



BRAGA
Cidade autêntica

7 ENERGIAS
RENOVÁVEIS
E ACESSÍVEIS



11 CIDADES E
COMUNIDADES
SUSTENTÁVEIS



PLANO DE AÇÃO PARA A ENERGIA SUSTENTÁVEL E O CLIMA

13 AÇÃO
CLIMÁTICA



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Executive summary

By signing the Covenant of Mayors for Climate and Energy, the Municipality of Braga has made a commitment to support the implementation of the 40 per cent greenhouse gas reduction target by 2030, the reduction of energy poverty and the creation of a long-term vision to achieve climate neutrality by 2050. This process starts from an approach based on Sustainable Development, supported globally by the United Nations 2030 Agenda and the respective Sustainable Development Goals, in a joint approach to mitigating and adapting to climate change.

In this context, taking into account the Sustainable Development Strategy and the path already taken by the municipality, a more ambitious local objective has been set: to reduce its CO₂ emissions by at least 55 per cent by 2030. In this way we hope to accelerate the territory's carbon neutrality in an equitable and sustained manner.

In order to fulfil this commitment, the municipality has undertaken to define various energy sustainability measures that are part of the Sustainable Energy and Climate Action Plan (PAESC).

The PAESC identifies any situations with potential for improvement, based on the continuous evaluation of indicators. These indicators are defined in accordance with the recommendations of the Covenant of Mayors and the *Joint Research Centre*.

This plan presents a reference inventory of emissions, which aims to quantify the energy consumption and CO₂ emissions inherent to the activities carried out in the municipality (with reference to 2008) and an Assessment of Risks and Vulnerabilities to Climate Change.

The proposed results stem from the use, for the territory in question, of a specific model developed by IrRADIARE, *Science for evolution*[®].

Short summary

The Municipality of Braga, through the signature of the Covenant of Mayors for Climate and Energy, committed to support the implementation of the 40% greenhouse gas reduction target by 2030, the reduction of energy poverty and the creation of a long-term vision to achieve climate neutrality by 2050. This process is based on a Sustainable Development approach, globally supported by the United Nations 2030 Agenda and the respective Sustainable Development Goals, in a joint approach to climate change mitigation and adaptation.

In this framework, considering the strategy for Sustainable Development and the path already developed by the municipality, it is established a more ambitious local goal, to reduce its CO₂ emissions by at least 55% by 2030. In this way, it is hoped to accelerate the territory's carbon neutrality in an equitable and sustained manner.

In order to fulfil this commitment, the Municipality is defining various energy sustainability measures that are part of the Sustainable Energy and Climate Action Plan (PAESC).

The SECAP identifies possible situations with potential for improvement, based on the continuous assessment of indicators. These indicators are defined according to the recommendations of the Covenant of Mayors and the Joint Research Centre.

This plan presents a reference inventory of emissions, which intends to quantify the energy consumption and CO₂ emissions inherent to the activity developed in the municipality (having 2008 as reference year) and an Evaluation of Risks and Vulnerabilities to Climate Change.

The proposed results are derived from the use, for the territory under consideration, of a specific model developed by IrRADIARE, Science for evolution[®].

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Glossary

Evaluation: A process that seeks to assess the effectiveness and efficiency of public programmes and policies by analysing the adequacy of the means or resources used and the partial or final results obtained, with reference to the proposed objectives and targets. The exercise of evaluating a public intervention seeks to assess the suitability of the strategy outlined in relation to the diagnosis made, including analysing the relevance and internal and external coherence of the intervention.

Emission factors: coefficients that quantify emissions per unit of activity.

Indicators: measure the direct effect of a policy and are used to assess whether policy objectives are being achieved using the information available.

Reference emissions inventory: this is a quantification of the amount of CO₂ emitted due to energy consumption in the territory of a signatory Pact during a reference year. It makes it possible to identify the main sources of CO₂ emissions and their potential for reduction.

Benchmarking indicators: A continuous and systematic process that allows organisations and their functions or processes to compare their performance against what is considered "the best level", with the aim of not only matching performance levels, but also surpassing them.

Joint Research Centre: the European Commission's scientific and technical service. It works in cooperation with the Covenant of Mayors and is responsible for providing signatories with clear technical guidelines and models.

Targets: identify the scale of policy change over a given period of time.

Monitoring: the process of observing and systematically collecting data on the state of the environment or the environmental effects of a given project and periodically describing these effects by means of reports for which the applicant is responsible, with the aim of making it possible to assess the effectiveness of the measures provided for in the ESCP to avoid, minimise or compensate for the significant environmental impacts resulting from the implementation of the respective project.

NUT: Nomenclature of Territorial Units for statistical purposes. It defines three levels, I, II and III. Level I consists of three units, corresponding to the territories of the mainland and each of the autonomous regions of the Azores and Madeira; level II consists of seven units, corresponding, on the mainland to the North, Centre, Lisbon and Tagus Valley, Alentejo and Algarve, and also to the territories of the Autonomous Regions of the Azores and Madeira; level III consists of thirty units, of which twenty-eight on the mainland and two corresponding to the 13 Autonomous Regions of the Azores and Madeira.

CEFSP: a key document that sets out the strategy that will enable a given signatory to achieve the goal of reducing CO₂ emissions by at least 40 per cent by 2030, reducing energy poverty and creating a long-term vision for achieving climate neutrality by 2050. It is drawn up on the basis of the reference emissions inventory and uses the results of this diagnosis to identify the key areas for action.

Signatories to the Pact: local authorities that have signed the Covenant of Mayors.

Acronyms and abbreviations

EIB - *Baseline Emissions Inventory* ETS - European Emissions Trading Scheme

CoM - *Covenant of Mayors* EU - European Union

GHG - *Greenhouse Gas*

GT PAESC - PAESC Working Group

IPCC - *Intergovernmental Panel on Climate Change*

IRE - Emissions Reference Inventory JRC -

Joint Research Centre

MEI - *Monitoring Emissions Inventory* NUT - Nomenclature of Territorial Units

SECAP - Sustainable Energy and Climate Action Plan



Framework

Municipality of Braga

The municipality of Braga is located in the Norte region (NUT II) and Cávado sub-region (NUT III), and is also the capital of the Braga district. The municipality is made up of 37 parishes, as shown in figure 1.

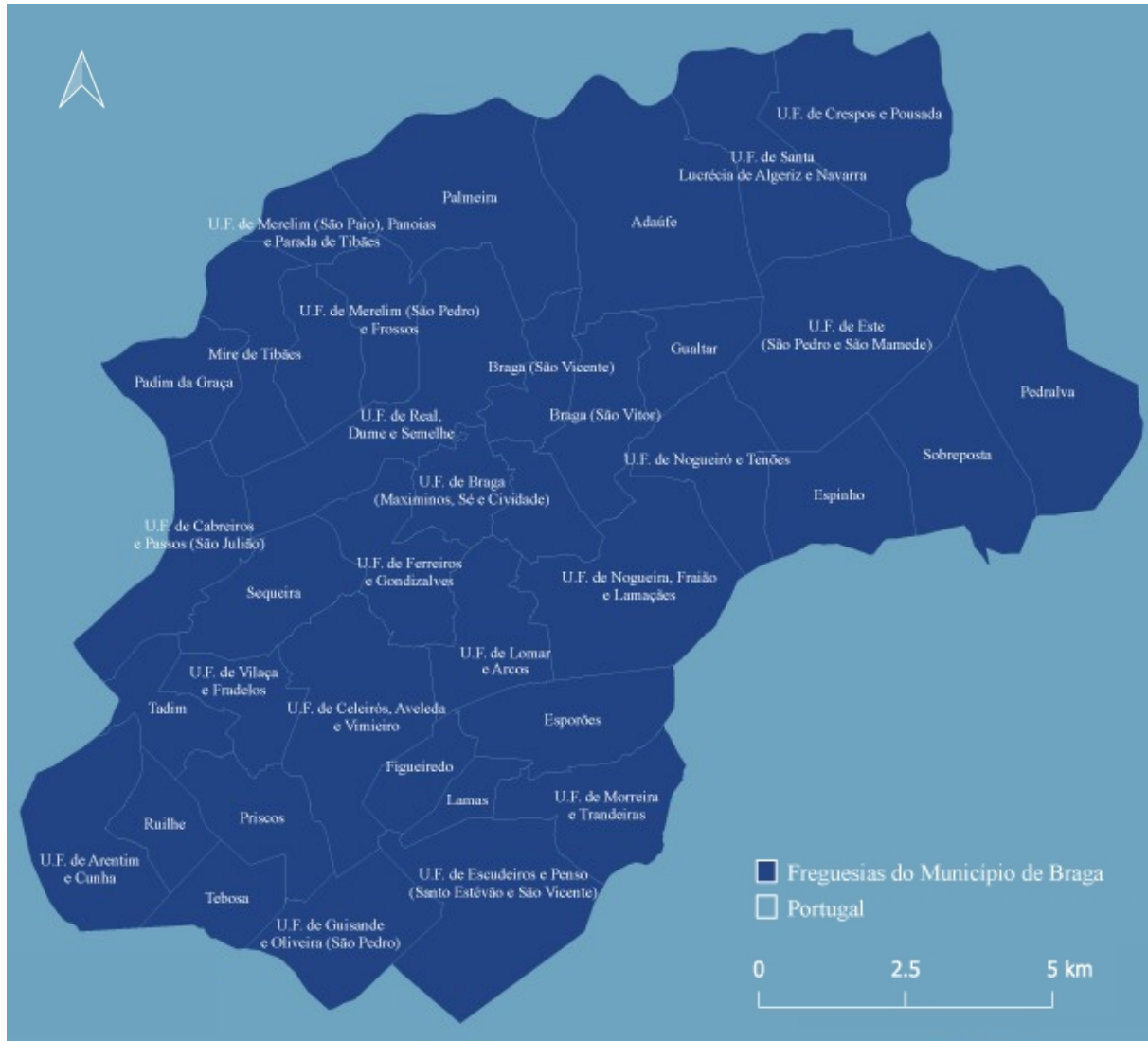


Figure 1 - Geographical location of the parishes in the Municipality of Braga.

Territory

The Municipality of Braga is located at latitude. 41° 33' 6" N and Longitude: 8° 25' 22" W, being bounded to the North by the river Cávado, to the South by the set of elevations that form the Serra dos Picos, to the East by the Serra dos Carvalhos and to the West by the Municipalities of Famalicão and Barcelos¹.

¹ Braga Municipal Forest Fire Defence Plan, Book I - 2015-2019

The relief is therefore characterised by relative irregularity, with valley areas scattered throughout the territory, as opposed to some mountainous formations that are arranged along parallel lines to the main rivers. With the predominance of valley areas, there are no high altitudes, ranging from 20 to 570 metres, so sun exposure is generally good throughout most of the territory¹.

With regard to land use and occupation, Braga's Municipal Master Plan considers three main zones:

- Serrana Zone - Characterised by an altitude of over 500m, with forest occupation and often large areas of uncultivated land. Housing tends to agglomerate.
- Intermediate or Transition Zone - Characterised by altitudes between 200 and 500m. It is a forest zone par excellence, covering the upper half of the slope. In the lower half of the slope, agriculture begins to emerge in very traditional and difficult to manage ways. The forest is almost entirely made up of intensive production species such as pine and eucalyptus.
- Lower Zone - This is the agricultural zone by definition. In this area, where the altitude is limited to 200 metres, the soils are deeper and the valleys, although small, are open and flat. The property, which is deeply cut up, is generally divided by vineyards, hanging vines or loose stone walls.

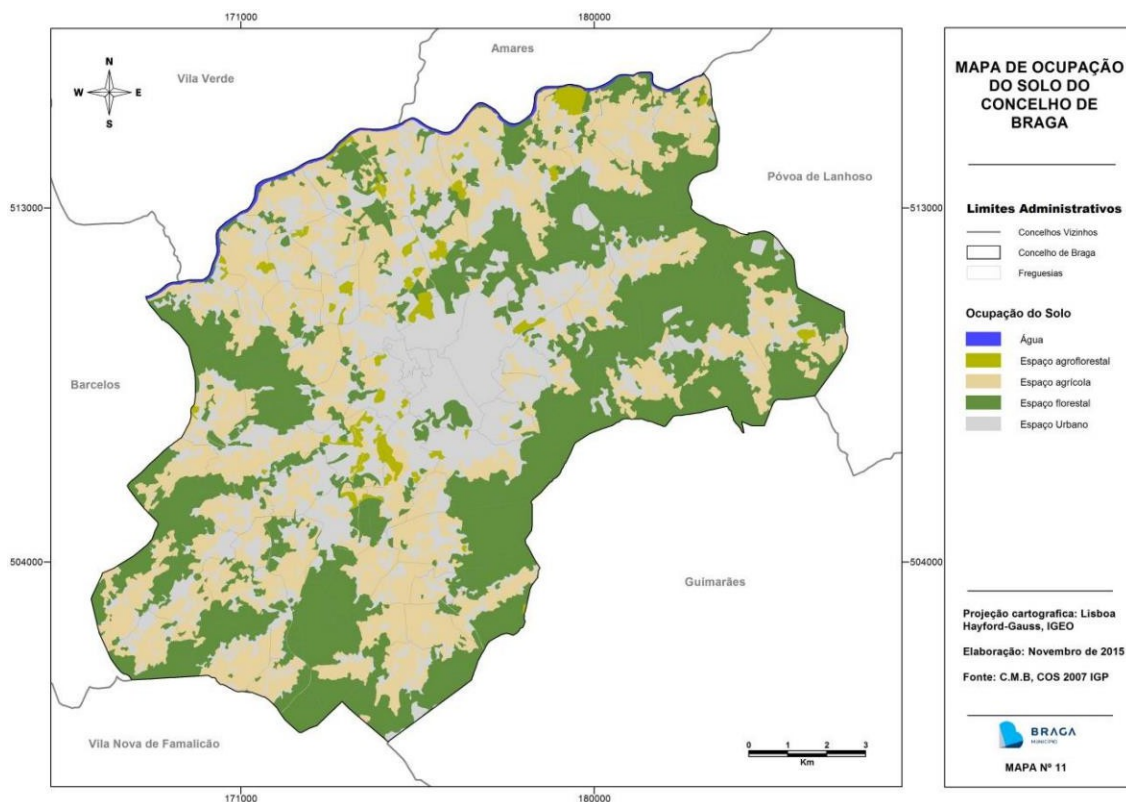


Figure 2 - Land use and occupation (Source: Braga Municipal Forest Fire Defence Plan, 2015-2019)

Social areas occupy 29 per cent of the municipality's total area, forest areas 43.7 per cent, agricultural areas 26.6 per cent, while areas occupied by water only 0.48 per cent².

In the municipality, forest stands are mainly occupied by maritime pine, totalling 2,150 ha. Stands of other hardwoods occupy around 925 ha and eucalyptus stands account for 361 ha.

Population

Braga has 193,333 inhabitants (year 2021). According to data released by the INE, the resident population has been increasing, as illustrated by the following figure.

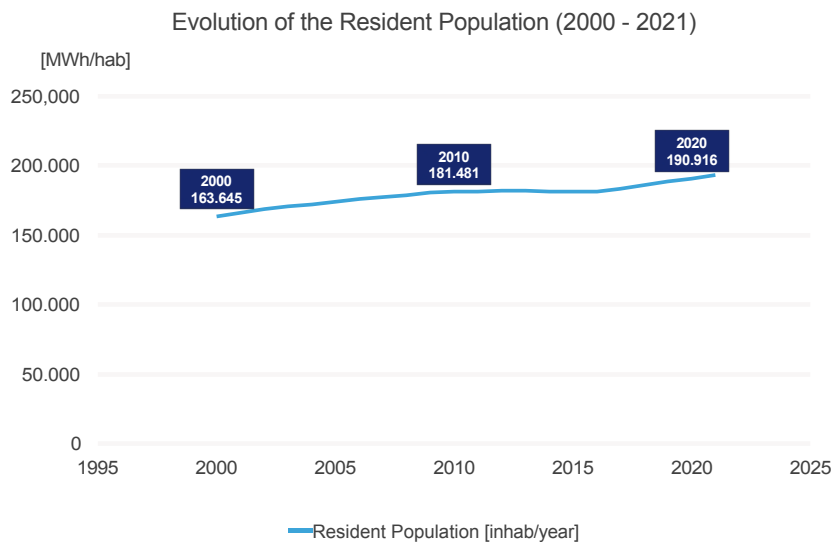


Figure 3 - Evolution of the resident population between 2000 and 2021 (Source: adapted from INE, 2000 - 2021).

Figure 4 shows the breakdown of the resident population by age group and sex in Braga in 2021. The predominance of the population in the 45-64 age group stands out, representing 30 per cent of the population, followed by the 25-44 age group, with 27 per cent of the inhabitants. In turn, the younger population, between the ages of 0 and 24, accounts for around 25 per cent of the population, with only 18 per cent of the population in the older age group (65 and over).

² Braga Municipal Forest Fire Defence Plan, Book I - 2015-2019

Resident population by sex and age group (2021)

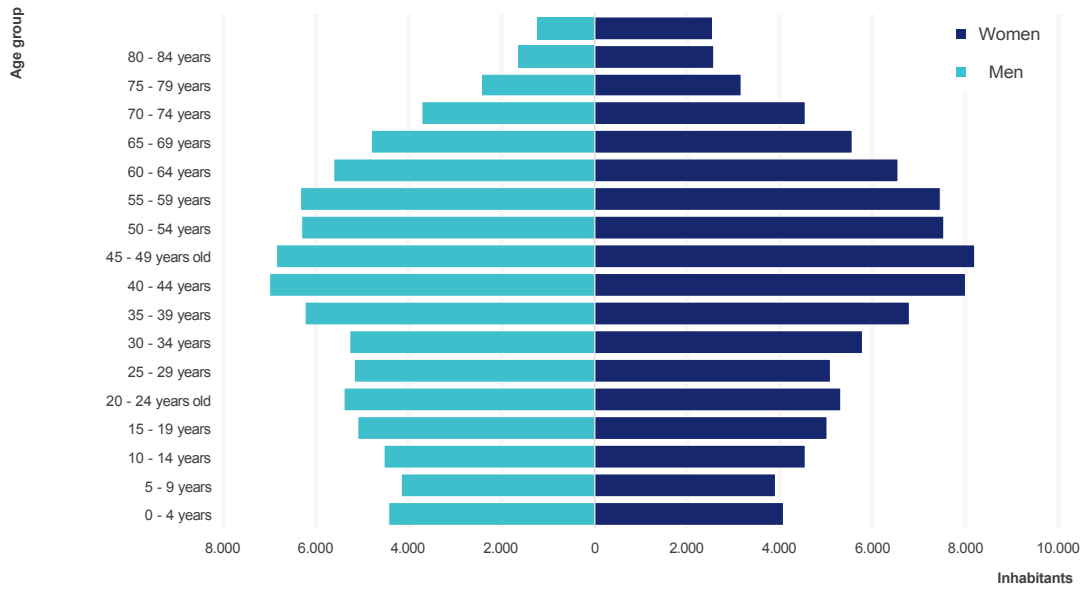


Figure 4 - Resident population in the Municipality of Braga, by age group (Source: adapted from INE, 2021)

Braga's population density (1,052 inhabitants/Km² , 2021) is higher than the country's average population density (112 inhabitants/Km² , 2021).

Economy

Braga is characterised by strong economic dynamism. In recent years, the number of companies in the area has increased, with 22,982 companies (125 companies/km²) in 2019, with a Gross Value Added (GVA) of over 1.9 billion euros. Economic activity is centred on the industrial sector, whose Gross Value Added (GVA) represents 29% of the wealth generated in the territory. The commerce and construction sectors also play an important role in the economy, accounting for 19% and 15% respectively of the GVA of companies located in Braga.

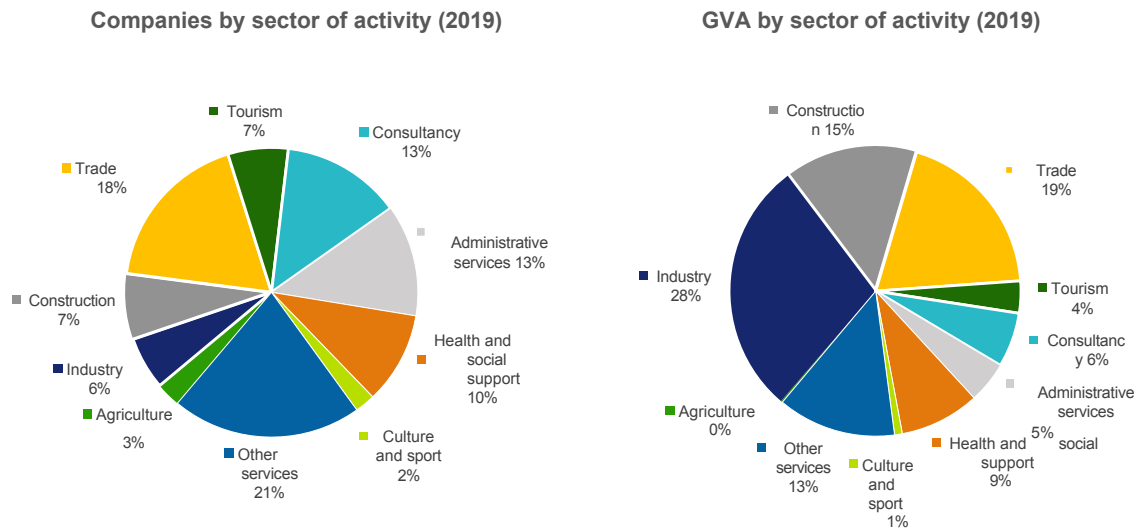


Figure 5 - Distribution by activity sector of companies located in the Municipality of Braga and their GVA in 2019 [%] (Source: adapted from INE, 2019).

Positioning of the Municipality in the District of Braga

The District of Braga covers an area of 2.706 Km² and is made up of 6 municipalities in the Cávado sub-region (Amares, Barcelos, Braga, Esposende, Terras de Bouro and Vila Verde), 7 municipalities in the Ave sub-region (Cabeceiras de Basto, Fafe, Guimarães, Póvoa de Lanhoso, Vieira do Minho, Vila Nova de Famalicão and Vizela) and 1 municipality in the Tâmega e Sousa sub-region (Celorico de Basto).

The District of Braga has a resident population of 846,515 inhabitants (year 2021) and a population density of 313 inhabitants/Km² (year 2021).

This district is characterised by heterogeneity, both in terms of administrative territorial diversity and also in terms of diversity between municipalities, with six municipalities that are more urban in nature (Esposende, Braga, Barcelos, Vila Nova de Famalicão, Guimarães and Vizela) and four municipalities that are more rural in nature (Terras de Bouro, Vieira do Minho, Cabeceiras de Basto and Celorico de Basto). This diversity is naturally reflected in the distribution of the population (figure 6), with the more rural municipalities accounting for around 6% of the population living in the District and the more urban municipalities accounting for around 94% of the population, 23% of which corresponds to the population living in the municipality of Braga.

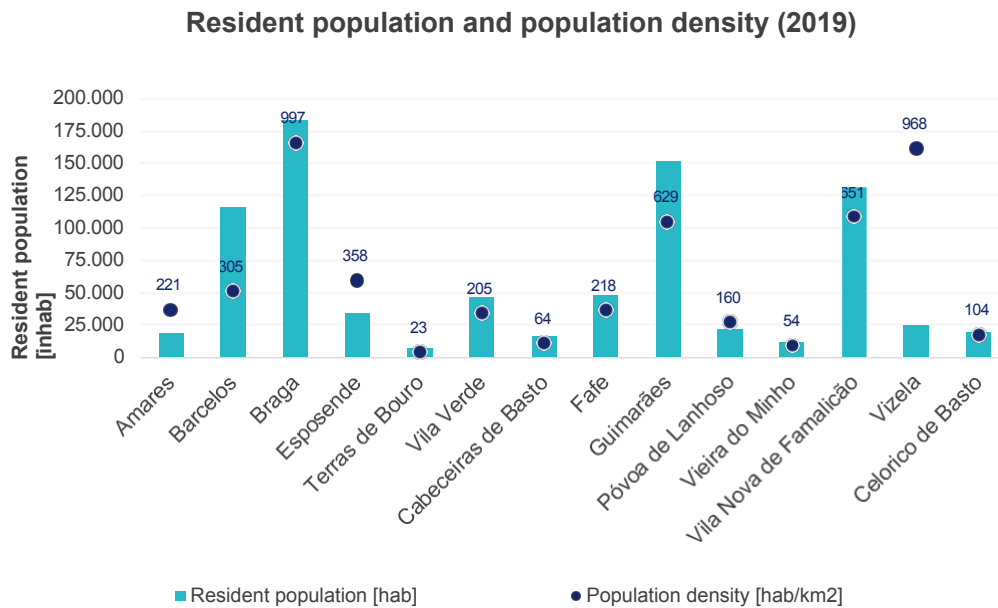


Figure 6 - Resident population in the District of Braga by Municipality [inhab] and respective population density [inhab/km²], in 2019 (Source: adapted from INE, 2019).

In 2019, the district of Braga was home to 93,446 companies (35 companies/km²), with a Gross Value Added (GVA) of over 7.2 billion euros. The district's economy is strongly centred on industry, whose Gross Value Added (GVA) represents 48% of the wealth generated in this geography. The trade and construction sectors are also important, accounting for 16% and 12% respectively of the GVA of companies located in the Braga municipality.

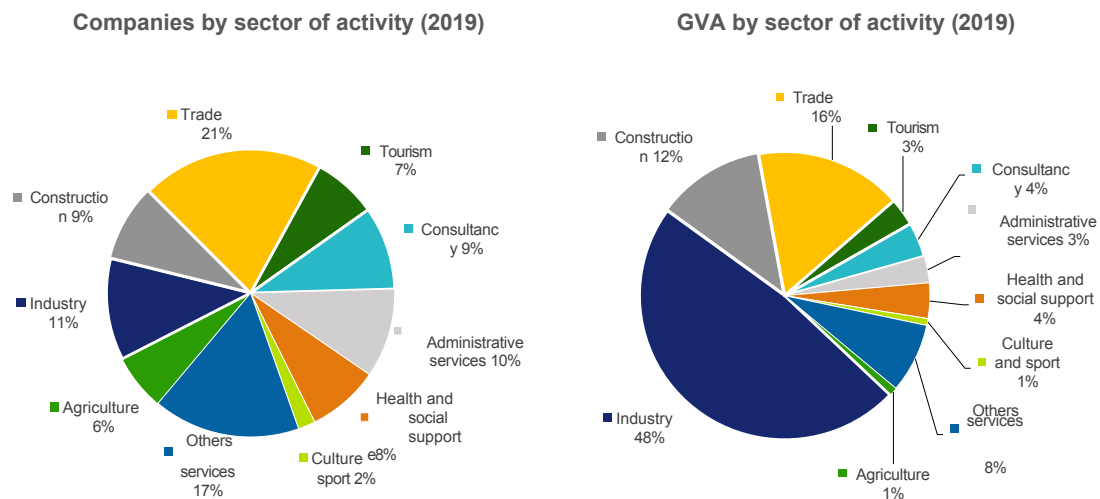


Figure 7 - Distribution by sector of activity of companies located in the District of Braga and respective GVA, in 2019 [%] (Source: adapted from INE, 2019).

Companies in the Braga District employ 341,200 workers, with the highest employment capacity in Braga (24 per cent), Guimarães (21 per cent) and Vila Nova de Famalicão (17 per cent).

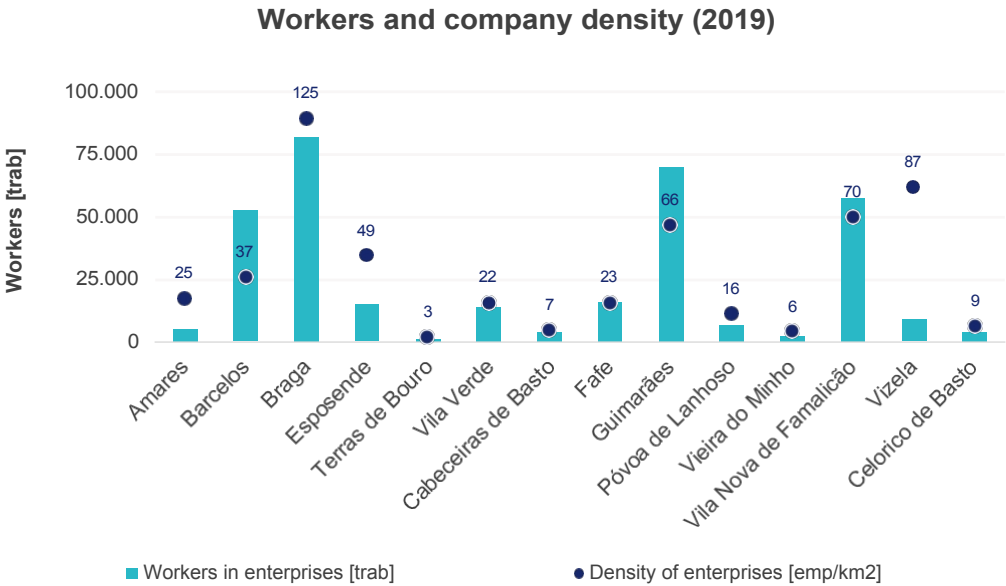


Figure 8 - Workers in companies located in the District of Braga [trab] and density of companies [emp/km²], by municipality, in 2019 (Source: adapted from INE, 2019).



Covenant of Mayors

About the Covenant of Mayors

The Covenant of Mayors for Climate and Energy is the world's largest movement of cities and regions for climate and energy action at local/regional level, bringing together local/regional governments committed to implementing climate and energy objectives. Currently, this initiative brings together more than 10,700 signatories in 53 countries around the world, including 170 signatories in Portugal.

The Covenant of Mayors was launched in 2008 in Europe with the ambition of bringing together local governments voluntarily committed to achieving and surpassing the EU's climate and energy targets. In 2016, it took on new objectives by merging with the *Mayors Adapt* initiative, aimed at adapting to climate change, giving rise to the new Covenant of Mayors **for Climate and Energy**.

The signatories of the Covenant of Mayors for Climate and Energy endorse a shared vision: to accelerate the decarbonisation of their territories, strengthen their capacity to adapt to the inevitable impacts of Climate Change and enable their citizens to have access to safe, sustainable and affordable energy. To achieve this vision, the signatories commit to reducing CO₂ emissions in their territory by at least 40 per cent by 2030, reducing energy poverty and creating a long-term vision to achieve climate neutrality by 2050.

In order to translate their political commitment into measures and projects, the signatories commit to presenting a Sustainable Energy and Climate Action Plan (SECAP), outlining the key actions they plan to implement. The signatories also undertake to report on the implementation of the SECAP by submitting progress reports every two years.

The ESAP is based on a Reference Emissions Inventory (RIE) that provides an analysis of the reference situation. These elements serve as the basis for defining a comprehensive set of actions that local authorities plan to implement to achieve their climate mitigation and adaptation goals. The ESCP covers areas where the municipality can influence energy consumption in the medium to long term (such as spatial planning), encourage markets for energy-efficient products and services (public procurement), as well as changes in consumption patterns (working with citizens).

Accession of the Municipality of Braga

The Municipality of Braga joined the Covenant of Mayors on 22 November 2013. The municipality's adherence to this initiative was another step towards promoting sustainable development.

In 2015, Braga's Sustainable Energy Action Plan was submitted to the Covenant of Mayors, with the aim of reducing 20 per cent of CO₂ emissions in the municipality by 2020.

Through this document, the Municipality of Braga is currently promoting its ESCP, committing to a 55 per cent reduction in CO₂ emissions by 2030, the reduction of energy poverty and the creation of a long-term vision to achieve climate neutrality by 2050.

Reference emissions inventory

Methodology

The aim of the Braga Emissions Reference Inventory (IRE) is to quantify the energy consumption and CO₂ emissions inherent in the activities carried out in the area. The IRE uses the energy consumption and production inventory and the CO₂ emissions inventory as tools.

Inventory of energy consumption and production

The energy inventory of the Municipality of Braga includes the calculation of energy consumption and production, as well as the respective local evolutionary trends. This analysis proposes scenarios for the evolution of energy demand for a time horizon ending in 2050, and also quantifies the endogenous production of renewable energy.

The scenarios are calculated using a specific mathematical model for the municipality, developed by IrRADIARE, *Science for evolution*[®], which is based on projections available from international organisations and public bodies responsible for planning and prospective studies. These projections refer to macroeconomic and demographic variables. In addition, scenarios for the evolution of the national energy system, estimated for the national space, are considered.

The set of entities whose references were taken into account include *Eurostat*, the European Environment Agency, the International Energy Agency, the European Commission's Directorate-General for Mobility and Transport, the European Commission's Directorate-General for Energy, the European Commission's Joint Research Centre (JRC), the Organisation for Economic Cooperation and Development and, of course, the relevant national bodies such as the Directorate-General for Energy and Geology, the Portuguese Environment Agency, the Energy Services Regulatory Authority and the National Statistics Institute. The macroeconomic and energy scenario proposed by the European Commission in 2016 in "*EU Energy, transport and GHG emissions trends to 2050*" stands out among the elements considered as a reference for the proposed scenarios. These scenarios used the PRIMES model as a resource, supported by some more specialised models and databases, such as those geared towards forecasting the evolution of international energy markets. The POLES model of the world energy system, GEM-E3 and some macroeconomic models are also considered as references.

The following figure schematises the methodology for calculating the Inventory of energy consumption and production.

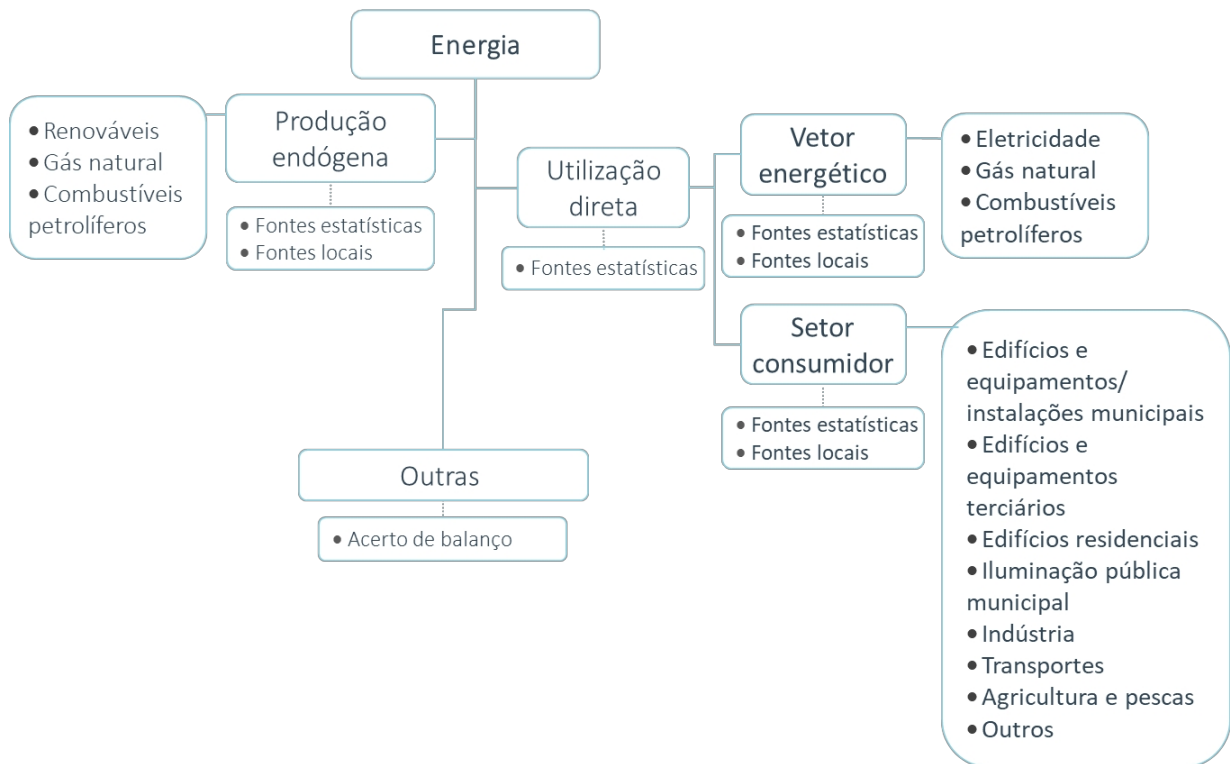


Figure 9 - Schematic representation of the Energy Inventory calculation methodology.

Inventory of CO₂

The CO₂ emissions matrix is the main result of the emissions inventory, quantifying CO₂ emissions resulting from energy consumption in the municipality's geographical area and identifying the main sources of these emissions.

The methodology adopted for determining CO₂ emissions is based on the methodology used in the reference inventory, following the JRC's recommendations for the execution of the ESAPs.

As such, the scenarios presented are determined by applying emission factors to the scenarios resulting from the execution of the energy matrix, opting to use *standard* emission factors in line with IPCC principles.

The following figure schematises the methodology for calculating the CO₂ emissions inventory.

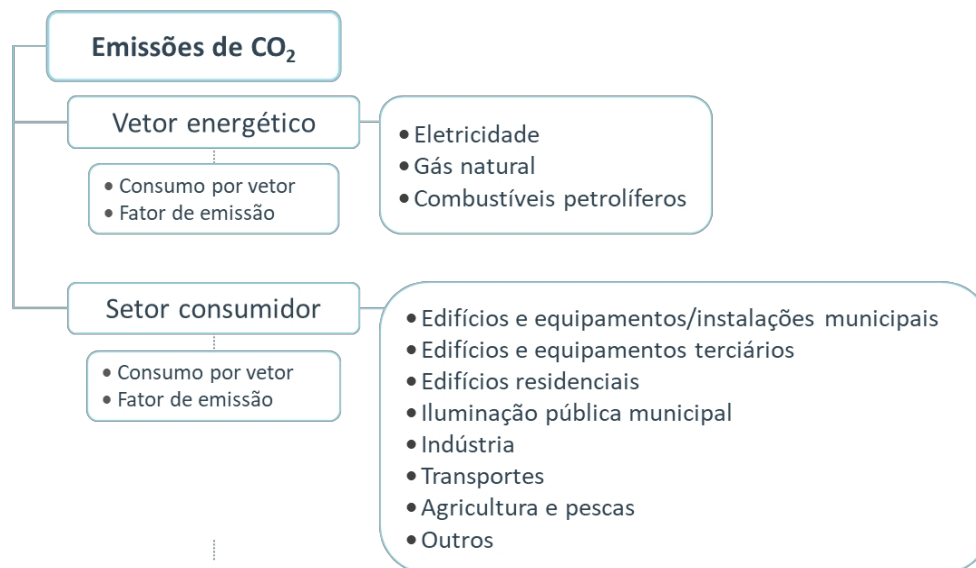


Figure 10 - Schematic representation of the methodology for calculating the CO emissions inventory₂.

Inventory of Energy Consumption and Production

Reference scenario

The baseline scenario corresponds to the reference base needed to draw up the scenarios for forecast developments up to 2030, illustrating energy use before the Sustainable Energy Action Plan is drawn up.

Total final energy consumption in Braga in 2008 was 2,446,547 MWh/year. Energy use in the transport sector accounted for 39% of consumption, followed by residential buildings with 28% of consumption and industry with 16% of consumption. In terms of the most used energy sources, we highlight oil products (56%) associated mainly with energy consumption in the transport sector, and electricity (26%), used mostly in buildings.

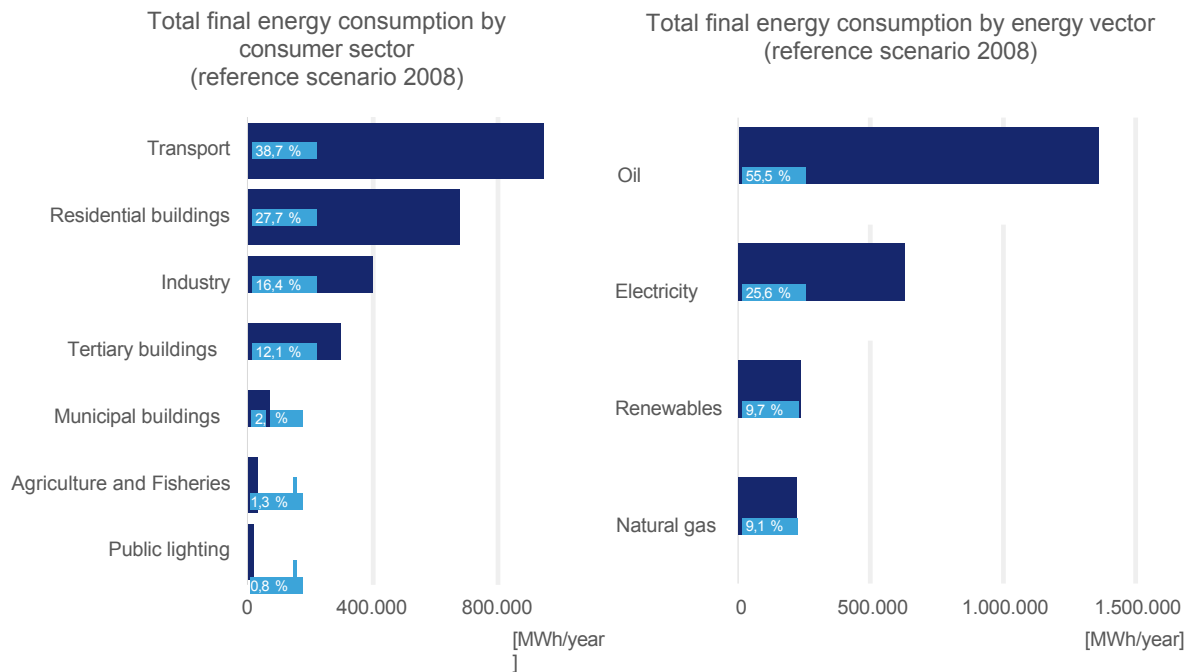


Figure 11 - Energy consumption in the reference scenario (year 2008), by subsector and energy vector [MWh/year]³.

Current scenario

The current scenario corresponds to the state of energy demand in 2019, making it possible to assess the evolution of energy consumption since the reference year and to know the starting point for drawing up scenarios of predicted evolution up to 2030 and for defining actions for sustainable energy.

In 2019, total final energy consumption in Braga was 2,156,957 MWh/year. Energy use in the transport sector accounted for 36% of consumption, followed by residential buildings with 28% of consumption and industry with 17% of consumption. In terms of the most used energy sources, we highlight oil products (42 per cent), mainly associated with energy consumption in the transport sector, and electricity (32 per cent), mostly used in buildings.

³ Renewable energy sources include the direct use of biofuels, biomass and solar thermal energy.

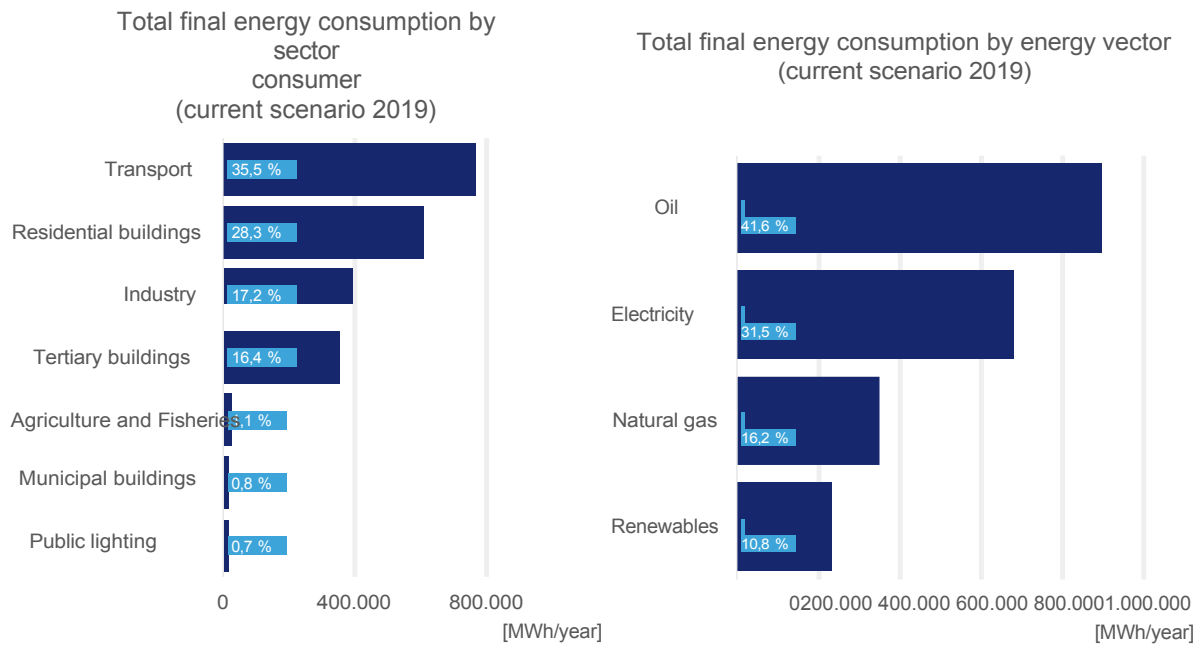


Figure 12 - Energy consumption in the current scenario (year 2019), by subsector and energy vector [MWh/year]⁴.

Since 2008, the Municipality of Braga has been promoting numerous initiatives to improve sustainability, developing and monitoring the creation and implementation of energy efficiency and endogenous renewable production projects and measures.

Compared to the baseline scenario (2008), there is a decrease in total energy consumption in 2019 (table 1). Since 2008, a reduction in energy consumption has been achieved in all sectors of activity, with the exception of tertiary buildings, which saw an increase in consumption of 19%⁵.

The downward trend in the use of energy in the territory indicates a positive evolution in its energy sustainability, although it is worth highlighting the still very significant weight of fossil fuels (natural gas and oil), whose consumption accounted for 58% of energy use. There is also an increase in energy demand in tertiary buildings, highlighting the importance of taking action in this sector by implementing measures to promote energy sustainability.

⁴ Renewable energy sources include the direct use of biofuels, biomass and solar thermal energy.

⁵ It is worth highlighting the existence of a break in the series in the 2013-2014 period, associated with the revision and updating of the EAC for energy-consuming sectors, which may have been associated with the transfer of consumption from the municipal buildings sector to the tertiary buildings sector, influencing the sharp decrease in consumption in municipal buildings and the increase in consumption in tertiary buildings.

Table 1 - Final energy consumption in 2008 and 2019 in the Municipality of Braga⁶.

	Total final energy consumption [MWh/year]		
	2008	2019	Evolution 2008/2019
Municipal buildings	70.467	17.641	● -75%
Tertiary buildings	297.116	352.849	● 19%
Residential buildings	678.910	609.434	● -10%
Public lighting	20.434	15.414	● -25%
Industry	401.425	370.786	● -8%
Transport	946.853	766.417	● -19%
Agriculture and Fisheries	31.342	24.416	● -22%
Total	2.446.547	2.156.957	● -12%

Prospective scenario

The forward-looking scenario makes it possible to see trends in energy consumption in the region, considering a *Business as Usual* scenario, and to identify needs for improving energy sustainability in order to ensure that the objectives are met by 2030.

Figure 13 illustrates a downward trend from 2015 to 2020, albeit slight, in all sectors of activity, including residential and services.

The transport sector stands out due to the sharp decrease in energy needs associated with the improvement in efficiency seen in recent years, both in terms of vehicles and transport services. After 2020, the *Business as Usual* scenario indicates a much more moderate downward trend.

⁶ It is worth highlighting the existence of a break in the series in the 2013-2014 period, associated with the revision and updating of the EAC for energy-consuming sectors, which may have been associated with the transfer of consumption from the municipal buildings sector to the tertiary buildings sector, influencing the sharp decrease in consumption in municipal buildings and the increase in consumption in tertiary buildings.

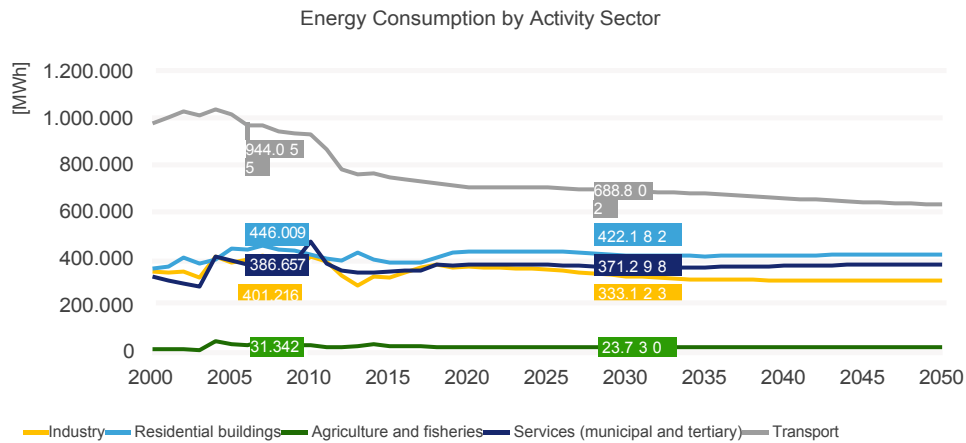


Figure 13 - Evolution of final energy consumption by activity sector from 2000 to 2050 in the Municipality of Braga (Business as Usual scenario) [MWh/year]⁷

Endogenous renewable production

In the municipality of Braga, around 21 MWh/year of renewable energy was produced in 2019. Of particular note is the production of electricity from water (42%), biogas (33%) and photovoltaics (24%).

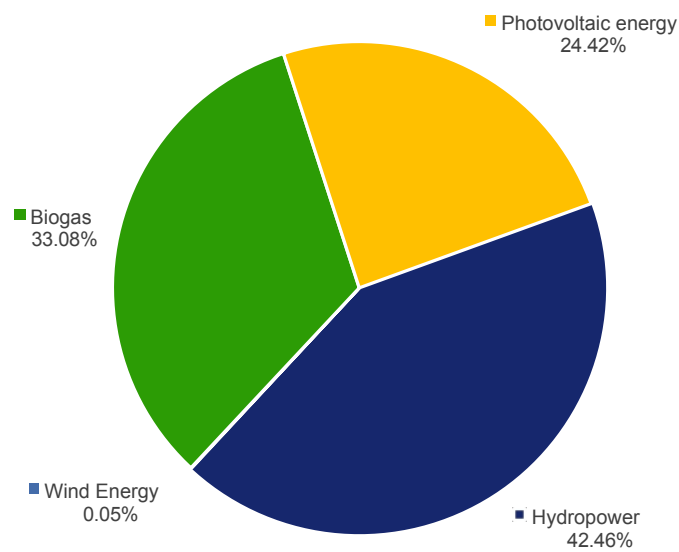


Figure 14 - Breakdown of Renewable Energy Production in the Municipality of Braga by energy source in 2019 [%].

⁷ Does not include consumption of renewable energy sources.

Inventory of CO₂

Reference scenario

In 2008, 640,137 tCO₂/year were emitted. Energy use in the transport sector accounted for 39% of CO₂ emissions in the municipality, followed by residential buildings with 21% of emissions and industry with 19% of emissions. Considering the breakdown of CO₂ emissions by source of energy consumed, emissions associated with the use of oil products (55%) and electricity (39%) stand out.

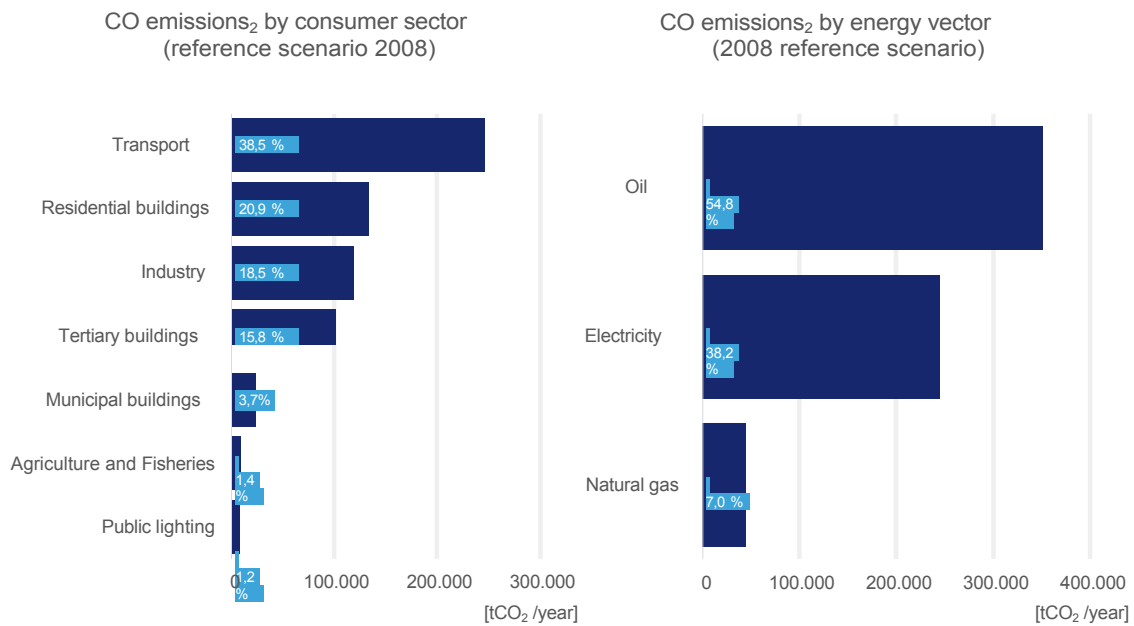


Table 2 - CO emissions₂ in the reference scenario (year 2008), by subsector and energy vector [tCO₂/year].

Current scenario

In 2019, CO₂ emissions associated with energy consumption in the territory totalled 475,300 tCO₂. Energy use in the transport sector accounted for 40% of emissions, followed by residential buildings with 22% of emissions and industry with 18% of emissions. In terms of emissions by source of energy used, the impacts of using oil products (49%) and electricity (36%) stand out.

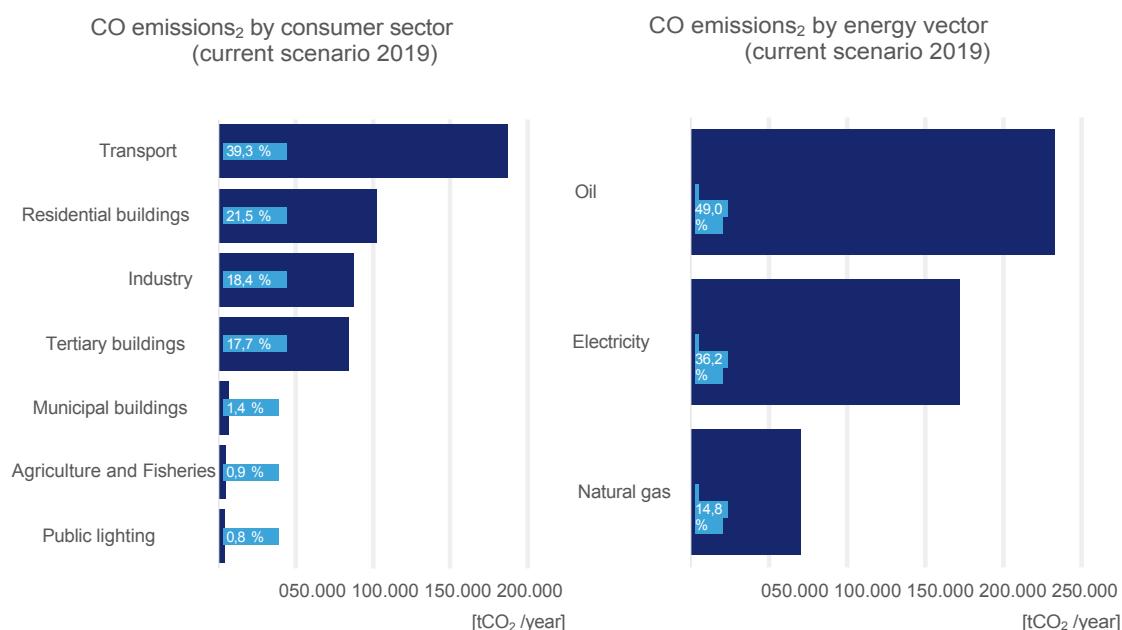


Table 3 - CO emissions₂ in the current scenario (year 2019), by subsector and energy vector [tCO₂/year].

Compared to the baseline scenario (2008), in 2019 there was a 26 per cent reduction in CO₂ emissions in the municipality (table 1). The contribution of all sectors of activity to this reduction is noteworthy, particularly municipal services, both in terms of buildings os⁸, and public lighting.

Table 4 - CO emissions₂ in 2008 and 2019, in the Municipality of Braga⁸.

	CO emissions ₂ [tCO ₂ /year]		
	2008	2019	Evolution 2008/2019
Municipal buildings	23.500	4.298	● -82%
Tertiary buildings	101.129	84.225	● -17%
Residential buildings	133.727	102.067	● -24%
Public lighting	7.969	3.900	● -51%
Industry	118.287	87.350	● -26%
Transport	246.739	186.973	● -24%
Agriculture and Fisheries	8.785	6.487	● -26%
Total	640.137	475.300	● -26%

⁸ It is worth highlighting the existence of a break in the series in the 2013-2014 period, associated with the revision and updating of the EAC for energy-consuming sectors, which may have been associated with the transfer of consumption from the municipal buildings sector to the tertiary buildings sector, influencing the sharp decrease in consumption in municipal buildings and the increase in consumption in tertiary buildings.

Prospective scenario

Analogous to the trends observed - a reduction in energy consumption in the municipality, the *Business as Usual* scenario indicates a reduction in CO₂ emissions by 2030. This evolution results not only from the reduction in energy use, but also from the choice of energy sources with lower associated CO₂ emissions, namely from oil products to natural gas and electricity.

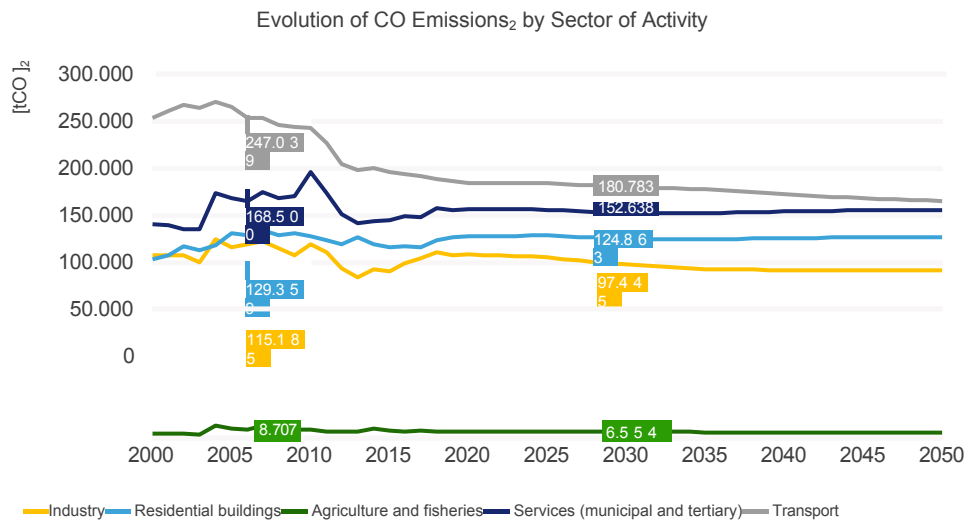


Figure 15 - Evolution of CO₂ emissions by activity sector from 2000 to 2050 in the Municipality of Braga (*Business as Usual* scenario) [tCO₂/year]⁹

⁹ Does not include consumption of renewable energy sources.



Actions for Sustainable Energy

Methodology

The Sustainable Energy Action Plan defines various energy sustainability measures for each energy-consuming sector and across the board, the implementation of which will enable the fulfilment of the commitment to the Covenant of Mayors, namely a reduction of at least 40% in CO₂ emissions by 2030 and achieving climate neutrality by 2050.

Given the reduction in CO₂ emissions in recent years, the municipality of Braga has seen a sustained evolution. This reading also shows that the reduction in CO₂ emissions in Braga, in addition to having been sustained, demonstrates the effectiveness of the municipal measures implemented in recent years. In addition, they counteract the rise in emissions due to the growing trend of attraction to the city that would be expected if nothing else were done. Thus, there are conditions for more ambitious targets in order to accelerate the territory's carbon neutrality. Thus, there are conditions for increasing the reduction target declared under the Covenant of Mayors to 55 per cent by 2030. In this context, taking into account the Sustainable Development Strategy and the path already taken by the municipality, a more ambitious local objective is to reduce its CO₂ emissions by at least 55 per cent by 2030.

The Action Plan presented here follows the methodology proposed by the Covenant of Mayors for Climate and Energy, with the necessary adaptations to the reality of Braga's territory, using as a reference the results obtained in the Inventories of Energy Consumption and Production and CO₂ Emissions, both in terms of the baseline situation and in terms of predicted developments. In order to ensure the feasibility of implementing the proposed measures and the successful implementation of the action plan, all the actions presented were analysed from the point of view of their potential to reduce emissions in the territory under analysis, based on their specific characteristics, energy characterisation and the identification of CO₂ emission sources resulting from the reference inventory. National and regional strategic objectives with an impact on energy sustainability in the municipality were also taken into account.

The implementation of the proposed measures covers a period up to the year of verification of the fulfilment of the proposed targets (year 2030).

The proposed sustainable energy and climate actions are identified taking into account the survey of intervention options and needs in the municipality, thus guaranteeing their applicability and their adjustment to needs.

Transport

Diagnosis

Considering the Reference Emissions Inventory, the transport sector stands out as the main final energy consumer (year 2019: 36% of consumption, 766,417 MWh/year) and the main source of CO₂ emissions in the territory (year 2019: 40% of emissions, 186,973 tCO₂/year). Compared to 2008, in 2019 energy consumption in the sector fell by 19% and CO₂ emissions by 24%.

In this sector there is a predominant consumption of petroleum products, namely diesel and petrol.

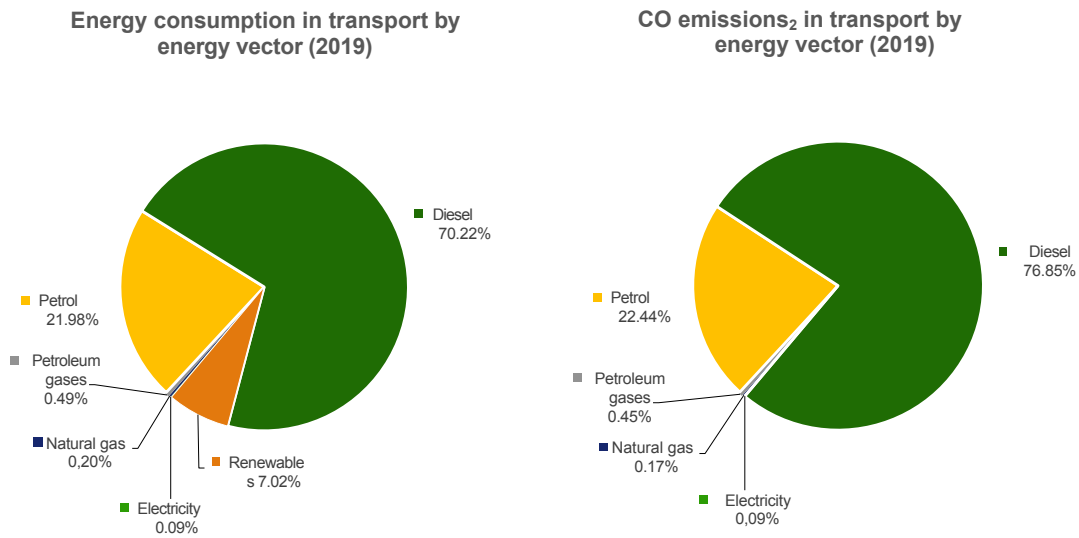


Figure 16 - Energy consumption and CO emissions₂ in the transport sector, by energy vector, in the Municipality of Braga, in 2019 [MWh/year]¹⁰

Considering the distribution of energy consumption and CO₂ emissions by type of transport, it can be seen that individual transport accounts for 84 per cent of energy use and CO₂ emissions in this sector and freight transport for 16 per cent.

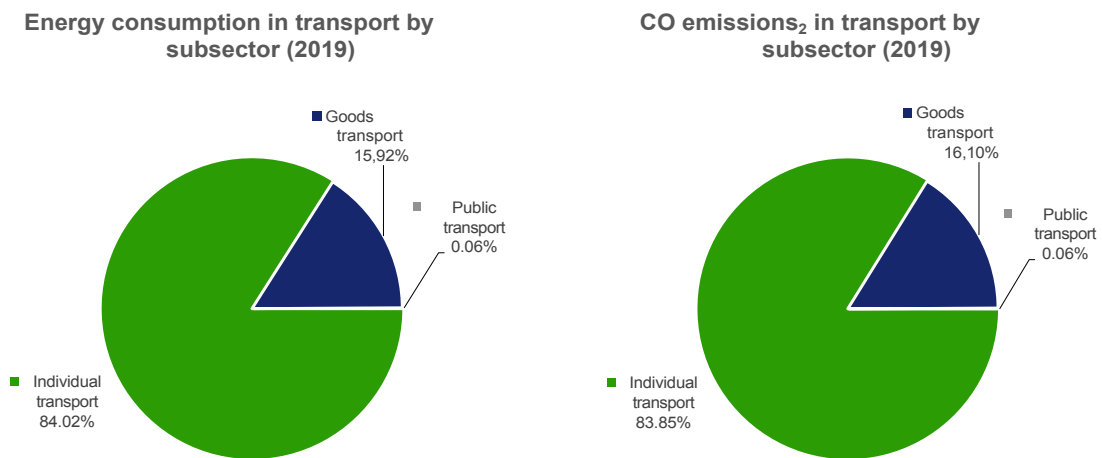


Figure 17 - Energy consumption and CO emissions₂ by type of transport in the Municipality of Braga in 2019 [MWh/year]

¹⁰ Renewable energy sources include the direct use of biofuels.

In terms of public transport, Braga has the Braga Urban Transport (TUB). Taking the Sustainable Urban Mobility Plan for the City of Braga as a reference, there has been a growing trend in the use of Braga Urban Transport, as illustrated in figure 18. Despite this positive trend towards increased use of public transport, the average number of daily users of Braga's urban transport represents only 17% of the resident population. This highlights the high share of individual transport in the overall mobility context.

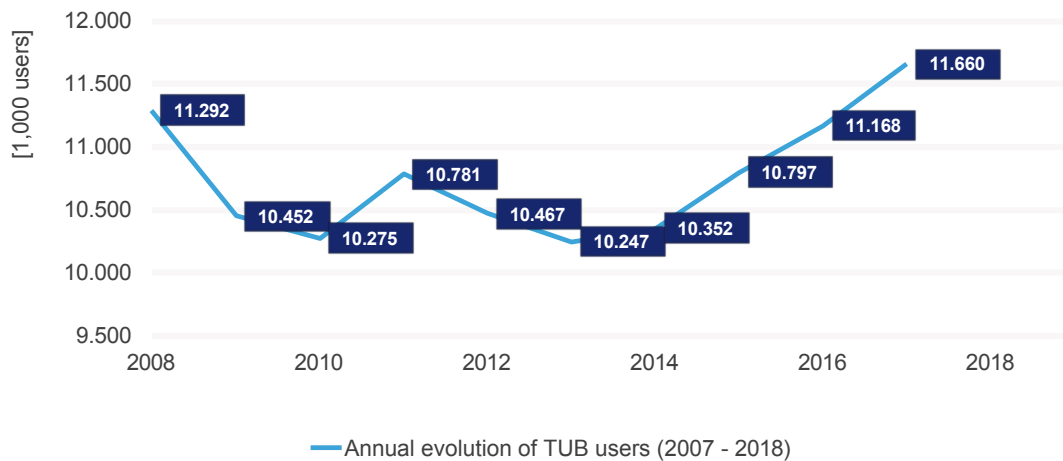


Figure 18 - Annual evolution of Braga's urban transport users [1,000 users/year] (Source: adapted from Plano de Mobilidade Urbana Sustentável da Cidade de Braga, 2019)

Maximum potential for improving energy sustainability

Taking the sector diagnosis presented as a reference, it is considered that the transport sector still has an additional potential to reduce CO₂ emissions in the 2019 - 2030 period by 50 per cent compared to the current scenario (year 2019).

Table 5 - Potential for reducing CO₂ emissions₂ in the period 2019 - 2030 in the transport sector by 2030.

	CO ₂ emission reduction potential in the period 2019 - 2030
Transport	50%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 6 - Energy sustainability measures to be implemented in the transport sector by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year] 2030	Reduction of CO ₂ Emissions [t/year]
Transport	Efficient vehicles and fleets	Car Fleet Renewal Plan	Gradual acquisition of efficient vehicles for the municipal fleet, incorporating solutions to optimise vehicle operations.	Municipal fleet managers	2016 - 2027	408.000 €	88,27	23,00
Transport	Efficient vehicles and fleets	Renewal and decarbonisation of the Braga Urban Transport (TUB) fleet	Renewal of the fleet with clean buses by at least 60 per cent compared to 2018, by 2025.	Municipal public transport operator	2021 - 2025	> 1.000.000 €	487,38	127,00
Transport	Electric mobility	Promote public charging of light vehicles	Implementation of public charging points for light electric vehicles, particularly with CCS2 connectors.	Municipal fleet managers	2021 - 2030	10.000 - 25,000 €	42,21	11,00
Transport	Optimising the public transport network	Electric public transport	Gradual replacement of 50 per cent of buses on the public transport network with 100 per cent electric vehicles.	Municipal public transport operator	2022 - 2030	> 1.000.000 €	810,59	3.110,76
Transport	Optimising the public transport network	<i>Bus Rapid Transport</i> (BRT)	Preparation of a preliminary study and implementation of a BRT public transport system, of a high standard and quality, which will operate with road passenger vehicles on a dedicated channel, along fifteen kilometres, with priority at intersections.	Municipal public transport operator	2019 - 2022	150.000 €	134,53	35,06
Transport	Optimising the public transport network	Braga Urban Transport (TUB) 100% ecological	Carrying out TUB services at the weekend using ecological vehicles, offering a 100% ecological mobility service.	Municipal public transport operator	2021 - 2030	0 €	141,99	37,00

Transport	Urban regeneration and optimising the energy and climate aspects of urban planning	Increasing Limited Duration Parking Zones (ZEDL)	Increase of ZEDL in the urban perimeter by at least 25 per cent by 2030.	Municipal technicians	2021 - 2030	25.000 - 50,000 €	134,98	35,17
Transport	Awareness-raising and education for climate sustainability	Raising awareness of sustainable mobility	Carrying out information and awareness-raising activities on the use of more sustainable modes of transport, the purchase of electric vehicles and sustainable driving, including the preparation and dissemination of an information guide.	Cultural and recreational associations Environmental associations Business associations Schools	2022 - 2025	10.000 - 25.000 €	61.136,68	15.930,72
Transport	Increased "pedestrianisation" and bicycle use	Urban insertion of cycling network	Insertion of the cycling network in the urban centre of Braga	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2023	610.000 €	92,10	24,00
Transport	Increased "pedestrianisation" and bicycle use	Implementation of <i>pop-up</i> measures for sustainable mobility	Implementation of the pop-up model of shared lanes between cars and bicycles, a road safety and cycle mobility promotion project. New strategies for bicycle circulation will be tested and the network will connect the city centre, main schools and other mobility-generating hubs via secondary streets.	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2025	25.000 €	90,77	23,65
Transport	Increased "pedestrianisation" and bicycle use	Cávado River Ecovia	Construction of the section of the Cávado River Ecovia located in the municipality of Braga	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2025	57.000 €	51,74	13,48

Transport	Increased "pedestrianisation" and bicycle use	Walking Route Network	Construction/upgrading of Braga's network of footpaths, as an important means of highlighting historical eras and the urban and rural culture that come together in Braga, while also emphasising other distinctive factors of a natural and scenic nature.	Cultural and recreational associations Environmental associations Business associations Schools	2019 - 2021	50.000 €	45,39	11,83
Transport	Optimising professional and commuter mobility	Offer discounts on public transport	Offering discounts to municipal employees to encourage them to use public transport.	Municipal technicians	0	500.000 - 1.000.000 €	1.789,37	466,26
Transport	Optimising professional and commuter mobility	Braga Business Mobility Pact - BCSD	Creation of the Braga Business Mobility Pact, promoting business commitment to the transition to sustainable mobility.	Cultural and recreational associations Environmental associations Business associations Schools	2021 - 2030	0 €	214,91	56,00
Transport	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the transport sector	Implementation of energy efficiency solutions and optimisation of climate sustainability.	Municipal technicians	2008 - 2020	> 1.000.000 €	180.435,79	59.766,55
Transport	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the transport sector	Study and implementation of additional actions to improve energy sustainability in the transport sector, focusing on innovation for decarbonisation.	Municipal technicians	2022 - 2030	> 1.000.000 €	38.058,67	9.917,15

Residential buildings

Diagnosis

Considering the Emissions Reference Inventory, in 2019 the residential buildings sector accounted for 28% of energy consumption (609,434 MWh/year) and 22% of CO₂ emissions (102,067 tCO₂/year). It is the second largest sector in terms of energy consumption and CO₂ emissions in the municipality. Compared to 2008, in 2019 energy consumption in the sector fell by 10% and CO₂ emissions by 24%. This sector predominantly consumes electricity and natural gas, while renewable energy sources such as biomass and solar energy are also used.

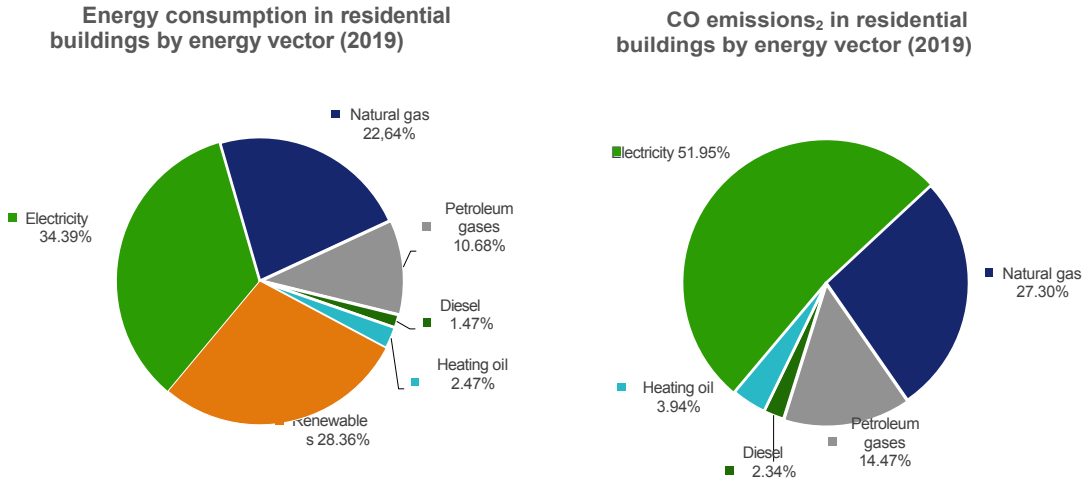


Figure 19 - Energy consumption and CO emissions₂ in the residential buildings sector, by energy vector, in the Municipality of Braga, in 2019 [MWh/year]¹¹

In terms of the housing stock, Braga is dominated by buildings constructed between 1981 and 2000, with more than 30 per cent of dwellings having energy certification. Of the certified dwellings, energy classes C (23%) and D (18%) predominate, although 20% of dwellings have energy class A or A⁺ (ADENE, 2021).

¹¹ Renewable energy sources include the direct use of biomass and solar thermal energy.

Potential for improving energy sustainability

Taking the sector diagnosis presented as a reference, it is considered that the residential buildings sector still has an additional potential for reducing CO₂ emissions in the period 2019 - 2030 of 55 per cent, compared to the current scenario (year 2019).

Table 7 - Potential CO emission reductions₂ in the period 2019 - 2030 in the residential buildings sector by 2030.

	CO₂ emission reduction potential in the period 2019 - 2030
Residential buildings	55%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 8 - Energy sustainability measures to be implemented in the residential buildings sector by 2030 and respective estimated reductions in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
Residential buildings	Efficient lighting in buildings	100% sustainable lighting in residential buildings	Carrying out information and awareness-raising actions on the use of sustainable lighting technologies, favouring LED technology whenever possible, including the preparation and dissemination of an information leaflet.	Condominium managers Residents' associations Schools	2022 - 2025	25.000 - 50,000 €	23.278,01	8.589,59
Residential buildings	Energy audits, efficient construction and building certification	Support service Efficient residential buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in residential buildings in terms of insulation, glazing, etc.	Condominium managers Residents' associations Schools	2022 - 2030	50.000 - 100.000 €	4.995,30	1.448,83
Residential buildings	Energy audits, efficient construction and building certification	Increased energy performance in remodelling and new residential buildings	Reduction of urbanisation fees for buildings with Class A or A+, or that have moved up 2 classes during rehabilitation.	Condominium managers Residents' associations Schools	2021-2030	50.000 - 100.000 €	41,37	12,00
Residential buildings	Energy audits, efficient construction and building certification	<i>Bragahabit</i> - Increasing the energy performance of social housing buildings	Development of environmental sustainability terms of reference for social housing in new constructions and major remodelling, with a particular focus on increasing energy performance.	Condominium managers Residents' associations Schools	2018 - 2026	100.000 - 250,000 €	41,37	12,00
Residential buildings	Efficient air conditioning and ventilation systems	Efficient air conditioning and ventilation in residential buildings programme	Carrying out information and awareness-raising activities on the use of efficient air conditioning and ventilation technologies for residential buildings, favouring renewable technology wherever possible, including the preparation and dissemination of an information leaflet.	Condominium managers Residents' associations Schools	2022 - 2030	25.000 - 50,000 €	802,82	232,85

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
Residential buildings	Efficient air conditioning and ventilation systems	Support service Efficient air conditioning and ventilation in residential buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in residential buildings in terms of air conditioning and ventilation systems.	Condominium managers Residents' associations Schools	2022 - 2030	50.000 - 100.000 €	15.253,52	4.424,09
Residential buildings	Sustainable water management	Water efficiency in residential buildings programme	Carrying out information and awareness-raising actions on water efficiency in residential buildings, including the drafting and dissemination of a guide.	Condominium managers Residents' associations Schools	2025 - 2028	25.000 - 50,000 €	1.329,44	363,15
Residential buildings	Efficient household equipment	Home appliances programme	Carrying out information and awareness-raising actions on the energy efficiency of household appliances, including the drafting and dissemination of a guide.	Condominium managers Residents' associations Schools	2022 - 2030	> 1.000.000 €	7.514,77	2.772,95
Residential buildings	Awareness-raising and for climate sustainability	Energy efficiency in residential buildings programme	Carrying out information and awareness-raising actions on energy efficiency in residential buildings, including the drafting and dissemination of a guide.	Condominium managers Residents' associations Schools	2022 - 2030	> 1.000.000 €	3.385,05	1.249,08
Residential buildings	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the industrial sector	Implementation of energy efficiency solutions and optimisation of climate sustainability.	Condominium managers Residents' associations Schools	2008 - 2020	> 1.000.000 €	69.476,34	31.660,55

Industry

Diagnosis

Considering the Emissions Reference Inventory, the activity of the industry sector in 2019 accounted for 17 per cent of energy consumption (370,786MWh/year) and 18 per cent of CO₂ emissions (87,350 tCO₂/year). This is the third largest sector in the municipality's energy consumption and CO₂ emissions. Compared to 2008, in 2019 energy consumption in this sector fell by 8% and CO₂ emissions by 26%. This sector predominantly consumes electricity, natural gas and diesel.

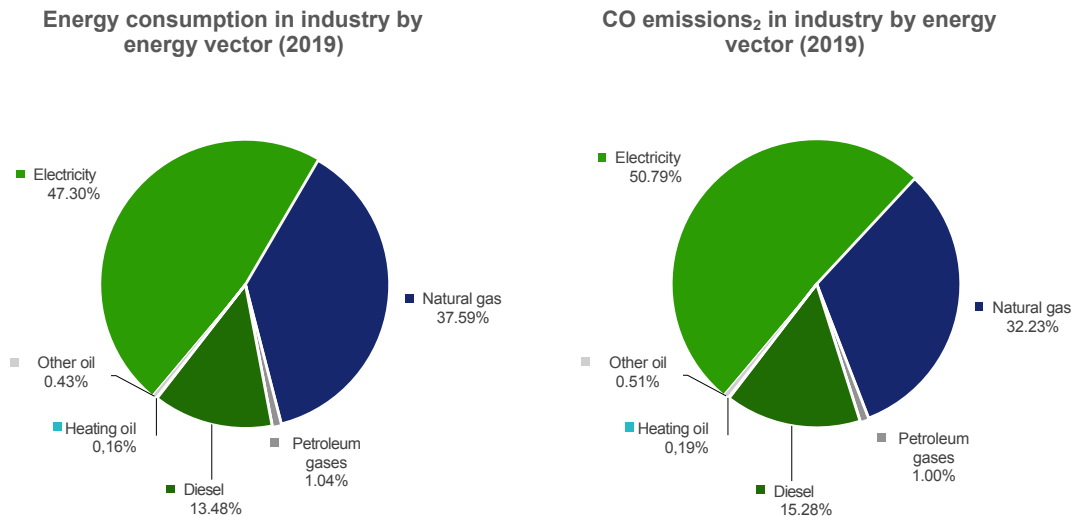


Figure 20 - Energy consumption and CO emissions₂ in the industry sector, by energy vector, in the Municipality of Braga, in 2019 [MWh/year]

Maximum potential for improving energy sustainability

Taking the sector diagnosis presented as a reference, it is considered that the industry sector still has the potential for an additional reduction in CO₂ emissions in the 2019 - 2030 period of 60 per cent compared to the current scenario (2019).

Table 9 - Potential CO emission reductions₂ in the 2019-2030 period in the industry sector by 2030.

	CO ₂ emission reduction potential in the period 2019 - 2030
Industry	60%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 10 - Energy sustainability measures to be implemented in the industrial sector by 2030 and respective estimated reduction in energy consumption and CO emissions.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
Industry	Efficient lighting in buildings	100% sustainable lighting in industry	Carrying out information and awareness-raising actions on the use of sustainable lighting technologies, favouring LED technology whenever possible, including the preparation and dissemination of an information leaflet.	Industry and business associations	2022 - 2025	25.000 - 50,000 €	9.084,57	3.352,21
Industry	Solar thermal energy	Solar thermal programme in industry	Creation of an information and best practice sharing programme to promote the use of solar thermal in industrial processes with low/medium temperature heat requirements.	Industry and business associations	2022 - 2030	25.000 - 50,000 €	3.033,97	637,28
Industry	Natural gas	Natural gas in industry programme	Creation of an information and best practice sharing programme to promote the use of natural gas in energy-intensive industrial processes.	Industry and business associations	2022 - 2030	> 1.000.000 €	4.416,65	1.052,87
Industry	Efficient industrial equipment and processes	Good industrial practice programme	Creation of a programme to inform and share good energy sustainability practices in the industrial sector, including the drafting and dissemination of guides.	Industry and business associations	2022 - 2030	25.000 - 50,000 €	297,09	82,90
Industry	Efficient industrial equipment and processes	Investment support service in the industrial sector	Creation of a service to publicise funding opportunities and support the preparation of applications for the purchase of equipment and the implementation of energy-sustainable industrial processes, particularly for electrification and automation.	Industry and business associations	2022 - 2030	50.000 - 100.000 €	5.644,71	1.575,07

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year] 2030	Reduction of CO ₂ Emissions [t/year]
Industry	Optimising professional performance	Optimising professional performance in industrial activities programme	Carrying out training, awareness-raising and education for energy sustainability for workers in the industrial sector who operate energy-consuming vehicles or equipment.	Industry and business associations	2022 - 2030	25.000 - 50,000 €	204,73	58,73
Industry	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the industrial sector	Implementation of energy efficiency solutions and optimisation of climate sustainability.	Industry and business associations	2008 - 2020	> 1.000.000 €	30.638,17	30.936,32

Tertiary sector buildings

Diagnosis

Considering the Reference Emissions Inventory, the activity of the tertiary buildings sector in 2019 accounted for 16% of energy consumption in the territory (352,849 MWh/year) and 18% of CO₂ emissions (84,225 tCO₂/year). Compared to 2008, in 2019 energy consumption in the sector increased by 19% and CO₂ emissions fell by 17%. This is the only sector where increases in consumption were recorded in the period under review. However, it should be noted that there was a break in the series in the 2013 - 2014 period, associated with the revision and updating of the PPA for energy-consuming sectors. This revision may have been associated with the transfer of consumption from the municipal buildings sector to the tertiary buildings sector and, as such, a possible inflation in the sharp decrease in consumption in municipal buildings and the increase in consumption in tertiary buildings.

In the tertiary buildings sector, electricity and natural gas are predominantly consumed.

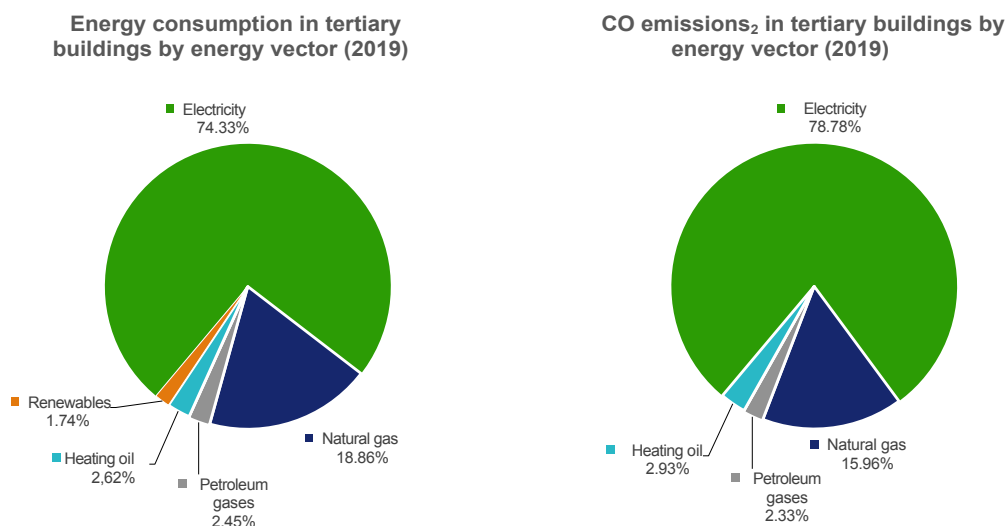


Figure 21 - Energy consumption and CO emissions₂ in the tertiary buildings sector, by energy vector, in the Municipality of Braga, in 2019 [MWh/year]¹²

Potential for improving energy sustainability

Taking the diagnosis of the sector presented as a reference, it is considered that this tertiary sector has an additional potential to reduce CO₂ emissions in the 2019 - 2030 period by 40 per cent compared to the current scenario (2019).

¹² Renewable energy sources include the direct use of solar thermal energy.

Table 11 - Potential CO emission reductions, in the period 2019 - 2030 in the tertiary buildings sector by 2030.

CO ₂ emission reduction potential in the period 2019 - 2030	
Tertiary sector buildings	40%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 12 - Energy sustainability measures to be implemented in the tertiary buildings sector by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
Tertiary buildings	Efficient lighting in buildings	100% sustainable lighting in tertiary services	Carrying out information and awareness-raising actions on the use of sustainable lighting technologies, favouring LED technology whenever possible, including the preparation and dissemination of an information leaflet.	Tertiary building managers Business associations	2022 - 2025	25.000 - 50.000 €	12.365,15	4.562,74
Tertiary buildings	Energy audits, efficient construction and building certification	Support service tertiary buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in tertiary buildings in terms of insulation, glazing, etc.	Tertiary building managers Business associations	2022 - 2030	50.000 - 100.000 €	5.904,16	1.948,10
Tertiary buildings	Integrated renewable generation	Photovoltaic for Self-consumption Services	Increased implementation of photovoltaic solar technology systems for self-consumption.	Tertiary building managers Business associations	2021 - 2030	50.000 - 100.000 €	74,57	27,52
Tertiary buildings	Integrated renewable generation	Increasing access to electricity production from renewable sources	Encouraging the formation of producer co-operatives and supporting existing ones	Tertiary building managers Business associations	2021 - 2030	< 10.000 €	8.372,02	3.089,28
Tertiary buildings	Efficient air conditioning and ventilation systems	Efficient air conditioning and ventilation in tertiary buildings programme	Carrying out information and awareness-raising activities on the use of efficient air conditioning and ventilation technologies, favouring renewable technology whenever possible, including the production and dissemination of an information leaflet.	Tertiary building managers Business associations	2022 - 2030	250.000 - 500.000 €	574,80	189,66

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction in CO ₂ emissions [t/year]
							2030	
Tertiary buildings	Efficient air conditioning and ventilation systems	Support service Efficient air conditioning and ventilation in tertiary buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in tertiary buildings in terms of air conditioning and ventilation systems.	Tertiary building managers Business associations	2022 - 2030	> 1.000.000 €	10.921,28	3.603,52
Tertiary buildings	Sustainable water management	Water efficiency programme for tertiary services	Carrying out information and awareness-raising actions on water efficiency in tertiary services, including the drafting and dissemination of a guide.	Tertiary building managers Business associations	2025 - 2028	25.000 - 50,000 €	72,68	26,50
Tertiary buildings	Efficient office equipment	Efficient office equipment programme	Carrying out information and awareness-raising actions on the energy efficiency of office equipment, including the drafting and dissemination of a guide.	Tertiary building managers Business associations	2022 - 2030	250.000 - 500,000 €	2.946,34	1.087,20
Tertiary buildings	Awareness-raising education and climate sustainability	Sensitisation of entities with tertiary service activities	Promote awareness-raising actions among entities with tertiary service activities, with the aim of promoting behavioural changes that translate into effective reductions in energy consumption.	Tertiary building managers Business associations	2022 - 2030	25.000 - 50,000 €	311,34	114,88
Tertiary buildings	Optimising professional performance	Optimising professional performance in tertiary services programme	Carrying out training, awareness-raising and education for energy sustainability for workers in tertiary services who operate energy-consuming tertiary businesses.	Tertiary building managers Business associations	2022 - 2030	25.000 - 50,000 €	148,68	49,13

Municipal buildings

Diagnosis

Considering the Emissions Reference Inventory, the activity of the municipal buildings sector in 2019 accounted for 3% of energy consumption in the municipality (70,467 MWh/year) and 4% of CO₂ emissions (23,500 tCO₂/year). Compared to 2008, in 2019 energy consumption in the sector fell by 75% and CO₂ emissions by 82%, corresponding to the sector with the greatest reductions achieved in this period. However, as mentioned for the tertiary buildings sector, there was a break in the series in the period 2013 - 2014, associated with the revision and updating of the EAC for energy-consuming sectors. This revision may have been associated with the transfer of consumption from the municipal buildings sector to the tertiary buildings sector and, as such, a possible inflation in the sharp decrease in consumption in municipal buildings and the increase in consumption in tertiary buildings.

In the municipal buildings sector there is a predominant consumption of electricity and natural gas.

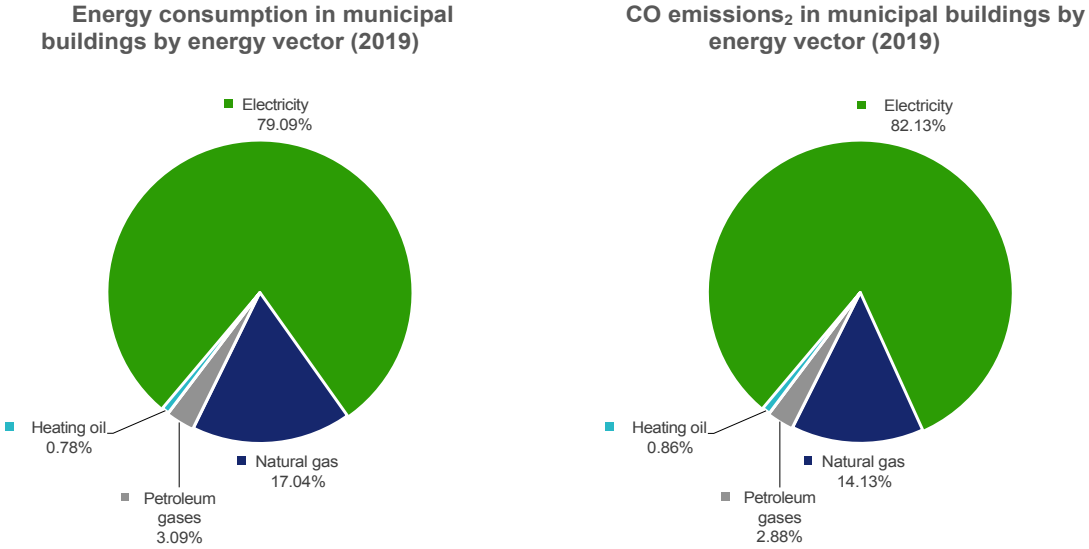


Figure 22 - Energy consumption and CO emissions₂ in the municipal buildings sector, by energy vector, in the Municipality of Braga, in 2019 [MWh/year]

Potential for improving energy sustainability

Taking the sector diagnosis presented as a reference, it is considered that the municipal buildings sector still has an additional potential to reduce CO₂ emissions in the 2019 - 2030 period by 12 per cent compared to the current scenario (year 2019).

Table 13 - Potential CO emission reductions₂ in the period 2019 - 2030 in the municipal buildings sector by 2030.

	CO ₂ emission reduction potential in the period 2019 - 2030
Municipal buildings	12%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 14 - Energy sustainability measures to be implemented in the municipal buildings sector by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year] 2030	Reduction of CO ₂ Emissions [t/year]
Municipal buildings	Efficient lighting in buildings	More Energy Efficient Lighting	Implementation of efficient lighting solutions in municipal buildings.	Municipal building managers	2018 - 2025	500,000 - 750,000€	35,23	13,00
Municipal buildings	Energy audits, efficient construction and building certification	Energy certification of municipal buildings	Establishing and prioritising intervention measures in the field of energy efficiency and renewable energies, according to a cost-benefit analysis of the measures that can be implemented, and within the framework of the requirements of national energy performance regulations for commercial and service buildings, trying to achieve 100% auditing and certification of the building stock.	Municipal building managers	2021 - 2030	< 10,000€	19,78	6,00
Municipal buildings	Energy audits, efficient construction and building certification	Repairs and improvements to municipal buildings	Conservation and energy improvement of municipal buildings, namely: Refurbishment of the Dr Francisco Sanches multipurpose building, Refurbishment of the Horto - Municipal Yard, Refurbishment of the S. Vitor council headquarters, Central Bus Station - improvement work, Conservation and maintenance of the Pópulo building and the Nogueira Citizen's Space.	Municipal building managers	2016-2027	2.171.800 €	412,12	125,00
Municipal buildings	Energy audits, efficient construction and building certification	Conservation of school equipment	Energy upgrading of the following school facilities: Maximinos Secondary School, Gualtar School, Nogueira EB1 School, Fraião EB1 School, Bairro Económico EB1 School - integrate JI B. Augusta - School Centre, Escola EB1 Este de S.	School equipment managers	2016-2027	4.255.000 €	286,84	87,00

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction in CO ₂ emissions [t/year]
								2030
			Pedro, Figueiredo Basic School, EB1 Ponte Pedrinha - Maximinos, EB1 Padim da Graça in CE - Integrate JI, JI de Gualtar, EB1 Quinta da Veiga School, EB23 Mosteiro e Cávado - Extension (articulated teaching), EB de Panoias - extension (articulated teaching), EB1 Ortigueira - Covered playground and improvements, Improvements to Sequeira Basic School, Improvements to Escudeiros School, Improvements to Carrascal EB, EB Bairro da Alegria - Covered playground and improvements					
Municipal buildings	Energy audits, efficient construction and building certification	Increased energy performance in refurbishments and new municipal service buildings	Creation of more demanding requirements for the construction of new municipal buildings, or in major refurbishments of existing municipal buildings, complying with the NZEB (<i>Net Zero Energy Building</i>) obligation from 1 January 2019, in accordance with the provisions of Decree-Law 118/2013 on the energy performance of buildings.	Municipal building managers	2021 - 2030	10,000 -25,000€	32,97	10,00
Municipal buildings	Energy audits, efficient construction and building certification	Energy Neutrality in Municipal Buildings	Contribute to energy neutrality in existing municipal buildings by purchasing more efficient equipment.	Municipal building managers	2018 - 2020	100.000 €	112,10	34,00
Municipal buildings	Open energy management systems	Implementation of an Integrated Centralised Technical Management System for Municipal Buildings	Introduction of Centralised Technical Management Systems in municipal buildings, in order to manage the municipal building stock in an integrated manner and to harness the potential of	Municipal building managers	2021 - 2030	100,000 -250,000€	1.849,59	615,65

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
			the energy efficiency of intelligent management.					
Municipal buildings	Integrated renewable generation	Integrated renewable generation in municipal companies	Implementation of renewable energy production units for self-consumption in water supply services	Managers of municipal companies	2022 - 2030	500,000 - 750,000€	621,75	229,42
Municipal buildings	Sustainable water management	Water efficiency plan for sports facilities	Drawing up a water efficiency plan for sports facilities and implementing solutions to improve water efficiency, such as flow reducers, automatic taps, among other solutions with potential for application in schools under municipal management.	Sports equipment managers	2023 - 2026	10,000 - 25,000€	114,49	41,74
Municipal buildings	Sustainable water management	Water efficiency plan for other municipal buildings	Drawing up a water efficiency plan for schools and other municipal buildings and implementing solutions to improve water efficiency, such as flow reducers, automatic taps and other solutions with potential for application in schools under municipal management.	Managers of schools and other municipal buildings	2023 - 2026	10,000 - 25,000€	49,07	17,89
Municipal buildings	Awareness-raising and education for climate sustainability	Sensitisation of Municipal Entities	Promote awareness-raising actions among municipal entities, such as municipal companies and parish councils, with the aim of promoting behavioural changes that translate into effective reductions in energy consumption.	Municipal building managers	2021 - 2030	10,000 - 25,000€	88,22	32,55
Municipal buildings	Green public procurement	Public Procurement	Establish high energy performance requirements for public purchases of equipment	Municipal building managers	2021 - 2030	250,000 - 500,000€	1.194,42	440,74

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
(where applicable).								
Municipal buildings	Optimising professional performance	Optimising professional performance in municipal services programme	Carrying out training, awareness-raising and education for energy sustainability for employees of municipal services that operate energy-consuming equipment.	Municipal building managers	2023 - 2026	<10,000€	41,23	12,94
Municipal buildings	Other actions to improve energy sustainability	Other actions to improve energy sustainability in municipal buildings	Implementation of energy efficiency solutions and optimisation of climate sustainability.	Municipal building managers	2008 - 2020	50,000,000 - 100,000,000€	52.826,07	19.202,82

Agriculture and fisheries

Diagnosis

Considering the Reference Emissions Inventory, in 2019 the agriculture and fisheries sector accounted for 1% of the municipality's energy consumption (24,416 MWh/year) and 1% of CO₂ emissions (4,298 tCO₂/year). Compared to 2008, in 2019 energy consumption in the sector fell by 22% and CO₂ emissions by 26%.

In this sector there is a predominant consumption of petroleum products, namely diesel.

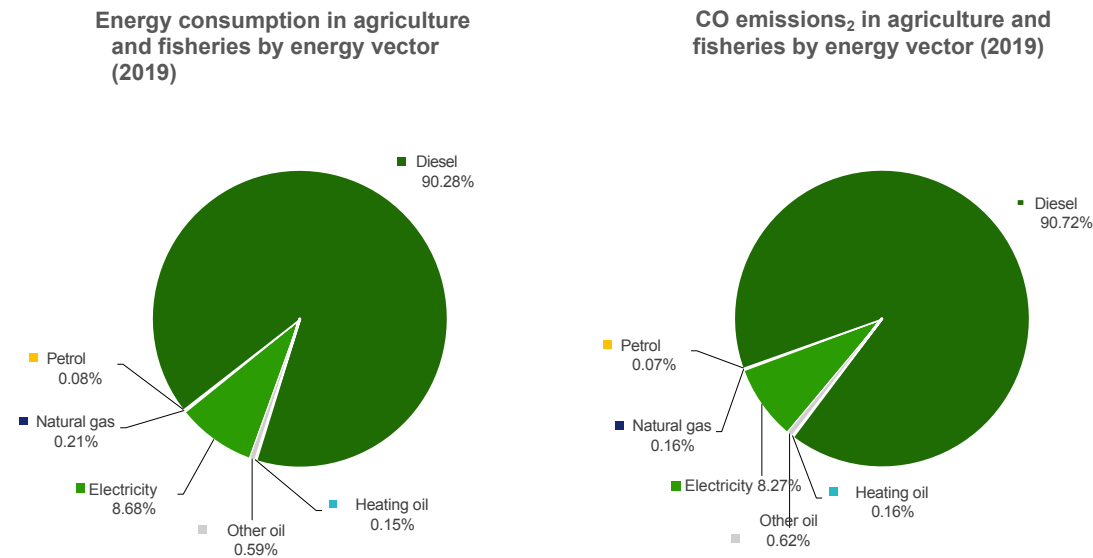


Figure 23 - Energy consumption and CO emissions₂ in the agriculture and fisheries sector, by energy vector, in the Municipality of Braga, in 2019 [MWh/year]

Maximum potential for improving energy sustainability

Taking the diagnosis of the sector presented as a reference, it is considered that the agriculture and fisheries sector still has an additional potential for reducing CO₂ emissions in the period 2019 - 2030 of 10 per cent, compared to the current scenario (year 2019).

Table 15 - Potential CO emission reductions₂ in the period 2019 - 2030 in the agriculture and fisheries sector by 2030.

	CO ₂ emission reduction potential in the period 2019 - 2030
Agriculture and fisheries	10%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 16 - Energy sustainability measures to be implemented in the agriculture and fisheries sector by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
Agriculture and Fisheries	Open energy management systems	Optimisation of professional performance in agricultural activities programme	Carrying out training and information actions to encourage the use of open energy management systems and <i>smart metering</i> in relevant agricultural activities	Agricultural and business co-operatives and associations	2022 - 2025	25.000 - 50.000 €	520	149
Agriculture and Fisheries	Efficient industrial equipment and processes	Good agricultural practices programme	Creation of a programme to provide information and share good practices in energy sustainability in the agricultural sector, including the drafting and dissemination of guides.	Agricultural and business co-operatives and associations	2022 - 2030	25.000 - 50.000 €	196	54
Agriculture and Fisheries	Efficient industrial equipment and processes	Agricultural investment support service	Creation of a service to publicise funding opportunities and support the preparation of applications for the purchase of equipment and the implementation of sustainable industrial/agricultural processes.	Agricultural and business co-operatives and associations	2023 - 2030	50.000 - 100.000 €	588	163
Agriculture and Fisheries	Optimising professional performance	Optimising professional performance in agricultural activities programme	Training, awareness-raising and education for energy sustainability for workers in the agricultural sector who operate energy-consuming vehicles or equipment.	Agricultural and business co-operatives and associations	2023 - 2026	25.000 - 50.000 €	16	4

Public lighting

Diagnosis

Considering the Emissions Reference Inventory, in 2019 public lighting accounted for less than 1% of energy consumption (15,414 MWh/year) and less than 1% of CO₂ emissions (3,900 tCO₂/year). Compared to 2008, in 2019 energy consumption in the sector fell by 10% and CO₂ emissions by 24%. This sector consumes only electricity.

Maximum potential for improving energy sustainability

Taking the sector diagnosis presented as a reference, it is considered that the public lighting sector still has an additional potential to reduce CO₂ emissions in the 2019 - 2030 period by 10 per cent compared to the current scenario (2019).

Table 17 - Potential for reducing CO emissions₂ in the period 2019 - 2030 in the public lighting sector by 2030.

	CO ₂ emission reduction potential in the period 2019 - 2030
Public lighting	10%

Sustainability measures

Based on the sector diagnosis presented and the maximum potential for improving energy sustainability, the actions proposed in the following table have been identified.

Table 18 - Energy sustainability measures to be implemented in the public lighting sector by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction of CO ₂ Emissions [t/year]
							2030	
Public lighting	Optimised street lighting management	Smart street lighting	Implementation of an optimised public lighting management system, covering 100% of luminaires, aimed at managing, monitoring and controlling the quality of public lighting, including automatic activation/deactivation and management of the luminous flux of the IP network according to lighting needs at each point in the territory and time period.	Public lighting managers	2022 - 2030	500.000 - 1,000,000 €	5.108,44	1.885,01
Public lighting	LED and efficient luminaires in street lighting	Refurbishment and upgrading of lighting networks (2nd phase)	LEDs and efficient luminaires in street lighting	Public lighting managers	2018 - 2025	250.000 - 500,000 €	29,81	11,00
Public lighting	Other actions to improve energy sustainability	Efficient street lighting (1st phase)	Implementation of LEDs and efficient luminaires and optimisation of the public lighting network.	Public lighting managers	2008 - 2020	> 1.000.000 €	5.020,00	4.069,00

Cross-cutting actions

Sustainability measures

In addition to the implementation of sectoral measures, cross-cutting actions were identified, as shown below.

Table 19 - Cross-cutting energy sustainability measures to be implemented by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction in CO ₂ emissions [t/year]
							2030	
Transversal action	Innovation lab	Implementation of the Urban Laboratory	Creation of the Urban Laboratory facilities in the Castle Building. Creation of the urban control and management room, aimed at supporting the development, validation and testing of new technologies, services and their applications in a real context, with a view to reducing greenhouse gas (GHG) emissions and carbon intensity from activities and services, implementing mobility measures to reduce traffic congestion, as well as characterising the behaviour and lifestyles of the population.	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2023	160.000 €	0,00	0,00
Transversal action	Carbon sequestration	Florestar Braga	Implementation of an environmental awareness programme involving the whole community in planting trees throughout the municipality.	Cultural and recreational associations Environmental associations Business associations Schools	2014 - 2030	99.429 €	0,00	1.103,76
Transversal action	Carbon sequestration	Oxygenating Braga	Implementation of an environmental awareness programme involving the whole community in the planting of fruit and riparian trees throughout the municipality.	Cultural and recreational associations Environmental associations Business associations Schools	2014 - 2030	8.500 €	0,00	12,63
Transversal action	Carbon sequestration	Caring for Braga I and II	Implementation of an environmental awareness programme involving forest and farm owners, avoiding the burning of leftovers, and	Parish Councils Alto Agricultural Co-operative	2020 - 2030	222.061 €	0,00	126,40

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption [MWh/year]	Reduction in CO ₂ emissions [t/year]
							2030	
			promoting the production of biofuels in the municipality.	Cávado (Cavagri) Forest and agricultural owners				
Transversal action	Integrated renewable generation	Assessment of the photovoltaic potential of buildings in the municipality	Evaluate the locations with the highest energy production resulting from the installation of photovoltaic panels and promote their implementation. The aim is also to assess the potential of installing photovoltaic panels with "bio-roofs" or green roofs. This solution, which can be adapted to different types of roofs, not only improves the aesthetics of the building, but also makes the photovoltaic panels more efficient by cooling the equipment with vegetation during the hottest months.	Cultural and recreational associations Environmental associations Business associations Condominium managers Residents' associations Schools	2021 - 2030	> 1.000.000 €	164.465,00	60.687,59
Transversal action	Urban sustainability management	Sustainable Energy Task Force	Creation of a working group to monitor Braga's energy performance from the main <i>stakeholders</i> . The PAESC will be the main monitoring tool and the Sustainability Report will be the final management tool.	Cultural and recreational associations Environmental associations Business associations Schools	2021 - 2022	0 €	0,00	0,00
Transversal action	Other actions to improve energy sustainability	Other actions to improve energy sustainability in terms of urban management and land use	Study and implementation of additional actions to improve energy sustainability in terms of urban management and land use, focusing on innovation for decarbonisation.	Cultural and recreational associations Environmental associations Business associations Schools	2022 - 2030	> 1.000.000 €	189.170,06	69.803,75

Global impacts on CO₂

The implementation of the sustainability measures proposed above will enable the municipality to achieve the CO₂ emissions reduction target it has set itself, as shown in Table 20.

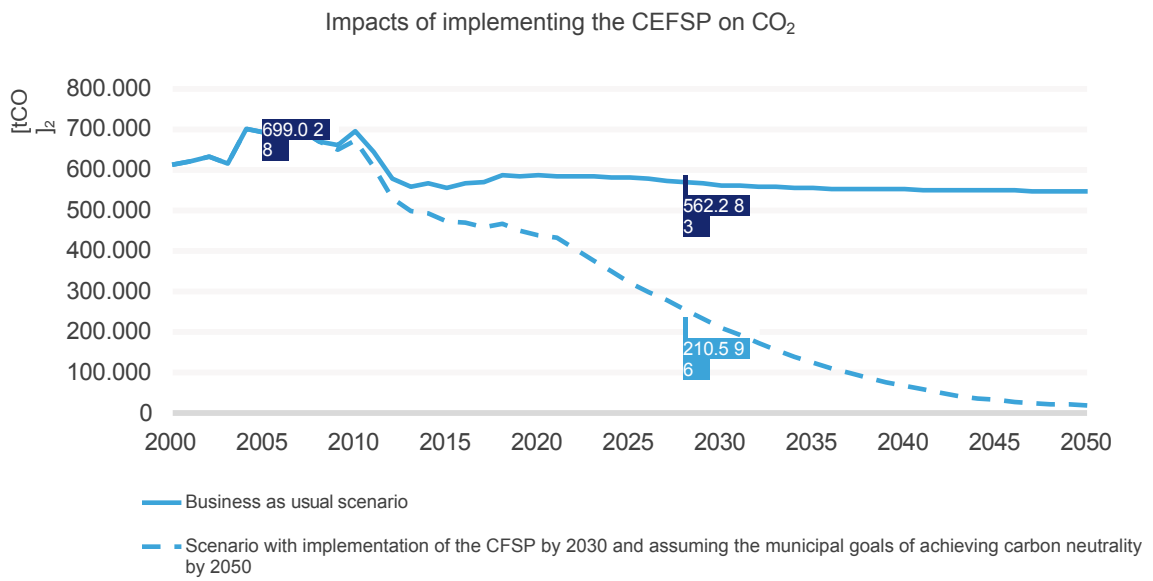
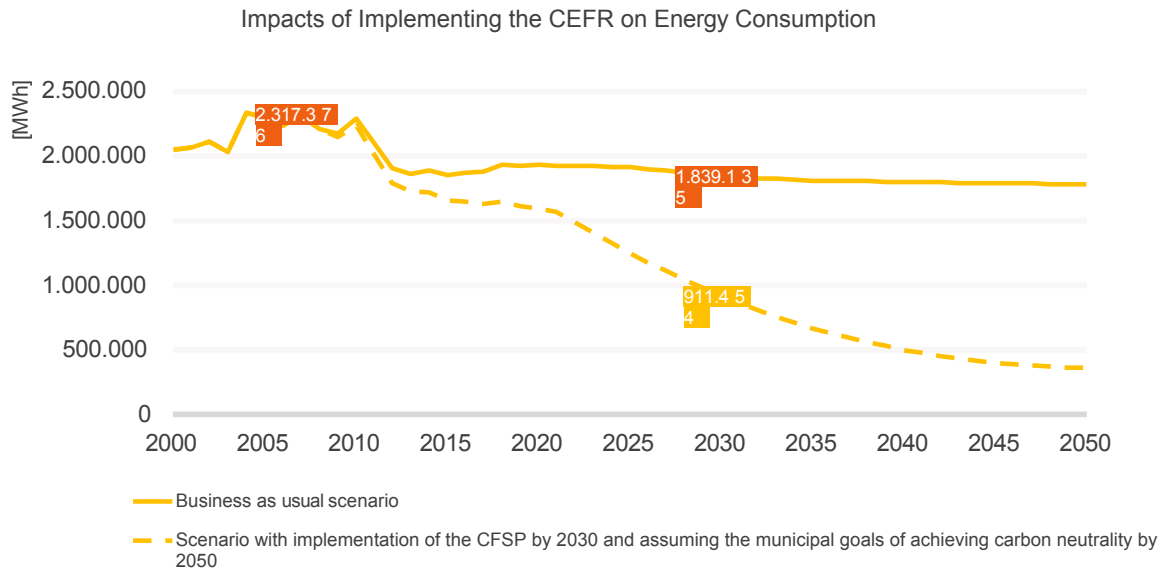
Table 20 - Summary table of the reductions achieved by implementing energy sustainability measures, with reference to 2008.

	Reductions relative to the reference scenario (year 2008)
Energy consumption	42%
CO ₂ emissions	56%

Figure 24 illustrates the impact of implementing the ESCP on the evolution of energy consumption resulting from the municipality's activities, and the respective CO₂ emissions, up to the year 2030.

For the period after 2030, it is assumed that there will continue to be a downward trend in energy consumption and respective CO₂ emissions, as a result of pursuing the municipal strategy of achieving carbon neutrality by 2050.

Figure 24 - Impacts of implementing the EEAP by 2030 and the municipal targets of achieving carbon neutrality by 2050 on energy consumption and CO₂ emissions in the Municipality of Braga in 2020 - 2050 [MWh/year].



Management, Monitoring and Follow-up

Implementation of the CEFSP

As part of the process of managing and monitoring the implementation of the PAESC, the municipality of Braga set up a Working Group (GT PAESC) to assess progress in implementing the PAESC and the results achieved, and to plan new steps. This Working Group is made up not only of members of Braga City Council, but also representatives of the main *Stakeholders*, with the aim of listening to and consulting on the drafting of the PAESC, and should organise quarterly evaluation and planning meetings.

With the aim of developing and validating new technologies, services and applications to reduce greenhouse gas emissions and carbon intensity in the municipality, Braga has created the Urban Laboratory. This laboratory will enable the collection and analysis of data to characterise urban activity, which is fundamental for supporting sustainability management in the territory.

Monitoring the progress made in implementing the CFSP is essential, both in terms of monitoring the implementation process and the results achieved. As such, the Working Group will be in charge of the process of monitoring the implementation of the CFSP. This process will be carried out on the basis of a set of monitoring indicators:

- Sector-specific indicators for monitoring the implementation of energy sustainability measures: relating to the sectoral evaluation and monitoring of the implementation of the CEFSP, making it possible to characterise the progress made in terms of energy consumption and emissions reductions in each sector;
- Indicators for monitoring the implementation of specific energy sustainability measures per measure: these aim to quantify the results obtained in each energy sustainability measure and the respective state of implementation, in order to verify the progress made in meeting the proposed targets.

These indicators make it possible to monitor the state of implementation of energy sustainability measures and are shown in the figure below.

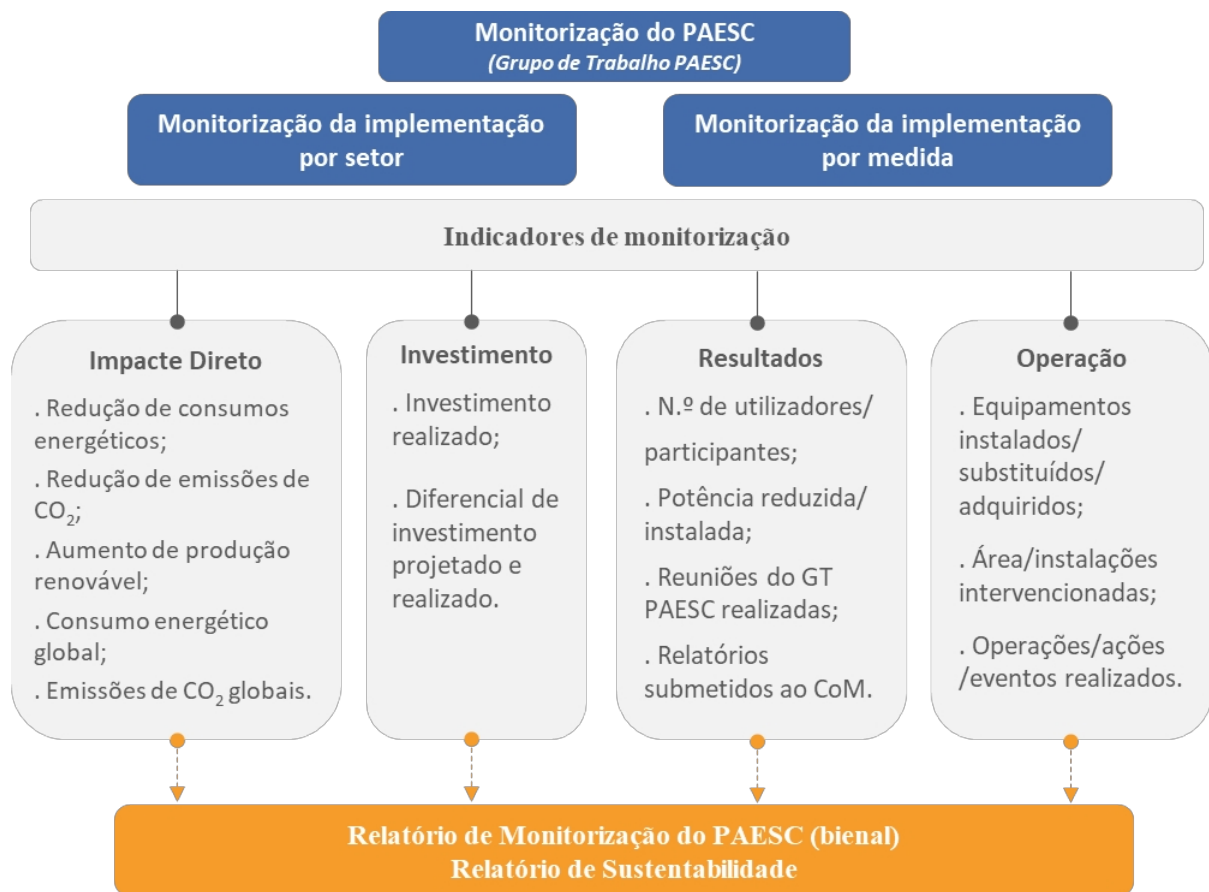


Figure 25 - Summary of the methodology to be adopted for monitoring the CEFSP

Final grade

The Municipality of Braga has developed strategies and actions to promote energy and climate sustainability in the territory, thus seeking to make a significant contribution to the preservation of natural resources while minimising impacts on the environment.

Within the framework of the Sustainable Energy and Climate Action Plan, a number of sustainability measures have been defined, the implementation of which will enable the commitment made with the signing of the Covenant of Mayors for Climate and Energy to be fulfilled and the strategic municipal objectives to be achieved, namely a 55 per cent reduction in Greenhouse Gases by 2030.

The implementation of the proposed solutions should respond, through its components, functionalities and constituent instruments, to the following processes:

- Reducing energy and carbon intensity;
- Articulation of solutions aimed at reducing energy intensity and GHG emissions, promoting improved quality of life, sustainability, economic competitiveness and equal opportunities.

In order to achieve the ambitious goals that the municipality has set itself, it is essential to mobilise public and private initiative around the objectives of improving energy and climate sustainability, especially in terms of strengthening the competitiveness and innovation of energy services markets and involving the population and social, institutional and economic fabrics in meeting targets for reducing energy intensity and greenhouse gas emissions in the area covered.

The initiatives developed by the Municipality, together with the drafting of this Sustainable Energy and Climate Action Plan, consolidate a message and a plan to set a course towards sustainable development.

This plan aims to leverage more initiatives in the area of sustainability, promoting the mobilisation of resources in order to build an increasingly inclusive and sustainable territory. The municipality thus intends to encourage public and private initiatives to improve energy sustainability and increase the participation of the population and social agents in the fulfilment of energy reduction and carbon intensity targets.



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Other information

ADENE: www.adene.pt

APA: www.apambiente.pt

Braga City Council: <https://www.cm-braga.pt/pt> INE:
www.ine.pt

Covenant of Mayors: www.pactodeautarcas.eu

Portugal2020: www.portugal2020.pt/Portal2020

Technical information

For reasons inherent to the calculation system, the balance is subject to rounding, so the last figure is not significant.

Technical Annex

Reference emissions inventory

The baseline scenario corresponds to the state of energy demand and carbon dioxide (CO₂) emissions before the plan was drawn up, and is the necessary reference basis for drawing up the scenarios of predicted developments up to 2030.

The following table summarises the main results of the reference emissions inventory for 2008.

Table 21 - Energy consumption in 2008, by subsector and energy vector

Category	FINAL ENERGY CONSUMPTION [MWh]																Total
	Electricity	Heat/cold	Fossil fuels								Renewable energies						
			Natural gas	Liquefied gas	Heating oil	Diesel	Petrol	Linhte	Coal	Other fuels fossils	Vegetable oils	Biofuels	Other forms of biomass	Solar thermal	Geothermal energy		
BUILDINGS, EQUIPMENT/INSTALLATIONS AND INDUSTRIES																	
Municipal buildings and equipment/facilities	47050	0	15303	2667	2029	3418	0	0	0	0	0	0	0	0	0	0	70467
Tertiary (non-municipal) buildings and facilities	199117	0	27968	13440	51036	1519	171	0	0	2506	0	62	0	1298	0	297116	
Residential buildings	207991	0	72150	156256	9612	0	0	0	0	0	0	0	229008	3893	678910		
Municipal street lighting	20434	0	0	0	0	0	0	0	0	0	0	0	0	0	20434		
Industries (not covered by the European Emissions Trading Scheme - ETS)	149056	0	98817	22162	2079	114613	69	0	0	14321	0	307	0	0	401425		
Industries (covered by the European Emissions Trading Scheme - ETS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Subtotal	623647	0	214238	194526	64757	119549	240	0	0	16827	0	369	229008	5191	1468352		
TRANSPORT																	
Transport subtotal	98	0	8051	3718	0	684435	246934	0	0	0	0	3617	0	0	946853		
OTHER																	
Agriculture	3338	0	0	0	0	27477	0	0	0	526	0	0	0	0	31342		
Total	627083	0	222290	198243	64757	831461	247174	0	0	17353	0	3986	229008	5191	2446547		

Table 22 - CO emissions₂ in 2008, by subsector and energy vector

Category	CO ₂ EMISSIONS [t]/ CO ₂ EQUIVALENT EMISSIONS [t]																
	Electricity	Heat/cold	Fossil fuels								Renewable energies					Total	
			Natural gas	Liquefied gas	Heating oil	Diesel	Petrol	Lignite	Coal	Other fuels s fossils	Vegetable oils	Biofuels	Other forms of biomass	Solar thermal	Geothermal energy		
BUILDINGS, EQUIPMENT/INSTALLATIONS AND INDUSTRIES																	
Municipal buildings and equipment/facilities	18349	0	3091	605	542	912	0	0	0	0	0	0	0	0	0	0	23500
Tertiary (non-municipal) buildings and facilities	77656	0	5649	3051	13627	406	43	0	0	698	0	0	0	0	0	0	101129
Residential buildings	81116	0	14574	35470	2567	0	0	0	0	0	0	0	0	0	0	0	133727
Municipal street lighting	7969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7969
Industries (not covered by the European Emissions Trading Scheme - ETS)	58132	0	19961	5031	555	30602	17	0	0	3989	0	0	0	0	0	0	118287
Industries (covered by the European Emissions Trading Scheme - ETS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	243222	0	43276	44157	17290	31920	60	0	0	4687	0	0	0	0	0	0	384612
TRANSPORT																	
Transport subtotal	38	0	1626	844	0	182744	61487	0	0	0	0	0	0	0	0	0	246739
OTHER																	
Agriculture	1302	0	0	0	0	7336	0	0	0	146	0	0	0	0	0	0	8784
Total	244563	0	44903	45001	17290	222000	61546	0	0	4833	0	0	0	0	0	0	640137

Emissions monitoring inventory

The monitoring inventory uses the energy matrix and the CO₂ emissions matrix as tools.

The following table summarises the main results of the emissions monitoring inventory for 2019.

Table 23 - Energy consumption in 2019, by subsector and energy vector

Category	FINAL ENERGY CONSUMPTION [MWh]																
	Electricity	Heat/cold	Fossil fuels								Renewable energies					Total	
			Natural gas	Liquefied gas	Heating oil	Diesel	Petrol	Linhite	Coal	Other fuels fossils	Vegetable oils	Biofuels	Other forms of biomass	Solar thermal	Geothermal energy		
BUILDINGS, EQUIPMENT/INSTALLATIONS AND INDUSTRIES																	
Municipal buildings and equipment/facilities	13952	0	3007	544	138	0	0	0	0	0	0	0	0	0	0	0	17641
Tertiary (non-municipal) buildings and facilities	262260	0	66531	8651	9252	0	0	0	0	0	0	0	0	0	5965	0	352659
Residential buildings	209569	0	137958	65076	15060	8932	0	0	0	0	0	0	157743	9774	0	0	604112
Municipal street lighting	15414	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15414
Industries (not covered by the European Emissions Trading Scheme - ETS)	175367	0	139362	3857	612	49998	0	0	0	1592	0	0	0	0	0	0	370786
Industries (covered by the European Emissions Trading Scheme - ETS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	676562	0	346858	78128	25062	58930	0	0	0	1592	0	0	157743	15739	0	0	1360613
TRANSPORT																	
Transport subtotal	674	0	1539	3730	0	538174	168484	0	0	0	0	53817	0	0	0	0	766417
OTHER																	
Agriculture	2120	0	52	0	38	22042	19	0	0	145	0	0	0	0	0	0	24416
Total	679356	0	348448	81857	25100	619146	168503	0	0	1736	0	53817	157743	15739	0	0	2151446

Table 24 - CO emissions₂ in 2019, by subsector and energy vector

Category	CO ₂ EMISSIONS [t] / CO ₂ EQUIVALENT EMISSIONS [t]																
	Electricity	Heat/cold	Fossil fuels								Renewable energies					Total	
			Natural gas	Liquefied gas	Heating oil	Diesel	Petrol	Linhite	Coal	Other fuels & fossils	Vegetable oils	Biofuels	Other forms of biomass	Solar thermal	Geothermal energy		
BUILDINGS, EQUIPMENT/INSTALLATIONS AND INDUSTRIES																	
Municipal buildings and equipment/facilities	3530	0	607	124	37	0	0	0	0	0	0	0	0	0	0	0	4298
Tertiary (non-municipal) buildings and facilities	66352	0	13439	1964	2470	0	0	0	0	0	0	0	0	0	0	0	84225
Residential buildings	53021	0	27868	14772	4021	2385	0	0	0	0	0	0	0	0	0	0	102067
Municipal street lighting	3900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3900
Industries (not covered by the European Emissions Trading Scheme - ETS)	44368	0	28151	875	163	13349	0	0	0	0	443	0	0	0	0	0	87350
Industries (covered by the European Emissions Trading Scheme - ETS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	171170	0	70065	17735	6692	15734	0	0	0	0	443	0	0	0	0	0	281840
TRANSPORT																	
Transport subtotal	170	0	311	847	0	143692	41952	0	0	0	0	0	0	0	0	0	186973
OTHER																	
Agriculture	536	0	10	0	10	5885	5	0	0	0	40	0	0	0	0	0	6487
Total	171877	0	70387	18582	6702	165312	41957	0	0	0	484	0	0	0	0	0	475300

CO emission factors₂

The following table shows the *standard* CO₂ emission factors, in line with IPCC principles, for the years 2008 and 2019, for each of the energy carriers considered.

Table 25 - CO emission factors₂ in 2008 and 2019, by energy vector.

Category	CO ₂ EMISSION FACTORS [t/MWh]														
	Electricity	Heat/cold	Fossil fuels								Renewable energies				
			Natural gas	Liquefied gas	Heating oil	Diesel	Petrol	Linhite	Coal	Other fuels fossils	Vegetable oils	Biofuels	Other forms of biomass	Solar thermal	Geothermal energy
Year 2008	0,360	-	0,202	0,227	0,267	0,267	0,249	-	-	-	0,279	0,000	0,000	0,000	0,000
Year 2019	0,253	-	0,202	0,227	0,267	0,267	0,249	-	-	-	0,279	0,000	0,000	0,000	0,000

Sustainability measures

The following table compiles all the energy sustainability measures to be implemented by 2030 and their estimated reduction in energy consumption and CO₂ emissions.

Table 26 - Compilation of energy sustainability measures to be implemented by 2030 and respective estimated reduction in energy consumption and CO emissions₂.

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Municipal buildings	Efficient lighting in buildings	More Energy Efficient Lighting	Implementation of efficient lighting solutions in municipal buildings.	Municipal building managers	2018 - 2025	500,000 - 750,000€	35,23	13,00
Municipal buildings	Energy audits, efficient construction and building certification	Energy certification of municipal buildings	Establishing and prioritising intervention measures in the field of energy efficiency and renewable energies, according to a cost-benefit analysis of the measures that can be implemented, and within the framework of the requirements of national energy performance regulations for commercial and service buildings, trying to achieve 100% auditing and certification of the building stock.	Municipal building managers	2021 - 2030	< 10,000€	19,78	6,00
Municipal buildings	Energy audits, efficient construction and building certification	Repairs and improvements to municipal buildings	Conservation and energy improvements to municipal buildings, namely: refurbishment of the Dr Francisco Sanches multipurpose building, refurbishment of the Horto - Municipal Yard, refurbishment of the S. Vitor council headquarters, Central de Camionagem - refurbishment work, conservation and maintenance of the Pópulo building and Espaço de Cidadão de	Municipal building managers	2016-2027	2.171.800 €	412,12	125,00

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
			Nogueira					
Municipal buildings	Energy audits, efficient construction and building certification	Conservation of school equipment	Energy upgrading of the following school facilities: Maximinos Secondary School, Gualtar School, Nogueira EB1 School, Fraião EB1 School, Bairro Económico EB1 School - integrate JI B. Augusta - Centro Escolar, Escola EB1 Este de S. Pedro, Escola Básica de Figueiredo, EB1 Ponte Pedrinha - Maximinos, EB1 Padim da Graça em CE - Integrate JI, JI de Gualtar, Escola EB1 da Quinta da Veiga, EB23 Mosteiro e Cávado - Expansion (articulated teaching), EB de Panoias - expansion (articulated teaching), EB1 Ortigueira - Covered playground and improvements, Improvements to Sequeira Basic School, Improvements to Escudeiros School, Improvements to Carrascal EB, EB Bairro da Alegria - Covered playground and improvements	School equipment managers	2016-2027	4.255.000 €	286,84	87,00
Municipal buildings	Energy audits, efficient construction and building certification	Increased energy performance in refurbishments and new municipal service buildings	Creation of more demanding requirements for the construction of new municipal buildings, or in major refurbishments of existing municipal buildings, complying with the NZEB (<i>Net Zero Energy Building</i>) obligation from 1 January 2019, in accordance with the provisions of Decree-Law 118/2013 on the energy performance of buildings.	Municipal building managers	2021 - 2030	10,000 - 25,000€	32,97	10,00

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Municipal buildings	Energy audits, efficient construction and building certification	Energy Neutrality in Municipal Buildings	Contribute to energy neutrality in existing municipal buildings by purchasing more efficient equipment.	Municipal building managers	2018 - 2020	100.000 €	112,10	34,00
Municipal buildings	Open energy management systems	Implementation of an Integrated Centralised Technical Management System for Municipal Buildings	Introduction of Centralised Technical Management Systems in municipal buildings, in order to manage the municipal building stock in an integrated manner and to harness the energy efficiency potential of intelligent management.	Municipal building managers	2021 - 2030	100,000 - 250,000€	1.849,59	615,65
Municipal buildings	Integrated renewable generation	Integrated renewable generation in municipal companies	Implementation of renewable energy production units for self-consumption in water supply services	Managers of municipal companies	2022 - 2030	500,000 - 750,000€	621,75	229,42
Municipal buildings	Sustainable water management	Water efficiency plan for sports facilities	Drawing up a water efficiency plan for sports facilities and implementing solutions to improve water efficiency, such as flow reducers, automatic taps, among other solutions with potential for application in schools under municipal management.	Sports equipment managers	2023 - 2026	10,000 - 25,000€	114,49	41,74
Municipal buildings	Sustainable water management	Water efficiency plan for other municipal buildings	Drawing up a water efficiency plan for schools and other municipal buildings and implementing solutions to improve water efficiency, such as flow reducers, automatic taps and other solutions with potential for application in schools under municipal management.	Managers of schools and other municipal buildings	2023 - 2026	10,000 - 25,000€	49,07	17,89

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Municipal buildings	Awareness-raising education and for climate sustainability	Sensitisation of Municipal Entities	Promote awareness-raising actions among municipal entities, such as municipal companies and parish councils, with the aim of promoting behavioural changes that translate into effective reductions in energy consumption.	Municipal building managers	2021 - 2030	10,000 - 25,000€	88,22	32,55
Municipal buildings	Green public procurement	Public Procurement	Establish high energy performance requirements for public purchases of equipment (where applicable).	Municipal building managers	2021 - 2030	250,000 - 500,000€	1.194,42	440,74
Municipal buildings	Optimising professional performance	Optimising professional performance in municipal services programme	Carrying out training, awareness-raising and education for energy sustainability for employees of municipal services that operate energy-consuming equipment.	Municipal building managers	2023 - 2026	<10,000€	41,23	12,94
Municipal buildings	Other actions to improve energy sustainability	Other actions to improve energy sustainability in municipal buildings	Implementing energy efficiency solutions and optimising climate sustainability.	Municipal building managers	2008 - 2020	50,000,000 - 100,000,000€	52.826,07	19.202,82
Tertiary buildings	Efficient lighting in buildings	100% sustainable lighting in tertiary services	Carrying out information and awareness-raising actions on the use of sustainable lighting technologies, favouring LED technology whenever possible, including the preparation and dissemination of an information leaflet.	Tertiary building managers Business associations	2022 - 2025	25.000 - 50,000 €	12.365,15	4.562,74
Tertiary buildings	Energy audits, efficient construction and building certification	Support Efficient buildings service tertiary	Creation of a service to publicise funding opportunities and support the preparation of applications for audits	Tertiary building managers Business associations	2022 - 2030	50.000 - 100.000 €	5.904,16	1.948,10

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
			and implementation of solutions to improve energy efficiency in tertiary buildings in terms of insulation, glazing, etc.					
Tertiary buildings	Integrated renewable generation	Photovoltaic for Self-consumption Services	Increased implementation of photovoltaic solar technology systems for self-consumption.	Tertiary building managers Business associations	2021 - 2030	50.000 - 100.000 €	74,57	27,52
Tertiary buildings	Integrated renewable generation	Increasing access to electricity production from renewable sources	Encouraging the formation of producer co-operatives and supporting existing ones	Tertiary building managers Business associations	2021 - 2030	< 10.000 €	8.372,02	3.089,28
Tertiary buildings	Efficient air conditioning and ventilation systems	Efficient air conditioning and ventilation in tertiary buildings programme	Carrying out information and awareness-raising activities on the use of efficient air conditioning and ventilation technologies, favouring renewable technology whenever possible, including the production and dissemination of an information leaflet.	Tertiary building managers Business associations	2022 - 2030	250.000 - 500,000 €	574,80	189,66
Tertiary buildings	Efficient air conditioning and ventilation systems	Support service Efficient air conditioning and ventilation in tertiary buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in tertiary buildings in terms of air conditioning and ventilation systems.	Tertiary building managers Business associations	2022 - 2030	> 1.000.000 €	10.921,28	3.603,52
Tertiary buildings	Sustainable water management	Water efficiency programme for tertiary services	Carrying out information and awareness-raising actions on water efficiency in tertiary services, including the drafting and dissemination of a guide.	Tertiary building managers Business associations	2025 - 2028	25.000 - 50,000 €	72,68	26,50

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Tertiary buildings	Efficient office equipment	Efficient office equipment programme	Carrying out information and awareness-raising actions on the energy efficiency of office equipment, including the drafting and dissemination of a guide.	Tertiary building managers Business associations	2022 - 2030	250.000 - 500,000 €	2.946,34	1.087,20
Tertiary buildings	Awareness-raising and education for climate sustainability	Sensitisation of entities with tertiary service activities	Promote awareness-raising actions among entities with tertiary service activities, with the aim of promoting behavioural changes that translate into effective reductions in energy consumption.	Tertiary building managers Business associations	2022 - 2030	25.000 - 50,000 €	311,34	114,88
Tertiary buildings	Optimising professional performance	Optimising professional performance in tertiary services programme	Carrying out training, awareness-raising and education for energy sustainability for workers in tertiary services who operate energy-consuming tertiary businesses.	Tertiary building managers Business associations	2022 - 2030	25.000 - 50,000 €	148,68	49,13
Residential buildings	Efficient lighting in buildings	100% sustainable lighting in residential buildings	Carrying out information and awareness-raising actions on the use of sustainable lighting technologies, favouring LED technology whenever possible, including the preparation and dissemination of an information leaflet.	Condominium managers Residents' associations Schools	2022 - 2025	25.000 - 50,000 €	23.278,01	8.589,59
Residential buildings	Energy audits, efficient construction and building certification	Support service Efficient residential buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in residential buildings in terms of insulation, glazing, etc.	Condominium managers Residents' associations Schools	2022 - 2030	50.000 - 100.000 €	4.995,30	1.448,83

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Residential buildings	Energy audits, efficient construction and building certification	Increased energy performance in remodelling and new residential buildings	Reduction of urbanisation fees for buildings with Class A or A+, or that have moved up 2 classes during rehabilitation.	Condominium managers Residents' associations Schools	2021-2030	50.000 - 100.000 €	41,37	12,00
Residential buildings	Energy audits, efficient construction and building certification	<i>Bragahabit</i> - Increasing the energy performance of social housing buildings	Development of environmental sustainability terms of reference for social housing in new constructions and major remodelling, with a particular focus on increasing energy performance.	Condominium managers Residents' associations Schools	2018 - 2026	100.000 - 250,000 €	41,37	12,00
Residential buildings	Efficient air conditioning and ventilation systems	Efficient air conditioning and ventilation in residential buildings programme	Carrying out information and awareness-raising activities on the use of efficient air conditioning and ventilation technologies for residential buildings, favouring renewable technology wherever possible, including the preparation and dissemination of an information leaflet.	Condominium managers Residents' associations Schools	2022 - 2030	25.000 - 50,000 €	802,82	232,85
Residential buildings	Efficient air conditioning and ventilation systems	Support service Efficient air conditioning and ventilation in residential buildings	Creation of a service to publicise funding opportunities and support the preparation of applications to carry out energy audits and implement solutions to improve energy efficiency in residential buildings in terms of air conditioning and ventilation systems.	Condominium managers Residents' associations Schools	2022 - 2030	50.000 - 100.000 €	15.253,52	4.424,09
Residential buildings	Sustainable water management	Water efficiency in residential buildings programme	Carrying out information and awareness-raising actions on water efficiency in residential buildings, including the drafting and dissemination of a guide.	Condominium managers Residents' associations Schools	2025 - 2028	25.000 - 50,000 €	1.329,44	363,15

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Residential buildings	Efficient household equipment	Home appliances programme	Carrying out information and awareness-raising actions on the energy efficiency of household appliances, including the drafting and dissemination of a guide.	Condominium managers Residents' associations Schools	2022 - 2030	> 1.000.000 €	7.514,77	2.772,95
Residential buildings	Awareness-raising and education for climate sustainability	Energy efficiency in residential buildings programme	Carrying out information and awareness-raising actions on energy efficiency in residential buildings, including the drafting and dissemination of a guide.	Condominium managers Residents' associations Schools	2022 - 2030	> 1.000.000 €	3.385,05	1.249,08
Residential buildings	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the industrial sector	Implementing energy efficiency solutions and optimising climate sustainability.	Condominium managers Residents' associations Schools	2008 - 2020	> 1.000.000 €	69.476,34	31.660,55
Public lighting	Optimised street lighting management	Smart street lighting	Implementation of an optimised public lighting management system, covering 100% of luminaires, aimed at managing, monitoring and controlling the quality of public lighting, including automatic activation/deactivation and management of the luminous flux of the IP network according to lighting needs at each point in the territory and time period.	Public lighting managers	2022 - 2030	500.000 - 1,000,000 €	5.108,44	1.885,01
Public lighting	LED and efficient luminaires in street lighting	Refurbishment and upgrading of lighting networks (2nd phase)	LEDs and efficient luminaires in street lighting	Public lighting managers	2018 - 2025	250.000 - 500,000 €	29,81	11,00
Public lighting	Other actions to improve energy sustainability	Efficient street lighting (1st phase)	Implementation of LEDs and efficient luminaires and optimisation of the public lighting network.	Public lighting managers	2008 - 2020	> 1.000.000 €	5.020,00	4.069,00

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Industry	Efficient lighting in buildings	100% sustainable lighting in industry	Carrying out information and awareness-raising actions on the use of sustainable lighting technologies, favouring LED technology whenever possible, including the preparation and dissemination of an information leaflet.	Industry and business associations	2022 - 2025	25.000 - 50,000 €	9.084,57	3.352,21
Industry	Solar thermal energy	Solar thermal programme in industry	Creation of an information and best practice sharing programme to promote the use of solar thermal in industrial processes with low/medium temperature heat requirements.	Industry and business associations	2022 - 2030	25.000 - 50,000 €	3.033,97	637,28
Industry	Natural gas	Natural gas in industry programme	Creation of an information and best practice sharing programme to promote the use of natural gas in energy-intensive industrial processes.	Industry and business associations	2022 - 2030	> 1.000.000 €	4.416,65	1.052,87
Industry	Efficient industrial equipment and processes	Good industrial practice programme	Creation of a programme to inform and share good practices in energy sustainability in the industrial sector, including the drafting and dissemination of guides.	Industry and business associations	2022 - 2030	25.000 - 50,000 €	297,09	82,90
Industry	Efficient industrial equipment and processes	Investment support service in the industrial sector	Creation of a service to publicise funding opportunities and support the preparation of applications for the purchase of equipment and the implementation of energy-sustainable industrial processes, particularly for electrification and automation.	Industry and business associations	2022 - 2030	50.000 - 100.000 €	5.644,71	1.575,07

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Industry	Optimising professional performance	Optimising professional performance in industrial activities programme	Carrying out training, awareness-raising and education for energy sustainability for workers in the industrial sector who operate energy-consuming vehicles or equipment.	Industry and business associations	2022 - 2030	25.000 - 50,000 €	204,73	58,73
Industry	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the industrial sector	Implementing energy efficiency solutions and optimising climate sustainability.	Industry and business associations	2008 - 2020	> 1.000.000 €	30.638,17	30.936,32
Transport	Efficient vehicles and fleets	Car Fleet Renewal Plan	Gradual acquisition of efficient vehicles for the municipal fleet, incorporating solutions to optimise vehicle operations.	Municipal fleet managers	2016 - 2027	408.000 €	88,27	23,00
Transport	Efficient vehicles and fleets	Renewal and decarbonisation of the Braga Urban Transport (TUB) fleet	Renewal of the fleet with clean buses by at least 60 per cent compared to 2018, by 2025.	Municipal public transport operator	2021 - 2025	> 1.000.000 €	487,38	127,00
Transport	Electric mobility	Promote public charging of light vehicles	Implementation of public charging points for light electric vehicles, particularly with CCS2 connectors.	Municipal fleet managers	2021 - 2030	10.000 - 25,000 €	42,21	11,00
Transport	Optimising the public transport network	Electric public transport	Gradual replacement of 50 per cent of buses on the public transport network with 100 per cent electric vehicles.	Municipal public transport operator	2022 - 2030	> 1.000.000 €	810,59	3.110,76
Transport	Optimising the public transport network	<i>Bus Rapid Transport</i> (BRT)	Preparation of a preliminary study and implementation of a BRT public transport system, of a high standard and quality, which will operate with road passenger vehicles on a dedicated channel, along fifteen kilometres,	Municipal public transport operator	2019 - 2022	150.000 €	134,53	35,06

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
			with priority at junctions.					
Transport	Optimising the public transport network	Braga Urban Transport (TUB) 100% ecological	Carrying out TUB services at the weekend using environmentally friendly vehicles, offering a 100% ecological mobility service.	Municipal public transport operator	2021 - 2030	0 €	141,99	37,00
Transport	Urban regeneration and optimising the energy and climate aspects of urban planning	Increasing Limited Duration Parking Zones (ZEDL)	Increase of ZEDL in the urban perimeter by at least 25 per cent by 2030.	Municipal technicians	2021 - 2030	25.000 - 50,000 €	134,98	35,17
Transport	Awareness-raising and education for climate sustainability	Raising awareness of sustainable mobility	Carrying out information and awareness-raising activities on the use of more sustainable modes of transport, the purchase of electric vehicles and sustainable driving, including the preparation and dissemination of an information guide.	Cultural and recreational associations Environmental associations Business associations Schools	2022 - 2025	10.000 - 25.000 €	61.136,68	15.930,72
Transport	Increased "pedestrianisation" and bicycle use	Urban insertion of cycling network	Insertion of the cycling network in the urban centre of Braga	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2023	610.000 €	92,10	24,00
Transport	Increased "pedestrianisation" and bicycle use	Implementation of pop-up measures for sustainable mobility	Implementation of the pop-up model of shared lanes between cars and bicycles, a road safety and cycle mobility promotion project. New strategies will be tested for the circulation of bicycles and the network will be connected to the	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2025	25.000 €	90,77	23,65

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
			the city centre, the main schools and other centres that generate mobility through secondary streets.					
Transport	Increased "pedestrianisation" and bicycle use	Cávado River Ecovia	Construction of the section of the Cávado River Ecovia located in the municipality of Braga	Cultural and recreational associations Environmental associations Business associations Schools	2017 - 2025	57.000 €	51,74	13,48
Transport	Increased "pedestrianisation" and bicycle use	Walking Route Network	Construction/upgrading of Braga's network of footpaths, as an important means of highlighting historical eras and the urban and rural culture that come together in Braga, while also emphasising other distinctive factors of a natural and scenic nature.	Cultural and recreational associations Environmental associations Business associations Schools	2019 - 2021	50.000 €	45,39	11,83
Transport	Optimising professional and commuter mobility	Offer discounts on public transport	Offering discounts to municipal employees to encourage them to use public transport.	Municipal technicians	0	500.000 - 1.000.000 €	1.789,37	466,26
Transport	Optimising professional and commuter mobility	Braga Business Mobility Pact - BCSD	Creation of the Braga Business Mobility Pact, promoting business commitment to the transition to sustainable mobility.	Cultural and recreational associations Environmental associations Business associations Schools	2021 - 2030	0 €	214,91	56,00
Transport	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the transport sector	Implementing energy efficiency solutions and optimising climate sustainability.	Municipal technicians	2008 - 2020	> 1.000.000 €	180.435,79	59.766,55

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
Transport	Other actions to improve energy sustainability	Other actions to improve energy sustainability in the transport sector	Study and implementation of additional actions to improve energy sustainability in the transport sector, focusing on innovation for decarbonisation.	Municipal technicians	2022 - 2030	> 1.000.000 €	38.058,67	9.917,15
Transversal action	Carbon sequestration	Florestar Braga	Implementation of an environmental awareness programme involving the whole community in planting trees throughout the municipality.	Cultural and recreational associations Environmental associations Business associations Schools	2014 - 2030	99.429 €	0,00	1.103,76
Transversal action	Carbon sequestration	Oxygenating Braga	63) Implementation of an environmental awareness programme involving the whole community in the planting of fruit and riparian trees throughout the municipality.	Cultural and recreational associations Environmental associations Business associations Schools	2014 - 2030	8.500 €	0,00	12,63
Transversal action	Carbon sequestration	Caring for Braga I and II	64) Implementation of an environmental awareness programme involving forest and farm owners, avoiding the burning of waste and promoting the production of biofuels in the municipality.	Parish councils Alto Cávado Agricultural Cooperative (Cavagri) Forest and farm owners	2020 - 2030	222.061 €	0,00	126,40
Transversal action	Integrated renewable generation	Assessment of the photovoltaic potential of buildings in the municipality	Evaluate the locations with the highest energy production resulting from the installation of photovoltaic panels and promote their implementation. The aim is also to assess the potential of installing photovoltaic panels with "bio-roofs" or green roofs. This solution, which can be adapted to various types of	Cultural and recreational associations Environmental associations Business associations Condominium managers Property associations	2021 - 2030	> 1.000.000 €	164.465,00	60.687,59

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
			In addition to improving the aesthetics of the building, roofs allow photovoltaic panels to be more efficient, as the vegetation cools the equipment during the hottest months.	residents Schools				
Transversal action	Other actions to improve energy sustainability	Other actions to improve energy sustainability in terms of urban management and land use	Study and implementation of additional actions to improve energy sustainability in terms of urban management and land use, focusing on innovation for decarbonisation.	Cultural and recreational associations Environmental associations Business associations Schools	2022 - 2030	> 1.000.000 €	189.170,06	69.803,75
Agriculture and Fisheries	Open energy management systems	Optimisation of professional performance in agricultural activities programme	Carrying out training and information actions to encourage the use of open energy management systems and <i>smart metering</i> in relevant agricultural activities	Agricultural and business co-operatives and associations	2022 - 2025	25.000 - 50.000 €	520,20	149,08
Agriculture and Fisheries	Efficient industrial equipment and processes	Good agricultural practices programme	Creation of a programme to inform and share good practices in energy sustainability in the agricultural sector, including the drafting and dissemination of guides.	Agricultural and business co-operatives and associations	2022 - 2030	25.000 - 50.000 €	195,89	54,42
Agriculture and Fisheries	Efficient industrial equipment and processes	Agricultural investment support service	Creation of a service to publicise funding opportunities and support the preparation of applications for the purchase of equipment and the implementation of energy-sustainable industrial/agricultural processes.	Agricultural and business co-operatives and associations	2023 - 2030	50.000 - 100.000 €	587,66	163,26
Agriculture and Fisheries	Optimising professional performance	Professional performance optimisation programme in	Carrying out training, awareness-raising and education activities on energy sustainability for employees of the company.	Agricultural and business co-operatives and associations	2023 - 2026	25.000 - 50.000 €	15,98	4,44

Target sector	Energy sustainability measure	Energy sustainability projects	Description	Stakeholders	Execution period	Planned investment [€]	Reduction in consumption in 2030 [MWh/year]	Reducing CO ₂ Emissions 2030 [t/year]
		agricultural activities	agricultural sector that operate energy-consuming vehicles or equipment.					
Total							927.681,20	351.686,71
Total							42%	56%

