# SLOVENIA


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## 1. OVERVIEW OF THE REGION

**Characteristics of the Region**

Slovenia has a long tradition of regionalism and local self-government. Since there is no official intermediate level between the national and the local one, the municipalities are the basic administrative unites of local autonomy. There are 211 municipalities in Slovenia and The Municipality of Maribor (MOM) is the second biggest one after the Municipality of Ljubljana, the Slovenian capitol. Its territory is spread over 147,50 km$^2$ and had 113,487 inhabitants, representing 12% of Slovenian population (2 mio). Within the territory of urban region there are 33 settlements, with an average population density of 730 inhabitants/km$^2$, (in Slovenia 102 inhabitants/km$^2$). The MOM territory is divided in 6 administrative communities and 11 city districts.

The exceptional geostrategic position in the North East of Slovenia, between the Alps and Pannonia Lowlands, is of special advantage for MOM. The City of Maribor as the centre of the MOM is also the formal centre of the Statistical Region of Podravje with 310,743 inhabitants, which has no administrative function. Beside, Maribor is the University City with around 22,000 students that form the second biggest University institution in Slovenia. As an important national and international traffic hub, the MOM is at the crossing of two main European transportation routes, the first one linking the North West with the South East, and the second one linking the South East to the North West. Accordingly, it is the centre of administration, education, health services, cultural and financial institutions, and media for the North Eastern Slovenia.

According to the data by Census 2012, the MOM's GDP per capita is €17,343 that is close to the Slovenian average of €17,361. The active population comprises 37,137 people, but on the other hand, the unemployment rate of 14.1% is one of the highest in Slovenia. During past decades, the region suffered deep economic and social crisis and loss of traditional industries. Recently, the MOM has considerably improved its urban, social, and cultural image, as Maribor was the European Capital of Culture in 2012 and the European Youth Capital in 2013.

*Figure 1 – Slovenia and the Municipality of Maribor*

The MOM's position in Central Europe is at the meeting point of five regional entities of morphologically dominant typologies with influence on the diversity of economic activities. The first one belongs to the river Drava valley as the main axes for the transportation and the electrical energy supply for the region. The second one is the Pohorje hills with favourable conditions for livestock and tourism. The third one is hilly area of the Kozjak, covered mainly by forests. The fourth one is the attractive wine region of Slovenske gorice with vineyards and orchards, spreading to the agricultural land

along the river Drava, which is the fifth one. Over the centuries, urban development of the city region has been growing along the both of the river Drava, yet the historical city centre of Maribor is situated at the left bank. After the WWII, the residential and industrial areas have predominantly appeared at the right banks of the river. Currently, in the redevelopment processes in these suburban the new centres are growing followed by extremely dispersed urban pattern in the outskirts.

*Figure 2 – City of Maribor*

**Energy demand and supply of the Region**

When considering the Sub-Pannonia climatic conditions, the MOM is characterised by continental climate with an average yearly temperature of 9.4°C, the lowest average temperature of – 1.3°C in January and the highest of 19.7°C in July. Despite the yearly average of 266 sunny days the climatic conditions determine enormous energy consumption during a long heating period of 227 days. According to the Census 2010, the total energy consumption was 2,198 GWh.

The majority of energy consumption belongs to the domestic described as buildings (905 GWh), followed by transport sector (645 GWh), other consumers, mainly the industrial and commercial sector (636 GWh), and public lighting (11 GWh). Accordingly, the consumers of all sectors produced a total of 686,931 tons of $CO_2$ emissions that equal 6.1 tons per citizen. Concerning the energy source and the specifics of individual sectors, the $CO_2$ emissions share is differentiating in large. The largest shares belong to the public lighting (0,51 kg$CO_2$/kWh) and other consumers (0,40 kg$CO_2$/kWh), while the smallest share belongs to buildings (0,28 kg$CO_2$/kWh) and transport (0,25 kg$CO_2$/kWh). The highest $CO_2$ emissions within the street lighting sector are caused by the electricity as a energy source while in buildings also renewable sources and fossil fuels with lower $CO_2$ emissions than electricity are used (*Figure 3*).

Concerning the consumption of energy, the ratio between the energy for electricity and the energy for heating is 37:63, and the ratio for the production of $CO_2$ emissions between electricity and heating is 59:41.

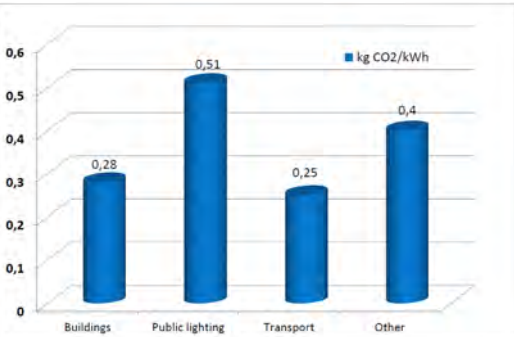


*Figure 3 – $CO_2$ emissions from energy consumed in MOM, 2010*

Currently, the energy for electricity is produced by hydro, coal and nuclear energy. Electricity is basicly produced by thermal power plants (47.5%), followed by nuclear (24.2%) hydro (30.9%) and photovoltaic energy sources (1.74%). The measurement of the $CO_2$ emissions is standardised by Technical Guidelines as 0,553 kg/kWh. In yearly calculation the exact emissions are determined by the % of primary sourced used for the energy production.

For the conventional combustion heating technologies mainly traditional energy sources as petroleum products, gas, and wooden biomass are used. According to the Census 2010, the share of renewable energy production (REP) for electricity was in total 299 GWh (51.67%). The share of renewable energy production for heating amounts at 16%. There was some additional energy produced for electricity by two small cogeneration stations, one small hydroelectric power plant and some photovoltaic modules, and for heating via heat pipes.

The analyses on REP capacity for the MOM have determined the high potential of sun- and wooden biomass energy, as well as of geothermal energy while the research on the potential of biogas is still in the preparation phase. However, for the next future there is no ambition to upgrade conventional technologies, but to eliminate petroleum products for heating.

The most informative data of energy consumption indicate the shares by individual consumers, as presented in *Figure. 4* in detail. The ratio between sectors of buildings and equipment and transport is 70:30, while the residential buildings achieved the highest share of 40% of total energy consumption in the MOM.

| **Buildings and equipment** | **Energy consumption Share in %** |
|---|---|
| Municipality buildings (kindergartens, schools, administration buildings) | 1.04 |
| Residential buildings | 40.15 |
| Municipal public lighting | 0.50 |
| Other | 28.95 |
| Subtotal | 70.64 |
| | |
| Transport | |
| Municipality vehicles | 0.01 |
| Public transport | 1.64 |
| Private and commercial cars | 27.71 |
| Subtotal | 29.36 |
| Total | 100.00 |

*Figure 4 – The shares of energy consumption in the MOM, 2010*

## 2. CURRENT SITUATION: THE ENERGY POLICY TARGETS VERSUS IMPLEMENTATION

During the 1990s and 2000s, a range of EU energy directives and guidelines were adapted with the intention of harmonising national legislation. A few of them are directly transferred in the national Energy Law, while the others are integrated in different sectors' documents, such as environmental protection, spatial planning, building construction, public procurement, and public-private partnership. In 2004, the MOM Spatial Development Strategy 2002 stated the main aspects of the long-term perspectives including the energy sector. Among others, it has introduced a new instrument, the Local Energy Concept for regions, cities, and local communities. In 2005, the Development Strategy of Slovenia defined the main sustainability criteria, such as the encouragement of energy-saving measures and the re-usage of materials. The energy-efficiency and renewable energy-sources were set as priorities for raising the awareness of public concern about the negative climate change impacts on build environment.

Another new instrument of crucial importance for the implementation of sustainability measures was the Law on Public-Private Partnerships. Introduced in 2006, it enables concrete actions over the building sector concerning the refurbishment and renovation of new and existing buildings. In parallel, in 2006 the Environmental Protection Law introduced operational programmes providing specific measures for the reduction of energy operating-costs, renewable-energy sources and environmentally friendly materials incorporated also within the Local Energy Concept. Further, a series of documents based on the Resolution on the National Energy Program 2004, the Law on Energy 2005, and the National Energy Efficiency Action Plan 2008 – 2016 initiated energy-efficiency measures for new and existing buildings.

The renewed version aims at achieving a 20% reduction of GHG emissions, a 20% increase in energy-efficiency, and a 25% special additional increase in renewable-energy involvement. Energy-efficient measures are also the central promotion topic for financial incentives provided by the Environmental Public Fund (Eco Fund) for new and existing buildings. Established in 2008, the Eco Fund offers subsidies and affordable loans for energy efficient, environmentally friendly energy sources and systems for private and public

investments. Recent conditions regarding energy policies' implementations seek the establishment of new organisation at local levels, especially about the substantial need for the adaptation of the users' behaviour to the new conditions. In this regard, supported by EU co-financing, several regional energy agencies were established.

Among Slovenian municipalities, the MOM was extremely active during the last period, especially in view of the acceptance, programming and implementation of environmental protection measures. A range of energy savings measures was included as sustainability goals in strategic documents at local level. The Urban Development Concept for the City Municipality of Maribor was the first modern spatial planning document in independent Slovenia, launched in 2001.

Parallel, following the principles of the Aalborg Charter of European Cities towards Sustainability (1999) the City Council of Maribor adopted the Local Agenda 21 and the Environmental Action Program 2004 – 2008. In these documents, under the sustainability umbrella, the strategic goals as energy saving and the reduction of the $CO_2$ emissions are integrated. Finally, in 2006, the MOM and 17 small neighbouring municipalities established the Energy Agency of Podravje (EnergaP) as a coordination body, covering the territory of 180,000 inhabitants. During following years, the majority of activities were dedicated to the MOM, especially concerning the data collection.

In 2009, the MOM adopted the Local Energy Concept (LEC). It identifies a list of long-term sustainability objectives dedicated to the reduction of energy consumption and the raising of the REP. In the Action Plan, the main targets for 2020 are the reduction of the total $CO_2$ emissions at 20% compared to 2010, and yearly reduction of 137,386 tons of $CO_2$ emissions each year after 2020. Within the Action Plan objectives, the most relevant ones are the reduction of energy use (REU) at 20% in public buildings and street lighting, increase of the share of the REP in all sectors at 25%, and in public bus system at 10% by 2020. Concerning the construction sector, special attention is paid to the low energy buildings standard for new buildings. For the street lighting, the limit of energy consumption is maximum 44 kWh of energy consumption per capita per year.

The sustainability goals for 2020 are set as 30% reduction of greenhouse gas (GHG) emissions, 20% increase of REP, as well as 20% increase of energy efficiency in total by public transportation, households and companies.

**The EnergaP targets, barriers and drivers**

The awareness of the effects of energy efficiency measures on the users' behaviour is of paramount importance among activities of EnergaP. In this view, the EnergaP is permanently performing information, advice, and training concerning energy efficiency, renewable energy sources, and sustainable mobility. Within energy management issues, the EnergaP offers support for the preparation of local/regional energy plans, and the energy audits for public and private buildings, among others.

Concerning the information and educational campaign, EnergaP started the activities for the young generation between 6 and 15. Further, around 40 workshops and training courses for the city administration and interested citizens were organised. These incentives were encouraged also by the international cooperation, such as the network of EU Covenant of Mayors' Initiative signed in 2011, which promotes the importance of sustainable energy use for city development and the networking of local authorities and experts in research and practice. In 2009, the EnergaP upgraded the activities by the preparing of the LEC that determined the key guidelines for increasing the energy-efficiency, in particular in public buildings. One of the main objectives the reduction of energy consumption at minimum 3% yearly was adopted. In addition, the LEC highlighted the activities oriented towards the improvement of knowledge on energy-efficiency and energy renewable policies for initiating a network were of particular importance for neighbouring municipalities.

Among the first activities concerning the reduction of energy consumption, the EnergaP

started with systematical collection of the data on it in public buildings. In municipalities, public buildings include administration and office buildings, primary schools, and kindergartens. The EnergaP coordinated the energy management system in form of different initiatives for city districts supporting the introduction of the centralised energy management system, incorporating the data on energy consumption, energy costs and $CO_2$ emissions, and the integration of REP.

EnergaP, established by financial support of EU, acts also as a contact point for European networks, serving the local, regional, and national players, as well as for the collaboration in the field of energy-management incentive funds at national and EU level.

Additionally, in the transport sector sustainable mobility was the topic of several research projects conducted by EnergaP. They set the theoretical and practical basis for increasing the awareness of the efficient energy use, followed by presenting the best practice models to the community. In order to achieve the LEC's objectives, the EnergaP also integrated the motivation of the industrial and commercial sector, which interest for the energy issues seemed to be declining.

One of the first projects initiated by the EnergaP was the international three-year' 'Minus3%' Project, established by five European cities as project partners: Dublin, Derry, Graz, Malacky, Teruel, and Maribor in the period 2009 – 2011. The main objective was to develop innovative methodology for the monitoring and assessment of energy consumption in existing buildings as a new instrument adaptable for other regions. The 'showcase project' was dedicated to the analyses and monitoring the energy-efficiency in 120 public buildings. As a main idea, the financial model on how to achieve the 3% savings yearly was systematically prepared. The first part focused on the step-by-step energy management process, dealing with the commitments, roles, and responsibilities of the energy manager and his team, the setting up of the energy database, and action plan, which integrates the implementation of appropriate measures in practice. The second part was a showcase project dedicated to concrete renovation of the building of the primary school (Osnovna šola Tone Cufar) in Maribor that integrated the refurbishment of facades, roof and floors, the retrofitting of entrance doors and windows, and the renovation of the heating system. In case of the renovation of heating system, the modern gas condensation boilers replaced old fuel driven boilers.

Within the Minus3% Project the Central Energy Management System (CEMS), launched in September 2008, has been tested. As one of the main initiatives by EnergaP, the CEMS was prepared in collaboration with experts and companies for controlling and monitoring the energy consumption for electricity and heating in public buildings. Among them, for the MOM primary schools and kindergartens were most relevant in view of energy costs, as well as GHG emissions. Based on the information and communication technologies, the CEMS enables the access to energy database for individual units, buildings, and group of buildings via Internet. The database's intention was primarily recording of authorised persons for monthly controlling of electricity and heat consumption, including costs, taxes and fees. Additional data on certain values, such as weather conditions, fuel prices, specific energy delivery agreements, and physical characteristics of buildings are included in the model. The system automatically calculates the GHG emissions concerning the source of energy for individual building, analyses the data and presents the results in different modes.

The most indicative data is the calculation of costs of energy consumption in € per unit of one $m^2$ or user per building. The controlling of energy consumption, costs, and $CO_2$ is based on the comparison between the calculated and the predicted savings over years. It enables the controlling of the system's functionality, and, in parallel, motivates the users for savings higher than the calculated ones. In such a case, the costs are attributed back to the users. Since the CEMS is based on the four-steps-principle planning– doing–checking–acting, the EnergaP acts as the main manager to overview both, the users' and buildings' energy consumption.

## 3. CASE STUDY: THE ENERGAP, DEMONSTRATING THE IMPACTS OF THE LOCAL ENERGY CONCEPT ON THE RENOVATION OF PRIMARY SCHOOLS

Although the relatively small number of public buildings (461) is using only 5% of total energy consumption, schools and kindergartens account for a large share of energy costs for the MOM, since the three quarters share of the existing buildings are estimated as inappropriate. Additionally, in public buildings also the inappropriate users' behaviour is a fact. On the other hand, high number of privately owned residential buildings have recently intensively improved the energy efficiency by renovation processes, financially supported by national subsidy schemes introduced by Eco Fund recently.

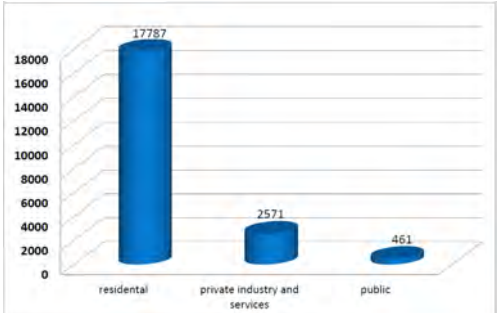


*Figure 5 – Number and type of buildings in Maribor, (Census, 2010)*

In regard to the improvement of the energy efficiency, the CEMS represents a special benchmarking system that enables the monitoring of energy consumption, the $CO_2$ emissions, and the financial saving potentials for individual buildings and a group of buildings on a monthly basis, by integrating different technologies for optimisation of energy systems. This experience is of paramount importance for the EnergaP ambition to implement the system also at national level.

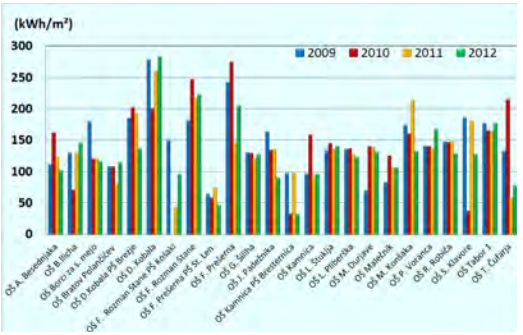


*Figure 6 – Energy consumption for heating in 24 primary schools*

The case study represents the results of the CEMS introduced in regard to the renovation of 24 primary schools in MOM. *Figure 6* indicates the results of the renovation presented by energy consumption for heating in kWh/m2 in 2009, 2010, 2011, and 2012. The results have confirmed the viability of the investment in the energy-efficiency refurbishment measures as reasonable.

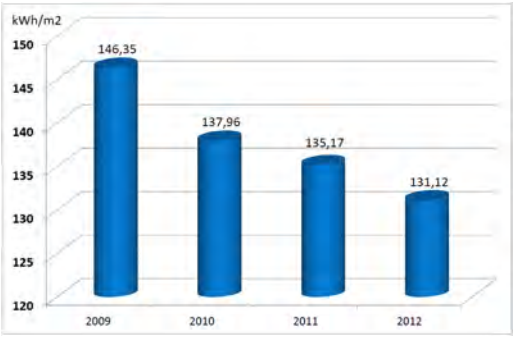


*Figure 7 – Specific energy consumption for heat production in kWh per m² in 24 primary schools*

The average specific energy consumption decreased from year to year, as presented in *Figure 7*. The first targeted value of the action was to reach the energy consumption of 80 kWh/m² by systematic step-by-step renovation process as experienced in the frame of the Minus3% Project. In 2012, the target of 3% of savings per year was achieved. *Figure 8* clearly demonstrates the savings in case of the renovation of the one primary school (Tone Cufar Maribor), already mentioned in frame of the Minus3% Project.

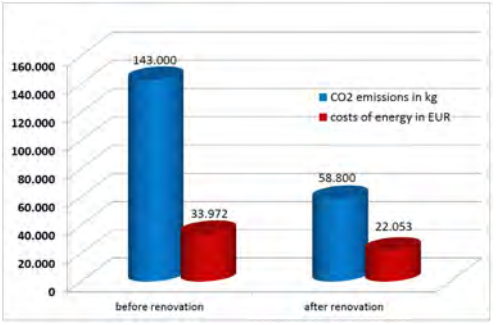


*Figure 8 – Comparison of the $CO_2$ emissions and costs before and after the renovation of the primary school Tone Cufar Maribor*

Concerning financial results in 2010, the MOM's investment in energy efficient renovation of 24 primary schools was €581,963, resulted in 5.7% energy savings and the decrease of specific energy consumption for heating from 146,35 kWh/m$^2$ to 137,96 kWh/m$^2$. In 2011, the investment of €337,191 resulted in 2% energy savings and the specific energy for heating decrease from 137,96 kWh/m$^2$ to 135,17 kWh/m$^2$. The CEMS' results have been presented to the decision makers annually, in order to encourage them for undertaking adequate changes of the implementation methods. Positive experience with the implementation of the CEMS is supporting the EnergaP tendency to develop an optimal methodology for energy efficient measures in the processes of renovation. Based on the experience with primary schools in the MOM, the renovation comprises the improvement of thermal insulation of the envelope including the facades, roofs and basements, the retrofitting of windows and doors, as well as the renewal of heating systems.

## 4. CONCLUSIONS

Energy efficiency represents one of the main challenges for local and regional communities in Slovenia. Concerning the stimulation of the energy savings and reduction of the $CO_2$ emissions, the experience of the CEMS in public buildings, especially in primary schools and kindergartens, has shown that for an appropriate management for improving the energy efficiency of buildings an integrated approach for the optimising energy consumption is needed. In this regard, the adoption of the CEMS for controlling and monitoring the energy use in primary schools and kindergartens was of essential importance. Although first reactions to the implementation of the CEMS were rather sceptical, the system soon gained the reputation of the Slovenia's showcase for a long-term management. The special attention was payed to the transparency of financial and operational issues, including the users' behaviour that enables the prediction of the maintenance costs not only for the users, but also for the owners and potential investors.

For the MOM economy, the construction sector is of paramount importance for the realisation of measures related to increasing investments in energy efficiency in new and existing buildings. A range of positive impacts has been also registered in relation to various energy efficiency activities that appered as a key element for new commercial opportunities and job creation. At the national level, in 2012 the Eco Fund subsidies of €23.6 million resulted in the investment in energy efficient renovations of nearly €132.0 million that inclusively the tax rate of at 8.5% caused the tax revenues for the state budget of €11.2 million. Additionally, as a survey among providers of co-financed energy efficiency measures indicates, the construction industry has employed more than 1,000 workers excluding the number of jobs for the manufacturing industry of construction materials and products in Slovenia.

Based on the adoption of long-term vision of a clean, green and interconnected city municipality that integrates innovative economies for sustainable communities, the MOM's ambition is the image of an economically, socially and environmentally sustainable city region that was documented as a long perspective vision in the Development Strategy of Maribor 2030. In regard to the negative impacts on the environment, energy efficiency is one of the main challenges for local communities. However, the existing technical and technological infrastructure for the implementation of the measures planned seems to be insufficient to meet these extremely high energy efficiency objectives at national, regional and local level.

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# COST DESCRIPTION

## THE ORGANISATION OF COST

COST - European Cooperation in Science and Technology is an intergovernmental framework aimed at facilitating the collaboration and networking of scientists and researchers at European level. It was established in 1971 by 19 member countries and currently includes 35 member countries across Europe, and Israel as a cooperating state.

COST funds pan-European, bottom-up networks of scientists and researchers across all science and technology fields. These networks, called 'COST Actions', promote international coordination of nationally-funded research.

By fostering the networking of researchers at an international level, COST enables break-through scientific developments leading to new concepts and products, thereby contributing to strengthening Europe's research and innovation capacities.

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- building capacity by connecting high quality scientific communities throughout Europe and worldwide;
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