Application Form

European Green Capital Award 2020

.

GUIMARÃES

Application Form for the European Green Capital Award 2020

City Introduction & Context

Indicator		Units	Year of data
Population	158124	Inhabitants	Census, 2011
Area	241.3	km2	2017
Population Density	656	Inh/km2	2011
GDP	14693	€/Capita	2015
Köppen climate classification	csb		temperate, yet wet winters and mild, yet dry Summers

Figure 1 Guimarães panoramic view | Guimarães mais Verde

The landscape of Guimarães – the "Birthplace of Portuguese Nationality" – clearly demonstrates co-evolution between humans and nature. Guimarães hosted the first Industrial Exhibition in Portugal in 1884 and has maintained its industrial character. Past activities centred on leather and textiles, but today the city has creative industries in the central area and technological and manufacturing on the outskirts. But agriculture never diminished, and today Guimarães has a contrast between the two. Physical evidence of this enduring rich mosaic of biocultural history uses makes the city unique in Portugal and in Europe.

Figure 2 Guimarães polycentric nature and diversity

Even the densely populated locations display the pattern of the lived landscape and the 14ha educational urban garden set in the city centre encourages more than 500 citizens to cultivate crops.

The city's history is renowned and well preserved. In 2001, the centre was inscribed on the **UNESCO World Cultural Heritage** list, acknowledging innovative housing construction methods that spread throughout the world as well as the carefully preserved examples of this exceptional heritage.

In 2012, Guimarães became **European Capital of Culture** because it integrates social and cultural values with local development policy. In preparing for the ECC (2007), the city began to improve managing its water supply, constantly under stress from industrial needs. Best practices were adopted, including an integrated system, addressing floods, and controlling urban runoff and pollution. The important **Landscape Lab** was established in partnership with the University of Minho, to provide a dedicated space for studying and

interpreting the city landscape, for generating actions and project and thus improve urban planning and environmental control in an historical city.

In 2013, Guimarães was the **European City of Sport**, an achievement that links the social function of sport with an incentive for a healthier lifestyle.

Figure 3 2012 European Capital of Culture and 2013 European City of Sport

This continued external recognition, which increases and strengthens civic pride and identity, demonstrates that our city has the courage to dream, the will to mobilize resources, and to nurture aspirations among people and organizations to build an increasingly inclusive and sustainable territory.

Important in this process is the continuous restoration of public spaces. Such an approach gains particular importance through emphasising architectural quality and heritage, increasing community enjoyment, and attracting people and sustainable services.

From leather to textiles, Guimarães has confronted different development cycles with various outcomes of success, failure and resilience. Both industries depended on water, the former since the 14th century, and the latter in the 19th/20th centuries. Both were organized in very small units, often a single family, and prosperity was predicated on the availability of low-skilled human resources. As economic activity increased, the stress on the environmental resources grew, and as technology and competition arose, manufacturers and industrialists were forced to move and modernize. Nonetheless, transforming into a new era was not successful because workers and manufacturers/industrialists were not able to foresee nor adapt to new challenges.

Figure 4 Rehabilitation of leather industries in Couros Zone (1990-2016) for public use

Despite difficulties, the consequences of this environmental history were not totally disruptive. The diversity of family income sources, including a small vegetable garden near their home, obviated more serious consequences. But visionary governance and innovation was not lacking. We provide just two examples. The design for housing industrial workers, offering different-sized houses, each with a flower garden, decreased the stigmatization of the poor. The street design around the railway station was modelled on Versailles. The endurance of the biocultural resources that contribute to the sustainable development of our city has not only been remarkable, but shaped the municipal economic and social activities. Industrial location has been beneficial and led to structured road and rail access to other commercial and manufacturing areas. Guimarães developed a polycentric structure, creating a mosaic-like landscape that reveals an eco-social structure, where each part plays a role in a system intended to be sustainable.

Using history as an opportunity to reinvent itself and improve, to raise its standards and quality, Guimarães has been promoting healthier life styles, and a sustainable coexistence between man and nature. By developing green spaces, housing new and environmentally friendly, creative industries, engaging the population in being proud of the past, while adapting and adopting more sustainable paths for the future.

A survey conducted about the environmental consciousness of its inhabitants shows that the population is behind the city governors in supporting access to green areas (agricultural, forest and public parks), using of public transport demanding inter-modality and systems integration, and showing concern about excessive traffic, particularly in the historic centre and the surrounding area. We are proud to announce that the Ecological Footprint of Guimarães, and our carbon footprint, are lower than the national rates although our per capita income is higher. We will use the EF to guide our greening policy to develop a consistent vision of sustainability, especially in land use and consumption, and interventions in food and transport will be prioritized. We are also reinforcing our policies on sustainable mobility alongside a major awareness-raising and information campaign: **Guimarães mais verde.**

Our application to EGC 2020 has been a wide-ranging and exciting participatory process, overseen by the Municipality and the University of Minho, a long-term partner. Each indicator was studied by a team with members from both institutions thus ensuring the scientific and technological expertise.

The process received regular input from an Advisory Board with more than 100 leading figures, and an External Advisory Committee, with distinguished members Mohan Munasinghe (chair), Mauro Agnoletti, Jane Carruthers and Will Wynn.

Birthplace of nationality, many times precursor and example, becoming European Green Capital is yet another step for Guimarães in its territorial construction merging the natural and the human, producing and perpetuating the physical and intellectual support of life for all of us!.

Figure 5 Guimarães Awards and Recognitions

Application Form for the European Green Capital Award 2020

1. Climate Change: Mitigation

1A. Present Situation

		Base Year	Target Year	% Reduction
City Reduction Targets		2008	2020	20% of CO_2 emissions
		2008	2030	39% of energy consumption and 42% of respective emissions
		2008	2030	30% of CO_2 emission (non-ETS sectors)
		t CO_2/inh -Total	**Transport t CO_2/inh**	**Total (less transport) t CO_2/inh**
CO_2 emissions / capita	2008	3.27	1.51	1.75
	2009	3.12	1.52	1.60
	2010	2.85	1.53	1.33
	2011	2.85	1.41	1.45
	2012	3.23	1.40	1.83
	2013	3.04	1.39	1.65
	2014	2.65	1.40	1.25
	2015	2.85	1.37	1.47
	2016	2.72	1.36	1.36
	2017	2.60	1.35	1.24
Total CO_2 emissions (tonnes) per year		520936	Tonnes	2008
		496157	Tonnes	2009
		451122	Tonnes	2010
		451185	Tonnes	2011
		507531	Tonnes	2012
		475621	Tonnes	2013
		412126	Tonnes	2014
		441121	Tonnes	2015
		420480	Tonnes	2016
		399684	Tonnes	2017
Total CO_2 emissions per MWh electricity consumed		213415	Tonnes	2008
		189650	Tonnes	2009
		138087	Tonnes	2010
		165762	Tonnes	2011
		174609	Tonnes	2012
		149162	Tonnes	2013
		133526	Tonnes	2014
		172119	Tonnes	2015
		154305	Tonnes	2016
		136336	Tonnes	2017

Emission Inventory[1]

[1] The **CO_2 balance** is calculated by applying emission factors specific to each energy vector to the final energy consumptions obtained from the energy balance. The annual update of the emission factor for electricity is provided by the Portuguese Environment Agency and by the Directorate General for Energy and Geology, for the period 2008-2014. For the period 2015-2017, the emission factor for electricity was estimated on the basis of the scenario proposed by the EC in 2016 in the report "EU Energy, transport and GHG emissions trends to 2050". The remaining emission factors used are defined in Decision no. 17313/2008 of 26 June and by the Joint Research Centre, under the Covenant of Mayors

The strategy established for Climate Change: Mitigation was defined by a **Mission Structure**[2] created by the City Hall in 2015, in a proactive and strategic partnership with UMinho[3], that is also responsible for coordinating the entire EGC2020[4] application and the development of the Action Plan 2015-2017 (incorporating the twelve ECG areas), whose implementation will decisively contribute to the **Guimarães 2030 Sustainable Plan**.

This commitment to sustainable development is consolidated in **declarations of political** and **individual consensus[1]**, that strengthen the community identification with the process.

A City that meets its targets

The Ecological Footprint of Guimarães is lower than the national average, with the greatest difference being in carbon emissions - due to a lower demand for housing, water, electricity, gas and other fuels in Guimarães compared to that of Portugal. Guimarães has therefore succeeded in taking the extra step beyond the National climate policies of Portugal.

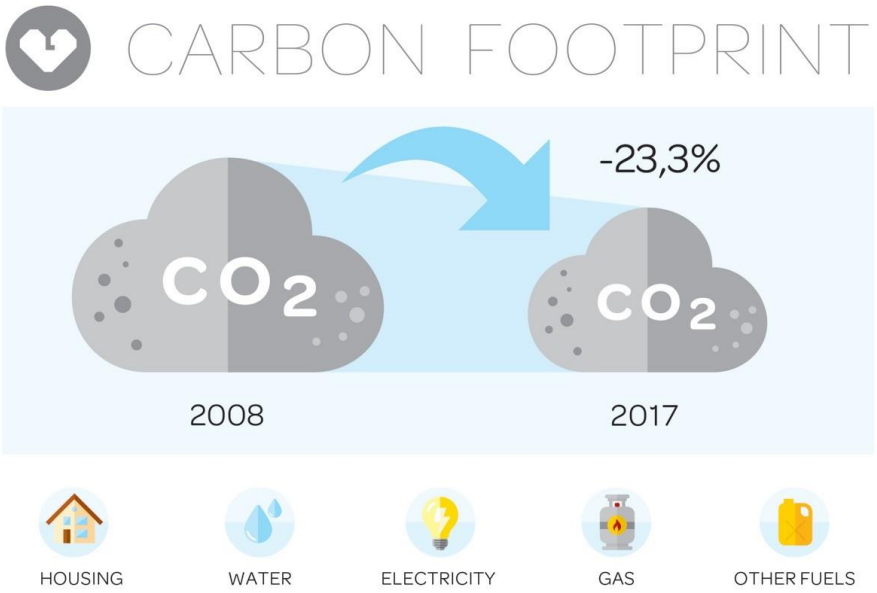


Figure 1 Guimarães Carbon Footprint

Portugal was one of the first countries to ratify the **Paris Agreement[2]**. Numbers show a strong commitment to renewable energies and the greater weight that they have gained in primary energy, together with an increase in the use of more sustainable energy sources: replacing the consumption of fossil oils for natural gas and increasing the use of biofuels and thermal solar energy. These results show that Portugal also benefits from a recent positive trend in energy efficiency which may be associated with the reduction of energy costs related with the recent economic crisis and with the return to investing in renewable energies.

[2] **Mission Structure** can be found in all the sections and it is described in Good Practice **1**
[3] **UMinho** - University of Minho
[4] **EGC2020** - European Green Capital 2020

In Guimarães, this trend in energy consumption[5] results from the adoption of awareness-raising actions and examples set by the municipality and other state authorities, which are responsible for changing consumption behaviours and the adoption of energy-efficient habits, based on a strategy aiming at a low-carbon society.

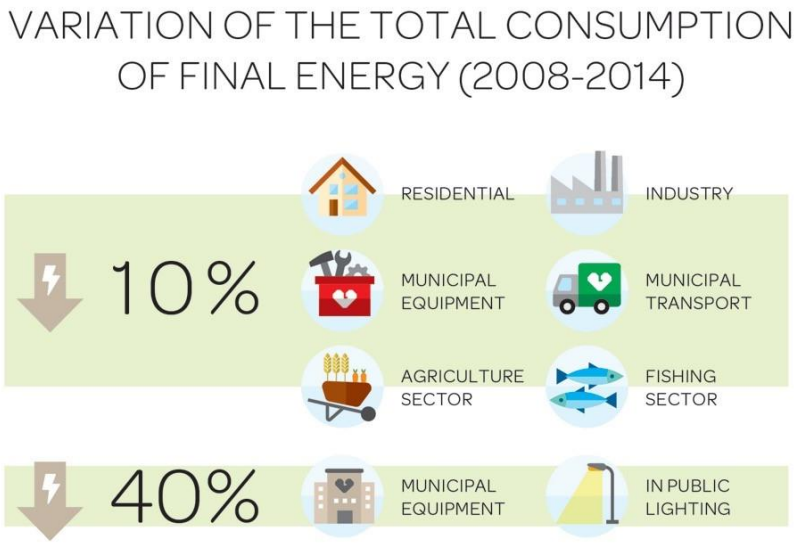


Figure 2 Variation of the total consumption of final energy[6] (2008-2014)

The CO_2 emissions per capita follow the same downward reduction (for the period between 2008 and 2017 the reduction was of 20.5% - lower than the national average), with values close to 2 tonnes of CO_2e/inhabitant[7], thus meeting the vision of making Guimarães an example of a low-carbon society.

A major contribution to the national targets

CO_2 emissions per capita in the transport sector also shows a downward trend (-10.6% between 2008 and 2017). Recent data released by the European Environment Agency places Portugal first in Europe for the efficiency of new cars, with the most efficient and less polluting fleet of new cars. Taxation structures encourage the purchase of more environmentally friendly vehicles (tax weighs CO2 in 30%). In addition, the municipality has recently implemented measures to reduce carbon emissions, through the promotion of hybrid and electric vehicles and alternative means of transport[8].

[5] **Energy consumption** can also be found in section 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **11** | 12

[6] The results for the final **energy consumption in the period 2008-2014,** for the Agriculture and Fishing, Industry, Domestic, Services and Public Lighting activity sectors, are based on information provided by the Directorate -General for Energy and Geology (regarding the consumption of electric energy and the sales of natural gas and petroleum-based fuels). For the Transport sector, the results are estimated by modelling, taking as reference information provided by the Directorate-General for Energy and Geology (regarding the consumption of electric energy and the sales of natural gas and petroleum-based fuels) and by the Portuguese Environment Agency under the National Atmospheric Emissions Inventory (on the emissions of greenhouse gases in motor vehicles).

[7] In line with the **European objectives** and with the long term convergence of the per capita emissions at a global level of around 2 tonnes of CO_2e/inhabitant.

[8] This information can also be found in sections 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

Figure 3 Promotion of electric mobility: PAYT System, eBus, Municipal police, charging Station

The largest proportion of CO_2 emissions in 2010, 42%, was associated with electricity consumption, which has also been trending downward, not only due to recent poor economic environment but also adopting efficiency measures, resulting from national laws on energy certification of buildings and from behavioural changes towards energy efficiency. Emissions associated with the energy sector follow this trend, decreasing approximately 36% between 2008 and 2017[9].

A local commitment that is fulfilled

Bearing in mind the goal of becoming a low-carbon city by 2050 [in line with the **Low-Carbon National Roadmap[3]**, Guimarães will reduce greenhouse gas emissions.

Figure 4 Commitments of Guimarães to reduce CO_2 emissions

[9] This information can also be found in sections 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | **11** | 12

Some measures have already been implemented, reaching or even exceeding National and European targets (as of 2015), not only through integrated policy options, but also with the involvement, awareness and behaviour change of the population towards greater environmental sustainability, thus reducing greenhouse gas emissions, in a win-win situation**[4]**.

Figure 5 Sharing and Learning – Mission Structure for Sustainable development of Guimarães

1B. Past Performance

1. **An integrated long-term strategy based on a sustainable vision**

In line with the current scientific knowledge and EU and National targets, Guimarães has developed a strategy of decarburisation by defining goals and commitments aimed at reducing greenhouse gases. Tools such as the **Action Plan for Sustainable Energy[5]**, of the Covenant of Mayors, as well as increasing energy efficiency, are key to reducing emissions. The decarburisation process also extends to the transport sector, buildings, and other sectors that impact CO_2 emission reduction.

This vision stemmed from the commitment of Guimarães to the **Aalborg Charter[6]**, the implementation of **Agenda 21 Local[7]**, the accession to the **Basque Declaration[8]** and the **Paris Agreement[2]**, and **ClimAdaPT.local[9],** which contributed significantly to combat climate change through processes of mitigation and adaptation **(Guimarães Strategy for Adaptation to Climate Change[10])**. This approach comes from the city having introduced into municipal management, the concern and sensitivity to empower and adapt to the impact of climate change, thereby making the city not only greener, but sustainable and resilient.

An integrated approach to climate and energy issues and synergies between mitigation and adaptation actions form the basis for projects that focus on a variety of structural (green and grey infrastructure) and non-structural (design and implementation of policies, strategies and processes) measures/actions, seeking to promote a more sustainable municipal area.

Figure 6 Guimarães in action to Climate Change´s mitigation

2. **A city in the process of Decarburization**

Regarding low-carbon trajectories, Guimarães has been achieving greater energy efficiency by introducing new technologies and more efficient resource management, increasing electrification and introducing

renewable energies. As a result, a reduction in CO_2 emissions by 20%, compared to 2008, was achieved, thus exceeding the targets set for 2020 within the Action Plan for Sustainable Energy[10].

Measures adopted by Guimarães[11] which contributed to low energy and carbon intensity and to a high energy independence result from:

- optimized management of public lighting;
- energy audits in housing buildings, public services and industries;
- installation of solar panels that promote the production of electrical energy;
- improvements in the use of indigenous and renewable energy resources.

Guimarães restructured social housing buildings to improve their energy performance by adding thermal insulation in the building envelope, replacing existing windows and installing solar thermal equipment and photovoltaic systems**[11].**

In municipal buildings, the goal was to reduce energy consumption by 30% by 2020. In the biennium 2016-2018, a reduction of 10% in the costs relating to energy consumption in Municipal buildings had already been achieved, together with an increase in the consumption of natural gas.

In the municipal school estate, 10 school centres were restructured through active and passive building solutions aiming at achieving thermal comfort and favouring natural lighting, using thermal insulation and shading canopies, HVAC equipment and centralized technical management systems. 12% of schools already have central heating that operate through the burning of biomass[12]. 16 units for the production of solar hot water were installed.

Electronic ballasts and 4-track heat pumps were installed, together with thermal insulation in the building envelope and an intelligent power management system for the municipal sports facilities.

In 2017, the **Gymnastics Academy**[13] was built, a self-sustainable building with recovery of heat and energy, due to its unobstructed solar orientation. In addition, the building was equipped to reuse all water after treatment**[12].**

[10] **Action Plan for Sustainable Energy** can also be found in section 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **11** | 12

[11] The **measures** adopted by Guimarães that contributed to a low energy intensity can also be found in sections 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **11** | 12

[12] In 2016, 30 tonnes of Biomass came from the Green waste from the maintenance of the Municipal Green Areas – Guimarães for Circular Economy project. This information can also be found in sections 1 | 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | 11 | 12

[13] Gymnastics Academy can also be found in sections 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | **11** | **12** and Good Practice **5**

Figure 7 Gymnastics Academy of Guimarães, a self-sustainable building

Since 2016, a plan has been in place for monitoring municipal buildings and equipment, together with energy and indoor air quality audits in municipal buildings (IEMSY platform for the management and monitoring of energy consumption)[14]**[13]**.

Guimarães has planned to decrease consumption in public lighting by installing 43 energy flow regulators and 16 units of energy production at strategic points in the municipality. The locations of public lighting were

[14] IEMSY can also be found in sections 1 | 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | **11** | 12

also analysed and areas where use was low were switched off to reduce energy wastage. Lighting in public buildings with less efficient technology, as well as 10,000 sodium vapour lights, were replaced by LED technology**[14].** A reduction of 10% was observed in 2016-2018 in the costs of energy related to Municipal public lighting.

Traffic light-signalling has also been replaced by LED optics (100%) and photovoltaic panels (57%) since as early as 1998.

In 2017, the Strategic Matrix of Energy and Climate Sustainability**[15]** was drawn up, aimed at characterizing the local energy consumption and corresponding evolutionary trends. This was designed to help with demand and supply management, and to help achieve sustainability.

In addition to structural measures, the city also has provisions that encourage and enhance the recovery/construction of buildings with A or A+ energy certification (since 2013): Municipal Regulation for Urbanization and Edification; Regulation of municipal taxes for urbanization and edification; Administrative procedures in urban operations; Definition of specific construction lots or areas; Tax benefits regarding the Municipal Property Tax; Urban rehabilitation areas**[16].**

In Guimarães, transport accounts for reductions of CO2 emissions per capita of approximately 11% compared to 2008. Energy efficiency, electrical mobility and alternative mobility play a fundamental role in the decarbonisation of the transport sector[15].

Our Sustainable Urban Mobility Plan[16]**[17]** defines application fields that represent a sequence of consistent and related actions aimed at helping to reduce the emission of greenhouse gases.

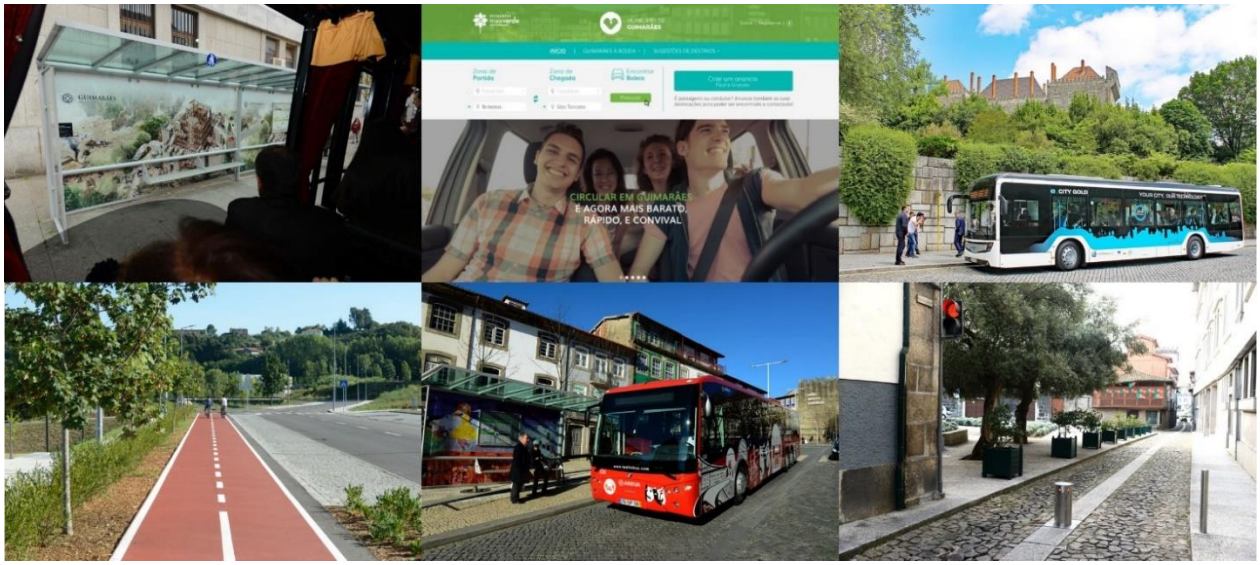


Figure 8 Mitigation actions/Sustainable mobility: public transport stops', Carpooling System, eBus, Bicycle path, World Heritage traffic restrictions

The reduction in greenhouse gas emissions also derives from a change in how waste is managed with solutions geared towards prevention and recovery - by increasing selective collection, options for energy,

[15] Guimarães **Mobility Measures** can also be found in section 1 | **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[16] **Guimarães SUMP** can also be found in section 1 | 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

organic and multi-material recovery, reduction of methane emissions in landfills due to the decrease of biodegradable waste sent to landfills and, more recently, the end of the direct deposit in landfills).

In terms of **water management** and **waste water management**, Guimarães has been developing projects aimed at reducing leaks and energy consumption[17].

Guimarães invests in green and circular economy in order to preserve natural capital, reduce emissions and waste, and combat climate change:

- **The Rural Based Incubator of Guimarães[18][18]** encourages qualified and creative entrepreneurship in agricultural production, forestry, food industry, related services and applied technology, by providing a group of services and support of intangible nature (summarized below) with the efficient use of the soil as the main goal.

- **Guimarães for Circular Economy**[19]**[19]** Programme focused on education and Research and Development.

Figure 9 Guimarães for Circular Economy (G4CE)

[17] Guimarães: **Water measures** can also be found in section 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12
[18] **Rural Based Incubator of Guimarães** can also be found in section 1 | 2 | 3 | **4** | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12
[19] **Guimarães for Circular Economy** (G4CE) can also be found in sections 1 | 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | 11 | 12

The green areas and green infrastructure are essential commitments in the mitigation process to tackle climate change, not only through decarbonisation by increasing the uptake of carbon and therefore creating compensations and encouraging a low-carbon economy based on natural matter, but also raising the population's awareness by giving value to green areas and encouraging people to frequent and treat them as an added value of their city. In this sense, through the defence and promotion of biodiversity, either by increasing the area of green spaces or classifying areas of interest, it is important to highlight the integrated vision that this indicator area implicitly shows.

The key to achieving climate protection goals is based on the awareness participation and active co-operation of local government and citizens, by developing a culture of good practices for living in and using the city. Our approach has already been rewarded by several eco-distinctions**[20].**

Figura 10 Eco distinctions and awards

1C. Future Plans

A commitment for the future of our Planet

Using the Covenant of Mayors for Climate and Energy and the EU Strategy on Adaptation to Climate Change as starting point, new goals for 2030 were established in the **Sustainable Energy and Climate Action Plan (SECAP)**, in line with the strategy followed by Guimarães for 2020.

The preparation and implementation of SECAP will allow the municipality to achieve a 39% reduction in energy consumption and 42% of the respective emissions in 2030, thereby exceeding the national targets for non-ETS sectors of a 30% reduction in CO_2 emissions by 2030, as defined in the 2020/2030 NPCC[20].

Figure 11 Guimarães Action Plan for Energy and Climate Sustainability

In order to find the best solutions for future urban challenges that can contribute to the decarburization of the economy, Guimarães intends to be a "**Laboratory for the Future**"[21], through the **living lab** approach (with the creation of a Living Lab for Decarburization[22]), by inviting citizens to co-create a smart-city through innovation and transformation.

[20] **NPCC** - National Programme for Climate Change

[21] **"Guimarães, Laboratory for the Future" includes** twelve urban challenges in the fields of Energy, Mobility, Data, Circularity, Green Area, Waste, Equipment, Culture, Climate, Knowledge, Governance, Economy

[22] The **"Living Laboratory for the Decarbonisation of Guimarães"** focuses on the areas of mobility, energy, circular economy and environment, and buildings

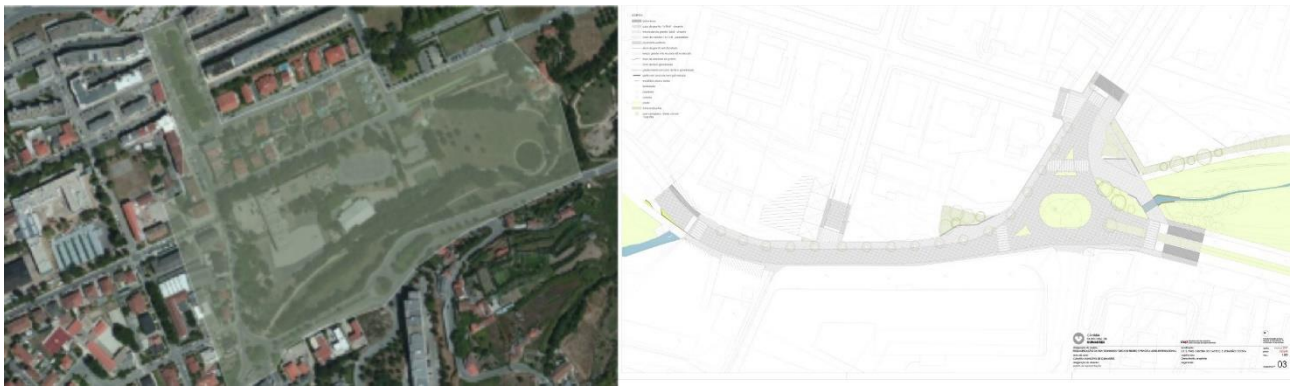


Figure 12 Area of implementation of the project Living Lab in Guimarães

Figure 13 Living Lab for Decarbonisation

Using knowledge acquired over the last two years, Guimarães will adopt an integrated strategy for the mitigation of climate change, highlighting the following actions in the short and medium term that will simultaneously contribute to reduce emissions and increase resilience:

Supply plan of the municipality of Guimarães (under development) - 2050 "zero emissions municipality" - a reduction equivalent to 100% of its emissions, to be achieved through the production of indigenous energy from renewable sources for local supply.

Implementation of the Action Plan for Sustainable Energy (2015-2020) - Application of sustainability measures - Municipal and equipment/facilities. Municipal public lighting. Service and agricultural buildings and equipment (non-municipal), residential buildings, industry and transport. Monitoring/Indicators to improve: CO_2 emissions and energy consumption.

Urban Master Plan for Public Lighting (2018-2021) - Preparing and beginning to implement the Urban Master Plan for public lighting, by integrating investment in equipment and energy rationalisation and management measures. Monitoring/Indicators to improve: Energy consumption in public lighting.

Environment Monitoring System (2018-2020) - Providing services that allow timely public access to real time data and reliable information concerning the environment, including emissions, and air, water, soil and acoustic environment quality. Guimarães offers 3 meteorological stations, associated to metering devices, leading to the installation of a monitoring network of the municipal climate and atmosphere that will be expanded in the future.

Implementation and monitoring of the adaptation options for the Municipal Strategy for Adaptation to Climate Change of Guimarães (2017-2020) - According to the vulnerabilities and climate risks assessment, together with the identification and evaluation of the identified adaptation options, the operational implementation of the Municipal Strategy for Adaptation to Climate Change of Guimarães will continue.

Implementation of the City Lab (2017-2020) - A participatory process of the community in structuring projects for Guimarães, thus contributing to the evolution and development of the region. The City Lab will be associated with the **Integrated and Strategic Management Office,** to address all projects and structuring strategic decisions for the city and its population, in a transversal and multidisciplinary manner, either for a specific time and location, or with a general and timeless scope.

Figure 14 Integrated Environmental Management System: analysing the territory to find solutions (City Lab in Landscape Lab)

Ecological Footprint and Biocapacity of Guimarães[23] (started in 2017)[21] - We are using the Ecological Footprint and Biocapacity calculation to guide our greening policy to develop a consistent vision of sustainability, especially in land use and consumption; interventions in food and transport will be prioritized. We are also reinforcing our policies on sustainable mobility alongside a major awareness-raising and information campaign: **Guimarães mais verde.**

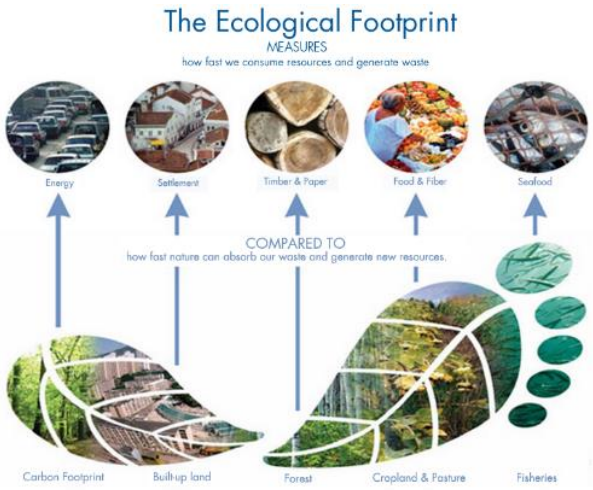


Figure 15 Guimarães Ecological Footprint and Biocapacity Calculation

Risk Aqua Soil Project (2017-2019), INTERREG Atlantic Area[22] - Atlantic Plan for the Management of Risks associated with soil and water, designed to promote resilience in the areas of the Atlantic, structured around three axes: management of soil, water management and damage compensation systems. It requires the establishment of a Laboratory on Climate Change in the Atlantic.

Periodic surveys of the thermal image of Guimarães, with the help of airborne equipment using unmanned aerial vehicles to assess, among other aspects, the thermal efficiency of buildings and the general heat flow in the municipality. Measures of energy efficiency will be implemented in municipal buildings and raising public awareness for the energy losses of buildings.

1D. References

[1] Declarations of political and individual consensus

a. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf
b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf
c. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

[2] Paris Agreement http://expresso.sapo.pt/sociedade/2016-09-30-Portugal-ratificou-hoje-o-acordo-pelo-clima

[3] Low-Carbon National Roadmap
https://www.apambiente.pt/index.php?ref=16&subref=81&sub2ref=117&sub3ref=301

[4] Actions

a. Guimarães mais verde platform www.guimaraesmaisverde.pt

b. Guimarães leads European capitals of culture at DREAM http://www.smart-ities.pt/pt/noticia/guimaraes-lidera-dream2202/

c. National Network of Municipalities for Adaptation to Climate Change http://www.cm-guimaraes.pt/pages/991?news_id=2869&related_news_list_5_page=2

d. ClimAdaPT.local http://climadapt-local.pt/

e. Mission Structure for Sustainable Development of Guimarães http://www.cm-guimaraes.pt/pages/1094

f. Guimarães Urban Master Plan http://www.cm-guimaraes.pt/pages/568

[5] Guimarães Sustainable Energy Action Plan
http://www.covenantofmayors.eu/about/signatories_en.html?city_id=6639&seap;
http://www.guimaraesmaisverde.pt/_energia_7

[6] Aalborg Charter
http://www.sustainablecities.eu/fileadmin/repository/Aalborg_Charter/Aalborg_Charter_signatories.pdf

[7] Agenda21 Local http://www.cm-guimaraes.pt/pages/118

[8] Basque Declaration http://www.sustainablecities.eu/endorsers-basquedeclaration/

[9] ClimAdapt.local http://climadapt-local.pt/

[10] Guimarães Strategy for Adaptation to Climate Change http://www.cm-guimaraes.pt/pages/1241

[11] Social housing buildings – Energy http://www.cm-guimaraes.pt/frontoffice/pages/1123?news_id=2254

[12] Guimarães Gymnastics Academy https://www.youtube.com/watch?v=SLzpRjwZPwQ

[13] IEMSY http://aeave.irradiare.com/

[14] LED Public lighting

a. http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2243

b. http://www.cm-guimaraes.pt/frontoffice/pages/1141?news_id=2500

[15] Matrix of Energy and Climate Sustainability http://www.guimaraesmaisverde.pt/op/document/?co=1&h=f6p3e

[16] Municipal regulations

a. http://www.cm-guimaraes.pt/pages/649

b. http://www.cm-guimaraes.pt/pages/1132

[17] Sustainable Urban Mobility Plan

a. Abstract http://www.cm-guimaraes.pt/pages/1248?folder_id=1376

b. MpT (2016). Plan for the Sustainable Urban Mobility of Guimarães – Stage I Characterization and Diagnosis (2016)

c. MpT (2017). Plan for the Sustainable Urban Mobility of Guimarães – Stage 2 Intervention strategy (2017)

[18] Rural Based Incubator of Guimarães

a. http://www.cm-guimaraes.pt/uploads/document/file/11784/28_-_Anexo_I_-_Regulamento_Incubadora_de_Base_Rural_de_Guimar_es.pdf

a. http://www.labpaisagem.pt/?s=incubadora+de+base+rural

[19] Ribeiro,C.; Sepúlveda,D.; Carvalho,J., Vilarinho, C., Cristino, J.; Loureiro,I. (2017). **Guimarães Circular Economy: towards a sustainable city**. International Journal of Sustainable Development, 5(3) pp 68-74

[20] Eco Awards

a. ECOXX1'2017 – The most sustainable Municipality of Portugal https://ecoxxi.abae.pt/municipios/municipios-ecoxxi-2017/

b. ECOXXI'2016 http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2814

c. ECOXXI'2015 http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2282

d. Green Project Award http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2890

e. Guimarães: Municipality of the Year 2017 https://www.umcidades.uminho.pt/pt/concurso-municipio-2017/Paginas/Municipios-vencedores.aspx

[21] Guimarães Ecological Footprint and Biocapacity report

a. Digital version

b. http://expresso.sapo.pt/sociedade/2017-09-02-ZERO-e-6-municipios-portugueses-lancam-projeto-inedito-a-nivel-mundial-para-calcular-Pegada-Ecologica

[22] INTERREG Atlantic Area http://www.atlanticarea.eu/

2. Climate Change: Adaptation

2A. Present Situation

The strategy established for Climate Change Adaptation was defined through a **Mission structure**[1] created in 2015, in a partnership between the city and UMinho[2] which is co-responsible for coordinating the application process to EGCA2020 and the development of Action Plan 2015-2017 (incorporating the twelve ECG areas), implementation of which will decisively contribute to **Guimarães Sustainable Plan 2030**[3].

Our commitment to sustainable development is consolidated in **declarations of political** and **individual consensus**, which strengthen the community involvement with the process**[1].**

Guimarães is a signatory to the new **Covenant of Mayors for Climate and Energy**[4]**[2]** supporting a shared vision for 2050: accelerate decarbonisation, strengthen adaptation to climate change and give citizens safe, sustainable energy at a reasonable price. This strategy is complemented by Guimarães' commitment to **Aalborg Charter[3]**, **Agenda21 Local[4]**, **Basque Declaration[5]** and **Paris Agreement[6]**, and by integrating **ClimAdaPT.Local[7]**.

Guimarães undertakes actions to reach reduced greenhouse gas emissions in the European Union by 40% by 2030, and to adopt a joint approach in terms of mitigation and adaptation to climate change.

To translate political commitment into practical measures and projects, Guimarães has developed the **Municipal Strategy for Adaptation to Climate Change[8]**, which analyses climate risks and vulnerabilities defining 28 adaptation options to combat and reduce risks.

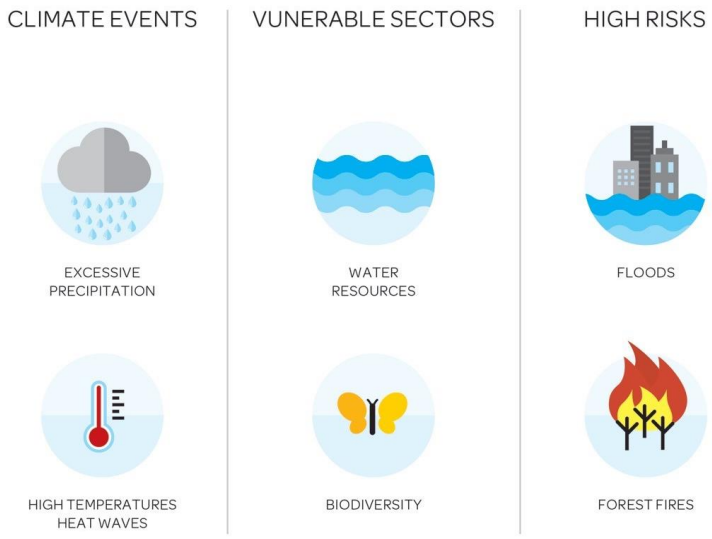


Figure 1 Main climate risks and vulnerabilities identified in Guimarães (EMAAC, CMG)

[1] **Mission Structure** can also be found in all sections and it's described in Good Practice **1**
[2] **UMinho** - University of Minho
[3] **Guimarães Sustainable Plan 2030** is described in Good Pratices **1**
[4] **Covenant of Mayors for Climate and Energy** can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | **11** | **12**

Guimarães has implemented some of these measures through integrated management of territorial planning, water resources, green areas and biodiversity.

Figure 2 First five measures (from the 28 options)

1. **Expand green infrastructures**

   - Promotion of **urban park**s and **green areas** for public use - over the last 3 years more than 27 2540.33 m^2 of public green areas were created[5] **[9]**.

   - Preserving and promoting biodiversity to increase resilience against extreme events (for example, storms or forest fires), pests and invasive species. Projects integrate scientific knowledge with community participation, like **P2GREeN**[6] **[10]**.

   - Promoting **soil permeability** , setting urban parameters to limit soil sealing, in particular by using permeable or semipermeable pavement[7] **[11]**.

   - Cleaning and restoration of water bodies without harming the ecological system, by implementing the **Special Plan for the Prevention of Floods[12]**, the **Action Plan of Ave River**[8] **[13]** and **Aquabioscape**[9] **[14]**.

   - Implementing the **Action Plan of Ave River and Vizela River** through green and blue corridors.

   - Promoting the municipal network of **social urban gardens**: practicing a sustainable agriculture in an urban context **[15]**.

[5] Description of the **Public Green Areas** can also be found in sections 1| 2 | 3 **| 4** | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[6] **P2GREeN– Protection and Promotion of the Biodiversity of Guimarães** can also be found in section 1| 2 | 3 **| 4** | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 and Good Pratice **2**
[7] **Via the Urban Master Plan**
[8] **Action Plan for Ave River** can also be found in section 1| 2 | 3 **|** 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12
[9] **AquaBioscape** is a scientific project held by Landscape Laboratory of Guimarães and funding by City Hall; it can also be found in section 1| 2 | 3 **|** 4 | **5** | 6 | 7 | 8 | **9** | 10 | 11 | 12

Figure 3 P2GREeN - Protection and Promotion of the Biodiversity of Guimarães

2. Building as infrastructural preparation for the future, thus equipping the territory with the necessary artificialization in tune with the environment - Grey infrastructures

- Incorporating climate change adaptation in the new municipal buildings: **Gymnastics Academy of Guimarães**[10]**[16]**.

- Permanently updating the Special Plan for the Prevention of Floods.

- Designing structures to improve water flow in critical areas, and expanding public rainwater drainage, as is the case of **Retain Basins**[11]**[17]**.

3. Managing the Territory - Combining green and grey infrastructures

- Reducing city temperature by increasing green areas, replacing asphalt, reducing air pollution through sustainable mobility and position construction taking wind into account.

- Creating three retention basins using natural engineering to improve and maintain the hydraulic function of Ribeira da Costa, thus solving flowing in the lower city [9]**[17]**.

4. Cooperation: Adopting non-structural measures

- Emergency systems - more efficient prevention, management and monitoring of risks:

[10] **Gymnastics Academy** can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | **11** | 12 and Good Practice **5**
[11] **Retain basins** projects can also be found in Good Practice **4**

. Special Plans for the Prevention and Adaptation to Floods and Extreme Events**[12]**

. Infrastructure of spatial data for emergency planning[12].

- H2020 "CO-creation and Climate aDAPTation in cities: "Integrating Society in Science and Innovation - An approach to co-creation"[13].

- Cooperation with Civil Society through **Guimarães mais verde commitment**[14].

Figure 4 Guimarães cooperation with - Local, Regional, National and International - Institutions

[12] Under the Operational Programme for Sustainability and Efficient Use of Resources - POSEUR
[13] City Hall applied for this call
[14]**Cooperation** is a part of Guimarães mais verde commitment and can also be found in sections 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | **12** and Good Practice **1**

5. Dissemination, communication, advocacy and **awareness-raising**, throughout:

   - PEGADAS[15] **[18]**
   - Brigadas Verdes[16] **[19]**
   - European celebrations[17] **[20]**

Figura 5 Guimarães mais verde awareness-raising actions: scouts commitment, Eco-parliament, +65, mobility, Guimarães mais floresta

2B. Past Performance

In 2015, City Hall began developing its Municipal Strategy for adaptation to Climate Change within the **ClimAdaPT.Local project**[18] **[7]**. To guide the development and implementation of this strategy, a basic methodology called **ADAM**[19], was followed. This methodology was entirely developed within the scope of the ClimAdaPT.Local project, having been specially adapted to the Portuguese reality from the model developed by the UKCIP[20].

By analysing the major needs in terms of decision-making at a municipal scale, our methodology sought to address two key issues:

[15] **PEGADAS** - Programme of Education for Environmental Sustainability for all population created by City Hall, covering 100% of schools, parishes, public institutions and associations (NGOs)
[16] **Brigadas verdes –** group of volunteers self-created to protect Guimarães Natural Heritage
[17] Sustainable European Mobility Week, Let's clean Europe, European Week for Waste reduction
[18] **ClimAdaPT.Local** - pioneering project for local adaptation to climate change which involved 26 Portuguese municipalities in the creation of Municipal Strategies for Adaptation to Climate Change can also be found in section **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[19] **ADAM** - Support for the Municipal Adaptation Decision adjusted to the Portuguese reality from the UKCIP Adaptation Wizard and whose regulation is properly described in the "Methodological Guide" for the development of the EMAAC.
[20] **UKCIP** - UK Climate Impacts Programme

1. What are the main climate risks that affect or may come to affect the municipal territory and the decisions made by City Hall?

2. What are the main adaptation actions required and available to address these climate risks?

The ADAM methodology is composed of six interrelated steps forming a cycle of strategic development.

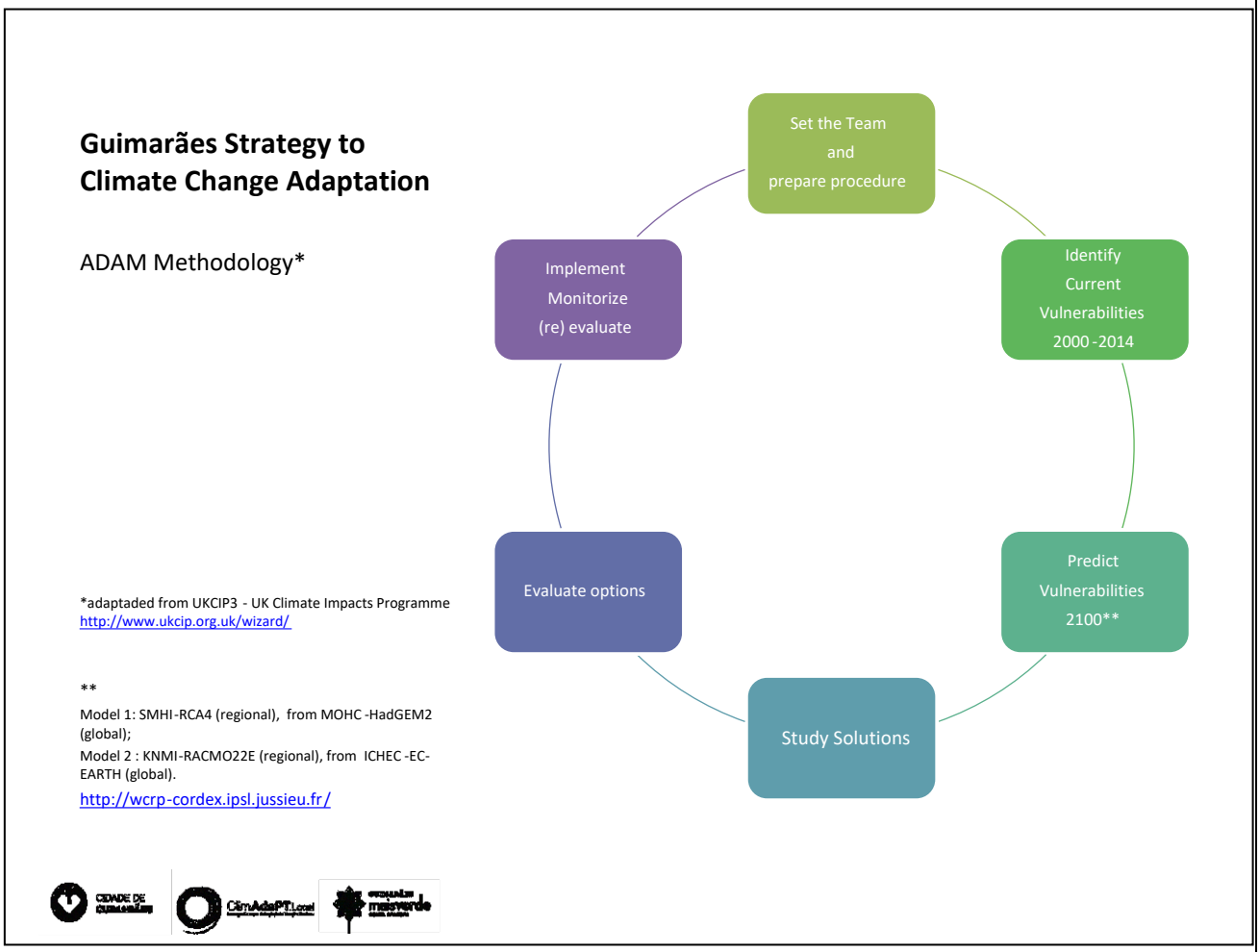


Figure 6 ADAM methodology developed under the ClimAdaPT.Local project (presented at **Resilient Cities2017**, ICLEI Bonn 2017)

The first step of the **ADAM** methodology intends to support the analysis of different aspects related to the vulnerability to the current climate in Guimarães. Therefore, a Profile of Local Climate Impacts was developed, which allowed the systematic identification of sources and gathering weather data for Guimarães between 2000 and 2014 (15 years).

The information was fed into a database that also includes the impacts and the consequences of these events, identifying critical thresholds that may have been exceeded, and the response actions of the municipality and other agents to these events and consequences (adaptive management).

To identify the main vulnerabilities and future risks associated with climate change in Guimarães, the

second step had the following main objectives:

- To better understand how climate can change through the use of projections (climate scenarios) until the end of the century;

- To identify the main climate impacts/risks associated with these projections;

- To create a basis for the identification of sectors, activities and social groups particularly vulnerable to these potential risks;

- To assess the current climate vulnerability and its future in the city buildings in terms of thermal comfort of their occupants.

Taking into account these projections of climate change and the potential impacts, the risk levels associated with these impacts and their evolution were also analysed over three time periods (present, half of the century and end of the century). Finally, the main risks (direct and indirect) were identified and prioritized, as were the potential opportunities (positive impacts) that may require a response at the level of adaptation. In order to show the evolution of risks, a risk matrix has been used for each of the periods considered.

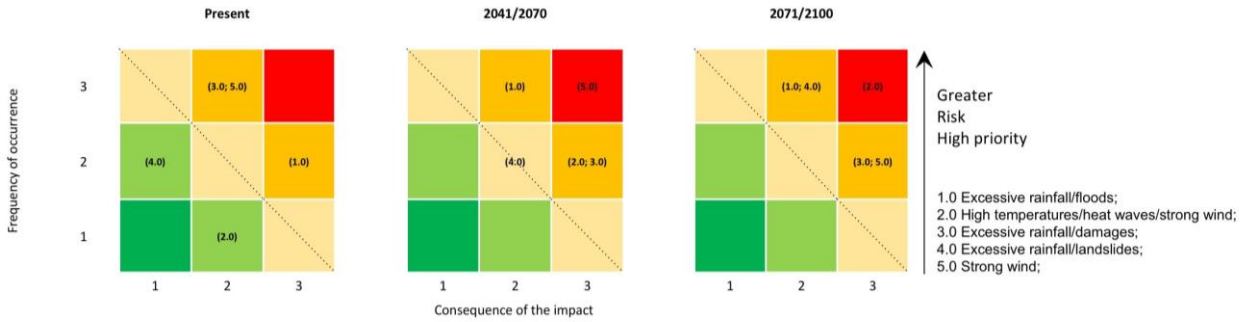


Figure 7 Matrix for Risk assessment

This risk matrix was used to support the prioritization of different climate risks, in relation to potential needs of adaptation. The priority of a particular risk was considered for its frequency and associated consequences and impacts on the municipality. A greater priority was given to the analysis and evaluation of risks that present, currently or in the future, an increased frequency and/or greater consequences.

With regard to the vulnerability of the city buildings in terms of thermal comfort of their occupants, the parishes were classified based on their climate vulnerability on a scale of 1 (slightly vulnerable) to 20 (very vulnerable).

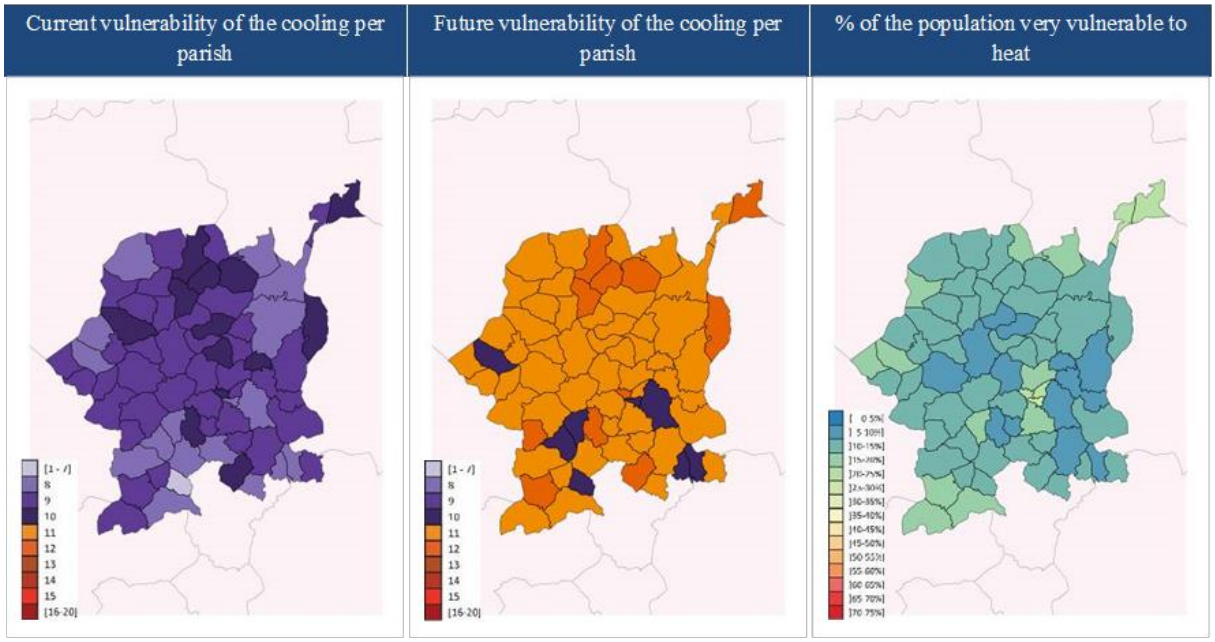


Figure 8 Thermal comfort in buildings, by parish and percentage of the population that is very vulnerable to heat[21]

The relevant adaptation options in the context of Guimarães were identified, characterized, and then evaluated in order to be included in the strategy and be discussed with local key actors.

To take into account the multiplicity and the heterogeneous nature of the different adaptation options, these were described according to the type of actions that they promote, namely:

- Grey infrastructures: physical or engineering interventions to ensure that buildings and other infrastructures are better equipped to handle all events (including extreme events);

- Green infrastructure: contribute to more resilient ecosystems and to goals such as reversing biodiversity loss, degradation of ecosystems and the restoration of the water cycles;

- Non-structural measures: correspond to the design and implementation of policies, strategies and processes.

The adaptation options identified as relevant for further evaluation were also characterized according to their scope and general objectives: The need to improve adaptive capacity and to reduce vulnerabilities and/or seizing opportunities requires developing concrete actions to reduce the sensitivity and/or the exposure of the city to the climate (current or projected) and allowing to seize opportunities that may ultimately arise.

In order to promote a structured and consistent approach in the evaluation between alternative options, a multicriteria analysis was applied using a comprehensive set of evaluation criteria. The options identified

[21] Population aged 65 years and over who resides in parishes with vulnerability equal to or greater than 10 in a future heat wave.

were evaluated against: effectiveness, efficiency, equity, flexibility, legitimacy, urgency and synergies (consistency with other strategic objectives). A supplementary process was also promoted based on the presentation of some approaches used in the economic evaluation of the adaptation options.

The entire process was based on a participatory model, in which key actors were involved in identifying and evaluating adaptation options.

Adaptation options were analysed from the perspective of planning to determine their potential integration into the municipal instruments of territorial management. Priorities as well as solutions for implementation, monitoring and review we also considered.

In 2016, the **Municipal Strategy for Adaptation to Climate Change** in Guimarães was completed, with 28 adaptation options being identified.

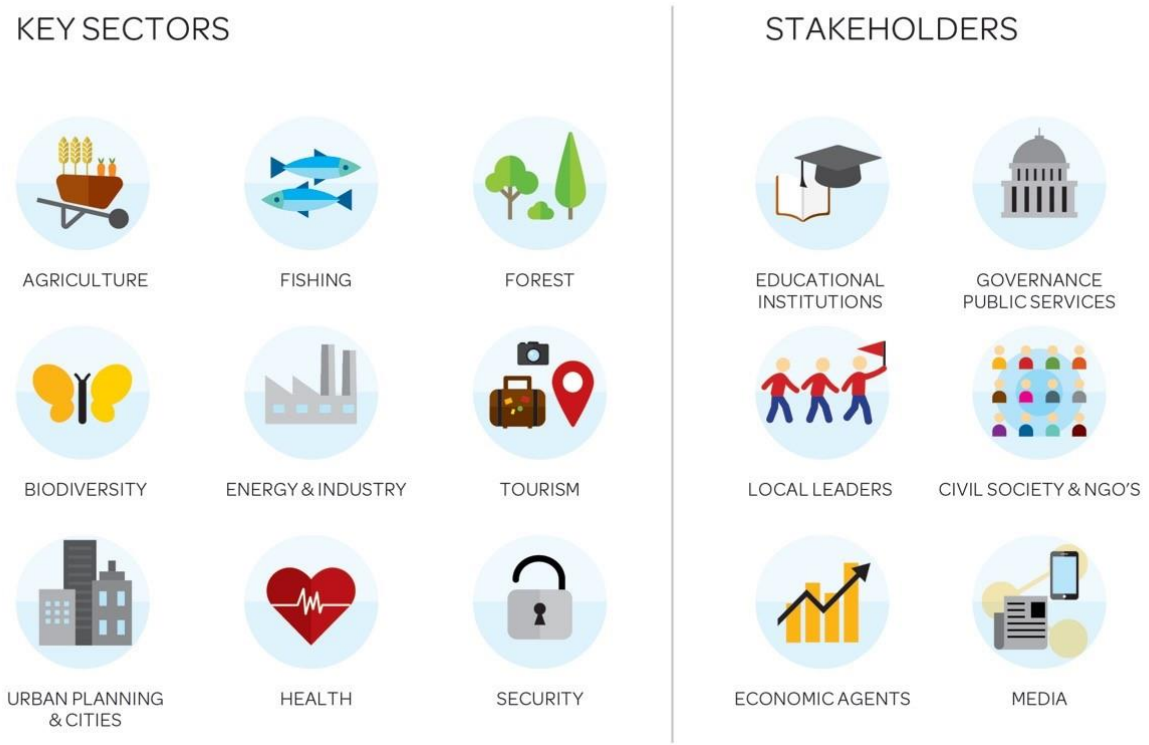


Figure 9 Municipal Strategy for Adaptation to Climate Change - Key sectors and stakeholders

In 2017, Guimarães joined the **Network of Municipalities for Adaptation to Climate Change[21]** and created the **Local Council for Monitoring Climate Change**, integrated in the **Advisory Board of the Mission Structure**[22]. The process of integrating the adaptation measures in instruments of municipal planning began.

The **Urban Master Plan[11]** (in force since 2015), is decisive in adapting to climate change. The approach to

[22] **Mission Structure** for Sustainable development of Guimarães is described in Good Pratices **1**

territorial and urban planning performed in this plan actually takes into account the effects of climate change on specific features of the municipal territory. Through the strategy defined, the organization model of the territory and its legal and operational application, the Urban Master Plan optimizes adaptation responses, avoiding forms of use, occupation and transformation of the soil that intensify the exposure to the most significant impacts, by taking advantage of the conditions of each area to provide more sustainable solutions.

Finally, through the Urban Master Plan, it is also possible to combine strategies for mitigation and adaptation to climate change, notably through the **Strategic Environmental Assessment procedure**. In fact, this procedure reveals the domains and areas of interest (by weaknesses and/or opportunities) that the plan can and should evaluate/assess, and that its implementation can decrease or optimize respectively.

Figure 10 - Implementation of adaptation measures, from Urban Master Plan (in force since 2015)

2C. Future Plans

Adaptation to climate change is already underway in Guimarães. Strengthening the strategic approach based on timely and effective adaptation measures is important, thus ensuring the consistency of several sectors and focusing on the creation of synergies with other strategic objectives of the municipality.

The measures provided in “Climate Change: Mitigation” are repeated in this form, assuming that all of the

actions that decrease vulnerability also reinforce the adaptive capacity. Some key measures are described below:

Environment Monitoring System (2018-2020) - Providing services that allow for timely access to data and reliable information concerning the environment, particularly climate change, and air, water, and acoustic quality.

Figure 11 Implementation and monitoring

Implementation and monitoring of the adaptation options for the Municipal Strategy for Adaptation to Climate Change of Guimarães (2017-2020) – should be done according to the vulnerabilities and climate risks assessment, together with the identification and evaluation of identified adaptation options.

Figure 12 Municipal Strategy for Adaptation to Climate Change of Guimarães

Implementation of a City Lab - associated with the **Integrated and Strategic Management Office,** which will address all projects and structuring or strategic decisions for the municipality and the population in a transversal and multidisciplinary manner, either for a specific time and location, or with a general and timeless scope, allowing the continuity of a participatory process of the community in structuring projects for Guimarães, thus contributing to the evolution and development.

Figure 13 Guimarães City Lab

Ecological Footprint Project of Guimarães (2018-2021) - calculation of the Ecological Footprint and Biocapacity of the city to build local knowledge and empowerment and obtain and interpret information to mitigate risks and encourage ecological services adapted to climate change.

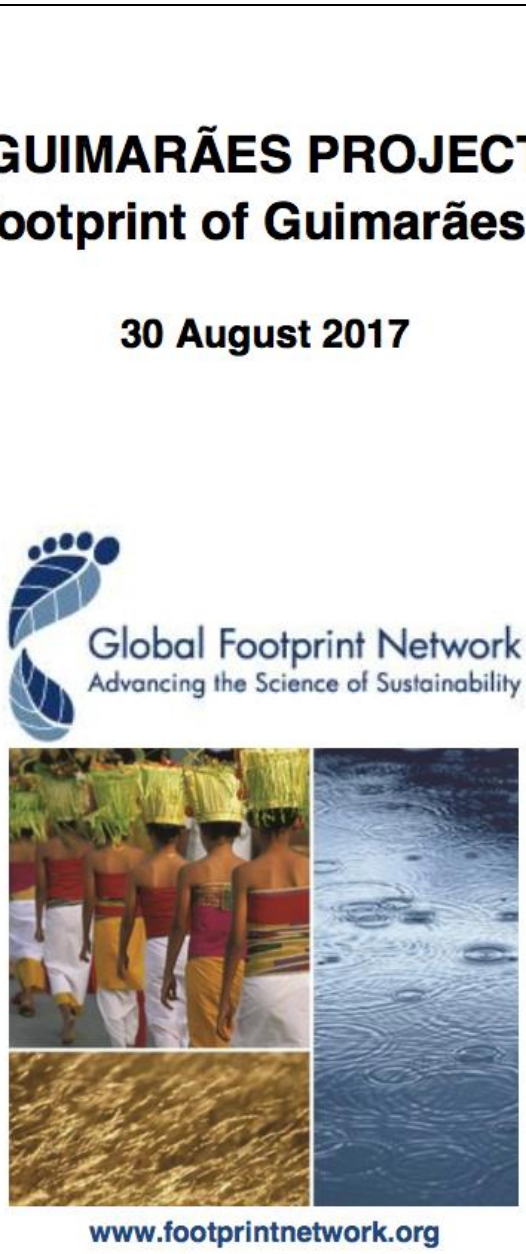


Figure 14 Guimarães Ecological Footprint and Biocapacity Calculation

Energy and Climate Agency (2018-2021) - replication of the Municipal Strategy for Adaptation to Climate Change in Guimarães in other municipalities (within the scope of the Network of Municipalities for Adaptation to Climate Change).

Creation of an Atlantic Lab for Adaptation to Climate Changes, focused on monitoring the use of soil, the green structure, air quality and CO2 emissions, integrated into the Risk AquaSoil project, as approved by Interreg Atlantic**[22].**

Municipal actions aimed at promoting adaptation in the most vulnerable sectors focused on the following

objectives:

1. Control of flood risks, through the following:

   - Assessing changes behind the main flood risk factors;

   - Changes in the methodologies and criteria for scaling infrastructure;

   - Preparing a Management and Monitoring Plan of the Risk of Flooding;

   - Strengthening the protection infrastructure against floods or assessing desirable human and other occupation in high risk areas.

2. Promote resilient forest areas through planning and management and by implementing the following:

   - Incorporating responses to potential impacts of climate change in revising or changing the Municipal Plan for Defence Against Forest Fires;

   - Strengthening the adaptation to climate change component in Municipal Plans of Territorial Planning;

   - Strengthening mechanisms and instruments necessary to improve forest management and reduction of abandonment;

   - Forest fires prevention actions, with monitoring and implementation of the Municipal Plan for Defence Against Forests Fires;

   - Incorporating a reforestation proposal selecting forest species better suited to new climate conditions within the Control Plan of Invasive Species;

   - Preparing a Management and Monitoring Plan of the Risk of Fire.

When considering the Municipal strategy for Adaptation to Climate change in Guimarães, we would like to highlight the following:

   - We optimize both models and interventions in the management water resources, particularly regarding irrigation practices (farmers) and water contamination which may have implications for public health, as our municipality is particularly affected by floods;

   - Carrying out forest surveys to assist in the development of forests and fight fires;

   - Encouraging the involvement of key actors, and engaging civil society in local policies;

   - Defining a strategy of public communication for different social and economic stakeholders, especially farmers;

   - Make use of financial support for the implementation of these Municipal Strategy for Adaptation

of Climate Change of Guimarães (operational programmes of Portugal 2020);

- Apply green tax measures (particularly in the context of mobility) that already exist at a national level;

- Strengthening and improvement of database creation through coordination with the University of Minho, the Landscape Lab, the Ave Energy Agency, ADRAVE, and other regional research centres.

For the implementation and monitoring of the Municipal Strategy for Adaptation to Climate Change in Guimarães, a series of actions were organized based on the vulnerability and climate risks assessment, with the identification and assessment of the respective adaptation options.

The actions listed correspond to priority adaptation options identified and assessed, containing information on their potential implementation including: timeline, leadership, degree of effort and potential monitoring means.

There is a Local Monitoring Council driving the necessary implementation, supervision and monitoring of the adaptation actions carried out within the framework of the Municipal Strategy for Adaptation to Climate Change of Guimarães.

Figure 15 Supervision and monitoring Climate change adaptation options

2D. References

[1] Declaration of political consensus and Declaration of individual consensus

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

c. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

[2] Covenant of Mayors for Climate and Energy
http://www.eumayors.eu/about/signatories_en.html?city_id=6639&benchmarks=4492

[3] Aalborg Charter
http://www.sustainablecities.eu/fileadmin/repository/Aalborg_Charter/Aalborg_Charter_signatories.pdf

[4] Agenda21 Local http://www.cm-guimaraes.pt/pages/118

[5] Basque Declaration http://www.sustainablecities.eu/endorsers-basquedeclaration/

[6] Paris Agreement http://expresso.sapo.pt/sociedade/2016-09-30-Portugal-ratificou-hoje-o-acordo-pelo-clima

[7] ClimAdaPT.Local http://climadapt-local.pt/

[8] Municipal Strategy Climate Change Adaptation http://www.cm-guimaraes.pt/pages/1241

[9] Guimarães Green Areas http://www.cm-guimaraes.pt/pages/411

[10] P2GREeN

a. http://www.labpaisagem.pt/ecologia/p2green/

b. http://urbact.eu/sites/default/files/339_Guimaraes_GPsummary.pdf

[11] Guimarães Urban Master Plan http://www.cm-guimaraes.pt/pages/568

[12] Special Plan for the Prevention of Floods - Digital version

[13] Action plan for Ave River http://www.cm-guimaraes.pt/uploads/writer_file/document/4706/Plano_de_Ac_a_o_-_combate_a__poluic_a_o_no_rio_ave.pdf

[14] Aquabioscape http://www.labpaisagem.pt/aquabioscape/

[15] Municipal network of community and urban gardens http://www.cm-guimaraes.pt/uploads/document/file/2794/Regulamento_Geral_Rede_Municipal_Hortas_Comunit_rias.pdf

[16] Gymnastics Academy of Guimarães https://www.youtube.com/watch?v=SLzpRjwZPwQ

[17] Retain Basins

a. http://www.cm-guimaraes.pt/frontoffice/pages/1116?news_id=2471

b. Resilient Cities ICLEI, 2017 http://resilientcities2017.iclei.org/fileadmin/sites/resilient-cities/files/Resilient_Cities_2017/Documents/RC2017_Program_Book_post_congress.pdf

c. Biosphera http://www.labpaisagem.pt/biosfera-da-rtp2-destaca-iniciativa-do-laboratorio-da-paisagem/

[18] PEGADAS

a. http://www.cm-guimaraes.pt/pages/1080

b. http://www.labpaisagem.pt/pegadas/

[19] Brigadas Verdes http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2978

[20] European celebrations

a. http://www.labpaisagem.pt/semana-europeia-da-mobilidade-arranca-sabado-guimaraes/

b. www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2706

c. www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2706

d. www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2778

e. www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2356

f. http://www.guimaraesmaisverde.pt/_semana_da_mobilidade

g. https://www.facebook.com/pg/labpaisagem/photos/?tab=album&album_id=1083859191698774

h. http://www.guimaraesmaisverde.pt/_semana_europeia_prevencao_resíduos

i. https://www.facebook.com/pg/labpaisagem/photos/?tab=album&album_id=1149810728436953

j. http://www.guimaraesmaisverde.pt/_dia_internacional_acao_pelos_rios

k. https://www.facebook.com/labpaisagem/posts/955825477835480

l. http://www.guimaraesmaisverde.pt/_festa_da_primavera

m. https://www.facebook.com/pg/labpaisagem/photos/?tab=album&album_id=1266338020117556

n. http://www.guimaraesmaisverde.pt/_guimaraes_noc_noc_2

o. https://www.facebook.com/pg/labpaisagem/photos/?tab=album&album_id=1097146587036701

p. http://www.guimaraesmaisverde.pt/_greenweek

q. https://www.facebook.com/645061308911900/photos/?tab=album&album_id=1348488285235862

r. http://www.guimaraesmaisverde.pt/_festa_do_ambiente_dia_da_crianca

s. https://www.facebook.com/pg/labpaisagem/photos/?tab=album&album_id=1339693076115383

[21] Network of Municipalities for Climate Change http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2869

[22] INTERREG Atlantic Area http://www.atlanticarea.eu/

3. Sustainable Urban Mobility

3A. Present Situation

Indicator	Data		Units	Year of Data Provided
Proportion of population living within 300 metres of an hourly (or more frequent) public transport service	51% (17.751 inhabitants)		%	2011
For all journeys under 5 km, proportion of these journeys undertaken by: i) Car; ii) Public transport; iii) Bicycle; iv) Foot; and v) Other.	Car	43%	%	2012
	Public Transport	18%		
	Cycling	0%		
	Foot	38%		
	Other	1%		
Proportion of buses operating in the city that are low emission (at least Euro V)	54%		%	2016

Source: Survey on resident population, 2012; INE 2011; Arriva, 2016

Urban Mobility strategy was defined by the **Mission Structure** for Guimarães Sustainable development[1] created in 2015.

Commitment to sustainable development is consolidated in **declarations of political** and **individual consensus[1]**, which strengthen the community involvement. Mobility patterns in the city were surveyed in 2012 through the Urban Quadrilateral study[2]. Data remains unchanged due to the lack of significant changes in land use**[2]**.

51% of the population live less than 300m away from Public Transport, with frequency under 1 hour. Individual Transport[3] accounts for 43% of trips, followed by Soft Modes[4] with 38% and journeys by Public Transport[5] with 18%[6]**[2]**.

For journeys originating in the city, IT accounts for the largest share of use with 56% (46% - driver and 10% - passenger), followed by the pedestrian mode (28%) and the PT mode (14%). The Cycling mode, included in "other", represents only 2% of the total**[2]**.

[1] The **Mission Structure** for the Sustainable Development of Guimarães was created by the City Hall in 2015, in partnership with UMinho, which is co-responsible for coordinating the application process to EGCA2020 and development of Action Plan 2015-2017 (incorporating the twelve ECG areas), implementation of which will decisively contribute to **Guimarães Sustainable Plan 2030**. This Structure is fully described in Good Practice 1

[2] **Urban Quadrilateral study** was conducted by four Municipalities: Barcelos, Braga Famalicão e Guimarães

[3] Individual Transport- IT

[4] **Soft Modes** - SM

[5] **Public Transport** - PT

[6] This information can also be found in section 1 | 2 | 3 | 4 | 5 | **6 | 7** | 8 | 9 | 10 | 11 | 12

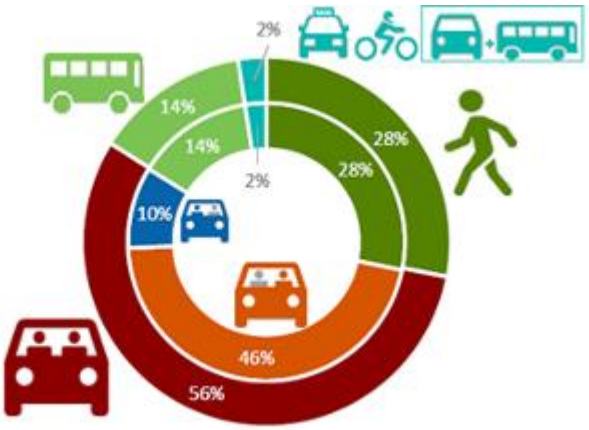


Figure 1 Modal split of Guimarães' population (from Survey on resident population, 2012)

Residents have most trips within the municipality (84%)**[2]**.

"Home-work" generates approximately 53% of the journeys. For "home-school" journeys the value is lower than expected since the surveys were conducted among resident population over 18 years of age.

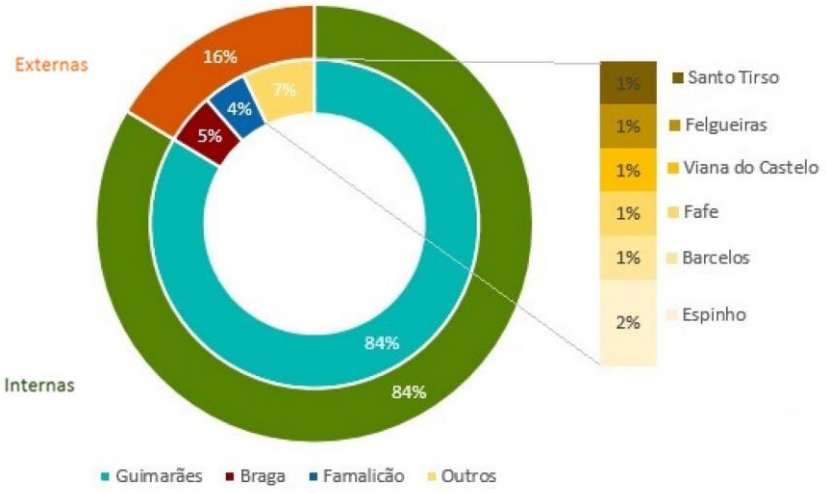


Figure 2 Destination of the trips of the residents of Guimarães
Source: Survey on resident population, 2012

Therefore, conclusions show that Guimarães will be able to improve its environmental performance by transferring journeys with less than 5 km, in IT, to SM and PT by investing into cycling tracks and PT infrastructure.

Urban transportation in the city is operated by ARRIVA**[3]**[7], with a fleet of 28 buses. Starting in 2017, 100% of these buses will be electric. 54% of buses comprising the city's urban network produce emissions below the EURO V limits.

There are two important interfaces (road and rail) near the city centre. The Bus Central Station offers non-urban PT service (express and international) and includes 34 bays.

The Guimarães Train Station is a rail terminal of the Porto-Guimarães line, serving the municipality with 4 other stations, offering urban, long distance[8] and national services[9]**[4].**

The municipal bus network has 21 lines (255.3 km), covering 27 parishes, with 500 sheltered stops.

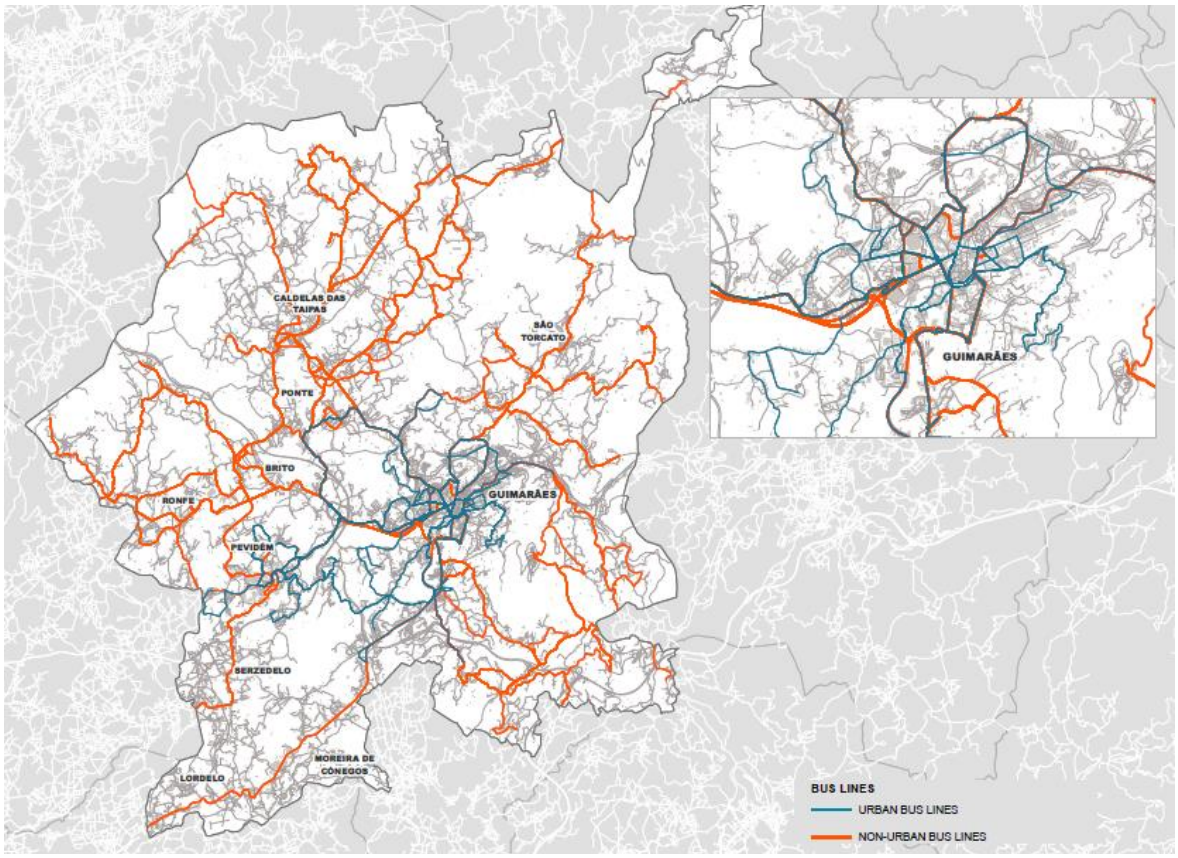


Figure 3 Roads and Bus transport infrastructure

The city line covers the entire urban perimeter, with a 30-minute frequency. Demand for this line has grown from 56 683 validations(2010) to 188 097(2014).

[7] **Arriva** is a Green destination Company
[8] Intercity services
[9] Recent fast connection by Alfa Pendular connecting Guimarães to Lisbon

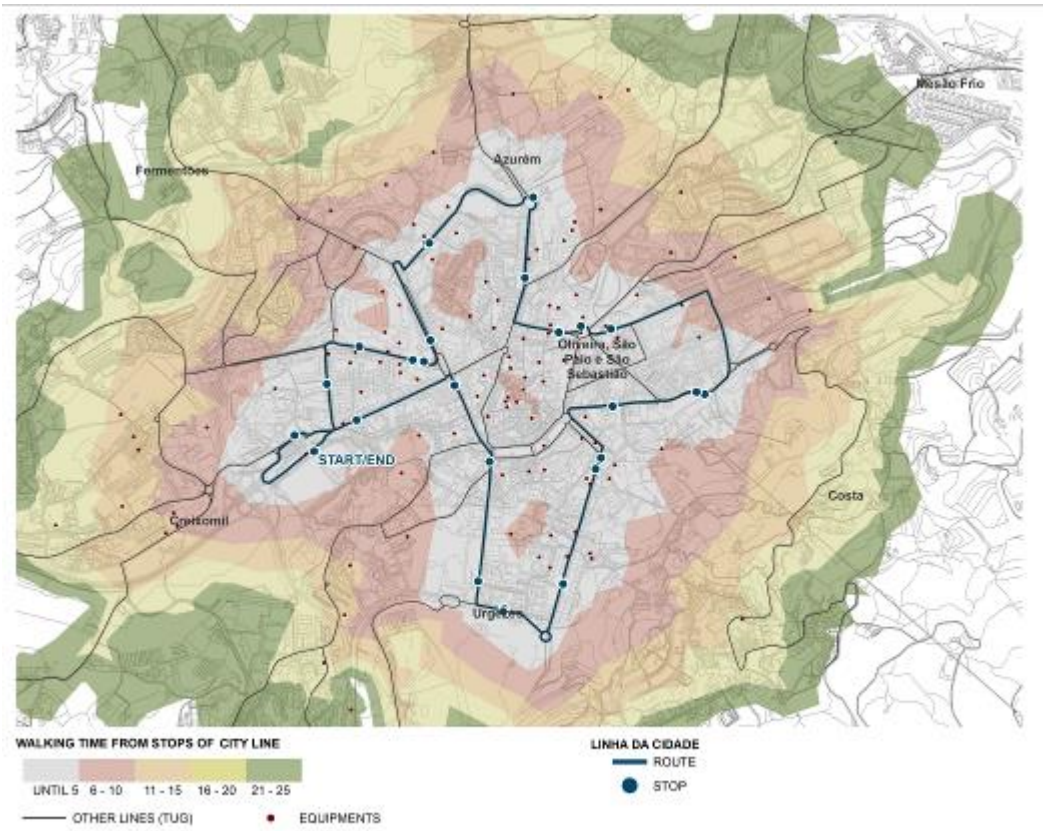


Figure 4 Bus City line

The road network has some constraints in terms of urban accessibility, resulting in congestion on main roads and some parts of the inner city, as shown in the **noise map** and **air quality chart**[10].

City Hall has launched a CarPooling platform "**Guimarães à boleia**[11]**[5]** and a Car-sharing programme with electric vehicles, **"ZENCAR"[6]**.

By sponsoring public-private relations, the City Hall is committed towards supporting private entities in the development of innovative projects[12]: **EducaBicla**[13]**[7]** was set up with a local company**[8]** to promote SM. **UBIKE[9]** is a programme for long-term bicycle rental for members of the local academic community[14].

Guimarães has installed the **first urban rapid charging point in Portugal[10]** in view of having a decarbonized transport sector[15].

[10] Noise maps and air chart can also be found in sections 1| 2 | 3 | 4 | 5 | **6 | 7** | 8 | 9 | 10 | 11 | 12
[11] **Carpooling "Guimarães à boleia"** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12
[12] City Hall supporting innovation can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12
[13] **Educabicla** is included in the Municipal Programme for Education for Sustainable development – PEGADAS and can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12 and Good Practice **2**
[14] **UBike** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

In addition, electric vehicles are exempted from parking fees until 2020 at the **18 charging points** that are part of the **Mobi.e**[16]**[11]** network.

City Hall has acquired 13 electric vehicles aiming to **converte** the 124 vehicles of **municipal fleet to electric vehicles**[17]. The PAYT' vehicles are already electric[18].

Figure 5 Electrical vehicles in public spaces

In 2017, **Local Transport Authority**, for public passenger municipal transport services, in accordance with the LFPPTS[19], established guidelines supporting governance on implementing more sustainable mobility policies in the short and long term.

Guimarães **Sustainable Urban Mobility Plan[2]** is a strategic and operational document promoting SM and PT and reducing IT, while simultaneously ensuring levels of accessibility and mobility, social inclusion, competitiveness, quality of life and preservation of historic built and environmental heritage.

3B. Past Performance

In recent years, the municipality has been integrating the best environmental practices, with the clear contribution of the **Mission Structure for Sustainable development**, established in 2015, which includes an **Operational Unit for Sustainable Mobility and Local Transportation**[20].

These Good Practices align with national and international trends, and recommend several strategic and operational measures for action and awareness in sustainable mobility. Promoting rational articulation between different modes of transport will ensure adequate mobility, the promotion of social inclusion, competitiveness, the quality of urban life and the preservation of the historical heritage of the city.

Profound changes in the restoration of public spaces and, as a consequence, changes in public attitudes and movement habits have taken place. The rehabilitation of the Historic Centre of Guimarães, classified as World Heritage by UNESCO in 2001, together with European Capital of Culture in 2012, boosted the tourism and leisure sectors. The city is unique in its cultural offerings and a growing number of visitors and residents frequent squares and plazas. Guimarães hosted the 2004 UEFA European Championship which led to the recovery of the area surrounding the municipal stadium. The improvement in public spaces means greater

[15] Within the scope of the 15/17 Action Plan
[16] **Mobi.e** is part of the Municipal Plan for the Promotion of Electric Mobility and can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12
[17] The renewal of the Municipal fleet to 100% electric vehicles had a positive impact on indicators **1| 2 |** 3 | 4 | 5 **| 6** | **7** | **8** | 9 | **10 | 11 | 12**
[18] **PAYT** is the waste system implemented in the Historical Centre and can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | 11 | 12 and Good Practice **6**
[19] **LFPPTS** – Legal Framework of the Public Passenger Transport Service
[20] **Mission Structure** is described in Good Practice section

pedestrian accessibility and better operation and efficiency of the transport system. This includes a network that is better integrated with other modes, and a more sustainable mobility pattern is evolving.

The historic centre is a functional and comfortable area and pedestrians can move safely and enjoy many amenities. Pedestrian access resulted in restrictions on vehicles (beginning in 1986 with retractable bollards on access roads) and on parking, so that movement of all parties – pedestrians, persons with reduced mobility, loading and unloading, priority vehicles – is unhampered.

Parking in the central urban area (city) of Guimarães has a balanced relation between supply and demand**[12]**. Although there is paid parking, illegal parking is common both day and night, and accounts for 30% overall. Two paid parking areas were established by the municipality in 1986, red (in the centre) and green (in the surroundings), followed by an increase of the green area in 2012 to make IT less attractive[21]. While much has changed in the last five years, parking restrictions apply only to a small part – the historic centre – of the city. But the wider municipal area is where the activities and services are concentrated and thus remains attractive for cars.

Public Transport in Guimarães lacks a diversified offer: the rail service has low municipal coverage, which is compensated by high use of the bus public transport (BUS PT). This covers approximately 86% of the population, 50% of the municipality's area, with an amplitude of service schedule which generally exceeds 18 hours in a working day, being less than 12 hours in a limited number of areas (22%) with an amplitude of less than 12 hours. The operator of the Urban BUS Transport covers the city of Guimarães and its broader surroundings, being complemented by two operators[22]. There are 852 properly identified and well maintained bus stops, although most do not have information boards.

In recent years, strategies for BUS PT improvement were based on increasing route frequency to the city centre and replacing bus fleet by less polluting vehicles with emissions below the Euro V standards (increasing from 32% to 54%).

The poor competitiveness of rail PT in relation to buses (road transport) is mainly due to: very high journey times on inter-municipal connections, only one fast service per day and per direction, Guimarães line in single track, virtually non-existent or very weak connection between rail mode and PT**[4]**. Therefore, the railway service can only be competitive if interconnected with other modes of transport, including buses, taxis among other types of PT. For these reasons, it became necessary to plan and design railway interfaces in Guimarães.

[21] This measure was conducted by VITRUS - Municipal company that is responsible for Public parking parks management

[22] Transdev and Arriva are private operators that operate in the Municipality area

Table 1 Main interventions in the interfaces of Guimarães (Atkins and W2G, 2014)

Interface	Proposed level	Main interventions
Guimarães	Higher	- Bicycle parking - Articulation with Bus Station - Improve access to BUS stops and provide related information
Covas	Intermediate	- Bicycle parking - Maintenance
Nespereira	Lower	
Pereirinhas	Lower	- Improve articulation with collective road transport, including access to BUS stops and provide related information - Bicycle parking
Cuca	Lower	- Maintenance
Lordelo	Lower	
Giesteira	Lower	- Improve articulation with collective road transport, including access to TCR stops and provide related information - Bicycle parking
Guimarães	Higher	- Articulation with railway station - Improve information system - Bicycle parking

A proposal to connect the road (Bus Central Station-ECC) and railway (Station de Guimarães) interfaces through a BUS service (shuttle), is schematically presented in Figure 1, to promote intermodality in the PT network. A new Bus line resulted from this[23].

Figure 6 Connection between the two higher level interfaces to the city (Atkins and W2G, 2014)

[23] See Figure 4 - Present Situation

Historically, industry played a fundamental role in the dynamics of mobility, and goods transport is done almost exclusively by road. Most industrial areas in the municipality are less than 30 minutes away from the main port and airport infrastructure in the northern region of Portugal. However, some industrial nodes are accessed by roads that present some degree of saturation**[12]**, which have forced the construction of high capacity roads dedicated to heavy traffic so as to reduce the impact on populations.

Special emphasis should be given to the construction of the first bicycle paths in the municipality, especially in inter and intra-municipal connections. The process was difficult and required coordinated actions in the creation of cycling tracks with special focus on the connections of the city of Guimarães with other urban areas, using previously existing channels, examples of which are the bicycle paths, totalling 12.2km distributed as follows:

- Cycling track Guimarães/Fafe (8.3km), 1st bicycle path built in 1999;
- Cycling track Taipas/Avepark (1.5km);
- Path parallel to Creixomil by-pass (1.5km);
- - Royal path (0.9km).

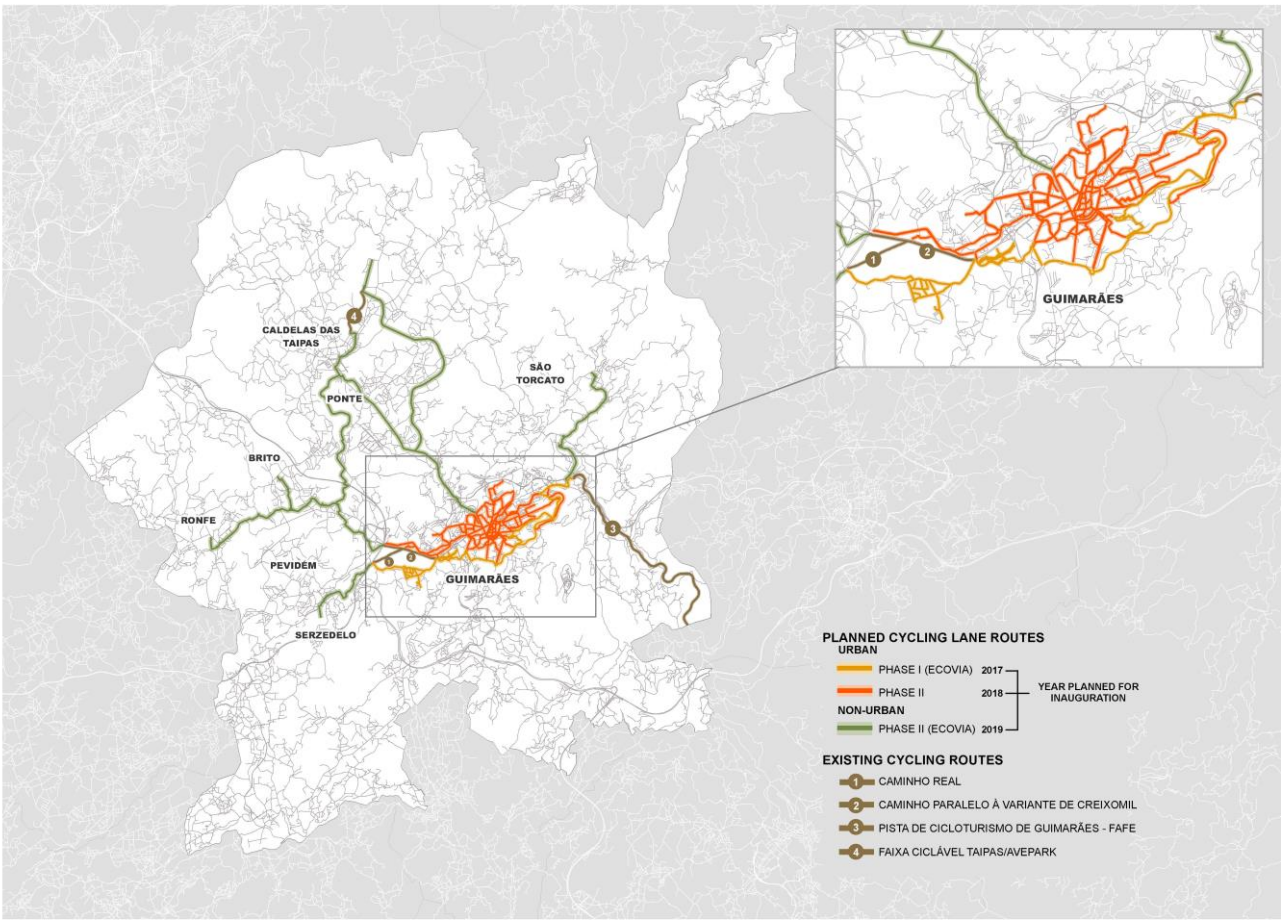


Figure 7 Guimarães, Bicycle paths (from Guimarães SUMP, 2016)

Between 2010 and 2012, Guimarães set up a pilot network for charging electric vehicles, having placed 17 charging points in the central urban area of Guimarães. A package of local incentives for electric mobility was also applied, following the Municipal Plan for the Electric Mobility of Guimarães developed within the scope of the national electric mobility programme **Mobi.e**.

Figure 8 Location of the charging stations (2010-12), 17 charging points (1 has 3 points)

It is now possible to check and compare the values of the mobility patterns (considering home-work trips) of the resident population for the parishes in the municipal area.

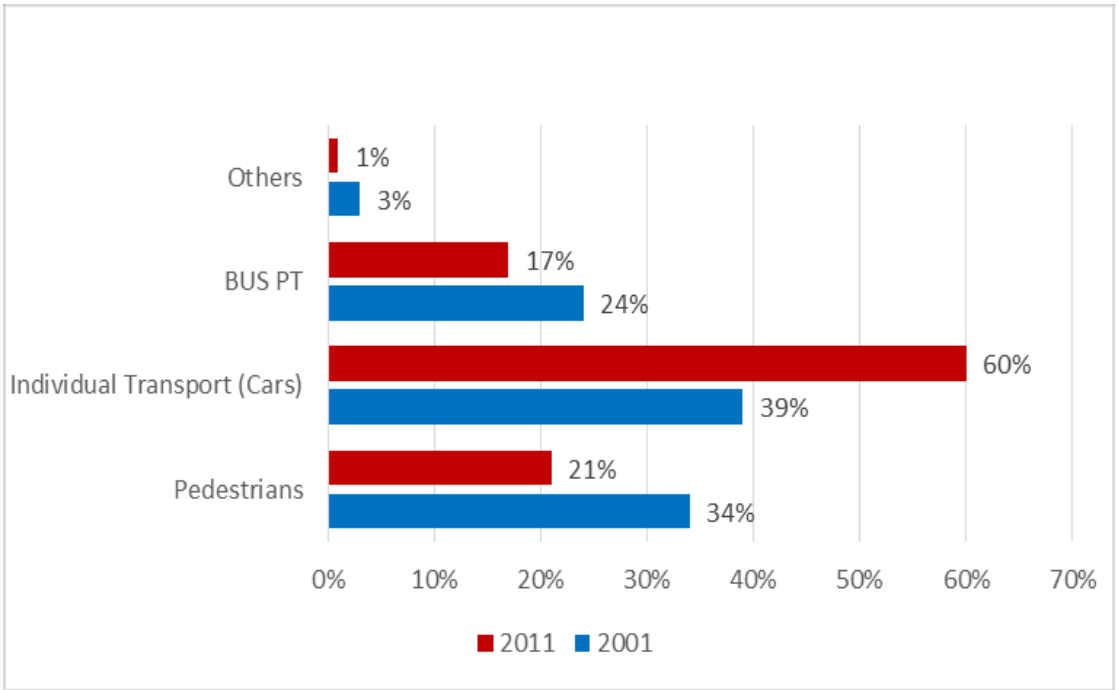


Figure 9 Modal split of commuting trips for the parishes of Guimarães

Source: INE, 2001 and 2011

Using CENSUS of 2001 and 2011, this chart compares the evolutionary process for the BUS PT, IT and pedestrian modes, showing the great evolution of the IT (39% to 60%) as compared to other modes, and a reduction of 7% and 13% for the BUS PT and the pedestrian mode, respectively. This data reveals a somewhat unsustainable evolution in the modal choice, resulting from applying municipal transportation solutions, while clearly reflecting the past performance.

Concrete plans for change include awareness-raising and training, involving the diversity of stakeholders. The underlying drivers for a new urban policy will be to complete cycling networks, integrating them into Sustainable Urban Mobility Plans and then incorporating bicycles in the urban mobility system as well as in the daily lives of citizens.

Action has already begun within the **Guimarães mais verde Commitment[1]** and **PEGADAS**[24]**[13]**. Since 2015, awareness is being accomplished in particular among the youth but also for the entire population, and since then Guimarães has actively participated in the European Mobility Week with the involvement of the whole community.

3C. Future Plans

Mobility affects the quality of life of citizens. Urban Mobility of Guimarães is based on **sustainability**

[24] **PEGADAS** – Municipal Programme of Education for Environmental Sustainability for all population created by the City Hall, covering 100% of schools, parishes, public institutions and associations (NGOs)

promotion (balance between the economic, environmental and social vectors), **quality of the urban environment** and the **territorial cohesion of the entire Municipality**.

Guimarães aims to be outstanding in the next 10 years realising the vision bellow:

I. **Promote sustainable modes of transport and integrated articulation**, as viable alternatives to individual cars;

II. **Refocus mobility on the individual**, not maximizing conditions for vehicles;

III. **Ensure universal accessibility** through public spaces, justice and social inclusion;

IV. **Ensure safety**;

V. **Humanize public space**;

VI. Create **greater balance between environmental, economic and social concerns**, reducing noise, air and visual pollution.

Within the urban centre, short journeys predominate (compact character), travel times are low (65% of the movements take less than 15 minutes, higher than the national average - 55%).

Most equipment is concentrated in the urban centre and can therefore be accessed within a short period of time, without the need to use cars. However, commuting trips made within the municipality and parishes are relatively high (72% and 34%, respectively).

Therefore, the **Integrated Environmental Management System**[25] will focus on soft modes.

First, **walking**, since it presents the lowest levels of "intrusion" in the urban environment and the highest levels of energy and environmental efficiency.

Second, **cycling mode**, where landscape allows. In addition, citizens appreciate the paradigm shift towards cycling, including the initiative of the Municipality in constructing bicycle paths. This type of infrastructure may receive considerable funding.

Third, **Public Transport**. Sustainable modes of transport will be prioritized and positively discriminated.

[25] **IEMS** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12**

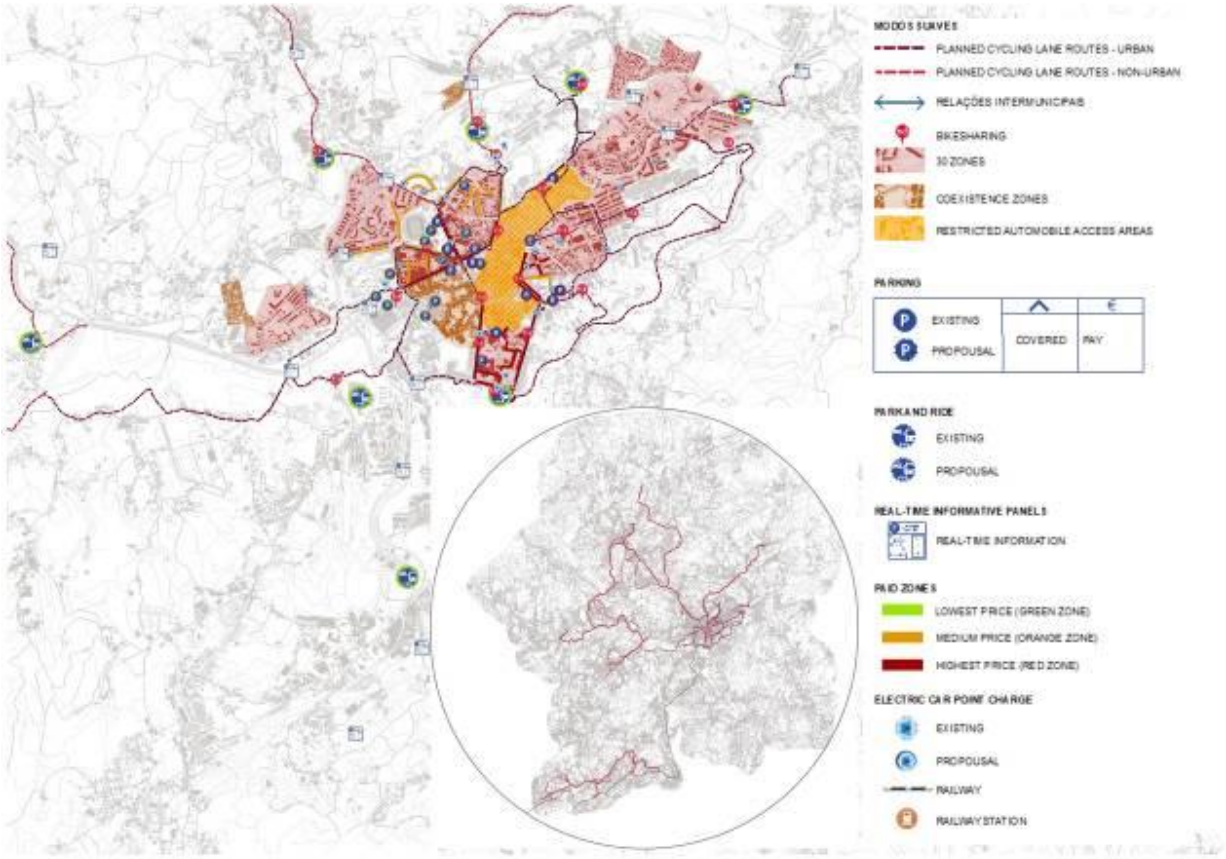


Figure 10 Sintesis of the application of the strategic and specific objectives of Guimarães SUMP

Integration

Equally important is integrating different modes of transport (intermodality) and complementarity between different modes through transport networks, so that the most suitable mode is selected for each specific journey.

Management

Nonetheless, cars usage must be rationalized and reduced. **Parking management** is a high priority tool, since it is felt directly and immediately.

Moreover, mobility and how land is used are aligned, and the reduction in distances for travelling promotes the use of sustainable modes.

Mobilization

Little will be accomplished without fully involving citizens. A global vision - the global strategy – is required, not one-off measures. Education and awareness campaigns have already begun: EDUCABICLA[26] or Teatro Bus**[14]** in PEGADAS.

Therefore, under the Guimarães SUMP, general guidelines will follow eight **Strategic Objectives:**

1. Promote pedestrian mode as the factor for policies.
2. Enhance use of bicycles to minimise use of individual transport.
3. Promote Green Public Transport thus reducing GHG emissions.
4. Promote intermodality and sustainability by integrating all means of transport.
5. Decrease motor vehicle advantages to reduce traffic.
6. Promote parking that reverses modal split.
7. Foster behavioural change encouraging the use of sustainable modes both in companies and citizens through information, communication and education.

Table 2 below presents the indicators and targets needed to achieve the strategic and specific goals of the SUMP.

Table 2 Indicators and targets for 2027 of the Guimarães SUMP

Indicator	Target for 2027
Universal accessibility	100%
Pedestrian areas (m2)	5 700 m2
Cycling network	14 km by 2019 26 km by 2027
Bicycle sharing points(n)	20
Movements below 4km by bicycle	10%
Comfort and accessible Bus stops	100%
Vehicles/1000 inhabitants	465 Vehicles/1000
Occupants per vehicle	2
Reduction of fatalities in accidents	35%
Individual motorized vehicles transferred to sustainable modes	10%
Mobilization	100%
Reduction of emissions	10%

The Intervention strategy for the next decade includes the implementation of concrete measures to achieve the goals, while respecting the objectives of the SUMP action plan.

[26] **EDUCABICLA** is described in Good Practice **3**

Table 3 Proposals of the Guimarães SUMP

THEMATIC AREAS	PROPOSALS
Soft Modes (Figure 11)	**Walking** More pedestrian routes Waiting/walking times and audible signals Increase restrictions and expand conditional access areas for vehicles **Cycling** 2nd phase of cycling path Bike-sharing system Encourage bicycles use when commuting home-work
Collective Transport	Improve stops conditions Progressive fleet replacement to more sustainable vehicles flexible system Optimize circuits Integrate information systems Check the possibility of expanding fleet of taxis Integrate the new legal framework of the public passenger transport service Schedules coordination of the collective road and railway transports Apply for financing
Road Circulation	Define a new road hierarchy with road safety plan Apply measures to slow down traffic including 30 km/h zones Draw up a circulation and signalling plan Promote carpooling system
Parking System	Create parking areas at the entrances of the urban perimeter in coordination with the collective road transport system Restrict parking in areas with restricted access for vehicles Gradually replace parking on public road by parking areas with differentiated fees Strengthen the role of limited duration parking on public roads Act on illegal parking Rreal-time information system in car parks Expand e-charging stations Resize parking areas for persons with reduced mobility
Intermodality (Figure 11)	Create a website to integrates all modes of transport Develop a free app that delivers information mobility centre Integrate bicycle in public transport Integrate a ticketing system
Logistics	Regulate loading and unloading Promote less polluting vehicles
Awareness and Education Campaign Figure 12	Give continuity to Guimarães Mais Verde commitement

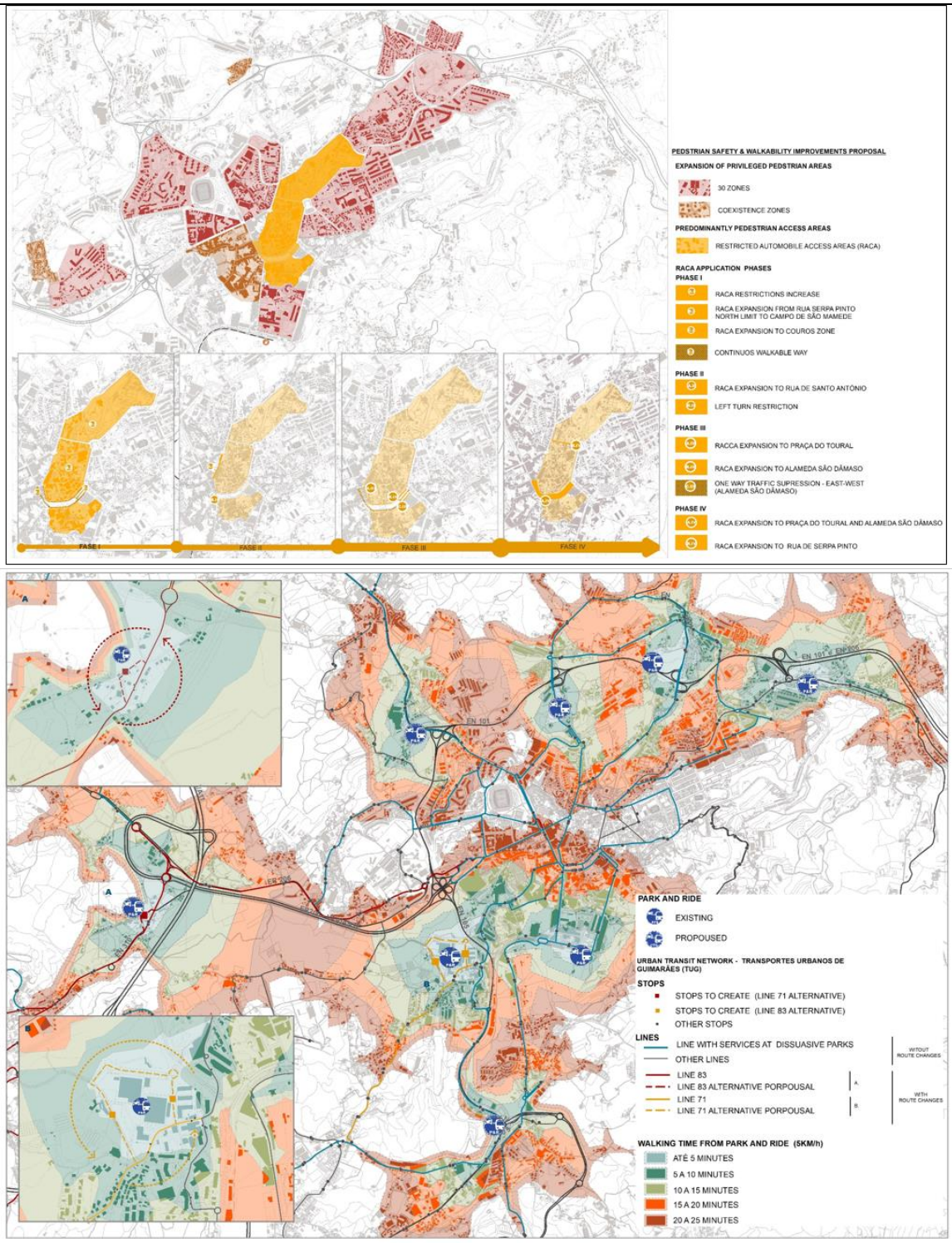


Figure 11 Proposals for interventions in the pedestrian network and, intermodality using parking areas

Figure 12 Awareness and Education Campaign for sustainable mobility

3D. References

[1] Declarations of political and individual consensus

a. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

c. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

[2] Guimarães SUMP

a. Abstract http://www.cm-guimaraes.pt/pages/1248?folder_id=1376

b. MpT (2016). **Plan for the Sustainable Urban Mobility of Guimarães** – Stage I Characterization and Diagnosis (2016)

c. MpT (2017). **Plan for the Sustainable Urban Mobility of Guimarães** – Stage 2 Intervention strategy (2017)

[3] Arriva (Green destination company) http://www.arriva.pt/

[4] CP https://www.cp.pt/passageiros/pt

[5] "Guimarães à boleia" https://guimaraes.boleia.net

[6] Car-sharing "ZENCAR" https://www.youtube.com/watch?v=jd8Xg6kczZk

[7] EducaBicla Programme to promote the use of bicycles for the municipality of Guimarães

a. http://www.educabicla.pt/

b. http://www.cm-guimaraes.pt/uploads/document/file/11195/Plano_Promocao_Bicicleta.pdf

[8] Get Green http://www.getgreen.pt/

[9] UBIKE https://www.fpguimaraes.pt/alunos-da-uminho-um-novo-transporte-dispor/

[10] Rapid charging station http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2907

[11] Municipal Plan for Electric Mobility of the municipality of Guimarães 2010-15 http://www.cm-guimaraes.pt/pages/991?news_id=784

[12] Atkins and Way2Go (2014) STUDY ON INTEGRATED MOBILITY. Report 3 - Strategic report - Part 2 - **Specificities of municipalities**. Association of municipalities of specific purposes Urban quadrilateral

a. Atkins and Way2Go (2014-a) **STUDY ON INTEGRATED MOBILITY**. Summary report. Association of municipalities of specific purposes Urban quadrilateral

b. Atkins and Way2Go (2014-b) **STUDY ON INTEGRATED MOBILITY**. Report 3 - Strategic report - Part I - Strategical guidance. Association of municipalities of specific purposes Urban quadrilateral

[13] PEGADAS

a. http://www.cm-guimaraes.pt/pages/1080

b. http://www.labpaisagem.pt/pegadas/

[14] Teatro Bus https://www.youtube.com/watch?v=3H7KTTfnIt8

4. Sustainable Land Use

4A. Present Situation

Land use within the city (this will provide important background information on the character of the city and is not an evaluation criterion itself)				
Land Use Data	**Inner City**	**Overall City**	**Unit**	**Year of Data Provided**
Public Green Area	8.51	0.44	%	2007 - 2014
Private Green Area	8.66	39.3		
(Urban) Agricultural Land	18.53	22.61		
Blue	0.17	0.36		
Residential	41.81	17.13		
Industrial/Economic	6.93	2.88		
Mixed*	4.69	7.16		
Brownfield**	0	0.02		
Other***	10.67	9.85		
Total	**100**	**100**		
Population Data	**Inner City**	**Overall City**	**Unit**	**Year of Data Provided**
Population density in built-up areas (city area minus green and blue)	45.82	6.89	Inhabitants per ha	2011
Population density (inhabitants per hectare) for new developments	n.a	n.a	Inhabitants per ha	
Percentage of people living within 300 m of green urban areas of any size	89.4	60.5	%	2011
Percentage of people living within 300 m of green urban areas of >5000 m^2	76.8	21.6	%	2011

Important Remarks in footnote[1]

[1] forest areas were included in the "Private Green Areas".
agricultural areas were included in the "(urban) agricultural land" class
"Industrial/Economic" class includes industrial areas, quarries, commercial areas, cultural and historic areas, and public and private equipment
"mixed" class includes the SAF and Cultural systems and complex plots areas
"residential" class includes the urban industries
"other" means a group of areas that do not have a dominant use, either natural or artificial
the municipality does not have the category "population density for new developments"

Guimarães results from dynamic land appropriation, deeply rooted upon the combination of being able to reinvent itself through the centuries and to surmount developmental challenges, aiming always to respect the environment by conserving agricultural fields, forest areas or water resources.

It is precisely this versatile, multifaceted, and yet continuous occupation that has, historically, blended the natural and built elements that identifies Guimarães as unique in nurturing an intrinsic biocultural diversity together with a human occupation and the appropriate transformation of natural assets.

The ability to benefit from nature, making this integral to daily lives, combined with the co-construction of cultural heritage and appreciation of the common good, pervades the whole history of Guimarães. Today, this combination makes it possible for the city to offer the world an exemplar extensive sutainable area that comprises land and soil as a mosaic of green and blue areas - parks, water line corridors and fields – that define city life.

Guimarães has been shaped by its history and traditional land usage. While green and blue urban public areas occupy only 436ha (1.81% of total Municipal Area[2]), the situation in the inner city is, unusually, very different: the figure increases to 9.97% (Table I and Figure 1).

We also, however, have areas that are not dominated by single usage. Despite showing some degree of artificialization, these localities have great environmental potential and we envision their natural features as ultimately contributing to a creative, distinctive and unique means of strengthening land quality and sustainability.

These multiusage areas have gradually and progressively become truly regenerated green areas, returned to public enjoyoment – like the leisure park of Ínsua, Selho**[1]** and part of the Meadow of Creixomil**[2].**

Therefore, we emphasise a structural component of the municipal vision: combining the natural and the man-made, using land sustainably for human well-being, regenerating sites (such as industrial areas) for public use, planning for more permeable soils, enhancing afforestation, rehabilitating rivers and banks. Current examples includes the recovery of the Couros quarter and its surroundings, as well as the land around the Landscape Lab.

The relationship between the population and green and blue areas is 27.59 m^2/inhab in the wider city, and 32.63 m^2/inhab in the inner city.

Table 1 Distribution of soil use in the municipality of Guimarães (COS'2010)

	Municipality		Urban Perimeter	
Soil Use	**km^2**	**%**	**km^2**	**%**
Artificialized Territories	60.48	25.10	10.32	61.57
Agricultural and Agroforestry Areas	71.63	29.73	4.01	23.93
Forests and natural and semi-natural environments	108.06	44.84	2.43	14.49
Bodies of Water	0.79	0.33	0	0
Total	**240.96**	**100**	**16.77**	**100**

[2] **Municipal Area**: MA

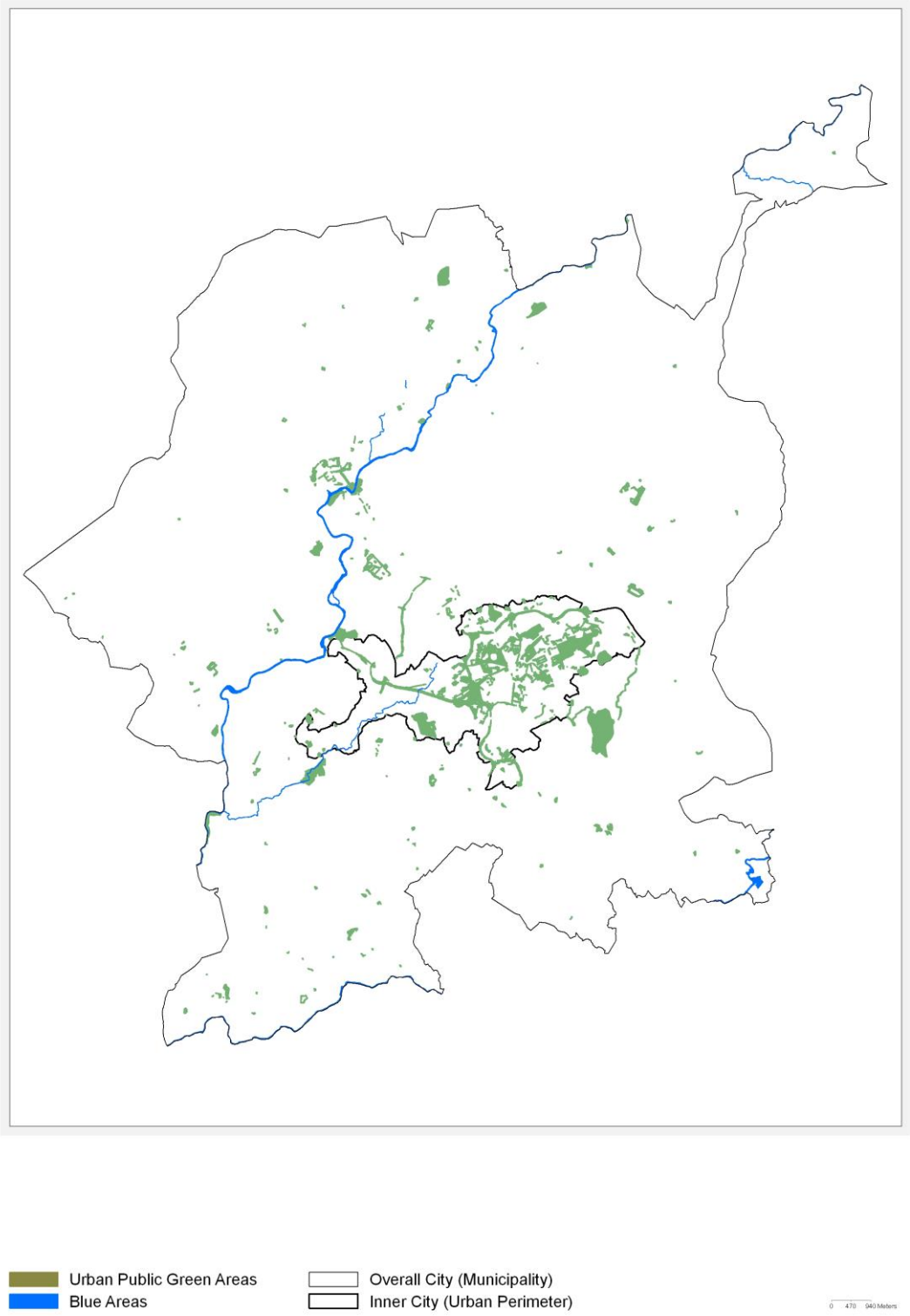


Figure 1 Soil use in Guimarães (based on the Land Use Map, 2010. Source: IGP, 2010)

Adding private urban green areas and forest green areas, the total rises to 33.4% (overall city) or close to 15% (inner city), respectively.

In terms of availability of green and blue areas near constructed and residential environments (Table 2), the percentage population living within a 300m radius from those larger than 5000m^2 is 21.6% for the wider city. However, for the inner city it is 76.8%, reflecting the higher density of urban public green and blue areas in the most urbanized part of the MA. Due to our mosaic of biocultural history[3], and considering all types and dimensions of green and blue areas, the proportion living within a 300m radius increases significantly to 60.5% in the case of the MA, and 89.4% for the inner city.

Table 2 Relationship between the Population and the green and blue areas

	Green and Blue Areas >5000 m^2			**All Green and Blue Areas**		
	Resident Population	Resident Population at 300m	%	Resident Population	Resident Population at 300m	%
Wider city	158108	57705.6	**21.6**	158108	95592.1	**60.5**
Inner city	47564	36507.0	**76.8**	47564	42508.3	**89.4**

Since the early 1900s, Guimaraes has been working to regain the desired balance between natural and artificial environments. Actions have included revising the urban master plan, creating urban parks, and recovering centralities of villages in the wider area. The major goals have been to create clusters for residential areas[4], to provide an articulated network of green public areas, and create awareness of soil **permeability**, **afforestation**[5] and **recovering water lines**[6].

[3] Described in City context

[4] This measure contributes to avoid the dispersion of our municipal area that could lead to a wasteful use of soil

[5] Measures for **Afforestation** can also be found in section 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | 10 | 11 | 12

[6] Measures for Water lines **Recovering** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12

Figure 2 Leisure parks with sports and entertainment equipment

In addition, there are actions to recover agricultural meadows, particulary **Creixomil**[7]**,** developing an innovative programme to link private farming with public parks, roads, pedagogical gardens and community equipment (with a global area far greater than 300 ha).

[7] **Meadow of Creixomil** and **Social and Pedagogical Garden** can also be found in section 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | **10** | 11 | 12

Figure 3 Social and Pedagogical garden

The exercise is to use what were previously regarded as an 'urban void' that separated clusters as connectors of these communities, with direct public use while maintaining environmental quality.

Significant green areas include **Penha Mountain**[8] (60ha, for recovering native species, replenishing soil and allowing intensive public use), and the important **city park[3]** (9.70 ha). In addition, there is **Ponte Park** and **Taipas Park[4]** (over 10ha along Ave River), **the sports city park[5]** (15ha) and the **stadium park[6]** (5ha). Green areas have increased and more are planned for the future.

Moreover, in the central areas of the main clusters urban planning has included green areas for public use.

An extremelly important aspect is the **Integrated Requalification of Ave Valley System**[9]**[7],** an essential and pioneering infrastructure.

As of 2010, interventions were designed to use green areas sustainably, identifying them as distinctly Guimarães by reflecting its polycentric matrix of different urban clusters via linked green corridors (large linear wood formations), grey corridors (road connections) and blue corridors (water lines).

The tool for this vision has been the all-important **Master Plan [8].** Areas for construction have been reduced by 26.1%, and green areas concomitantly increased. Building restrictions are in place with regard to soil sealing so that land will remain permeable.

[8] **Penha Mountain** can also be found in section 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | 10 | 11 | 12

[9] **Integrated Requalification of Ave Valley System (SIDVA in Portuguese)** comprises 126 km of collectors and two wastewater treatment plants. Full description can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12

Table 3 Uses provided for in the Urban Master Plan

	Variation between previous Plan/Plan in force (%)
NER[10]	30.8
NAR[11]	26.7
Forest areas	32.5
Construction areas	**26.1**
Equipment areas	1.5
Industrial areas	2.6
Green areas	0.9

Vital to the Master Plan is the **Municipal Ecological Structure**[12], which aims at "the integration of the ecological and environmental systems in the construction of the MA, thus ensuring the continuity and co-operation among them". It also limits construction in many ways to favour environmental recovery and sustainability. Also central are the studies that recognise the clusters of Guimarães and its polycentricity.

There is a **Municipal Defense Plan for Forest Fire** [13]**[9]**, a fundamental defence of green areas, not only in terms of firefighting, but prevention, cleaning, tree handling and limitation of construction in vulnerable areas. Public use is critical and there is a programme for new parks and collective use areas, some structured and others for more casual use. Today, these parks cover over 16ha.

As a part of the **P2GREeN programme**[14]**[10]**, several walking paths have been developed, particularly in the Penha area.

We highlight the following measures to encourage community connectivity through green and blue areas:

1. An **Action plan for the Ave River**[15]**[11]** aiming at cleaning it completely, restoring clear water and long-lost flora and fauna.

2. Recovering **river banks** for public use and environmental continuity;

3. Developing a **water line characterisation plan** to provide improve knowledge of the main water sources and enable consolidated and appropriate action;

4. Constructing **retain basins**[16]**[12]**, to regulate the Couros River that crosses the main urban cluster so that the flow is stabilised, banks treated and re-naturalized;

5. Developing **Guimarães mais floresta** [17]**[13]**;

[10] **NER** - National Classification for Ecological Reseve
[11] **NAR** – National Classification for Agricultural Reserve
[12] **Municipal Ecological Structure** can also be found in section 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[13] **Municipal Plan of Defence of the Forests Against Fires** can also be found in sections 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12**
[14] **P2GREeN** programme is described in Good Pratice **2**
[15] **Integrated Requalification of Ave Valley System** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12
[16] **Retain basins** can also be found in section 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 and Good Practice **4**

6. Encouraging **Brigadas verdes**[18] **[14]**.

Citizens regard these actions very favourably and the future seems bright for a greener Guimarães.

4B. Past Performance

Guimarães is an unusual city, characterized by a mix of urban and rural areas. There is green nature, blue water, and grey construction, resulting in a territorial mosaic that is diverse, unique and rich. Quality of life is high, and also healthy. The type of land occupation has always allowed for the coexistence of different uses and the blending of the natural and built environment. Daily life is close to the green and blue elements and this is valued by citizens who recognise this as unique.

By virtue of its topography and hydrography, valleys have been used for cultivation, mountains for protected forests and intermediate areas for urbanization and construction. Throughout history, Guimarães has reflected its environmental history with forest, cultivation and human livelihoods blending into a whole. Divided into public and private spaces, the public accessible and freely used, the private with limited access to the public.

As the population has expanded with urban densification, private green spaces have proliferated at the expense of public. The historically clear physical organisation between green and urban has diminished and the natural connections between the major urban clusters have become less visible. But these are fundamental to what makes Guimaraes the exceptional city that it is, and are responsible for the polycentric mosaic that has come into being. The long-term aim is to restore the corridors leading from one part of the city to the next and to connect neighbourhoods through green areas that meander through urban agglomerations.

In 2007, 25% of municipal land was artificialized (which, subtracting the major urban cluster, has led to a more pronounced diffuse occupation), while agricultural use was 30% of occupied land and the remaining 45% being forests and woodlands (Table 4 and Figure 4).

Table 4 Distribution of soil use in the municipality of Guimarães (COS'2007)

	Municipality		**Urban Perimeter**	
Soil Use	**km²**	**%**	**km²**	**%**
Artificialized Territories	60.36	25.05	10.99	65.55
Agricultural and Agroforestry Areas	72.90	30.25	3.84	22.90
Forests and natural and semi-natural environments	106.91	44.37	1.94	11.55
Bodies of Water	0.79	0.33	0	0
Total	**240.96**	**100**	**16.77**	**100**

[17] **Guimarães mais Floresta** aiming to plant 15 000 trees - mostly by school children - by the end of 2017; is integrated in **P2GREeN** and described in Good Practice **2**

[18] **Brigadas verdes** groups of volunteers aiming at promote environmental awareness like cleaning and maintaining the rivers and riverbanks, walking paths and forest areas. It can also be found in sections **1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12**

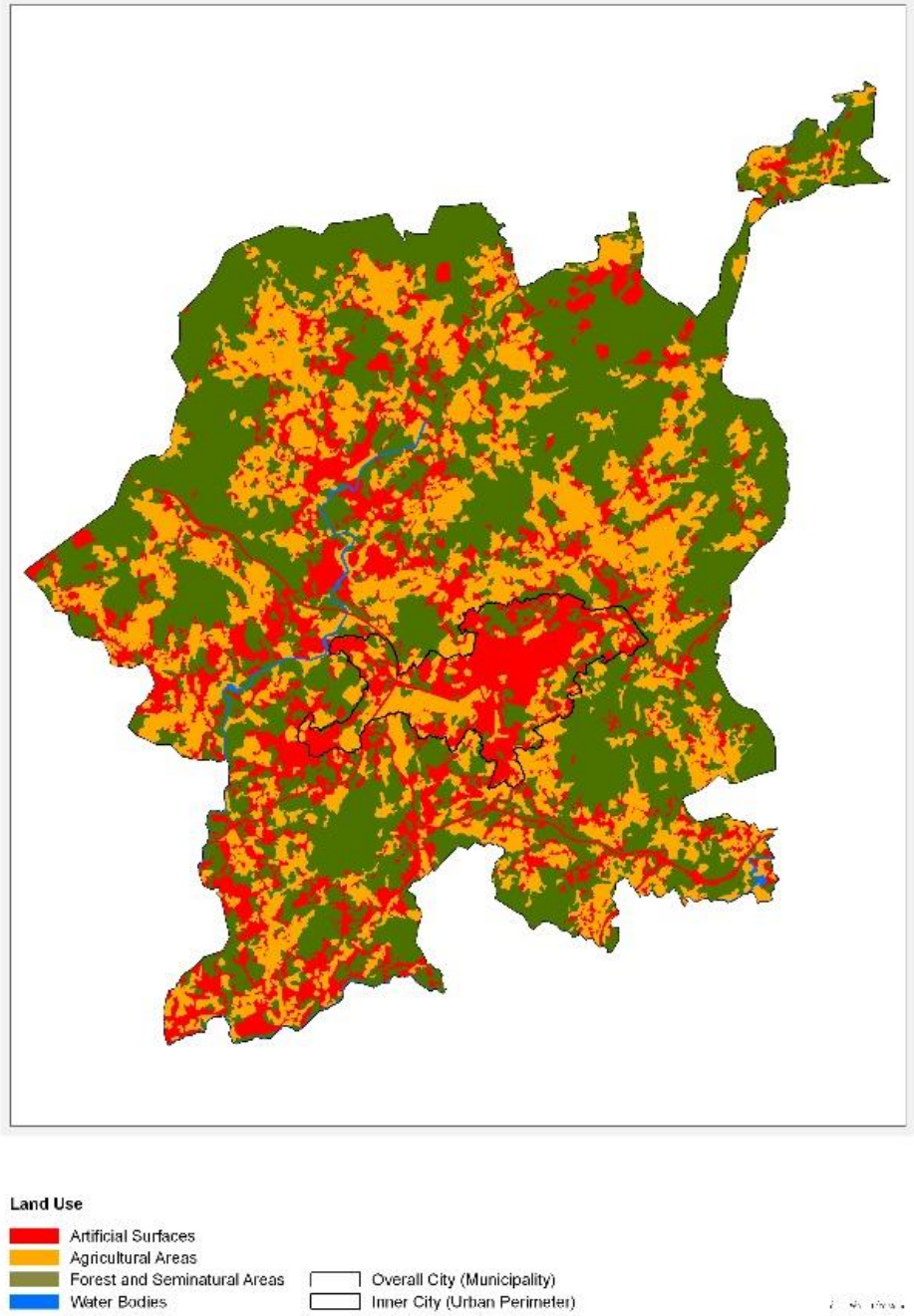


Figure 4 Soil use in Guimarães (based on the Land Use Map, 2010. Source: IGP, 2010)

Over the years, this led to a Municipal area where the visibility and the perimeters of substantial green areas were lost or diluted, and where the importance of the green component of the Municipal area became blurred either because of diffuse occupation (not always supported by capable urban infrastructures), or disorganised cultivation and afforestation.

Moreover, cultivation – and agriculture generally – lost its place the primary economic activity. Many fields, so productive in the past, were abandoned, others were artificialized and urbanisation was relentless. In

addition, invasive vegetation was not curbed, and intensive afforestation of specific species harmful to the soil – particularly Eucalypts – was promoted.

Nontheless, pockets of naturalness were preserved and conservation management took place. Of these, the largest and most important is Penha. This is a place for contemplation, where the local landscape can be appreciated and valued, and where spiritual and religious meditation is encouraged. But most significantly, Penha is a very important source of fresh water and soil and forest resources, as well as invaluable biological and environmental wealth. With the loss of the larger agricultural meadows, the lack of public green spaces, free of conditions for enjoyment, demonstrated that the landscape of Guimaraes was losing its traditional character. Historically, as mentioned, valleys were for agriculture, the uplands for forests and hillsides for human settlement. For citizens, there was a disconnect between their enjoyment of green areas and their working lives and the differences between the main administrative cluster (inner city), and the wider municipal area became ever greater. This resulted in a loss of the landscape that made Guimarães unique and distinctive.

Nonetheless, there was some action to restore this humanised landscape and insert public green spaces into the city planning. Initiatives were both public and private and green spaces increased in number and grew larger. Once green space is lost it is very hard to recover, and Guimaraes has an important and proud record of doing so.

One example is Sports City Park. It is a green area of 15ha that is part of the National Ecological Reserve and National Agricultural Reserve lands. It has an extensive lawn area and is well treed. There is also a swimming pool complex and the Gémeos Castro sports complex and other amenities for leisure, including playgrounds, and sport**[15]**.

Figure 5 Sports City Park

Another highly relevant green area is located in the very heart of the inner city. This is City Park, built between 2004 and 2005, the largest green space in the urban perimeter of Guimarães, occupying about 9.7 ha (97 352 m²)**[3].** It represents a fundamental element of the urban green structure, integrating and maintaining elements of the agricultural function which was previously dominant in that area: maize fields, meadows and vineyards, but now joined by features to encourage recreation, leisure and environmental recovery. Planning has been exceptional.

The various hubs and tree alignments represent the structuring elements of the Park, being fundamental to its visual context, shading, air purification and environmental amenity. The Park includes a pedestrian path and a track for bicycles, a children's playground, an area suitable for different types of recreation, as well as other support equipment. It is both extremely popular and very important.

Figure 6 City Park

As already alluded to, another green space of inestimable environmental value is Penha Mountain, particularly that part belonging to the Irmandade da Penha[19]**[16].** In recent decades this has been the focus of interventions to recover its landscape potential and biodiversity, as well as to provide infrastructures and support equipment designed for so that the space can be enjoyed to the full.

[19] **Irmandade da Penha** - group of local individualities which, since 1867 assumes the responsibility of preserving and promoting the natural and religious heritage of Penha.

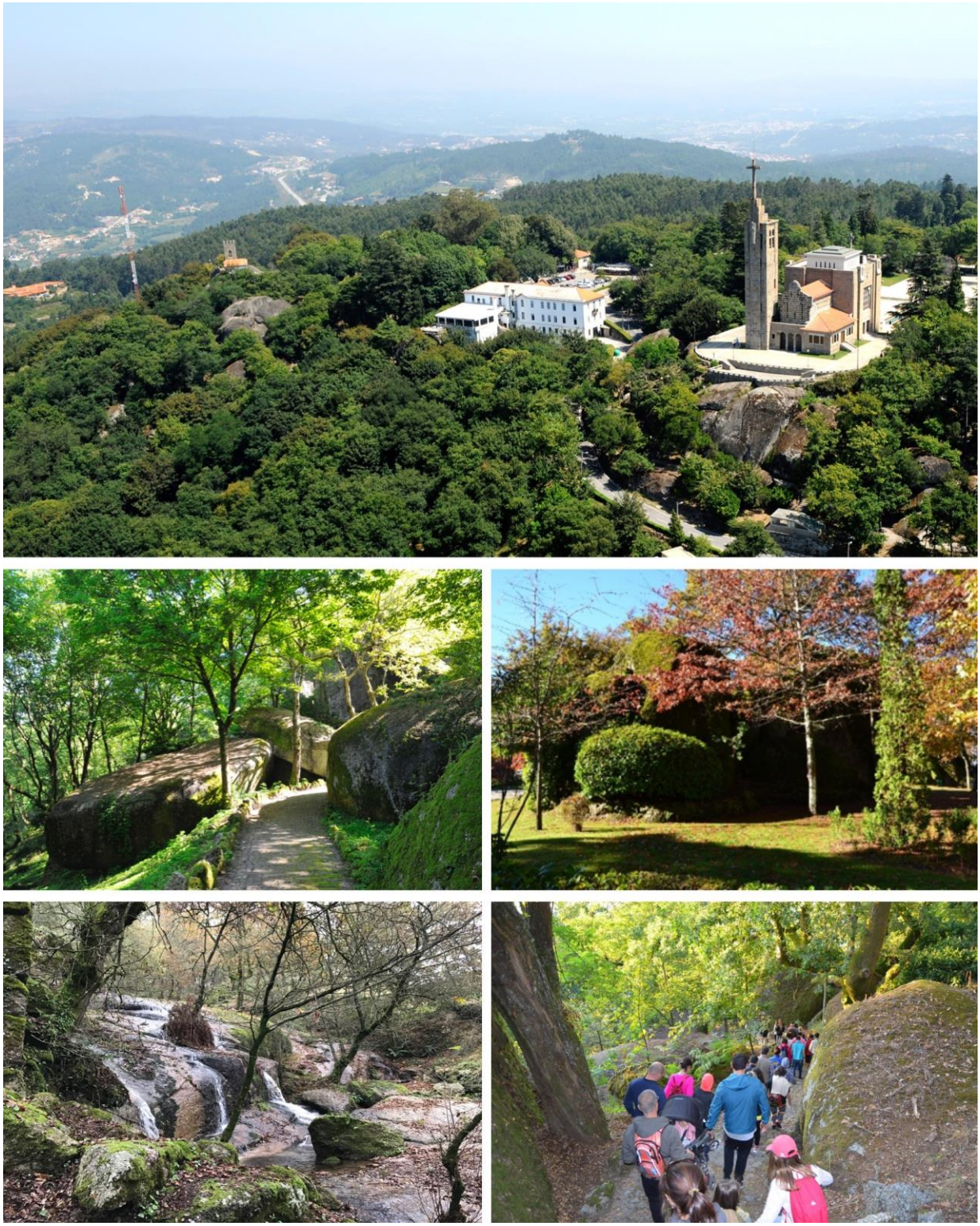


Figure 7 Landscape of the Penha Mountain

4C. Future Plans

1. Through **Integrated Environmental Management System** and Territorial management [20], many actions are in train to contribute to sustainable development.

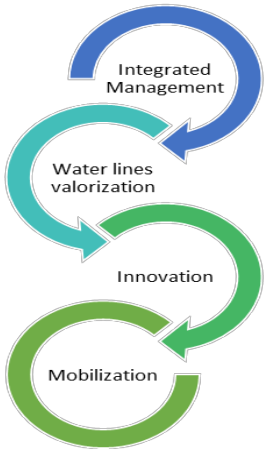


Figure 8 Key areas for land management

Integrated Planning

The **Urban Master Plan of Guimarães** will intervene in the "protection and recovery of the territory's environment and landscape, thus promoting its physical stability and ecological sustainability".

The area of urban soil will be replenished through control and limitation of soil sealing. Green areas will be substantially increased through the **Municipal Ecological Structure**, by safeguarding biodiversity, strengthening and recovering the green component and rivers.

Already in the early stages of implementation, there is a comprehensive set of operationalized initiatives to attain this goal.

Together with MES's implementation strategy and promoting mobility[21] **[17]** (through pedestrianism and cycling), a network of bicycle paths is being designed to connect all the villages in the municipality. The Action Plan for the Promotion of Cycling aims to "raise awareness, educate and train" people to cycle. The first stage of the Eco-path began in March 2017. It will be 9.3km long and connect the existing Mesão Frio Cycling Track to the City Park and Creixomil, including paths on the hillside of Mesão Frio, in the former railway track that connects the roundabout of Avenida D. João IV, on Rua das Eiras, on Caminho Real to the viaduct of Creixomil By-pass.

The second stage will connect the villages of Brito, Ronfe, Pevidém and Caldas das Taipas Park. This will be implemented by 2020 and the fundamental structure of the network of cycling tracks will then be in place.

[20] The knowledge comes from the partnership of CMG with UM, through the Mission Structure for the sustainable development of the MA, formed in 2015

[21] **Sustainable Mobility Urban Plan** can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

Recovery of water lines

The city will also develop a set of integrated interventions to recover water lines, thus meeting the climate change adaptation strategy presented by Guimarães in 2016.

In this context, there will be:

- a programme to analyse current situation, intervention and preservation measures, how best to intervene and monitor;

- municipal technicians will be trained;

- a manual of good practices will be provided to riverside owners as well as information brochures and booklets;

- explanatory public sessions.

Innovation in territory management

The geographical situation of Guimaraes is favourable as it is better watered and sheltered than the more arid regions of continental Portugal. The Ave basin is extremely rich in resouces, temperatures are moderate and rainfall relatively high. Guimarães itself has agricultural potential that needs to be realised. There is more than 4 000ha (of SAU[22]) of arable land and permanent crops could flourish that are economically viable and use soil sustainably. The underutilization of agricultural land is an opportunity to generate local economies and shared resources that are both efficient and well suited for rural-based entrepreneurial initiatives. The Strategic Model promoting such entrepreneurship in Guimarães is expressed in its Vision: **Guimarães wants to assert itself as territory of reference in the good use of Agricultural and Forest land**, promoting qualified and creative entrepreneurship related to farming and forestry, recovering and improving the rural landscape, using a fundamental tool of access to land, a l**and bank and stock** to counter their abandonment and improve biocapacity.

The **Rural Based Incubator**[23] emerged from this initiative**[18].**

Figure 9 Rural Based Incubator of Guimarães

[22] **SAU** Superfície Agrícola Utilizável means Utilised Agricultural Area
[23] **Rural Based Incubator** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

This is an **incubation and qualification, training and capacity building programme for rural based entrepreneurship** directed to promoters in farming, forestry and agri-food sectors. Composed of private or public abandoned plots, the **Land Bank and Stock** was created to facilitate access to land for new rural entrepreneurs, by giving those with an interest in agriculture use and benefit so that they can transform it into their main activity.

An **Incentive System** will also be offered, comprising technical and monetary support in the early period of creating and launching the endeavour, ensuring equal opportunities and social inclusion, and prioritising projects in organic farming and permaculture. Entrepreneurs are challenged to integrate experimentation and integration into their practices by promoting the **Transfer of R&D** with various Science and Technology entities. Several initiatives are also envisaged to **promote and stimulate** these entrepreneurial initiatives, including a rural entrepreneurship fair.

Figure 10 Rural Based Incubator 2020 Targets

Mobilization of the Population

The municipality's goal is to have **Brigadas Verdes** sprea throughout the entire Municipal area, thus strengthening the **Guimarães mais verde** commitment. There is a budget of €200.000 to support and coordinate initiatives for environmental protection.

Figure 11 Brigadas Verdes in action

Similarly, **Guimarães mais floresta** will remain active, encouraging community involvement in defending and promoting green and blue areas.

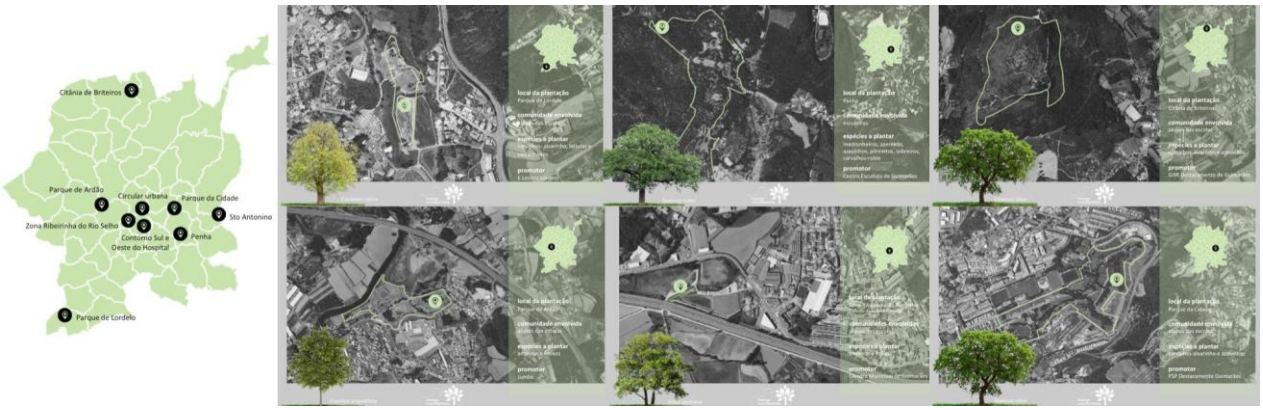


Figure 12 Guimarães mais Floresta – identification of the local for 15,000 trees plantation (2017)

4D. References

[1] Park of Ínsua and Park of Selho

a. http://www.cm-guimaraes.pt/uploads/document/file/1254/18624.pdf

b. http://www.cm-guimaraes.pt/uploads/document/file/2795/18628.pdf

[2] Meadow of Creixomil

[3] City Park http://www.cm-guimaraes.pt/uploads/document/file/2/18623.pdf

[4] Ponte Park e Taipas Park http://www.cm-guimaraes.pt/uploads/document/file/1255/18625.pdf; http://www.cm-guimaraes.pt/uploads/document/file/2188/18626.pdf

[5] Sports city park http://www.cm-guimaraes.pt/uploads/document/file/2189/18627.pdf

[6] Stadium park http://www.cm-guimaraes.pt/uploads/document/file/3601/18635.pdf

[7] Integrated Requalification of Ave Valley System (SIDIVA in Portuguese) http://www.tratave.pt/sidva.html

[8] Guimarães Urban Master Plan http://www.cm-guimaraes.pt/pages/568

[9] Municipal Defense Plan for Forest Fire http://www.cm-guimaraes.pt/pages/1130

[10] P2Green http://www.labpaisagem.pt/ecologia/p2green/

[11] Action plan for the Ave River http://www.cm-guimaraes.pt/uploads/writer_file/document/4706/Plano_de_Ac_a_o_-_combate_a__poluic_a_o_no_rio_ave.pdf

[12] Retain Basins http://www.cm-guimaraes.pt/frontoffice/pages/1116?news_id=2471

[13] Guimarães mais Floresta http://www.labpaisagem.pt/guimaraes-mais-floresta/

[14] Brigadas verdes http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2978

[15] Meadow of Creixomil facilities

a. http://www.tempolivre.pt/pub/index.aspx?view=instalacoes&cat=7&subview=noticias

b. http://www.labpaisagem.pt/

[16] Irmandade da Penha http://www.penhaguimaraes.com/pt/

[17] Guimarães SUMP

a. Abstract http://www.cm-guimaraes.pt/pages/1248?folder_id=1376

b. MpT (2016). Plan for the Sustainable Urban Mobility of Guimarães – Stage I Characterization and Diagnosis (2016)

c. MpT (2017). Plan for the Sustainable Urban Mobility of Guimarães – Stage 2 Intervention strategy (2017)

[18] Rural Based Incubator of Guimarães

a. http://www.cm-guimaraes.pt/uploads/document/file/11784/28_-_Anexo_I_-_Regulamento_Incubadora_de_Base_Rural_de_Guimar_es.pdf

b. http://www.labpaisagem.pt/?s=incubadora+de+base+rural

5. Nature and Biodiversity

5A. Present Situation

Please complete the following table providing the most recent data that is available:

Indicator	Number	Total Area (ha)	Year of Data Provided
Number and total area of Natura 2000 sites that are located in the city or nearby (i.e. within 10 km)	n/a	Close to Guimarães is located the only Natural Park of the country, the largest Natura 2000 area in the Northern region (see bellow Regional Protected Areas)	
Number and total area of designated sites of national biodiversity importance within the city (habitat/species management areas)	National Ecological Reserve and National Agricultural Reserve	14 679.94ha	2016
Number and total area of designated sites of local (city) biodiversity importance within the city (habitat/species management areas)	5	>50 ha Penha Mountain (120ha); Meadow of Creixomil (300ha) <50 ha City Park (30ha); Colina Sagrada/Monte Latito Park (10ha); Citânia de Briteiros (24ha)	2017
Date and time horizon of your city's Biodiversity Action Plan	[1]P2GREeN – Protection and Promotion of Guimarães Biodiversity – Natural Heritage	Entire territory	2016-2020

RESILIENT TERRITORY

"....Then one day, Man discovered the factory, and from the factory built of cement and iron, he made money, and from the money, more factories. To build them, he crossed hills, dried up rivers and flattened mountains, filled up valleys and cut down trees (…)'In the hurry and bustle of life on earth, human reactions have not everywhere been the same. The Portuguese, fascinated by the adventures of foreign seas, discovered treasures more exquisite than industrialization. This was not ever their quest. This was fortunate for the nation, land, its rivers, mountains, valleys and trees" (Natural Sanctuaries Portugal)

Although Guimarães has been an industrialised city for generations, it clearly demonstrates a coevolution between humans and nature, being extremely proud of its natural and cultural heritage. Our environmental history demonstrates how economic prosperity was predicated on its natural resources. These are now the focus of conservation, not exploitation. Over the last years, our green policies on Nature and Biodiversity (NB) has been reinforced to preserve/promote our natural heritage.

[1] **P2GREeN** - Protection and Promotion of Guimarães Biodiversity - Natural Heritage can also be found in section 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 and Good Practice **2**

Figure 1 Tannery in Guimarães

REGIONAL PROTECTED AREAS

Owing to its geography, Portugal is extremely diverse biologically[2]. Guimarães is 40km away from the **only National Park[1,2]** and the largest Natura 2000 area in the northern region (Peneda-Gerês) comprising more than 80.000ha**.**

Figure 2 Guimarães is located in the same region of the only National Park of the country (Peneda-Gerês)

[2] There are **59 Special Protection Areas** and **96 sites of Community Importance** in the country, comprising 1 980 758ha, some 21% of the surface area. This is **higher than the European average** that, according to the Commission, is of 18%**[1]**

1.

ECOSYSTEM SERVICES IN GUIMARÃES

The large prevalence of NAR[3] and NER[4] together with an **urban green corridor**[5] and an extensive network of water lines[6], enables distinct habitats/biotopes promoting migration, foraging and breeding and mitigating negative effects of urbanisation – pollution, habitat fragmentation, and biodiversity loss**[3]**.

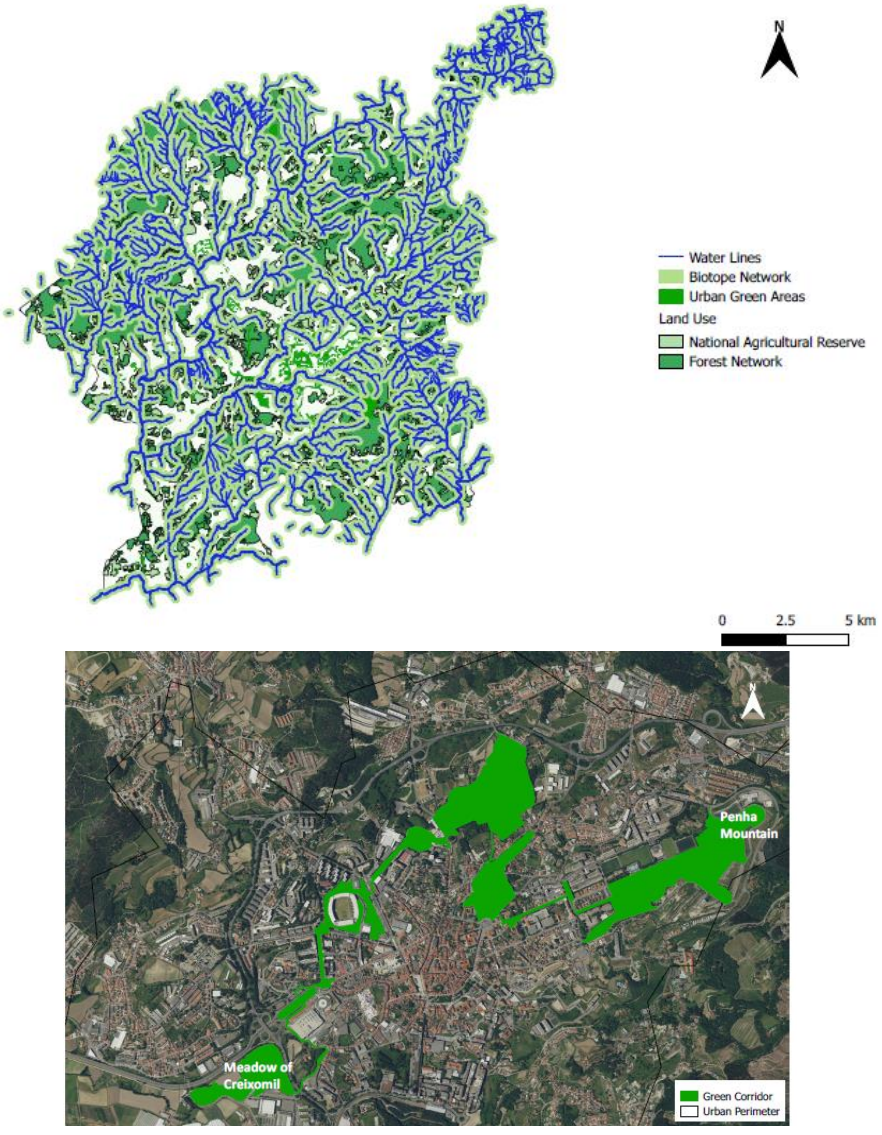


Figure 3 Habitats/biotopes and, Urban Green Corridor promoting connectivity between natural green areas

[3] **NAR** - National Classification for Agricultural Reserve
[4] **NER** – National Classification for Ecological Reserve
[5] The **urban green corridor** extends from the Meadow of Creixomil to the Penha Mountain
[6] **Retention basins and scientific projects** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12 and **Good Practice 4**

2.

SPECIES AND HABITAT MONITORING PROGRAMMES

Guimarães is addressing the EU goals for biodiversity's preservation. The **Biodiversity GO! Programme** contributes to evaluate species' state of conservation and to map habitats**[4,5]**.

Also, a **Control Plan of Invasive Species** was implemented contributing to the identification of areas where eradication was needed, promoting the **plantation of autochthonous species**. Owners of some abandoned lands and private/associations were engaged in the process**[6,7]**.

Ecological status and water quality of water lines are continuously monitored by following a pioneering methodology - **AquaBioScape**[7]**[8]**.

3.

PLANS FOR ECOLOGICAL NETWORKS MANAGEMENT

Within the scope of the **MS**[8], Guimarães adopted an integrated approach to classify **Areas of Local Interest**[9]**,** diagnosing green areas' ecological wealth and variety. Several indicators were used regarding NB, Acoustic/Air Quality.

A **Green Area Management Plan** was also established resulting in **environmental certification**[10] of urban green areas, comprising:

- Gardener's Manual-Code - guidelines for maintenance
- Measures to increase floral index (>50 taxon)
- Waste recovery[11]

All landscapes in the wider area are being evaluated for their quality, applicable policies and measures for protection, management and/or planning through an innovative **Landscape Plan[9]**.

[7] **AquaBioScape** Project can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12
[8] **MS** - Mission Structure for Sustainable development of Guimarães
[9] **Areas of Local Interest:** Penha Mountain, Meadow of Creixomil, Taipas and Ponte Park and Monte Latito. This information can also be found in sections 1| 2 | 3 | 4 | 5 | **6** | **7** | 8 | 9 | 10 | 11 | 12
[10] Certification by **the International Organization for Standardization** (NP EN ISO 14001:2012).
[11] Waste recovery projects are a part of **Guimarães for Circular Economy programme (G4CE)** and can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | **10** | 11 | 12

Figure 4 Guimarães Natural Heritage – A mosaic of diverse biotopes

A holistic approach **P2GREeN**[12] - awarded by **EU-URBACT Programme[10,11]** as Good Practice – reinforced the green policies in NB adopted by the City Hall. The plan integrates municipal technical knowledge with R&D and public participation.

4.

COMMUNITY ENGAGEMENT

Under the ***Guimarães mais Verde*** **Commitment**[13] and the **Educational Programme for Environmental Sustainability (PEGADAS)** more than 1100 awareness-raising, education and mobilization actions have taken place:

[12] **P2GREeN P**rotection and **P**romotion of **G**uimarães Biodiv**er**sity – **N**atural Heritage comprises two phases with different projects: 1st Diagnosis/Characterization: a) Control Plan of Invasive Species (Mapping and impact study); b) Guimarães mais Floresta – Environmental Education Activity/Afforestation with autochthonous trees; c) Biodiversity GO! – Creation of a Biodiversity Database, 2nd Promotion: a) Creating Biodiversity Routes; Promoting Species Observation; Promoting Nature Tourism can also be found in section 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 and **Good Practice 2**

[13] **Guimarães mais Verde commitment** can be found in **Good Practice 1**

- To promote the **elimination of invasive species**[14];

- To **plant 15 thousand autochthonous trees – Guimarães mais Floresta[12]** - with the participation of community/companies;

- To preserve local biodiversity - **Brigadas Verdes:** groups of volunteers from all parishes**[13].**

Supported by a citizen's science concept, the community was engaged by **Biodiversity GO![15]**. We launched "Guimarães Bioblitz" and we are the only Portuguese city to have joined the **City Nature Challenge 2018**[16].

Our commitment to sustainable development is consolidated in the **declaration of political and individual consensus**, which strenghtens the community involvment with the entire process**[14].**

Figure 5 Action for nature: Engaging our community

5B. Past Performance

For several decades, the municipality's economy has been industrial: footwear, leather and textiles. These are not environmentally friendly industries and contributed to deteriorating water and air quality.

Nonetheless, Guimarães has always recognised NB. The Penha Mountain, the major green area, is an example: "*until the second half of the 20th century, the Penha Mountain was a mountain devoid of tree*

[14] **Control Plan of Invasive Species** already described in Present Performance
[15] **Biodiversity GO!** already described in Present Performance
[16] **City Nature Challenge** is a world event that intends to invite the entire community to identify and catalogue species in green urban areas.

cover(...) the vast expansion of the Mountain's tree cover began in 1947, which led to the current situation of the mountain"**[15]**. Today, it is a functioning diverse *ecosystem* and became the site of the first garden in the 19th century.

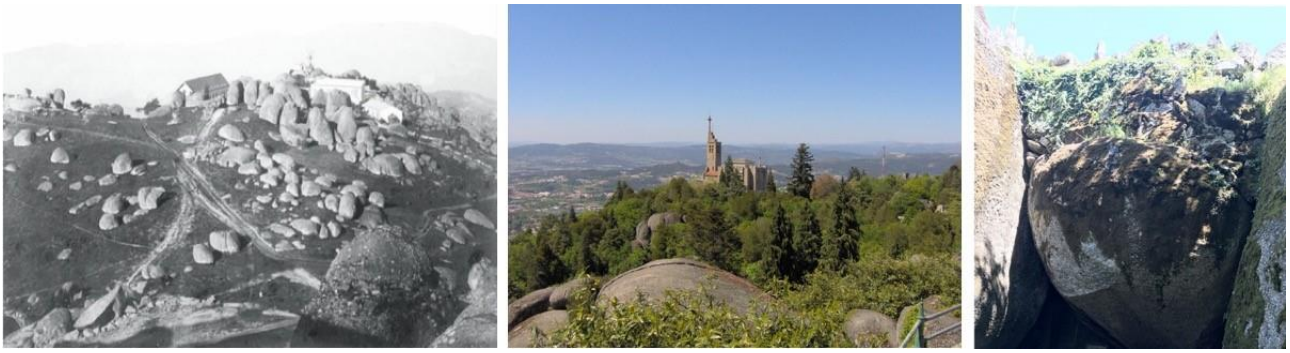


Figure 6 Penha Mountain: 1940's, today the main green lung and 1st Garden "Hanging Garden" 19th century

1.

ECOLOGICAL NETWORK PROTECTION AND NATURALISATION

In 1983, Portugal legally established the NAR**[16]** and the NER**[17]**. The nation, therefore, sought to ensure appropriate environmental conservation. NER is "a basic and diversified biophysics structure that ensures the protection of ecosystems and the permanence and intensification of the biological processes essential to a balanced framing of human activities". In Guimarães, NER accounts for 39% of the total area. NAR focuses on cultivation of many species and subsistence agriculture as opposed to monoculture and intensive farming, thus preserving biodiversity. NAR and NER areas comprise 60.84% of the total municipal area. The area registered as Natural amounts to 51.28%, which means that almost the entire Natural area is under a regime of protection.

The Penha Mountain is outstanding. Part of it is NER (58.33% of the total municipal NER). There is a variety of habitats, among which oak woods, stands of lauroid species and *Ilex aquifolium*. Rocky substrates provide other niches for heathers, brooms, chestnuts, cork oak stands and pine forests. Some of these are listed in the Habitats Directive[17].

2.

HABITATS AND SPECIES – FAUNA AND FLORA IN GUIMARÃES

A wide forest area accounts for 78 km^2, about 32.4% of the total municipal area, exceeding the European average of 30%. To **extend protected areas**, a group of technicians and researchers is carrying out all the surveying of the floristic and faunistic potential of its green areas.

[17] **Habitats** such as: heaths and shrubs of temperate zones, European dry heaths, *sclerophyllus shrubs, Mediterranean scrubland*, *Laurus nobilis* scrubland, rocky habitats and caves, rocky slopes with chasmophytic vegetation, forests, European temperate forests, *Quercus robur* mesotrophic oak woods, *Alnus glutinosa* and *Fraxinus excelsior* alluvial forests (*Alno-Padion, Alnion incanae, Salicion albae*), Mediterranean deciduous forests, *Salix alba* and *Populus alba* gallery forests, *Castanea sativa* forests, Mediterranean sclerophyllous forests, *Quercus suber* forests and *Ilex aquifolium* forests

Forest areas are relatively homogeneous with mixed stands of *Pinus pinaster* and *Eucalyptus globulus*. Native species include *Quercus robur*, *Prunus lusitanica*, *Arbutus unedo* and *Ruscus aculeatus*, but there are other alien species like *Castanea sativa* or *Fagus sylvatica*, which are well adapted.

The faunal community is also relatively diversified and all are subject to conservation legislation**[18,19].**

Amphibians - *Triturus marmoratus*, *Rana iberica*, *Bufo bufo* are frequently encountered; these are protected species although not endangered.

Birds - *Streptopelia turtur* is vulnerable and thus strictly protected, while *Delichon urbica* and *Phoenicurus ochruros*, are not vulnerable but are also protected.

Mammals - *Crocidura russula*, *Oryctolagus cuniculus*, *Apodemus sylvaticus*, *Mus musculus* and *Vulpes Vulpes* are abundant.

Fish - Most common is the commercially endangered *Esox lucius,* critically endangered *Oncorhynchus mykiss*, *Salmo trutta trutta,* while *Salmo trutta* is not endangered.

Figure 7 Some of the species that can be observed in Guimarães

3.

MANAGEMENT AND RESTORATION

The **Urban Master Plan** (since 1994; revised 2015), is the vital tool for planning. In terms of this plan, the main green areas are protected; the construction area decreased by 26% and planning is based on natural and ecological elements and preserving corridors and ecological systems**[20]**. In 2005, the Municipality adopted **Local Agenda 21**[18]**[21]**. In 2014, in collaboration with UMinho, the action plan was updated/revised.

A main challenge has been to improve river quality. There are initiatives for more pollution control, including the Integrated Clean-up System for the Ave River (SIDVA) in 1998, the **Action Plan** for this river**[22]** and the **Management Plan of the Cávado, Ave and Leça Hydrographic Network[23]**.

For forest areas, €80.000 is allocated annually to clean tracks and roads, cleaning and regularize water accessibility and landscape rehabilitation. This is done under the **Municipal Plan for Defence Against Forest Fires** of 2015**[24].**

The management and conservation of biodiversity includes the need to eradicate the use of glyphosate – "**Guimarães without glyphosate**" and less harmful alternatives are being utilised**[25]**.

4.

NATURALISATION OUTSIDE NATURE RESERVES

Outside nature reserves, at the entrance of the city, another important ecosystem is the **Meadow of Creixomil,** a recreation park of great environmental importance, as well as a **Social and Pedagogical Garden (SPG)**[19] with more that 500 users, **promoting agriculture/biodiversity outside nature reserves[26]**. Recently, the addition of the "**Houses of Insects**"**[27]** in the SPG contributes to the promotion of biodiversity and serves as shelters for predatorial and pollination species, helping in the fight against pests without using pesticides.

Creixomil includes the Selho River, one of the most important water resources, whose monitoring and rehabilitation within the Water Framework Directive**[8,28]** has seen the reappearance of long-departed species - *Lacerta schreiberi*, *Alcedo atthis* or *Lutra lutra*.

[18] **Local Agenda 21** is an action plan for sustainability serving as the foundation for strategies currently in progress for nature and biodiversity

[19] Social and Pedagogical Garden can also be found in section 1| 2 | 3 | **4** | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

Figure 8 Meadow of Creixomil, an important green area and an ecosystem of great relevance.

To the city's east lies the **City Park** that promotes urban diversity. There are several valuable tree species, including *Populus nigra*, *Pinus pinea*, *Alnus glutinosa* and *Quercus robur*. The park is bisected by the Costa/Couros River, which, together with the existing vegetation, creates opportunities for small species of birdlife and flora to flourish.

Within the urban area, in a perfect **match between history and nature**, Monte Latito offers meadows with several important tree species. A biodiversity route was recently created to provide a unique example of how heritage mingles with environmental history. Other routes have been plotted in collaboration with the universities to promote natural heritage.

Guimarães is committed to improve NB in the urban context, through the **analysis of the ecological network** to improve ecological cohesion**[29]** and to determine how the city can boost urban biodiversity

through green corridors**[3]**.

Also, every year the city **plants 2000 new trees in the urban area**, thus strengthening the link between cultural/historic heritage and nature. Guimarães has about 100 thousand trees in the public areas, 30% in the urban perimeter. Several tree specimens were identified in the past as 'heritage' and requiring protection. They were declared '**Public Interest**'[20].

Figure 9 a) A heavily afforested Historic Centre, combining cultural/natural heritage; b) Examples of classified trees

5.

INVOLVED AND COMMITED COMMUNITY

Over the past few years, several strategies have informed and mobilised citizens about the challenges of

[20] **Public interest classification** in 1940 - specimens of *Quercus robur*, *Quercus rubra*, *Castanea sativa*, *Cedrus atlantica*, *Cupressus lusitanica and Eucalyptus globulus*; in 1953: a specimen of *Quercus robur*; in 2011: two masses of 18 specimens of *Camellia japonica*, 2 *Platanus orientalis*, 1 *Aesculus hippocastanum*; 1 *Pinus pinea* and 1 *Cedrus deodara*

sustainable development. One example is the **PEGADAS** environmental programme, contributing to promote awareness of NB among young and old citizens**[30]**.

Environmental education is high on the agenda[30], with various awareness-raising events**[31]**, talks in schools**[32]** and parish councils. "**Coffee with Environment**" is a popular discussion forum for promote urban sustainable development.

Over the last years, Guimarães was the only Portuguese city that celebrated the **International Day of Action for Rivers**, involving young people and known sportsmen in the river's defence against main threats**[33]**. Also, every year, Guimarães celebrates the **Environment European Week** by developing several activities**[34]**.

Through the simulation of a parliament – the **EcoParliamen**t - the school community is also challenged to present and defend solutions within the context of sustainability**[35].**

During the school break, **school holidays** are organized for young people, along with several awareness action **[36].**

Guimarães also recognizes the importance of bringing research closer to citizens and is committed to R&D in association with two universities[21] to create an institution for environmental education and research[22]. The result was the unique Landscape Lab, which develops educational and scientific projects aimed at involving the community[23], such as "**EcoPontas and PapaChicletes**"[24]**[37].** The school community was involved to promote these new structures. The project was recognized in the "Green Project Awards"[25].

[21] University of Minho and University of Trás-os-Montes and Alto Douro
[22] **Landscape Lab** can be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12
[23] Projects such as **Biodiversity GO!** and **AquaBioScape** described in Present Performance.
[24] New structures of urban furniture developed due to the impact of micro-trash for biodiversity, through the pollution of water lines or streets
[25] **EcoPontas and PapaChicletes** can also be found in Indicator 1| 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | 11 | 12

Figure 10 Environmental education actions: +65 Project, Coffe with Environment, Brigadas verdes, Eco Parliament, Eco Hollidays, EcoPontas e PapaChicletes

5C. Future Plans

Our city has a remarkable cultural heritage and combining this with our natural heritage is a major goal in coming decades. Guimarães is fundamentally committed to sustainable development, through the conservation and promotion of biodiversity. In line with the 2030 strategic objectives of the United Nations, Guimarães will continue to promote quality health and education through environmental education and measures aimed at protecting its green areas and biodiversity (objectives 3 and 4), ensuring basic sanitation and clean drinking water for the entire population, reducing contamination of its water resources (objective 6), constructing a sustainable territory, through the protection of aquatic and terrestrial ecosystems (objectives 14 and 15), adapting to climate change by protecting its natural resources (objective 13) and creating employment and economic growth (objective 8), supported by a strong commitment in promoting agriculture, nature and biodiversity.

Therefore, Guimarães has adopted these goals in its Strategic Plan for Biodiversity 2030 and by adhering to European strategies. Local, national and international biodiversity hotspots will be identified and conservation duly strengthened. Following the latest directive of the European Commission**[38]**, Guimarães will reinforce its financial support to classify areas of biological interest (Penha Mountain Classification in progress). The particular landscape characteristics of the territory with the polycentric concept established as the development plan and justified by this application, make it essential that the measures identified in this indicator be extended to other sites of high ecological importance.

In support of this, there will be more investment in nature tourism, through new "**Biodiversity Routes**" that will join existing routes**[39]**. The new "Guimarães Ornithological Centre" will become a popular destination and link with Portugal's wider natural wealth and potential for Nature Tourism. Overall, there is a "high diversity of habitats, with conditions that allow implementing observation programmes of birds in different habitats". Guimarães has "21% of its territory formed by Classified Areas with strong natural and biodiversity values - fauna, flora and quality of the landscape and environment".

In addition, through partnerships with academic and private institutions, Guimarães will continue to invest in R&D so that political decisions are always supported by technical/scientific knowledge. Simultaneously, the city will be a beacon for attracting suitable scientific projects. The second stage of the Rural Based Incubator (already in progress) will also be framed, and innovative organic farming will continue to receive priority to increase local biodiversity.

More money will be spent on upgrading Guimarães' water lines, with special focus on the continuous monitoring of water quality, cleaning, and promotion of its use. Clean river beaches are projected. The Plan for the Clean-up of the Ave River is on course as is the Action Plan for the Clean-up of the Vizela River**[40]**. Interventions in the riparian zone will promote increased biological communities. Water in the Selho River should be ecologically 'reasonable' by 2021 and 'good' by 2027 following the Management Plan for the Hydrographic Region, while the Ave River should achieve the ecological status of 'good' or 'better' in 2027. These are two of our main challenges.

Figure 11 Caldelas river beach. It is still closed off since the Ave River presents hydromorphological disturbance

In the forest, the objective is to recover oak woods and control the expansion of eucalyptus plantations as a way of preventing the spread of fires, as well as containing invasive species. Recovering soil quality and caring for wild fauna are also goals in conserving biodiversity.

Recently, Guimarães submitted European applications regarding the rehabilitation of areas in need,

another initiative for improving biodiversity and enhancing the quality of life of citizens. Besides contributing to the mitigation of climate change and the promotion of biodiversity, the solutions will take into account improving everyone's life through living close to green areas and enjoying the benefits of having nature close by. Scientific projects to study the impacts of these initiative on health will be developed.

A fundamental pillar of the future policy in Guimarães is to prioritise nature and biodiversity. This will happen within the directives of the EC, and soon Guimarães will be in the front rank. The work already done within the school and the general community will continue and the message that all citizens are responsible for caring for their natural environment will be reinforced.

Guimarães is also involved in several European networks to promote new approaches and strategies for sustainable development through the EU Biodiversity Strategy 2020. Another objective is to achieve full compliance of all plans developed up to this point, particularly "**Guimarães without Glyphosate**", throughout the territory. The remaining plans underway for the control of invasive species and the reforestation of native species will continue to be developed. Planting mixed stands will also be promoted in the reforestation plans, allowing the natural regeneration of the forest space and reinforcing preventive measures to fight fires, which will also include improving the road network, monitoring the forest, training of forest firefighters and cleaning and maintaining fuel management tracks.

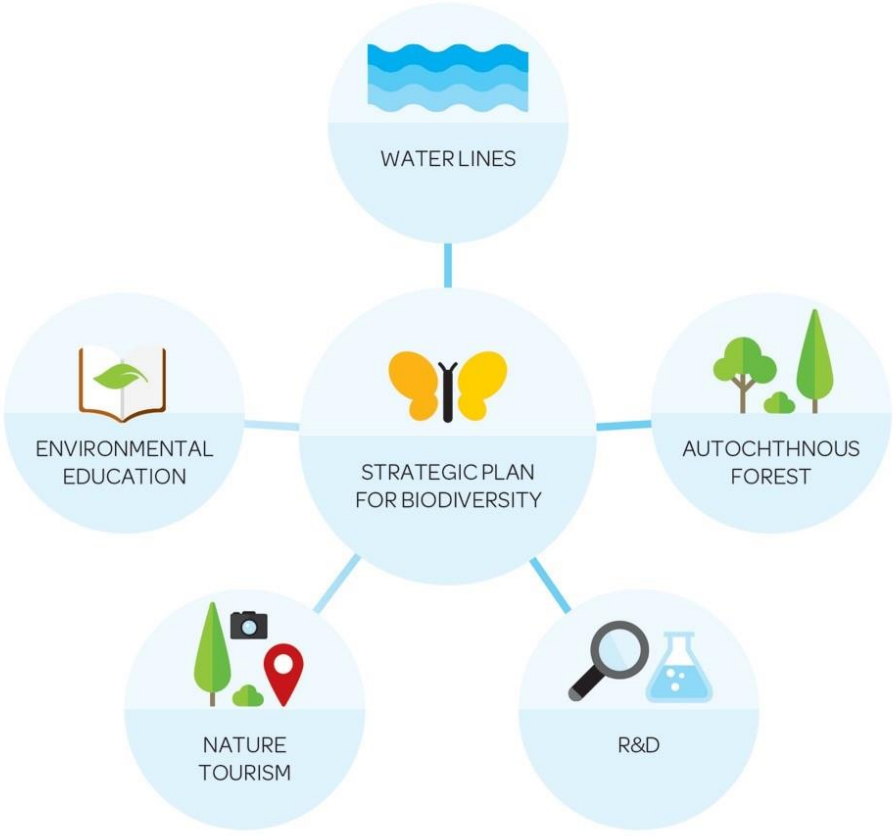


Figure 12 Main pillars of the Strategic Plan for Biodiversity 2030 to be established by the Municipality

5D. References

[1] Classification of the National Park of Peneda-Gerês - Portuguese Official Gazette https://dre.pt/application/dir/pdf1sdip/2011/02/02501/0000200030.pdf

[2] National Park of Peneda-Gerês http://www.icnf.pt/portal/ap/resource/ap/pnpg/brochur2013

[3] Master's Thesis "Enabling Urban Biodiversity in Guimarães - Green Corridors" http://repositorium.sdum.uminho.pt/handle/1822/34254

[4] Biodiversity GO! Project http://www.labpaisagem.pt/biodiversity-go/

[5] Biodiversity GO! App http://biogo.labpaisagem.pt/#/app/menu

[6] "Control Plan of Invasive Species" Project http://www.labpaisagem.pt/especies-invasoras/

[7] A**ctions for Addressing Biodiversity Loss - European Union** European Commission - Protecting Europe's nature: more ambition needed to halt biodiversity loss by 2020. - [s.l.]: European Commission - Press release, 2015

[8] Project for Monitoring the quality and ecological status of Water Lines http://www.labpaisagem.pt/aquabioscape/

[9] "Guimarães Landscape Plan" Project http://www.labpaisagem.pt/plano-de-paisagem-de-guimaraes/

[10] Guimarães receives seal of Good Practice of the European URBACT programme http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=3068

[11] P2GREeN – Project for the Protection and Preservation of Guimarães Biodiversity - Natural Heritage https://www.labpaisagem.pt/p2green

[12] Environmental Education/Afforestation Programme - Guimarães mais Floresta http://www.labpaisagem.pt/guimaraes-mais-floresta/

[13] Brigadas Verdes of Guimarães http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2978

[14] Declarations of political and individual consensus

a. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf
b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf
c. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf
d. http://www.labpaisagem.pt/quatro-mil-escuteiros-assinam-compromisso-guimaraes-verde
e. https://youtu.be/LmFyCaJ2bk4

[15] Master's Thesis - The Green Structure of Penha and surroundings https://repositorio-aberto.up.pt/bitstream/10216/78221/2/34133.pdf

[16] Creation of the National Agricultural Network - Portuguese Official Gazette

https://dre.pt/application/dir/pdf1sdip/1982/11/26500/38283832.pdf

[17] Creation of the National Ecological Network - Portuguese Official Gazette https://www.ccdr-alg.pt/site/sites/ccdr-alg.pt/files/Ordenamento/ren/dl_321-83.pdf

[18] Red Book of Vertebrates of Portugal http://www.icnf.pt/portal/naturaclas/patrinatur/lvv/livro-verm-vert

[19] Convention on the Conservation of European Wildlife and Natural Habitats http://www.icnf.pt/portal/naturaclas/ei/berna

[20] Urban Master Plan – in force http://www.cm-guimaraes.pt/pages/568

[21] Agenda 21 Local - Biodiversity http://www.cm-guimaraes.pt/uploads/writer_file/document/791/471351.pdf

[22] Integrated Requalification of Ave Valley System http://www.cm-guimaraes.pt/uploads/writer_file/document/4706/Plano_de_Ac_a_o_-_combate_a__poluic_a_o_no_rio_ave.pdf

[23] Hydrographic Planning and Management of the Ave, Cávado and Leça Rivers 2016-2021 https://www.apambiente.pt/_zdata/Politicas/Agua/PlaneamentoeGestao/PGRH/2016-2021/PTRH2/PGRH2_Parte1.pdf

[24] Municipal Plan Against Fires http://www.cm-guimaraes.pt/pages/1130

[25] Guimarães Without Glyphosate Project http://www.guimaraesdigital.pt/noticias/64015/camara-de-guimaraes-promete-abandonar-uso-de-herbicida-ate-final-do-ano

[26] Guimarães Social and Pedagogical Garden http://www.cm-guimaraes.pt/pages/410

[27] House of Insects https://www.facebook.com/labpaisagem/photos/a.1274680975949927.1073742003.645061308911900/1274681989283159/?type=3&theater

[28] Project for Managing the Water Lines in the Municipality http://www.labpaisagem.pt/gestao-de-linhas-de-agua/

[29] Ecological Network Cohesion https://repositorio.ul.pt/bitstream/10451/23621/1/ICS_SAlves_Fatores_A.pdf

[30] PEGADAS Programme and Other Environmental Education Activities (Youth and Senior Citizens)

a. http://www.labpaisagem.pt/pegadas/

b. http://www.labpaisagem.pt/atividades-criancasjovens/

c. http://www.labpaisagem.pt/65-2/

[31] European Awareness Weeks http://www.labpaisagem.pt/agenda/biodiversidade-go/

[32] Launch of the Guimarães Biodiversity Database Project http://www.labpaisagem.pt/laboratorio-da-paisagem-lanca-o-projeto-base-de-dados-da-biodiversidade-de-guimaraes/

[33] International Day of Action for Rivers https://www.internationalrivers.org/dayofactionforrivers2017

[34] Green Week http://www.greenweek.pt

[35] EcoParliament Activity - Environmental Education and Awareness http://www.labpaisagem.pt/pegadas/ecoparlamento/

[36] School Hollidays http://www.labpaisagem.pt/ecoferias/

[37] Reduction and Recovery of Waste Project: EcoPontas e PapaChicletes http://www.labpaisagem.pt/ecopontas-papachicletes/

[38] Social and Health Benefits resulting from Nature and Protection and Biodiversity http://www.europarc.org/wp-content/uploads/2016/02/Health-and-Social-Benefits-Workshop-Background-Report.pdf

[39] Pedestrian Routes and Trails http://www.guimaraesturismo.com/pages/171

[40] Plan for the Clean-up of the Vizela River http://www.cm-vizela.pt/33-noticias/1197-plano-de-acao-de-despoluicao-do-rio-vizela-apresentado-em-vizela

6. Air Quality

6A. Present Situation

Context of the territory

The municipality of Guimarães is a bio-cultural polycentric model, with the Historic Centre at its heart. Several times, this has been transformed and recognised as significant,[1] and today buildings and factories have been converted into centres for the Arts, Innovation, Education and Environmental Sustainability. The heritage policy has rescued squares that were once used as vehicle parking into magnificent flagship spaces for the enjoyment of the whole community.

About one-third of the population lives in the central urban areas, the locality of most services and amenities. The other two-thirds live outside this in industrialised or agricultural areas. Because the city is structured as polycentric, commuters move between urban centres and 9 villages[2]. Mobility patterns[3] are highly variable.

Historic framing of industries in the territory, relocation and rehabilitation of urban spaces

The territory of Guimarães is the result of industrialisation and urbanisation, with no explicit distinction between rural and urban. Industry arose along the main water line, and access routes developed accordingly. Textile, leather, cutlery, metalworking and casting, and jewellery industries sprang up, and the city became one of Portugal's largest manufacturing hubs, indeed the epicentre of industrialization in the Ave Region, accounting for 44% of its workforce. Industrial parks were set up in the 1980s to regenerate the city and curb unrestricted and random industrial development. In this initiative, 74 industrial areas were created adjacent to the urban centre and this had a positive impact on the improvement of air quality.

Strategy implemented

Policies adopted for **improving air quality** intend to meet EU goals and are included in the AQMP[4] established by **a Mission Structure**[5] in 2015.

This commitment to sustainable development is consolidated in **declarations of political** and **individual consensus[1]**, strengthening community identification with the process.

The AQMP includes:

- Regular Air Quality evaluation;

[1] **Guimarães achievements** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12**
[2] São Torcato, Caldelas, Ponte, Brito, Ronfe, Selho, Serzedelo, Lordelo and Moreira de Cónegos
[3] **SUMP**, Guimarães can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[4] **AQMP** - Air Quality Management Plan
[5] **Mission Structure for Guimarães Sustainable developement** was created by the City hall in 2015 in a partnership with the University of Minho. UMinho is coordinating the application process of Guimarães to EGCA2020 and the Action Plan 2015-2017 (which incorporates the twelve ECG areas), whose implementation will contribute decisively to the Guimarães 2030 Sustainable Plan. It is fully described in Good Practice 1

- Regular quantification of pollutant sources through the Guimarães Pollutant Matrix;
- Identification of Low Emission Areas and vulnerable population groups;
- Creating infrastructure for Acquisition, Storage, Processing and Reporting air quality data;
- Creating a Monitoring and Alert System;
- Preservation of "ambient air quality when it is good", i.e., creation and protection of low emission zones[6].

Indicator		Unit	Year of Data
Number of PM_{10} monitoring stations	1*	No. of monitoring stations	2013
For each station provide the number of days per year PM_{10} exceeded 50 µg/m^3	0	Days	2013
For each station provide annual average PM_{10} concentration	13.6	µg/m^3	2013
Number of NO_2 monitoring stations	1	No. of monitoring stations	2013
For each station provide the number of hours with NO_2 concentrations higher than 120 ug/m^3	14	Hours	2013
For each station provide annual average NO_2 concentration	67.1	ug/m^3	2013
Number of $PM_{2.5}$ monitoring stations	1**	No. of monitoring stations	2015
For each station provide the annual average $PM_{2.5}$ concentration	8.2	ug/m^3	2015

***Azurém station (Urban/Traffic) and **Paços de Ferreira station**

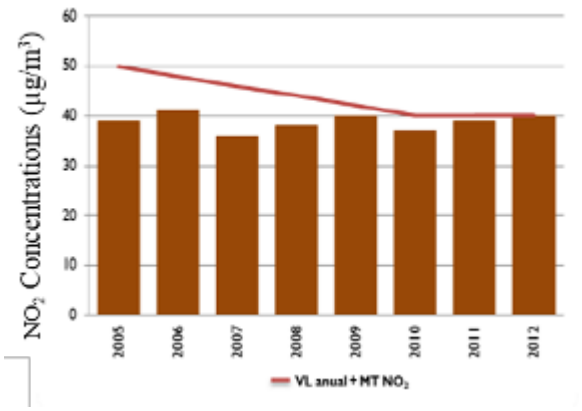
Concentration trends

Guimarães is committed to fulfilling the objectives set by the European Union for environmental air quality[7]**.** In compliance with the air quality objectives[8] for NO_2, the evolution of average recorded annual NO_2, between 2005 and 2012, shows that the limit has not been exceeded since 2005.

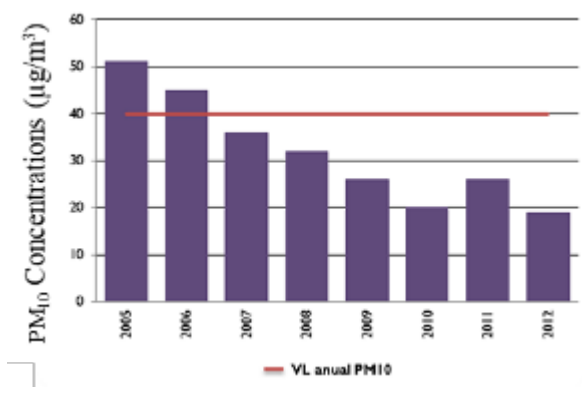
[6] According to the WHO targets

[7] **EU standards & objectives** - avoid, prevent and limit harmful effects of major air pollutants on human health and the environment

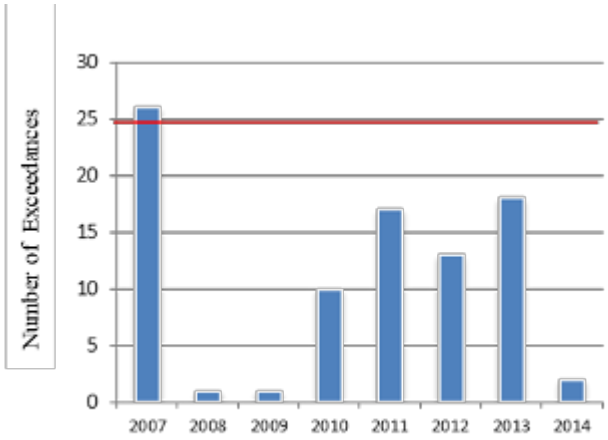
[8] Based on the **Decree-Law no.102/2010**, of 23 September, taking into account the standards, guidelines and programmes of the World Health Organization, it aims at preserving the quality of ambient air, not exceeding the limit values laid down in the legislation and defining strategies for improvement when necessary



a) Annual NO_2 averages, Guimarães monitoring station



b) Annual PM_{10} averages, Guimarães monitoring station



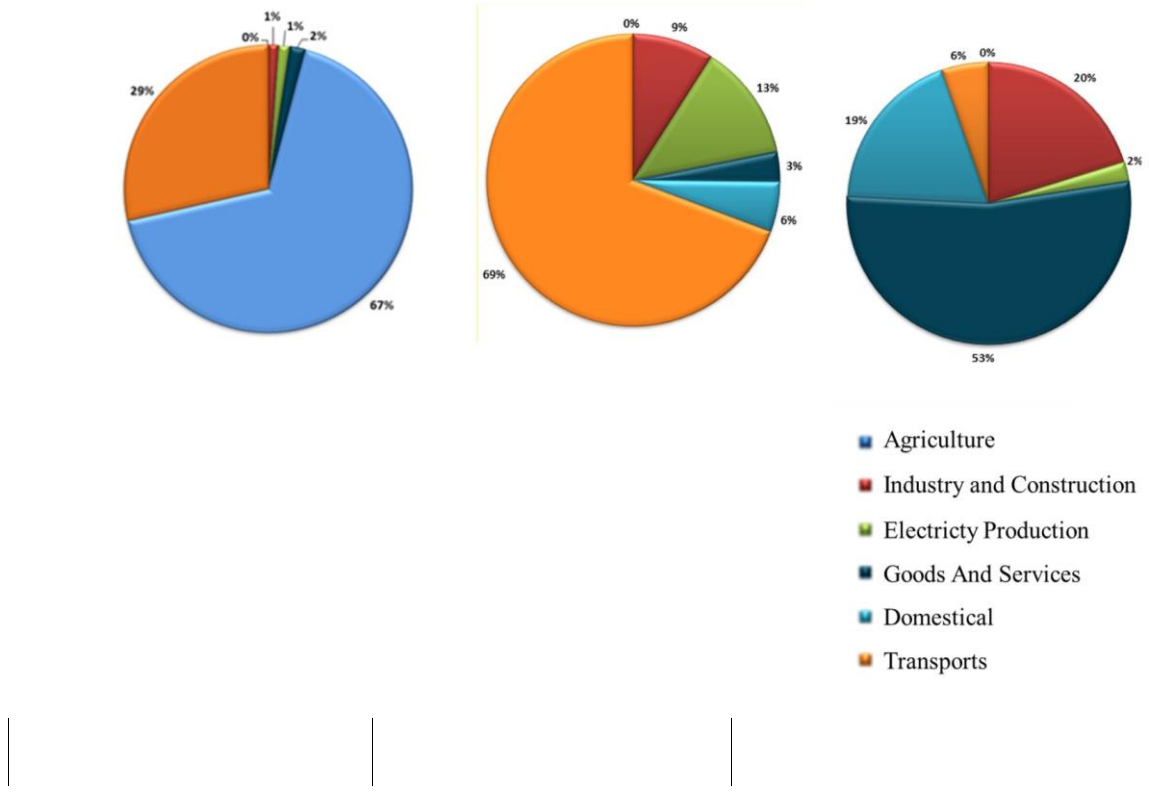
c) Number of days *per year* where SO_2 was exceeded, Braga monitoring station

Figure 1 Concentration trends of main pollutants prior to 2015

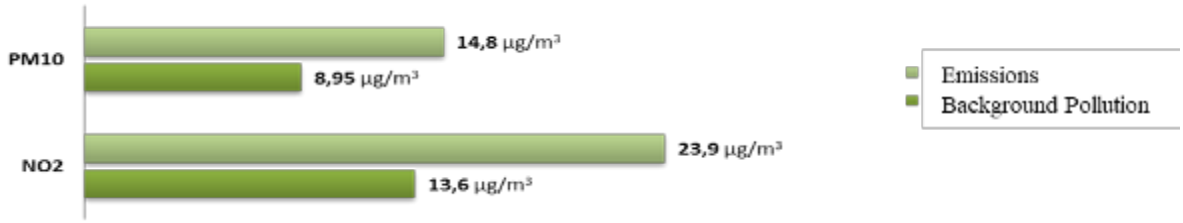
Annual PM_{10} averages, observed in the period between 2005 and 2012, have decreased, with the limit value for PM_{10} having been exceeded only in 2005 and 2006. Between 2007 and 2014 the 8-hour limit value was exceeded only in 2007. There are no records of legal limits being exceeded since 2008.

Pollutant Matrix of the Municipality of Guimarães

Integrated within our Strategy is an inventory of the major air pollutants in 2016. The aim has been to assess the contribution of Guimarães to the overall concentration and thus identifying aspects require future air quality improvement**[2]**.



a) PM_{10} emissions **b)** NO_x emissions **c)** SO_2 emissions



d) Background pollution in Guimarães

Figure 2 Pollutant matrix of Guimarães, emissions *per* sector of activity and background pollution, 2014

SO_2 emissions totalled 31.5 tonnes/year mainly from the "Trade and Services" and "Industry and Construction" sectors that account for 73%. The NO_X emissions were 1546.9 tons/year, arising especially from "Road Transport" (69%). This figure comes from emissions resulting from the combustion of petroleum products. The total emissions of PM_{10} are 161.7 tonnes/year released mainly from the "Domestic" sector, accounting for 67% of the total emissions, and the "Road Transport" sector that contributes with 29%.

The contribution of background pollution of PM_{10} and NO_2 in Guimarães (Figure2d) is based on the average concentration in a central area of the city. The background pollution concentration of the SO_2 pollutant was estimated at 2.2 µg/m^3, taking as reference the value of average concentration located 50m from the industrial area with the greatest activity.

Air Quality Chart

Air Quality was assessed through a summary indicator – **CityAIR[3,4]**, which varies depending on the concentrations of three typically urban atmospheric pollutants: PM_{10}, NO_2 and SO_2. The CityAIR model uses Pollutant Concentration Maps[5], and the values for each point or area are compared with a standard limit[9]. This comparison generates a "*dummy*" variable: zero if the standard is exceeded and one if it is not.

The cityAIR index results from the weighted linear combination of normalised concentration values, which are subjected to the product of the dummy variables. The fact that the index is understandable for the general public is highlighted.

When combined through the CityAIR index, concentrations of assessed atmospheric pollutants show that, overall, Guimarães presents air quality ratings of mostly Good and Very Good. However, the air quality map (Figure 3) shows the existence of some potentially troubling areas, mainly due to road traffic. For the problematic areas, a Monitoring&Mitigation Plan is being prepared.

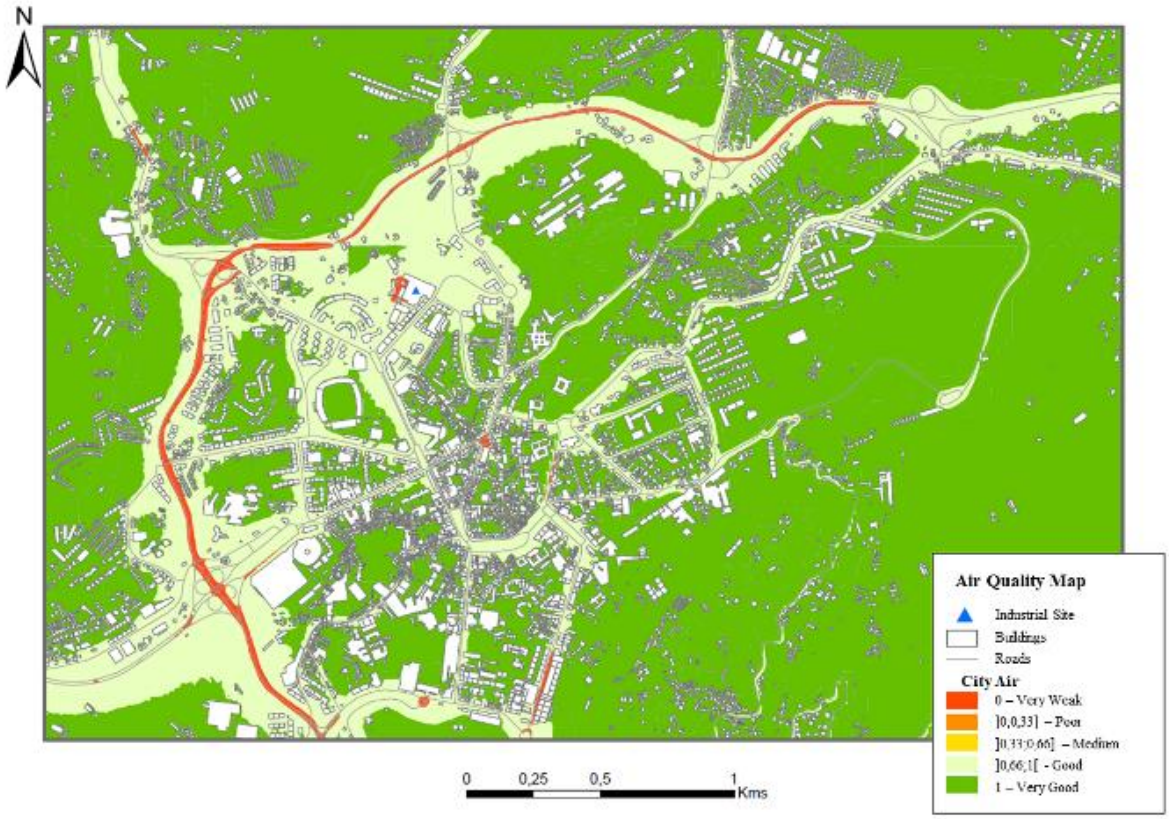


Figure 3 Guimarães CityAIR, 2016

[9] **Decree-Law no.102/2010**, of 23 September

Table 1 Population and area exposed to CityAir

CityAir	Population	
	Inhabitants	%
Very Poor	1760	1,1
Poor	0	0
Medium	2498	1,6
Good	66638	42,1
Very Good	87228	55,2

Pollutant Concentration Maps

NO_2

The NO_2 concentration map shows that the highest concentrations are directly influenced by main traffic roads. NO_2 concentrations are mainly within limit values, except in areas close to some major roads and industrial areas.

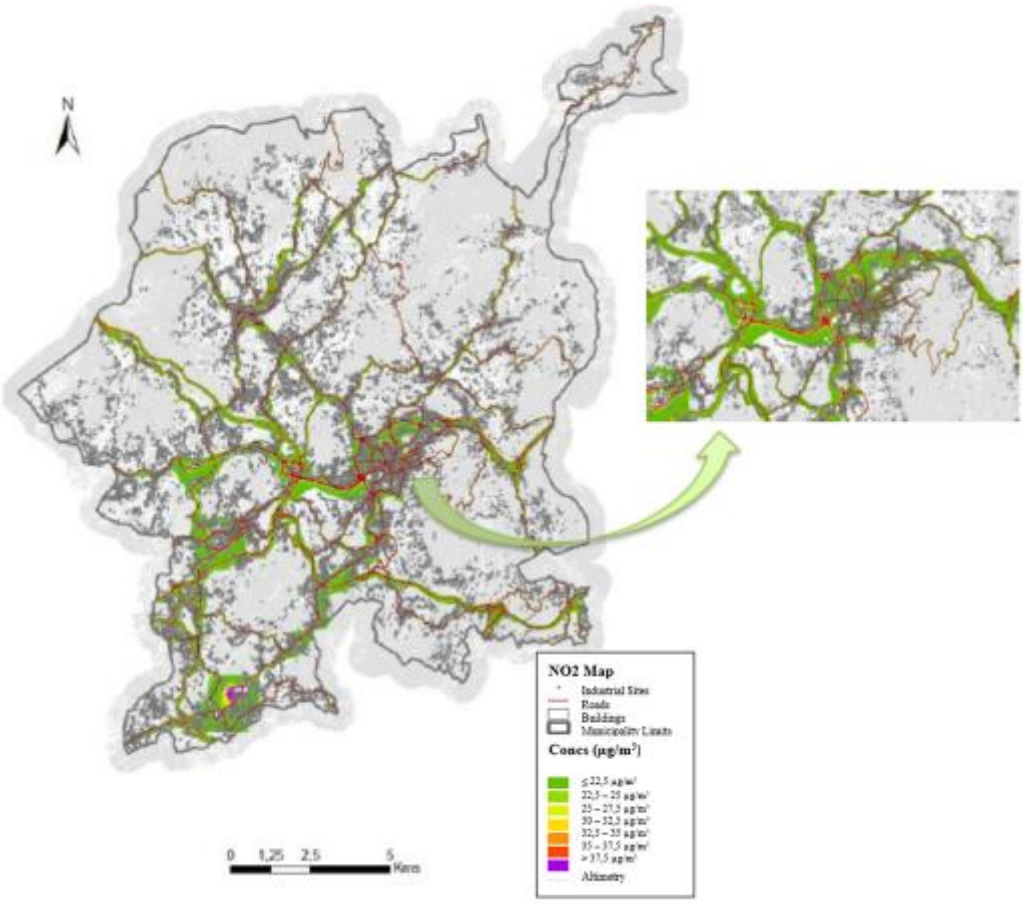


Figure 4 Guimarães NO_2 concentration map, 2016**[5]**

PM$_{10}$

The PM_{10} concentration map shows that the highest concentrations are directly influenced by main traffic roads. The concentrations do not exceed limit values, except very occasionally in the close proximity of industrial areas of greater activity.

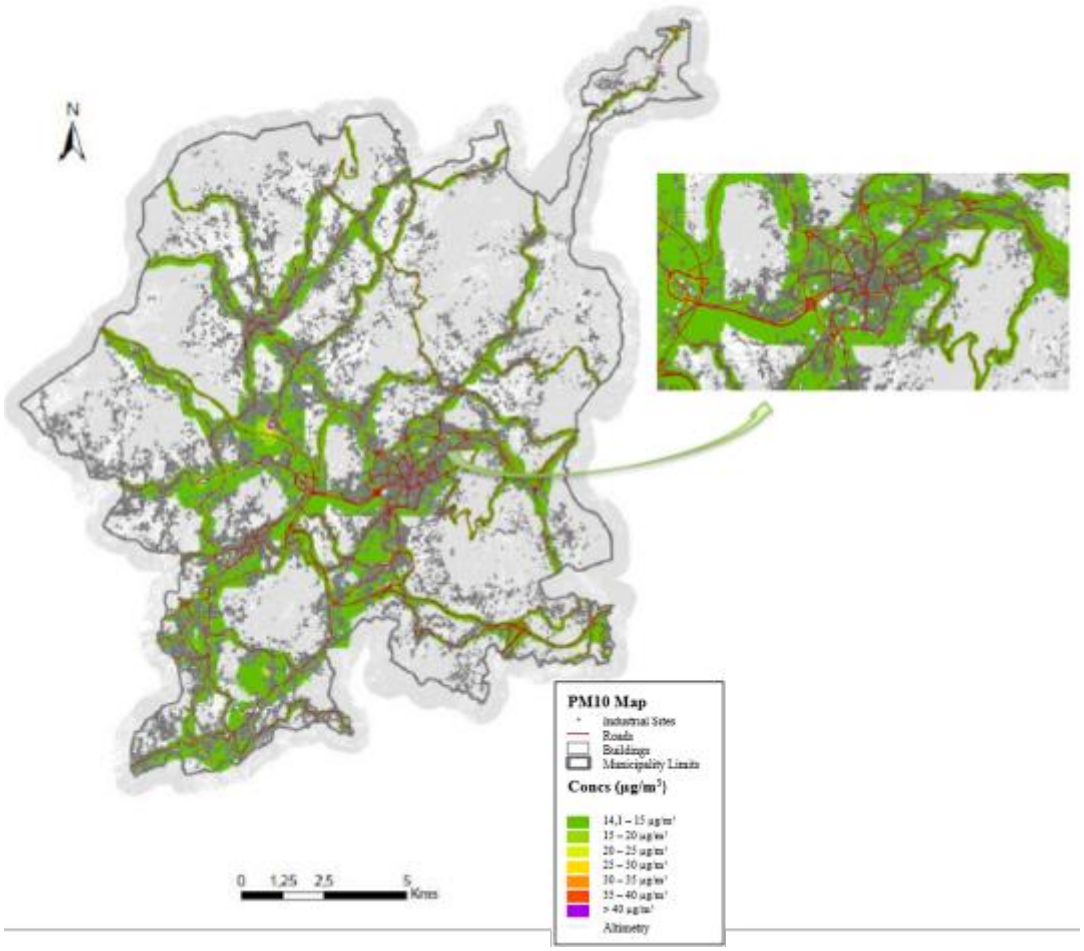


Figure 5 Guimarães PM10, 2016**[5]**

SO$_2$

The SO_2 concentration map**[5]** shows that the highest concentrations are directly influenced by main traffic routes. However, the limits are not exceeded in the municipality.

Within the scope of the Mission Structure, Guimarães recently adopted an integrated approach for the classification of **areas of Local Interest**[10].

[10] **Areas of Local Interest**: Penha Mountain; City Park; Meadow of Creixomil; Taipas and Ponte Parks and Monte Latito. This information can also be found in section 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | 10 | 11 | 12

Several indicators were used regarding:

- Nature and Biodiversity,
- Acoustic,
- Air quality.

As these areas have low pollutant concentrations, usually with a large number of trees and offering a better quality of life, a classification of **Green and Urban Low Emission Zones** will also be adopted. Our citizens are fortunate. Since 2005, 65.6% live less than 200m from a green area[11]. Every one of them enjoys 22.50 m^2 of green areas, exceeding the United Nations benchmark of 20m^2.

6B. Past Performance

Following Guimarães greening policy, **Air Quality Management Plan** was developed in 2015 by **Air Quality Operational Unit** integrated in the Mission Structure. Up to that date there was no local air quality assessment process, only a regional level analysis under the responsibility of CCDR-n[12].

The Plan comprises the following main objectives:

- Evaluating motorised traffic;
- Monitoring noise, air quality and meteorological parameters;
- Maintaining a digital cartography of noise, atmospheric pollutants and meteorological parameters;
- Generating ways to predict noise and atmospheric pollution;
- Maintaining signalling and alert systems in exceptional situations.

[11] This information can also be found in section 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | 10 | 11 | 12

[12] CCDR-N North Portugal Regional Coordination and Development Commission (CCDR-N) is a public institution that works towards the integrated and sustainable development of the North Region of Portugal, contributing to the country's competitiveness and cohesion.

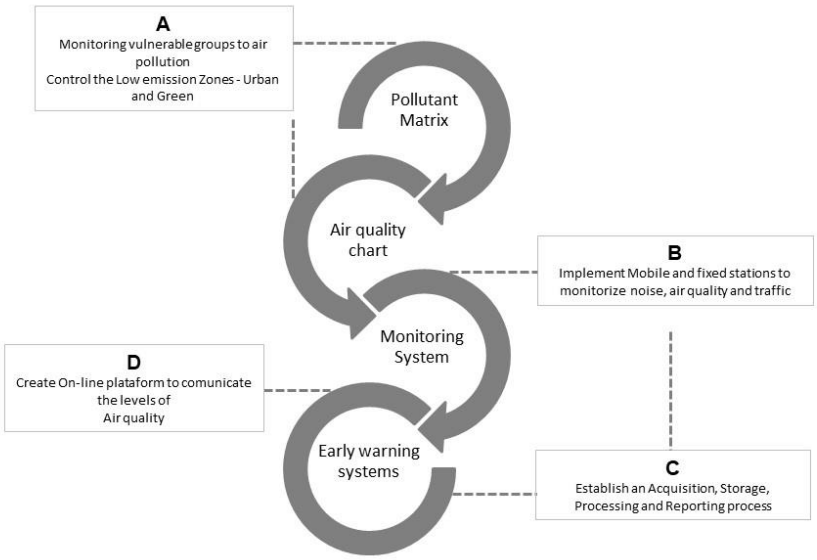


Figure 6 Guimarães Air Quality Management Plan

Plan' implementation started with diagnosis phase, resulting in the 2016 Pollutant Matrix of Guimarães and the Air Quality Chart. Future actions already encompass improvement through establishing LEZ[13] and respective regulation, and a Continuous Monitoring Infrastructure for the Acquisition, Storage, Processing and Reporting of air quality data. Scientific Studies and policies are included in the plan to evaluate air quality, traffic and industrial emissions-information that will be available to the public.

Overall evolution of emissions resulting from various measures implemented locally and nationally

The SO_2 emission dropped sharply between 2009 and 2013 as a result of substituting high sulphur content fuels with "Natural Gas" in "Industry and Construction" and "Energy Production". Measures to shift the energy matrix began in 1990s and are now reflected in Regional and National inventories. The NO_X emission profile shows a decrease in recent years: with its main source being-Road Transport-the consumption of fossils fuels has been gradually decreasing.

The PM_{10} emissions show an abrupt decrease between 2009 and 2012. This is because forest fires were included until 2009, but not in following years. Over the last three years there has been a slight decrease (almost stabilization).

[13] Low Emission Zones

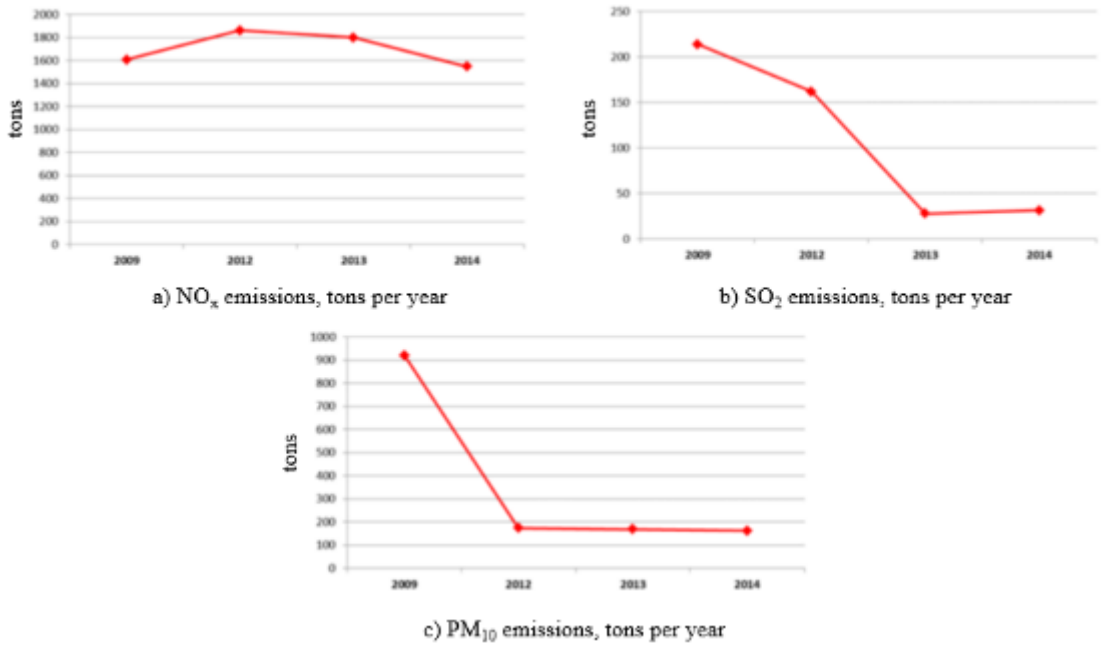


Figure 7 Evolution of emissions of the main atmospheric pollutants in Guimarães

Although AQMP only started in 2015, some actions carried out by the municipality were identified as being related to 2016'results:

In 2010, Municipality and CCDR-N defined and implemented practical measures and awareness-raising initiatives for improving air quality through: **Programme for the Implementation of the Air Quality Improvement Plan in the Northern Region[6].**

In 2011, Municipality **forced the relocation of a stone handling industry** located in city centre. Noise reduction was immediate,[14] as was PM generated. Traffic was reduced and so was pollution and noise as heavy vehicles vacated the location. The area was regenerated by the city as a public space-Platform of Arts and Creativity**[7]**. This cultural unit has a mix of pavement, trees and water, there is no noise and air pollution. At the same time, the Reclassification of the Abandoned Industrial Park[15] began, together with moving several industries into strategically positioned industrial parks.

2012 was ECC[16]year**[8]**. To prepare the city, several structural and architectural changes were implemented, including in the City centre main square and adjacent areas. This zoning led to reducing and discouraging traffic and limiting speed. Bus stopping was eliminated, parking was reduced and commercial "loading and unloading" was regulated. Not only did traffic flow better but there were less exhaust emissions that could affect air quality.

[14] This measure can also be found in section 1| 2 | 3 | 4 | 5 | 6 | **7** | 8 | 9 | 10 | 11 | 12
[15] e.g. Couros Zone
[16] ECC- European Capital of Culture, 2012

Figure 8 Largo do Toural, Alameda de São Dâmaso and Platform of Arts and Creativity

Other traffic management measures

A two-tier **parking system** with green and red zones was created, the latter with higher fees but closer to the central city.

Between 2010 and 2012, Guimarães set up a pilot network for charging **electric vehicles**, having placed 17

charging points in central urban area. Local incentives for electric mobility was also applied, following the Municipal Plan for the Electric Mobility developed within the scope of Mobi.e[17]. Guimarães is the first Portuguese city to have a fast charging station.

In 2013, the municipality started to renew the fleet to electric vehicles and it is about to acquire two electric buses. Note that PAYT waste system is 100%Electric[18].

Figure 9 eBus, Mobi.E network, Electric vehicles of the municipal services

In 2013, the City Hall joined the **Covenant of Mayors[9]** and in 2014 approved the **Sustainable Energy Action Plan[10]**. By the following year, measures had already achieved the EU objectives of reducing CO_2 emissions by 20%[19].

The **historic centre** is a functional and comfortable area where pedestrians can move safely and enjoy many amenities. Pedestrian access resulted from restrictions on vehicles (with retractable bollards on access roads) and on parking, so that movement of all parties – pedestrians, persons with reduced mobility, loading and unloading, priority vehicles – is unhampered.

Recovery of the automated Air Quality monitoring station

Since 2016, the City Hall is committed with the Portuguese Environment Agency to manage an automated continuous station for monitoring traffic associated to the network of monitoring stations of the Agency[20]. Data is available for consultation at QUALAR - Air Quality, where the levels of urban pollutant concentration are also available**[11].**

Awareness and Education Actions

Through the **Guimarães mais verde commitment[21]** and **PEGADAS[22]**, several public awareness raising programmes have been promoted since 2015, focusing especially on youth. Also, **"Guimarães Marca"[23]** was launched to promote environmentally friendly good practices among industrials.

[17] **MOBI.e** can also be found in sections 1| 2 | **3** | 4 | 5 | 6 | **7** | 8 | 9 | **10** | **11** | 12
[18] **PAYT System** is described in Good Pratice 6
[19] This information can also be found in sections 1| 2 | **3** | 4 | 5 | 6 | **7** | 8 | 9 | **10** | **11** | **12**
[20] Even though this is a responsibility of the National agency, Guimarães City Hall took the first step requesting the agency to manage the station as well as data gathering and analysis.
[21] **Guimarães mais verde commitement** can also be found in Good Practice 1
[22] **PEGADAS** is the Municipal Programme for Environmental Education and Sustainability presented in Good Practice 1
[23] Guimarães marca can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

Figure 10 Information/awareness actions

6C. Future Plans

Together with other policies already adopted by the municipality to preserve air quality where it is good, and improve it where not, an Air Quality Management Plan was already defined for implementation and comprises the following stages:

1. **Monitoring** (regular assessment of) **Air Quality**, including regular updates and control of pollutant sources through the Pollutant Matrix of Guimarães by creating a monitoring network to continuously evaluate the air quality.

   The monitoring network comprises a mobile monitoring station that will travel around the municipality area in periods that were already established, as well as several fixed monitoring points linked to the central system. Specific requirements were considered according to the municipal area under analysis. The priority areas for continuous monitoring using sensors are the tighter grid inside the urban LEZ's and wider grid in the remaining areas of the city. The Priority areas for monitoring through the monitoring mobile station are the 9 villages urban centres and Green LEZ's.

2. **Creation, protection and control of Low Emission Zones** according to WHO targets (Urban Low Emission Zones and Green Low Emission Zones located in urban areas). The protected area (see past performance) are in formalizing process. These areas are also considered as LEZ's which implies a dedicated management plan. Several constraints and restrictions were already integrated in the plan to be implemented:

In the Low Emission Urban Zone (urban LEZ's):

- Restrict and/or heavily limit movement of motor vehicles;
- Grant permission to use buses with electric or gas engines;
- Regularly monitor urban pollutants;
- Limit pollutant activities;
- Relocate industrial polluting activities;
- Requirement for all urban operations to follow a Strategic Environmental Assessment.

In the Green Areas (green LEZ's), anticipating the creation of preventive measures designed to preserve air quality:

- Regularly monitoring of urban pollutants;
- Assessment of the level of population exposure to air pollutants inside the green LEZ;
- Provide public information through an electronic board located in each green LEZ;
- Combine green areas and the reduction of atmospheric pollution (natural barriers), using trees and green barriers to reduce the concentrations and transport of pollutants;
- Limit pollutant activities within a "300 m buffer"**[12]**.

To control the quality of the Zones, several *EFFICIENCY INDICATORS were already established:*

- *% of citizens living within a radius of 300m of the LEZ;*
- *Information platform to the public/LEZ users;*
- *Average concentrations of pollutants in each LEZ;*
- *No. of days in the year in which the O3 target-value is exceeded;*
- *No. of days in the year in which the PM10 target-value is exceeded.*

3. Combining **knowledge with management** by investing in i**nnovative monitoring green structures** that can be used as fixed monitoring points. Under the framework of the Mission Structure, the University of Minho is developing structures aiming to have a monitoring and reporting system using functional materials conveying information about Urban Environmental Quality. In this initial stage, sites that will benefit from the implementation of these structures were already identified.[24] These structures will also integrate information screens to inform the general public.

[24] This R&D project was submitted to the reGREENerate_H2020-SCC-2016-2017)

Figure 11 Green facade of a building (as example)

4. Creating early warning systems when pollution levels are high

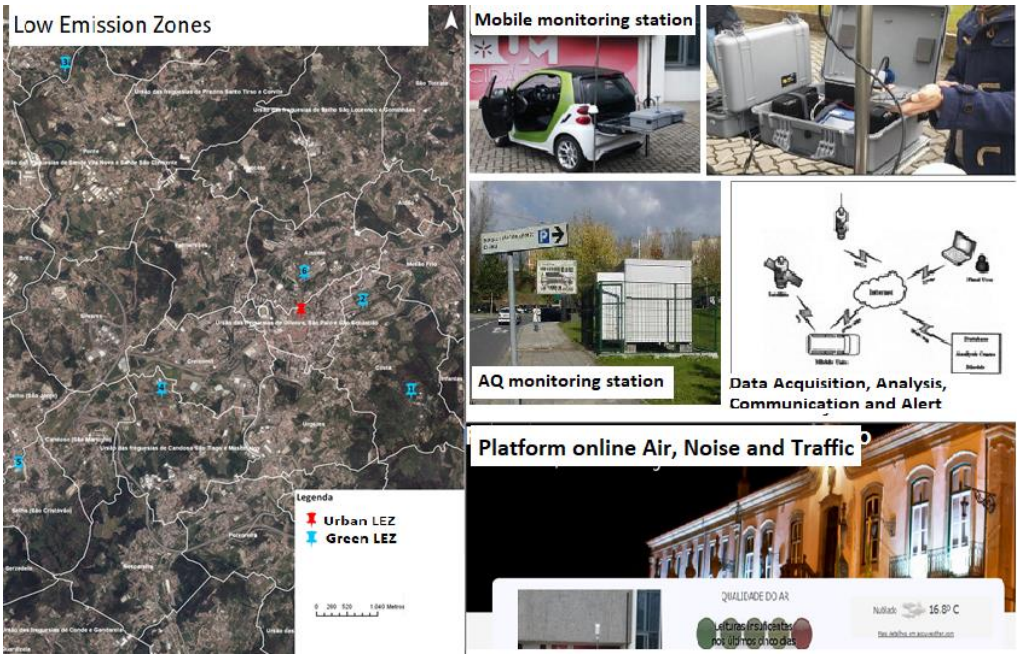


Figure 12 Air Quality Management Strategy in Guimarães

5. Monitoring **groups vulnerable** to air pollution through scientific work (Master and PhD thesis) supervised by one of the members of the Air Quality Operational Unit[25] of the Mission Structure for Guimarães' Sustainable development.

6. Implementing a **Code of Good Practice and awareness**, information and public participation through the Guimarães mais verde platform (See Good practice 1).

6D. References

[1] Declaration of political consensus and Declaration of individual consensus

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

c. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

[2] Silva, L.T.; Jesus, M.P. **PLANO DE MEDIDAS PARA A MELHORIA DA QUALIDADE DO AR E RUÍDO EM GUIMARÃES, FASE I. Matriz Poluente de Guimarães. 2017. Universidade do Minho**

[3] Silva, L.T., Mendes, J.F.G. (2011), A New Air Quality Index for Cities, Advanced Air Pollution, ISBN 978-953-307-511-2, August 2011, InTech (Ed.). [http://hdl.handle.net/1822/17680]

[4] Silva L.T., Mendes J.F.G. (2012), City Noise-Air: an environmental quality index for cities, Sustainable Cities and Society, Elsevier, DOI: 10.1016/j.scs.2012.03.001

[5] Silva, L.T.; Mendes, B.; Jesus, M.P. **PLANO DE MEDIDAS PARA A MELHORIA DA QUALIDADE DO AR E RUÍDO EM GUIMARÃES, FASE I. Mapas de poluição de Guimarães (PM10, NO2, SO2). 2017. Universidade do Minho**

[6] Programme for the Implementation of the Air Quality Improvement Plan in the Northern Region http://www.ccdr-n.pt/servicos/ambiente/qualidade-ar

[7] Platform of Arts and Creativity http://www.pitagorasgroup.com/project/plataforma-das-artes-e-da-criatividade/?lang=pt-pt

[8] European Capital of Culture http://www3.eeg.uminho.pt/economia/nipe/docs/Policy%20Papers/2012/relatorio_maio_CEC_UMINHO_v02.pdf

[9] Convenant of Mayors http://www.covenantofmayors.eu/about/signatories_en.html?city_id=6639&seap

[10] Guimarães Sustainable Energy Action Plan http://www.guimaraesmaisverde.pt/_energia_7

[11] QualAr Online database on air quality, APA http://qualar.apambiente.pt/

[12] Pereira, M. (2016) Preservation mechanisms of Green Urban Areas regarding air pollution. Master dissertation in

[25] **Operational units:** the Guimarães Mission structure for sustainable development integrates 12 operational units, one for each ECG Indicators and responsible for the 15/17 Action Plan. Each operational unit comprises specialists from some of the most important institutions linked to the sustainable development and technicians from the Municipality. That is, integrating Science and Tecnhology to the Knowledge of the territory held by the City Hall. A full description of the Mission Structure is provided in Good Pratice 1

Civil Engineering. University of Minho

7. Noise

7A. Present Situation

The noise strategy was defined by the Acoustic Operational Unit from the **Mission Structure for Sustainable development of the Territory**[1] created by the City Hall in 2015, in partnership with **UMinho**[2], which is co-responsible for coordinating the application process to EGCA2020 and the development of Action Plan 2015-2017, implementation of which will decisively contribute to the **Guimarães Sustainable Plan 2030**[3]. The firm commitment to sustainable development is consolidated in **declarations of political and individual consensus[1]**, strengthening community identification with the process.

The municipality is also committed to fulfilling the European Union acoustic objectives set out in Directive 2002/49/EC, that aims to prevent or reduce noise that affects human health, comfort and sleep. It also commits to preserve "*acoustic quality when it is good*", that is, creating Quiet Zones.

The strategy includes:

- Reduce noise pollution, improve quality of life for all citizens and fulfil applicable legislation;
- Define a continuous global plan to monitor/ control the municipal acoustic quality;
- Establish a plan for integrated management of urban noise;
- Identify and evaluate highest priority actions and major points of acoustic conflict by establishing adequate preventive measures.

In recent years, noise levels have decreased thanks to the implementation of reduction measures and awareness-raising actions.

Indicator		Unit	Year of Data
Share of population exposed to total noise values of L_{den} above 55 dB(A)	19.5	%	2016
Share of population exposed to total noise values of L_{den} above 65 dB(A)	5.0	%	2016
Share of population exposed to total noise values of L_n (night noise indicator) above 45 dB(A)	21.1	%	2016
Share of population exposed to total noise values of L_n (night noise indicator) above 55 dB(A)	5.2	%	2016
Percentage of citizens living within 300 m of quiet areas	92.6	%	2016

[1] **Mission Structure** can also be found in all sections and it's described in the Good Practices section
[2] **UMinho** – University of Minho
[3] **Guimarães Sustainable Plan 2030** is described in the Good Pratices section

Noise in the Municipality

Guimarães is a bio-cultural space with a polycentric structure. In fact, 84% of Residents have most of their trips within the municipality of Guimarães.

Due to the polycentric structure, a number of commuting movements are generated between urban centre and various surrounding villages. "Home-work" movements generate approximately 53% of the journeys, where Individual Transport accounts for the largest share of use (56%), meaning that commuting traffic is the greatest source of noise nuisance due to the polycentric structure of Guimarães, associated with Individual Transport use**[2]**.

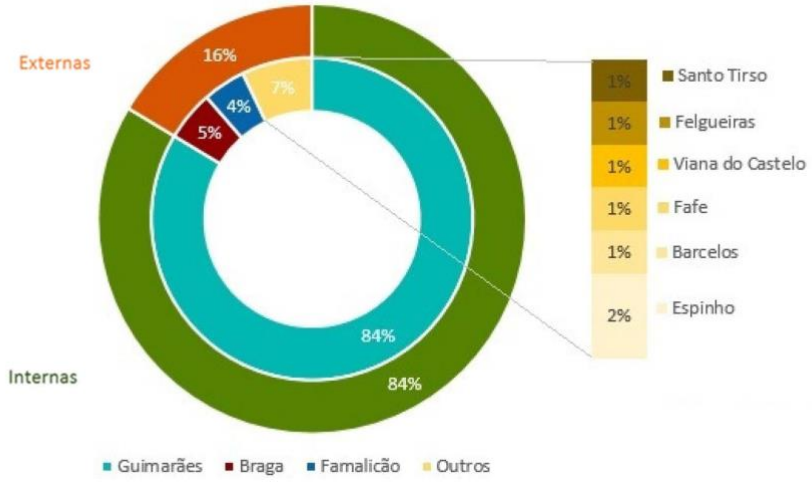


Figure 1 Mobility patterns in the municipality

Guimarães Train Station is a rail terminal of the Porto-Guimarães line, serving the municipality with four other stations, offering urban, long distance[4] and national services[5].

Bus central station offers non-urban public transport services and includes 34 bays. In 2009, its access and building underwent improvement works.

Municipal bus network has 21 lines (255.3 km). The city line covers the entire urban perimeter, with a 30-minute frequency. Demand for this line has grown from 56.683 validations to 188.097 (2010-2014).

The municipal environmental noise assessment was done for the entire municipal area, covering 241.3Km^2**[3].**

For the whole municipality, noise nuisance caused by road traffic, rail traffic and industry is recorded in noise maps, with the average noise impact/24 hours-L_{den}. There are also maps of the average night noise levels, comprises/13 hours-L_n. Most noise is therefore concentrated along main access roads[6]. These

[4] Intercity services
[5] Recent fast connection by Alfa Pendular connecting Guimarães to Lisbon
[6] **Main roads**: E.N. 206 Centre By-pass, the Urban Circular, E.N. 101 and sections of highways A7 and A11

convey traffic to the city centre and to neighbouring towns and villages. Environmental measures are integral to the city's management, thus optimizing resources, protecting the environment and reducing environmental pollution[7].

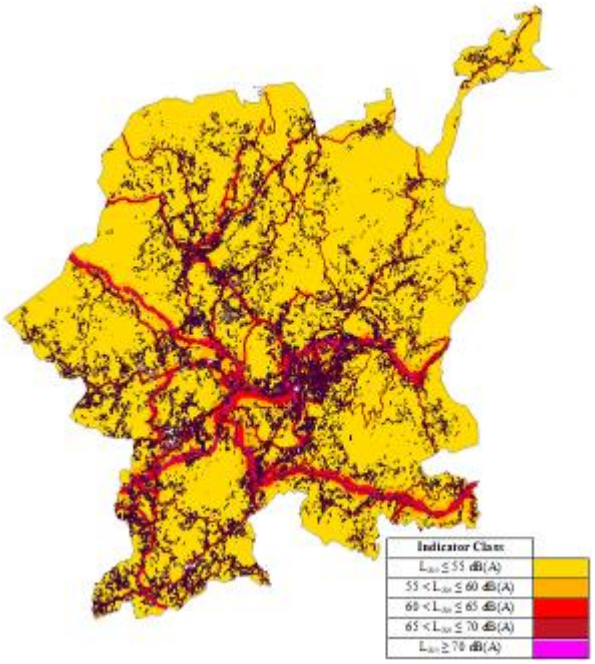


Figure 2 Average noise levels in Guimarães 2016 L_{den}**[3]**

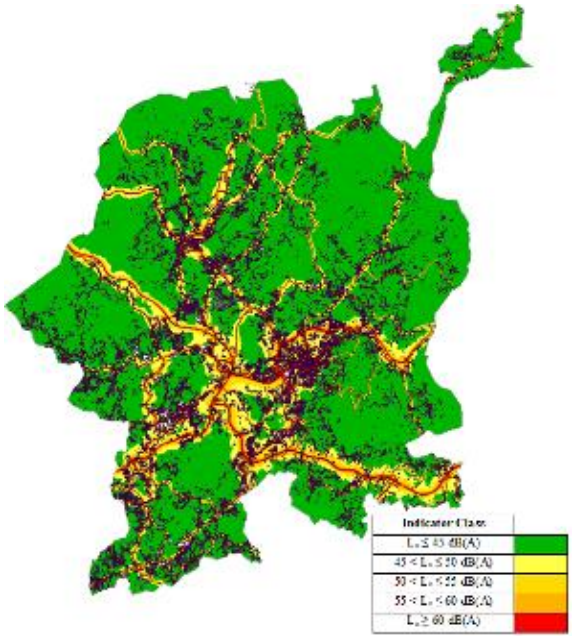


Figure 3 Night noise levels in Guimarães 2016 L_n**[3]**

[7] This information can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

Seven significant acoustic conflict zones were identified in the centre of the city[8].

In villages[9], situations of acoustic conflict were also identified. Villages with higher noise levels, considering the contributions of road and industrial traffic are, in descending order of noise overexposure: Serzedelo, Caldelas, Brito, Selho, Lordelo and Ponte. However, Ronfe, Moreira de Cónegos and S. Torcato have low noise levels.

The conflict areas in the surroundings of industrial parks are mostly due to logistic services, mainly generated by heavy traffic**[3]**.

Quarries are also significant sources of noise. However, they are located outside the main urban conglomerates and the acoustic conflict from these facilities is small.

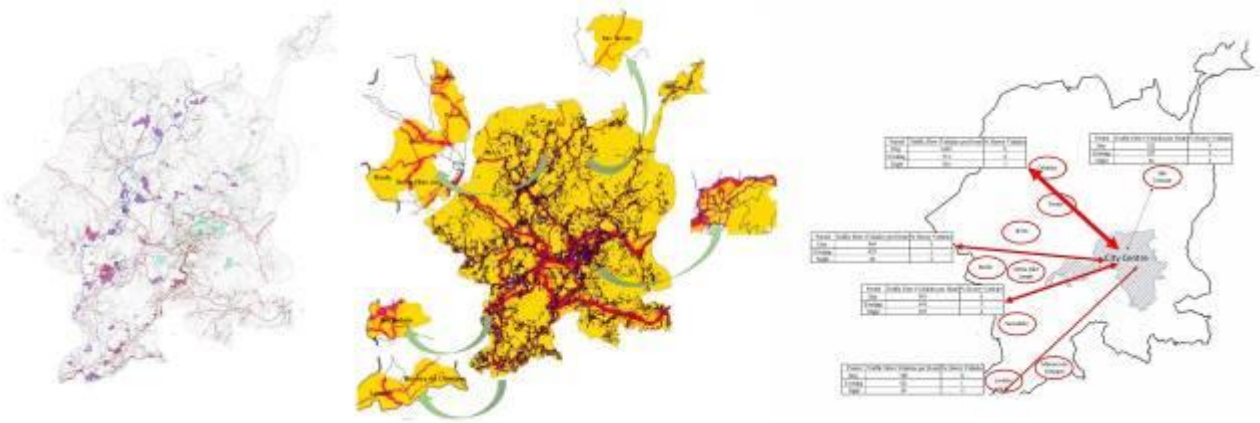


Figure 4 Industrial parks (marked purple), Map of L_{den} noise and traffic flows

In conclusion, Road traffic is in fact the **main noise source** in Guimarães. In turn, industry and rail traffic are co-contributors at a lower level.

As the municipal area with noise impact lower than 50 dB Lden is accessible for 92.6% inhabitants in the immediate proximity to their houses (300m), a classification of **Quite Zones (Green and Urban)** will be adopted in several areas to preserve the low noise levels.

Within the scope of the Mission Structure, Guimarães recently adopted an integrated approach for the classification of **areas of Local Interest** (green areas)[10] using several indicators:

- Nature and Biodiversity,

[8] Surroundings of the Urban Circular, Surroundings of the Creixomil Variant, Zone of the Alto Ave Hospital Centre - Guimarães Unit, Toural Zone, Alameda de São Dâmaso and Largo República do Brasil and surroundings of Rua Padre António Caldas
[9] **Villages of Guimarães** - Serzedelo, Caldelas, Brito, Selho (São Jorge), Lordelo, Ponte, Ronfe, Moreira de Cónegos and São Torcato
[10] Penha Mountain; City Park; Meadow of Creixomil; Taipas Park and Ponte and Monte Latito

- Acoustic,

- Air quality.

Two of the identified green areas already have a certification for environmental quality management**[4]** and can therefore be designated as green quiet zones with target Lden levels below 50 dB(A) in the central area.

Urban QZs are dense urban public and leisure areas that also meet acoustic quality targets: Lden below 55dB(A). These QZs are those in the Historic Centre Area (World Heritage Site) and the Couros Zone. It is important to highlight that 50.5% of the total area of the city centre is exposed to levels below 55dB(A). In Urban QZs, road traffic will incrementally be replaced by soft modes and noise will be reduced. Careful management and monitoring will be needed for optimum acoustic quality.

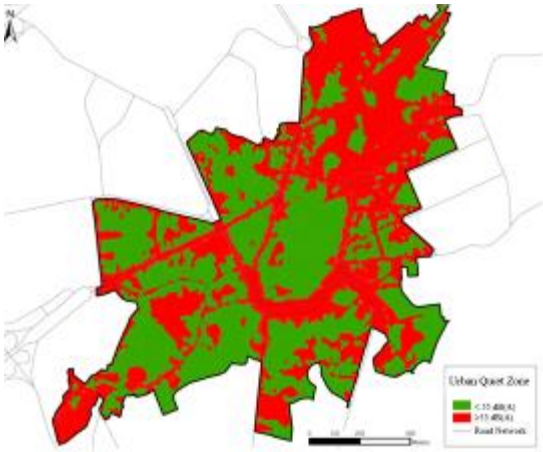


Figure 5 World Heritage Site, Buffer Zone and Couros Zone – green represents the areas bellow the target

7B. Past Performance

Following Guimarães greening policy, a Noise Strategy was stablished in 2015. The implementation of a diagnosis phase resulted namely in Municipality noise maps from 2016. Before that, the City Hall had maps produced in 2008. Several measures were identified that contributed to the municipal environmental noise improvements and a comparative analysis between 2008/2016 was also done.

Comparative analysis - 2008/2016[5]

At a municipal scale, both noise maps reveal improvements in the municipal environmental noise. Regarding L_{den}, the percentage of the population exposed above 55 dB(A) slightly decreased (20% to 19.5%). With regard to L_n, the percentage of population exposed over 45 dB(A) decreased in a more significant manner, dropping from 24% to 21.1%.

The Lden indicator in the **city centre** (2008/2016) reveals an improvement of the acoustic environment in some of the areas (decrease of red areas).

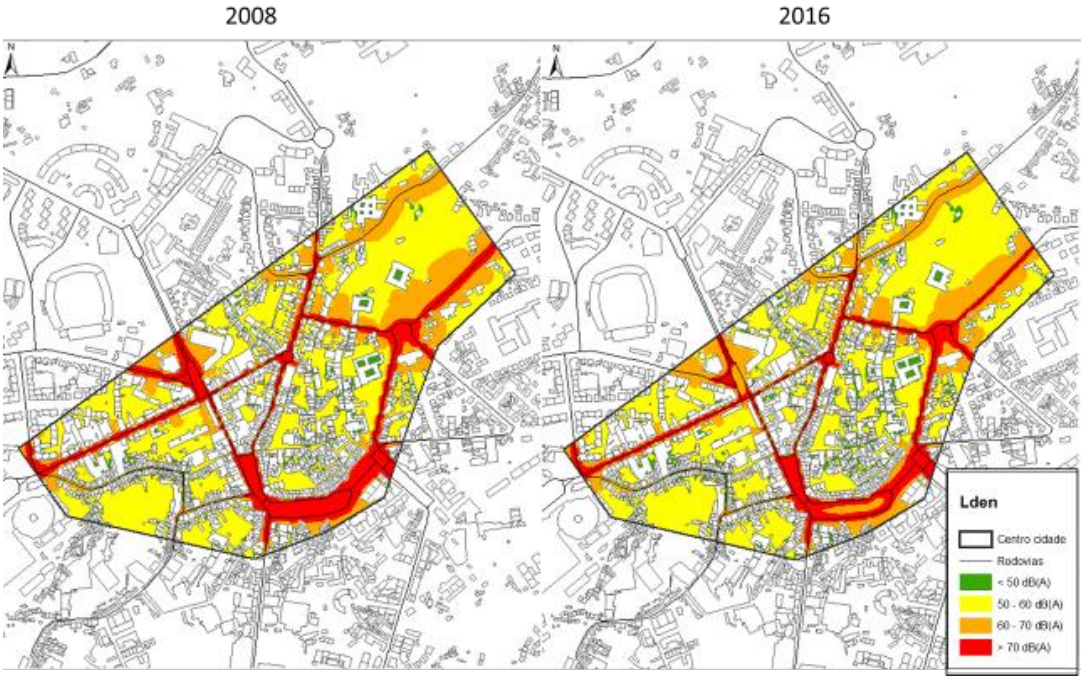


Figure 6 Noise map: City centre, 2008 vs 2016 (L_{den})

The results in the table also show that there is a reduction in the population exposed to noise levels, and the percentage of total area presenting good environmental noise has also increased (classes <55dB(A) and <45dB (A)).

Table 1 Assessment of the population and area exposed to noise in the **city centre**

	Classes dB(A)	Exposed area 2008 (%)	Exposed area 2016 (%)	Variation 2008/16	WHO targets
	< 55	65.8%	67.2%	↑	☺
L_{den}	55-65	21.8%	20.7%	↓	☺
	> 65	12.4%	12.0%	↓	☺
	< 45	61.9%	65.1%	↑	☺
L_n	40-60	24.9%	22.6%	↓	☺
	> 60	13.3%	12.3%	↓	☺

Measures implemented over the last years

At a **municipal level,** since 2013 over **12.5M€ were invested to improve the municipal road network**, including some of the roads close to industrial parks. The pavement was changed to a quieter material.

An **investment of 65,5M€** was also **done in all the Parishes** over the past four years, creating new facilities and public services. The investment in territorial cohesion is expected to have an impact on commuting movements and, as a consequence, on traffic congestion and noise annoyance.

Over the past years, it was possible to identify several measures that were implemented in the **city centre**,

resulting in the improvement of the environmental noise quality of this area:

In 2011, the **removal of a stone handling industry** from the city centre was effective in reducing the noise and PM generated. Heavy traffic decreased and acoustic and air quality improved alike. Simultaneously, this area was regenerated with a new public space - Platform of Arts and Creativity**[6]**. Here, pavement, trees and water go hand in hand and noise and air pollution were reduced. Similarly, the Couros Zone was part of the Reclassification of the City's Abandoned Industrial Park, with noise levels concomitantly reduced, as industries were removed to strategically positioned industrial parks.

The restoration and reconstruction of the *Largo do Toural/Alameda São Dâmaso/Rua de Santo António* in the city centre in 2012 (through the ECC**[7] Requalification of the Urban Setting**) changed the use of this space by **reducing vehicle access**, **restricting parking**, **disallowing buses**, and **reorganising commercial loading and unloading**. Noise levels – and pollution – decreased accordingly**[8,9].** The same happened years before in several squares of the Unesco World Heritage site where cars were replaced by people.

Figure 7 Requalification of the Urban Setting

In 2012, traffic – and thus noise – declined through:

- **Parking management**: VITRUS[11] created a parking system with two types of zones, namely green and red zones, the latter with higher charges but closer to the central city.

- Through **MOBI.e**[12], City Hall installed a network of charging points for electric vehicles. In 2017, the first fast charging station was installed, the first of its type nation-wide.

In 2013, the City Hall started the process of **renewal of the municipal fleet with electric vehicles**. By now, almost 11% of the fleet is electrical, the Payt system is 100% electric and the city line for public transport is covered by a 100% electric bus (since September 2017)[13].

Figure 8 Promotion of electrical mobility

Also in 2015, **traffic restrictions in the historic centre**[14] were implemented**.** At the moment, access is only allowed to residents, merchants, municipal and other authorized vehicles. Guimarães is the first Municipality in Portugal to have a **public carpooling** system[15]**[10],** in addition to a **car-sharing** programme with electric vehicles: **ZENCAR**[16]**[11]**.

Communication and stakeholder involvement

Concrete plans for change include awareness-raising and training, involving the diversity of stakeholders. The underlying drivers for a new urban policy will be to complete cycling networks, integrating them into Sustainable Urban Mobility Plans and then incorporating bicycles in the urban mobility system as well as in the daily lives of citizens. Since 2015, several actions were developed among the community in themes such as Noise, Mobility and Air Quality. These also include the programmes **Guimarães mais verde Commitment** and **PEGADAS**[17] - with awareness raising actions being prioritised among the school community. These included the participation in the **International Day for Noise Awareness** by first-cycle students and their parents, accompanied by informative talks, competitions, exhibitions and noise measurements.

The City Hall as already developed the **Acoustic Zoning Map[12]** of the Municipality identifying Mixed and Sensitive Zones. This is the baseline of the Municipal regulations concerning noise management.

[11] **VITRUS** – Municipal Company
[12] **Electric Mobility** can also be found in sections 1| 2 | **3** | 4 | 5 | 6 | **7** | 8 | 9 | **10** | **11** | 12
[13] **PAYT** System can also be found in sections 1| 2 | **3** | 4 | 5 | 6 | **7** | 8 | 9 | **10** | **11** | 12 and Good Practice 6
[14] This information can also be found in sections 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[15] **Guimarães à boleia**: it is a free platform that allows sharing a car
[16] **Carpooling System** can also be found in section 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[17] **PEGADAS** - Municipal Programme for Environmental Education and Sustainability. Is described in Good Practice 1 and comprises more than 104 activities carried out with several partners, reaching 19 227 students (data from 2016)

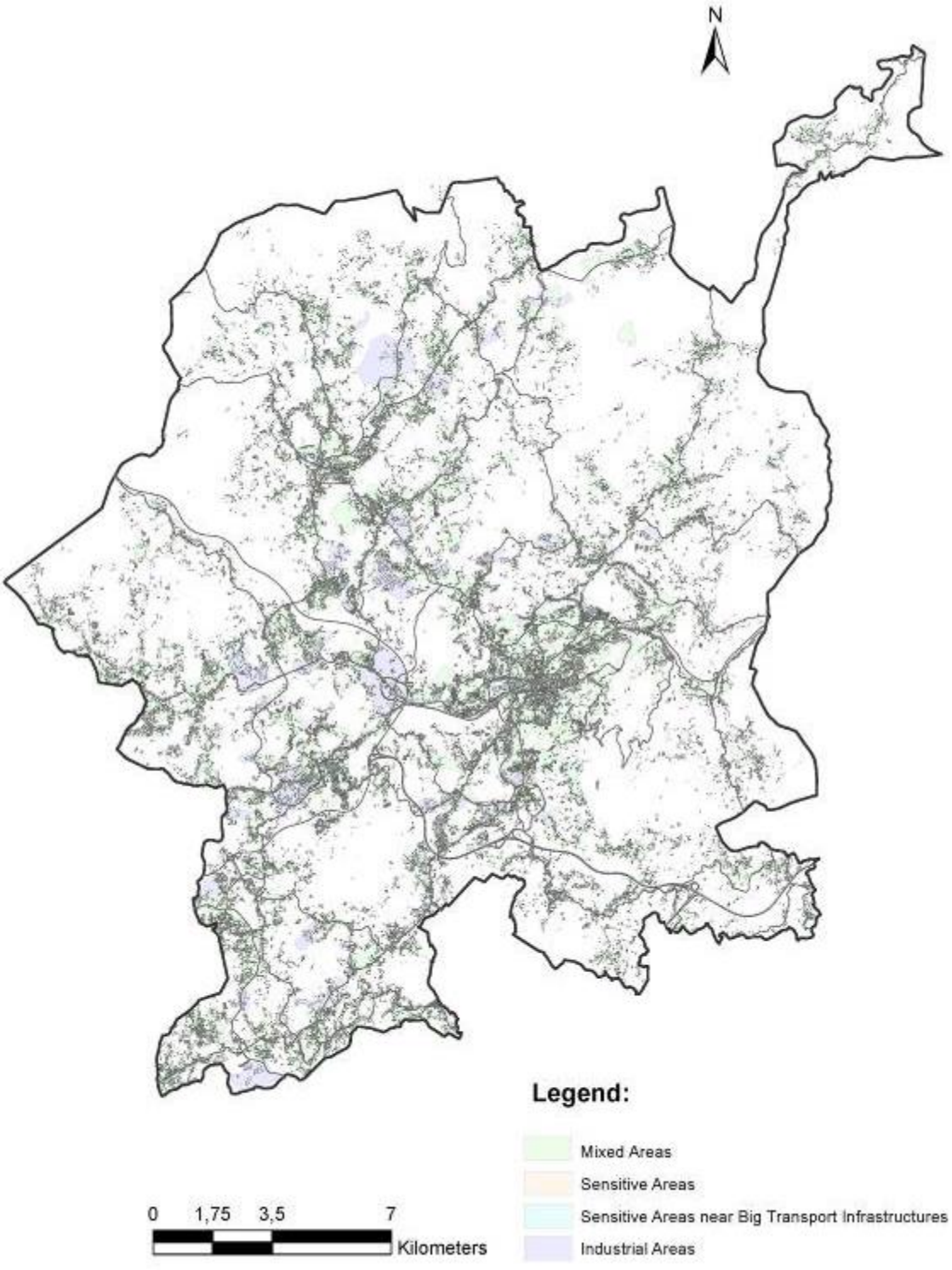


Figure 9 Guimarães Acoustic Zoning Map

7C. Future Plans

A **Noise Strategy**, aligned with the **Guimarães Sustainable Plan 2030**[18], is in development comprising the **NRP**[19] and the **MRN**[20], which are still in a tendering stage.

Noise Reduction Plan for Guimarães

Acoustic conflict zones that require priority action were identified.

Priority acoustic conflict zones:

1. By-pass of Creixomil;

2. Hospital Centre of Alto Ave - Unit of Guimarães;

3. Quintã Area and University of Minho - Campus of Azurém;

4. Toural Area, Alameda de S. Dâmaso and Largo República do Brasil;

5. Rua Padre António Caldas.

Figure 10 Priority intervention areas

In order to minimize noise in conflict zones, measures have by now been defined with some already in the implementation phase.

- Zone 1: Short term project already approved and financed connecting the highway to the city centre solving one of the main traffic constraints.

- Zone 2: Traffic speed will be reduced from 70 to 50 kilometres/hour, achieving an expected reduction of the exposed area above 65 dBA and above 55 dBA of 16.4% and 13.7% respectively**[13]**. A natural noise barrier will also be installed.

[18] **Guimarães Sustainable Plan 2030** is described in the Good Pratices section 1
[19] **NRP** - Noise Reduction Plan for Guimarães
[20] **MRN** - Municipal Regulation on Noise

- Zones 3: Protection using noise barriers (in the urban circular) + protection by natural acoustic barriers.

- Zones 4 and 5: Install phono-absorbent pavement**[13]**.

Figure 11 Project to solve a conflit zone: connection of the highway and city centre

According to a survey conducted to assess the perception of the environmental quality of the Municipality using a stratified random sampling procedure with a sampling error of 5%, the major source of annoyance for 68.9% of the respondents is road traffic. Results indicated that greening policies should include more actions to promote 'sustainable mobility' as it is already considered in Guimarães SUMP:

- promoting soft modes, including promoting pedestrianism and the Cycling mode to avoid the use of private transport;

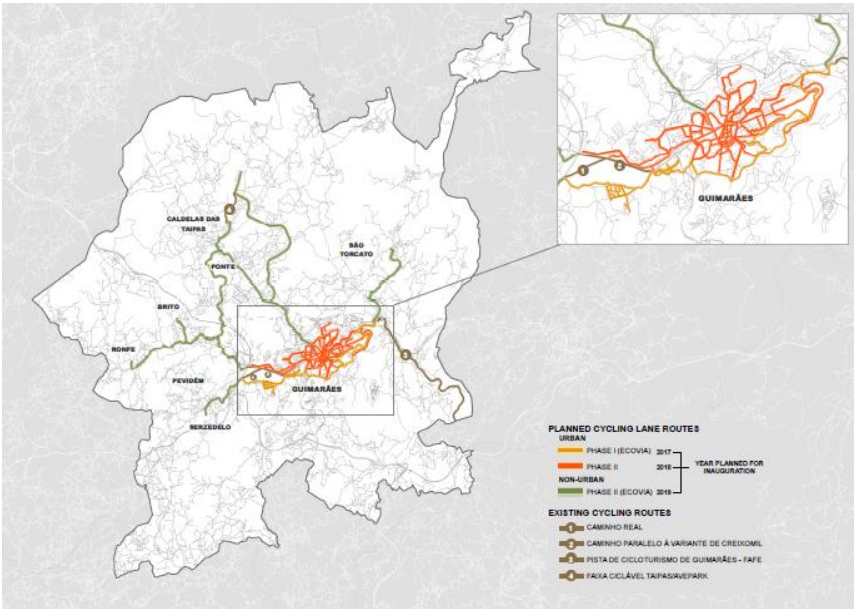


Figure 12 Cycling lane routes

- Improve transport management and definition of a new network of collective transport (encouraging public transport by improving the service and information, and creating peripheral parking areas);

- Increase electric mobility;

- Integrating the different modes of transport;

- The City Hall will continuously improve on stakeholder engagement through the "**Guimarães marca"[14]** programme, focused on promoting environmental Good Practices among Industrials and Private entities, who also are encouraged to develop innovative projects: **Educabicla**, **Ubike** or **Teatro Bus[15,16,17].**

Table 2 – Indicators and targets for 2027 of Guimarães SUMP**[2]**

Indicator	Target for 2027
Universal accessibility	100%
Pedestrian areas (m2)	5 700 m2
Cycling network	14 km by 2019 26 km by 2027
Bicycle sharing points(n)	20
Movements below 4km by bicycle	10%
Comfort and accessible Bus stops	100%
Vehicles/1000 inhabitants	465 Vehicles/1000
Occupants per vehicle	2
Reduction of fatalities in accidents	35%
Individual motorized vehicles transferred to sustainable modes	10%
Mobilization	100%
Reduction of emissions	10%

Other Measures:

- Create a web portal to promote shared vehicles;

- Create school paths/routes (promoting walking to schools) to decrease commuting traffic due to home- school trips.

Municipal Noise Regulation (in tendering stage) aiming to define a set of rules to ensure good acoustic quality at home, work and leisure. It applies to loud permanent and temporary activities and other sources of noise likely to cause discomfort.

Commitment to the preservation of "acoustic quality when it is good"

The following measures are foreseen for the Urban and Green Quiet Zones.

Urban Quiet Zones

- Ongoing monitoring and information to the public on the noise levels existing in the QZ;
- Restrict and/or heavily limit motor vehicles;
- Permission to use buses with electric or gas engines;
- Limit loud permanent activities;
- Relocate loud industrial activities;
- "Park and Ride" Strategies;
- Create routes for goods vehicles through less sensitive areas;
- Establish time restrictions for circulation, loading and unloading of heavy goods vehicles;
- Enforce noise limiters in audio equipment in night bars and at outdoor events;
- Building Acoustics Assessment (BAA) to all constructions operations.

Green Quiet Zones

- Regularly monitor noise levels in each Green QZ;
- Inform the public via electronic board located in each Green QZ;
- Combine green areas and the reduction of noise pollution (natural barriers), using trees to reduce noise;
- Limit loud activities in a buffer with different dimensions depending on the power of the source.

Development of an Acoustic and Air Quality Monitoring System of fixed sensors and a monitoring mobile unit, linked to a public information and warning system.

Goals to achieve:

- Create an infrastructure to acquire, store, process and report urban data that leads to efficient management of environmental quality, including noise.

Definition of priority areas for continuous monitoring using sensors:

- Tighter grid inside the urban QZ;
- Wider grid in the remaining areas of the city;

Definition of priority areas for monitoring through the mobile monitoring station:

- In the 9 villages, urban centres;
- In the green QZs.

Create public warning systems when noise and air pollution levels are high

Create a platform for public information about noise levels, air pollution and traffic (for example, webpages, information screens) in order to raise public awareness and promote behavioural change.

Figure 13 Noise Management Strategy in Guimarães

Implement a Code of Good Practices and awareness, information and public participation.

7D. References

[1] Declaration of political consensus and Declaration of individual consensus

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

c. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

[2] Guimarães SUMP

a. Abstract http://www.cm-guimaraes.pt/pages/1248?folder_id=1376

b. MpT (2016). Plan for the Sustainable Urban Mobility of Guimarães – Stage I Characterization and Diagnosis (2016)

c. MpT (2017). Plan for the Sustainable Urban Mobility of Guimarães – Stage 2 Intervention strategy (2017)

[3] Silva, L.T.; Mendes, B. Ribeiro, P. (2017). **Plano de Medidas para a Melhoria da Qualidade do Ar e Ruído em Guimarães**, Fase I. Mapa de Ruído do Município de Guimarães. Universidade do Minho

[4] **Green Areas Certification** under ISO 14001:2012, certificate of Registation 17/06129

[5] **Mapa de Ruído do Município de Guimarães (2008).** dBLab Laboratório de Acústica e Vibrações, Lda – digital version

[6] **Platform of Arts and Creativity** http://www.pitagorasgroup.com/project/plataforma-das-artes-e-da-criatividade/?lang=pt-pt

[7] **European Capital of Culture 2012** http://www3.eeg.uminho.pt/economia/nipe/docs/Policy%20Papers/2012/relatorio_maio_CEC_UMINHO_v02.pdf

[8] Fernandes, P. (2013) **Impacto na qualidade do ar após intervenção urbanística no Toural, na cidade de Guimarães**.n. Master dissertation in Civil Engineering. University of Minho http://hdl.handle.net/1822/31018

[9] Cruz, C. (2013) **Avaliação do Impacto Acústico produzido pela Intervenção Urbanística na Praça do Toural e Envolvente**, Guimarães. Master dissertation in Civil Engineering. University of Minho http://hdl.handle.net/1822/30682

[10] **Public carpooling** https://guimaraes.boleia.net

[11] **ZENCAR** https://www.youtube.com/watch?v=jd8Xg6kczZk

[12] **Urban Master Plan**, in force http://www.cm-guimaraes.pt/pages/568

[13] Silva, L.T.; Mendes B. (2017) **PLANO DE MEDIDAS PARA A MELHORIA DA QUALIDADE DO AR E RUÍDO EM GUIMARÃES**, FASE I. Mapa de Conflito Acústico de Guimarães. Cenários de Redução de Ruído. Universidade do Minho – digital version

[14] **Guimarães Marca** http://www.guimaraesmarca.com/

[15] **Educabicla Programme** http://www.educabicla.pt/

[16] **Ubike** https://www.fpguimaraes.pt/alunos-da-uminho-um-novo-transporte-dispor

[17] **Teatro BUS** https://www.youtube.com/watch?v=3H7KTTfnIt8

8. Waste

8A. Present Situation

82% of Municipal Solid Waste (MSW) is sent to mechanical and biological treatment stations. 62.4 kg/inhab/year is MSW from packaging, well above the national target for 2020 (47 kg/inhab/year). MSW produced *per capita* is 390kg/inhab/year - below the national target for 2020 (410 kg/inhab/year). 46% is the percentage of total recycled MSW, with Guimarães target for 2020 being of 50%. 24,873 MWh was the energy recovery[1] of biogas at landfill, an increase of 11% in the production and injection of energy into the network, in comparison to 2015.

Indicator	Type of Data (City/Regional/National)	Unit	Year of Data
Percentage of household waste sent to landfill	City	%	1.70
Percentage of household waste sent for thermal treatment or similar recovery (Mechanical biological Treatment)	City	%	81.57
Percentage of organic waste collected separately *(food-waste)*	City	%	1.35
Percentage of recycled household waste	City	%	45.99
Percentage of recycled packaging waste	City	%	15.99
Percentage of recovered packaging waste	City	%	15.51
Amount of household[2] waste generated per capita	City	kg/capita	390.00
Amount of municipal waste generated per capita	City	kg/capita	No figures[3]

[1] **Energy recovery of biogas** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **11** | 12

[2] Domestic waste + commercial waste, equivalent to domestic.

[3] The collection of industrial waste is not within the competence of the Municipality. Each industry hires the collection service to a company licensed for that purpose, not being forced to provide information.

1.

Table 1 Waste Plans and Strategies in progress

Nacional Plans
Strategy Solid Waste[4]
Waste Management Plan[5]
Municipal Plans
PERSU2020 Action**[1]**
Strategy for Waste**[2]**[6]
PAYT Implementation**[3]**
Waste management services Regulation**[4]**

Figure 1 Strategy of Guimarães' Waste Management Plan[7]

[4] PERSU 2020 approved by Decree no. 187-A/2014, published in Portuguese Official Gazette (Series I) no. 179 of 17 September
[5] Approved by Council of Ministers on 31-12-2014 and published in Portuguese Official Gazette on 16-03-2015
[6] Established in accordance with **Directive 2008/98//EC, of the European Parliament and Council of 19 November 2008 on Waste**
[7] According to the **Detailed assessment of Waste Management Plans Final Report**: "Assistance to the Commission on the assessment of Waste Management Plans and on compliance monitoring and support of the implementation of the Waste Framework Directive" – January 2016

2.

Guimarães has created several partnerships aimed at rethinking/reducing/reusing/reclaiming waste[8], in a perspective of circular economy, such as the Centre for Waste Valorisation[9] **[5].**

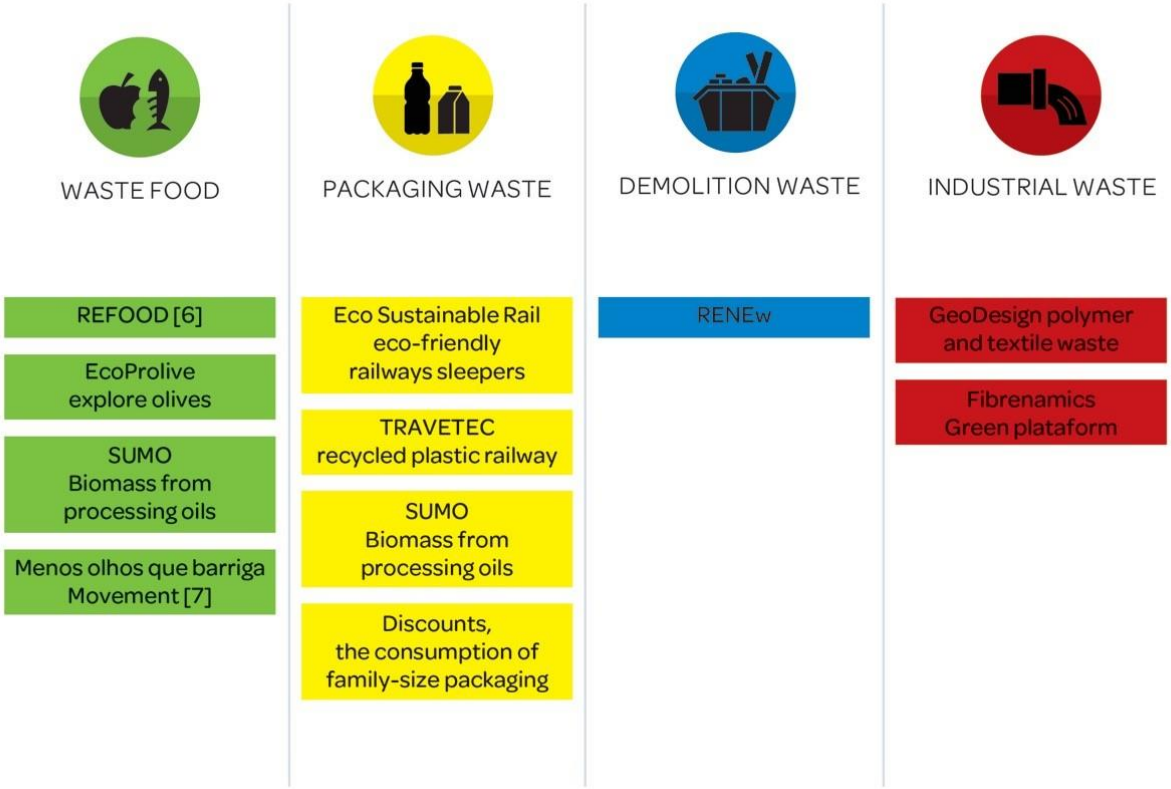


Figure 2 Waste reduction and circular economy projects[10] developed in partnership with external entities[11]

[8] According to **The new general Union Environment Action Programme to 2020 – 7th EAP** (p 33)
[9] Centre for Waste research – CVR in Portuguese, scientific analysis and implementation of real solutions in the area of waste recovery. The only one at the national level in which the Municipality is part of the Board of Directors supporting all projects. It is one of the partners of the Mission Structure and can also be found in sections 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | **10** | 11 | 12
[10] **G4CE** - **Guimarães for Circular Economy** can also be found in sections 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | **10** | 11 | 12
[11] **Renew** project is in line with the Management of construction and demolition waste (CDW) in accordance with the European Green Capital Award - Guidance Note 2020 and Preparing a Waste Prevention Programme Guidance document, October 2012

3.

- "CONSIGO" Project provides a supply database of used equipment for disabled people through reuse/recycling of such equipment; non-recoverable equipment is sent for recycling.

- Municipality promotes a second-hand market, providing a place for sale of used goods and articles on the first and third Sundays of each month, currently with approximately 130 vendors.

With the adoption of these prevention/minimisation/reuse and recycling policies, it was possible to achieve impressive results.

Table 2 Evolution of the collection system in Guimarães (2010-2016)

Indicator	Units	2010	2011	2012	2013	2014	2015	2016
Total recycle waste + domestic waste	Ton	65374.04	63313.32	62379.72	61023.30	62636.00	62402.82	61669.00
Household waste sent to Landfill	%	44.37%	62.81%	62.11%	35.81%	16.17%	2.69%	1.70%
Household waste sent to Mechanical biological Treatment	%	44.13%	25.33%	25.85%	51.88%	71.84%	82.69%	81.57%
Organic waste collected separately	%	nd	nd	nd	nd	nd	nd	1.35%
Recycled household waste	%	24.73%	19.46%	19.80%	27.87%	33.54%	36.85%	45.99%
Recycled packaging waste	%	11.33%	10.65%	10.28%	10.55%	12.44%	14.61%	15.99%
Recovered packaging waste	%	10.94%	10.27%	9.92%	10.18%	12.06%	14.18%	15.51%
Amount of Municipal Waste generated per capita	kg/per capita/year	413.44	400.40	394.50	385.92	396.12	394.64	390.00
Amount of Municipal Waste generated per capita	kg/per capita/day	1.133	1.097	1.081	1.057	1.085	1.081	1.069

4.

Three entities are responsible for waste collection in Guimarães: **Municipality**, **VITRUS[8]**, **RESINORTE[9]**.

Due to combined dynamics of dispersion/agglomeration, Guimarães is a city with an extended urban perimeter and many villages and parishes with very distinct characteristics, polarities and presences. Being a vast and diffuse territory, it was necessary to create MSW collection circuits to address this polycentrism effectively, dividing it into predominantly urban areas, semi-urban, rural, and industrial areas, with the physical composition of respective residues reflecting these characteristics**[10].**

MSW collection covers 100% of the population, being performed through pre-defined circuits, with distinct schedules and frequencies in accordance with geographical and physical factors of the collection area. Thus, collection mainly occurs three times per week, except in the city area and villages of Taipas and Pevidém, where it takes place six times a week, due to higher population density in those areas**[11].**

Separate collection of packaging covers 100% of population, with 74% having such service available less than 200m from their homes. Collection occurs via ecopoints and on a door-to-door system in the main commercial areas. Guimarães also offers a free door-to-door pick-up service for bulky waste by prior appointment with users, which is then forwarded to the three municipal EcoCentres/Recycling Centres**[12].**

5.

Waste collected separately is forwarded to the Sorting Station, which performs manual and mechanical sorting operations**[13].**

6.

MSW is forwarded to the Mechanical and Biological Treatment Station, by composting, consisting of three bioreactors, with unit capacity of 120 t/day. Waste from mechanical treatment is torn apart and composting takes place through forced fermentation, resulting in fresh compost, which is routed to a covered maturation park, where it is stabilized.

Waste from the treatment plant, along with some waste from collection, is destined for the sanitary landfill, which includes a network of vertical drain collectors that transport biogas to burners. Plants simultaneously produce electric power and thermal energy to heat the facilities**[13].**

7.

In 2016, the **PAYT System**[12] was implemented in the area classified as UNESCO World Cultural Heritage, with Guimarães being the first and only municipality in Portugal to adopt this system. This project was the topic of a Master's dissertation, which won the Award "Prémio Obra Prima Escrita Original" in 2015 and was published as a book. PAYT was also recognized in 2016 with an honourable mention by the Green Projects Awards[13]. Guimarães is Municipality of the Year 2017 with the implementation of the Pay-As-You-Throw system in the Historic Centre, promoted by the UM-Cities platform[14]**[14].**

Before Payt implementation, selective collection of biowastes[15] wasn't done. Treatment of undifferentiated waste allowed separation of biodegradable waste from remaining residues, resulting in fertilizer for agriculture at the end of the maturation process, used in educational and municipal gardens. With PAYT' implementation, and to encourage separation of all types of materials, separate collection of organic waste

[12] **PAYT System** is described in Good Practice **6**

[13] **Green Project Awards** is an international project, with editions in Portugal, Brazil and Cape Verde. GPA is an initiative promoted in partnership with local authorities and has an international network that represents the main sectors and areas of activity, with the sponsorship of the European Commission, and can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12**

[14] UM-Cities plataform https://www.umcidades.uminho.pt/en/Pages/default.aspx

[15] **Biodegradable waste - Preparing a Waste Prevention Programme Guidance document, October 2012**

was introduced, being subsequently forwarded to a local composting plant.

Collection is carried out door-to-door, using electric vehicles, through mini-ecopoints, pre-paid bags for undifferentiated waste (and only these are charged[16]) and mini-containers for organic waste. This system showed excellent public acceptance, proven by its results, with an increase of 126% in separate collection and a reduction of 34% in waste production. These values are significantly higher than those expected in the first year of implementation, where values comparable to other European countries were expected - 30% reduction in waste production and 15% increase in collection of separate waste. A substantial change in behaviour and attitude of citizens was also noticed, through good practices of waste management, and the adoption of a selective door-to-door collection policy was definitely crucial in this process**[15].**

Figure 3 PAYT System in Guimarães

[16] **Polluter-pays principle** according to **The new general Union Environment Action Programme to 2020 – 7th EAP** (p 10,64)

8A. Past Perfomance

1.

Table 3 History of waste production in the past 12 years

Years	2004	2010	201
Total recycle waste + domestic waste (ton)	68021.94	65374.04	6166
Percentage of household waste sent to Landfill (%)	57.13	44.37	1.7
Percentage of recycled household waste (%)	5.16	24.73	45.
Amount of Household Waste generated per capita (kg/percapita/day)	1.18	1.13	1.0

2.

Research for recycling of inert industrial waste and CDW in the construction of landfills, bases and sub-bases of roads, as well as studies for the incorporation of waste in mortar and concrete is done since 2002 in collaboration with CVR.

In 2010, Guimarães joined the "Clean Portugal Project", with the participation of more than 1200 volunteers in the first year to clean waste hotspots throughout the municipality.

In the last decade, several parishes in the municipality have created so-called "Brigadas Verdes" [17], with the objective of cleaning their residential areas.

[17] **Brigadas Verdes** can also be found in sections 1| **2** | 3 | **4** | **5** | 6 | 7 | 8 | 9 | **10** | 11 | **12** and Good Practice 1

Figure 4 Brigadas Verdes in action

Guimarães has been part of the initiative "Let's clean up Europe" and "European Week for Waste Reduction" since 2015, with countless actions and the involvement of several partners and the community in general[18].

One of the Municipality's biggest concerns, dating from the beginning of the century, is the separation of waste in numerous cultural, sports and festive events held in Guimarães, promoting actions to raise awareness, providing adequate equipment and creating mechanisms for reducing the generation of waste

[18] Under the **Guimarães mais verde Commitment**

according to the specific nature of each event**[16].**

Figure 5 Examples of actions developed to promote separate collection and reduce the production of bio-waste

- Project in the area of biofuels, an initiative of the City Hall and CVR, initiated in 2011; production of biomass pellets containing textile, polymeric and leather waste; AGROGAS project - Methanation of waste for diversification of energy resources in agriculture and agri-food sectors.

- Guimarães has promoted the separate collection of candles in cemeteries since 2011, turning wax into a raw material for the manufacture of cutlery. The revenue obtained by recycling this material is converted into food for social projects.

- The Municipality of Guimarães is the representative of the National Association of Municipalities in

the coalition for Green Growth in waste management are, since 2015. Its mission is to promote economic green growth in Portugal with national impact and international visibility by stimulating economic activities, promoting efficient use of resources, and contributing to sustainability**[17]**.

- Since 2016, Guimarães has installed on its streets the project **EcoPontas** and **PapaChicletes**[19], which are innovative solutions aimed at reducing the accumulation of cigarette butts and chewing gum in public spaces**[18].**

In addition to the environmental impact reduction, this project has a R&D nature, promoting waste recovery and reinforcing the circular economy concept. In the first six months of implementation, with placement of just eight of these structures in the city centre, more than 45000 cigarette butts and 5000 chewing gum pieces were collected.

In 2016 this equipment won the Social Innovation award of Green Project Awards[20].

Figure 6 EcoPontas and Papachicletes installed

- Since 2012, Guimarães promotes an annual "Paper-for-Food" campaign, which collects paper in exchange for food.

- The municipality's environmental policy is reflected in the recovery and capitalization of the energy potential of wood, resulting from logging and pruning trees in public gardens. In the

[19] **EcoPontas and PapaChicletes** developed by the Landscape Lab of Guimarães funded by the City Hall.
[20] The **Green Project Awards** is an international project, with editions in Portugal, Brazil and Cape Verde. The GPA is an initiative promoted in partnership with local authorities and has an international network representing the main sectors and areas of activity, with the sponsorship of the European Commission.

2016/2017 academic year, about 50 t of firewood were distributed by several basic education schools in the municipality during a period of four months.

Waste communication programme is based on tools and activities involving citizens, such as:

a) Satisfaction surveys;

b) Flyers and billboards;

c) School visits to Waste Treatment Plants and Recycling Centres;

d) Awareness-raising actions in the school community, geriatric centres, Social Housing Districts among others;

e) Webpages and Facebook;

f) Cooperation with Local Associations.

3.

In recent years, MSW management underwent a significant change, reducing to 2% the disposal of waste in landfills and increasing to 82% the waste forwarded and treated in mechanical and biological treatment stations. In addition, separate collection increased by 9% since 2008, moving from 44 to 62 kg/inhab/year.

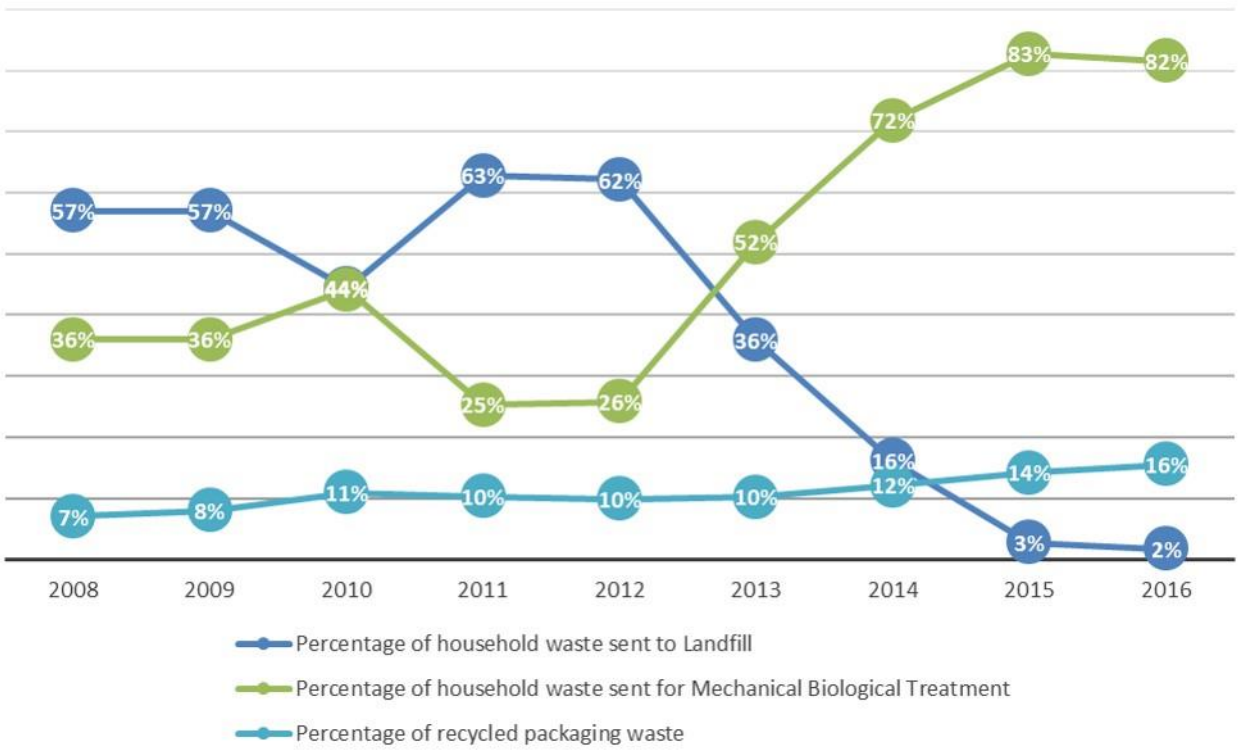


Figure 7 Evolution of the waste in Guimarães in recent years

4.

Since 1992, Guimarães has implemented the polluter-pays principle by charging waste fees and expanding MSW collection to the entire municipality, traversing approximately 9000km every week to ensure service. In 2001, a fleet management system was implemented, which facilitates control and analysis of the collection processes, favouring the operational and automatic management of the fleet and system monitoring. In parallel, separate collection of glass began by placing isolated bottle banks in major urban centres, and collecting bulky waste by appointment with parish councils.

Separate collection of paper/card started in 1995, by placing paper collecting containers next to bottle banks and school areas, and in 1998, separate door-to-door collection was initiated in commercial areas in the city centre and main villages.

From 1998, underground containers were placed to collect undifferentiated waste.

The first surface and semi-buried ecopoints to collect packaging waste were placed on public roads starting in 2000, with a ratio of 500 inhab/ecopoint. In 2001, construction of EcoCentres/Recycling Centres recycling yards began in Guimarães. In 2002, “Ecogest” was installed, which includes control by telemetry to check

the ecopoints filling level.

The Municipality was a pioneer at national level in implementing Local Agenda 21, with significant effects in the MSW area.

In 2008, Guimarães received the National Prize for Best Practices in Local Administration[21], for the project "Georeferecing of MSW Collection Circuits with the help of fleet management tools"[22].

5.

Collection of undifferentiated and organic waste in Guimarães is 100% a municipal service. Separate collection, sorting, recycling and disposal are the responsibility of RESINORTE, a private entity that provides this public service.

6.

The biological treatment plant, by composting, has been in operation since 1995, followed by mechanical treatment since 2011, which was expanded in 2013.

The dumping ground of Gonça was converted into landfill in 1998, operating until 2008 and being completely sealed in March 2015.

The Manual Sorting Station began operating in 2001, was partially automated in 2008 and fully automated in 2012.

7.

Initial waste regulations were implemented in 1998, amended in 2004, 2010 and 2016. All regulations were approved by the City Hall and Municipal Assembly, underwent a public debate period and were published in the Portuguese Official Gazette.

A first outline and study of collection circuits began with the preparation of the Urban Master Plan-1994, with an initial waste management plan in 1998, and updated in 2004 with the introduction of a management component in geographic information systems. From 2004 until now, several action plans have been prepared taking into account the hierarchical pyramid of waste.

8C. Future Plans

1.

Targets for prevention or reduction of adverse impacts from production and management of waste in the

[21] in the category "Local Sustainability"

[22] **ECO distinctions** can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12**

Municipality involve the following goals and objectives over the next few years[23]:

a) Reduction of waste production, an indicator measured through the percentage of waste reduction produced by the country, compared to the reference value considered. In a logic of prevention, it is aimed at limiting waste production and reducing the operations required for waste management, which cause environmental impacts (e.g. transport and recovery and disposal operations). The target for the Plan's horizon, i.e., 2030, entails a stabilization of the annual value and a perspective of reduction in 11% of the reference value, during 2014-2030.

b) Eradication of direct disposal of waste in sanitary landfills[24], in 2017. Disposal operations should be considered end of line operations that do not promote circular economy, and generally involve greater environmental impacts. Given current standards of production and waste management in Portugal, the waste policy should consider the reduction of the amount of disposed waste as a goal.

c) Expand separate collection in door-to-door system to the entire municipality and decrease frequency of undifferentiated collection.

d) Expand collection of biowaste until 2020.

e) Draw up a plan for reducing, reusing and recycling textile waste, aiming at integrating this waste in a circular economy, with creation of specific collection circuits.

f) Increase separate collection of packaging waste in 10% until 2030.

g) Expand the implementation of PAYT in a radial manner until 2030.

h) Introduce PAYT by reading user cards in underground and semi-buried containers.

i) Integrate the Municipality of Guimarães in the "Zero Waste Europe" European platform**[19]**.

j) Increase efficiency of the system and infrastructure for Municipal Waste management, with corresponding sustainable cost reduction and recovery.

k) Increase the promotion and integration of Guimarães in the "European Weeks for Waste Prevention", with the objective of adopting preventive behaviours.

l) Expand "Brigadas Verdes" to all parishes in the municipality, involving Parish Councils, schools, local associations and the community in general.

m) Expand partnerships with universities and technology centres for research in new processes of waste integration within a circular economy.

[23] According to the **Rules of Contest of EGCA2020** (p 20)
[24] In accordance with **The new general Union Environment Action Programme to 2020 – 7th EAP** (p 40,43)

n) Strengthen the participation of stakeholders in awareness-raising and mobilization actions.

2.

The municipal action plans define the MSW management strategy and actions to be undertaken in articulation with national and regional policy planning, prevention and management of waste and respective principles, goals, targets, instruments and infrastructures, including treatment centres and final destination of Municipal Waste in Guimarães.

The regulation of the Waste Management Service in Guimarães, the Municipal Strategic Plan for Waste 2017-2030, and other action plans in this matter, are subjected to approval of City Hall and Municipal Assembly, preceded by a period of public participation, so that everyone can get involved and committed in defining the main policies for waste management in the future**[2,4].**

The Activities Plan and Budget of Guimarães City Hall for 2016 and 2017**[20]**, amount to €88.3m and €105.9m respectively, and are based on a set of actions within the framework of the application of Guimarães to European Green Capital 2020. In 2017, the increase of 14M€ will come from implementing several environmental projects financed within the framework of Portugal 2020. In these plans, 60% of the value will be applied in the parishes of the municipality, taking into account the ground to cover within the scope of the application to European Green Capital.

Also worth mentioning is the project "Implementation of the PAYT System in the Historic Centre of Guimarães", approved by POSEUR within the scope of the action "promotion of multi-material and organic recycling of municipal waste in 2016".

For MSW treatment, the budget until 2020 is of 29M€, whereas for Recycling Centres and recycling collection, the budget amounts to 6.4M€.

3.

With the intention of optimizing and developing MSW management systems in Guimarães, and with strong investment in preventing MSW production, in separate door-to-door collection and in increasing collection of bio-waste, as well as in adopting new solutions, or improving existing techniques, the waste management plan of Guimarães anticipates a reduction of 11% in the production of MSW in 2030, compared to 2014, and an increase of 38% in the preparation for reuse and recycling.

Monitoring the entire system will be carried out regularly and systematically recommending strategies and technical solutions for Guimarães accomplishing its targets and surpassing National and European targets.

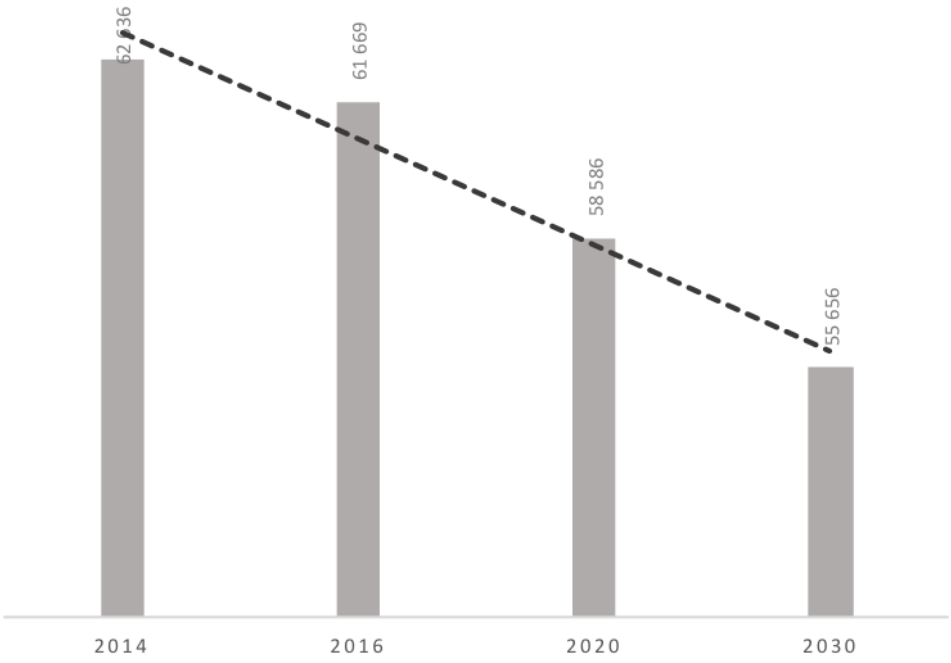
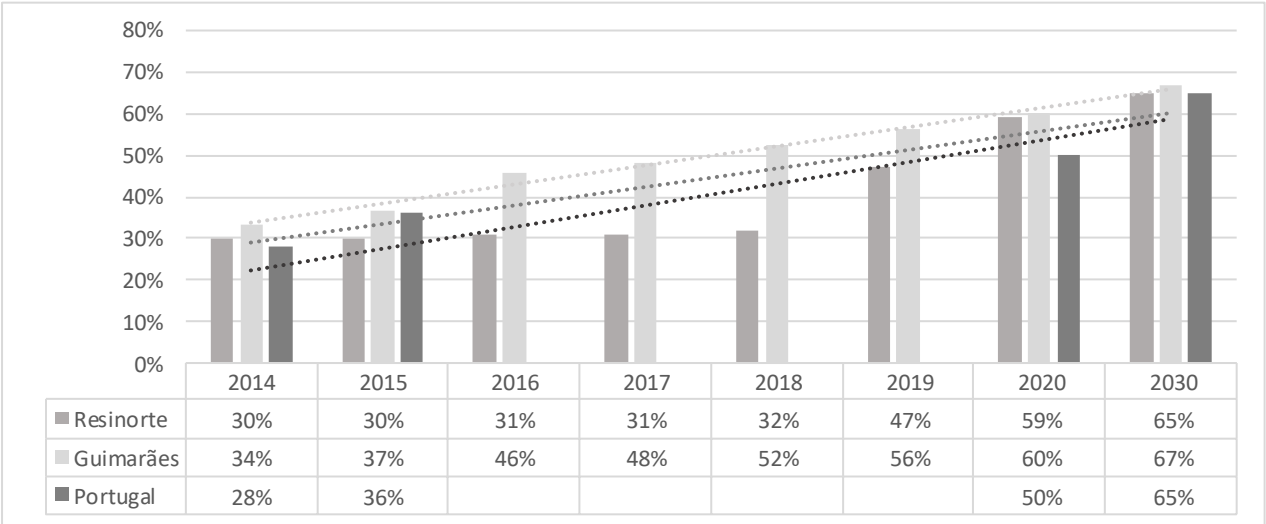


Figure 8 Targets by 2030 for reducing urban waste production in Guimarães



	2014	2015	2016	2017	2018	2019	2020	2030
Resinorte	30%	30%	31%	31%	32%	47%	59%	65%
Guimarães	34%	37%	46%	48%	52%	56%	60%	67%
Portugal	28%	36%					50%	65%

Figure 9 Comparison of targets by 2030 of preparation for reuse and recycling in the national context

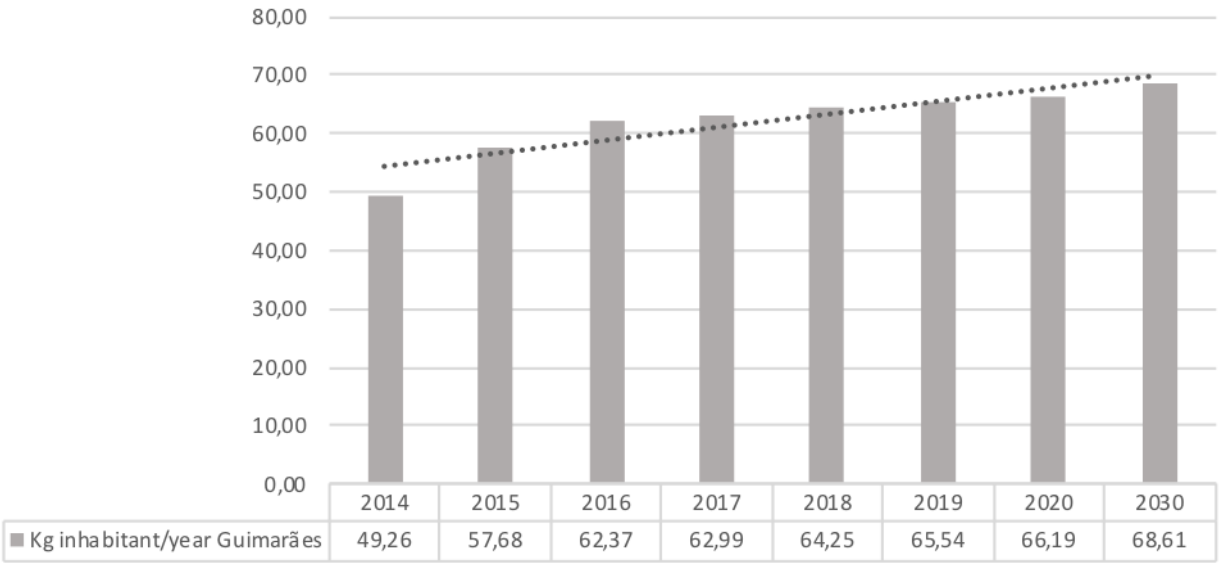


Figure 10 Targets for separate collection in Guimarães per inhabitant/year

4.

Several partners[25] were engaged with a programme "Guimarães for Circular Economy"[26] developing projects[27], to undermine the waste management options with a higher circular economy potential, such as waste prevention and recycling. Most of these are R&D based-projects. Also, the Social affairs department of the City Hall and local association were integrated in the Circular Economy Task force and by now, several projects are implementedinsuring the best possible conditions for those most in need**[21]**.

[25] Universities, Centre for Waste Valorization - CVR, Vitrus, Resinorte, Landscape Laboratory, and local and social associations
[26] Circular economy in accordance with **The new general Union Environment Action Programme to 2020 – 7th EAP** (p 13,37,45)
[27] According to the European Commission: Implementation of the Circular Economy Action Plan - 26/01/2017

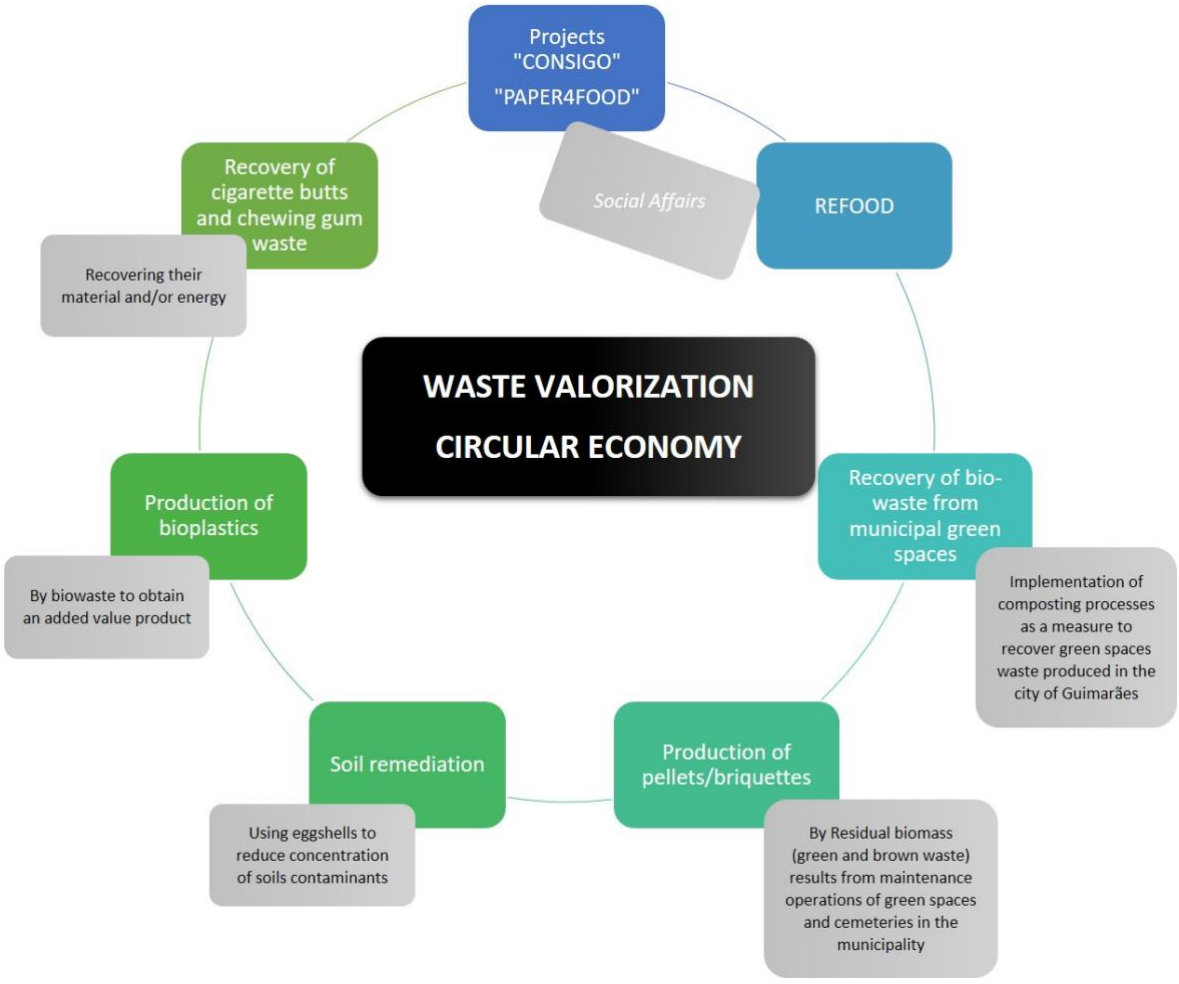


Figure 11 Guimarães for Circular Economy (G4CE), Projects

8D. References

[1] PERSU2020 Action plan (PAPERSU) – Digital version

[2] Guimarães Strategic Plan for Waste Digital version

[3] Plan to Assess the Implementation of the PAYT System Digital version

[4] Regulation of the waste management service in Guimarães Digital version

[5] CVR http://www.cvresiduos.pt/

[6] REFOOD https://www.facebook.com/RefoodGuimaraes/

[7] Menos olhos que barriga https://www.sas.uminho.pt/ModuleLeft.aspx?mdl=~/Modules/Eventos/EventosView.ascx&ItemID=104&Mid=28&lang=pt-PT&pageid=3&tabid=0

[8] VITRUS https://www.vitrusambiente.pt/residuos_payt

[9] RESINORTE http://www.resinorte.pt/

[10] Sepúlveda,D.; Loureiro,I.; Vilarinho, C.; Carvalho,J.. (2016). **Municipal Waste Map: a Case Study of Guimarães, Portugal**. International Journal of Sustainable Development, 5(4) pp 77-90

[11] Circuits and frequency of waste collection in Guimarães Digital version

[12] Accessibility to separate collection in Guimarães Digital version

[13] Description of the separate, mechanical and biological treatment units and final destination Digital version

[14] Copy of the awards and book publication Digital version

[15] Report of the first year of PAYT Digital version

[16] Manual of environmental good practices - ceremony of the official start of the Vodafone Rally de Portugal http://www.resinorte.pt/pages/noticia/136

[17] The formalization of the **Coalition for Green Growth**, as a component of strategic definition and boost to the green growth in Portugal, took place in April 2015 with the publication of the Resolution of the Council of Ministers no. 28/2015, of April 30. http://www.crescimentoverde.gov.pt/compromisso/areas-tematicas/residuos/

[18] Ecopontas and PapaChicletes http://www.labpaisagem.pt/ecopontas-papachicletes/

[19] Zero Waste Europe Platform https://www.zerowasteeurope.eu/about/principles-zw-europe/

[20] Activity plan and Budget

a. **2016** http://www.cm-guimaraes.pt/uploads/document/file/7917/GOPO2016.pdf

b. **2017** http://www.cm-guimaraes.pt/uploads/document/file/10721/Grandes_Opcoes_do_Plano_e_Orcamento_2017.pdf

[21] Ribeiro,C.; Sepúlveda,D.; Carvalho,J.; Vilarinho, C.; Cristino, J.; Loureiro,I. (2017). **Guimarães Circular Economy: towards a sustainable city**. International Journal of Sustainable Development, 5(3) pp 68-74

9. Water

9A. Present Situation

Indicator		Unit	Year of Data
Domestic usage (drinking water) - litres per capita per day	98	litres/capita/day	2016
Total usage (drinking water) - litres per capita per day	135	litres/capita/day	2016
Water loss in pipelines, leakage management and network rehabilitation	18.7	%	2016
Percentage (%) of total annual generated waste water load, connected to waste water collecting system + urban waste water treatment plants (UWWTPs)	82,5	%	2016
No. of WWTP	5	Number	2016
Total design capacity (Population Equivalent - PE)	264 510,73	PE	2016
Total load received by UWWTP (PE)	132 028,41	PE	2016
Connection rate	90,2	%	2016
Treatment level which is applied in each UWWTP: secondary or more stringent; in this case, type of treatment: nitrogen and/or phosphorus removal, disinfection etc.	a) Sto. Emilião WWTP: Secondary treatment and UV disinfection b) Serzedelo I e II WWTP: Secondary treatment c) Serzedo WWTP: Tertiary treatment with nutrient and colour removal Lordelo WWTP: Tertiary treatment with nutrient removal and colour	Treatment level	2016
Waste water re-use (describe type of re-use)	0	%	2016

Guimarães is characterized by a natural landscape with a high presence of water, a resource which has played a decisive role in the city's development, supporting economic activities, the population and ecosystems.

The Water Strategy was revisited by **the Mission Structure**[1], and consolidated in **declarations of political** and **individual consensus[1]**, thus strengthening community involvement with the process.

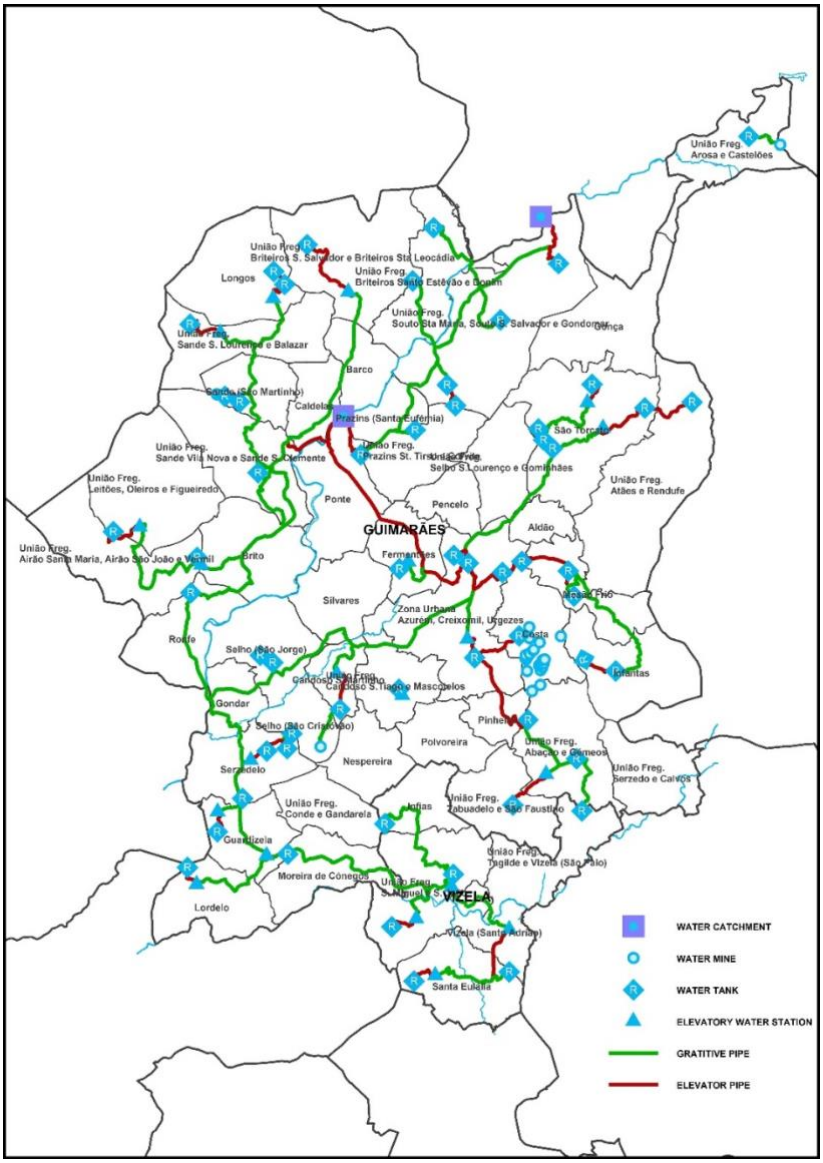


Figure 1 Guimarães water supply system

The city's first public water supply system started in the **Mines of Penha**[2] in 1899.

[1] **Mission structure for the Sustainable development of Guimarães** was created in 2015 by the City hall in partnership with the University of Minho, which is responsible for coordinating the application of Guimarães to EGCA2020 and the development of the Action Plan. This information is presented and fully described in Good Practice 1

[2] **Mines of Penha** resulted from scientific studies carried out by geologist Paul Choffat and microbiologist Charles Lepierre, in 1899.

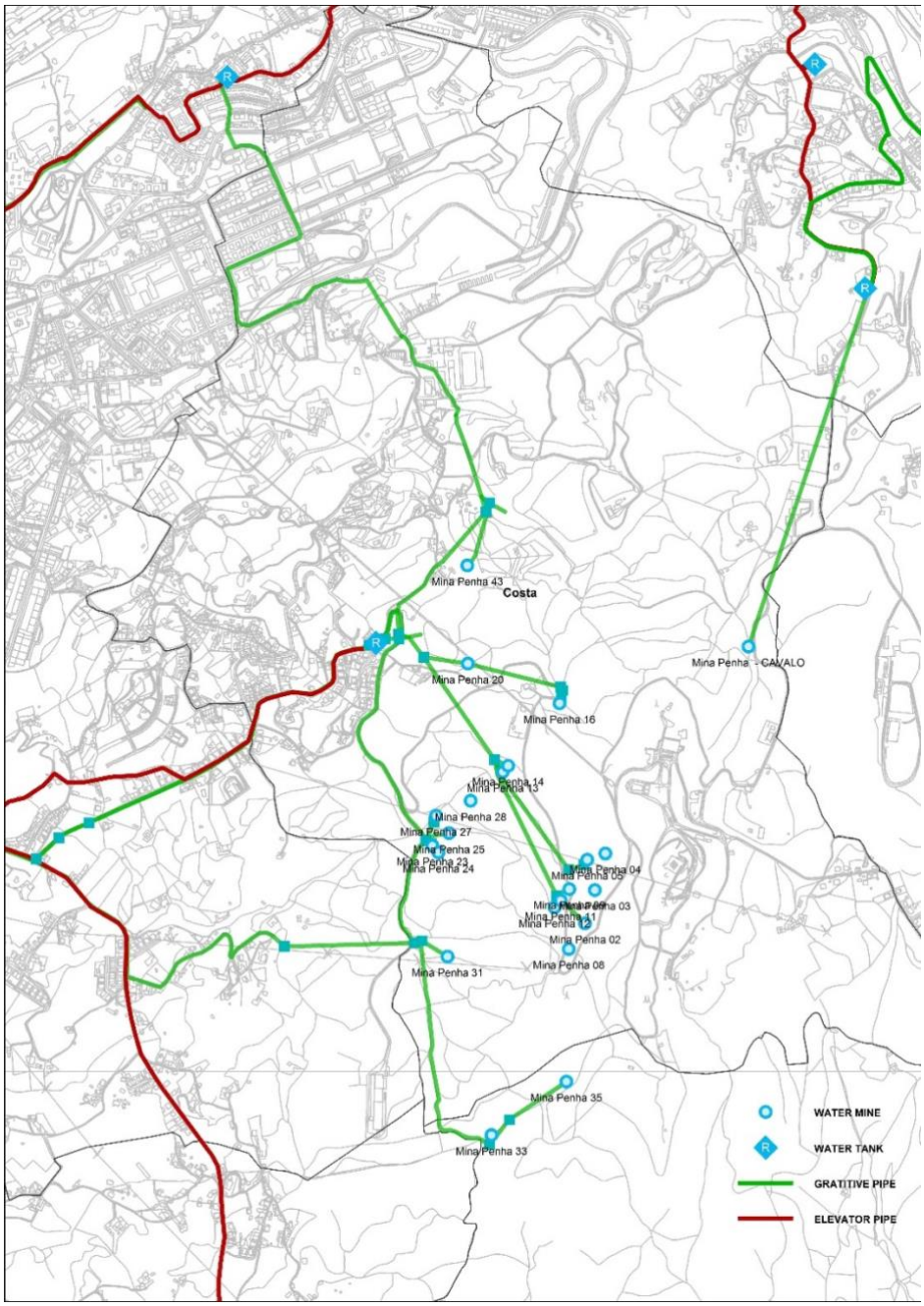


Figure 2 Mines of Penha water abstraction system

Today, two other water sources are used and about 1.365 km of pipes supply safe water (97.7% in 2016) to the city.

Vimágua, a municipally-funded company, is responsible for the distribution of safe water and the urban

drainage management**[2]**. The effective operational policies and a **Water Quality Control Plan**[3]**[3],** have resulted on high safe water standards**[4].**

Table 1 Safe water distributed (%)

2011	2012	2013	2014	2015	2016
99,00	99,92	99,75	99,52	99,52	99,80

In 2015, 2,98m^3/Km/day (69.1 l/(branch.day)) corresponds to loses. A **Water monitoring system** has been implemented on pipes and other operational units. The annual rehabilitation of ducts ranged between 0.02 and 0.8% (2011-2015).

Due to the specific orography, approximately 9.410.355Kwh of energy is required by the water supply infrastructure. Most is associated with water supply facilities (97.35%), out of which 87.69% is consumed to pressurize the water. From 2011 to 2015, the specific energy consumption of these lifting plants remained between 0.74 and 0.95 kWh/m3.

Vimágua also manages approximately 812 km of **wastewater collectors**, connecting 43.907 households, and 51 Wastewater Pumping Stations. The urban drainage and treatment increased from 88.75% in 2011, to 90.50% in 2016, thanks to large investments and firm political commitment. Non-connection of the remaining 15% is due to existing septic tanks located in areas of the city where public infrastructures are still very recent.

All the collected wastewater is delivered to W**astewater Treatment Plants (WTP)**[4] where the pollutant load is reduced to comply with the discharge standards and quality required for ecosystem conservation.

Vimágua has been raising public awareness to the sustainable use of urban water. In 2007, Vimágua developed a school community project "**Taking Life To You!"**[5]**.** Given the success of this campaign, a **new reusable bottle** was designed and produced, receiving the IF DESIGN AWARD[6]. A customized glass jug for use at public meetings[7] was also distributed.

[3] The **Water Quality Control Plan** comprises Legal and Operational Control/Monitoring of water quality at the origin, water for human consumption, and treatment processes in Treatment Plants

[4] Serzedo, Lordelo / Aves, Serzedelo, Rabada, Santo Emilião and Agra

[5] The **Taking Life To You!" project** was developed in partnership with the local Public Health Unit. This project encouraged students to use reusable bottles to collect potable water from public supply. More than 60 000 bottles were distributed to kindergartens and first cycle schools in the municipalities of Guimarães and Vizela

[6] **IF design award** - The new bottle of Vimágua is a reusable, eco-friendly, 100% recyclable and lightweight water bottle, created to be offered to the local school communities. It's much more than a bottle, it's a mission to promote the consumption of tap water and raise awareness among the young, on the importance of water to the environment and health. The design, inspired by both the drop and the water surface ripple effect, is ergonomic for children and is meant to fit in a small lunch bag. The 450 ml PET bottle weights 25 g, and its manufacturing process uses less energy when compared to reusable bottles produced in other materials. The PP cap is also optimized and weights 1.3g

[7] City Hall and Municipal Assembly Meetings as well as other organizations in the municipalities of Guimarães and Vizela

Also in 2015, a **Water Learning Centre**[8] was created to educate children about the importance of water**[5]**.

Figure 3 Raising awareness campaign

Vimágua has developed a strategic plan to ensure the separation of domestic wastewater and rainwater. In 2015 and 2016, 7.101 buildings were monitored and 16.000 buildings are scheduled for inspection in 2016/2017.

Figure 4 Monitoring drainage system (coloured effluent technique)

[8] The **Water Learning Centre** raises awareness about the importance of water and public systems for water and sanitation, public health, the environment and quality of life of the population, as well as respect for biodiversity and maintaining balanced ecosystems

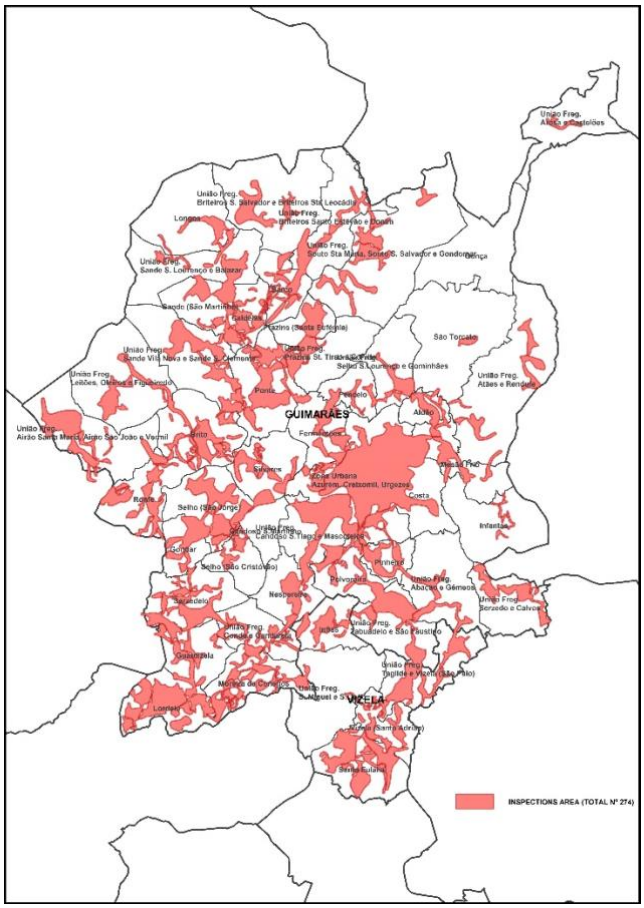


Figure 5 Inspections in 2016/2017

Based on these inspections, unnecessary connections between the residual and rainwater drainage networks have been eliminated with economic and environmental benefits.

9B. Past Performance

For centuries, Guimarães has been recognised as nationally and regionally important. When it was elevated to a city in 1853, the municipality was the fourth most important industrial district in Portugal. D. Maria II, then Queen, stated that this city "enjoys the primacy of being one of the most populated in the Minho region, and the most flourishing in various branches of industry, to which its opulence and prosperity, and trade relations within and outside the country are owed". Guimarães had been industrialised as early as the 18th century.

In 1864, David Justino described Guimarães as the sixth largest nucleus in the country, with smallholding land ownership, dense population and abundant water resources. Because of its prosperous industry, in 1884 Guimarães hosted the first Industrial Exhibition in Portugal. At that time, the main industries included leather, textile, and metal, cutlery being particularly noteworthy. Textiles and leather depended almost entirely on abundant water courses and this shaped the urban space that is Guimarães today.

The leather industry was originally located along the Couros River, expanding to the Selho River after 1923, while the textile industry, mostly near the Selho and Ave Rivers, one of the most important industries came to represent more than 20% of exports**[6]**.

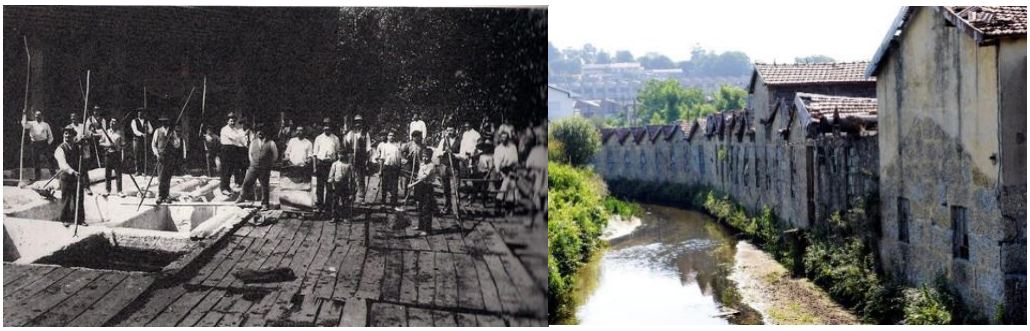


Figure 6 Leather industry in the Couros Area and Textile industry near the Selho River

There are records from the mid-19th century that indicate that fountains and public water tanks existed in the city. But there was also a cultural objective in bringing people together at these facilities for social interaction. Particularly important in this regard is Campo da Feira (currently Largo da República do Brasil). Engineer Pinto de Menezes described how water was transported from Penha to the city in 1869. But despite the abundance of water, there was no guarantee that its quality would be maintained in distribution at that time because many sections were poorly piped and some people made improper use of the water (Fernandes, 2002). These factors encouraged a project to expand the distribution system into areas that had no supply, and also to create reservoirs that would be used for fire-fighting or to supply urgent water needs. Once the work suggested by the improvement commission in 1869 had been completed, Guimarães was "one of the most delightful cities in the kingdom - if not the most - for the proportionate abundance and unsurpassed quality of its waters"**[6].**

It is worth noting that Guimarães also invested in exploiting its thermal resources and, in 1900, it actually budgeted the cost for "plants, designs and budget for a new thermal facility in Taipas", and plumbing and supply of water to the city and slaughterhouses in the villages of Vizela and Taipas. Since then, this complex network has played an important role in the city**[6].**

Figure 7 Municipal tanks and Taipas bathhouse

The intensive exploitation of the river water for the leather industry, and for the discharge of industrial and domestic sewage, inevitably led to the deterioration of the quality of adjacent water resources. The situation became so serious that many policies have been implemented since 1970 to clean-up the river, through a long process that involved several ministries and that resulted in the creation of an **Integrated Requalification of Ave Valley System** [9]**[7]**, covering five municipalities in what was once considered the "most polluted area" of this region.

This new system included an extensive collector network of approximately 126km, sited along the Ave River and its main tributaries, divided into four subsystems, that lead wastewater to five **Wastewater Treatment Plants** (WWTP) that integrate SIDVA[10]. SIDVA began operating with the First Drainage Front and its WWTP of Serzedelo in late 1998, with almost two more years required to complete the other two Drainage Fronts. On 25 September 1998, **TRATAVE** - Tratamento de Águas Residuais do Ave, S.A.**[8]** became the managing entity of SIDVA, the company responsible for 25 years in "that area of intervention" - which covers the five municipalities involved in the "exploitation and management, on an exclusive basis, of Public Drainage Service, purification and final destination of wastewater materialized by SIDVA".

Figure 8 Integrated Pollution Control for the Ave Valley

Municipal policies of the 20th century facilitated a new relationship with water, motivated by cultural factors and notions of sustainability. Nonetheless, despite the improvement of water quality in water lines, some problems remain, particularly flood control in the Costa/Couros River, which runs through Guimarães, as well as monitoring effects of diffuse pollution, particularly originating in urban run-offs.

Thus, a protocol with the University of Minho and University of Trás-os-Montes and Alto Douro was signed, creating the **Landscape Lab of Guimarães**[11]**[9]**. Research projects have been developed by the Lab to increase the municipality's resilience to climate change, to implement sustainable urban drainage systems, and manage urban water lines sustainably.

[10] **Integrated Requalification of Ave Valley System (SIDVA in Portuguese)** can also be found in sections **1**| 2 | 3 | **4** | 5 | 6 | 7 | 8 | **9** | 10 | 11 | 12

[11] **Landscape Lab** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

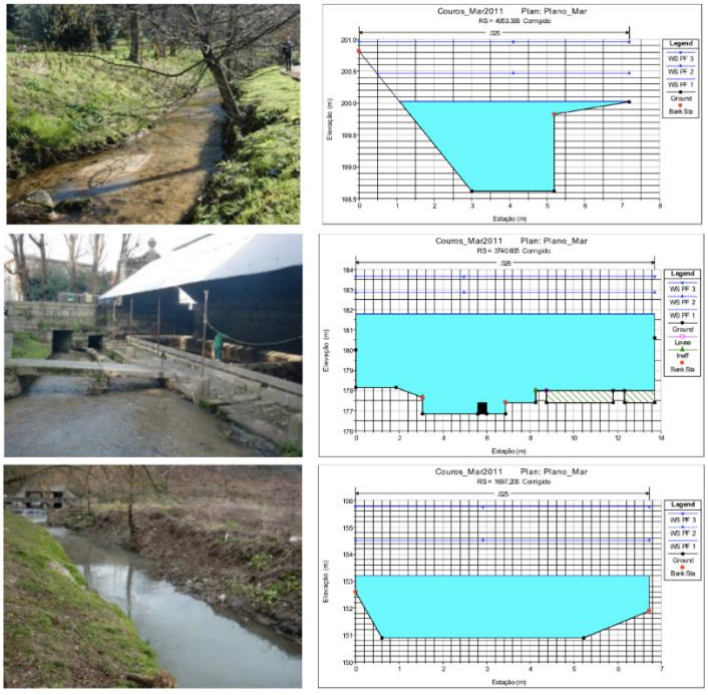
Figure 9 Landscape Laboratory projects

In an initial stage, situations that might eventually contribute to degrading the natural system were immediately identified. These included domestic and industrial effluents and an excessive urban occupation of the soil.

Aware of the difficulties associated with managing and rehabilitating urban water lines, this project sought to extend the scope to other water lines in the municipality, in addition to resolving this initial case study. The main objectives were to minimize the flooding problem in the urban centre; mitigate the effects of pipelining several sections of the water line (reduced speed, erosion, bottlenecks); stabilize river banks in critical locations where erosion is very significant; maintain or create recreational areas, promote the interaction with the population and raising awareness for preserving the riparian corridor; eliminate the sources and occurrences of pollution (installing collectors to allow wastewater treatment).

This initiative resulted in the creation of a hydrological model of the basin, a hydrodynamic model of the river and in the identification of critical locations.

a)



b)

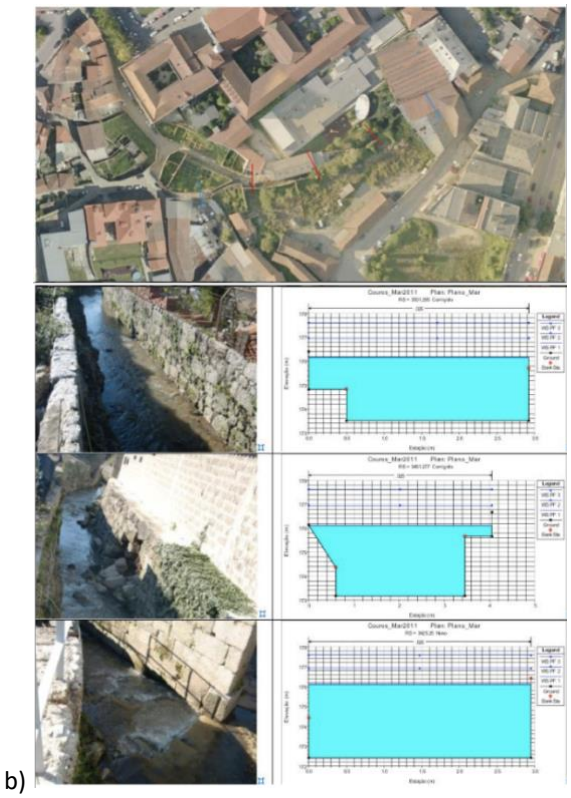


Figure 10 a) Hydrological model of the basin; b) hydrodynamic model of the river and identification of critical locations

Today, Couros[12] is part of the UNESCO World Heritage Site (since 2001) and is evidence of how the past and present city coexist. In order to increase its attractiveness, a rehabilitation of the Couros River was carried out in the first decade of the 21st century, and doing so also solved the recurring flooding problems in the historic centre of Guimarães. These results have been followed by water quality monitoring and environmental education programmes directed at the Couros River, the Canhota River (Taipas) and Selho River, that resulted in an improvement of the ecological status of the hydric systems, with evidence from physical, chemical and biological analyses, as well as the assessment of related ecosystems.

This experience has been shared through the large number of visits made to the Landscape Lab of Guimarães, where the methods developed are elucidated and shared.

9C. Future Plans

Water Supply

- Increase physical accessibility to water networks in the parishes from the current 98% to approximately 100%, thus guaranteeing a safe and quality water across the population.

- Increase investment in renewing older water networks, and those where ruptures are frequent, with the aim of reducing disruptions in supply and water loss.

- Reinforce implementation levels of the Loss Reduction Plan, to reduce loses to higher reference values defined by the Water Services Regulatory Authority.

- Improve the efficiency and implement an endogenous production through the substitution of more effective electric pump groups, gradual replacement of the fleet of vehicles by electric vehicles, and the installation of photovoltaic panels in the headquarters building, the Water Treatment Station of Prazins and in the water lifting stations that consume a large amount of energy, thus contributing to the reduction of CO_2 emissions.

- Invest in water collection to optimize water treatment, and increase the strategic reserve of drinking water, aiming at improving the system's resilience to the effects of climate change.

- Strengthen investment in the geographical information system as a management tool to monitor network performance, thus enabling the production of hydraulic models that may assist in decision-making regarding how best to the optimize the public water supply system.

Wastewater

- Increase the physical accessibility to sewage networks in the parishes from the current 91% to approximately 95%, thus guaranteeing public health and the protection of soil and water resources, improving environmental sustainability and the quality of life of the population.

[12] **Couros** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

- Reduce undue inflows in wastewater collectors, continuing investment in the duplication of mixed manholes of wastewater and rainwater, in the inspection of buildings in order to assess whether rainwater and wastewater are properly separated and forwarded to the respective collectors.

- Prepare a Master Plan for the Drainage of Rainwater, as a way to reduce the pollutant load and control urban run-off and floods.

- Study the pollutant load of urban run-offs (with UMinho) in a sector of the city, so as to evaluate the measures to be implemented for the installation of BMPs and increase the water quality in the Couros River.

- Strengthen the investment in the geographical information system as a tool for monitoring the performance of the wastewater sanitation networks, thus allowing to identify areas with a great number of undue connections for rainwater, and consequently, direct inspection efforts to these areas.

9D. References

[1] Guimarães mais verde Commitment

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

c. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

[2] Vimágua website http://www.vimagua.pt/

[3] Water Quality Control Plan http://www.vimagua.pt/s/37

[4] ERSAR http://www.ersar.pt/pt; http://www.vimagua.pt/s/38

[5] Water training centre - Oficinas da água http://www.vimagua.pt/s/87

[6] Ramísio, P., Pinto, Lígia and Joanaz, C. (2016). **The co-evolution Guimarães Urban Landscape: Relations between man and water resources (1853-2001)**. University of Minho. Research project for Guimarães City Hall

[7] Integrated Requalification of Ave Valley System – SIDIVA http://www.tratave.pt/sidva.html

[8] TRATAVE http://www.tratave.pt/aTratave.html

[9] Landscape Lab

a. http://www.labpaisagem.pt/
b. http://www.labpaisagem.pt/aquabioscape
c. http://www.labpaisagem.pt/gestao-de-linhas-de-agua

10. Green Growth and Eco-innovation

10A. Present Situation

Indicator		Unit	Year of Data
Number of electric vehicles owned by the municipality	13[1]	Number	2017
Number of electric vehicles owned by the municipality (in % of all cars owned by the municipality)	10,48%	%	2017
Number of charging outlets available for cars owned privately	18 Public [2] 11 Private	Number	2017
Number and percentage of procurement contracts that take into consideration green issues, particularly employment and eco-innovation.	49,48%	Number	2016

Today, Guimarães is one of the most enterprising, innovative and industrial cities in Portugal. Seven years after a crisis that affected the whole country, and in the post-austerity period, Guimarães showed a growth rate of around 10% and is the **most sustainable municipality in Portugal[1].**

1.

The Eco-Innovation programme demonstrates the city's ability to reinvent itself even in times of crisis. This was achieved in the last five years, with the implementation of several innovative projects targeted at the **management of the territory**, **cooperation and sharing of knowledge** and **defining priorities** based on sustainability and innovation.

Guimarães was able to prepare infrastructures for the future and to align itself with the new European policies for the protection of the environment: **Gymnastics Academy[2]**, **G4CE**[3] and **RENEw**[4].

[1] Including **PAYT system**

[2] **MOBI.E** can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

[3] **G4CE: Guimarães for Circular Economy** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | 11 | 12

[4] **Renew** – R&D projects fund by PORTUGAL 2020, Directive no. 03/SI/2017, of 23 February 2017 – aiming to deal with waste on a large scale trough an integrated consortium of which the Guimarães Municipality is a part of. The main objective is to create a Recycling of construction and demolition wastes (CDW) with the aim of developing structural concrete and bituminous concrete for structures and pavements.

Figure 1 Gymnastics Academy, a near zero carbon building; sustainable use of soil, water, air and solar efficiency[5]

[5] **Guimarães Gymnastics Academy** – Near Zero Carbon building described in Good Practice **5**

Figure 2 Guimarães for Circular Economy (G4CE)

Guimarães is the first National Municipality to have a **public carpooling** system[6]**[3]**, in addition to a car-sharing programme with electric vehicles: **ZENCAR**[7].

Guimarães Social and Pedagogical Garden offers 536 urban plots for community use, including users with

[6] Guimarães à boleia: a free platform that allows sharing car can also be found in section 1| **2** | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
[7] **Carpooling System** can also be found in section 1| **2** | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

disabilities and families in need**[4].**

Guimarães is the only municipality in Portugal to implement **PAYT**[8]**[5]**. Investments in innovative **Nature Based Solutions** were also carried out eliminating frequent flooding in the lower city area**[6].**

Guimarães is committed to the Energy targets.

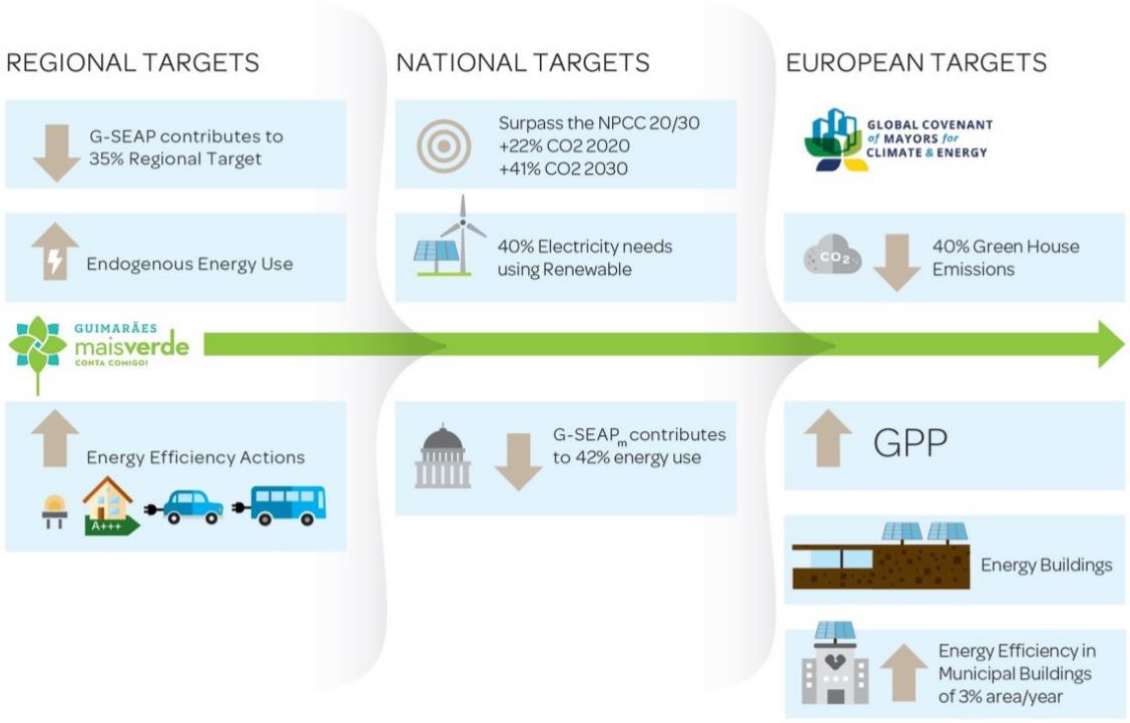


Figure 3 Guimarães Compliance with Energy Performance Targets (SEAP- Sustainable Energy Action Plan; SEAPm – monitoring)

2.

The City Hall promotes Green Growth for local companies, having created the **Economic Development Division**[9]**[7**]. Within its scope, the **Advisory Council for Investment and Employment**[10] was also created**[8]**. The project **"Guimarães Marca"[9]** was launched to promote local industry internationally, by associating it to cultural heritage and environmental sustainability**.**

[8] **PAYT** System: Guimarães has won Municipality of the Year Portugal 2017 with the implementation of Pay-As-You-Throw in the Historic Centre, supported by the UM-Cities platform. It can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | **8** | 9 | 10 | 11 | 12 and Good Practice **6**

[9] **Economic Development Division** was created to define, support and implement the municipal economic development strategy while creating employment

[10] The **Advisory Council for Investment and Employment** incorporates 221 organizations and companies, supporting incentive programmes for local economy implementation

3.

The City Hall is focused on promoting entrepreneurship**[10]**, through a partnership with TecMinho[11]**[11],** covering 1.141 young entrepreneursand by joining **InAve**[12]**[12].** City Hall also funds popular projects - **We are all Guimarães: participate with your idea -** with 500.000€[13]**[13]** and awards a scholarship to the best student of **Applied Biology**[14]**.**

On a different level, **"Guimarães inclusive"[14]** supports unemployed and inactive people to take up work or training.

4.

48,49% of companies supplying goods and services to the municipality are certified. Suppliers' assessment was carried out within the framework of the quality management system**[15]**. The Public Construction Contracts for the Gymnastics Academy and Eco-path also included the incorporation of sustainability measures.

Guimarães was considered the **Best Digital Municipality** in 2016**[16].**

5.

The City Hall promotes eco-citizenship, raising awareness throughout the community for the importance of following sustainable and eco-friendly policies, through the **Guimarães mais verde commitment**[15]**[17]**. The **Brigadas Verdes** are encouraged in all Parish Councils for the conservation of nature. Private entities are encouraged to develop innovative projects: **Educabicla**[16]**, Ubike**[17] or **Teatro Bus**[18]**[18].**

At a political level, all the parties and Parish Council presidents are committed to local sustainable development - **Declaration of Political Consensus[19].**

6.

The City Hall promotes an **Ecosystem of Innovation and Entrepreneurship**, through the incubation of

[11] The City Hall is part of the **TecMinho** Board, which is an interface of the University of Minho

[12] InAve- is the Ave Region Entrepreneurial Network created by the Presidency of the Council of Ministers and Ministry of the Economy and Employment under the Decree no. 432-B/2012, of 31 December

[13] Programme launched by the City Hall -

[14] The main goal of the Undergraduate Degree Course in **Applied Biology** is to prepare professionals with a solid knowledge in Life Sciences, using interactive teaching/learning methods with a strong component on experimental techniques and practices. Graduates will be qualified in multiple areas of Biology and gain knowledge ranging from the molecular and cell biology, organisms, populations and communities.

[15] **Guimarães mais verde** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12** and Good Practice **section**

[16] **Educabicla** was set up with a local company, GetGreen aimed at raising awareness, educating and involving citizens by encouraging the use of bicycle paths. It can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 and Good Practice

[17] **UBIKE** is a programme for long-term bicycle rental for members of the local academic community supported by POSEUR (Operational Programme for Sustainability and Efficient Use of Resources), Portugal 2020. It can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

[18] **Teatro Bus -** Watching a play on a bus does not happen every day, but it's a very strong probability in Guimarães. A stage on wheels takes theatre about environment to all the schools of the Municipality. This a private project sponsored by the City Hall of Guimarães.

creative companies and industries in the so-called **Creative Labs[20]**, or through the direct management of **AvePark**-Science and Technology Park of Guimarães**,** that includes: **Discoveries Centre for Regeneration and Precision Medicine**[19] and **Spin-off Park of UMinho**[20].

Figure 4 AvePark, Science and Technology Park of Guimarães

Guimarães participates in **HeritageCare**[21] promoted by **Science and Innovation Institute for Bio-Sustainability**[22]**[21].**

7.

City Hall devoted about 1.5M€ (15/17) to funding R&D environmental projects including Landscape Lab.

8.

Despiste 2010 crisis, at a city level, total number of Green jobs sgighly increase. **Public Green Jobs** increased

[19] **Discoveries Centre for Regeneration and Precision Medicine** - http://web.spi.pt/discoveriesctr/ This project has received funding from the European Union's Horizon 2020 Research and Innovation programme, under the Grant Agreement number 641739

[20] **SPIN-off Park** generated a turnover of around 5M€, driven by 161 new graduate employees, 2016

[21] **Heritagecare** – funding by Interreg Sudoe Programme through the European Regional development fund http://heritagecare.eu/

[22] **IB-S** is one of the partner of the Mission Structure for Sustainable Development of Guimarães

due to City's greening Policies (including Landscape Lab[23])

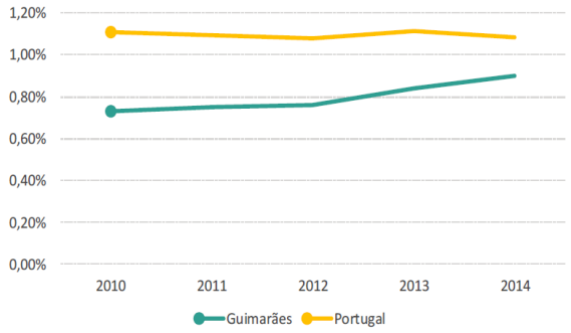


Figure 5 Number of public jobs (2015/2016) versus City's Evolution (2010/2014)

9.

Municipal fleet comprises 13 electric, 2 hybrid-total of 124[24], being 10 new vehicles in open procedure. By 2017, 40% of Vimágua[25] fleet will be electrical. Guimarães has 18 public and 11[26] private charging points being the first Municipality to have a Rapid charging station**[22].**

10B. Past Performance

1.

Guimarães integrates the Ave Intermunicipal Community[27] since 2013, developing the **Territorial Employment Pact[23]**. It includes measures and strategies for social inclusion, qualification, and to combat unemployment. In 2014, Guimarães had 14.400 companies, employing 61.000 workers and a turnover of 4140M€. After the national financial crisis (2010), these companies, having employed 4.1% fewer staff (2012), were able to recover to levels of pre-crisis employability in 2014, by creating 1820 jobs, approximately 1.64% of the working population of Guimarães.

The companies in the municipality created more jobs and revenue between 2014 and 2015 than the regional or national average. During this period, the GVA Concentration Indicator for the four largest companies in Guimarães was 5.7%, compared to 15.9% of the NUT III[28], thus indicating a greater growth in Guimarães compared to its surrounding municipalities, showing greater local resilience of the job market in the face of financial crises and social instability**[24].**

Guimarães contributed most to the decline in unemployment in Northern Portugal with approximately

[23] source: ECO XXI Guimarães application 2015&2016– ABAE
[24] including PAYT System
[25] Vimágua is the Water Management which City Hall company co-owns
[26] 11 new private charging points for Vimágua and 4 for Vitrus (Waste management company, which City Hall co-owns) are in open procedure
[27] **Ave Intermunicipal Community** is an association of 8 municipalities of multiple ends created in 2009, to promote the management of intermunicipal projects, in the Ave territory.
[27] NUT III - Ave

15.3% of unemployed people**[25].**

In addition to the economic issue, and during the crisis and post-crisis period, the City Hall took advantage of its bio-cultural mosaic and was able to boldly invest in innovation centred on **Urban Regeneration**, **Culture and Sports**, **Science and Technology**, **Education** and **Community**, thus improving the quality of life of its citizens.

Guimarães is the only Municipality in Portugal that has a **Mission Structure for the Sustainable Development of the Territory**[29]**.**

The City Hall created **incentive measures for businesses**, thus contributing to promoting and recovering the environment, by implementing the **Regulation for Economic Projects of Municipal Interest**, the **Special Regime for the Regularisation of Economic Activities**[30], and coordinating the **GUIMARÃES FINICIA**[31]**[26].**

The City Hall aims at strategic partnerships at regional, national and international level, improving the services provided to the population, expanding the economy and competitiveness of the Municipality, meeting national and European targets and sharing experiences in the area of green growth. For that purpose, an effort to create specialized municipal companies was done, and protocols of cooperation here established with twinned towns. In addition to this broad institutional cooperation, Guimarães is integrated in the Ave Energy Agency, having established, since 2013, a set of goals for Energy Performance. It also joined the National Green Growth Coalition[32].

[29] **Mission Structure** for the Sustainable development of the Territory was created in 2015, in a partnership between the city and UMinho[29], which is co-responsible for coordinating the application process of EGCA2020 and the development of Action Plan 2015-2017 (incorporating the twelve ECG areas), whose implementation will decisively contribute to the **Guimarães Sustainable Plan 2030**. It can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12** and Good Practice 1
3.[30] Under Law no. 21/2016 of 16 June

[31] **Guimarães Finicia** programme coordinated by Guimarães that offers financial solutions for investment projects of micro and small companies. Measures were designed to encourage the improvement of product and/or services provision by updating facilities and equipment, resulting in the creation of jobs, by allowing access to mutual guarantee and bank financing on more favourable conditions

[32] The formalization of the **Coalition for Green Growth** as a broad organization of strategic definition for the promotion of green growth in Portugal occurred in 2015 (Resolution of Council of Ministers no. 28/2015 of 30 April). It is an advisory body whose mission is to advise the Government and promote the participation and coordination of the interventions of public and private entities with attributions relevant in this context

Figure 6 Municipal Networking System cooperation with local, regional, national and international institutions

The promotion of the GPP is done through the certification of the Quality Management System **[27].**

Public and business investments, in particular those promoted within the framework of **P2020**[33], reveal public policies with the best ratios of per capita investment in cultural and creative activities, both in the region and the country, and companies heavily engaged in promoting the balancing of national accounts

[33] **P2020** - It is the PARTNERSHIP AGREEMENT adopted between Portugal and the European Commission (see DECISION), that brings together the action of the 5 European Structural and Investment Funds - FEDER, Cohesion Fund, FSE, FEADER and FEAMP - and that defines the programming principles that include the economic, social and territorial development policy to be promoted in Portugal between 2014 and 2020.

through exports and internationalization. By 2016, 38 projects were approved, amounting to 66M€.

The City Hall joined two H2020 consortia, demonstrating a willingness to integrate and share knowledge and innovation: **DREAM and ReGREENerate**[34]. Guimarães has been internationally acknowledged for its **P2GREeN**[35] by Urbact[36].

The creation of the MS[37] resulted in the preparation of seven environmental reports in total [38]and nine newsletters to provide information to the public. A Political Committee to monitor the application process was also established. Every year, the Monitoring Report on the Implementation of the Municipal Plan for Sustainable Energy, the Annual Report of Activities of the Landscape Laboratory, and the Pegadas Activity Report are submitted for approval.

The **Ecological Footprint Of Guimarães**[39]**[28]** shows that we are richer but still greener and, accordingly, the City Hall makes available the Municipal Transparency Index on its website[40]**[29].** For some years Guimarães has been a city promoting healthier life styles, translated into the sustainable coexistence between man and nature, heritage and culture.

Recovery of the Historic Heritage by placing it at the service of the community

The establishment of the University of Minho in the 1980s had a very significant impact on the qualification of human resources essential to improve business competitiveness. Companies in the region (especially industry), received hundreds of engineers that joined the production lines and contributed to the expansion of certain sectors. In a second phase, the projects promoted within the scope of a university-company cooperation ultimately contributed to the development of manufacturing processes and technologies, with direct influence on the economic value of the region. The University of Minho was the first in Portugal to publish the Sustainability Report[41], resulting in an increased importance placed by higher education on sustainable development**[30].**

The City Hall promotes knowledge transfer by being a strategic partner in four UMinho centres for technology transfer, as well as for the advanced qualification of employment in the region, setting up several cooperative projects.

[34] **DREAM** - network for innovation bringing together Heritage, Smart and Green concepts [20])**, ReGREENerate** - project aimed at reducing territorial and urban problems, such as risk management, climate change adaptation and mitigation, or the preservation of ecosystems and green capital

[35] **P2GREeN** – Protection and Promotion of Guimarães' Biodiversity

[36] **Urbact:** European Territorial Cooperation Programme

[37] **Mission Structure** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12** and is described in Good Practice **1**

[38] Four activity reports were presented to the Advisory Council and three for scientific validation by the External Advisory Committee (Both from the Mission Structure Organization)

[39] **Ecological footprint and Biocapacity calculation** of Guimarães were done under the supervision of Global Footprint Networking

[40] The **Transparency Portal** is an initiative of the 19th Constitutional Government to increase the transparency of the management of local public administration to the citizens

[41] Under the **Guidelines of the Global Reporting Initiative**

Figure 7 Research and knowledge transfer centre with participation of the City Hall

The City Hall joined the University of Minho to develop **CampUrbis or Couros Campus[31]**, an urban campus located in the historic centre, adjacent to the area classified by UNESCO. The investment in eco-innovation was increased, as is evident by the programme already in place: Design Institute of Guimarães, Post-Graduation Centre, United Nations University (e-government), Living Science Centre, Youth Hostel and University Residence. This joint project allowed the development of this area, wherefore the National Commission for UNESCO registered the extension of the Couros Area as Cultural Heritage of Mankind in the Indicative List of Portugal.

This new phase of rehabilitation in the Couros area makes use of old textile factories and tanneries, now deactivated and abandoned[42].

[42] **Couros River** can also be found in section 1| 2 | 3 | 4 | **5** | 6 | 7 | 8 | **9** | 10 | 11 | 12

Figure 8 Couros area rehabilitation so as to host services, people, science, education, creativity and culture

The rehabilitation process focused on hosting Science and Technology institutions, services to the community, creativity and culture facilities. The recovery was sustainable, making use of traditional techniques of construction - mud rotation and mud fasquio - where wood was maintained as the primitive element.

Promotion of Natural Heritage by placing it at the service of the community

The restoration of the **Green Natural Heritage** is evident in the **Meadow of Creixomil [32]**, a peri-urban area with high patrimonial value, hosting science, sports and recreation, history and culture, green and blue areas. There is also the **Penha Mountain[33]**, which is becoming a living lab in the forest defence arena, with the preservation of biodiversity and strengthening its status as natural and landscape heritage, with

emphasis on the active role of the organization responsible for managing all of that territory - Irmandade da Penha - or the Vimágua company itself. The latter has preserved the **Natural Blue Heritage of the Mines of Penha[34]**, by maintaining the 1904 network of water for human consumption, operated on a gravitational basis, that accounts for 7% of the municipal supply network. There are many examples of investment in the rehabilitation of water lines, using innovative R&D projects – including **AquaBioscape**[43].

Figure 9 Natural Heritage: Mines of Penha and Meadow of Creixomil

In 2015, the City Hall recovered an abandoned industrial unit to create the Association for Sustainable Development - **Guimarães Landscape Laboratory [please see 35]**, in partnership with two Higher Education institutions[44]

Installed in the Meadow of Creixomil, near the banks of the Selho River, the Landscape Laboratory promotes knowledge and innovation, research and scientific dissemination in: Ecology, Hydraulics, Geography and Urban Environment, thus contributing to an integrated action for environmental policies and Sustainable Development.

Today, the Landscape Lab is a centre of excellence in the field of environmental education, also being the coordinator of PEGADAS[45] and headquarters of Mission Structure and promoter of Guimarães mais Verde commitment.

[43] **The River and the City** and **AquaBioscape** can also be found in section 1| 2 | 3 | 4 | **5** | **6** | 7 | 8 | **9** | 10 | 11 | 12
[44] University of Minho and University of Trás-os-Montes and Alto Douro.
[45] **PEGADAS** Education Project for Environmental Sustainability can be found in Good Practice 1

Figure 10 Landscape Lab, Association for the Sustainable Development (R&D and Environmental Education)

10C. Future Plans

Guimarães Green Growth Plan promotes healthier life styles, sustainable coexistence between man and nature, and innovation and knowledge. This stemmed from the ability to use its historic heritage as an opportunity to reinvent itself and improve, therefore raising stand ards and quality.

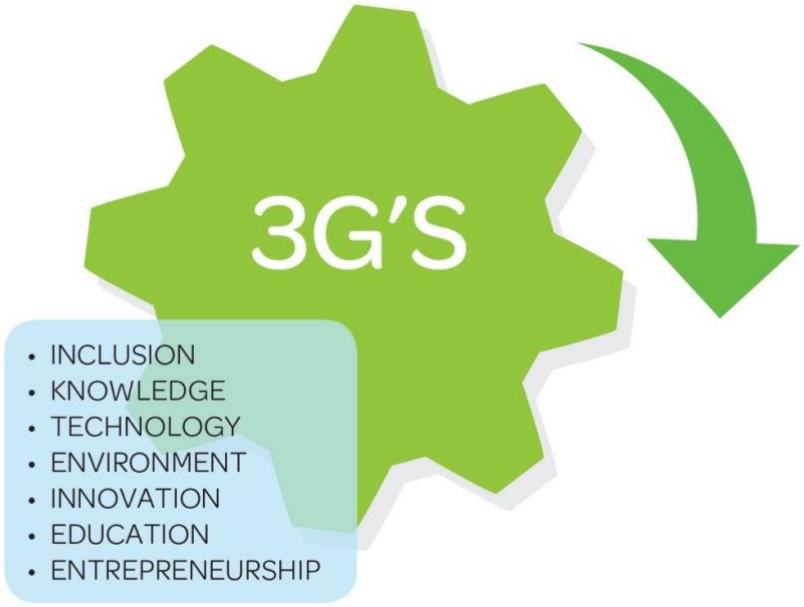


Figure 11 Guimarães Green Growth Plan (3Gs plan)

Guimarães wants to be The Birthplace of Entrepreneurship – by changing the way industry promotes innovation, placing it on the path to Industry 4.0, and promoting the protection and recovery of natural heritage through sustainable soil use.

In 2017, City Hall will implement **The Innovation Warehouse** - a public and private initiative incubator that will be a business development centre for new entrepreneurs and industries, supporting industrial growth based on innovative ideas, assisting technology start-ups to support the industry, creating laboratories open to universities and businesses, and developing new eco-systems for certification and manufacture of materials and industrial processes.

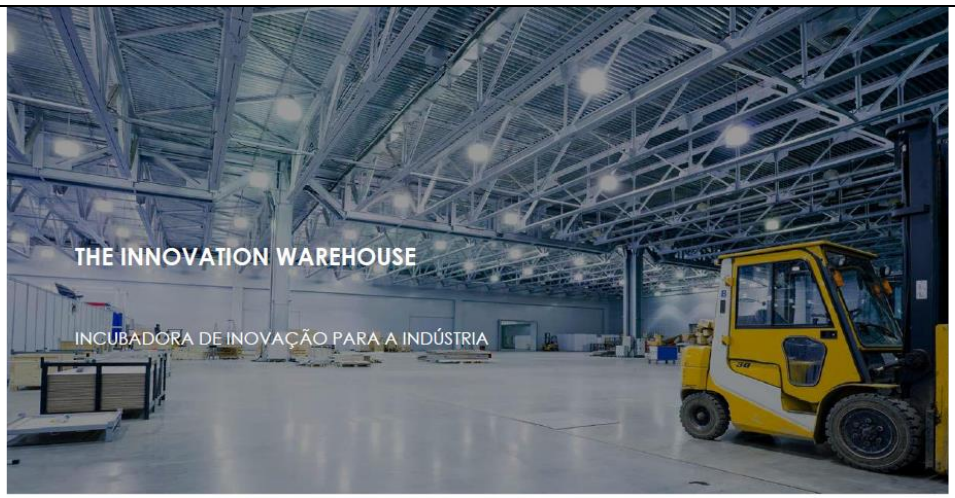


Figure 12 The Innovation Warehouse "do you have a good idea… develop it at the Warehouse"

Already being implemented**,** and with an initial budget of more than 100.000€, the **Rural Based Incubator[36]** intends to make Guimarães a beacon in the good use of agricultural and forest land, promoting qualified and creative entrepreneurship related to farming and forestry, and creating a land bank.

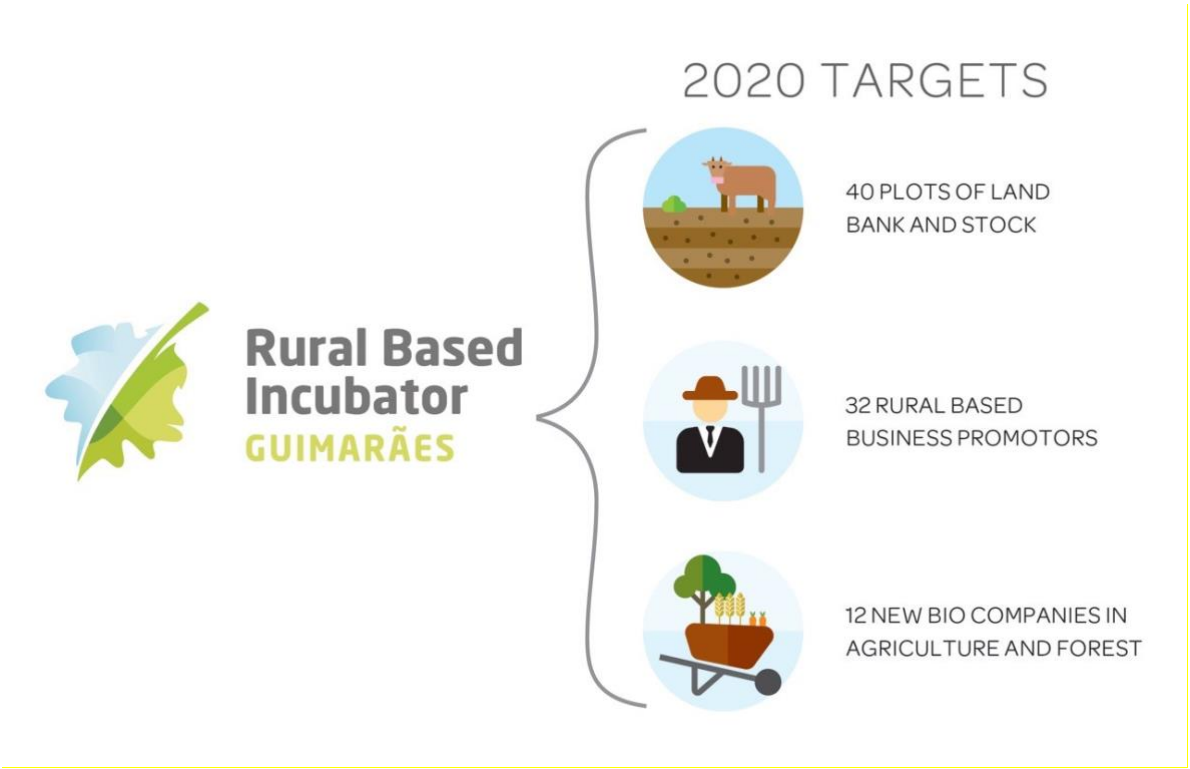


Figure 13 Rural Based Incubator – targets for 2020

Guimarães will commit to **decarbonisation**, by investing in electric mobility, such as expanding the

Electrical Network by constructing a charging station at the Central Bus Station, together with soft transport modes. The city has already established a **Municipal Transport Authority**, resulting in changes to the organization and management of public transport, with gradual and progressive introduction of electric buses throughout the territory as early as 2019, when the city will fully assume the management of the above-mentioned system.

The investment in soft modes, such as expanding the Guimarães Eco-path, which will comprise a total of 28 km, serving the entire urban area and paving the way for connecting various parishes and villages of the Municipality (to be implemented in a second stage that is already under study).

The future demands that the City Hall combines **knowledge and land management**. The relation with the university will be strengthened accordingly, thus contributing to a growing consolidation of Guimarães in the region, the country and in Europe.

There are many projects that demonstrate synergies between the City Hall and Higher Education institutions:

- The direct investment in R&D for sustainable development will be reinforced through the Landscape Laboratory – which has a municipal budget for this purpose.

- The University of Minho will provide higher education degrees in areas of environmental science, geology, agri-food and hospitality.

- The Institute of Science and Innovation for Bio-Sustainability will provide cutting-edge fundamental and applied research for sustainable development.

- University of Minho's *Couros* Campus[46] will be reinforced with rehabilitating the former facilities of Teatro Jordão and Garagem Avenida where the new higher education degrees in the fields of theatre, performing arts and music will soon begin. In this same location, the **already** existing United Nations e-Government Operational Unit[47] will be converted into an Institute, thus contributing even more to the consolidation and internationalization of Guimarães.

[46] See information provide in the past performance section

[47] **United Nations e-Government Operational Unit** is the result of a protocol established between the government and the United Nations University

Figure 14 3G's in action: reinforcement of the United Nations e-Government Operational Unit in Couros Campus

- The City Hall, as managing entity of Avepark, has **already** agreed with the Government to an investment of approximately €10M to build a new connecting road between Avepark, the city and the motorway access. This is already raising the interest of new technology-based companies and will largely benefit one of the biggest research centres that is going to be installed there - the Discoveries Centre - which over the next five years is estimated to attract investments of approximately 50M€.

- In 2018, the City Hall and the Polytechnic Institute of Cávado and Ave will initiate the rehabilitation of a building with great historical and patrimonial value[48] to host the Higher School for Tourism and Hotel Studies**[37]**, thus promoting the hospitality area throughout the region and contributing to the affirmation of Guimarães' Tourism of Excellence.

Guimarães intends to remain a municipality of reference in the implementation of **good practices in planning**, by using its potential to favour the community and create public spaces, thus respecting the natural elements that coexist with the built and artificial space. An immediate striking example is the

[48] **Higher School for Tourism and Hotel Studies**: The building is a seventeenth-century manor house located in the centre of Guimarães that was acquired by the City Hall. It has a historic garden that was conceived by the greatest Portuguese horticulturalist of the 19th century, José Marques Loureiro. Beside the requalification of the building, the City Hall wants to recover and preserve it.

rehabilitation of the Caldelas Civic Centre.

Figure 15 Project for the rehabilitation of the Caldelas Civic Centre

Guimarães aims to be a leader in **Integrated Management**, by finding a harmonious balance between economic, cultural, social and environmental development, thus contributing to retaining the population in their traditional spaces by enhancing their quality of life. Therefore, the City Hall intends not only to carry on with the **Mission Structure** but also to include in its municipal organizational chart a new service capable of making an integrated management of all projects associated to this theme[49].

The City Hall proposes to strengthen **environmental education**, by raising the awareness, qualification and training of its citizens, institutions, and companies, thus enabling active eco-citizenship. Several projects are model examples of work in progress that will be reinforced accordingly.

10D. References

[1] **Guimarães is the most sustainable city in Portugal** ECO XXI, 2017

a. https://ecoxxi.abae.pt/municipios/municipios-ecoxxi-2017/

b. http://www.cm-guimaraes.pt/

[2] **Near zero carbon building**

a. https://www.youtube.com/watch?v=SLzpRjwZPwQ

b. https://guimagym.pt/

[3] **Carpooling "Guimarães à Boleia** https://guimaraes.boleia.net

[49] **Integrated and Strategic Management System** can be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12**

[4] Guimarães Social and Pedagogical Garden certified NP EN ISO 14001:2012 http://www.cm-guimaraes.pt/pages/410

[5] PAYT https://www.vitrusambiente.pt/residuos_payt

[6] Retain basins

a. Resilient Cities ICLEI, 2017 http://resilientcities2017.iclei.org/fileadmin/sites/resilient-cities/files/Resilient_Cities_2017/Documents/RC2017_Program_Book_post_congress.pdf

b. Biosphera http://www.labpaisagem.pt/biosfera-da-rtp2-destaca-iniciativa-do-laboratorio-da-paisagem/

[7] Economic Development Division of the Guimarães City Hall http://www.cm-guimaraes.pt/pages/689

[8] Advisory Council for Investment and Employment http://www.cm-guimaraes.pt/pages/951

[9] Guimarães marca http://www.guimaraesmarca.com/

[10] Green Skills http://www.cm-guimaraes.pt/pages/957

[11] City Hall in TecMinho's General Assembly

a. http://www.tecminho.uminho.pt/showPage.php?url=166_oacutergatildeossociais.html&zid=569

b. Training offer http://www.tecminho.uminho.pt/emp_index.php?zid=215

[12] InAve http://www.inave.pt/

[13] We are all Guimarães: participate with your idea http://op.cm-guimaraes.pt/

[14] Guimarães inclusive http://www.fraterna.org/index.php/departamento-de-estudos-e-projectos/arca-social

[15] GPP - certification Municipal Certification for Quality http://www.cm-guimaraes.pt/uploads/writer_file/document/483/pqcmg.pdf

[16] GPP

a. **dematerialization** http://www.cm-guimaraes.pt/pages/96

b. **Guimarães leads ranking of cities with more presence on the Internet** http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=3024

[17] Guimarães mais verde http://www.cm-guimaraes.pt/pages/1092

[18] Private's engagement

a. **Educabicla** http://www.educabicla.pt/

b. **TeatroBus** https://www.youtube.com/watch?v=3H7KTTfnIt8

[19] Declaration of Political Consensus

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

[20] Creative Labs https://www.ccvf.pt/ficheiros/eventos/evento_3134_3.pdf

[21] Heritagecare

a. http://heritagecare.eu/

b. **IB-S** www.ib-s.uminho.pt

[22] Rapid charging station http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2907

[23] Ave Territorial pact http://www.cim-ave.pt/images/cimave/documentos/Pacto%20Territorial%20para%20a%20Empregabilidade%20do%20Ave%202014.pdf ; http://www.cim-ave.pt/images/cimave/documentos/PCIAVE.pdf

[24] P2020 link http://www.ccdr-n.pt/norte-conjuntura

[25] Employment http://www.ccdr-n.pt/sites/default/files/ficheiros_ccdrn/ficheiros_RegNorte/nc_4t2016.pdf)

[26] Incentive Measures

a. http://www.cm-guimaraes.pt/pages/949

b. http://www.cm-guimaraes.pt/pages/989

[27] Quality Management System

NP EN ISO 9001:2008; NP EN ISO 14001:2012; NP EN ISO 19011:2012 st

[28] Guimarães Ecological Footprint and Biocapacity report

a. Digital version

b. http://expresso.sapo.pt/sociedade/2017-09-02-ZERO-e-6-municipios-portugueses-lancam-projeto-inedito-a-nivel-mundial-para-calcular-Pegada-Ecologica

[29] Municipal Transparency Index http://www.cm-guimaraes.pt/pages/1075

[30] RSUM

a. https://www.uminho.pt/PT/uminho/Sustentabilidade/Documents/RSUM14_final_28jan.pdf

b. https://www.unglobalcompact.org/system/attachments/cop_2016/323881/original/COE.pdf?1476094413

[31] Couros Area

a. Design Institute of Guimarães https://www.youtube.com/watch?v=hIPyBMu3DVA

b. Post-Graduation Centre United Nations University (e-government) http://www.cm-

guimaraes.pt/frontoffice/pages/991?news_id=2115

c. Living Science Centre http://ccvguimaraes.pt/

d. Youth Hostel https://pousadasjuventude.pt/pt/pousadas/guimaraes/

[32] Meadow of Creixomil

[33] Penha http://www.cm-guimaraes.pt/uploads/document/file/3436/18632.pd»?ç[33] Penha http://www.cm-guimaraes.pt/uploads/document/file/3436/18632.pdf

[34] Mines of Penha

a. http://www.guimaraesdigital.com/noticias/64379/video-vimagua-mostrou-minas-da-penha-no-dia-mundial-do-ambiente

b. https://www.facebook.com/pg/labpaisagem/posts/?ref=page_internal

[35] Landscape Lab http://www.labpaisagem.pt/

[36] Rural Based Incubator

a. http://www.cm-guimaraes.pt/uploads/document/file/11784/28_-_Anexo_I_-_Regulamento_Incubadora_de_Base_Rural_de_Guimar_es.pdf

b. http://www.labpaisagem.pt/?s=incubadora+de+base+rural

[37] Higher School for Tourism and Hotel Studies http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2961

11. Energy Performance

11A. Present Situation

Indicator		Unit	Year of Data
Final Energy Consumption	1765578	MWh	2015
Final Energy Use/capita	11400	kWh/capita	2015
Share of Renewable Energies of Final Energy Demand	30	%	2015
Share of Locally Produced Renewable Energies of Final Energy Demand	9	%	2015
Energy Performance of Municipal Buildings	18,57[1]	kWh/m^2	
Final Energy Usage /Sector			
Agriculture & Fisheries	0.77	%	2015
Industry & Commercial	9.6		
Transport	49.78		
Domestic	22.77		
Services	16.40		
Other	0.68		
Total	**100**		

1, 2 and 3

The **Final Energy consumption** *per* indicator, sector and source over the past ten years is presented in Table 1.

Since joining the **Covenant of Mayors in 2013**[2], Guimarães has submitted the **Sustainable Energy Action Plan[1]** in 2014, undertaking to reduce CO_2 emissions by 20% by 2020. When submitting the **SEAP**[3] **Monitoring Report[2]**[4]**,** Guimarães reported an energy consumption of 1800 GWh/year[5] in 2016.

Despite having already reached the goals proposed for 2020 by 2014, Guimarães still has a significant energy intensity, albeit decreasing, associated to the high levels of economic activity[6] and population.

[1] This value was obtained trough a random sampling
[2] **Accession to the Covenant of Mayors in 2013** can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | **12**
[3] SEAP – Sustainable Energy Action Plan
[4] http://www.eumayors.eu/about/signatories_en.html?city_id=6639&monitoring
[5] Energy consumption values relating to the 2014 monitoring year, corresponding to the most recent statistical year available in 2016
[6] In 2016, Guimarães was the fourth largest national exporter (National Statistics Institute , 2016)

Table 1 Final energy evolution per indicator sector and source (2007-2017)

Final Energy usage											
INDICATOR / SECTOR / SOURCE	2008	2009	2010	2011	2012	2013	2014	2015	2016(1)	2017(1)	Unit
Final Energy Consumption	1 982	1 978	2 051	1 905	1 853	1 814	1 789	1 766	1 756	1 746	GWh/ year
Final Energy use/capita	12,42	12,44	12,97	12,05	11,79	11,61	11,5	11,4	11,37	11,35	MWh/capita
Share of Renewable Energies of Final Energy Demand	28	29	29	29	30	31	30	30	35	38	%
Share of Locally Produced Renewable Energies of Final Energy Demand	12	12	12	8,4	8,7	9,3	9,2	9,0	9,3	9,5	%
Energy Performance of Municipal Buildings											kWh/m2
Final Energy usage /sector											
Ag & Fisheries	1,01	0,92	1,02	1,21	1,08	1	0,77	0,77	0,77	0,77	%
Industry and Commercial	14,01	11,73	12,91	13,72	10,69	10,56	9,51	9,6	9,68	9,77	
Transport	46,87	48	45,85	47,78	48,73	49,44	50,23	49,78	49,54	49,2	
Domestic	25,36	25,91	25,35	23,26	23,66	23	22,58	22,77	22,84	22,88	
Services	11,88	12,51	13,96	12,88	15,16	15,34	16,24	16,4	16,49	16,69	
Public Lighting	0,87	0,94	0,91	1,15	0,68	0,66	0,67	0,68	0,68	0,69	
Total	100	100,01	100	100	100	100	100	100	100	100	
Final Energy usage /sector											
Ag & Fisheries	20,02	18,20	20,92	23,05	20,01	18,14	13,77	13,59	13,52	13,44	GWh/ year
Industry and Commercial	277,65	232,00	264,81	261,33	198,08	191,57	170,10	169,50	169,94	170,54	
Transport	928,87	949,35	940,49	910,09	902,93	896,88	898,43	878,90	869,72	858,82	
Domestic	502,58	512,45	519,99	443,05	438,40	417,24	403,87	402,02	400,98	399,39	
Services	235,44	247,42	286,35	245,33	280,90	278,28	290,47	289,55	289,50	291,34	
Public Lighting	17,24	18,59	18,67	21,90	12,60	11,97	11,98	12,01	11,94	12,04	
Total	1981,80	1978,01	2051,23	1904,76	1852,92	1814,08	1788,63	1765,58	1755,58	1745,58	
Energy consumption by source											
Eletricity	27,61%	26,64%	28,05%	30,01%	29,45%	29,37%	26,76%	27,12%	27,39%	27,66%	%
Natural Gas	4,54%	4,93%	6,47%	5,34%	5,76%	5,60%	5,95%	5,91%	5,87%	5,83%	
Fossil Fuels	56,37%	55,97%	53,84%	53,60%	53,24%	52,85%	55,19%	54,79%	54,53%	54,26%	
Use of Renewables	11,48%	12,46%	11,64%	11,05%	11,55%	12,18%	12,10%	12,18%	12,21%	12,25%	
(1) Estimated values											

Guimarães has managed to reduce final energy consumption between 2008 and 2017 by 12%. Its energy consumption per capita is 12 MWh, lower than the 16 MWh/inhab national average.

The current European geopolitical and economic landscape and increase in cost of fossil fuels, associated with the commitment of the municipality of Guimarães to promote rationalization and sustainability measures, contributed to reducing energy consumption and improving energy intensity. Guimarães signed the Covenant of Mayors for Climate and Energy in 2013, having already produced its **Action Plan** with measures set forth for the horizon **2030[3].**

Portugal has invested in producing renewable energy, particularly hydropower and wind power[7]. Even though the morphology of the Guimarães territory hinders the implementation of these measures, the City Hall promoted renewable energy production from hydroelectric plants in the Ave basin where five mini-hydroelectric plants were installed, generating 4.9 MW of power**[4].**

Mini-hydroelectric plant of Campelos - 0.9 MW

Mini-hydroelectric plant of Ronfe - 1 MW

Mini-hydroelectric plant of Carvalho do Moinho - 0.2 MW

Mini-hydroelectric plant of the Textile factory of Vizela - 1.2 MW

Mini-hydroelectric plant of Caneiro - 1.6 MW

The Municipality installed 3.68kW photovoltaic systems in 16 schools with a production capacity of 4.32 MWh/month, and biomass boilers in 12% of the first cycle/elementary schools and kindergartens, delivering 63 tonnes of biomass sourced from their own green areas in the 2016/2017 school year, which amounts to savings worth around 6330€**[5].**

Figure 1 Mini-hydroelectric plant, biomass boilers & photovoltaic systems

[7] Programme E4 – RCM n.º 154/2001 of september 27th

4. Fossil and renewable energy production

Table 2 Guimarães Fossil and renewable energy production (2007-2017)

	2007(1)	2008	2009	2010	2011	2012	2013	2014	2015	2016(1)	2017(1)
Electricity generation (GWh/year)	354	316	313	290	265	268	279	266	266	266	264
Heat generation (GJ/year)	208	191	187	175	166	170	197	197	193	189	186
Renewable electricity generation (GWh/ano)	12	11	13	17	12	8,1	15	15	11	15	18
Fossil electricity generation (%)	97	97	96	94	95	97	95	94	96	94	93
Renewable electricity generation (%)	3,3	3,3	4,2	6	4,7	30	5,3	5,8	4	5,7	6,7
Fossil heat generation (%)	100	100	100	100	100	100	100	100	100	100	100
(1) Estimated values											

5. Buildings

With 40% of housing stock built over 40 years ago - C and D energy classes prevail in the residential segment, while G and B classes stand out in services buildings. Guimarães encouraged improved energy performance in Areas of Urban Rehabilitation as well as tax benefits for more efficient buildings. The Guimarães City Hall inaugurated the Gymnastics Academy in June 2017[8], a "**Positive Energy Building**"**[6]**, improved 358 **social housing** fractions by installing thermal insulation and frames, and photovoltaic and solar thermal systems**[7].**

[8] **Gymnastics Academy** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12 and Good Practice 5

Figure 2 Good Practices: Positive Energy Building in the Gymnastics Academy

Leading by the example

The City Hall initiated the renewal of the municipal fleet[9] by acquiring **hybrid and electric vehicles[8].**

[9] **Electric Mobility** can also be found in sections **1**| 2 | **3** | 4 | 5 | 6 | 7 | **8** | 9 | **10** | 11 | **12**

The City Hall is upgrading the entire public lighting system, replacing it with 37 000 LED fixtures by the end of 2017**[9].**

The City Hall has brought together several organizations [10]so as to develop and implement the **Manual on good practices for sustainability in sports** for the 100 local sports associations and clubs**[10]**.

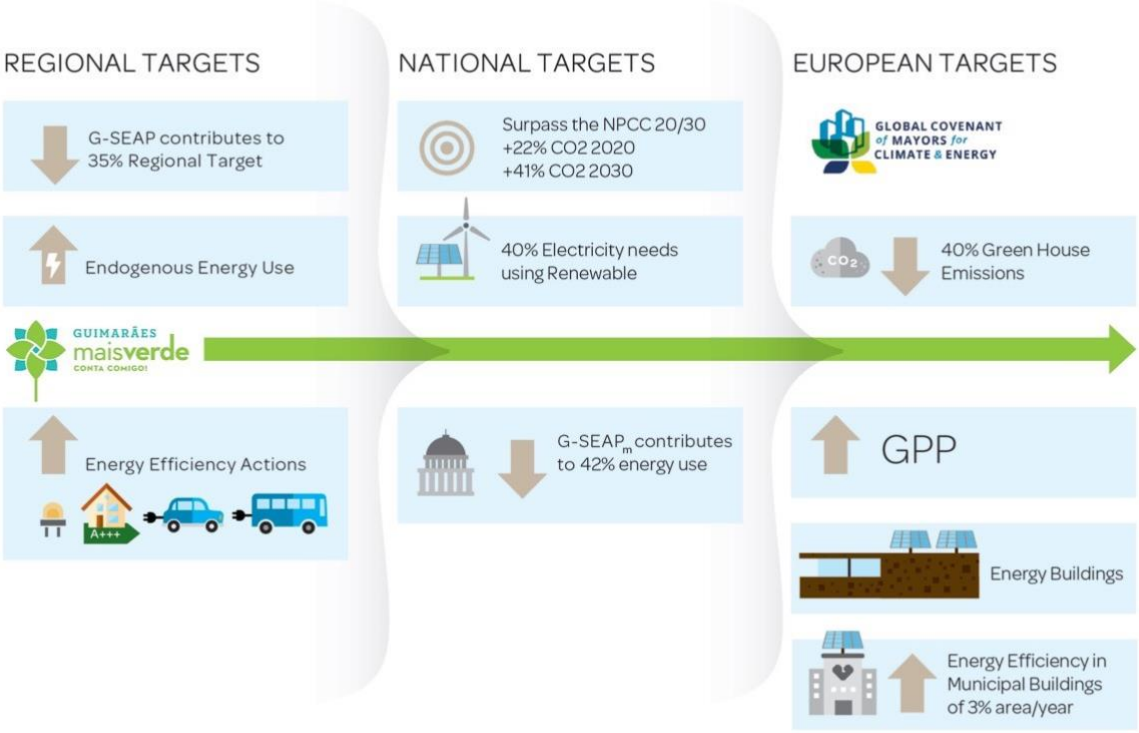


Figure 3 Compliance with regional, national and european targets
(SEAP - Sustainable Energy Action Plan, SEAPm - Monitoring)

In 2016, the City Hall joined a consortium named **DREAM**[11]**[11]** (focused on energy efficiency, information technologies and urban mobility) established with UNESCO Heritage cities demonstrating a willingness to integrate and share knowledge and innovation in seeking solutions adjusted to the territorial context.

[10] Energy Agency of Ave, Vimágua (Water Company), RESINORTE and VITRUS (Regional and Municipal waste companies)
[11] **DREAM** can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

11B. Past Performance

1.

Energy performance: improvements

The revitalization of the industrial sector in the last century led to a growth in energy consumption, particularly in the industrial park of the Historic Centre where most leather industries in the Municipality were situated. Recently, the city relocated these to peripheral areas of Guimaraes by creating business parks[12], thus attracting with it the associated workforce. This, and the determination to have the historic centre classified as a UNESCO World Heritage Site**[12],** prompted the city to promote the urban recovery of municipal buildings, stimulating private investment for the rehabilitation of the housing sector. This led to improvements in the energy performance of buildings, despite constraints imposed by the unfavourable economic environment of the recent past that limited capacity for public and private investment. The municipality sought to overcome many difficulties, particularly the access to financing. Through communication and dissemination actions, establishing partnerships and obtaining external financing, the city was able to find technical solutions for seasonal energy consumption disparities, efficiency requirements and requirements of integrating energy production through renewable sources.

The Municipality joined the Covenant of Mayors initiative on 21 November 2013[13] having developed and implemented the Sustainable Energy Action Plan[14]**[1]**.

Table 3 Energy consumption reduction targets, SEAP 2020 (Source: CoM C&E)

Sustainable Energy Measures	Consumption reduction (MWh/Year)	Consumption reduction (%)
Buildings	123.874	4,7
Governance	29.508	1,2
Transports	375.974	14
Total	**529.356**	**20**

With the implementation of the SEAP monitoring inventory, the energy consumption and CO_2 emissions generated by the activity developed in the municipality were quantified, resulting in a 10% reduction in consumption and 21% reduction in CO_2 emissions.

[12] Industrial Activity can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

[13] **Accession to the Covenant of Mayors in 2013** can also be found in sections **1**| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | **12**

[14] **SEAP** - Sustainable Energy Action Plan

Table 4 Baseline Emission Inventory (2008) and Monitoring Emission Inventory (2014) main results (Source:CoM C&E)

		Total Final Energy Use (MWh/year)		Reduction %	Increase %
		BEI 2008	MEI 2014		
Buildings, Equipments/ facilities and industries	Buildings and Equipments / Municipal facilities	470271	27529	42%	
	Terciary Buildings and Equipments (non municipal)	188196	260814		39%
	Residencial Buildings	502605	403977	20%	
	Public Lighting	17230	12019	30%	
	Industries (Excluding ETS)	277636	170110	39%	
	Subtotal	1032938	874449	15%	
Transports	Subtotal	928890	898410	3%	
Other	Agriculture & Fisheries	19974	13718	31%	
Total		**1981802**	**1786577**	**10%**	
		CO2 Emissions	(tCO2/year)	Reduction %	Increase %
		BEI 2008	MEI 2014		
Buildings, Equipments/ facilities and industries	Buildings and Equipments / Municipal facilities	15893	7450	53%	
	Terciary Buildings and Equipments (non municipal)	66214	68024		3%
	Residencial Buildings	92653	67261	275	
	Public Lighting	6720	3353	50%	
	Industries (Excluding ETS)	92094	44847	51%	
	Subtotal	273573	190935	30%	
Transports	Subtotal	241463	217484	10%	
Other	Agriculture & Fisheries	5901	3704	37%	
Total		**520936**	**412123**	**21%**	

2. and 3. Actions

Following City' **Greening Policies**, several measures were implemented promoting energy efficiency and energy consumption redution. Fundings were Leveraged by National and European co-financing programmes, as well as from Municipality own budget**[13].**

Schools

- Rehabilitation of 10 School Centres: new construction solutions comprising Efficient HVAC equipment and Centralized Technical Management
- Photovoltaic systems in 16 schools - Model based on ESCOs 3.68kW/h per school with a total production of 4.32 MWh/month

Social housing: 358 fractions

- Thermal insulation of the building envelope,
- replacement of frames,
- solar thermal equipment and photovoltaic systems.

Sports facilities

- SWH systems: electronic ballasts, 4-way heat pumps, thermal insulation of the building envelope

Urban Centre regeneration

- Rehabilitation of the Historic Centre, Unesco World Heritage since 2001
- Rehabilitation of abandoned industrial areas to more efficient buildings providing new services and new areas for public enjoyment

Transport and urban mobility

Promotion of electric mobility

- Guimarães has 18 public and 11 private charging points being the first Municipality to have a Rapid charging station
- 10,48% of the Municipal fleet is electrical being 10 new vehicles in open procedure
- By 2017, 40% of Vimágua[15] fleet will be electrical
- Energy efficient MSW collection vehicles (EURO6)
- Payt System 100% electrical

Promotion of collective public transport

- Optimization of routes and schedules
- Social benefits for +65 and students
- City line covered by eCityGold (100% electic bus)

Promotion of Soft modes

- Construction of a Cycling Network for inter and intra-municipal connections (1st phase completed).
- Promotion of Bicycle use through Educabicla programme

[15] **Vimágua** is the Water Management which City Hall company co-owns

Figure 4 Guimarães increasing Energy performance – Schools, Housing, Electical Mobility, Requalification

Mobilization and Engagement

With the decision to apply to the EGC, backed by 91.9% of the city's inhabitants**[14],** City Hall promotes eco-citizenship through **Guimarães mais verde commitment**[16]**.** At a political level, all the parties and Parish Council presidents are committed to local sustainable development - **Declaration of Political Consensus[15].**

Also, contributing to an integrated and participated action to promote knowledge and innovation, research and scientific dissemination, City Hall devoted about 1.5M€ (15/17) to R&D environmental projects including **Landscape Lab**[17]**[16].**

[16] **Guimarães mais verde** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **12** and Good Practice **1**
[17] **Landscape Lab** can also be found in section in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

To promote environmentally friendly good practice in the Economic sector, **Guimarães Marca**[18]**[17]** was launched.

Ave Energy Agency**[18]** promoted a programme to train municipal technicians, to provide technical consultancy and to implement actions in all municipality' schools ("Patrulha da Energia" - Energy Patrol and "Cantinho da Tocas"-Toca's Little Corner.

City Hall also funds popular projects - **We are all Guimarães: participate with your idea -** with 500 000€[19]**[19]** Through this programme, schools can raise funds to invest in energy efficiency measures, such as the exchange of ineffective light bulbs by LED technology.

Figure 5 Stakeholders' engagement: from industrial sector to schools and citizens

Leading by the Example

Guimarães is Member of Energy cities since 2008**[20]** and, in 2018, will host **ECOS 2018**[20]**[21].** Between 2008-2014, Endogenous Energy production **53 MWh/year→ to 15516 MWh/year** (1,1% of the municipality's total consumption of energy). In the same period, a **reduction of the consumption of buildings in 40% was achieved**, exceeding the ECO.AP targets[21].

[18] **Guimarães marca** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12
[19] Programme launched by the City Hall
[20] 31st International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy system
[21] For public administration organizations and services

In 2013, the installation of 43 Luminous flux regulators contributed to a **reduction of 30% in the consumption of Public Lighting[22].**

In partnership with the regional energy agency, the municipality adopted a smart energy management platform in 2013 - **IEMSY[23]** - which allows monitoring and managing energy consumption, as well as assisting investment measures and opportunities, making it an important tool to support the municipality as a *smart city*.

Table 5 Estimated investment for sustainable energy measures in Guimarães (2009- 2014) (Source: CoM C&E)

Target	Estimated Investment (€)
Buildings	14.089.158
Governance	8.092.474
Transports	5.608.328
Total	27.789.960

11C. Future Plans

Guimarães established new goals for 2030 to promote energy sustainability through the Covenant of Mayors for Climate and Energy and the preparation of the **Sustainable Energy and Climate Action Plan[22].**

The preparation and implementation of the SECAP will allow the municipality to achieve a 39% reduction in energy consumption and 42% reduction in emissions by 2030, contributing not only to improving energy efficiency, but also promoting a significant improvement in the quality of life and the urban environment, together with sustainable socio-economic development in the short, medium and long term.

The municipality aims to reduce 100% of its emissions by **2050**, becoming a **zero emissions municipality**. This will be achieved through producing energy from renewable sources for local supply. A Supply Plan is being developed to assess opportunities and define a strategy for the local renewable supply of 100% of the municipality's energy needs by 2050.

These targets take into account the potential of the municipality, as well as strategies and goals defined at national and European levels. With the implementation of the SECAP, the Municipality will exceed the national targets for non-ETS[23] sectors of a 30% reduction in CO_2 emissions by 2030, as defined in the 2020/2030 NPCA.[24]

These action plans will guide local decision-makers on the strategy to be followed, as well as support the acquisition of investment, assist access to national and international financing and cooperation programmes, and encourage partnerships and the involvement of civil society in the implementation of actions to improve sustainability and economic growth.

[22] **Sustainable Energy and Climate Action Plan: SECAP**
[23] **ETS** - Emissions Trading System (EU)
[24] **NPCA** – National Plan for Climate Adaptation

Table 6 Sustainable Energy and Climate Action Plan 2030 targets

Sustainable Energy Measures	Consumption reduction (MWh/Year)	Consumption reduction (%)	CO2 Emission Reduction [tCO2/Year]	CO2 Emission Reduction (%)
Buildings	86.698	4,9	30.355	5,8
Governance	241.806	14	93.689	18
Transports	357.837	20	93.018	18
Total	686.341	39	217.063	42

These initiatives aim to achieve a reduction of 464 809 MWh/year, corresponding to a **decrease of 26% in the energy demand**.

The implementation of the Guimarães SECAP anticipates an **increase in the renewable energy production** of approximately 221 531 MWh/year, equivalent to 13% of the municipality's energy needs.

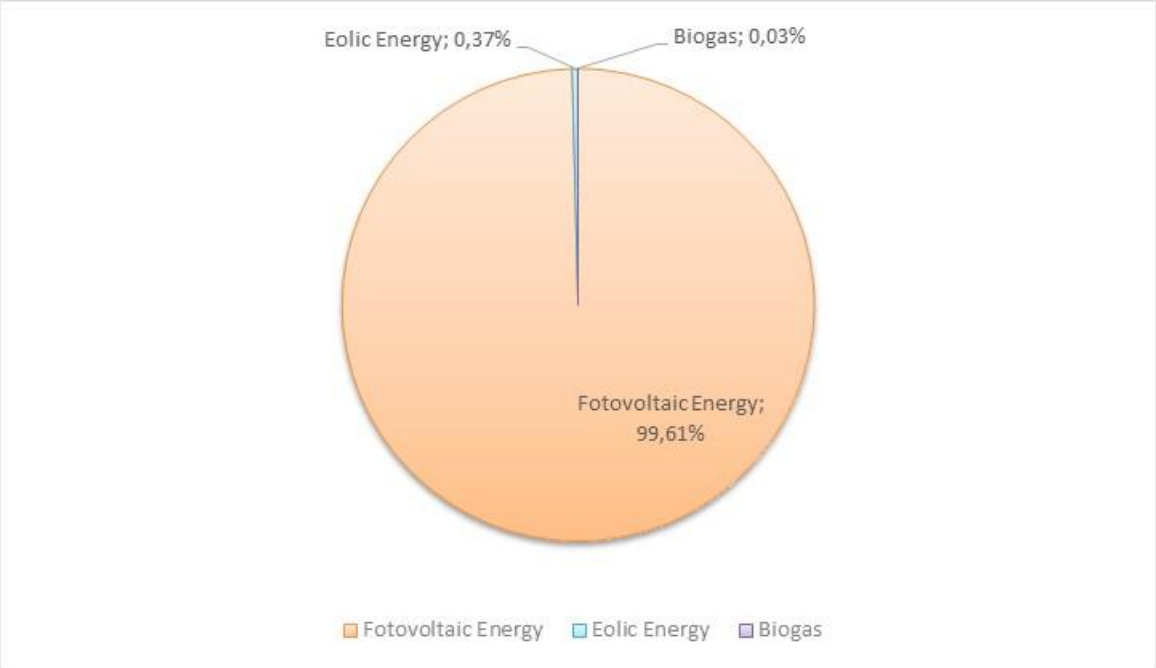


Figure 6 Projection of the production of renewable energy per energy source with the implementation of the SECAP

The implementation of the **SECAP** will take place parallel to other plans, in particular the **Municipal Strategy for Adaptation to Climate Change**[25] and the **Sustainable Urban Mobility Plan**[26].

[25] **Municipal Strategy for Adaptation to Climate Change in Guimarães** can also be found in section 1| **2** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

[26] **SUMP** can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

Figure 7 SECAP integration: SUMP, 3G's, MSACC

The definition of measures included in the Guimarães SECAP was carried out in line with the strategy followed when implementing the Guimarães SEAP for 2020, thereby continuing a strategy that has already produced positive results. Therefore, successful actions with potential for improvement were identified and new actions with potential to reduce specific energy consumption by consumer sector were proposed to improve energy use and mitigate the increasing use of energy consuming equipment, associated with the demand for comfort, quality of life and productivity increases.

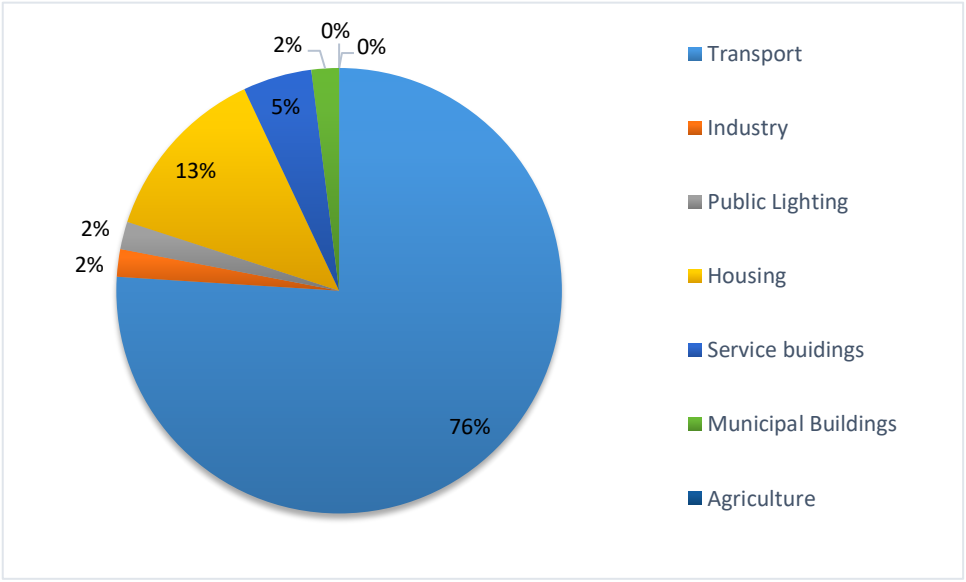


Figure 8 PASEC - Reduction of Energy consumption as consequence of PASEC implementation (estimated values)

All the energy sustainability measures projected as part of the implementation of the SECAP should require an investment of about 350M€, from which 5M€ would result from municipal investment, and 345M€ from the private sector. An estimated 110M€ will constitute financial support from structural funds, cohesion funds and government programmes.

The municipality will involve stakeholders and establish European and National partnerships in the areas of sustainability, energy efficiency and new technologies, to ensure that the proposed objectives are met.

A communication plan will be developed, supported by communication and dissemination tools adjusted for different target groups, for an active collaboration and support to projects. Guimarães is also supported by the Landscape Lab[27] and the Ave Energy Agency in carrying out awareness-raising and community mobilization actions to implement energy sustainability measures.

In order to ensure the achievement of the objectives proposed, the municipality of Guimarães defined a set of monitoring indicators that allow assessing the progress and performance of the SECAP's implementation, as well as identifying potential for improvement. The proposed monitoring indicators were separated into indicators to monitor the implementation of energy sustainability measures specific to each sector and each measure.

These indicators were defined according to the recommendations of the Covenant of Mayors and the Joint Research Centre for the creation of monitoring reports, and take into account the specific monitoring needs of energy sustainability measures presented in the Municipality's SECAP. An analysis of the information relating to the set of energy sustainability measures already implemented and planned was carried out accordingly in order to assess the compliance of the proposed monitoring indicators.

The municipality has a smart energy management platform to support the implementation and monitoring of the SECAP, the involvement and communication between stakeholders, as well as information and dissemination actions.

11D. References

[1] PAES 2013

a. http://www.guimaraesmaisverde.pt/_energia_7

b. http://www.covenantofmayors.eu/about/signatories_en.html?city_id=6639&seap

c. http://www.cm-guimaraes.pt/frontoffice/pages/1141?news_id=2171

d. http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2019

[27] The City Hall recovered an abandoned industrial unit to create the Association for Sustainable Development - **Guimarães Landscape Laboratory**, in partnership with two Higher Education institutions, University of Minho and University of Trás-os-Montes and Alto Douro. This laboratory promotes knowledge and innovation, research and scientific dissemination in four areas: Ecology, Hydraulics, Geography and Urban Environment, thus contributing to an integrated action for environmental policies and Sustainable Development. It is also a centre of excellence in the field of environmental education. It is also described in section1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **11** | 12

[2] PAES Monitoring Report

a. http://www.eumayors.eu/about/signatories_en.html?city_id=6639&monitoring

a. http://www.guimaraesmaisverde.pt/_energia_7

[3] Action plan 2030 (digital version)

[4] Mini-hydroelectric plants

a. http://geoportal.dgeg.pt/geoportal/catalog/search/resource/livedata-preview.page?uuid=%7BA5E81BDB-96C3-405C-85B0-B262CD032C89%7D&url=https%3A%2F%2Fagserver.sg.min-economia.pt%2Farcgis%2Fservices%2FDGEG%2FCH%2FMapServer%2FWmsServer&resourceType=wms&info=%2Fgeoportal%2Frest%2Fdocument%3Ff%3Dhtml%26showRelativeUrl%3Dtrue%26id%3D%257BA5E81BDB-96C3-405C-85B0-B262CD032C89%257D

b. https://www.apambiente.pt/_zdata/Politicas/Agua/PlaneamentoeGestao/PGRH/PGRH_ParticipacaoPublica/PGRH_2_Art5/RH2_Art5.pdf

[5] Biomass at schools http://www.cm-guimaraes.pt/frontoffice/pages/1141?news_id=2878

[6] Positive Energy Building

a. https://www.youtube.com/watch?v=SLzpRjwZPwQ

b. https://guimagym.pt/

[7] Intervention in Social Housing http://www.cm-guimaraes.pt/frontoffice/pages/1123?news_id=2254

[8] Municipal fleet Renewal

a. http://www.eumayors.eu/about/signatories_en.html?city_id=6639&benchmarks

b. http://www.cm-guimaraes.pt/frontoffice/pages/1123?news_id=2773

c. http://www.cm-guimaraes.pt/frontoffice/pages/1141?news_id=2475

[9] Public lighting system of Guimarães

a. http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2243

b. http://www.cm-guimaraes.pt/frontoffice/pages/1141?news_id=2500

[10] Good Pratices in Sports

a. http://www.labpaisagem.pt/guimaraes-recebe-abril-conferencia-internacional-sustentabilidade-no-desporto/

b. http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2973

c. https://www.facebook.com/guimagym/photos/a.1771541629750396.1073741828.1760904640814095/1856398667931358/?type=3&theater

d. https://www.facebook.com/pg/labpaisagem/photos/?tab=album&album_id=1286458861438805

[11] DREAM http://www.cm-guimaraes.pt/frontoffice/pages/1010?news_id=2938

[12] UNESCO 2001 http://www.cm-guimaraes.pt/pages/921

[13] Municipality actions

a. Rehabilitation of Briteiros school http://www.cm-guimaraes.pt/frontoffice/pages/1143?news_id=2867

b. Ronfe School Centre http://www.cm-guimaraes.pt/frontoffice/pages/1143?news_id=2056; http://www.cm-guimaraes.pt/frontoffice/pages/1143?news_id=2065

c. Electric charging stations - http://www.cm-guimaraes.pt/frontoffice/pages/1123?news_id=2907

d. Guimarães Mais Verde http://www.cm-guimaraes.pt/frontoffice/pages/1123?news_id=2179

e. PEGADAS http://www.cm-guimaraes.pt/frontoffice/pages/1141?news_id=2173 ; http://www.cm-guimaraes.pt/pages/1169

f. APP Energy efficiency http://www.cm-guimaraes.pt/frontoffice/pages/1123?news_id=2786

[14] Pina, S. (2015). **Estudo da perceção ambiental da população do Concelho de Guimarães.** Relatório de Estágio da Licenciatura em Estatística, Universidade do Minho

[15] Declaration of political consensus and Declaration of individual consensus

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf
b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf
c. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

[16] Landscape Lab http://www.labpaisagem.pt/

[17] Guimarães marca http://www.guimaraesmarca.com/
[18] AEdoAVE www.aeave.pt; http://www.guimaraesdigital.com/index.php?a=noticias&id=55480
[19] Participatory budget http://op.cm-guimaraes.pt/PageGen.aspx?WMCM_PaginaId=27775&noticiaId=28911&pastaNoticiasReqId=27692
[20] Energy cities http://www.cm-guimaraes.pt/pages/991?news_id=1154; http://www.energy-cities.eu/Guimaraes

[21] ECOS 2018 https://ecos2018.org/
[22] Luminous Flux Regulators http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=1319
[23] IEMSY http://aeave.irradiare.com/

12. Governance

12A. Present Situation

Indicator	Yes/No	Date From:
Signatory of CoM	Yes	2nd November 2013
Aalborg Signatory	Yes	9th September 2004

Vision, Strategy

Guimarães is unique. Known as the "Birthplace of the Portuguese Nationality" the city strives to honour its proud heritage by becoming **Portugal's most sustainable**[1] and resilient city in the future.

Its vision is to be '***more than green'***. To this end, over the past 30 years, our environmental governance has aimed at becoming a model of urban development characterised by difference, boldness and innovation. In combining environmental best practices with cultural heritage, Guimarães intends to evolve further as a biocultural and sustainable territory that meets the needs of all its citizens. Our coherent policy is to restore outstanding architectural heritage and integrate environmentally sound practices. Initially focused on regenerating the Historic Centre[2], today, however, that vision has been expanded throughout the municipal area. As outlined in its application, the City Hall encourages continuing public participation, with citizens enthusiastically committed every day to belong to a municipality that they can be proud and take ownership of.

Guimarães plans to design a space and a lifestyle that displays clear signs – recognised by the country, by Europe and the world – of a successful, permanent, and consistent effort to acquire an unrivalled quality of life.

Guimarães is proud to be part of the European Union and is constantly vigilant to paradigm changes within Europe. Environmentally, the EU vision has long been incorporated into the city's political and popular agenda. It is already well on the path of knowledge, research, culture and inclusion, where all are mobilized to contribute and to participate in the New Urban Agenda. Such a motto calls for **eco-citizens,** aware and sensitive to the need to provide their territory with the sustainability that the Anthropocene future demands.

[1] In 2017, Guimarães is the **Most sustainable city in Portugal** – ECO XXI, European Blue Flag Association
[2] **UNESCO World Cultural Heritage since 2001**

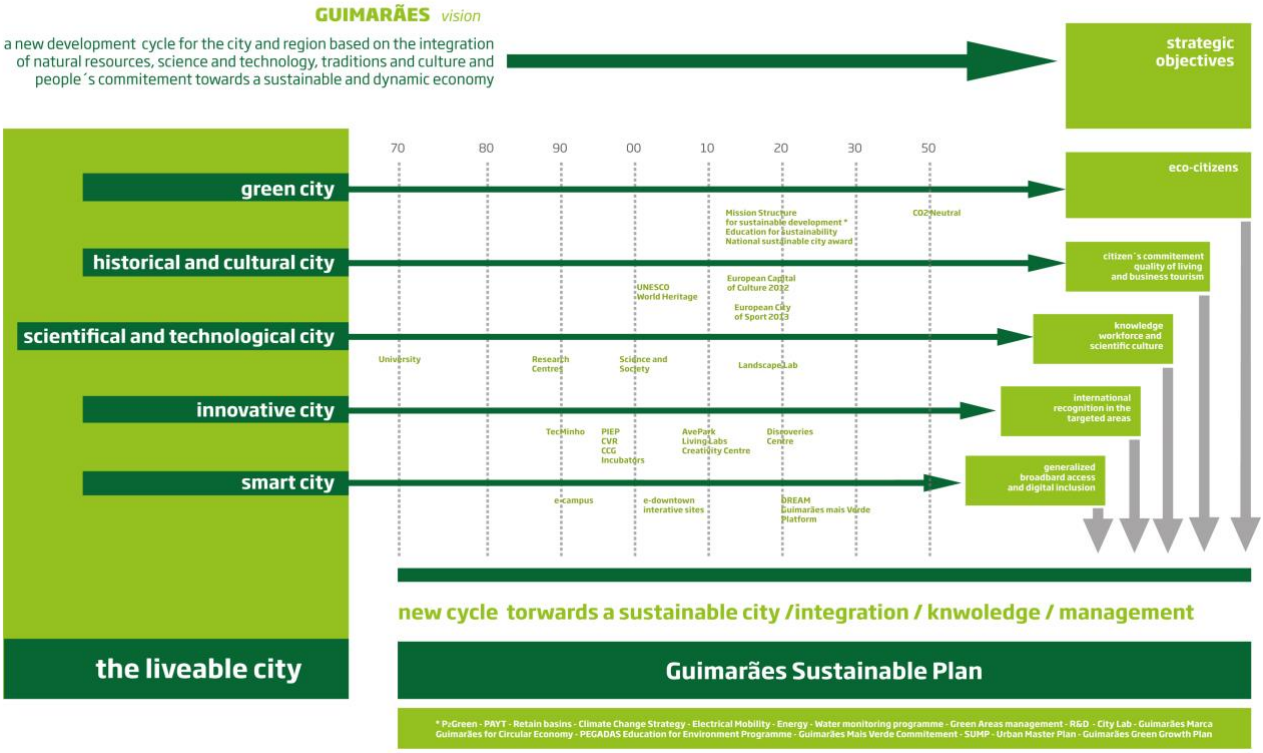


Figure 1 Guimarães Vision

Our commitment gained momentum in 2013, when the Mayor adopted the EGC[3] guidelines as an inspiration to shape Guimarães' future by integrating the SDG in the 12 areas. A **Mission Structure**[4] (MS) was created linking the City Hall, Universities, Institutions and people**.** This resulted in an action plan for sustainable development that has indelibly marked our future. Today, this is the hallmark of local political and governmental action - that institutions replicate and citizens interiorize on a daily basis – its purpose being to construct a greener and more sustainable territory. This is a commitment that goes far beyond politics, since all political parties and parish councils have taken ownership by signing a **declaration of political consensus[1]** that brings them all together in the construction of this exciting future.

Guimarães has fully incorporated Environmental Sustainability as its developmental target, applicable across all areas of city life and its daily path. This is the **2030 Guimarães Sustainable Plan**, that expresses the collective will of combining past achievements - **UNESCO World Cultural Heritage 2001**, **European Capital of Culture 2012** and **Best European City of Sport 2013** – with the new achievement of being the **most sustainable national city**[5].

[3] **EGC** – European Green Capital
[4] **Mission Structure for Sustainable Development of Guimarães** is fully described in Good Practice 1
[5] **Guimarães is the Most sustainable city in Portugal – ECO XXI 2017, ABAE from European Blue Flag Association**

Guimarães drew closer to the University of Minho, placing knowledge, science and technology at the forefront of the environmental management, creating a **Landscape Lab**[6]**[2]-** a R&D centre unique in the country - to promote the construction of a biocultural mosaic, singular and unique. We have already proven to be capable of implementing an integrated environmental local management system, by focusing on innovative, multidisciplinary, and inclusive projects, easily replicable in any territorial context.

Figure 2 Guimarães Mission Structure for Sustainable Development

[6] The City Hall recovered an abandoned industrial unit to create the Association for Sustainable Development - **Guimarães Landscape Lab,** in partnership with two Higher Education institutions, aiming at promoting knowledge and innovation, research and scientific dissemination. The Landscape Laboratory is also a centre of excellence in the field of environmental education, also being the coordinator of PEGADAS and headquarters of the Mission Structure and promoter of the Guimarães mais Verde commitment

Management, Monitoring and Evaluation

To that end, the Municipality has adopted various progress monitoring instruments since 2013: calculation of the City's **Energy consumption[3]** (since 2003[7]), **CO_2 monitoring[4]** (since 2013[8]), **policy monitoring** (since 2015) by ECO XXI[9] and EAC[10], **Consulting and Participation** on local policies (since 2015), through the Advisory Council for Sustainable Development**[5]**[11] and the Advisory Council for Investment and Employment**[6]**[12], **Measuring** and **managing our environmental impacts** through the **Carbon Disclosure Project[7]** and **Green digital Charter[8]**[13] (since 2017). Finally, we are promoting the global use of municipal-level **Ecological Footprint analysis[9]** as a key step towards urban sustainability. We continue monitoring the impacts of land use and consumption activities to reinforce our greening policy, introduce novel solutions, and reduce impacts over time. Results show that since our EF is below the national average, we have achieved our goal of becoming greener! Furthermore, our per capita income is higher than the national average, thereby making us richer but still greener - i.e., more sustainable.

Figure 3 Commitments of Guimarães to reduce CO_2 emissions

[7] **Energy Action Plan** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1**0** | **11** | 12

[8] http://www.covenantofmayors.eu/index_en.html

[9] **ECO XXI:** this instrument evaluates 21 local Sustainability Indicators granting the ECO-Municipality award according to the score obtained. The key areas are: Environmental Education for Sustainable Development; Civil Society; Institutions; Preservation of Nature; Air; Water; Energy; Waste; Mobility; Noise; Agriculture; Tourism and Territorial Planning. European Blue Flag Association - Public Interest Organization recognized by the Decision no. 9364/2009 published in the Portuguese Official Gazette of 30 March.

[10] **EAC: External Advisory Committee** is a part of the Mission Structure latter presented in this document comprising distinguished members: **Mohan Munasinghe**, **Jane Carruthers**, **Mauro Agnoletti** and **Will Wynn**

[11] **Advisory Council for Sustainable Development** is a part of the Mission Structure comprising more than 100 leading figures of Guimarães, including political and private representatives, school directors, presidents of Parish Councils and NGOs

[12] **Advisory Council for Investment and Employment** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

[13] **Green Digital Charter** is a EUROCITIES response to the 2009 European Commission recommendation on mobilising Information and Communication Technologies (ICT) to facilitate the transition to an energy-efficient, low carbon economy.

Leading by the example

Anticipating the Agenda 2030 targets, the City Hall voluntarily and pro-actively formed the **Mission Structure (MS)[10]**, comprising a Board, an Executive Committee, an External Advisory Committee with several prominent individuals, and an Advisory Council(AC)[14], in addition to a Monitoring Committee under the scope of the Municipal Assembly. This MS is organized at different levels, based on a matrix system, allowing for addressing each area transversally, reporting permanently to the Board for analysis and decision. Scientific validation is carried out by the EAC, and public syndication through quarterly Newsletters and the information platform '**Guimarães mais verde'[11].** This MS also monitors the city's management tools.

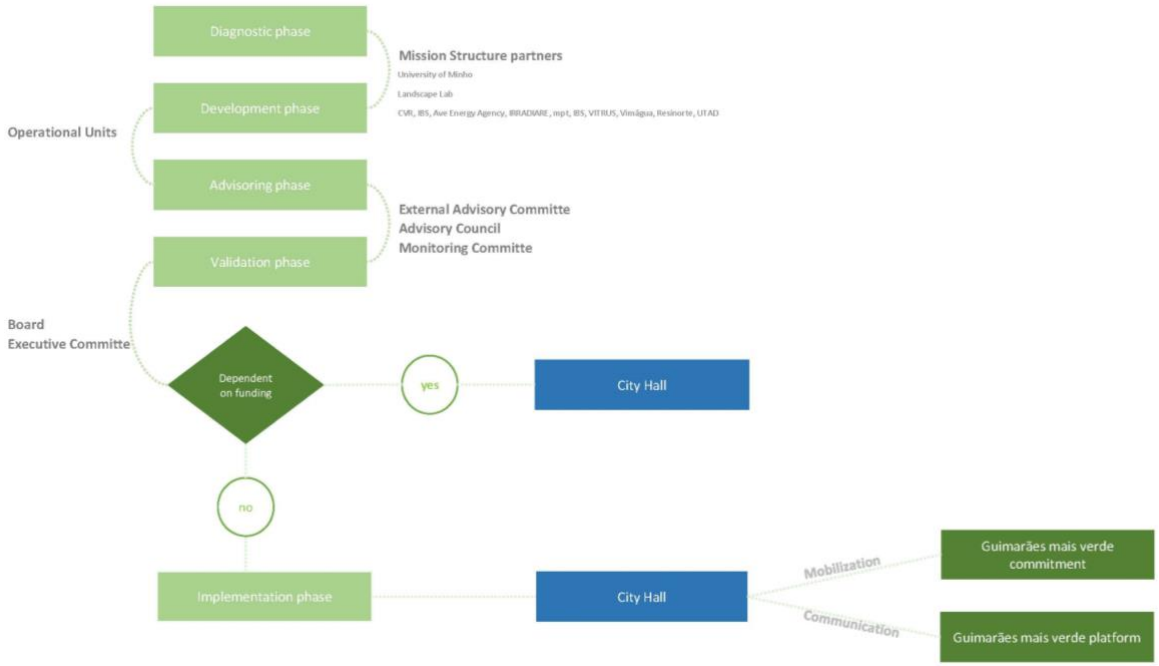


Figure 4 Mission Structure Flowchart

To set an example and implement good practices, an **international networking process** was also initiated, allowing us to integrate with regular presence and activity: Agenda 21, ICLEI, Eurocities, Civitas Network and Covenant of Mayors.

Involvement

At the same time, the City Hall launched an Environmental Education Programme, **PEGADAS[12]**, involving all schools and students, bringing together more than 200 partners to raise awareness and train and empower the community to protect the environment. It also encouraged the creation of **Brigadas Verdes[13]**[15]; promoting green jobs in companies through **Guimarães Marca[14]**[16]; encouraging and

[14] **Advisory Council** of the Mission Structure for the Sustainable development of Guimarães composed of 100 representatives of political parties and local associations, schools and Parish Councils

[15] **Brigadas Verdes** communities of volunteers self created to develop projects for the protection of the environment

[16] **Guimarães Marca** can also be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12

supporting private entities to develop innovative projects in this field [17]; it also substantially financed R&D projects through the **Landscape Lab**.

Figure 5 Guimarães mais Verde

[17] Projects on Sustainable Mobility promotion such as **Educabicla**, **U-Bike** and **TeatroBus** can also be found in section 1| 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

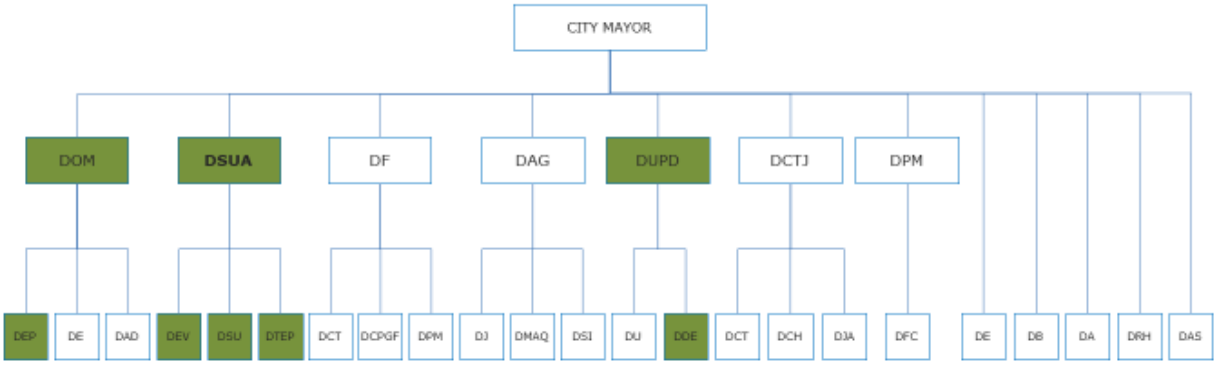
Today, Guimarães is already a model and an inspiration for others with its the pioneering spirit, its strategy, priorities, projects and investments. One prime example is the construction of the first near-zero carbon building in Portugal[18], or the national recognition it received for its environmental policies towards sustainable development that have resulted in the award of various distinctions and awards.

Figure 6 Guimarães Eco awards

[18] Guimarães Gymnastics Academy can be found in section 1| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **10** | 11 | 12 and Good Practice 5

12B. Implementation

The City Hall has an organizational model in line with the legislative system structuring local public administration in Portugal, with a political administration composed of a Mayor and ten elected Councillors, with only six having exclusive decision-making powers. The supervision of its activity is performed by an also elected Municipal Assembly composed of 95 members. The City Hall integrates seven Departments and 23 Divisions in its organizational structure, many of which are directly or indirectly connected to the areas of environment and sustainable development. These are the Department of Urban Services and Environment with the Green Areas, Urban Services and Transit and Public Space Divisions; Department of Urban Planning and Economic Development with the corresponding Urban Planning and Economic Development Divisions; Department of Municipal Works with its Division of Studies and Projects - whose activity is directed by the Activity Plan and Budget and the Pluri-annual Plans of Investment, approved annually by the City Hall and Municipal Assembly and that, since 2014, have incorporated a strategy and vision specifically oriented towards promoting the environment and the construction of a territory anchored in sustainable development.



DEPARTMENTS

DOM	Municipal Works Department
DSUA	Urban and Environmental Services Department
DF	Finance Department
DAG	General Administration Department
DUPD	Urbanism and Development Promotion Department
DCTJ	Culture, Tourism and Youth Department
DPM	Municipal Police Department

DIVISIONS

DEP	Studies and Projects Division (DOM)
DE	Contracts Division (DOM)
DAD	Direct Administration Division (DOM)
DEV	Green Spaces Division (DSUA)
DSU	Urban Services Division (DSUA)
DTEP	Traffic and Public Space Division (DSUA)
DCT	Accounting and Treasury Division (DF)
DCPGF	Public Procurement and Funds Management (DF)
DPM	Municipal Heritage Division (DF)
DJ	Legal Division (DAG)
DMAQ	Administrative Modernization and Quality Division (DAG)
DSI	Information Systems Division (DAG)
DU	Division of Urbanism (DUPD)
DDE	Economic Development Division (DUPD)
DCT	Division of Culture and Tourism (DCTJ)
DCH	Historic Centre Division (DCTJ)
DJA	Youth and Associativism Division (DCTJ)
DFC	Inspection and Litigation Division (DPM)
DE	Education Division
DB	Municipal Library Division
DA	Archive Division
DRH	Human Resources Division
DAS	Division of Social Action

Figure 7 Organization chart of Guimarães City Hall

In addition, and as the pivotal tool of this political and organizational vision, aiming at the integrated and consistent management of all processes and investments previously defined or in progress, a **Mission Structure** was created, previously detailed in 12A. This is an **innovative and unique model in Portugal**,

responsible for a permanent and committed connection to institutions and networks (local, regional, national and international), in collaboration with the political representatives of the City Hall, through which we participate on bilateral or multilateral cooperation projects, as well as on the most important platforms, commitments and institutions in the area of the environment.

Figure 8 Networking at local, regional, national and international level

The continued involvement of institutions and citizens is fundamental to this environmental policy, embodied in models of **public participation** in the analysis, decision-making and intervention on all defined proposals and projects. Some important references of this include the **Participatory Budget[14**], the **Eco Youth Parliament[15],** the **Monitoring Committee** for the application to EGC2020 in the Municipal Assembly of Guimarães, or the **Advisory Council for Sustainable Development**, whose action and performance are reflected through the TI platform and the **Eco-magazine "Guimarães mais Verde"[16]**. These are the dedicated tools for communication and dissemination of all this work in support of the environment and sustainable development.

Figure 9 Guimarães mais Verde communication**[11]**

12C. Future Plans

Future decisions for integrated and cross-cutting governance, centred on Environmental Sustainability and focusing on Sustainable Development goals and New Urban Agenda, are guaranteed through a political agreement between all Political Parties and Parish Councils. Aware of the environmental challenges worldwide, together they assume responsibility on behalf of the entire population to collaborate actively in seeking solutions and in resolving local environmental problems. For this reason, the City Hall will promote a local sustainable development capable of satisfying the material and human needs of present generations, without compromising those of future generations. There is a strong commitment to establish consistently and gradually, at all levels of legal competencies, a set of actions, initiatives and investments whose focus is the sustainable development of the municipality. These are defined in a large number of documents already validated by the City Hall and Municipal Assembly of Guimarães (i.e. Urban Master Plan, Agenda 21, the strategic planning document of the application of Guimarães to EGC 2020 and the Basque Declaration). These will be supplemented by future action plans, by a strategy consolidated through technical evaluation and review, as well as ongoing surveys to citizens and specialists, in order to ascertain those forms of intervention and action most relevant to environmental sustainability and capable of improving the environmental indicators in our territory.

To achieve this, the **Mission Structure for Sustainable Development** will continue its mission and activity

far beyond this EGC application. Furthermore, the City Hall will also establish an **Integrated and Strategic Management Office**, to provide an integrated and holistic approach to projects, investments, programmes and strategies for Guimarães. This will be founded on an urban vision that articulates and combines different areas of knowledge and different perspectives of how to use and experience the city, thus integrating nature and the environment in planning, education and culture.

Figure 10 Knowledge|Management|Integration

In addition, Guimarães is committed to developing a **City Lab**, integrated in ISMO, not only to ensure continuity in the community's participatory process, but to contribute to a transversal and multidisciplinary approach to all projects and to structure strategic decisions for the territory and the population, whether specific to time and place, or with broader, general and timeless scope.

Figure 11 Guimarães City Lab

Guimarães has a philosophy, vision and concrete plans to ensure that it is sustainable and 'more than green' as it embraces its future. Its strategic management structures – outlined in all the EGC indicator areas – are integrative, innovative, robust, owned by its citizens and the basis of city governance. These, together with the wide commitment to add to the city's already outstanding reputation, will operationalise all our future plans. Our city is alive, makes history and reshapes its future. Our respect for heritage is evident in our World Heritage Site and European Capital of Culture awards, and our engagement with science and technology is translated in a partnership with the University of Minho; we are strongly commited to people by making sports and recreational facilities and green-lung areas available, and our approach towards territorial management by combining urban planning and natural lifestyle as well as environmental health makes it possible for us to maintain the city's polycentric nature and diversity / our polycentric mosaic landscape pattern.

We should like to summarise our future as building on our past, based on the following:

Guimarães as a **committed city**. The political will of the City Hall, the many structures and public agreements that have been put into place, together with the enthusiasm of citizens young and old, will ensure that the dynamics of EGC – that have galvanised the city – will continue into the future. We have reinvented progress in centuries past and are committed to doing so in times to come.

Figure 12 Guimarães **more than green** commitment – Political and People's commitment

The **birthplace of entrepreneurship** – our eco-innovation was recognised by the World Heritage Site Award and continued in the many projects outlined in Indicator 10. After the economic crisis, Guimarães has grown at about 10% and, despite its small size and geographical location, is in the top three sustainable municipalities in Portugal.

Guimarães is a **smart city**, making use of available technology, partnering with the University, investing in research and development, and monitoring our progress by using the latest techniques.

A model **city of knowledge** generation and dissemination through modern urban management and publicity programmes, through public participation and firm links with the university, R&D and keeping abreast of environmental improvements.

A **liveable city**, one in which citizens have a high quality of life, good environmental education, clean rivers and streets, free of noise and air pollution and the ability to explore the environment through green corridors and outdoor facilities.

A **neutral municipality** with minimal waste of all resources, carbon neutral and without pollution and noise. Electric transport is already a firm commitment.

The **urban planning** of Guimarães has been organic and occurred over many centuries. Our mosaic of parishes, agricultural land and green areas throughout the polycentric framework is unique and enables the City Hall and the public to continue on this path of mixed use and environmental health.

Figure 13 Guimarães, the city that continues to make history

12D. References

[1] **Declaration of political consensus** and **Declaration of individual consensus**

a. http://www.cm-guimaraes.pt/uploads/writer_file/document/6150/dec_consenso_politico_partidos.pdf

b. http://www.cm-guimaraes.pt/uploads/writer_file/document/6149/dec_consenso_pol_tico_juntas.pdf

c. http://www.labpaisagem.pt/wp-content/uploads/2017/09/Compromisso-Guimaraes-mais-verde.pdf

[2] **Landscape Lab** http://www.labpaisagem.pt/

[3] **Guimarães Sustainable Energy Action Plan**

a. http://www.covenantofmayors.eu/about/signatories_en.html?city_id=6639&seap

b. http://guimaraesmaisverde.pt/_energia_7

[4] **PAES Monitoring Report** http://www.eumayors.eu/about/signatories_en.html?city_id=6639&monitoring

[5] **External Advisory Committee – please see reference 10**

[6] **Advisory Council for Investment and Employment** http://www.cm-guimaraes.pt/pages/951

[7] **Carbon Disclosure Procedure** Digital version

[8] **Green digital Charter –** http://www.greendigitalcharter.eu/?s=guimaraes

[9] **Guimarães Footprint and Biocapacity Calculation**

a. digital version

b. http://expresso.sapo.pt/sociedade/2017-09-02-ZERO-e-6-municipios-portugueses-lancam-projeto-inedito-a-nivel-mundial-para-calcular-Pegada-Ecologica

[10] **Mission structure for Sustainable development of the Territory** http://www.cm-guimaraes.pt/pages/1094

[11] **Guimarães mais verde platform** www.guimaraesmaisverde.pt

[12] **PEGADAS**

a. http://www.labpaisagem.pt/pegadas/

b. http://www.labpaisagem.pt/atividades-criancasjovens/

c. http://www.labpaisagem.pt/65-2/

[13] **Brigadas Verdes** http://www.cm-guimaraes.pt/frontoffice/pages/991?news_id=2978

[14] **Municipal Paricipatory Budget - We are all Guimarães: participate with your idea** http://op.cm-guimaraes.pt/

[15] Eco Parliament http://www.labpaisagem.pt/pegadas/ecoparlamento/

[16] Newsletter Guimarães mais verde

a. http://www.guimaraesmaisverde.pt/_ecorevista

b. http://www.labpaisagem.pt/guimaraesmaisverde/

c. https://www.youtube.com/watch?v=Y1C7SmQDPfc

d. https://www.youtube.com/watch?v=u8XHikXrGOg

e. https://www.youtube.com/watch?v=M6CLcoSdlMc

Application Form for the European Green Capital Award 2020

Good Practices

Good Practice 1

2030 Guimarães Sustainable Plan (2030 GSP)

Indicator: Governance

The 2030 GSP, established in 2013, created a **Mission Structure** to ensure our greening policies, and set up the **Guimares Mais Verde** Commitment and Platform. We believe this is an outstanding, long-term flagship initiative that is an example to Europe and beyond.

The Mission Structure, established in a pro-active and cooperative manner by the City Hall, has also pioneered a strategic partnership with University of Minho. The structure includes an *External Advisory Committee*, composed of prominent individuals recognized internationally in different areas of sustainability; *an Advisory Council*, composed of 100 representatives of political parties and local associations, schools and Parish Councils*; 12 operational units* integrating the work of specialists in each ECG area with Municipal experts; and a *Monitoring Committee*, created to facilitate political management led by our Municipal Assembly.

Figure 1 Mission Structure in action: External Advisory Committee meeting, Advisory council meeting and City Lab

An Action Plan (2015-2017) was defined and implemented consisting of multidisciplinary projects implemented throughout our territory, participation in international networks, and promotion of seminars and training. We want to be more than green, and for that we are committed to continuing with this Mission Structure that assures our **Footprint reduction**.

Figure 2 Action Plan 2015/2017 examples: Urban Green areas, Energy perfomance in social housing, eCityBus, City Lab, Ecopath, Educabicla

The **Guimarães Mais Verde Commitment** unifies the community, promoting eco-citizenship and sustainability programmes, and building Ecological and Social Capital. It incorporates: **PEGADAS** - fully focused on schoolchildren, which is a key factor for ecologically sustainable practices; **Brigadas Verdes** - groups of volunteeres aiming to develop projects for environmental conservation and incentivize private stakeholders to participate in good environmental practices; **Green Key**; **Guimarães Marca**; **Educabicla**; Teatro Bus; etc.

Over the past two years, the city has held almost 1200 events under these schemes. We are confident we will achieve a green paradigm shift in the behaviour and lifestyles of our community.

Figure 3 Guimarães more than green: Political and People's commitment

Finally, the **Platform** includes a comprehensive process of managing information, communication and dissemination flows of all the above activities, that includes all stakeholders[1].

[1] **Guimarães mais verde platform** www.guimaraesmaisverde.pt

Good Practice 2

P2GREeN - A strategic biodiversity planning composed of six different but interrelated actions that can be used to promote urban biodiversity[2]

Indicator: Nature and Biodiversity

Aiming to promote best guidelines for promoting and conserving environmentally sustainable urban areas within Guimarães, an integrated **Urban Biodiversity Plan** was created**.** This adds value to our green areas, encouraging enjoyment and respect from citizens. No less important, the plan includes removing alien invasive vegetation and increasing native species. Strong leadership is a critically important objective because it will raise awareness, educate and involve citizens and local stakeholders (e.g. private companies, academia and scholars). By integrating a multidisciplinary team that strives to preserve biodiverse urban green areas, citizens were encouraged to value a green city. Following upon this, a holistic approach (P2GREeN) addressing the need to promote urban biodiversity has been developed and implemented.

P2GREeN good practice comprises two main steps: **diagnostic/characterization** and **promotion** of potential City green areas.

Figure 1 P2GREeN - Urbact Good Practice - Holistic approach on 2 stages comprising 6 actions

[2] Biodiversity Database: www.labpaisagem.pt/biodiversitygo; Educational Programme (Re)Forestation: www.labpaisagem.pt/guimaraes-mais-floresta; Educational Programme PEGADAS: http://www.labpaisagem.pt/plano-de-atividades/; Nature Routes: http://www.guimaraesturismo.com/pages/171; Mobile Application "Biodiversity GO!": https://play.google.com/store/apps/details?id=com.eupasistemas.BiodiversityGO&hl=en; https://appsto.re/pt/Pcjtib.i. ; Invasive Alien Species: http://www.labpaisagem.pt/especies-invasoras/

This is a participatory process, promoting public and private interactions, recognizing the importance of citizen science and community engagement. The PEGADAS programme contributes to P2GReEN's holistic approach by integrating the educational field on sustainability.

An exciting mobile app – **Biodiversity GO!** – is a tool for citizen scientists and people, where all are invited to co-construct the municipality's biodiversity database.

The **Guimarães mais Floresta** reforestation programme is *per se* a participatory process with two interrelated levels. One is educational, and designed to alert the community to the importance of native species. Scientific information has been produced by specialists from the City Hall, and included details about the identification, collection, growing and planting of seeds. Students were invited to collect seeds from neighbouring areas and then plant them at school, where every student would care for his/her own tree. A later campaign was expanded to include wider private participation with trees being planted throughout the entire city area.

Figure 2 P2GREeN: Guimarães mais Floresta

Finally, **biodiversity routes** and **species observation** are also promoted, with citizens and students encouraged to take part.

Figure 3 P2GREeN in action

Good Practice 3

EducaBicla

Indicator: Sustainable Urban Mobility

EducaBicla stems from a challenge launched by the City Hall to a local company – Getgreen – to develop a programme of awareness, education and involvement of citizens for an active life. This was, itself, part of a larger plan to promote soft modes, following the construction of the new Ecovia (Eco-path) of Guimarães. The low cost of implementation (30.000€/year) and the innovation of the methodology adopted demonstrate the programme's high degree of replicability in different contexts, types of cities and citizens.

Figure 1 Educabicla received the National Award on Cycling Mobility becoming a reference to other cities

Educabicla focuses mainly on the school context, affirming / consolidating itself as a project of non-formal education. It also serves the entire community by organizing weekly two-hour sessions in several green areas in the Municipality. The actions include a theoretical component, which encompasses the benefits derived from cycling (economic, ecological, health and social), the cyclist's guide (use of the bicycle in a safe and responsible manner), learning and conflict mediation, a mechanical component (concepts of ergonomics and safety) and a practical component that includes exercises dedicated to learning how to pedal, improving safe manoeuvring techniques, mechanical exercises from the viewpoint of the user and testing of simulation courses. These sessions are complemented by educational material, games, signposted courses and instruments for data collection to evaluate results and the habits of mobility, in order to mobilize and educate the whole population.

Figure 2 Educabicla in schools

The "EducaBicla Manual" accurately describes all its methodology, programme, objectives, educational games, presentations, courses, inventory of material (road signs, bicycles, helmets, caps, vests, etc.) and the analysis of results. The site http://www.educabicla.pt/ includes an automatic translation tool allowing to share and expand the project in an international context.

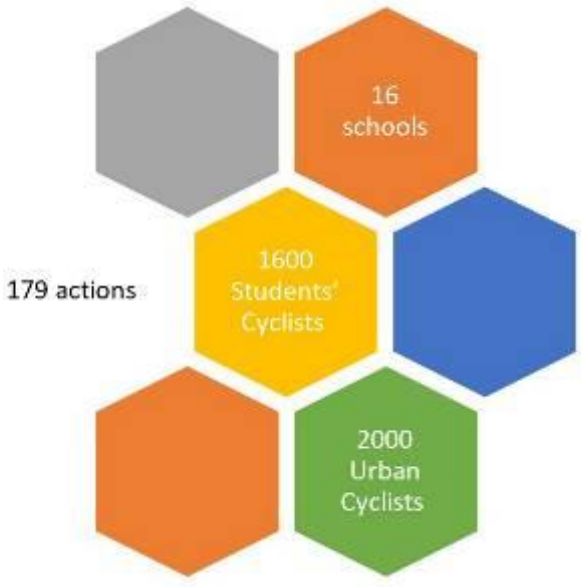


Figure 3 First year results

Good Practice 4

Innovative multipurpose Nature Based Solution [1]

1. This project was presented at the 4th Open European Day Resilient Cities 2017 and at the session Integrating ecosystem-based adaptation and ecosystem services into urban management strategies on the 8th Global Forum on Urban Resilience & Adaptation - Bonn Germany

Indicator: Climate Change Adaptation

The Couros River is one of the tributaries of the Selho River, crossing the city of Guimarães for about 6.2 km, alternating between areas where the flow occurs freely at the surface with areas where it is piped underground. The corresponding basin has approximately 11.23 km^2.

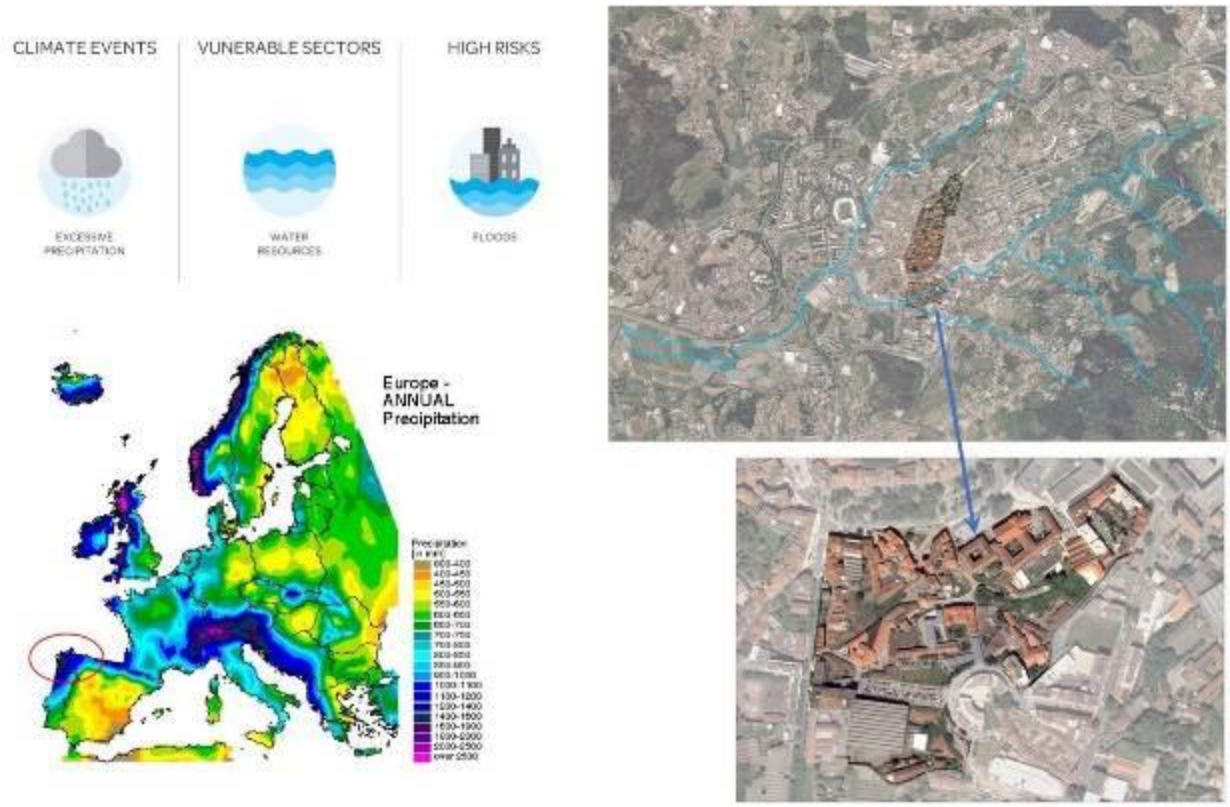


Figure 1 Flood area

The **Couros River redevelopment and recovery project** involved the area corresponding to the City Park and urban area, where challenges at the level of the erosion of the banks and sealing were observed. For years this particular areas have been affected by an increasing number of floods in periods of greater rainfall, directly affecting more than 2000 people, forcing the repair and cleaning of houses and shops, and allocating municipal services to the crisis - such as agents of civil protection for evacuating those affected, removing fallen trees, and coping with traffic disruptions.

Figure 2 Floods, 2015 (Source City Hall)

This project included the construction of three reservoirs, with a capacity of retention and flow control with a total of 25.500 m^3.

Figure 3 City Park basin: 10.000m3; Parque das Hortas: north basin, 10.000m3 and south basin: 5.500 m3

While this measure was introduced to adapt to climate change, it has had many other benefits. These include solving some of the flooding problems, preserving and recovering green spaces, and also improving the ecological status of the water line by creating a green and blue corridor. The project included consolidating rock faces and structurally supporting the river banks. Intervening in the banks improved both the environment and the landscape, promoting the hydrological and ecological function of the water courses. Local riparian vegetation was used preferentially because it is adapted to the climate of the region and thus can cope with the force of the water and periodic submersion.

Good Practice 5

Leading by Example: Newly Constructed Near-Zero Carbon Municipal Building

Indicator: Eco-innovation

The **Gymnastics Academy of Guimarães**[3] has been an aspiration of the City Hall since 2013 when Guimarães held the title of European City of Sport. It's a near-zero carbon and self-sustaining building, representing the Municipality's concern with constructing buildings that do not have a negative environmental impact.

Figure 1 Guimarães Gymnastics Academy

[3] Guimarães **Gymnastics Academy** - https://www.youtube.com/watch?v=SLzpRjwZPwQ

Figure 2 Guimarães Gymnastic Academy – Trombe wall

The GAG has integrated solutions designed to ensure environmental and economic sustainability. These include the use of cork for the outer coating, 100% eco-friendly and certified by the Environmental Product Declaration, collecting rainwater for sanitary use and cooling of AVAC equipment, using natural light and ecological interior paint and a Trombe wall.

The investment was made with the assumption of a return by producing more energy than the comsumption requirements, reducing the water bill through rainwater use and also by using river water for cooling systems and underground air for heating, thus reducing the energy bill required to maintain a stable internal temperature of 20ºC (temperature required for Gymnastics activity).

Figure 3 Guimarães Gymnastics Academy

In addition to being used as a facility for the practice of sports, already with more than 400 gymnasts, it contributes, as the example that it is, to environmental education and awareness, positioning itself as a true and inspiring Living Lab.

Good Practice 6

PAYT, Pay-as-you-Throw System

Indicator: Waste

The implementation of the Pay-as-You-Throw (PAYT) system in the Historical Centre of Guimarães (UNESCO World Heritage) started on April 2016 and resulted in the practical implementation of a scientific work developed within the framework of a Master's thesis that won the Green Project Award in 2015. So far, PAYT has been implemented in the Historical Centre, comprising 34 streets, with high density housing and commercial buildings, being mandatory for all residents and merchants.

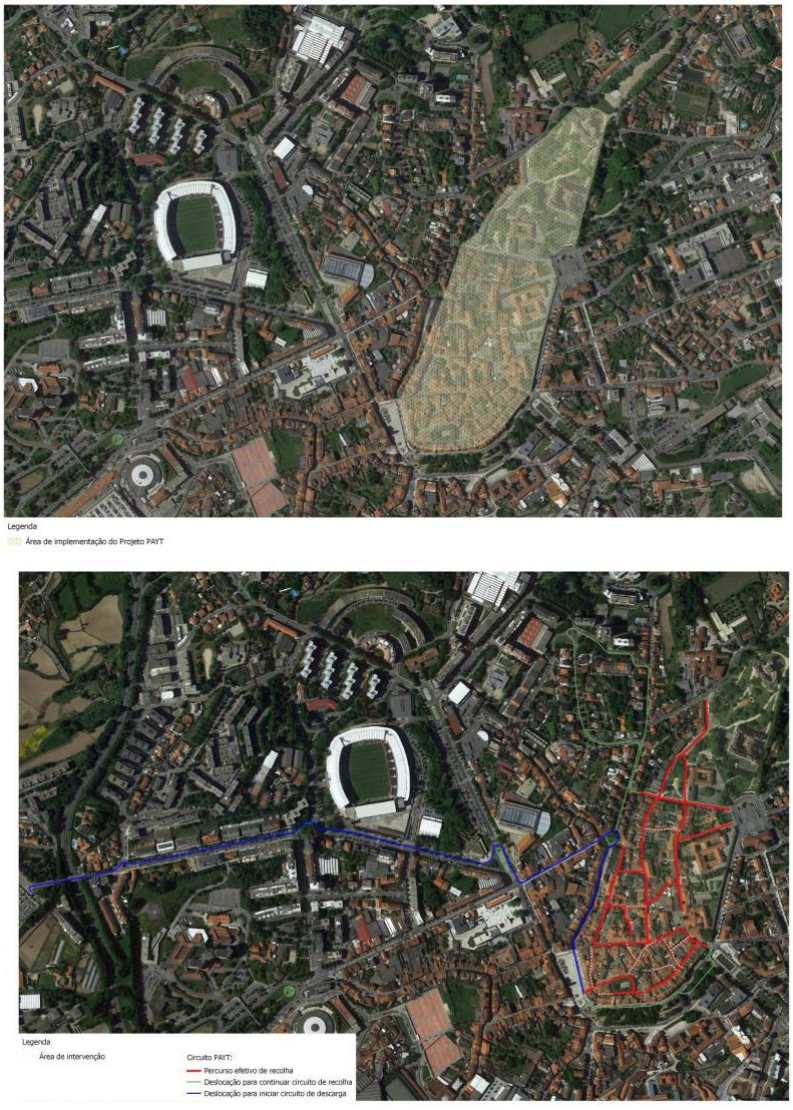


Figure 1 UNESCO World Heritage Historic Centre and waste collection circuit

Collection is made by 100% electric vehicles. The pioneering innovation of the project on a national scale and the results obtained so far have received considerable media attention. Guimarães was considered municipality of the year 2017 with this system. PAYT is considered to be a model and inspiring project, that gives a new dynamic to the waste management service.

Figure 2 Guimarães PAYT on the National news as an inspiration for other cities

Based on the polluter-pays principle, the user pays only for real waste production. The waste fee charged is reflected on the purchase of bags of different capacity and cost. Recyclable waste is collected free of charge.

With the introduction of PAYT, all garbage containers were removed, and collection is done door-to-door, five times a day.

The results for the first year show an increase of recyclable waste (126%) and a 34% reduction in household waste, surpassing the European expectations (15% and 30%, respectively).

Figure 3 1st year of PAYT exceded city's expectations and surpassed European targets

On average, over 800kg of recyclable waste are collected daily, and just in the first eight months more than 200 tonnes were collected, roughly the equivalent to the weight of the Louvre Pyramid; the recycling of paper and cardboard corresponds to approximately 800 trees; with the glass collected it would be able to produce 127 tonnes of new glass without resorting to raw materials; and with the plastic collected it would be possible to manufacture 21 million XL sized t-shirts. Bearing in mind such positive results, the City Hall has already implemented studies to progressively and gradually expanding it throughout the city by January 2018.

Mayoral Declaration on Application for European Green Capital Award 2020

I, the Mayor of **Guimarães**, in **Portugal**, hereby declare that **Guimarães** has submitted an application for the European Green Capital Award 2020.

I confirm that all information submitted in the application is true and accurate to the best of my knowledge and I agree in full to the Rules of Contest.

Signed:

Name in block capitals:

DOMNGOS BRAGANÇA SALGADO

Mayor of Guimarães[1]

Date:

September 25th, 2017

[1] Signatory authorised by national law to legally represent the city