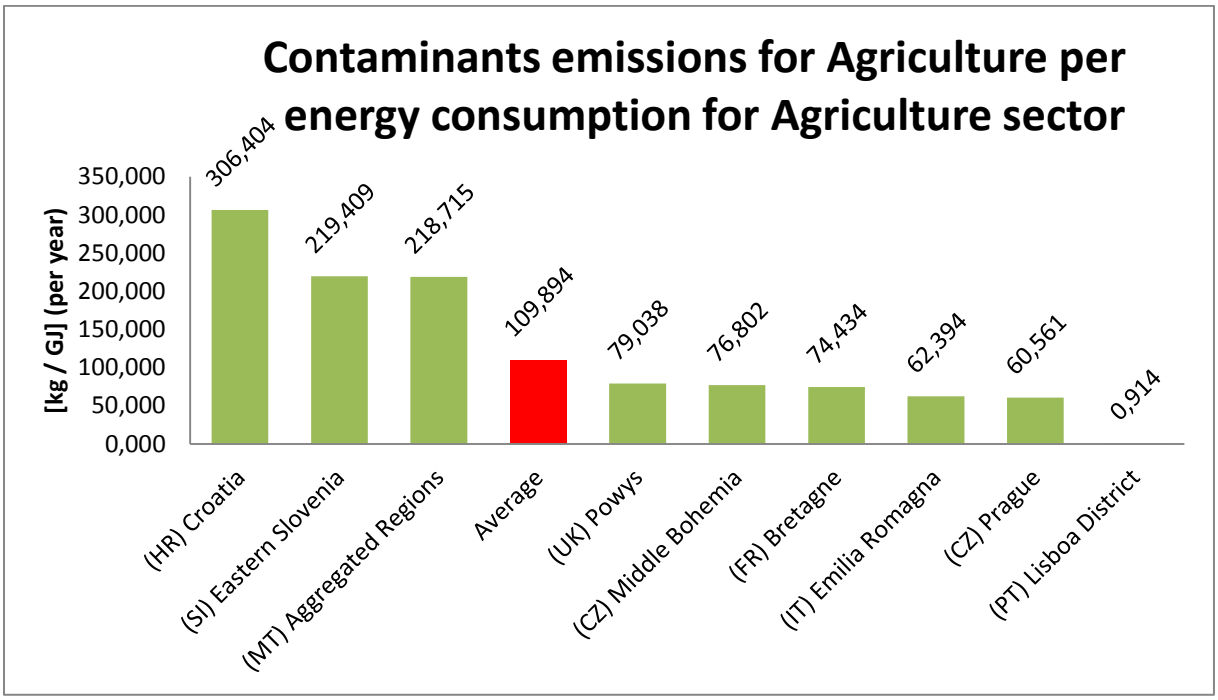


We can see extremely high emission in Lisboa District (PT) which can be even considered as a mistake that might have emerged from source data used for analysis. Besides Lisboa District, the most emissions per energy consumed region are in Eastern Slovenia (SI) and Podkarpakcie (PL). The cleanest energy in the Industry sector is in Prague (CZ), Bretagne (FR) and Emilia Romagna (IT).

2.4.3.3 Agriculture sector

The next figure shows region comparison for the Agriculture sector. Croatia emits the most contaminants on every GJ, followed by Eastern Slovenia (SI) and Maltese regions. Other regions are below average with Lisboa District (PT) being the least emitting region, which should be connected with its high emissions in the Industry sector or a source data mistake.

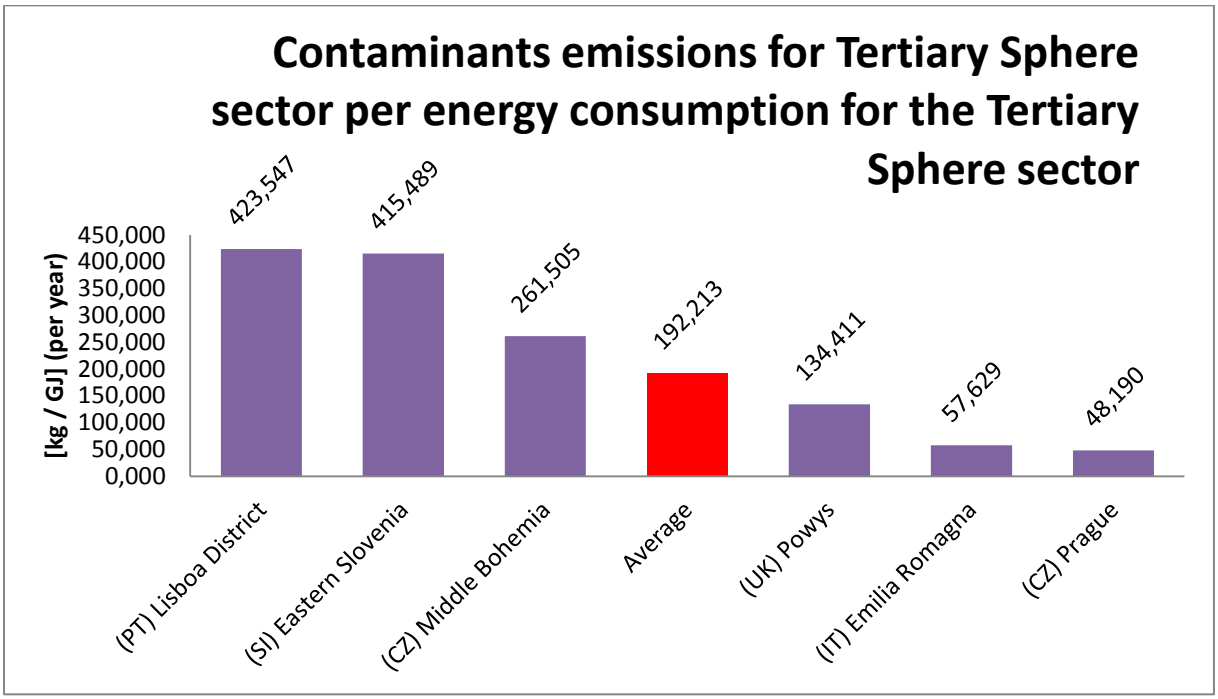
Figure 82: Contaminants emissions for Agriculture per energy consumption for the Agriculture sector in target regions



2.4.3.4 Tertiary Sphere sector

Contaminants emissions for Tertiary Sphere sector per energy consumption for the Tertiary Sphere sector are presented in the following figure.

Figure 83: Contaminants emissions for Tertiary Sphere sector per energy consumption for the Tertiary Sphere sector in target regions

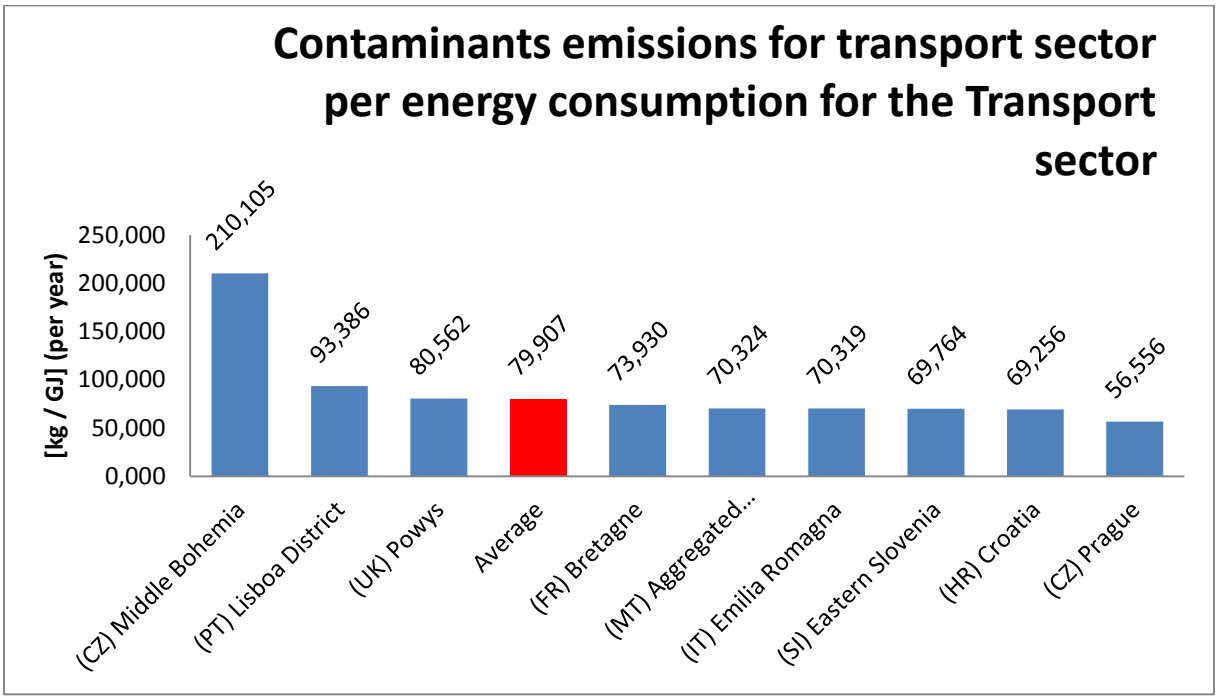


We can see that the most contaminating energy used is in Lisboa District (PT) and Eastern Slovenia (SI) and the least contaminating energy used is in Emilia Romagna (IT) and Prague (CZ).

2.4.3.5 Transport sector

The next figure explains contaminants emissions for Transport sector per energy consumption for the Transport sector.

Figure 84: Contaminants emissions for Transport sector per energy consumption for the Transport sector in target regions

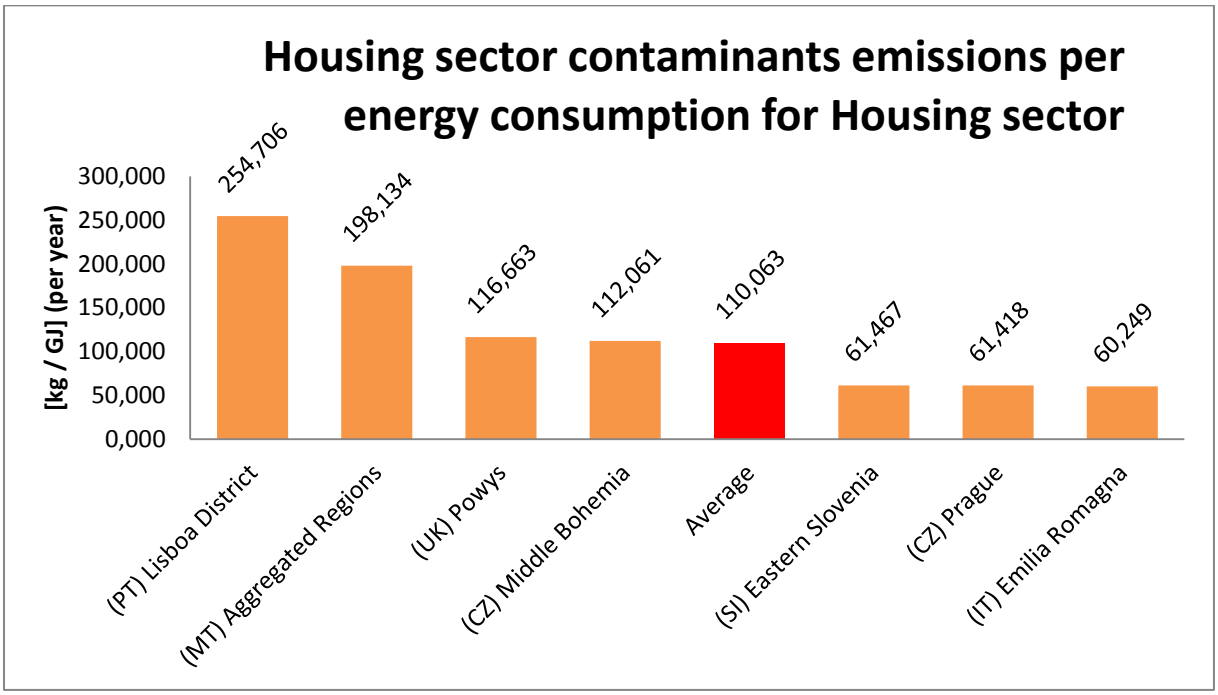


In transport, all regions are around average with the exception of Middle Bohemia (CZ), where there are more than twice the contaminants per GJ consumed than average.

2.4.3.6 Housing sector

Housing sector contaminants per energy comparison is presented in the following chart.

Figure 85: Housing sector contaminants emissions per energy consumption for the Housing sector in target regions

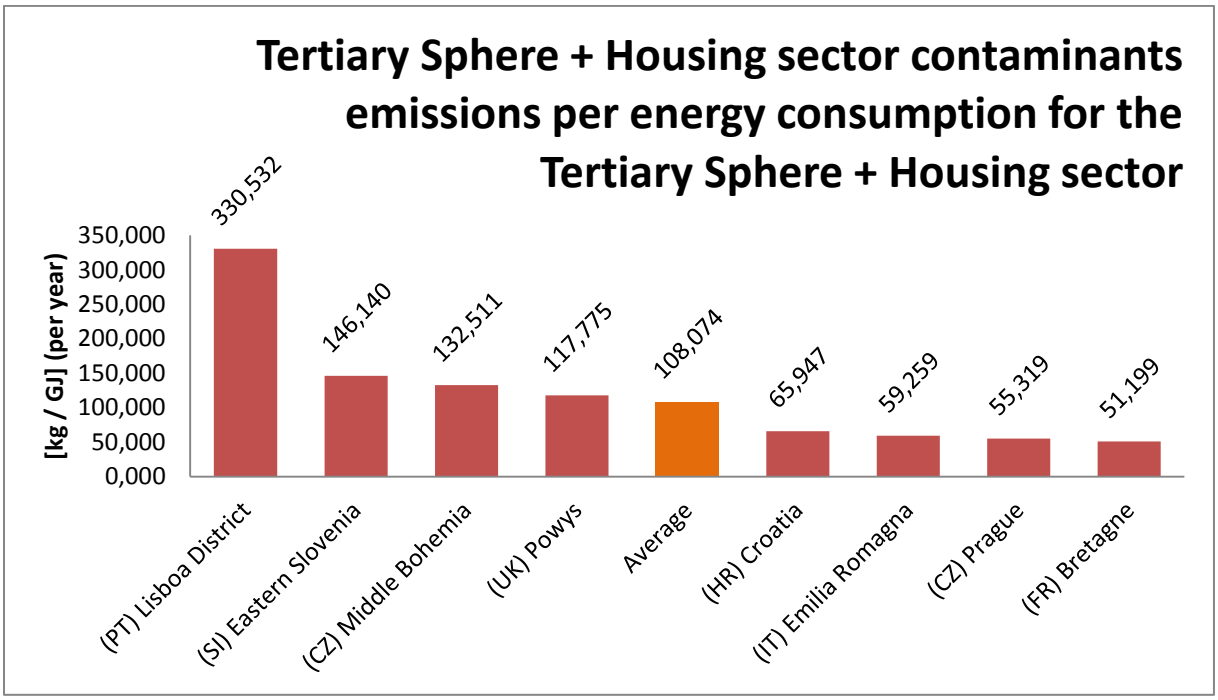


As we can see, Lisboa District (PT) and Maltese regions have the biggest emissions on GJ consumed, followed by Powys (UK) and Middle Bohemia (CZ). The rest of the regions are below average.

2.4.3.7 Tertiary Sphere + Housing sector

Since some regions only had available statistics for the Tertiary Sphere and Housing sector combination, this aggregated sector comparison was added as well. In the following figure, we can see the results.

Figure 86: Tertiary Sphere + Housing sector contaminants emissions per energy consumption for the Tertiary Sphere + Housing sector in target regions



Lisboa District (PT) has the most emissions for every GJ consumed and other regions are around average with Eastern Slovenia (SI), Middle Bohemia (CZ) and Powys (UK) being above average and Croatia, Emilia Romagna (IT), Prague (CZ) and Bretagne (FR) being below average.

2.5 Summary and concluding remarks

This report consists of two parts. Each of these parts deals with two main topics and their environmental, economic and social impact – energy consumption and contaminants emissions.

2.5.1 Partners specification

The first part (chapter 2.3) dealt with partners specification. Statistical data provided by each partner according to methodological note in chapter 2.2.1 were presented and explained. Current states of the situation were analysed and strengths and weaknesses were formulated. Future risks were outlined and possible solutions were described. The topic of energy consumption and contaminants emission seems to be more important for each of the participating partners. Each of the partners has different conditions and obstacles to deal with, but there are some topics which are similar for the most of the partners. Both aspects open possible ways of cooperation and knowledge sharing in the future to get better results in the examined topics, especially in lowering energy consumption and contaminants emissions.

2.5.2 Partners comparison

The second part (chapter 2.4) dealt with partners comparison. Data provided by each participating partners (and presented in chapter 2.3) were sorted and adjusted according to the methodological note in chapter 2.2.2). This research resulted in comprehensive and deep comparison of each participating partner from the point of view of energy consumption, contaminant emissions and the combination of both.

2.5.2.1 Energy consumption

When talking about energy consumption, total energy consumption comparison was made and a data base was used to allow direct comparison of different regions in chapter 2.4.1. Total consumption was adjusted per capita, per total area, per GDP (in PPS) and per GDP per capita (in PPS).

After total energy consumption, each of the examined sectors (Industry, Agriculture, Tertiary Sphere, Transport and Housing) was then examined separately. Shares of each sector were compared for all participating regions and total numbers for every sector per capita, per total area, per GDP (in PPS) and per GDP per capita (in PPS) were compared as well.

In the end, energy consumption shares per fuel types were compared to show what kind of fuel is used in which region the most.

2.5.2.2 Contaminants emissions

Contaminants emissions were compared in a similar way to energy consumption in chapter 2.4.2.

Firstly, CO_2 contaminants emissions were compared and a data base was used to allow direct comparison of different regions. CO_2 emissions were adjusted per capita, per total area, per GDP (in PPS) and per GDP per capita (in PPS). After CO_2 emissions, other contaminants were examined for those partners, who provided these optional data. Other

contaminants were compared in total numbers and adjusted per population, per total area and per population density.

Secondly, contaminants emissions were compared for each examined sectors (Industry, Agriculture, Tertiary Sphere, Transport and Housing) and for one aggregated sector (Tertiary Sphere + Housing sector). Shares of each sector were compared for all participating regions and total numbers for every sector per capita, per total area, per population density and per sector area (where available) were compared as well.

2.5.2.3 Consumption and emissions combination

At the end of chapter 2.4, consumption and emissions combination for each participating partner was compared with chapter 2.4.3. For each of the examined sectors (Industry, Agriculture, Tertiary Sphere, Transport and Housing) and for one aggregated sector (Tertiary Sphere + Housing sector), a kilogram of contaminants emissions per GJ of energy used were calculated and participating regions were sorted, showing which regions have the most contaminants emitted for their energy consumption, i.e. whose energy use is the most efficient, or, “the cleanest”

2.5.3 Future research

This report is the first of three reports in WP2 package of the ENESCOM project. The second report will contain a census of present Local Plans and Regulations, projects and actions, targeting all different participating European regions. The third report will consist of methodological and quantitative transferable methods for the reduction of consumption and CO_2 emissions in the short/medium term, taking into account Pioneer contributions.

3 Appendix

3.1 Data index

3.1.1 List of figures

3.1.2 List of tables

3.2 Annex tables and documents

Annex 1 includes tables with collected data of 14 partners - ENESCOM project researchers

- Energy Consumption in selected Branches in the Target Regions - Table 5
- Emissions in selected Branches in the Target Regions - Table 6

Annex 2 includes analyses of 14 partners information:

- Energy Consumption in the Target Region - Analyses 1
- CO_2 Emissions in the Target Region - Analyses 2

The two annexes present the base of statistical data and information from which the report was made.