NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

Climate City Contract

2030 Climate Neutrality Action Plan

2030 Climate Neutrality Action Plan of Guimarães

Guimarães 2030
Join the Green Transition

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Summary

Summary of the 2030 Climate Neutrality Action Plan of the Municipality of Guimarães

The Municipality of Guimarães developed its 2030 Climate Neutrality Action Plan 2030 (Action Plan) as one of three complementary elements to guide its commitment to Guimarães Vision 2030 and move closer to climate neutrality by 2030.

The Action Plan is a collaboratively created and ever-changing document that will be updated over the years to reflect the reality of the municipality and its changing environment and variables.

It has always been the municipality's goal to link its Vision 2030 for Guimarães and its governance ecosystem with the implementation of an action portfolio that also acknowledges the work of the last decades.

For the process of developing and co-designing the Action Plan, there were several interactions in the municipality with stakeholders, e.g. citizens, associations, industry and business, public and private institutions and universities, to gather inputs for the Action Plan, such as the Guimarães Climate Pact, for which more than 70 signatures were collected, the first round of Rapid Mass Engagement (REM) workshops and sectoral meetings within the Municipality of Guimarães.

In addition, the municipality was supported by experts from the Netzero Cities Consortium (NZC) to engage the industrial sector in the region and include these important actors in the process, as they are responsible for the majority of emissions in Guimarães. In addition, the municipality participated in both Summer Schools (2023) in Milan and Santander organised by the NZC consortium to gather as much knowledge as possible and to network with other municipalities.

It is important to mention that the municipality has engaged with the “capacity building programme building a strong economic case” for the development of its economic case, using the tool developed by the NZC consortium and partners to support the implementation of the planned actions in terms of investments. Meetings were also held with the financial coach appointed by the NZC consortium to refine the investment plan.

Finally, the Guimarães Transition Team met every week to discuss next steps and strategies for the Climate City Contract and met bi-weekly with the city's advisor.

The Action Plan is structured to logically follow the process of developing the Guimarães Action Plan.

It starts with Part A, which consists of the assessment of the greenhouse gas emissions (GHG) emissions, with 2019 as the base year to set the baseline on which the municipality will work, with a gap of 80% (baseline emissions: 592 kt CO_2e; emissions reduction target: 479 kt CO_2e) and 20% of residual emissions, for which the municipality has developed a strategy.

Secondly, the municipality lays the groundwork for the development of the actions, as it explores the current policies, plans, strategies, policies, projects at local, national, and European level that are related to climate change and the social dimension. This provides a holistic overview of what the municipality has done so far and sets the tone for identifying systemic barriers and opportunities.

In Part B, the Municipality of Guimarães developed its approach to the NZC Theory of Change, outlining the pathways that would lead to short- and long-term change, as well as direct impacts, and indirect impacts (co-benefits) associated with the implementation of climate neutrality actions in the following fields of action: energy systems, mobility and transport, built environment, waste and circular economy, green infrastructure and nature-based solutions, industry and cross-cutting actions.

Then, the Municipality of Guimarães moves on to explore the action portfolio, which builds on actions that will be tested in the pilot city of Guimarães – District C, actions that the municipality has already implemented, as well as ambitious actions needed, involving stakeholders in their implementation.

For which action, the municipality developed an indicator that is best suited to measure, evaluate and draw lessons from the implementation of the action, depending on whether it is an action focused on generating a direct or indirect impact.

Finally, Part C complements the Action Plan by describing the governance, organisational and social innovation actions already implemented by the municipality, to support the achievement of the climate neutrality pathway, by engaging the complex environment of stakeholders in the transition.

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Abbreviations and acronyms

Abbreviations and acronyms	Definition
AFOLU	Agricultural, Forestry and Land Use
ARU	Rehabilitation Urban Area
BAU	Business As Usual
CCC	Climate City Contract
CDP	Carbon Disclosure Project
CoM	Covenant of Mayors
DGEG	General Directorate of Energy and Geology
DHW	Domestic Hot Water
EAC	Economic Activity Code
EC	Early Change
EP	Entry Point
ESCO	Energy Service Company
EV	Electric Vehicle
HVAC	Heating, Ventilation and Air Conditioning
GHG	Greenhouse Gas
ICT	Information and Communication Technologies
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Process and Product Use
LED	Light Emitting Diode
LO	Later Outcome
LPG	Liquefied Petroleum Gas
MEL	Monitoring, Evaluation, and Learning
NBS	Nature-Based Solutions
NIR	National Inventory Report
NZC	Net Zero Cities
NZC PCP	Net Zero Cities Pilot City Programme
OAU	Used Cooking Oil
OSS	One-stop-shop

PAYT	Pay-As-You-Throw
REC	Renewable Energy Communities
RES	Renewable Energy Sources
RME	Rapid Mass Engagement
SECAP	Sustainable Energy and Climate Action Plan
TOC	Theory of Change
UNFCCC	United Nations Framework convention on Climate Change
WHO	World Health Organisation

1 Introduction

Introduction

Guimarães through the Climate City Contract (CCC) aims to relish a new way of working with local, regional, and national stakeholders in order to achieve the ambitious goal of climate neutrality by 2030. Having in mind the phases of the Climate Transition Map from Netzero Cities (NZC), the Municipality of Guimarães hopes to create a multi-level integration of stakeholders and emissions domains to break down the conventional silo approach, as well to challenge the business-as-usual approaches.

The 2030 Climate Neutrality Action Plan was developed through co-creation processes that involved the mission Transition Team, where all the partners worked closely together to shape, not only the Action Plan itself, but the Climate City Contract. This process gathered the participation and inputs from stakeholders, namely academia, universities, companies, associations, and citizens.

Guimarães Action Plan is harmonised with the other Climate City Contract components, namely the 2030 Climate Neutrality Commitments and the 2030 Climate Neutrality Investment Plan:

1. 2030 Climate Neutrality Commitment: The Action Plan embodies the climate-neutrality ambition by the municipality and all the stakeholders that embrace this challenge. The Action Plan materialises into actions how to achieve climate neutrality, honouring all the work that has been done, as stated on the 2030 Climate Neutrality Commitment.
2. 2030 Climate Neutrality Investment Plan: The Investment Plan is intimately connected to the Action Plan since mirrors the feasibility and economic viability of the defined actions. Through the mapping of costs and capital needed to achieve the desired goal, the Investment Plan acts as an instrument to the Action Plan as a comprehensive long-term economic and financial strategy aimed at achieving climate neutrality by 2030.

The Municipality of Guimarães intends to align the existing climate actions plans, projects and strategies with the development and consequent implementation of the 2030 Climate Neutrality Action Plan. Regarding the fact that the municipality is a signatory of the EU Covenant of Mayors (EUCoM), has submitted two Sustainable Energy and Climate Action Plans (SECAP) in 2014 and 2016, and has regional and local climate action plans and strategies (e.g., Municipal Strategy for Adaptation to Climate Change Action Plan for Energy and Climate Sustainability), Guimarães intends to integrate and blend elements from the existing sources available, as well to work on and add elements for the 2030 Climate Neutrality Action Plan.

The Municipality of Guimarães is currently pursuing strategies to tackle climate change and reduce greenhouse gas emissions in several areas, which are also covered by the 2030 Climate Neutrality Action Plan: Buildings, Transport, Waste, Industrial Processes and Product Use (IPPU) and Agriculture, Forestry and Land Use (AFOLU).

Current local policies, strategies and plans are considered as a basis to build on the Action Plan and develop a harmonious and coherent approach to climate neutrality. The aim is to fit the Action Plan into the municipality's existing climate change plans and strategies, e.g., Municipal Strategy for Adaptation to Climate Change, and to complement the climate change actions measures already implemented.

In developing the actions, the municipality followed three main directions: District C a zero-carbon commitment (the Guimarães NZC pilot city programme) as a test bed for city-wide implementation; updating current actions and plans; and new actions and strategies from stakeholders. This will ensure that the action plan considers the work and commitments to climate neutrality to date, the first

trial of the District C pilot city activities and their expansion to the whole area, and the actions that have emerged from the interaction and co-design processes with stakeholders.

The Guimarães 2030 Climate Neutrality Action Plan addresses a gap of around 80% of emissions (absolute emissions 2019: 589 297 tCO_2e) that need to be reduced. It considers what has been done so far and what still needs to be done through this plan to achieve climate neutrality by 2030. The plan will focus on buildings and transport sectors, as these are sectors for which the Municipality of Guimarães currently records and reports emissions according to CDP (Carbon Disclosure Project and CoM - Covenant of Mayors) and can have a more direct impact through policy, regulations, incentives, and actions. By involving industry in the process of co-designing the action portfolio, the municipality engages with the agencies responsible for this emission area to address the problem.

However, this does not mean that the Municipality of Guimarães will only take action to close the gap in the buildings and transport sectors. As mentioned above, Guimarães believes that climate neutrality should be approached holistically, encompassing several sectors such as waste, land use, industrial processes, as well citizen awareness and participation.

Knowing that alone the Municipality of Guimarães cannot achieve climate neutrality by 2030, the municipality is committed to building meaningful relationships with stakeholders, from business and industry to associations, organisations, academia, and citizens. These stakeholder groups need to be engaged as they are responsible for a significant proportion of emissions in the municipality and are the ones who will implement actions to address climate change. The municipality, in collaboration with the Landscape Laboratory of Guimarães, considering the existing capacity and the lessons learned throughout the process of involving associations and citizens, efforts have been made to develop a series of co-creation sessions with the private sector. A first series of workshops has been launched to stimulate the joint elaboration of actions to be included in the Action Plan. This is not a one-off event, but an opportunity to foster relationship building between the municipality and stakeholders, as well as synergies between stakeholders. The aim is to initiate a process that enables integrated systemic change.

Regarding the exclusion areas, greenhouse gas (GHG) emissions in the Municipality of Guimarães are quantified in terms of carbon dioxide equivalents (CO_2, CH_4, and NO_2), following the guidelines specified in the Expression of Interest of the Mission on 100 Climate-Neutral and Smart Cities. However, it is important to note that the Industrial Processes and Product Use (IPPU) sector presents challenges in terms of GHG quantification.

The lack of GHG quantifications for the IPPU sector can be attributed to various factors. Firstly, collecting accurate data on GHG emissions from industrial processes and product use is challenging due to the complexity and diverse nature of these activities. Additionally, there may be a shortage of experts and technicians with the necessary expertise in this field. The disclosure of information by industries regarding their emissions is another obstacle, as it may not be readily available or easily accessible. Lastly, the absence of comprehensive inventories specifically focused on the IPPU sector further contributes to the difficulty in quantifying emissions from this sector.

Given these challenges, it is crucial for the Municipality of Guimarães to address the gaps in data collection and inventories pertaining to the IPPU sector. This involves collaborating with industry stakeholders and implementing mechanisms to encourage industry to disclose relevant emissions information. By addressing these barriers, the municipality can improve its understanding of GHG emissions from the IPPU sector and ensure a more comprehensive approach to emission reduction strategies and climate action planning. This collaboration will be reinforced over the next year and presented in the next CCC iteration, expected to be delivered in the next year.

The Agriculture, Forestry, and Other Land Use (AFOLU) is another sector for which Guimarães has not yet provided specific data on its greenhouse gas (GHG) emissions. However, the municipality is actively engaged in the analysis of this sector's emissions and aims to report the findings in the near future. Efforts are underway to gather and evaluate relevant data related to AFOLU activities,

including agricultural practices, forestry management, and other land use activities within the municipality.

By conducting a thorough analysis of the AFOLU sector, the Municipality of Guimarães aims to gain a comprehensive understanding of the GHG emissions associated with these activities. This data will contribute to the municipality's efforts to develop effective strategies and initiatives to address emissions and promote sustainable practices within the agricultural, forestry, and land use sectors.

It is important to mention that the Municipality of Guimarães intends to revise and update the CCC on a yearly basis.

In summary, this is the overall of the 2030 Guimarães Climate Neutrality Action Plan, which outlines the municipality current climate neutrality policies and strategies, and how, through multi-stakeholder engagement, the emissions gap will be addressed for a sustainable and greener future through systemic change.

2 Work Process

In this section, the Municipality of Guimarães explains the working steps towards the development of the Guimarães' Climate City Contract along the NZC Climate Transition Map.

Work Process

The Municipality of Guimarães, when designing the 2030 Climate Neutrality Action Plan, intended to align it with the NZC Climate Transition Map (Figure 1), based on the development of a climate neutrality framework towards a just climate transition. The Action Plan fits into the first three processes of the NZC Climate Transition Map:

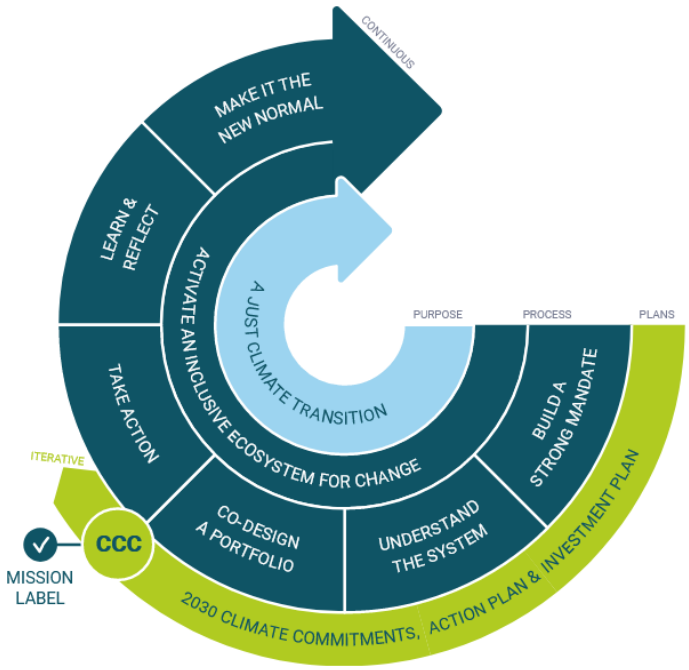

Figure 1. NZC Climate Transition Map.

1. Build a strong mandate:

To build a strong mandate, the Municipality of Guimarães is aware that a key factor for a successful climate action is to ensure an alignment of all actors among the planned actions and investments towards the climate neutrality goal. By joining the 100 Climate-Neutral and Smart Cities Mission, the municipality express its interest and ambition, and through the Climate City Contract re-affirms that commitment in a practical and concrete action.

To build a strong mandate within city government, the Municipality of Guimarães has an internal municipal team that combines members form different departments, e.g., Office of Energy Efficiency, Department of Smart Systems and IT, Department of Urban Services, Department of Mobility and Transport, Department of Economic Development, Department of Green Spaces, that are not only involved in the CCC development process, but also in other projects related with climate transition. Therefore, the municipality can mobilise the within resources and capacities needed to act upon the climate transition.

The Municipality of Guimarães, to build a strong mandate within the local ecosystem, developed a multi-actor Transition Team that enables the combination of several different backgrounds, expertise, and know-how, resulting on a cohesive, capable, and multifaceted team to coordinate the climate transition.

Through the 2030 Guimarães Governance Ecosystem, the municipality can build new collaborative governance structures and networks and strengthen those already in place. This means that, through this governance ecosystem, the municipality hopes to gather the entities that are all willing to collaborate with the city on the path to climate neutrality, and to gain movement to support new alliances and strengthen the ones already in place.

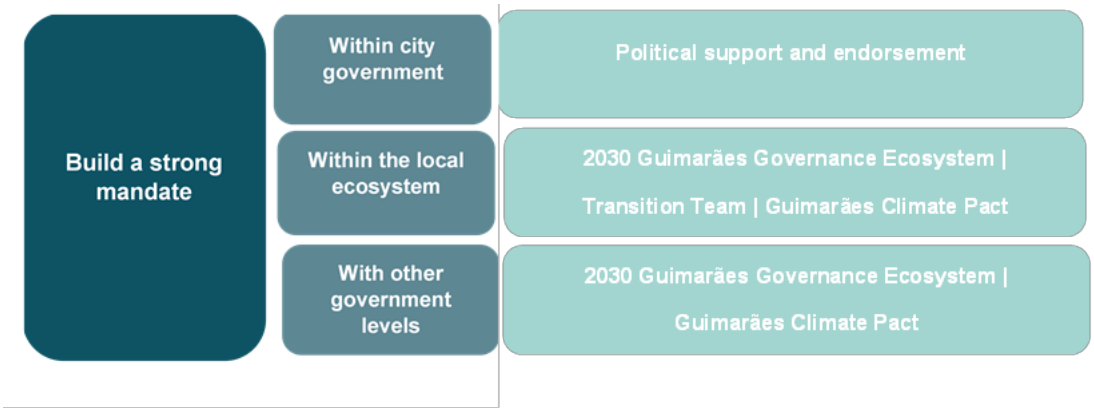

Figure 2. How to build a strong mandate within city government, local ecosystem and with other government levels.

Finally, to build a strong mandate with other levels of government, the 2030 Guimarães Governance Ecosystem is also a key factor, since through this governance ecosystem, the municipality can extend the climate transition towards actors outside the city limitations, e.g., ICLEI, Adapt Local, Euro Cities, CDP, CoM, Agenda 21 Local, Energy Cities, Circular Cities Declaration, Mission Zero Academy, Circular Cities and Regions Initiative, Climate Alliance, Green City Accord, ECSA, Bio Plastics Europe, Global Footprint Network, United Nations Climate Change, as shown on the Figure 3 bellow from the Guimarães European Green Capital candidacy, cycle 2025. The Municipality of Guimarães can also engage in meaningful dialogues with stakeholders on a regional and national level, to build future partnerships that endure the political cycles. As Guimarães is part of the Intermunicipal Community of Ave (CIM do Ave - an intermunicipal community of 8 municipalities), Guimarães can take a leading role in combating climate change and has the opportunity to involve all these municipalities in the process of sustainability at a regional level, drawing inspiration from Guimarães and vice versa. It is also worth noting that the quadrilateral region (Barcelos, Braga, Famalicão and

Guimarães) has almost one million inhabitants and aims to strengthen cooperation between the four municipalities by focusing on the area as a whole and working in partnership with the community and stakeholders to improve the quality of life, with the aim of investing in digital technologies, mobility, and culture.

Figure 3. How to build a strong mandate for the Municipality of Guimarães - networks

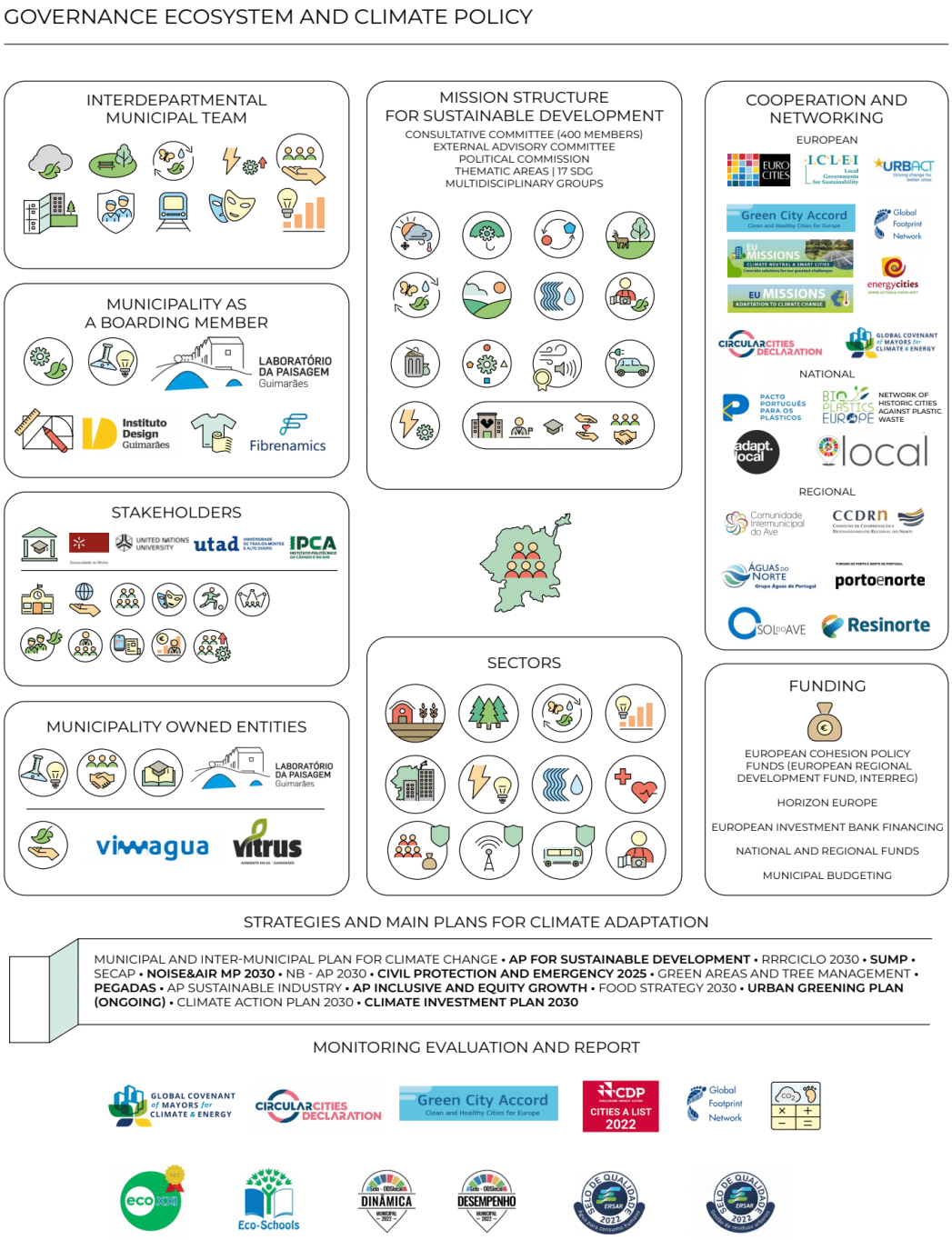

Figure 4. How to build a strong mandate for the Municipality of Guimarães – Governance Ecosystem and climate policy.

Guimarães Networking System: local, regional, national, and international cooperation promoting green-growth, knowledge-transfer and reinforcing innovation in public services (source: Guimarães European Green Capital candidacy, cycle 2025)

- **Transition Team:** Constituted by an interdisciplinary team and three core entities (Municipality of Guimarães, Landscape Laboratory of Guimarães, and external partners), with different but complementary backgrounds. This team meet weekly to design and develop the Climate City Contract and is intended to keep a close contact and partnership during the deployment of the Climate City Contract, including the implementation of the Action Plan and Investment Plan.
- **Political support and endorsement**: The mayor and political structure of the Municipality of Guimarães strongly support the involvement on the 100 Climate Neutral and Smart Cities Mission [1] and subsequently the journey of Guimarães towards climate neutrality by 2030 through the Climate City Contract.
- **Guimarães Climate Pact** [2]: To involve the entities that are aligned with the 2030 Guimarães vision, the municipality designed a first step towards the commitment, that consists of a climate pact that is voluntary and non-binding, representing an intention from the signatory entity to embark on this journey alongside the municipality and posteriorly to sign the Climate City Contract. Therefore, on 5th on June, to mark the 50th anniversary of the World Environment Day, more than 70 entities signed the pact, including the mayor, providing a sense of unification towards the common goal.

Figure 5 - Guimarães Climate Pact.

- **2030 Guimarães Governance Ecosystem** [3]: Guimarães has a strong and reliable governance ecosystem model, since 2013, that ensures a collaborative governance structure and networks among various stakeholders (local, national, European), strengthen mutual commitments towards a more sustainable a just city (more detail information on Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality).

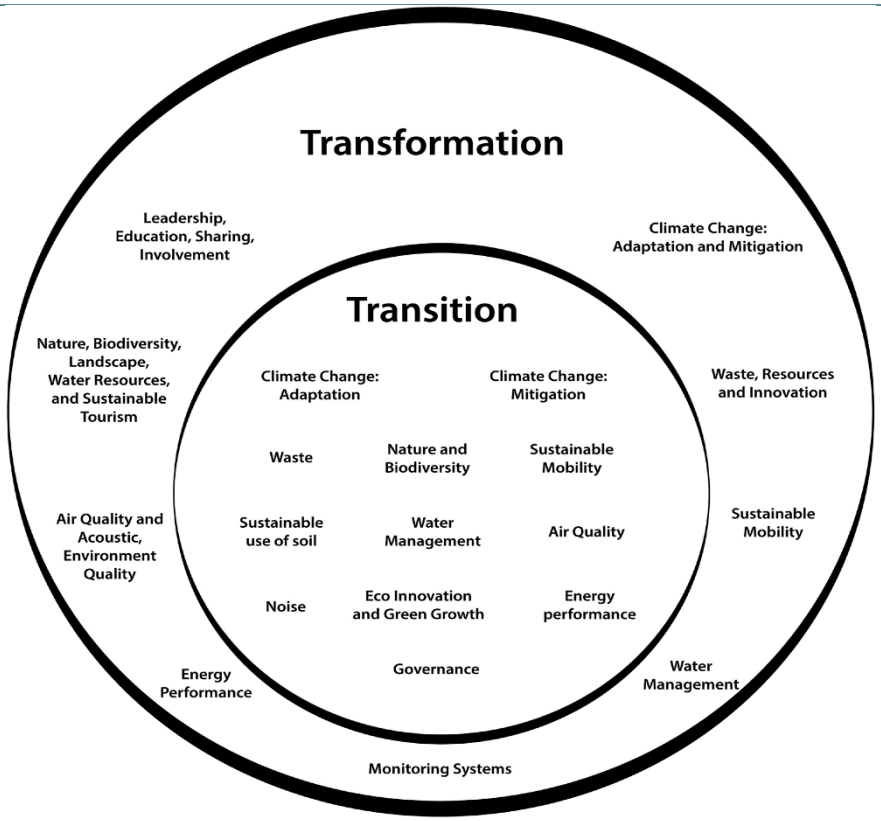

Figure 6. Guimarães 2030: a Governance Ecosystem

Loureiro, I., Ribeiro, C.A. and Sepúlveda, D. Guimarães 2030: a Governance Ecosystem. Euro-Mediterr J Environ Integr 7, 319–328 (2022). https://doi.org/10.1007/s41207-022-00331-5

2. Understand the system:

- **GHG emissions baseline**: The Municipality of Guimarães will consider Scope 1 and Scope 2 emissions for the CCC, as it reports these emissions for the Carbon Disclosure Project (CDP). The municipality intends to start accounting for Scope 3 emissions soon, to gain a more holistic perspective on the municipality's emission sources and improve accountability for the municipality's emissions. The GHG base year, from which the municipality will measure progress, is 2019, to correspond to a scenario prior to COVID-19 that is more representative to the reality in Guimarães.
- **Current state assessment and gaps towards the 2030 ambition**: The municipality has already taken measures to decarbonise and reduce emissions through local actions and plans, e.g., Guimarães has reduced its CO_2eq emissions by 18,40% by 2020, starting from 2008. The 2030 Climate Neutrality Action Plan serves as a strategic plan to continue the work done so far and to set ambitious actions to be implemented in order to close the existing gap on the path to climate neutrality by 2030. The municipality intends to use this opportunity to analyse the current local, regional, and national climate policies, examine the progress made so far (what has worked, what needs to be reformulated or added), map the existing cross-sectoral strategies with stakeholders and understand what additional partnerships are needed to implement the planned actions.
- **Stakeholders mapping**: The Transition Team conducted an exercise to map stakeholders interested on achieving climate neutrality by 2030 and be aligned with the municipality vision. Stakeholders who may hinder this path were also mapped, as well the ones that can influence

others (for more information on this exercise, please see on Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality).

- **Identification of barriers**: The Municipality of Guimarães proceeded to identify the key obstacles regarding the implementation of actions. These barriers are mainly related to gaps in funding and financing capacity, policy and regulation, as well as cultural and behavioural changes. The municipality is aware of these barriers through its large experience and record on climate change mitigation and adaptation actions on the municipality.
- **Identification of levers of change – Theory of Change:** After identifying the obstacles that undermine the path to climate neutrality, the Municipality of Guimarães defined the levers of change that will enable strategies on the fields of action of energy systems; mobility and transport; waste and circular economy; green infrastructure and nature-based solutions; built environment based on the NZC Theory of Change (NZC TOC). Ideally, these levers will enable the municipality to address its emissions gap and barriers. More information about this step is mentioned on Module B-1 Climate Neutrality Scenarios and Impact Pathways.

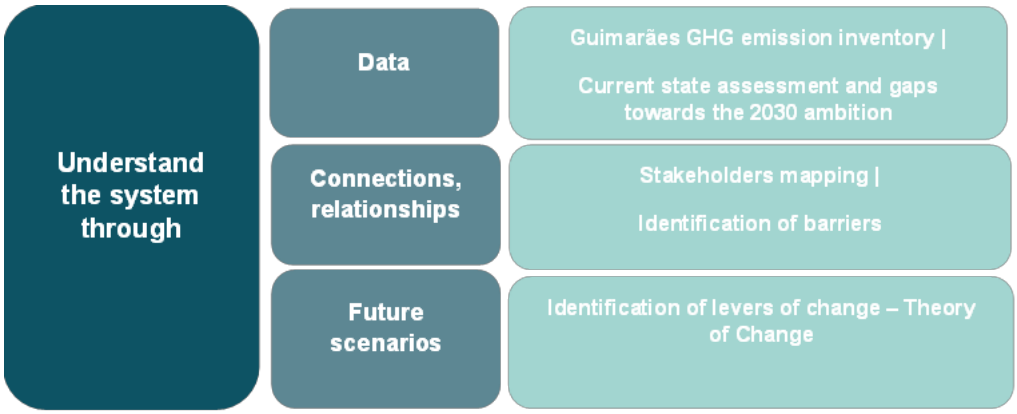

Figure 7. How to understand the system through data, connections, relationships, and future scenarios

3. Co-creating an action portfolio:

- **Rapid Mass Engagement (RME) sessions**: The Municipality of Guimarães together with the Landscape Laboratory of Guimarães designed layout and workflow for the RME approach to create a climate positive culture among the stakeholders that followed the official ceremonial signatory moment of the Guimarães Climate Pact (on the 5th of June). The RME is cyclical comprising several sets of workshops. The first series was composed by three workshops, with two main goals: to involve the interested stakeholders on the climate neutrality journey by 2030 through the CCC; and to gather a holistic set of possible actions to integrate on the Action Plan. A more detail explanation of the flow of The RME approach is presented on Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality.
- **Impact pathways**: the Municipality of Guimarães established impact pathways according to the Netzero Cities Theory of Change (NZC TOC) based on the planned actions and its early changes, late outcomes, and direct and indirect impacts. On Module B-1 Climate Neutrality Scenarios and Impact Pathways is possible to infer how Guimarães approached the NZC TOC.
- **Indicators to monitor, evaluate and learn (MEL)**: Given the planned portfolio of actions, and having establish the impact pathways, the Municipality of Guimarães is able to select the most adequate indicators to measure the progress achieved through the implementation of

actions on the territory. Therefore, the municipality can focus on the data that is important to collect and to measure, having an Action Plan that is traceable and can be accounted for.

- **Finance**: The action portfolio is not completed without an investment and financial plan that can support the implementation of actions. Having this in mind, the municipality in articulation with the 2030 Climate Neutrality Investment Plan, demonstrates how the actions in the portfolio will be financed, taking advantage of rearranging existing approaches/create new ones, e.g., participatory finance, existing public investment streams and leverage private.

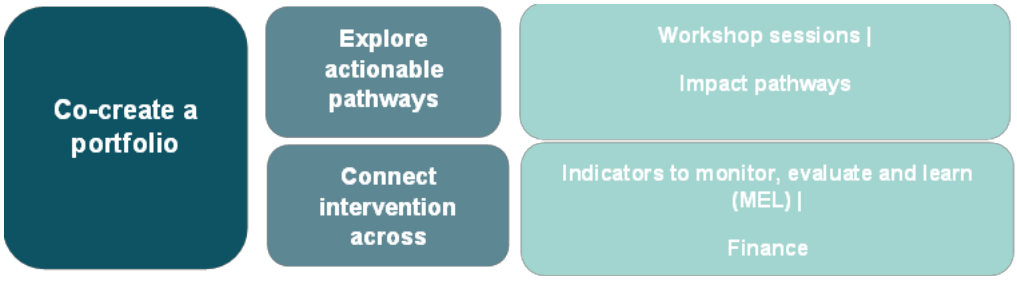

Figure 8. How to co-create a portfolio for the Municipality of Guimarães

3 Part A – Current State of Climate Action

In Part A of this 2030 Climate Neutrality Action Plan, the Municipality of Guimarães goes through the assessment of the 2019 baseline year greenhouse gas (GHG) inventory and the analysis of the business-as-usual scenario to identify the existing gap to achieve climate neutrality by 2030.

It also includes the current policies, strategies, plans and projects that the municipality has already undertaken towards its Guimarães 2030 vision, as well as the implementation gaps.

Finally, the last section of Part A presents the stakeholders that will play an important role on the path to the Climate City Contract, as well as a description of the existing systemic barriers and opportunities.

3.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

Module A-1 Greenhouse Gas Emissions Baseline Inventory details and describes the Guimarães' latest GHG inventory to establish the emission baseline and the gap to 2030 climate neutrality. Table A-1.1 depicts the total emissions of GHG in 2019, by sector.

A-1.1: Emissions by source sectors						
Base year	2019					
Unit	t CO_2 equivalent/year					
Scope	Scope 2	Scope 1				
(Fuel type/ energy used)	Electricity	Natural gas	Non-Energy Use	Petroleum Products	Total	% of Total
Agriculture forestry and fisheries	**656**	**11**	**6**	**1 995**	**2 668**	**0,39%**
Agriculture and Livestock	655	11	3	1 995	2664	0,39%
Forestry	1	0	0	0	1	0,00%
Fisheries	0	0	3	0	3	0,00%
Residential	**42 548**	**12 431**	**0**	**12 310**	**67 288**	**9,89%**
Industry	**76 503**	**103 739**	**8 732**	**6 918**	**195 891**	**28,80%**
Water	1992	0	0	0	1 992	0,29%
Construction	2 168	76	8 495	3 317	14 056	2,07%
Food	4 243	701	0	324	5 268	0,77%
Minning	1 520	0	3	0	1 523	0,22%
Wood	597	4	3	656	1 261	0,19%
Metallurgical	2 703	5 419	9	352	8 484	1,25%
Chemicals and Petroleum	259	30	113	84	487	0,07%
Textiles, clothing, and footwear	55 376	95 570	96	857	151 899	22,33%
Other industries	7 645	1 938	12	1 326	10 923	1,61%
Public Lightning	**2 768**	**0**	**0**	**0**	**2 768**	**0,41%**
Energy production	**326**	**120 161**	**139**	**0**	**120 627**	**17,73%**
Electricity, steam, hot and cold	326	120 161	139	0	120 627	17,73%
Waste	**3 784**	**0**	**0**	**0**	**3 784**	**0,56%**
Services	**37 872**	**6 309**	**6**	**4 496**	**48 683**	**7,16%**

A-1.1: Emissions by source sectors						
Public administration	2 616	428	0	423	3 468	0,51%
Banking and insurance	561	112	0	0	673	0,10%
Commerce	10 898	156	6	870	11 930	1,75%
Education	1 867	530	0	125	2 522	0,37%
Health	933	515	0	116	1 564	0,23%
Tourism	4 557	1 131	0	571	6 259	0,92%
Other Services	16 440	3 436	0	2 390	22 266	3,27%
Transport	**19**	**0**	**575**	**237 947**	**238 541**	**35,07%**
Total	164 476	242 651	9 459	263 665	680 251	100,00 %
% of Total	24,2%	35,7%	1,4%	38,8%	100,0%	

Table A-1.2 presents the emission factors applied to the baseline year – 2019, to the economic case for decarbonisation tool, using the methodology of the Intergovernmental Panel on Climate Change (IPCC) and the Covenant of Mayors for Climate and Energy.

A-1.2: Emission factors applied						
From economic case for decarbonisation tool data inputs (here)						
2019						
For calculation in t or MWh of primary energy						
Methodology of the Intergovernmental Panel on Climate Change (IPCC) and the Covenant of Mayors for Climate and Energy						
Primary energy/ energy source	Carbon Dioxide (CO_2equivalent [CO_2 + CH_4 + N_2O])	Methane (CH_4)	Nitrous Oxide (N_2O)	F-gases (hydrofluorocarbons and perfluorocarbons)	Sulphur hexafluoride (SF_6)	Nitrogen trifluoride (NF_3)
Buildings and Heating						
Heat production (district heating) (g/kWh)	0					
Heat production (local heating) (g/kWh)	152					
Transport						
Passenger cars + motorcycles (g/km)	186	0,0226	0,0060			
Buses (g/km)	1230	0,0615	0,0165			
Light duty trucks (<3.5 t) (g/km)	257	0,0034	0,0063			
Heavy duty trucks (>3.5 t) (g/km)	600	0,0328	0,0184			
Electricity						
Electricity generation (g/kWh)	224					

The next table, A-1.3 displays the energy demand by activity and emissions scope, for 2019, obtained through the economic case for decarbonisation tool.

A-1.3: Activity by source sectors			
From economic case for decarbonisation tool data inputs (here)			
Base year		2019	
	Scope 1	Scope 2	Scope 3
Buildings and Heating			
Heating demand (space heating + domestic hot water) (GWh/year)	265		
Transport			
Transport need - passenger cars + motorcycles (M km/year)	599		
Transport need - buses (M km/year)	4		
Transport need - trains/metro (M km/year)	7		
Transport need - light duty trucks (<3.5 t) (M km/year)	22		
Transport need - heavy duty trucks (>3.5 t) (M km/year)	237		
Electricity			
Electricity demand within city boundaries (GWh/year)		748	
Waste			
Collected waste within city boundaries (tonnes)			71 612

Following, Table A-1.4-a depicts the GHG emissions by sector obtained through the economic case for decarbonisation tool, representing the input data to obtain the Business as Usual scenario for 2030 and the emissions gap.

A-1.4-a: GHG emissions by source sector					
From economic case for decarbonisation tool inputs					
Base year	2019				
Unit	t CO_2 equivalent/year				
	Scope 1	Scope 2	Scope 3	Total	% of Total
Buildings and Heating	35 497			35 497	6%
Transport	176 619			176 619	28%
Electricity		168 818		168 818	26%
Waste*			14 459	14 459	2%
Others**	241 727			241 727	38%
Total	453 843	168 818	14 459	637 121	100%
* Includes Scope 1 Waste emissions (produced and processed in the city) and Scope 3 (produced by the city but processed outside the city border) ** Includes Industry, Agriculture, and other sources					

Table A-1.4-b depicts the GHG emissions for the 2030 Business as Usual scenario, by sector obtained through the economic case for decarbonisation tool.

A-1.4-b: GHG emissions by source sectors					
From economic case for decarbonisation tool (here)					
Base year	BAU 2030 (Business as Usual 2030)				
Unit	t CO_2equivalent/year				
	Scope 1	Scope 2	Scope 3	Total	% of Total
Buildings and Heating	37 293			37 293	6%
Transport	139 107			139 107	24%
Electricity		158 098		158 098	27%
Waste*			13 071	13 071	2%
Others**	241 727			241 727	41%
Total	418 128	158 098	13 071	589 297	100%

* Includes Scope 1 Waste emissions (produced and processed in the city) and Scope 3 (produced by the city but processed outside the city border)
** Includes Industry, Agriculture, and other sources

Bellow, Figure 9 shows the analysis boundaries and systems considered for the climate neutrality transition, which corresponds to the administrative limits of the municipality. Followed by Figures 10 to 13 which illustrate the emissions breakdown for the baseline inventory. Figure 14 depicts the deviation found between the emissions inventory for 2019 and the data obtained using the economic case for decarbonisation tool. As seen, there is a variation of 14% for scope 1 emission and of 3% for scope 2.

A-1.5: Graphics and charts

Figure 9. City boundaries and systems

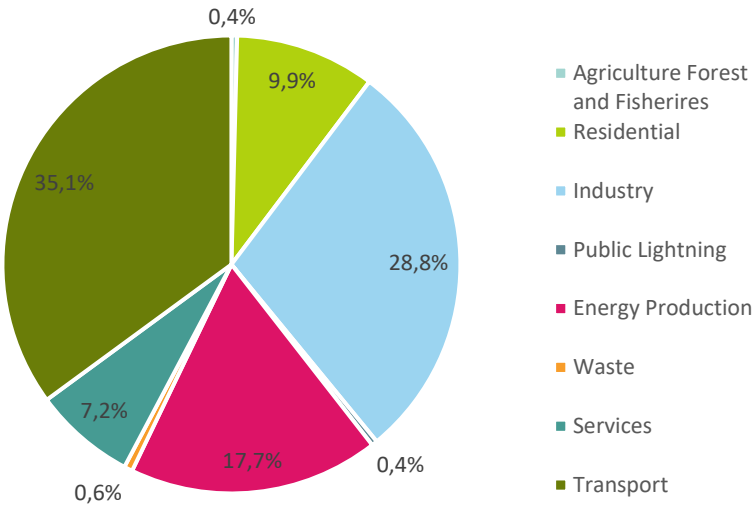

Figure 10. Baseline Inventory (2019) - Emissions breakdown by sector

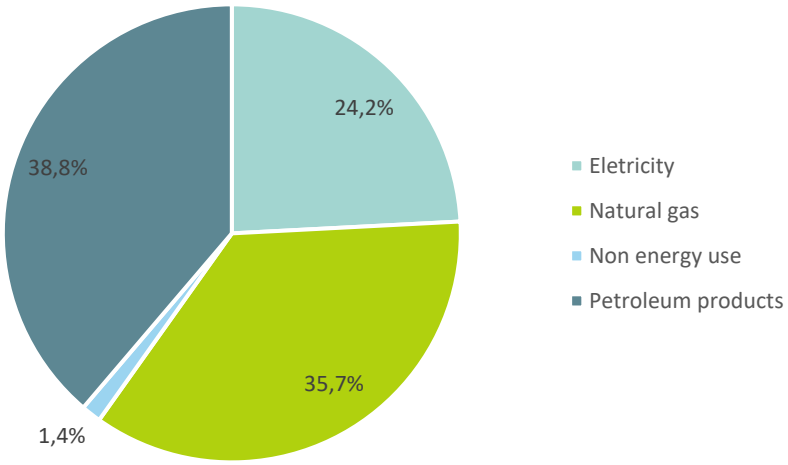

Figure 11. Baseline Inventory (2019) - Emissions breakdown by energy source

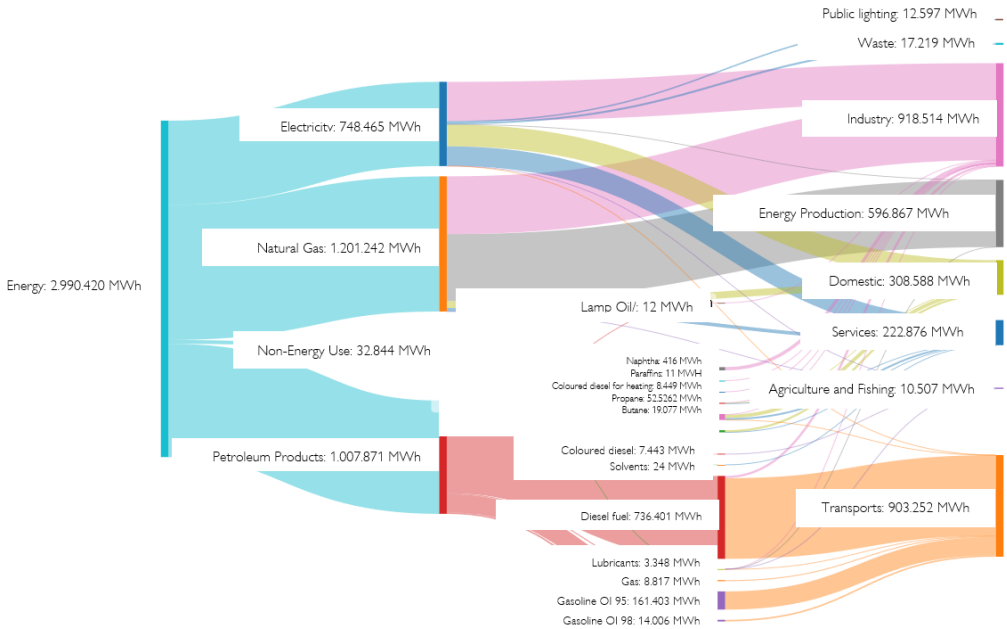

Figure 12. Baseline Inventory (2019) – energy sectorial flows (MWh)

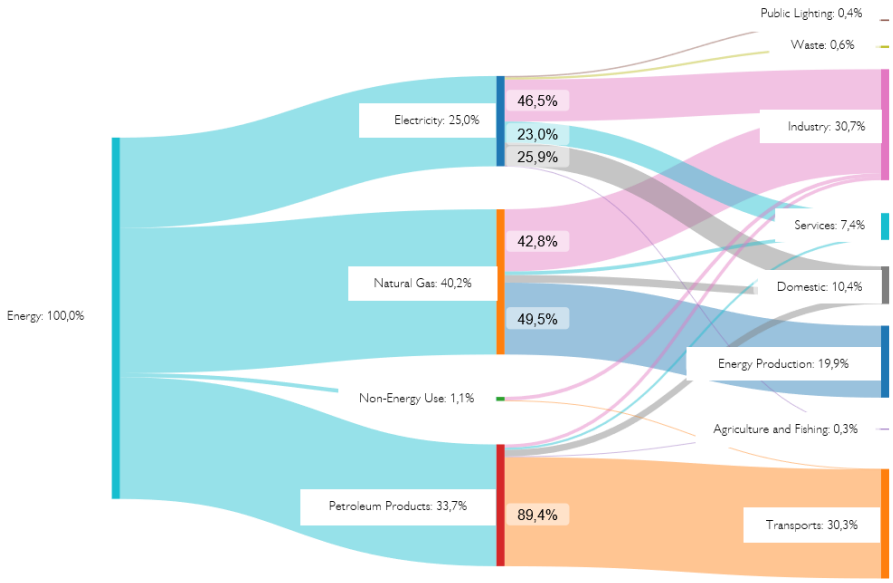

Figure 13. Baseline Inventory (2019) – energy sectorial flows (%)

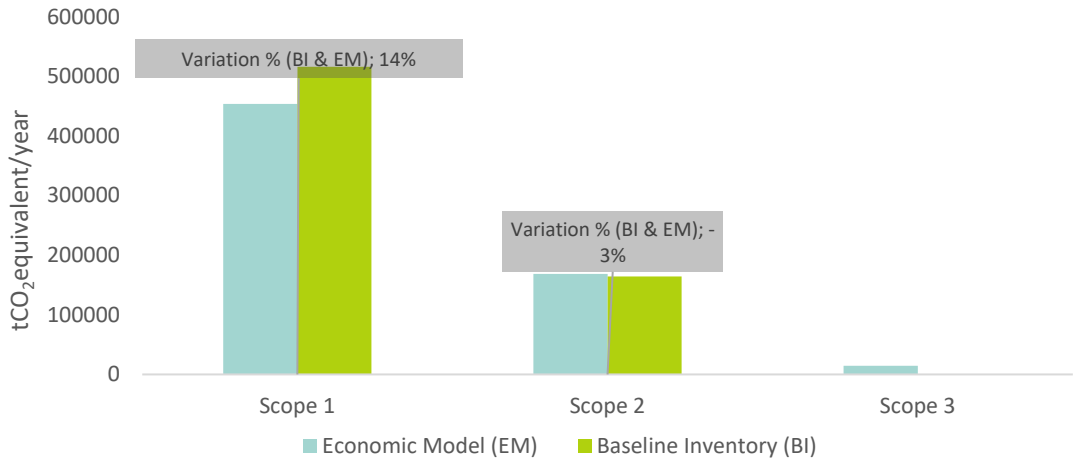

Figure 14. Baseline Inventory (BI) vs Economic Model (EM)

A-1.6: Description and assessment of GHG baseline inventory

- **Guimarães current monitoring system of CO2 emissions (table A-1.1)**

The Guimarães GHG baseline inventory is calculated annually using the IPCC methodology (*2006 IPCC Guidelines for National Greenhouse Gas Inventories*) and accordingly to the European Commission Joint Research Centre guidelines.

The base inventory is calculated based on final energy use and comprises three GHGs, carbon dioxide (CO_2), methane (CH_4), and nitrogen oxide (N_2O). The results are presented in equivalent CO_2 units (sum of CO_2, CH_4 and N_2O emissions expressed in t CO_2 equivalent). The main source for obtaining the emission factors is the 2006 IPCC. Excepting electricity, where the emission factor of the national electricity system is used, since it is the one used in the National Inventory Report (NIR) submitted under the United Nations Framework convention on Climate Change (UNFCCC).

The data for calculation is obtained from the national entity General Directorate of Energy and Geology (DGEG) that provides the data for electricity and natural gas consumption, and petroleum products sales. These data are contained within the administrative limits of the municipality and can be disaggregated by Economic Activity Code (EAC).

Only direct emissions from the use of fuels for energy are considered. This means, for instance, despite the inventory sectorial desegregation, emissions from Industrial Processes and Product Use (IPPU), waste, Agriculture, Forestry and Other Land Use (AFOLU), are not estimated in its full methodological standard. Greenhouse gases like CH_4 originating from biological processes, N_2O from agriculture, or PFCs, HFCs, and SF_6 resulting from the chemical and physical transformation of raw materials in the industrial transformation processes, have not been accounted in the inventory. The intention is to carefully improve the inventory process and start incorporating these emissions, for forthcoming updates.

- **Baseline situation**

In 2019, the total emissions were 680 251 t CO_2 eq. These are related to the consumption of electricity (24,2%), petroleum products (38,8%), natural gas (35,7%) and non-energy use petroleum products (1,4%). Dividing petroleum products into their components is verified that diesel constitutes the largest portion, validating that its consumption is made mainly by the transport sector.

Disaggregating GHG emissions by sector, it is verified that the largest contributor is the transport sector (35,07%), followed by industry (28,80%), energy production (17,73%), residential (9,89%), services (7,16%), waste (0,56%), public lightning (0,41%), and agriculture, fisheries, and forestry (0,39%).

In 2019, for the first time since 2008, the transport sector recorded a higher share of emissions than industry. This fact did not go unnoticed and was subjected to investigation by the municipality with the competent authority DGEG. The return obtained was that data from years after 2018 presented errors in the reporting of fuel quantities, as anomalous fuel sales were attributed to the municipality. Even after some corrections, prudence is needed in approaching the data, as fuel consumption remains abnormally high for the consumption patterns historically verified in the municipality. Transport emissions are mainly due to the consumption of diesel (80,7%) and gasoline (18,4%).

In the industrial sector, the textile and footwear sectors are the largest emitter with 77,7% of industrial emissions, and the second with greater representativeness is the construction sector (7,2%). Regarding the type of final energy consumed, industrial emissions are mainly due to the consumption of natural gas (52,6%) and electricity (39,5%).

The energy production sector, which is directly linked and is intrinsic to the industrial sector, registers as the main source of emissions natural gas, representing 99,6% of the sector's emissions.

In the residential sector, the GHG shares are distributed in petroleum products with 18,3%, natural gas with 18,5% and electricity with 63,2%.

In the services sector, the share of electricity accounts for 77,8% of emissions, followed by natural gas with 13,0%.

The waste sector is totally dependent on electricity. There is no consumption of natural gas or petroleum products. Given that this sector has associated fleets of heavy vehicles, the associated consumption is encompassed in the transport sector.

- **The economic case for decarbonisation tool and the baseline emissions inventory**

Guimarães, recognises the usefulness of the economic case for decarbonisation tool for the quantification of emissions and investments necessary for their mitigation. The economic case for decarbonisation tool results congruency with Guimarães baseline inventory are verified, establishing it as a very useful tool for the mission. This added value translates mainly to buildings (residential and services), transport and waste sectors. Since Guimarães has a high industrial character, these emissions are allocated in the "Others" section of the economic model. Even with this nuance, the Guimarães Climate City Contract takes due diligence in climate action for achieving neutrality in this sector.

As the “Others (Industry)” sector represents the highest GHG emissions share (41%) of the economic case for decarbonisation tool, decarbonising industry in Guimarães is not only important but also a high priority. This priority brings the necessity to provide a highly resourceful and effective Climate City Contract in steering industry toward sustainability. This brings an added challenge for Guimarães in adapting actions aimed at decarbonising the industry, going beyond what the tool proposes but measuring results through it.

The economic case for decarbonisation tool has also brought improvements in the waste sector, as it adds detail to the level of Scope 3 emissions, which in the baseline inventory were not calculated. This is already an additional value brought by the model to Guimarães GHG inventory by improving the waste sector including the scope 3 emissions.

As a city, Guimarães needs to find the means to calculate on a distance base methodology the emissions from the transport and mobility sector. The CCC appears as an opportunity to study and introduce this new approach of calculation, improving the baseline constraints mentioned above.

3.2 Module A-2 Current Policies and Strategies Assessment

Module A-2 “Current Policies and Strategies” lists the most relevant policies, strategies, initiatives, projects, and plans, from local, regional, and national level concerning the pathway for 2030 climate neutrality by the Municipality of Guimarães.

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Plan	Regional	Intermunicipal Plan for Adaptation to Climate Change and Risk Management and Prevention (PIAAC)	Proposals and projects for a range of themes from ecological regeneration to the transition of governance.	By contemplating concrete measures and actions for each Municipality in the region, the relevance of the PIAAC is to meet the requirements of the National Strategy for Adaptation to Climate Change (ENAAC), contributing at an inter-municipal scale, to its implementation and to enabling the fulfilment of the goals for the territory, in terms of adapting to climate change.	
Plan	Regional	Rio Ave Depollution Plan	It outlines the municipality's efforts and strategies to address pollution in the Ave River and ensure its preservation and restoration.	A river depollution plan is highly relevant as it simultaneously addresses crucial challenges. Reducing water pollution protects ecosystems and human health, the assumptions involved in preserving waterways minimise emissions, strengthening resilience against climate change. Strategic integration of these goals optimises resources and promotes a sustainable environment for current and future generations.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Plan	Regional	Castro de Sabroso Invasive Flora Management Plan	The plan addresses the management of invasive plant species in Castro de Sabroso, aiming to control and mitigate the negative impact of these invasive plants on the local ecosystem and biodiversity.	Controlling invasive flora is vital to conserving native ecosystems, increasing carbon sequestration, and preserving biodiversity. This aligns with climate neutrality by protecting habitats and reducing emissions, strengthening environmental resilience.	
Plan	Local	Sustainable Energy and Climate Action Plan (SECAP)	Includes a set of measures resulting from municipal and private initiatives, and their cooperation. These measures focus on the promotion of energy efficiency, on the integration of small-scale renewable energies, and increase the resilience to climate change.	SECAP is vital to mitigate climate change, by guiding energy efficiency and sustainable actions, reducing CO_2 emissions, promoting resilience, and driving the transition to a low-carbon economy.	
Plan	Local	Sustainable Urban Mobility Plan (SUMP)	Assessment of the circulation and mobility models in the urban areas.	The Sustainable Urban Mobility Plan (SUMP) directs the city towards more efficient transport, focusing on sustainable alternatives such as bike lanes and public transport. This tends to reduce traffic, emissions and improves quality of life, which is in line with climate neutrality goals.	
Plan	Local	Sustainable Development	Considers ongoing actions with innovative character in the sectors that range from leadership to climate change, environment, waste, air	The sustainable development plan is essential when addressing territorial emissions. Guiding action for all areas of sustainability plays a crucial role in	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
		Action Plan (2021-2022)	quality, sustainable mobility, energy efficiency, amongst others.	planning for climate neutrality and preserving the environment.	
Plan	City scale	Guimarães Bio-Waste Management Plan 2030	Establishes the objectives and measures to be implemented in the management of the urban waste, considering that it is necessary take advantage of their socioeconomic value and acting to minimise their environmental impacts.	The biowaste plan is highly impactful in reducing emissions. It promotes proper collection and treatment of organic waste, preventing the release of potent GHGs, such as methane. Contributes to promoting the circular economy and reducing emissions associated with the value chain.	
Plan	Local	Sustainable Energy Action Plan (SEAP)	Includes the formulation, project, execution, and maintenance of implementation models that can improve the energy efficiency.	Highlights the commitment to reducing energy consumption and emissions. These efforts are crucial for reducing the municipality's reliance on fossil fuels and minimising CO_2 emissions, thereby contributing to its broader goal of achieving climate neutrality.	
Plan	Local	Municipal Strategy for Adaptation to Climate Change (EMAAC)	Identifies the more impactful climatic risks that affect the municipality in the present and in the future, and the adaption measures needed and available to act accordingly to these climatic risks.	The acronym "EMAAC" stands for "Municipal Strategy for Adaptation to Climate Change". It concerns the municipality's efforts towards climate neutrality since it focuses on addressing the challenges posed by climate change and creating a resilient and sustainable city. It enables a comprehensive approach to climate adaptation, encompassing various sectors and aspects of urban life. It emphasizes the importance of understanding local vulnerabilities,	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
				assessing risks, and developing strategies to enhance the city's resilience to climate-related impacts. By proactively addressing these challenges, the municipality aims to create a more environmentally sound and climate-resilient urban environment.	
Plan	Local	Municipal Plan for Forest Defence Against Fires	The plan aims to prevent, manage, and intervene in forest fires within the municipality. To ensure the safety of the population, protect the environment, and minimise the damage caused by forest fires in the Municipality of Guimarães.	Not only reduce GHG emissions from fires and associated with ecosystems, but also promotes carbon sequestration. By preventing fires and keeping forests healthy, the ability of trees to absorb carbon is enhanced. These further strengths the efforts towards climate neutrality.	
Plan	Local	Guimarães Master Plan - 2015	Strategic urban planning document that outlines the development and land use policies for the municipality. It provides a framework for guiding urban growth, preserving natural resources, and promoting sustainable development. This Master Plan has a long-term vision as it shapes the municipality's physical development for years to come. Finally, it has also a policy coordination framework aiming at coordinate various policies related to land use, transportation, energy, and environment.	By guiding the planning of the territory, it promotes sustainable urban planning, optimising infrastructures, green areas, protecting heritage, among others. This contributes to climate neutrality through the outline of sustainable land use, transportation planning with the incorporation of transportation policies that prioritise public transport and alternative sustainable transportation modes, provisions and enhancement of green spaces, energy efficiency and building design, renewable energy integration, waste management and	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
				circular economy, and finally community engagement and education.	
Plan	Local	Civil Protection Emergency Plan for Guimarães	The plan outlines the roles and responsibilities of different stakeholders, including local authorities, emergency services, civil protection organizations, and community members, to respond to different types of emergencies, such as natural disasters, industrial accidents, public health crises, and other unforeseen events.	A civil and emergency protection plan is essential to deal with situations, such as extreme events. Responding effectively to disasters intensified by climate change, such as floods and fires, it strengthens community resilience, and indirectly contributes to climate neutrality.	
Plan	Local	Local Biodiversity Action Plan	Strategic document that aims to protect and enhance the biodiversity of the city and its surrounding areas. It sets out a series of actions and measures to preserve natural habitats, protect endangered species, and promote biodiversity-friendly practices.	By preserving natural ecosystems, carbon sequestration and climate regulation are promoted. In addition, conserving biodiversity strengthens the resilience of ecosystems, contributing to the mitigation of climate change and the pursuit of climate neutrality.	
Plan	Local	Municipal Plan for Gender Equality	Strategic document to promote gender equality and address gender-based disparities in Guimarães. The plan aims to create a more inclusive and equitable society by implementing a range of actions and initiatives focused on various aspects of gender equality.	The promotion of gender equality impacts on GHG emissions indirectly, through social progress. Including all identities strengthens climate awareness, driving sustainable practices and thus contributing to emissions reductions.	
Plan	Local	Zero Waste Plan	Address waste management challenges and promote sustainable	A zero-waste plan is crucial to reduce GHG emissions. Minimises waste across	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
			waste practices in the city. The plan aims to achieve the goal of Zero Waste by implementing various initiatives and actions. The plan identifies key areas of focus, including waste reduction, recycling, composting, and proper disposal.	the value chain, cutting emissions associated with production and disposal. This moves towards climate neutrality and environmental sustainability.	
Plan	Local	Guimarães Action Plan 2018-2021 - Child Friendly City	The Municipality of Guimarães systematically and continuously promotes actions for children and with children. In recent years, several public policy initiatives promoted by and in the municipality of Guimarães have relied on the active participation of children.	A Child Friendly City is relevant when addressing GHG emissions. It promotes sustainable practices in transport, waste green spaces and others reducing pollution. By creating safe and healthy environments, it indirectly contributes to climate neutrality.	
Plan	Local	Booklet of best-case practices for Sustainability: Eco-innovation	Encourage good practices in various areas related to sustainable development and environmental protection. The manual covers a wide range of topics and provides practical guidelines and recommendations for individuals, businesses, and organisations to adopt eco-friendly and sustainable behaviours.	It empowers local authorities, businesses, residents, and other stakeholders to adopt sustainable behaviours, technologies and practises that collectively contribute to achieving community carbon neutrality. The content of the handbook can be used as a reference for implementing measures that, not only reduce emissions, but also improve the overall quality of life of residents and promote a more resilient and environmentally aware community.	
Plan	Local	Social Development Plan	The plan addresses social challenges and promote the well-being and quality of life of its residents. It covers the	A Social Development Plan for Inclusive Growth is relevant because, by improving access to opportunities, and reducing	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
		for Inclusive Growth 2022-2026	period from 2022 to 2026 and outlines strategies and actions to tackle various social issues and ensure social inclusion and equality for all members of the community.	inequalities. This may influence consumer choices and lifestyles, indirectly impacting GHG emissions and promoting a path towards climate neutrality.	
Plan	Local	Action Plan for the Surveillance and Control of *Vespa Velutina*	Address the environmental and economic challenges posed by the invasive species of Asian hornet (*Vespa Velutina*). The plan outlines strategies and measures to control and mitigate the impact of this harmful insect on the local ecosystem, biodiversity, and agricultural activities.	An Action Plan for the Surveillance and Control of *Vespa Velutina* is relevant in protecting ecosystems. By reducing the threat to pollination and biodiversity, it contributes indirectly to the mitigation of climate change, thus strengthening efforts towards climate neutrality.	Mention on Module-C2
Plan	Local	Cultural Management Model of the Territory of Guimarães - Cultural Plan	Intends to enrich citizens through cultural and education capacity building, defining the municipal cultural strategy, grounded on a tolerant, resilient, democratic, engaged, and respectful citizens led society.	A Cultural Management Model in Guimarães is relevant in enriching local life and promoting sustainable tourism. This can indirectly affect GHG emissions by encouraging local cultural activities that promote the region's identity, contributing to climate neutrality goals.	
Plan	Local	Corruption Prevention Plan	Intends to foster a transparent and guided public management, through risk identification and mitigation measures.	A Corruption Prevention Plan is relevant as it ensures efficient use of resources. By reducing losses and mismanagement, it indirectly impacts GHG emissions by optimising processes, contributing to financial sustainability and, consequently, to efforts towards climate neutrality.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Plan	Local	Municipal Youth Plan	Aimed to define and establish public policies for the younger who live, study and work in Guimarães.	A Municipal Youth Plan is relevant because, by involving young people in sustainable actions, it influences behaviours that can indirectly reduce GHG emissions, contributing to climate neutrality and a greener future.	
Project / Plan	Local	Plan to reduce water losses in the supply system of the municipalities of Guimarães and Vizela	Aimed at controlling and reducing water losses in the distribution and supply networks of water in the municipalities of Guimarães and Vizela. This comprehensive effort is expected to effectively reduce real losses within the public water supply system.	By reducing water losses, the municipality increases resource efficiency, which is critical for sustainable development and reducing unnecessary energy consumption associated with water treatment and distribution. Effective water management is consistent with sustainable practises and preserves water resources.	
Plan	Local	Guimarães Urban Tree Management Plan	Ongoing, to be developed.	An Urban Tree Management Plan is essential to reduce GHG emissions. Promotes the management and increases green areas, helps reducing the heat island effect and energy demand in buildings. It also contributes to improving air quality and CO_2 sequestration, being an essential aspect for climate mitigation, promoting a more sustainable and a climate neutrality aligned city.	
Plan	Local	Green Spaces Management Plan	The development of a Management Plan for green spaces focused on monitoring and eradicating invasive species, while also promoting	The implementation of the plan enhances carbon sequestration, improves air	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
			reforestation of road infrastructures, contributing to increased green areas by planting 2 000 trees annually in urban zones.	quality, and fosters overall environmental resilience within the municipality.	
Plan	Local	Biodiversity Action Plan	New Biodiversity Action Plan under development. This plan aims to harness the collective knowledge, insights, and commitment of the local community to create a comprehensive strategy for preserving and enhancing biodiversity. Several activities are still under development with the collaboration of the community (see more information here).	Biodiverse ecosystems play a pivotal role in the battle against climate change by acting as nature's carbon reservoirs. Through conservation and restoration efforts, the plan can amplify the process of carbon sequestration, a crucial means of curbing the impact of climate change. Moreover, these ecosystems offer a suite of invaluable ecosystem services that bolster Guimarães resilience in the face of climatic challenges. Preserving and nurturing biodiversity is not just an ecological endeavour, it is a climate resilience strategy that the municipality see as priceless ally for achieving climate change.	
Plan	Local	Tourism Ambassadors from the Tourism Strategy for Guimarães 2019-2029	In connection with the implementation of the Tourism Strategy Action Plan, the municipality report here on the most important ongoing actions and projects:	The emphasis on new projects to diversify the tourism offer indicates a forward-looking approach that is consistent with the idea of creating sustainable and resilient tourism that can thrive while minimising negative environmental impacts. Also, the strategy's focus on valorising the whole territory and establishing a network of ambassadors for	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
			- Network of “Ambassadors: project to create “Informal Routes through Nature”. - Coordination of tour operators and “ambassadors" from the community to create content in line with communication. - Sustainability in Guimarães (GS): Development of projects with the Landscape Laboratory and the 2030 Mission Structure.	promotion is linked to the broader concept of sustainable development, which includes responsible land use and conservation.	
Plan	Local	Progressive decarbonisation of Vimágua's activity	Plan describing how the company will decarbonise its operations by replacing fossil fuel vehicles with electric vehicles, improving equipment efficiency, installing photovoltaic panels, and replacing lighting with LEDs.	Since Vimagua is a company responsible for managing services of general interest, in this case the management and operation of public systems for the collection, treatment and distribution of water for public consumption, a decarbonisation plan is a sign of the efforts made by the municipality and its related stakeholders towards decarbonisation.	
Pact	European	Cultura Carbono Zero	This new initiative, led by the city of Lille and Eurocities, invites mayors across Europe to commit to developing cultural policies and local events that prioritise sustainability and inclusion.	The initiative contributes to GHG reduction by promoting sustainable practices in cultural events, it impacts behaviours and raises community awareness about climate neutrality strengthening local climate actions.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Pact	National	Portuguese Plastics Pact	Platform that aims to create a compromise between the different players in the national plastics value chain, setting ambitious goals and objectives for 2025 with the intention to solve plastic-related problems.	The pact is relevant for municipalities as it promotes the responsible use of plastics, it minimises production and disposal, reducing product embedded emissions. This reduces many environmental impacts contributes to climate change mitigation and encourages more sustainable practices.	
Pact	Local	Green City Accord – Clean and Heathy Cities for Europe	Volunteer movement of European cities and their mayors to promote their cities to be more green, clean, and healthy.	Guimarães' decision to join the Green City Accord demonstrates its commitment to aligning with European environmental initiatives, which often play a vital role in advancing climate neutrality goals. In terms of relevancy for climate neutrality, the holistic sustainability approach - green areas, air quality, waste management, and sustainable transport – allows for a multifaceted approach required for achieving climate neutrality.	
Pact	Local	European Circular Cities Declaration	Signatories commit to a circular recovery and a more resilient future.	The European circular declaration is relevant in promoting circular economy. By minimising waste and consumption, finding new ways to improve throughout the value chain and lifecycle, it reduces the GHG emissions and contributes to climate neutrality by optimising resources and encouraging sustainable practices at every product/service stage.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Pact	Local	Network of Historic Cities Against Plastic Waste	Relation between cities recognised by their cultural heritage, whose buildings and urban infrastructures have an historical and architectonic value, that make them specifically vulnerable to the problems caused by plastic pollution.	The relevance for a municipality's carbon neutrality lies in the potential for reduced emissions, waste production, circular economy principles, innovation, economic development, political influence, and awareness raising related to more sustainable material choices.	
Pact	Local	Municipal Platform on Sustainable Development Goals (LocalSDG)	Promotion of public engagement to the Sustainable Development Goals (SDGs) proposed by the United Nations in the 2030 Agenda.	The platform is user-friendly and allows every citizen to be informed about the status of the achievement of the SDG of the municipality's achievement of the SDGs. By implementing the individual projects for each SDG, and monitoring the indicators, the municipality is also capable of interlink its ambition towards climate neutrality.	
Pact	Local	Guimarães Climate Pact	Initiative to engage citizens, companies, and institutions in a collaborative action towards Guimaraes' Climate neutrality by 2030.	The Guimarães climate Pact is vital when addressing GHG emissions. It promotes local actions for climate action reducing climate impacts. By involving the community and raising awareness and responsibilities, contributes to the municipality climate neutrality goals.	Mention on Module-C2
Project	European	Circular PSP: Public Service Platforms for Circular, Innovative	The project focus on citizens engagement and financial support to promote circular economy projects, manage the bridge between procurement and local businesses.	Through several circular economy targets, this project enhances the achievement of climate neutrality by building environmental education and awareness actions open to the community, reduce waste streams and general waste, expand	

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Type	Level	Name and Title	Description	Relevance	Need for action
		and Resilient Municipalities		the PATY system, increase the recycling and re-use rates at the municipality, and the valorisation if textile waste (75% by 2026).	
Project	European	DISTENDER	A Horizon Europe project that aims to achieve a better understanding on the links between climate change impacts and risks, mitigation, and adaptation options. It will deliver an integrated analysis of climate change impacts and risks, mitigation pathways and adaptation strategies, into a single framework heling understand and quantify their interactions. The outputs will provide further assistance in decision making towards climate neutrality. Guimarães is a case study where the developments of the project are to be tested in.	Contributes to the goal of climate neutrality by providing a comprehensive analysis of climate change impacts, risks, mitigation strategies and adaptation options. The integration of these elements into a single framework and using Guimarães as a case study, the project facilitates informed decision-making processes for the municipality's climate action. In this way, Guimarães can implement targeted and effective actions that are consistent with its climate neutrality goals and promote a more resilient and sustainable future.	
Project	Regional	Ave em transição	Survey of exemplary ongoing initiatives and the identification of the territory's main vulnerabilities and opportunities, the elaboration of thematic studies and the promotion of participatory sessions, along with events and other awareness-raising and training actions.	This project involves regional efforts and contributions to building a post-carbon society and strengthening territorial resilience. In an innovative way, it will integrate climate change mitigation and adaptation and launch a call for regional mobilisation. The municipality is networked with other regions and is aware that climate neutrality must be a joint	

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Type	Level	Name and Title	Description	Relevance	Need for action
				effort involving, not only local actors, but also regional actors.	
Project	Regional	Greentour: Circular Economy and Sustainable Tourism in the SUDOE region	Improve management methods in the natural and cultural heritage.	It is relevant as it reduces GHG emissions in tourist establishments. It minimises waste, encourages eco-friendly practices, and promotes energy and water efficiency, contributing to climate neutrality and a more responsible and resilient tourism sector.	
Project	Regional / Local	Ave, Selho, Vizela para todos	Rehabilitation of the municipality's main body of water.	The project embraces the entire community of Guimarães, which wishes to contribute to the protection of the Ave River as a common natural heritage and extends to other municipalities. The conservation of water resources, the natural heritage of the region, as well the biodiversity within is a must towards the climate neutrality.	
Project	National	CApt2: National network for water circularity	Promotes a cooperative and cocreated governance model with water management and circularity policies, bring together citizens, stakeholders, and public authorities.	By promoting collaborative and circular water management, it minimises waste and energy, while involving the community and authorities. This is crucial in reducing GHG emissions and contributes to climate neutrality, water resilience and sustainable resource practices.	

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Type	Level	Name and Title	Description	Relevance	Need for action
Project	National	Footprint and Biocapacity Guimarães	Aims to build local knowledge and capacity in making use of key environmental data as to support environmental policy decision-making.	The ecological footprint and biocapacity calculation are relevant when addressing GHG emissions. Enables informed decision-making in local environment policies, optimising resources and reducing impacts. This contributes to climate neutrality by proceeding and promoting environmental sustainability.	
Project	Local	BIOURB Project	This project aims to naturalise urban and residential areas, with the aim of establishing a link between agroforestry areas and green spaces in urban areas. It also aims to improve the quality of life of citizens in urban areas by taking measures to improve urban comfort, e.g., reducing the urban heat island effect. The project includes afforestation of streets, shading of car parks, renaturation of water pipes and promotion of green spaces. The project started in 2021 and is expected to be completed in 2027. It includes the identification of the villages and towns to be intervened in, the definition of the ecological systems and the typology of the interventions, the elaboration of the projects and their monitoring.	BIOURB Project embraces nature-based solutions for urban enhancement. By intertwining agroforestry with urban landscapes and leveraging natural processes to improve environmental conditions, the project paves the way for a more sustainable and climate-resilient municipality. The carbon sequestration by the afforestation and renaturation activities, the reduction of the urban heat island effect, and the ecosystem services (influencing improved air and water quality, enhanced biodiversity, reduced soil erosion, and regulation of water flow) contributes to climate neutrality by 2030.	

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Type	Level	Name and Title	Description	Relevance	Need for action
Project	Local	CARE	Use of reusable cups instead of disposable plastic cups. In a first phase, it will be implemented in the Historic Centre of Guimarães.	Reducing waste by not relying single-use plastic allows for a more sustainable approach to events in Guimarães and helps to reduce waste by using reusable cups in this case.	
Project	Local	Consigo	The “Consigo” project closely monitors the Interparish Social Commission (CSIF) Sudoeste da Montanha da Penha and has a loan bank of adaptive equipment for needy people covering the entire Municipality of Guimarães.	This project that focuses on social aid is important to achieve climate neutrality and addressing climate change by promoting equity and provide aid for the most vulnerable, e.g., elderly. These efforts ensures that the journey towards climate neutrality is inclusive, sustainable, and leaves no one behinds.	
Project	Local	“Corredor Verde da Veiga de Creixomil” Project	The project aims for planting trees, bushes, and seedbeds, increasing biodiversity and improving pedestrian and clickable paths, thus increasing resilience against the negative consequences resulting from climate change, in an agricultural area capable of providing environmental, economic, and social benefits.	Planting trees and improving green spaces is vital to tackle GHG emissions. In addition, it strengthens environmental resilience, contributing to the mitigation and adaptation to climate change, in line with climate neutrality goals.	
Project	Local	Guimarães Mais Floresta: tree planting plan	Strengthen the forest and ornamental coverage with native species, to adapt and mitigate climate change and improving natural ecosystems, biodiversity, air quality, etc., involving citizens from all ages and sectors.	Increasing forest cover and enhancing biodiversity in the municipality will allow for carbon sequestration, improved ecosystem services, biodiversity conservation, soil health and water management, and local climate regulation. "Guimarães Mais Floresta" is	

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Type	Level	Name and Title	Description	Relevance	Need for action
				in line with the municipality's goal of climate neutrality by actively contributing to carbon reduction, climate resilience and overall environmental sustainability.	
Project	Local	Digital Commercial District – "Bairro 1128"	A Horizon Europe project envisions the establishment of a digital and technological business district that fosters sustainable and technologically advanced businesses, leveraging digital tools for improved data management, e-commerce, stock control, mobility, and other processes, contributing to the municipality's commitment to sustainability and technological advancement in line with its climate neutrality goals.	The project contributes to the community's goal of climate neutrality by promoting sustainable practises and technological innovation among businesses. By improving data management, e-business efficiency and mobility dynamics, the initiative reduces resource consumption, supports green business practises, and promotes the adoption of environmentally friendly practises, in line with the municipality's goals to mitigate climate change and achieve climate neutrality. It also helps to establish a close relationship among the commercial actors and the municipality, helping to create a dynamic of mutual understanding.	
Project	Local	District C: a zero-carbon commitment	Project of discursive reinterpretation of the city, embodying in a social experimental laboratory a model for the development of the area based on culture, knowledge, and creativity.	District C has the format of a testing ground for innovative solutions and allows the municipality to test sustainable solutions in different areas (energy, transport, built environment, community engagement) that will contribute to climate neutrality in the medium term, as the main findings and solutions are extended to the whole area.	Mention on Module C1 and C2

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Type	Level	Name and Title	Description	Relevance	Need for action
Project	Local	Limp.AR	A project that encourages air and noise quality improvement in urban centres, promoting the integration of vegetation in urban areas and raise awareness, as well as the evaluation of noise and air quality in urban and school areas to assess the impact of the actions developed throughout the project.	The project aims to integrate vegetation in the urban environment, increasing the sequestration of GHG emissions. It also encourages citizens to use alternative and sustainable modes of transport, such as walking and cycling. This reduction in reliance on private vehicles helps to reduce carbon emissions and is in line with the municipality's goal of becoming climate neutral by promoting greener and more environmentally friendly forms of urban mobility.	
Project	Local	Green Gap	The project aims to protect, preserve and enhance nature and the elements that make up the green infrastructure in the cross-border area, promoting its planning, contributing to the enhancement of biodiversity and valuing natural ecosystems, the urban environment and ecosystem services.	The project will enhance the role of local administrations in the development of effective nature protection and conservation policies, this being the main innovative element of the project: making the local administration a key agent in the development of nature protection and conservation policies in a territory that shares the same geographical reality and environmental problems. It also aims to mitigate and adapt to the effects of climate change by designing a resilient landscape.	
Project	Local	River Green Ways	Over the past, as economic activity increased, stress on environmental resources grew, leading to water pollution, biodiversity loss and	The project plays an important role in achieving climate neutrality for the municipality, as it considers several environmental and social aspects. By	

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Type	Level	Name and Title	Description	Relevance	Need for action
			separating rivers and citizens. Guimarães river greenways are large-scale greenways (61 km) through the blue infrastructure, promoting the riverbanks' rehabilitation and territorial cohesion, based on a participatory methodology. The river greenways were created to improve the blue infrastructure; promote access to nature, improve the riparian landscape; reinforce urban-rural connectivity; and bring people closer to the rivers.	rehabilitating riverbanks and promoting greenways, the project improves urban-rural connectivity and encourages people to use non-motorised modes of transport such as walking and cycling. This reduces dependence on fossil fuel vehicles, leading to a decrease in carbon emissions and supporting the transition to more sustainable modes of transport. In addition, the project's focus on improving riparian landscapes and promoting access to nature contributes to biodiversity conservation, which in turn increases ecosystem resilience to climate change impacts.	
Policy / Programme	Local	Inter-municipal Programme to Protect the Sacro Montes	The objective is to safeguard the landscape of Sacro Montes, ensuring the preservation of the surrounding forest area and enhancing safety measures against potential fires.	The programme, which focuses on the conservation of Sacro Montes, allows for the development of reforestation activities that can have a significant impact on a community's goal of climate neutrality. By planting a variety of tree species and restoring natural ecosystems, the municipality aims to increase carbon sequestration, improve air quality, and contribute to overall climate mitigation. Afforestation plays a crucial role in offsetting carbon emissions, promoting biodiversity and creating more resilient	

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Type	Level	Name and Title	Description	Relevance	Need for action
				landscapes that are in line with climate neutrality goals.	
Policy / Regulation	Local	Economic Project of Municipal Interest (PEIM)	Guimarães through local policy supports economic projects with municipal interest with local tax benefits and technical support for bureaucratic procedures.	Economic projects of municipal interest can play a significant role in supporting the municipality's journey towards climate neutrality, by supporting the sustainable economic growth. Projects that are considered of municipal interest, have an attribution of a municipal tax benefits, with the reduction of the payment of municipal fees and with technical support in the instruction of the respective administrative procedures.	
Policy	Local	Community gardens	Adapt the current community garden model for schools.	By adapting the current community garden model to schools (but also piloting community gardens in District C), the municipality aims to improve carbon sequestration and local food production, promote education and awareness, create more green spaces and cooling effects, as well as promote community engagement and involvement of the young members of the community.	
Policy	Local	Green Brigades (Brigadas Verdes)	Green Brigades are a group of volunteers (mainly young citizens) that gather to promote awareness-raising activities. This initiative aims to encourage the local community to adopt environmentally friendly	Green Brigade initiative plays a vital role in instilling environmentally conscious values, behaviour, and practices within the community, which in turn supports the municipality's broader climate neutrality goals. This includes behaviour change	Mention on Module-C2

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Type	Level	Name and Title	Description	Relevance	Need for action
			practises and behaviours. By organising educational activities and events, the Green Brigade helps to promote a culture of sustainability and environmental awareness among residents.	and adoption of eco-friendly practices regarding waste production, energy conservation, and responsible consumption. It also engages the local community directly in environmental activities (sense of collective responsibility). Also, educated, and informed citizens are more likely to support and participate in broader climate neutrality initiatives. Finally, the initiative's focus on education and behaviour change has the potential to create lasting effects.	
Policy / Initiative	Local	Integrated Operations Centre of Guimarães	Joint project of the civil protection authorities to provide real-time information and coordination in emergencies. Even though the direct impact on climate neutrality is not immediately obvious, this initiative can indirectly contribute in several ways, such as, disaster preparedness and resilience, minimising environmental impact, and adaptive planning.	The Centre improves the municipality's preparedness for climate-related emergencies, which can indirectly support its climate neutrality ambitions by minimising environmental damage, optimising resource allocation, and promoting community resilience and engagement.	
Policy	Local	Guimarães 2030 Governance Ecosystem	Reinforces the role of the city as accelerator of green community-led transformation through establishing multidisciplinary, science-based, and participative processes, building bridges between academia, citizens, and political decision-makers.	The policy strengthens the municipality's goal to become climate neutral by promoting collaboration, science-based decision-making, community engagement and inclusive policies. It puts the city as a catalyst for green change - accelerates progress towards climate neutrality and	Mention on Module-C1

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Type	Level	Name and Title	Description	Relevance	Need for action
				promotes a resilient and sustainable future.	
Policy	Local	Energy communities	Through the EUCF investment concept, the municipality is embarking on a multi-phase project that aims to foster renewable energy communities, educate citizens about energy transition, install solar panels in public spaces, and develop photovoltaic systems in industrial parks and social housing, all of which collectively contribute to reducing GHG emissions, increasing renewable energy production, and advancing climate neutrality goals.	The establishment of renewable energy communities, improving energy efficiency in public buildings and the use of photovoltaic systems in commercial areas and social housing allows for a more just transition towards a climate neutral municipality. These initiatives contribute to a significant reduction in GHG emissions, an increase in renewable energy production and an overall transition to a more sustainable and climate-neutral urban environment.	
Policy	Local	Re-Ruralisation and Eco-villages	The establishment of eco-villages aims, not only to promote renaturation, but also to create projects with greater resilience and lower impact (self-sufficiency, circular economy, and waste management). The project started in 2020 and will be completed in 2027. It includes several phases, such as the creation of a plan for the revitalisation of rural areas, the creation of a dataset of plots and houses to be sold or rented in areas with low population density, subsidies for staying and moving to these areas,	This policy addresses environmental concerns but also creates a foundation for sustainable living, resource management, and community resilience, all of which are vital components of a climate-neutral municipality. Additionally, it deals with a part of the territory that is more vulnerable (rural areas) and incentivises the socio-economic flourishment of these areas in Guimarães.	

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Type	Level	Name and Title	Description	Relevance	Need for action
			the promotion of awareness campaigns about ecovillages and the integration of pilot projects for ecovillages.		
Policy	Local	Municipal fleet renewal programme	Promote use of hybrid and electric vehicles. The municipality already started renewing its municipal fleet, having the goal to have a 100% electric fleet.	The impact on the climate neutrality journey is quite direct concerning the fact that EV are “greener” than the fossil fuel ones. It directly addresses transportation related emissions, local air quality, energy efficiency, all of which are crucial elements in the journey towards a climate-neutral municipality. It also signals the stakeholders and the community that the municipality itself is committed to the goal.	
Policy	Local	Municipal Transport Plan	Concession for regular public passenger transport by the Guimabus company. Currently, the Guimabus fleet has 26 electric buses out of 80, and the aim is to update it until it becomes a 100% electric fleet.	The urban transport plan's focus on electric and potentially hydrogen-powered buses contributes significantly to Guimarães' goal of climate neutrality. It addresses reducing emissions, improving air quality, promoting sustainable transport, technology leadership and energy efficiency. This initiative serves as an outstanding example of how sustainable public transport can be an important driver of a city's efforts towards climate neutrality.	

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Type	Level	Name and Title	Description	Relevance	Need for action
Policy	Local	Electric vehicle charging points and infrastructure	Charging hub for electric vehicles. Guimarães has established a pilot network of 18 electric vehicle charging points in the city centre and aims to install 500 more across Renewable Energy Communities and the ECO Pathway, contributing to climate neutrality by promoting sustainable transportation.	The establishment of a pilot network of electric vehicle charging stations and the planned installation of additional stations in renewable energy communities and along the ECO Pathway will help reduce carbon emissions by encouraging the uptake of electric vehicles and sustainable transport choices, in line with the municipality's climate neutrality goals.	
Policy	Local	Waste tariff system: PAYT	PAYT is a free “pay as you throw”, charged according to the number and type of waste bags produced.	Involves implementing a waste management system where residents are charged based on the amount of waste they generate. This initiative is closely related to the municipality's climate neutrality ambition by incentive its residents to reduce their waste (charged based on the waste produced), conservation of resources (energy, water, raw materials), the reduction of waste sent to landfills and incineration facilities allows for a decrease of the carbon footprint, and adoption of circular economy practices.	
Policy	Local	Guimarães: Circular Economy Towards a Sustainable City – G4CE	Promote circular economy, valorisation of waste, extend lifetime of products. It focuses on two main areas: waste valorisation (projects – Forestry and Green Residues; Bubble gum and cigarettes buns; Agrowaste; Soil	This initiative can contribute to the climate neutrality ambition by reduce resource consumption and conservation/remediation of natural resources, e.g., soil.	

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Type	Level	Name and Title	Description	Relevance	Need for action
			Remediation; Re-Food); and social affairs (projects – “Consigo”; PAPER4FOOD).	By promoting resource efficiency, waste reduction, renewable energy integration, sustainable consumption and innovation, the initiative aligns well with the municipality's goals to reduce carbon emissions, preserve resources, and create a more resilient and sustainable urban environment.	
Policy	Local	Advisory Board Report - 12 volumes	Mission Structure Advisory Board involves all institutions in the municipality. It consisted of the involvement of all local institutions in the advisory council of the mission structure (Guimarães 2030 Mission Structure) towards a comprehensive and collaborative approach to address climate challenges and fostering sustainable development in the municipality.	The engagement of various local institutions in the advisory council demonstrates a collective commitment to addressing climate challenges, promoting sustainable practices, and advancing the municipality's climate neutrality goals through shared knowledge, expertise, and collaborative initiatives.	
Policy	Local	Municipal Activity Report	Economic, financial and asset information of the Municipality of Guimarães, from 2005 to 2023.	The municipality publishes the reports describing the upcoming planned investments and providing transparency on the procedures and the projects, initiatives and works to be carried out, as well as the priorities of the municipality.	
Policy	Local	Publication of the Report on	Statute of the Right of Opposition of the Municipality of Guimarães, from 2013 to 2022. Refers to a legal provision that grants the opposition	This policy does not directly affect the goal of climate neutrality but ensures that democratic procedures in the municipality are sound and that a democratic	

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Type	Level	Name and Title	Description	Relevance	Need for action
		Observance of the Right of Opposition	parties or groups within a local government the right to have a say and participate in decision-making processes, even if they are not in the majority.	approach is taken to decision-making in the municipality. A just transition is composed of environmental, social and governance elements.	
Policy	Local	Ecovia of Guimarães	The municipality's alignment with national and international sustainable mobility trends is demonstrated through initiatives like the "Ecovia de Guimarães," a 16.5 km cycle lane investment inaugurated in 2018, and the development of large-scale Guimarães river greenways (61 km), which promote rehabilitation, territorial cohesion, and participatory engagement along the blue infrastructure, thereby contributing to climate neutrality ambitions.	The Ecovia of Guimarães cycle routes and the development of green spaces along the river contribute to the city's goal of climate neutrality by promoting sustainable modes of transport, reducing dependence on fossil-fuelled vehicles and improving green infrastructure, ultimately leading to lower carbon emissions, better air quality and a more resilient urban environment.	
Programme	European	URBACT	As part of this European city group, Guimarães intends to develop a digital platform, or APP, to test the viability of a virtual solution to connect those who need assistance and those who want to help (articulation between companies and organizations of social, cultural, and sporting solidarity). Guimarães in 2023, was included in the networks Let´s go Circular and BiodiverCity.	It aims to enhance corporate social responsibility (CSR) practices in urban areas. To do so, it focuses on fostering partnerships between local authorities, businesses, and other stakeholders to develop and implement CSR initiatives that address social and environmental challenges. This project contributes to the municipality's climate neutrality ambition by promoting sustainable practices within businesses, encouraging community	

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Type	Level	Name and Title	Description	Relevance	Need for action
				engagement, and driving positive social and environmental outcomes.	
Programme	European	Covenant of Mayors	Guimarães is signatory of Covenant of Mayors where the municipality committed to implement EU climate and energy objectives.	By promoting the development of Sustainable Energy and Climate Action Plans (SECAPs), the municipality was able to outline actions to reduce greenhouse gas emissions and improve energy efficiency, signal a commitment to ambitious climate goals, access resources and support, share experiences and knowledge with other municipalities, have technical support and exert political influence by sending strong climate policy signals at national and international levels.	
Programme	Regional	Adapt4City: Climate Change Awareness Program in the Quadrilátero Urbano	Implement a concerted and inclusive communication and awareness strategy that promotes environmental and climate literacy in the Quadrilátero Urbano territory.	The programme helps to create a climate-conscious and engaged community that actively supports and participates in the community's climate neutrality efforts. By targeting families, schools, institutions and businesses, the programme addresses multiple dimensions of the community. It also provides community support (participatory and open engagement) and promotes environmental and climate literacy by equipping individuals and organisations with knowledge and skills to effectively contribute to climate neutrality efforts. This holistic approach ensures a	

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Type	Level	Name and Title	Description	Relevance	Need for action
				more comprehensive and integrated approach to achieving climate neutrality.	
Programme / Netwwork	National	ClimAdaPT.Local	National network of municipalities to support climate change adaption through humanitarian, inclusive, innovative, and sustainable matters.	Promoting local adaptation to climate change in Portugal is one way to significantly impact municipalities' climate neutrality efforts: Municipalities and other entities are encouraged to engage with their communities; climate change mitigation efforts, creating a comprehensive framework to address both aspects of climate change mitigation; climate change adaptation often includes strategies that align with climate neutrality goals; community resilience; collaboration can extend to joint climate change mitigation projects, resource sharing and knowledge exchange; local innovation; education and awareness; and collective impact.	
Programme	National	Agenda 21 Location	Local Agenda 21 encourages local authorities to take initiatives for sustainable development. It recognises that many of the issues and solutions addressed in Agenda 21 relate to local activities and emphasises the crucial role of local authorities in achieving its goals. The establishment of Local Agenda 21 programmes aims to improve sustainability at the local level	Through an integrated approach, the Agenda 21 assumes a holistic approach to sustainable development, considering social, economic and environmental factors. This helped the municipality to identify opportunities to reduce GHG across sectors (energy, transportation, waste management, and land use). Local Action is also key for this programme, since it encourages local	

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Type	Level	Name and Title	Description	Relevance	Need for action
			and contribute to global sustainability. This approach has been widely adopted worldwide and has led to various successful experiences in cities and municipalities. Local Agenda 21 embodies the ecological principle of "think globally, act locally". Agenda 21 involves identifying key environmental issues, developing action plans with local stakeholders, encouraging citizen engagement through discussion forums and documenting changes towards sustainability. The involvement of various social, economic, and institutional actors is central to addressing the challenges associated with current urban growth models.	authorities, stakeholders, and citizens to actively participate in sustainable development initiatives. This engagement leads to the implementation of climate friendly actions and policies that align with climate neutrality goals.	
Programme	Local	Zero Carbon Sports program	Plan for sustainability is designed for each Sport Club.	By promoting climate neutrality in sports clubs, the programme directly addresses the GHG associated with various sports activities. These include reducing energy consumption, minimising travel-related emissions and introducing environmentally friendly practises in club operations. All these data are monitored to keep track of the GHG reduction. The programme emphasis on creating behaviour change among the sport clubs, adding the fact that these clubs have a	Mention on Module-C2

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Type	Level	Name and Title	Description	Relevance	Need for action
				strong mobilising force, so that the club sports can lead by example. Through this mobilising power, the club sport can induce sustainable practices among the community that closely follows these clubs.	
Programme	Local	Guimarães Finicia	Programme that consists of a weekly schedule to receive entrepreneurs with innovative projects.	The programme may not have a direct focus on climate neutrality, but it can contribute to encourage innovative projects, and attract businesses that develop sustainable and eco-friendly solutions; attract entrepreneurs with a focus on climate-friendly businesses; fostering sustainable startups; green job; public and private collaboration. This all play an important role to support climate neutrality.	
Programme	Local	Pegadas	Pegadas is the Guimarães ecological program for learning sustainable environmental development. Programme dedicated to environmental education, a fundamental factor in the increase of community practises based on environmentally sustainable principles, with the aim of initiating a paradigm shift in people's behaviour and lifestyles. It has all public and public schools in the Municipality of	Because the focus is on the environmental and ecological education programme, it is able to disseminate knowledge among the different strata of the Guimarães community, stimulate behavioural change, gain political and public support, empower youth to bring about cultural change through consistent education and awareness initiatives towards sustainability, and experience the spillover effect, as people who adopt sustainable habits at home are able to	Mention on Module-C2

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Type	Level	Name and Title	Description	Relevance	Need for action
			Guimarães, with the entire educational community as the target group. Some of the most emblematic initiatives: 1. “Guimarães Mais Floresta”: initial goal to plant 15 000 trees, in the end 18 000 trees were planted; in 2019 project was relaunched - new objective 30 000 trees from native species. 2. Projeto Rios: Adota um Rio (Rivers project), from ASPEA. 3. Biodiversity Go: app based on citizen-science. 4. Eco-parliament. 5. Eco-escolas (Eco-schools). 6. Green Brigades.	pass on these practises in their workplaces, social circles and wider communities. This programme has an indirect impact on achieving climate neutrality as it lays the groundwork.	
Initiative	European	Circular Cities and Regions Initiative	In 2022, Guimarães became a pilot city in the Circular Cities and Regions Initiative, focusing on implementing circular systemic solutions, including the promotion of bioeconomy, as highlighted by the completion of the first roadmap using the CCRI Methodology, offering essential policy guidance for advancing Circular Systemic Solutions and contributing to	Guimarães can implement circular systemic solutions based on the CCRI methodology, enabling the municipality to transition towards a more sustainable and resource-efficient model, contributing to reduced resource consumption, waste generation, and emissions, aligning with the municipality's climate neutrality goals.	

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Type	Level	Name and Title	Description	Relevance	Need for action
			the municipality's climate neutrality ambitions.		
Initiative	Local	One Tree for Every Life: Creating Roots for a Better World" Initiative	Initiative that focuses on planting trees to create a better world, that aims to plant one tree per birth.	This initiative directly contributes to the climate neutrality ambition of the municipality by promoting carbon sequestration, enhancing biodiversity, improving air quality, and engaging the community in climate action.	
Initiative	Local	SW-UP Sport for Women in Urban Places	Initiative that promotes women participation in sport and physical activity, having a special attention to the barriers that women face, namely in the design of more accessible, safe, and friendly urban environments to sports practice.	The initiative can impact the climate neutrality ambition of a municipality by promoting sustainable and active transportation methods, such as walking or cycling, for women in urban areas. Encouraging physical activity and reducing reliance on carbon-intensive transportation modes, the project contributes to lowering GHG emissions, enhancing public health, and fostering a more sustainable urban environment. It also allows for equal use of the streets by women who want to engage in outdoor sports.	
Initiative	Local	Guimarães “Marca”	Local initiative as a mean to promote local economy through labelling the local products and promoting them.	Even though “Guimarães Marca” may noy address climate neutrality directly, as some of the exposed initiatives do, the companies and industries that make up the local initiative have the power to adopt sustainable practices and reduce its GHG. “Guimarães Marca” as a local network of	

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Type	Level	Name and Title	Description	Relevance	Need for action
				companies is capable to promote sustainable business practices, enhance the local economy, green innovation, community engagement, influence consumer behaviour, and contribute to the public perception of the municipality.	
Initiative	Local	Guimarães Green Week	Three days of celebrating the environment, promoting best practises, and showing Guimarães' path in sustainability.	This initiative aligns with the municipality's climate neutrality ambitions by creating a supportive environment for positive change and meaningful contributions to the cause. By combining environmental and cultural elements, the event promotes sustainable practises, encourages cooperation, and strengthens the sense of responsibility of residents and stakeholders.	
Initiative	Local	RRRCICLO: Strategy for circular economy	Guimarães is reducing, recycling, and reusing organic waste through a set of simple actions with great environmental benefits. This initiative seeks, by 2030, to involve the population in achieving the municipality's sustainability goals. It is a broad initiative on the circular economy domain, that encompasses several other initiatives, e.g., RRRCiclo: recovery of green waste	The initiative contributes to the goal of climate neutrality of Guimarães by reducing organic waste, promoting circular economy practises, engaging the population, and supporting sustainable behaviours. Through waste reduction, resource efficiency and citizen participation, the initiative contributes to moving the municipality towards climate neutrality and a more resilient and sustainable future.	

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Type	Level	Name and Title	Description	Relevance	Need for action
Initiative	Local	RRRCiclo: Urgezes Circular	Encompasses a repair café, a thrift shop, local trade revitalisation, artistic institutions, and environmental education, fostering sustainable practices, resource reuse, environmental education, and capacity building.	By focusing on waste reduction, recycling, and circular economy practices, directly contributes to the climate neutrality ambition of the municipality by minimising resource consumption, reducing waste generation, and promoting sustainable consumption patterns, all of which help to lower GHG emissions and enhance environmental sustainability.	
Initiative	Local	RURBAN Link	RURBAN Link is one of the four networks of circular cities selected and established in 2021, focusing on the priority theme of urban-rural relations and on the cross-cutting themes of digital transformation and equity and social inclusion. The network is led by the municipality of Fundão and has the municipalities of Bragança, Câmara de Lobos, Guimarães, Penela, Reguengos de Monsaraz and Ribeira Grande as partners, as well as Lisboa E- Nova - Agência de Energia-Ambiente de Lisboa. It focuses on the following topics: Circular Cities; Urban-Rural relations; Digital transition; and Equity and Social Inclusion.	The initiative impacts Guimarães' climate neutrality goal by promoting economic growth, circular economy principles, skills development, and sustainable entrepreneurship. By supporting innovative and collaborative approaches to employment, the initiative contributes to a more sustainable, resilient and climate neutral future for the municipality. It also allows for a more just transition among the rural areas and vulnerable rural communities.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Initiative	Local	Good practices for sustainable management/use of water	Consists of a campaign (also in a booklet format) for the sustainable use of water. The campaign emphasises the importance of responsible water consumption and efficient management practices. The municipality aims to encourage residents and businesses to adopt sustainable behaviours that contribute to the preservation of water resources and support the overall goal of climate neutrality.	The promotion of responsible water consumption and efficient management practices leads to a reduction of the demand for water resources, ultimately reducing the carbon footprint associated with water-related energy consumption. Also, environmental education and awareness campaigns can lead to long-term behavioural changes in residents and businesses. Therefore, fostering a culture of sustainability, the initiative lays the groundwork for ongoing actions that contribute to climate neutrality goals.	
Programme / Initiative	Local	Local market without plastic	Municipal initiative to give away both reusable and vegetable compostable bags in the local market no avoid single use plastic.	The initiative to offer reusable and compostable bags in the local market, not only directly reduces plastic waste, but also supports wider ambitions for climate neutrality. By promoting sustainable consumption, minimising plastic production, and involving the local population, the municipality contributes to achieving its climate goals while promoting environmental awareness among the population.	
Programme / Initiative	Local	Second-hand local market	Promotion of circular economy and products life cycle extension through a monthly second-hand market for citizens.	Promotes the principles of the circular economy, reduces resource consumption, reduces emissions, and promotes sustainable consumption patterns. By extending the life cycle of products and	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
				engaging the local community, the municipality contributes to its goal of climate neutrality while promoting a more environmentally aware and resilient society.	
Programme / Initiative	Local	Monte Latito Biodiversity Route / Biodiversity Route of the Latito Hill	An interpretive route, which allows the visitor to better understand the existing flora on Monte Latito, a unique space, full of history, but also of biodiversity.	Promote biodiversity conservation, education, and sustainable tourism. It demonstrates a holistic approach to climate action that encompasses ecological, cultural, and economic aspects. By highlighting the value of local ecosystems, the initiative contributes to community efforts to mitigate climate change, improve resilience, and promote sustainable behaviours.	
Programme / Initiative	Local	Job in Motion | Collaborative Laboratories for Employment	Developing collaborative laboratories for employment in different cycles, from immersion in different topics, to experimenting with ideas, to prototyping and testing products and services that enable people to enter the labour market.	The emphasis on skills development, innovation and entrepreneurship is consistent with a municipality's goal of climate neutrality by promoting a skilled and adaptable workforce, supporting sustainable practises, and stimulating the development of climate-friendly solutions. It is a comprehensive approach that addresses both economic and environmental sustainability, supporting the municipality's journey towards climate neutrality.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
Programme / Initiative	Local	Lagoas e charcas do Rio Ave: Strategies of km^2 promotion of environmental action	Actions to measure the area and to analyse, collect, process, and communicate scientific knowledge, developing technical and scientific content that provides a better understanding of the significance of the riverside gallery at this site.	The initiative impacts the community's climate neutrality goal in many ways by improving carbon sequestration, promoting natural infrastructure, raising community awareness, and fostering collaboration. The initiative's focus on preserving local ecosystems is consistent with broader climate goals while providing practical environmental and community benefits.	
Programme / Initiative	Local	Metrominute	Map that shows the distances between different places of interest and the time it takes to reach them on foot. It is intended to be an incentive for pedestrian mobility, especially in urban environments, and to help reduce commuting through private vehicles.	The initiative supports the goal of climate neutrality by encouraging walking, reducing vehicle emissions, improving air quality, promoting health, and encouraging sustainable behaviours. By providing an alternative to short car journeys and incentivising walking, the initiative contributes to a climate resilient and environmentally conscious community.	
Programme / Initiative	Local	RRRCiclo: recovery of green waste	Green waste from public spaces is collected and transformed as a biomass product to be used in public schools' space heating.	By reusing green waste as biomass to heat public schools, the municipality directly reduces carbon emissions, promotes circular economy principles, improves local energy resilience, and educates the community about sustainable practises. This initiative is a valuable component of the municipality's broader climate neutrality strategy.	

A-2.1: List of relevant policies, strategies and regulations					
Type	Level	Name and Title	Description	Relevance	Need for action
				This initiative also accommodates Social Solidarity Private Institution and school groups and can also be scheduled collection for home users.	
Study	Local	Study of Environmental Perceptions and Habits	The study sheds light on the perceptions and environmental habits of Guimarães residents and provides valuable insights into the municipality's sustainability and climate neutrality efforts. The study provides a comprehensive understanding of the municipality's attitudes, behaviours, and awareness of environmental issues.	The study allowed the identification of areas of concern and patterns of behaviour, so it is possible for the municipality to tailor its climate neutrality initiatives to address specific needs and challenges.	
Study	Local	Bluehealth: linking environment, health, and climate	This study examines the health and wellbeing impacts of temporary improvements to an urban park in northern Portugal. The area of focus is the urban park in the city of Guimarães, a site which includes several small bodies of water as well as the Couros river.	Explores the connections between urban streams, green spaces, and mental well-being. While the direct impact on climate neutrality ambitions might not be immediately evident, this study can indirectly contribute to a municipality's climate neutrality goals by promoting green infrastructures, encouraging sustainable urban planning, community engagement, reduce urban heat island effect, among others.	

A-2.2: Description and assessment of policies

Guimarães has been paving the way towards a greener and climate-neutral city over the last decades and has taken up this challenge by joining the mission of 100 climate-neutral and smart cities by 2030.

On this path, several plans, policies, strategies, programmes, and initiatives have been and are being implemented by the Municipality of Guimarães in the areas of buildings, transport, waste, AFOLU, IPPU, and other areas (Figure 15).

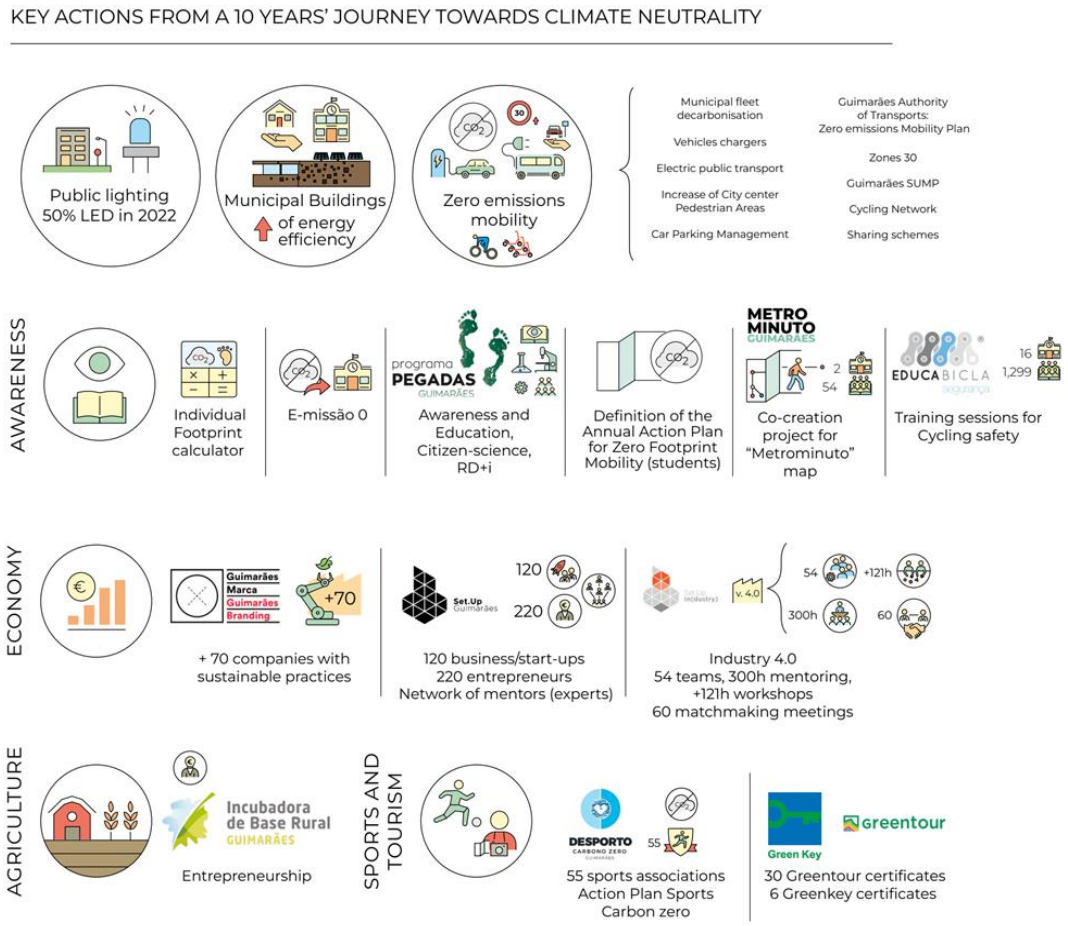


Figure 15. Ten years' journey to climate neutrality: key facts

European Green capital Award candidacy, Cycle 2025

A more detailed assessment of what the municipality has done so far towards climate neutrality is described for each sector to provide an overview of which existing plans, policies, strategies, programmes, and initiatives need to be improved and/or updated to support this goal, as well the direct and/or indirect impacts on the 2030 climate neutrality target. This forms the basis for understanding which actions can be expanded and further developed for the action portfolio, as well as the current implementation gap to achieve climate neutrality 2030.

Buildings:

Regarding the buildings sector, the Municipality of Guimarães has undertaken a comprehensive approach to enhance energy efficiency in buildings and promote building retrofitting, aligning with its

climate neutrality ambition. This entails, not only an approach to the buildings owned by the municipality, but also initiatives that promote energy efficiency and retrofitting of residential, commercial buildings, since this group of buildings make up for all the total buildings stock within the municipality area.

The Municipality of Guimarães has existing policies, strategies, programmes, and regulations concerning the buildings sector that impact directly the 2030 climate neutrality goal.

Taken the Sustainable Energy Action Plan (SEAP), where there are outlined sustainable buildings actions such as efficient lighting in buildings, air conditioning, and ventilation systems, as well efficient boilers, household appliances, office equipment and industrial equipment and processes. It also covers street lighting actions, renewable power actions as integrated renewable generation, biomass and forest residues, and thermal solar energy.

The SEAP addresses implementation models that can improve energy efficiency and complements the other plans and strategies related to efficient lighting, optimised public lighting, building certification, smart monitoring of energy consumption, heat pumps, solar energy, and biomass.

An example of a project is the District C: a zero-carbon commitment that entails pilot actions concerning the improvement of energy efficiency in historical heritage buildings at the centre of Guimarães, the development of a one-stop-shop that provides services for energy efficiency, renewable energy for the community, and the uptake of energy communities.

Also, the Intermunicipal Plan for Adaptation to Climate Change and Risk Management and Prevention (PIAAC) that approaches the urban rehabilitation of the Ave territory (in which Guimarães is a part of), aims to promote the urban regeneration of private buildings through the introduction of tax incentives and access to financial instruments linked to the existence of regeneration areas, thereby reducing the consumption of rural land for urbanisation.

The Municipality of Guimarães has already been implementing a series of actions and initiatives besides the plans and programmes mention in the previous table A-2.1, to name some of the most prominent examples:

- **Renovation of municipal schools**: Renovation of the municipality schools to achieve thermal comfort and energy efficiency, using passive and active building solutions, natural lighting, thermal insulation, and modern HVAC systems. Until 2020, this requalification included 10 education establishments in the municipality. Amongst the primary schools and kindergartens 12% already have centralised heating systems operating by biomass boiler. Furthermore, 16 units for solar thermal systems for Domestic Hot Water (DHW) were already installed. Since 2018, the mean energy consumption reduction is 15,5% per year.

  This initiative not only improves the learning environment, but also reduces energy consumption.

- **Renovation of social housing buildings**: Improved the energy efficiency of social housing by installing thermal insulation, upgrading windows, and integrating solar panels and photovoltaic systems. This project included the implementation of more efficient domestic hot water systems in the public social housing, leading to an improvement of 61% of the dwellings intervened. Furthermore, it is expected the enhancement of the energy efficiency of 166 social housing dwellings, considering the improvement of two levels in the efficiency classes. This will be accomplished by installing thermal insulation, replacement of windows and installation of solar thermal and photovoltaic systems.

  This contributes to reduce energy consumption, improve housing conditions, and reduce carbon emissions.

- **Improve public lightning:** By replacing inefficient lights with energy-efficient LED technology, the municipality was able to significantly reduce energy consumption and greenhouse gas emissions.

  The use of smart grid systems and LED technology will further increase the efficiency of public lighting.

- **Traffic Lights Enhancement:** Update the municipality traffic lights by installing LED lights and photovoltaic panels, contributing to energy savings and sustainability across its extensive territory. The installation of LEDs (100%) and photovoltaic panels (57%) represents a great effort as Guimaraes is a 240 km^2 diffuse territory.

- **Improvement of sports facilities:** Energy efficiency measures such as electronic ballasts, heat pumps, thermal insulation and intelligent energy management systems have been introduced in public sports facilities. The Gymnastics Academy of Guimarães is a sustainable reference building that uses renewable energy systems, heat recovery and environmentally friendly materials.

- **Sustainable Construction and Building Certification:** The municipality promotes sustainable construction practices, energy audits, and building certification to ensure that new and renovated buildings meet high energy efficiency standards.

- **Efficient Appliances and Green Procurement**: Guimarães applies green public procurement criteria to gradually replace less energy-efficient equipment with more efficient alternatives. This approach reduces energy consumption and promotes sustainability. The municipality have already established this for waste, transport, energy, public works, green spaces, goods and services, both the municipal budget and the activity plan are aligned with the 17 Sustainable Development Goals (SDGs) so that the distribution of public investments across the SDGs can be identified; this strategy will allow us to understand the evolution of municipal investments by SDGs and thus verify the degree of implementation of the planned agendas.

- **Housing Renovation and Urban Regeneration**: Urban renovation at Guimarães policy promotes the revitalisation of existing urban structures, minimises resource consumption and improves social cohesion. Fiscal incentives and financial instruments are used to promote building renovations that contribute to better housing conditions and energy efficiency.

  Urban regeneration is one of the most effective climate change adaptation policies. This policy aims to promote the urban renovation of private buildings through tax incentives and access to financial instruments linked to urban renewal areas (ARU), reducing the use of rural areas for urbanisation. It is expected that more than 22 ARU will be implemented in the Ave region. This policy encourages the renovation of buildings in poor condition, which affects the rental market, energy consumption and housing comfort. The project started in 2021 and will be implemented until 2024. It includes the definition and delineation of new ARUs, the promotion of public meetings to disseminate the objectives of these new areas and to promote sustainable building strategies. In addition, this project aims to develop strategic programmes to promote urban regeneration.

All the current, ongoing, and future programmes, and strategies regarding the building sector collectively contribute to enhancing energy efficiency, reducing carbon emissions, and advancing Guimarães' climate neutrality goals by embracing sustainable practices across various sectors, from housing to public infrastructure and urban development.

In a nutshell, the Municipality of Guimarães intends to close the current implementation gap (81% in the buildings sector to achieve climate neutrality by 2030) by expand the impact of these measures achieved so far. This will entail the update of current and ongoing plans to impact more households

and residential buildings, expand to other areas of the municipality the retrofitting of private and public buildings, and to keep improving energy efficiency and the uptake of renewable energy for the usage of such buildings.

It is also worth noting that some policy changes need to be made, such as updating the regulations for retrofitting historic buildings to allow the use of energy efficiency and renewable energy sources, such as photovoltaics, in these buildings. Such measures are being tested in the pilot city District C.

Transport:

As the transport sector is one of the main contributors to emissions in Guimarães, the municipality has a wide range of plans, policies, and strategies to reduce its impact and make the transition to a more sustainable approach to transport modes.

In essence, the municipality zero-emission mobility plans and policies play a critical role in a community's transition to a low-carbon and sustainable future. They contribute directly to emission reduction targets, improve public health and air quality, enhance the quality of life in the territory.

In recent years, Guimarães has made great efforts to create a more environmentally friendly public transport service (PT) and to develop a public transport network that includes a fleet of electric vehicles for public transport. Some of the public bus fleet is already electric, as a result of the municipality's efforts to establish a new collaboration with the Guimabus company for the urban transport system and inter-municipal services with CIM do Ave (Figure 16). So far, the Guimabus fleet has 26 electric buses out of 83, and the goal is full electrification. In terms of charging stations and infrastructure for electric vehicles, the municipality has 18 charging stations and intends to install 500 in the coming years.

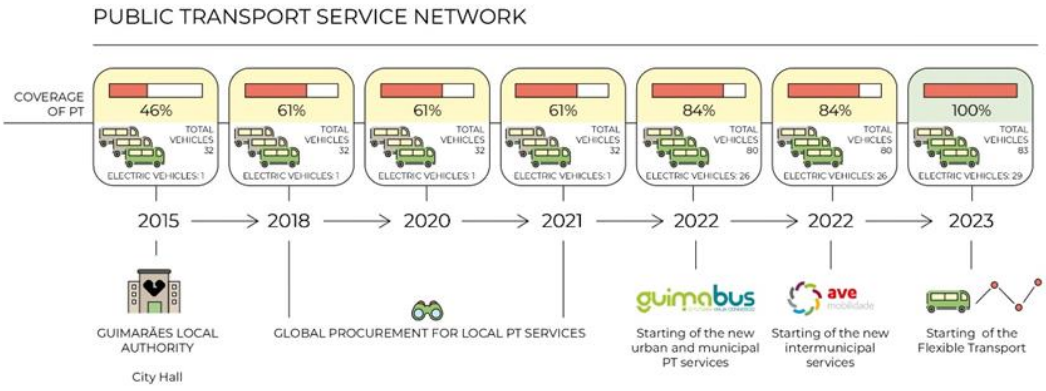


Figure 16. Zero emissions mobility: How Guimarães is making Public Transport accessible and inclusive for all

European Green Capital Candidacy, cycle 2025

In relation to current and ongoing plans, policies and strategies for the mobility and transport sector, the SECAP also outlines sustainable mobility measures to optimise the transport network, fleet distribution, commuting, electric mobility, pedestrian mobility, bicycle use and finally biofuels and alternative energy sources in transport.

Complementary to the SECAP and essential for the implementation of zero-emission mobility, the Sustainable Urban Mobility Plan (SUMP) also sets out measures already taken by the municipality, such as the expansion of pedestrian zones, improving the walkability of the city and connectivity to pedestrian zones, coexistence zones to allow for more harmonious pedestrian traffic, “KissandRide”

zones, the design of urban infrastructures to support pedestrian and rest areas, bicycle systems, e.g. public bicycles, bicycle parking zones. The project also addresses the public transport system, the interconnection of different transport modes inside and outside the city, the transition to more sustainable vehicles, the improvement of the comfort of bus stops, the development of electric vehicle charging stations and parking facilities.

The Metrominute contributes indirectly to reducing transport emissions by providing guidance to the whole community on how to move more sustainably in the city.

For the near future, the municipality intends to convert the municipal fleet to electric vehicles, achieve a 100% electric bus fleet, explore the possibility of using hydrogen buses, use biogas for waste collection and explore other applications of biofuels for mobility. As the transport sector is mainly dependent on petroleum products, which are responsible for a large share of greenhouse gas emissions, promoting the production and use of biofuels will help reduce the carbon footprint of this sector and reduce the community's energy dependence on fossil fuels.

In addition, electric car tariffs should be extended to the whole area, the acceptance of electric cars by citizens should be promoted and the use of public transport, walking and cycling as the main means of transport in the municipal area should be supported.

To conclude, in order to tackle the implementation gap of the transportation domain (77% in the buildings sector to achieve climate neutrality by 2030) the municipality intends to build on the previous work and upgrading existing plans, policies, and measures in terms of dimension, e.g., more EV charges, increase pedestrian and bicycle lanes and its accessibility, availability of public services and infrastructure, as well as ambitious plans to introduce new energy sources, such as hydrogen and biofuels.

Waste and Circular Economy:

Waste management and the circular economy is an area which the municipality is well acquainted, as it has been working on these issues for a long time. This can be seen in the numerous projects, policies, regulations, strategies and plans that the municipality has around waste and circular economy.

Although this area is not responsible for most of the municipality’s emissions, it plays an important role in the path towards climate neutrality, as the circular economy makes an important contribution to the overall goal of mitigating climate change by minimising waste, reducing energy consumption and shifting to sustainable consumption and production models. It addresses emissions associated with waste management, promotes resource efficiency, protects the environment, creates economic opportunities, engages communities, and contributes to a more sustainable and resilient future.

Regarding the existing policies, strategies, programmes, and regulations that impact the 2030 climate neutrality ambition, the waste tariff system PAYT (Pay-As-You-Throw) is the only project with this structure in Portugal. This system is implemented in the Historical Centre of Guimarães (UNESCO World Heritage). So far, PAYT comprises 34 streets, with high housing and commercial buildings density, being mandatory for all residents and retailers. Based on the polluter-pays principle, the user pays for the real waste production. In the first year after the implementation of this project, the amount of recyclable waste (paper, plastic packaging, metal, and glass) increased by 126% and the mixed waste decreased 34%. By 2022, it was expanded to 12 000 users, and 500 commercial establishments and Horeca channel. The programme successfully reduced mixed waste to 172 kg per capita/year and increase to 115 kg per capita/year packaging waste collection.

The Biowaste Plan Guimarães 2030 stresses the importance of keeping organic waste out of landfills and promoting its proper treatment through composting and other environmentally friendly methods. In this way, Guimarães aims to reduce greenhouse gas emissions, promote soil fertility, and support the circular economy.

In the same line, the Zero Waste Plan sets specific objectives and targets for each area - waste reduction, recycling, composting, and disposal - outlining the measures and strategies to achieve them. It promotes the circular economy concept, seeking to minimise waste generation and maximise resource efficiency.

Regarding the circular economy, the most prominent strategy of the municipality is the RRRCICLO that intends to switch from production and consumption linear models to circular models of sharing, reuse, repair, reintegration, and recycling, reducing waste to a minimum. It has direct and indirect contributions to the 2030 climate target, helping citizens identify, reduce, and separate the day-to-day waste. Bio-waste collection is already running, reaching the entire population by 2028.

There are, as listed on table A-2.1, several other projects and programmes that Guimarães is currently involved concerning the reduction of the different types of waste. The second life that can be attributed to them, awareness, and educational programmes, increase of the circularity of water, and innovative ways to valorise waste.

The municipality has implemented a comprehensive action based on its plans, projects, programmes, and strategies of waste management and circular economy aimed at reducing waste, promoting recycling, and harnessing the potential of waste as a resource. These measures include, for example:

- **Green waste recycling**: The municipality collects and recycles green waste from public areas and households to make compost for green spaces. In addition, part of the green waste is used to generate energy for heating boilers in public schools, which contributes to both waste reduction and energy efficiency. This strategy started in 2016 with the purpose to use available resources, reducing the waste and avoiding deforestation. The green waste generated in public areas (cemeteries, forest, and other green areas; 1 400 ton/year) and in households (with gardens) is collected by the municipality and is mainly used to produce compost for public green areas (1 250 ton/year). Furthermore, 1% of the green waste (~100 ton/year) is submitted to energy valorisation process to heat boilers in schools. The remaining 50 ton/year is sent to a mechanical biological treatment plants measure is expected to be extended to social solidarity private institution.
- **Collection of construction and demolition waste**: The municipality offers personalised collection services for construction and demolition waste on request to promote responsible disposal and recycling.
- **Selective collection in the commercial sector:** The municipality has extended the separate collection of packaging waste to the commercial sector through a door-to-door system to promote recycling among businesses.
- **Used cooking oil collection**: Guimarães promotes the collection of used cooking oil to improve waste prevention and avoid pollution.
- **Quality improvement of services and management systems**: The municipality works to improve the quality of waste management services and systems by seeking certifications for quality management (ISO 9001) and environmental management (ISO 14001 or EMAS).
- **Renewal of collection vehicles**: The municipality renews collection vehicles older than 12 years to ensure the efficiency of waste collection.
- **Civic engagement and waste awareness**: Guimarães focuses on raising public awareness and promoting citizen participation in waste management policies. This includes cooperation between the municipality, academia, and private companies to improve waste management practises and public participation.
- **Upgrading agricultural and forestry waste**: The municipality aims to reduce waste from activities, such as horticulture and agroforestry through selective collection, shredding and

reuse of green and brown waste, thereby contributing to waste reduction and fire prevention. This project is in implementation from 2020 to 2027 and includes the creation of strategies for the establishment of partnerships, the elaboration of a study for the location of the collection and eco-centres for composting, and the engagement of partners and conception of the treatment system for the forest biomass.

- **Improving treatment technology**: The municipality is improving treatment technology to upgrade mixed waste and include bio-waste from separate collection, which will keep waste out of landfills.
- **Waste prevention and reduction campaigns**: Guimarães carries out waste prevention and reduction campaigns based on the principles of the circular economy.
- **Education and awareness campaigns**: The municipality is increasing education campaigns to raise citizens' awareness of environmental sustainability and promote responsible waste management practises.
- **Awareness-raising and control measures in the hospitality sector**: Guimarães is stepping up awareness-raising and control measures in the hospitality sector to ensure compliance with waste management regulations and improve the quantity and quality of separate collection.
- **Expanding separate collection**: The municipality plans to expand separate collection in areas with potential for bio-waste and to complement the treatment network with municipal composting facilities in less densely populated areas.

To address the implementation gap in waste and circular economy domain (73% in the buildings sector to achieve climate neutrality by 2030), the municipality intends to expand its current programmes and strategies, e.g., increase the recycling rates, cover more areas at the municipality with the biowaste collection programme, to explore the option to introduce the production of biogas and the use of biofuels by the municipal fleet waste collection, and expand the circular economic models across the community, companies and industries of the territory.

Agricultural, Forestry, and Land Use (AFOLU):

The Municipality of Guimarães has strategically designed and implemented a series of interconnected actions concerning the Agricultural, Forestry, and Land Use domain that collectively contribute to achieving climate neutrality and enhance carbon sequestration through natural carbon sinks. These plans, strategies, policies, and initiatives reflect a holistic approach to urban planning, nature conservation and restauration, and biodiversity (fauna and flora) preservation and enhancement.

Plans and projects such as the Rio Ave Depollution Plan, the Corredor Verde da Veiga de Creixomil project and the River Green Ways aim to improve the municipality's green and blue infrastructure and its natural spaces and make the area more resilient to the effects of climate change. Depollution and restoring these areas allow for a cooling effect, carbon sequestration through enhancing existing green spaces and improving erosion control and soil health.

In terms of biodiversity, the Castro de Sabroso Invasive Flora Management Plan, the Biodiversity Action Plan, the Local Biodiversity Action Plan, the Green Gap and the Monte Latito Biodiversity Route play an important role for the area by focusing on biodiversity conservation, where measures are foreseen to identify, monitor and observe wildlife species, as well as to remove some invasive plants that threaten the harmonious functioning of natural ecosystems.

All these projects and plans aim to protect and enhance natural elements and green infrastructures, with a focus on planning that promotes biodiversity, enhances natural ecosystems and urban spaces, and supports ecosystem services. They also focus on addressing the impacts of climate change by creating a resilient landscape that can both mitigate and adapt to the impacts of climate change.

In the area of forestry and reforestation, Guimarães has a variety of strategies, including plans and projects, such as Guimarães Mais Floresta, One Tree for Every Life, the Municipal Plan for Forest Defence Against Fires and the Inter-municipal Programme to Protect the Sacro Montes, which aim to contribute to forest conservation, reforestation through the restoration of damaged forests and afforestation through the planting of trees in deforested and unused areas.

In addition, the municipality is working on the development of the future Guimarães Urban Tree Management Plan, with the aim of promoting the management and increase of green spaces and collecting data to track the results of the proposed actions.

With regard to green spaces, including those integrated into the city, projects and plans such as the BIOURB project, the Green Space Management Plan and community gardens focus on monitoring and removing invasive species to increase biodiversity, but also support the reforestation of road infrastructure, which is in line with the promotion of agroforestry and green spaces and contributes to the municipality's goal of increasing green spaces and carbon sequestration by planting 2 000 trees per year in urban areas, complementing efforts to improve urban comfort, reduce the urban heat island effect and mitigate the effects of climate change through various coordinated actions under these projects.

In summary, the municipality' strategies, policies, programmes, and plans have a direct impact on the achievement of the climate neutrality by 2030. As green spaces, biodiversity and forestry play a crucial role in mitigating climate change by sequestering carbon emissions and improving the overall resilience of ecosystems. These plans, strategies, and programmes are important components of nature-based solutions that contribute to carbon sequestration and storage while providing a range of other environmental, social, and economic benefits.

Finally, the municipality intends to enhance the green spaces areas among the city centre, e.g., development of a green belt under the pilot project District C, to launch an Urban Green Plan that is currently under development, that will allow the reinforcement of the protection of the natural heritage of Guimarães.

Industry:

The Municipality of Guimarães has a strong industrial presence, which is responsible for a large part of the municipality' emissions.

To transform the industrial structure into a green industry, the municipality recognises that only with a close relationship and involvement of this important group of stakeholders will be able to achieve climate neutrality by 2030.

It is worth noting that several businesses and industries in Guimarães have already developed plans and strategies to reduce their carbon footprint and promote circular economy within its industrial processes. In this context, some of them have also already committed to the Guimarães Climate Pact (here), demonstrating their commitment towards climate neutrality by being willing to share their efforts with the municipality and the community.

Companies such as Win-Win, a sourcing and consulting company for fashion brands in the garment industry, has already planned a public event to plant hundreds of trees in October. This type of collaboration with the municipality is essential to reach the goal of 30 000 trees planted and to support the current strategy of Guimarães Mais Floresta. This is just one of the examples of the active role that some companies have already taken towards the climate neutrality.

JF Almeida, another textile company in Guimarães, is a national landmark in the field of sustainability and has taken measures that will reduce emissions by 50% in the next two years compared to the reference year of 2021.

Companies and industries from the Guimarães territory such as Win-Win and JF Almeida are responding positively to the goal of climate neutrality by investing in PV panels, biomass heat pumps, electric fleets, and tree plantations (here).

Others:

The municipality of Guimarães also has European, national, and local programmes and projects that link different sectors and take a holistic approach to mitigating and adapting to climate change.

As the path to climate neutrality needs to be understood as a whole and the municipality recognises the need for an integrated approach linking environmental, social and governance issues, projects such as the pilot city District C, URBACT, Digital Commercial District – "Bairro 1128" aim to test innovative solutions for a more resilient and greener city and explore the role of digitalisation in this area.

The municipality also has programmes and plans to reduce plastic pollution through the signing of the Portuguese Plastic Pact, Aquaplastic: educate, reduce, and enhance; Local Markets without Plastic;the Network of Historic Cities against Plastic Waste; and CARE, which provides incentives for the use of reusable cups instead of single-use plastic cups.

As the social component cannot be separated from the green transition, several plans such as the Municipal Plan for Gender Equality, the Plan for Social Development and Inclusive Growth, the Cultural Management Model of the Guimarães Area - Cultural Plan, the Corruption Prevention Plan and the Municipal Youth Plan ensure that the climate neutral path considers gender equality, inclusive growth, social inclusion, and the young generations.

Finally, the municipality is aware that sharing experiences and knowledge with other cities (at national and European level) is crucial to learn what other cities are doing in terms of climate solutions in the different fields of action, to share best practises and to learn from their experiences what works and what does not. Guimarães also participates in programmes, such as the city twinning programme Netzero Cities, as well as projects and platforms that also function as networks, such as ClimAdaPT.Local, Municipal Platform on Sustainable Development Goals, CApt2: National Network for Water Circular Economy, to name a few.

At last, the next tableA-2.3 exhibits Guimarães emissions gap to be overcome with this Action Plan.

A-2.3: Emissions gap (kt CO_2e)

	Baseline emissions (BAU 2030)	**Residual emissions / offsetting**		**Baseline emissions reduction target**		**Emissions gap (to be addressed by action plan)**	
	Absolute value (%)	Absolute value	% of BAU 2030	Absolute value	% of BAU 2030	Absolute value	% of BAU 2030
Buildings and Heating	37	7	19%	30	81%	0	0%
Transport	139	33	24%	106	76%	0	0%
Electricity	158	32	20%	126	80%	0	0%
Waste	13	3	27%	10	73%	0	0%
Others[1]	242	41	17%	201	83%	0	0%
Total	589	116	20%	473	80%	0	0%

[1]Others: Includes Industry, Agriculture, and other sources. The majority of emissions from this sector corresponds to emissions from the industry sector. Activities and commitments to reduce these emissions are documented in the Climate Neutrality Action Plan, under the field domain "Industry".

3.3 Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality

Module A-3 “Systemic Barriers and Opportunities to 2030 Climate Neutrality” 2030" documents the expansion of the stakeholder mapping conducted in the previous section, which led to the identification of systemic barriers and opportunities.

It is imperative to emphasise that the Municipality of Guimarães is committed to regularly updating its systems and stakeholder mapping. This commitment stems from the recognition that engaging with stakeholders in the Climate City Contract (CCC) is an ongoing and dynamic process. The municipality aspires to gather as much support as possible for its ambitious goals. Notably, several stakeholders, including companies, organisations, universities, associations, and more, have already demonstrated their commitment to the 2030 Guimarães vision by endorsing the Guimarães’ Climate City Pact. This signifies their interest in aligning and actively participating in the CCC, making them noteworthy additions to the stakeholder mapping. These pioneering stakeholders are working alongside with the municipality to advance towards climate neutrality.

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
Actions implementation Financing and funding	- Municipality of Guimarães	Public entity	The municipality can influence its climate neutrality pathway by focusing on more sustainable practices, that influence the shift from business-as-usual practices: Environmental budgeting and reporting; green public procurement Divestment (in non-renewable energy sources), as an example.	Municipality of Guimarães is the leader of the climate change transition in the Municipality.
Actions implementation Financing and funding	- Brisa (main manager of motorway concessions and cross-cutting support services in Portugal) -GetGreen (Electric mobility) -Bird, Bolt (Electric mobility)	Companies from Mobility sector	Mobility/ transportation entities are key for the sustainable mobility infrastructure, services, technologies, and information to enable access to goods and services, cycling paths, public transport infrastructure. Private investment, strategy and actions implementation deeply support the capacity to change the mobility paradigm.	These stakeholders already expressed their interest by signing the Guimarães Climate Pact. The transport sector accounts for a considerable share of Guimarães' emissions, making it one of the key sectors for achieving climate neutrality, so it is in the municipality's interest to keep

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
				these types of actors on board. It is also in the interest of these entities to align with Guimarães' climate neutrality goals, as they help provide citizens with transport.
Actions implementation Funding and financing	- Guimabus (Guimarães public transports – bus company)	Mobility sector	Key stakeholder to shift mobility patterns to cleaner solutions. Support clean, safe, and reliable public transportation	In line with the municipality's strategic view to obtain the public bus concession.
Actions implementation	- Confeções Bugalhós - LASA - Mundifios S.A. - Win-Win - Tabel - Têxteis J. F. Almeida, S.A. - ALLCOST - Aqua Towel - Têxteis Penedo - Belfama - Bless International - Campelo SA - RECIT - FERMIR Think Green - Vaggan - Missuna - SamPedro - Solinhas – Finishing Wires, Lda - José Fontão	Textile sector companies and associations	The industry is responsible for around 1/3 of Guimarães emissions. Commitments and effective actions from this sector are a game changer for the climate neutrality. The textile industry particularly has a strong presence with great impact in the local socioeconomic conditions and on CO_2 emissions.	By improving cleaner production practices and considering circular economy, the textile industry becomes more resilient to the future impacts of climate change. This industry needs guidance on investment in circular economy actions, in energy efficiency and renewable production.

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	- Lasa Group - To-Be-Green - APICCAPS (Portuguese Footwear, Components, Leather Goods Manufacturers' Association)			
Strategic Learning and capabilities	- CITEVE (Textile and Clothing Technological Centre) - PIEP (Pole for Innovation in Polymer Engineering)	Research and technological centre	Can conduct research and develop new technologies related to decarbonisation and circular economy in the textile sector, supporting policy and guide implementation of decarbonisation initiatives.	Interest in energy and related cost savings and strategic position in the decarbonisation field.
Actions implementation Financing and funding	- RESINORTE (Recycling centre) - Ecomovimento (Collection of used cooking oils) - VITRUS (Municipal local company – waste management and green spaces) -CVR Centre for Waste Valorisation (Private non-profit association)	Waste collection players	Waste sector entities can support to waste reduction measures, while also impacting emissions from the transport sector, given the waste collecting trucks, and to create awareness on circular economy. Private financing and funding from the sector are capable for supporting and boosting the transition	Enrolment of waste sector is fundamental, not just to reduce direct energy emissions from waste collection and treatment processes, but also to evolve to scope III accounting for indirect emissions. Sector benefits from guidance and awareness raised to reduce emissions and increase their products added value through circular economy approach.
Actions implementation Financing and funding	- E-REDES (Main operator of the electricity distribution network in Portugal) - EDP (Energy company) - ESCOs	Energy sector	To fully implement the energy measures, companies from energy distribution sector are core players to provide the means to develop the municipal energy efficiency revolution, and	Integration, management and implementation of decentralised renewable energy production and energy efficiency supply.

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
			to act as financing partners (e.g., ESCOs). Electricity networks and producers are the backbone of the electrical value-chain, bringing electricity to consumers in though safe and stable supply.	
Actions implementation	- MCA Group (Construction company) - Casais (Construction company) - NVE, Engenharias, S.A. (Construction company)	Construction sector	Construction companies greatly influence buildings renovation actions, and implement the actions related with energy efficiency and renewable energy. Also, the building products industry is responsible for the embedded energy share in the built stock energy consumption.	Great demand for construction works will require specialised companies. Thus, companies can see their workload increase and be market leaders on sustainable construction.
Actions implementation Financing and funding	- Companies from "Guimarães Marca"	Private companies with local products	As part of the local business community, these companies can use their resources, expertise and reach to drive sustainable practises and contribute to the city's climate goals. Their collaboration with local authorities and other stakeholders can have a collective impact by encouraging innovation, sharing best practises and supporting a culture of sustainability within the community.	This industry needs guidance on investment in circular economy actions, in energy efficiency and renewable production. Also, private investment will support the municipality goals.
Actions implementation Financing and funding	- Vimágua (Water service management) - Tratave (management and operation of the public service of destination of industrial and	Water supply and wastewater operators	Water and wastewater collection, treatment and distribution process involve high energy consumption as well as scope III emissions from biological treatment processes.	These companies are in the path to decarbonisation, which will benefit from the support of the plan to implement the required measures. The municipality will benefit from the private investments

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	domestic wastewater)			supporting the whole CO_2 emission reduction
Actions implementation Social innovation, democracy, and participation	- Xico Andebol Sports Club - Ponte Sports Club - Tennis club of Guimarães - Ronfe Sports Club - GTEAM Guimarães F.C. (Women's football club) - GUIMAGYM - Vitoria Football Club - ERDAL Guimarães (promotion and organisation of sporting, cultural and recreational activities) - Tempo Livre (Physical and sporting activity in the community and management of the sports facilities owned by the municipality) -Fisical (Community sports and leisure centre)	Sport clubs, facilities, and promoters	Sports facilities and facilitators can adopt energy-efficient measures and act in the social domain to disseminate actions and raise awareness. These stakeholders can act and as a catalyst for lifestyle and social behaviour change, and they are also often a point for democratic participation in daily life in Guimarães	These players need guidance decarbonisation actions implementation. Also, as linked with social participation, have an interest in being aligned municipality goals and the well-being.
Actions implementation Financing and funding	- E.Leclerc (supermarket) - Celeste Atual, S.A. (Bakery Industry) - FBS-Sistema S.A. - INTERHIGIENE (Hygiene Products Industry) - Jordão (Refrigeration	Services and industry sector companies and associations	Service providers such as supermarkets or do-it-yourself suppliers, and industry play a relevant role in the municipality emissions. Also, they can influence and consumers to buy products with lower environmental impact, and vice-versa.	This industry needs guidance on investment in circular economy actions, in energy efficiency and renewable production. Also, private investment will support the municipality goals.

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	equipment company) - Leroy Merlin - Likewise pro (3D prints, electronics company) - Marcande (chemical products for industry in general and civil construction) - Smart Process (Energy and environmental solutions) - SMSA (Packaging industry) - XZ Consultores (Consultancy company) - VM systems (automation systems) - Sol do Ave (Integrated Regional Development of Vale do Ave) - ACTG (Traditional Commerce Association of Guimarães) - The Portuguese Chamber of Commerce and Industry -Business Association of Guimarães		The private sector can also act as a lever for public investment and have a major impact on financing and promoting climate neutrality measures.	
Actions implementation	- Taipas Termal (Spa) - Hotel de Guimarães Business and SPA	Hospitality and tourism sector	Hotels, and restaurants can adopt energy-efficient measures, raise awareness, and deliver products/services with lower environmental impact	This sector needs guidance on investment and new business models in decarbonisation

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	- HOOL Hotel Oliveira - MdA Hotel Mestred e Avis - Vimaranense Hotel and Tourism (Association) - A Cozinha (restaurante)			and circular economy. Community outreach, at the local, national, and international levels to drive the positive change.
Actions implementation	- Infantário Nuno Simões	kindergarten	Key role on raising the future generation. Makes the change from the inside, not just by changing its own practices but also, educating young children with environmental conscience.	The sector benefits from guidance to finance and funding and which actions that can take towards neutrality. Also, can outreach and engage community from very early in future generations life.
Actions implementation	- ACES Alto Ave - Guimarães, Vizela e Terras de Basto - Senhora da Oliveira Hospital	Cluster of health centres:	Health facilities contribute to the actions implementation and can support emissions reductions. Reducing climate change effects has strong impact in the population life quality.	Strategic partners in promoting health of citizens. Benefit from new business models and financial schemes to implement decarbonisation measures.
Actions implementation Social innovation, democracy, and participation Strategic Learning and capabilities	- Guimarães scouts - 3M (Social and - Cultural Artistic Association) - A Oficina CIPRL (Guimarães Traditional Arts Centre) - AVE (Vimaranense Association for Ecology) - Fraterna (Community centre	Social sector	A value ally on the dissemination of the actions towards climate neutrality, serving as a catalyst for lifestyle and social behaviour change, and they are also often a point for democratic participation in daily life in Guimarães.	The municipality has an interest in having these social actors on its side, as it is important for the dynamization and promotion of actions for decarbonisation by involving multiple actors. These entities are also linked to social participation, have an interest in being aligned with the climate neutrality

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	for solidarity and social integration) - Salgueiral – S.A.R.C (Solidarity, Associativism, Recreation and Culture) - Irmandade de São Nicolau - Irmandade de São Torcato			goals of the municipality and the well-being of the municipality.
Actions implementation	- Caldas das Taipas Volunteer Firefighters - Guimarães Volunteer Firefighters	Emergency responders	Firefighters are the first responders in emergencies thus can influence behaviour and implement actions.	As first responders they will benefit from the alignment with municipality goals and plans to act towards climate change action.
Actions implementation Financing and funding Governance and policy	- Associação de Municípios de Fins Específicos Quadrilátero Urbano (Association of Municipalities - for competitiveness, innovation and internationalisation) - CIM Ave (Aves' Intermunicipal Community)	Regional entities	Organisations can drive change through sustainable practises, innovation, and advocacy. A strong team and coordination are required to work with different tools and frameworks, across departments and institutions, with the community.	A close relationship with regional institutions is essential for coordination, exchange, and learning, as well as funding opportunities.
Actions implementation	- LABPAC (Creative hub) - TecPark (Technological Base Incubator)	Municipal Hubs	Municipal companies and hubs are essential in coordinating and executing local initiatives.	
Financing and funding	- CASFIG – (Coordination of the Social and Financial Scope of Housing in the Municipality of Guimarães, E.E.M)	Municipal companies	The municipality can influence climate neutrality pathway of homes by focusing on more sustainable construction practices. Environmental budgeting and reporting; green public procurement	Given the amount of investment that is needed to achieve the climate neutrality by 2030, only public investment is not enough. It is the interest of Guimarães to gather investment from the private sector as well (e.g., for buildings

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
			Divestment (in non-renewable energy sources), as an example.	renovations, energy efficiency measures), also through innovative financial schemes.
Financing and funding	- Citizens	Population	Citizens have the power to demand and implement for greener policies and products, act as a lever for public investment and policies, promoting climate neutrality measures.	Embracing the citizens and giving them a share fair part of the revenues of a green project, is a way to keep them interested in the decarbonisation pathway through innovative financial schemes (e.g., crowdfunding).
Financing and funding	- Financial intuitions - Banks	Private financing sector	Private institutions can leverage public investment to support climate action implementation.	Given the amount of investment that is needed to achieve the climate neutrality by 2030, only public investment is not enough. It is the interest of Guimarães and its citizens and businesses to gather investment from the private sector as well (e.g., for buildings renovations, energy efficiency measures).
Financing and funding Governance and policy	- IAPMEI (Agency for Competitiveness and Innovation) - Portuguese National Commission for UNESCO - Secretary of State for the Environment and Climate Action - Secretary of State for Energy	National governmental organisations and agencies	Stewardship and governance are critical. Having a strong governance model, enables the perpetuity of the actions through different political mandates. A strong team is required to work with different tools and frameworks, across departments, institutions, and with the community.	It is in the best interest of the Municipality of Guimarães that all departments are focused on the goal of climate neutrality to ensure that the work done so far is improved and the measures are implemented, regardless of who will lead the

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	- Secretary of State for Mobility - Secretary of State for Environment - Secretary of State for Nature Conservation, Forests and Territorial Planning - ANI (National Agency of Innovation) - FCT (Foundation for Science and Technology) - APA (Portuguese Environment Agency) - DGEG (Directorate-General for Energy and Geology) - AEP (Chamber of Commerce and Industry)			municipality in the future. A close relationship with national institutions is essential for coordination, exchange, and learning, as well as funding opportunities. It is important to highlight that these institutions are responsible for the majority of the public funding to be available for climate action.
Financing and funding Governance and policy	- European Commission - CINEA (European Climate, Infrastructure and Environment Executive Agency) - Clean Hydrogen Joint Undertaking (Supports research and innovation in hydrogen technologies in Europe) - EACEA (The European Education and Culture Executive Agency) -EEA (The European	European organisations and agencies	Stewardship and governance are critical. Having a strong governance model, enables the perpetuity of the actions through different political mandates. A strong team is required to work with different tools and frameworks, across departments, institutions, and with the community. European entities can influence the priority areas for funding opportunities and their allocation.	It is in the best interest of the Municipality of Guimarães that all departments are focused on the goal of climate neutrality to ensure that the work done so far is improved and the measures are implemented, regardless of who will lead the municipality in the future. A close relationship with European institutions is essential for coordination, exchange, and

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
	Environment Agency) -EIT (The European Institute of Innovation and Technology)			learning, as well as funding opportunities.
Learning and capabilities Social innovation, democracy, and participation	- University of Minho - UTAD - IDEGUI (Institute of Design) - IPCA (Polytechnic Institute of Cávado and Ave) - United Nations University - Middle and High schools - AAUMinho (Academic Association of Minho) - Curtir Ciência Ciência Viva (Promoter of Science among the school community and the public).	Universities and educational institutions.	Conduct research and develop and pilot new decarbonisation technologies, inform policy and guide implementation of decarbonisation initiatives, awareness by influence public opinion and drive demand for decarbonisation initiatives. Also, use expertise and influence to advocate for decarbonisation policies at local, national, and international levels.	Interest on Research and Development, testing pilots and finding finance and funding. By partnering with the municipality to undergo actions they can put their research into practice. Update educational plans towards decarbonisation learning and practices for the future. Interest direct actions to reduce energy consumption and emissions.
Strategic Learning and capabilities	- Landscape Laboratory of Guimarães	Research and dissemination sector	Implement projects and actions directly with citizens, influencing public behaviour and awareness, driving more demand for decarbonisation initiatives.	Outreach, build partnerships with businesses, governments, and other organisations to drive positive change in the community and demonstrate their commitment to sustainability.
Strategic Learning and capabilities	- Zero Association (Sustainable Earth System Association)	NGOs.	NGOs can build partnerships with businesses, and other organisations to drive positive change in the community and	Responsibility to address local and regional environmental challenges and decarbonising.

A-3.1: Systems and stakeholder mapping				
System description	Stakeholders involved	Network	Influence	Interest
			demonstrate their commitment to sustainability and climate neutrality, educate communities and use their expertise and influence to advocate for decarbonisation policies at the local, national, and international levels.	In terms of community outreach, build partnerships with businesses, governments, and other organisations to drive positive change in the community and demonstrate their commitment to sustainability. Interest in cost savings in energy consumption, which can benefit the universities, schools, associations, among other entities.

A-3.2: Description of systemic barriers and opportunities – textual elements

Even though Guimarães is leading efforts to achieve climate targets by 2030, the municipality recognises and acknowledges that there are still systemic barriers and challenges to overcome towards climate neutrality. By doing so, the Municipality of Guimarães lays the groundwork to identify and address key obstacles such as political constraints, limited resources, technological limitations, and cultural behaviour. Understanding these challenges enables targeted actions to effectively overcome the existing barriers. It also allows for strategic resource allocation so priority and focus can be given to the areas that need the most attention and the investment when allocating resources for action.

Overall, the municipality understands the main transversal barriers to all domains that are governance and policy, finance, technology availability, and capability to make the (behavioural) change. Part of this lack of capacity results from individual and institutional cultural patterns that are difficult to break/change.

This analysis also considered the stakeholder mapping (see Table A-3.2), as achieving climate neutrality requires stakeholder engagement and collaboration. The analysis of systemic barriers helps the municipality to foster support from key stakeholders and mobilise resources and expertise to work together towards climate neutrality.

A transversal barrier to all sectors is the complications regarding legislative requirements and legal liabilities. Every so often, in public procurement circumstances there is the likelihood to face cases of miscellaneous legal Interpretation. Such situations can cause obstruction of actions channelled to climate change mitigation. For example, contracting a company for a specific unequalled service and not comply with the presupposed competition legal requirements.

The following is a brief overview of some of the specific systemic obstacles Guimarães faces in each sector:

Buildings:

- **Electricity generated for buildings, facilities, and infrastructure**: buildings, especially households, have a considerable share in the municipality's emissions, and despite the current actions to reduce energy consumption, there is still room to improve. Regarding the residential buildings, the Municipality of Guimarães identifies financial constrains as a main barrier for citizens to improve houses' energy efficiency, as well as lack of fundamental acquaintance of energy matters. Not just the construction quality is poor and obsolete, citizens are unaware of what can be done and do not have the financial means to improve their house energy performance. Additionally, most homeowners do not heat their homes, given the inability to pay for the increase in the energy bill, makes it more difficult to find financing schemes to support the retrofit investment. Also, in multifamily buildings, condominium regulations and policy represent a barrier to hamper the change.
- **Non-electricity energy for thermal uses in buildings and facilities:** In parallel to the previous sector, the absence of the required investment capacity, energy knowledge and construction quality were identified as the main barriers to tackle consumption of non-electricity energy for thermal uses in buildings. Until recently, fossil fuel sources were cheaper than electricity, making it the preferable choice for thermal purposes. The lack of financial capacity to change from a non-renewable energy source to renewable energy solutions, or even the knowledge to understand its importance is relevant to this domain.

Transports:

- **Vehicles and transport (mobile energy)**: Guimarães actual planning follows a sprawl pattern, encouraging different demographic niches replying most on private automobile for daily transport. Such development pattern as proved threats to climate change mitigation, health, and life quality. The cultural behaviour of referring to individual vehicle created upon this necessity over the years, is deep-settled, and the excess of private vehicles represents a critical barrier to neutrality transition. The culture of referring to public transport is still not rooted and thus, (i) infrastructural constraints, given the sprawl and (ii) cultural behavioural habits, are key barriers to overcome. Also, the high costs of cleaner technology both for private vehicles and commercial ones, negatively impacts its adoption not just by citizens but also by enterprises. Thus, clean mobility is yet to be the common practice or to be fully implemented/adopted (at least) in Municipality of Guimarães. Policy and regulatory commitment and financing opportunities are required to boost cleaner mobility modes.
- **Technology uptake**: The introduction of other fuels sources such as hydrogen and biofuels are being studied by the municipality, as they are also an alternative to fossil fuels.
- **High dependence on central government for structural investments**: Investments in critical infrastructure like railways, BRT, and major roadways rely on government approval and financial backing. While the municipality acknowledges the necessity of establishing connections with high-speed trains and other pertinent mobility infrastructure to curtail individual car usage, discussions with the national government about funding availability for these initiatives are currently ongoing.

Waste:

- **Multi-sector waste management and disposal domain**: The main barrier identified in this domain is cultural behaviour to circularity and waste production and management problems. Business, industry, and citizens are still used to linear approaches and dependent on disposable goods, despite of the Guimarães efforts on this matter. Specific programmes and

plans are undergoing (see Module A-2) regarding the implementation of circular economy approach, e.g., second-hand local market, expansion of the biowaste collection programme. The extension of the current policies could be a game changer for this domain, as well as a close collaboration with the industry stakeholders and scientific institutions. Evolving from a linear approach to a circular one is key in all industrial domain.

- **Life-Cycle Assessment (LCA) of products**: In line with the above, LCA is a crucial tool to close the loop as it enables understanding the environmental impact products throughout its life cycle, from raw material extraction to production, distribution, use and disposal, especially in the dense industrial complex of Guimarães. Failure to consider LCA is a major barrier when addressing challenges such as textile products can prevent a comprehensive and strategic approach to reduce the carbon footprint of products. Integrating LCA into strategies and policies enables informed decision-making, supports a circular economy, and creates the opportunity for synergies between companies and industries, e.g., the waste and by-products of one industry can be incorporated into the industrial processes of another.

- **Technology uptake:** The production and use of biogas from biomass and biodegradable waste components is of interest to the municipality, especially as energy source to the waste collection vehicles. The region's waste treatment plant (Resinorte) does not currently have the necessary infrastructure for this type of action, nevertheless, investments are being made to make this possible.

Agricultural, Forestry and Land Use (AFOLU):

- **Land use (including agriculture, forestry, and other land uses):** The distance for daily contact with nature lead to unawareness and defamiliarization with the natural environment benefits. The city's space evolution drove to more paved spaces than green ones, hampering the carbon capture and all other co-benefits from having green/natural spaces in the city. Restoring green spaces into the city requires major changes in policy and governance, as recognised and being acted upon by the municipality. Also, finance is needed to promote green spaces and nature-based solutions existence and use, while citizens awareness should be promoting outdoor lifestyles. Improving the territories' forest and agricultural areas, through agroecology practices using native species, etc. help improve the territory resilience to climate change, reduce AFOLU emissions while, supporting carbon capture.

Industry:

The industry sector, along with the transport, is the main source of emissions in the municipality, being responsible for about one third of Guimarães emissions. It is a cornerstone of Guimarães path to climate neutrality. A challenge for the municipality is the fact that the municipality does not exercise control over industries, they are independent of the municipality's jurisdiction and have no direct responsibility for emissions from the sector. Therefore, it can be difficult for the municipality to engage these industries and companies and have a concrete impact on reducing emissions.

By involving the industrial sector in this process - the Guimarães Climate Pact is an important first step towards the final goal – is a game changer that industry and stakeholders publicly commit to aligning themselves with the municipality's 2030 vision.

At the national level, the Roadmap to Climate Neutrality 2050, industry also is a key sector. It should reduce its emissions by 73% (compared to 2005) by 2050. The temporal range to achieve neutrality varies 20 years from Guimarães commitment, imposing the significant challenge to the Municipality and its local companies.

It requires an energy-efficient dynamic systems consisting of decentralised energy supply, largely made up of renewable energy sources (solar thermal, biomass, PV), electrification, innovation and new financial models, and industrial symbiosis and resources reuse and efficiency. The use of fossil fuels should be replaced by green electricity and other alternative non-carbon fuels, such as green hydrogen or biofuels.

- **Textile and fashion industry:** Regarding the composition of Guimarães' industry, it should be noted that it has a strong tradition in the textile and fashion industry. Textile and fashion companies play an important role in the local economy, contributing to job creation and generating added value. This industry has energy-intensive spinning, weaving, dyeing, and finishing processes, many of which rely on fossil fuels, resulting in significant carbon emissions. In addition, the industry often uses a variety of chemicals in dyeing, printing, and finishing, which also contribute to carbon emissions. Water consumption also requires high amounts of energy for pumping and heating for the processes (only activities that have an impact on scope 1 and 2 of emissions were considered, as material waste in the fashion industry is one of the most pressing challenges on a global scale, as is packaging and transport).
- **Footwear industry:** Guimarães has also a significant presence in the footwear industry, with several companies dedicated to the manufacture of quality footwear and related components. This industry is known for its craftsmanship and expertise. Even though the footwear industry is not as energy intensive as the textile and metal industries, there are challenges and obstacles on the way to decarbonisation here as well. The footwear industry relies on a variety of materials, all of which have a different carbon footprint. Finding low-carbon alternatives for each material can be very complex and require significant research and development. The chemical processes used to dye and finish leather and textiles can be energy intensive and release greenhouse gases. Identifying more sustainable chemical alternatives while maintaining product quality can be difficult.
- **Metalworking industry:** The metalworking industry is also strongly represented in Guimarães. With companies specialising in the production of metal parts, machinery and equipment, this industry plays an important role in the local economy, providing solutions for various sectors. Metal production and processing are very energy-intensive activities. Traditional processes for extracting, refining, and shaping metals often involve high temperatures and energy-intensive processes, resulting in significant carbon emissions. In addition, many metalworking processes require high temperatures, often generated with fossil fuels. The transition to low-carbon energy sources, such as renewable electricity or hydrogen, can be technically complex and costly. The metalworking industry produces large volumes of products, often at high speeds. Implementing changes in high-volume production lines can be a logistical challenge. The industry operates in a competitive global market where cost considerations often take precedence. Shifting to low-carbon processes can initially incur higher costs.

In terms of climate neutrality, there are a number of challenges ahead for industry and business, namely available technologies such as the introduction of hydrogen or biofuels and the electrification of their processes, the conversion of entire fleets to more sustainable vehicles, industrial heat pumps and other technologies, the incorporation of circular economy practises from cradle to grave, and the creation of new partnerships with other industries in relation to bio-products and waste from other businesses. And to top it all off, the financial resources need to be made available to make the necessary changes, which particularly affects small and medium-sized enterprises that need financial support from national/local government, e.g., in the form of subsidies for decarbonisation.

The Municipality of Guimarães inquired via an online survey about the main obstacles for industry to implement energy efficiency and renewable energy. The barriers mentioned by industry were mainly related to financial constraints, technological challenges, and lack of technical knowledge.

Understand the system linked to the greenhouse gas emissions to build collaborations with the relevant stakeholders and organisations to monitor/reduce their environmental impact.

Through the CCC, the Municipality of Guimarães aims to create an understanding of how existing emissions gaps prevent the achievement of climate neutrality, as well as existing patterns, such as cultural behaviour towards circular economy and waste. To address this, the municipality has started a movement towards the vision 2030 for Guimarães and engaged stakeholders around the 100 Climate Neutral and Smart Cities through the Guimarães Climate Pact, the CCC itself and District C (NZC pilot programme).

The Guimarães Climate Pact is already enabling a dynamization of activities and actions by the actors who signed the pact. Two examples are the development of a tree planting campaign by a well-known textile company in the region, which invited several actors to join, and secondly, several signatories of the Guimarães Climate Pact had already requested a carbon and ecological footprint analysis from the Landscape Laboratory of Guimarães, to monitor their emissions and how to tackle them.

From the stakeholders' point of view, the main interest that binds them together is their commitment to contribute to the Guimarães climate neutrality goal by 2030. Each stakeholder group brings something different to the table - the associations and organisations can push citizens to adopt current and planned policies to drive change; businesses and industry have an interest in aligning themselves with sustainability requirements, for economic reasons, but also to reduce environmental impacts and improve public perception. Businesses are also valuable partners in implementing the measures and in promoting activities to implement the measures themselves and events.

This shows, not only the power of networking that can be achieved through stakeholder involvement, but also the replication of the co-working movement initiated by the municipality and multiplied by the stakeholders themselves.

Understand the system linked to policies and strategies to involve all relevant stakeholders, departments, and organisations.

The Municipality of Guimarães was able to delineate the current policies and strategies that have been guiding its climate transition (see Module A-2 Current Policies and Strategies Assessment).

To close the existing emissions gap, the municipality through the portfolio of action (see Module B-2 Climate Neutrality Portfolio Design) intends to link the needed actions (upgrade of current actions, strategies, and plans; new actions; pilot actions) to the actors that should be involved on its implementation. This connection is a work in progress, having the municipality as a facilitator, e.g., though workshops sessions and dedicated spaces.

It is also important to note that the stakeholder's involvement also concerns organisations, associations, academia, citizens, and the departments of the municipality itself, since for example, the Guimarães Climate Pact can be signed by any type of entity, and the workshop sessions (the first round so far) is open as well to a diversity of entities.

Analyse of systemic barriers to 2030 climate neutrality.

From the data collected in Table A-1.3. it can be deduced that the transport and building sectors are responsible for most of the emissions on which the municipality can have a more direct influence, in addition to the emissions caused by industry.

The Municipality of Guimarães has infer the systemic barriers to climate neutrality by 2030 for the domains on buildings, transports, waste, Agricultural, Forestry and Land Use (AFOLU), and industry.

The main identified barriers concern:

- Financial constraints.
- Lack of fundamental knowledge on energy matters (general community).
- Regulations and policy.
- Absences of the required investment capacity.
- Cultural behavioural habits.
- Linear approaches (instead of a circular economy approach).
- Technological challenges.
- Lack of technical knowledge.

Systemic barriers require a systemic approach to solving them, one that can address the obstacles holistically and consider the interconnections and interdependencies between them.

The Municipality of Guimarães will do its best to address systemic barriers by working with stakeholders to develop actions that can simultaneously bring about systemic change and close the existing emissions gap.

These actions will address the sectors responsible for the municipality's emissions, as well as governance, organisational and social sectors to holistically cover all dimensions on the path to a climate fair transition by 2030. This also allows for a closer look at systemic barriers ranging from financial constraints to cultural behaviours.

Monitoring progress on emissions reduction by actors in these sectors will be further analysed, but this is a priority for the municipality.

By understanding the challenges ahead, the Municipality of Guimarães will be able to create a comprehensive, evidence-based action plan that includes specific actions, timelines, and milestones to achieve climate neutrality by 2030.

In summary, the analysis of systemic barriers and challenges is crucial for the Municipality of Guimarães to overcome barriers and achieve climate neutrality by 2030. It enables the development of tailored solutions, strategic allocation of resources, stakeholder engagement, long-term planning, and effective monitoring and evaluation. By understanding and addressing these barriers, the municipality can start on the path to a sustainable and resilient future.

A-3.3: Description or visualisation of participatory model for the city climate neutrality – textual and visual elements

Guimarães has planted the seeds for the climate-neutral revolution in the community over the past decades. The participatory model for climate neutrality of Guimarães is intended to be permeable to the contributions and participation of the different stakeholders (public and private sectors, businesses, citizens, universities and colleges, and organisations) that make up the municipality of Guimarães, grounded in the Guimarães 2030 Governance Ecosystem.

The participatory model for Guimarães embraces (1) the set-up of the Transition Team, responsible for the management of all the activities and procedures embedded in the development and implementation of the CCC, as well the (2) engagement of Guimarães community and all interested parties, since Guimarães cannot achieve alone its climate neutrality ambitions by 2030.

1. Guimarães Transition Team

The Transition Team is the core team for the implementation of the planned actions on this 2030 Climate Neutrality Action Plan and to ensure the 2030 Climate Neutrality Commitments are achieved. The Municipality of Guimarães brought together members that enriched the team, to bridge the municipality and the ecosystem of multiple actors across the society towards the climate neutrality by 2030. Having that in mind, Guimarães Transition Team was based on:

- **Diversity**: Guimarães Transition Team members have different but complementary professional and scientific and technical backgrounds, which strengthens the results achieved. The Transition Team is composed of members from the Environmental and Public Space Division, the Energy Efficiency Office, and the Mobility division of Guimarães municipality, experts from the Landscape Laboratory, from the Centre for Environmental Research and Education, an association for the promotion of sustainable development, and the coordinator of Mission Structure 2030, as well experts in climate change mitigation and adaptation strategies.
- **Definition of roles, responsibilities within the team**: the Transition Team holds weekly meetings to coordinate tasks, exchange feedback and share ideas and lessons learned. The Transition Team also meets with Guimarães' city advisor once a fortnight to gain key insights for the climate city contract, share ideas and absorb knowledge and feedback. Transition team members were assigned responsibilities during the drafting and development of the CCC, always with the idea in mind that Guimarães' climate ambitions can flourish through the co-design process in the region. Maintaining good communication and a cooperative team culture was a key factor in the harmonious development of the CCC.
- **Shared principles and values**: all team members share a common ground of understanding of Guimarães vision and climate ambitions, embracing the transition challenge.

Guimarães is aware that, in addition to the transition team, transition management also involves engaging and extending to external agencies and actors. Project management is not the only factor in managing the transition to climate neutrality, but requires participatory, transdisciplinary approaches that bring together multiple perspectives and resources between different actors and stakeholders, and at different levels of government.

The Guimarães Transition Team starts as an "internal" team, but over time intends to expand "externally" by providing spaces for public interaction to bring together different actors in the Municipality of Guimarães to accelerate the transition to climate neutrality.

2. 2030 Guimarães Governance Ecosystem

Guimarães has its own governance ecosystem that considers the relationships between the actors and interested parties that make up the municipality of Guimarães.

Figure 4 (in Work Process section) shows the existing intertwined relationships between stakeholders, partnerships, different levels of government with the private sector, citizens, academia and research and innovation institutions – to overcome identified systemic barriers and take advantage of associated opportunities. As shown in the figure below, the seven pillars of the 2030 governance ecosystem are political consensus, research, mobilisation, communication, monitoring, consultation, and education. These lead to eco-citizen governance through integration processes, knowledge and technology, innovation, and management. The 2030 Guimarães Governance Ecosystem was also published as a scientific paper.

The Guimarães 2030 Governance Ecosystem has imbibed two different stages for sustainable development: (1) transition stage: set up procedures that allow the establishment of a strategy focused on the diagnosis and improvement of environmental indicators and raising awareness among

citizens; (2) transformative stage: related to the internalisation of the concept of sustainability in the daily basis city hall practices and how different stakeholders' groups are being involved.

3. Stakeholders' involvement

3.1. Stakeholders mapping

Guimarães within the Transition Team, engaged in a dynamic session to unveil the stakeholders that would be involved with the 2030 Climate City Contract. Some of them already work closely with the municipality, others would be an addition. Through the stakeholder analysis, it was possible to map possibles saboteurs, influencers, recommenders, end users, economic buyers, and decision makers. The stakeholders mapping and analysis session is represented on Figure 17.

Through an Ecosystem Mapping and Analysis, based on a stakeholder analysis canvas, Guimarães mapped the city assets (civic groups, NGOs, companies, associations, organisations, public and private sector), the power dynamics between them, and the role played on Guimarães transition towards climate neutrality. It is important to have in mind that this mapping process is susceptible to be refined throughout the CCC lifespan.

This stakeholder's analysis and mapping was crucial to understand how Guimarães can co-create meaningfully paths and relationships with the stakeholders identified, supporting the stakeholders mapping from A3-1 section.

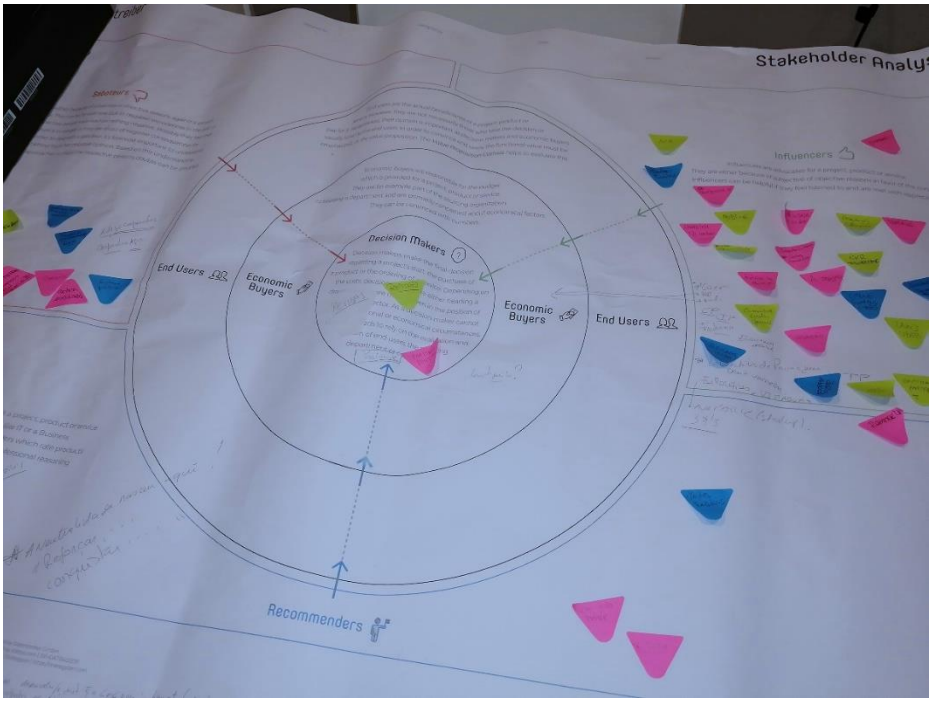


Figure 17. Stakeholders mapping and analysis.

3.2. Guimarães Climate Pact

Guimarães organised an online meeting with the industry sector, aiming at presenting the Guimarães Climate Pact and the Climate City Contract. Industry was selected given its major role in Guimaraes share of emissions. This meeting intended to inform the objectives of Guimarães' Climate City Contract and to involve businesses and industry in Guimarães' climate goals.

From this meeting it was possible to infer that several companies are already on their own path to sustainability and showed interest in participating and signing both documents, the Guimarães Climate Pact and the CCC. Figure 19 illustrates the invitation for the virtual event with Guimarães' companies and industry.

Figure 18. Presentation session with Guimarães' industry and companies.

On 22 May 2023, the Municipality of Guimarães held a session for all the interested entities on the Guimarães Climate Pact and the Climate City Contract (Figure 19). From civic organisations, NGOs, sports associations, universities and academy, hospitals, to industry, several entities remarked their commitment and intention to sign the pact. This was an important moment for the Municipality of Guimarães, as it allowed to create awareness about the 2030 Guimarães vision, and to bring together the first people interested in signing the Guimarães Climate Pact and being part of the Climate City Contract.

Figure 19. First informal presentation of the Guimarães Climate Pact and the Climate City Contract at the Main Hall of the City Council.

Following the first moment of presentation, on 5 June, on the 50th anniversary of World Environment Day, the Municipality of Guimarães held a ceremonial moment of the mayor signature of the Guimarães Climate Pact and launch of the website dedicated to the mission Guimarães 2030: Join the green transition. The event was also marked by the signature of 70 entities (Figure 20) reflecting the commitment of several entities towards the Guimarães climate neutrality goal, demonstrating the alignment of multisectoral stakeholders with the 2030 Guimarães vision. The agenda involved roundtables on sustainable public procurement, the climate neutrality challenge for the industry, and RandD plus innovation for the climate transition (Figure 21).

Figure 20. Formal presentation of the Guimarães Climate Pact.

Figure 21. Agenda for the Circular Economy Conference that held the signatory moment of the Guimarães Climate Pact.

To create a brand that mirrors the movement that will inspire the 2030 Guimarães vision, Guimarães Municipality also created a logotype with a message associated: Guimarães 2030 – Join the Green Transition. These logotype and image unify the municipality journey towards climate neutrality, embracing not only the Climate City Contract, but also the Pilot City Programme (District C), Guimarães Climate Pact, and the UE Cities Mission: 100 Climate-Neutral and Smart Cities by 2030. The dedicated website can be found on: https://guimaraes2030.pt/ (Figure 23).

Figure 22. Logotype and launch of the website for the mission 2030 Guimarães: Join the Green Transition.

3.3. Workshop sessions for the Guimarães Climate City Contract

The Municipality of Guimarães, in collaboration with the Landscape Laboratory of Guimarães, organised a first series of workshops on energy (on 22 June 2023), mobility (on 7 July) and waste and circular economy (on 20 July). A dedicated team from the NZC consortium was assembled to assist the municipality in engaging industry stakeholders and to provide feedback on how to improve the delivery of the workshop series. This was a valuable contribution to the Transition Team as it provided inputs to act in a real context and help the Municipality of Guimarães in the complex task of actively involving industry and businesses in the implementation of the actions of this Action Plan.

These thematic areas were chosen because, for the first interaction of the Climate City Contract, these areas are crucial to Guimarães' path to climate neutrality and to building a foundation for the 2030 Climate Neutrality Action Plan. Furthermore, energy, mobility, waste, and circular economy are areas of interest for different stakeholders, from industry to NGOs and citizens.

The three workshops followed the same framework to standardise the workshop sessions and to facilitate its delivery. The Municipality of Guimarães worked with a specialist in group dynamics that had worked with the municipality in the past.

The first workshop, dedicated to the energy sector, focused on five main themes: substitution of natural gas; renewable energy at small and community scale; renewable energy at a large scale; energy innovation; and energy efficiency.

The second workshop, on mobility and transport, focused on commuting, transport of materials/resources, and fleet management and outsourcing. These topics were previously selected based on the first workshop audience preferences, enquired through a quick online questionnaire.

Regarding the third workshop for the waste and circular economy, the themes discussed were: waste prevention; food waste; waste or by-products - circular economy and recycle more - increase recycling rates.

Each workshop started with a brief and uplifting presentation, followed by a quick group dynamic to break the ice among the participants and create the right mindset for the workshop, followed by a presentation on the topic by a key speaker, and then the canvas dynamic.

The canvas dynamic was divided in two parts:

- A dynamically aligned canvas with three categories of ideas: "Down-to-earth ideas", "Heavenly ideas" and "Ideas from another planet". The aim was for the group to first think about actions that were relatively easy to implement, the so-called "down-to-earth" ideas. The second phase was to think of ideas that were ambitious but feasible, ideas that fell in between and corresponded to the "blue sky ideas". Finally, for the last category, the "ideas from another planet", participants had to come up with the most ambitious, seemingly impossible, and outlandish ideas.
- The second part consisted of building on the inputs gathered in the first part, filling in the Climate City Contract canvas (Figure 24) that was specially created for the workshop sessions. There was one canvas for each theme and each group had to take one idea from each team and work out the timeline for action (2023, 2025, 2030), the partnerships and resources needed for implementation and the expected benefits and outcomes.

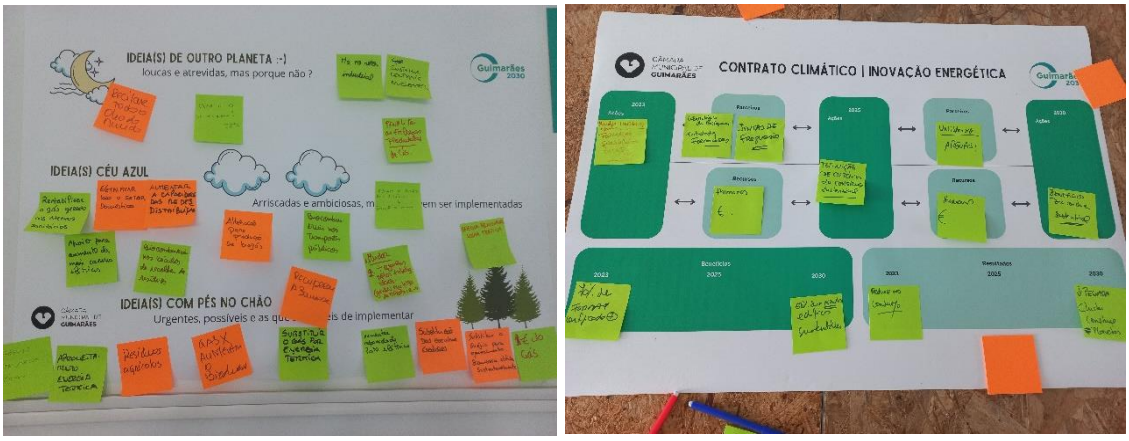


Figure 23. Ideas canvas (on the left) and the Climate City Contract canvas (on the right).

Source: Landscape Laboratory of Guimarães

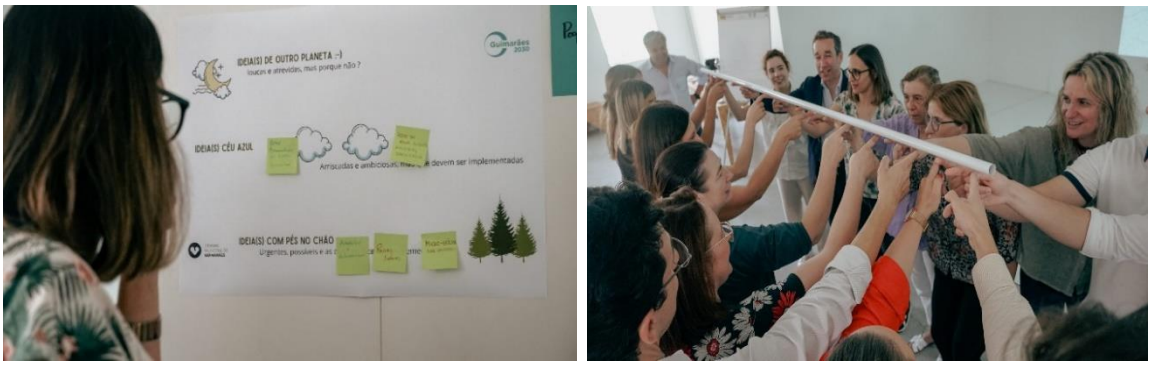


Figure 24. First role of workshop sessions for stakeholders' auscultation and actions co-creation procedures.

Source: Landscape Laboratory of Guimarães.

As for the outputs of the three workshops, in annex to this Action Plan, it can be found the most relevant outputs as, the canvas, the attendants, and the key results. Additionally, on chapter 0-

Annexes it can be found the main ideas that came from the first part dynamic, the creation of the canvas with the “Down-to-earth ideas", "Heavenly ideas" and "Ideas from another planet".

These workshops aimed to prepare stakeholders and the Municipality of Guimarães to work closely together under the Climate City Contract and to create a safe space for the joint development of possible actions to integrate the 2030 Climate Action Neutrality.

The Municipality of Guimarães is aware that, to achieve real change and address one of the greatest challenges of our time, it is necessary to create spaces where people can come together and think about solutions rather than focusing on barriers and obstacles. Therefore, the municipality has designed these workshops to involve stakeholders in a more concrete and meaningful way, in addition to the Guimarães Climate Pact.

For the successful development and implementation of this Action Plan, the municipality wanted to bring ideas and translate them into actions that come from the stakeholders (mainly industry, companies, and organisations), as they are the ones who will implement them and reaffirm their commitment to the climate neutrality of the territory.

In summary, the Municipality of Guimarães, together with the Landscape Laboratory of Guimarães, planned a second round of workshops to further nurture the bonds established between the stakeholders involved and with the municipality, as well as to promote these relationships to further develop the Climate City Contract with improved actions, outcomes, and new participants.

4 Part B – Pathways towards Climate Neutrality by 2030

Part B – Pathways towards Climate Neutrality by 2030 represents the core of the Guimarães' 2030 Climate Neutrality Action Plan comprising the analysis of the pathway that the municipality intends to follow having the NZC Theory of Change as a guideline, adapted to the reality of Guimarães. It also compresses the analysis of the scenarios, strategic objectives, impacts, action portfolios and indicators for monitoring, evaluation, and learning.

4.1 Module B-1 Climate Neutrality Scenarios and Impact Pathways

Module B-1 "Climate Neutrality Scenarios and Impact Pathways" lists the impact pathways, early and late outcomes and direct and indirect impacts (co-benefits) of the Municipality of Guimarães according to and adapted from the NZC Theory of Change, clustered by the fields of action: energy systems, mobility, and transports, built environment, waste and circular economy, green infrastructure and nature-based solutions, industry, and cross-cutting actions.

Bellow its presented on

Figure 25 is a summary of the approach of the municipality towards the Theory of Change (TOC) expressing its connecting with the 2030 Guimarães Governance Ecosystem.

The following schemes demonstrate in an illustrative approach the entry points (EP), early-changes (EC), later-outcomes (LO), impacts (I), and indirect impacts (co-benefits) for each action, levered by the systemic levers and the connections among them. To a more detailed approach see the Table 4 on the Annex: 0.

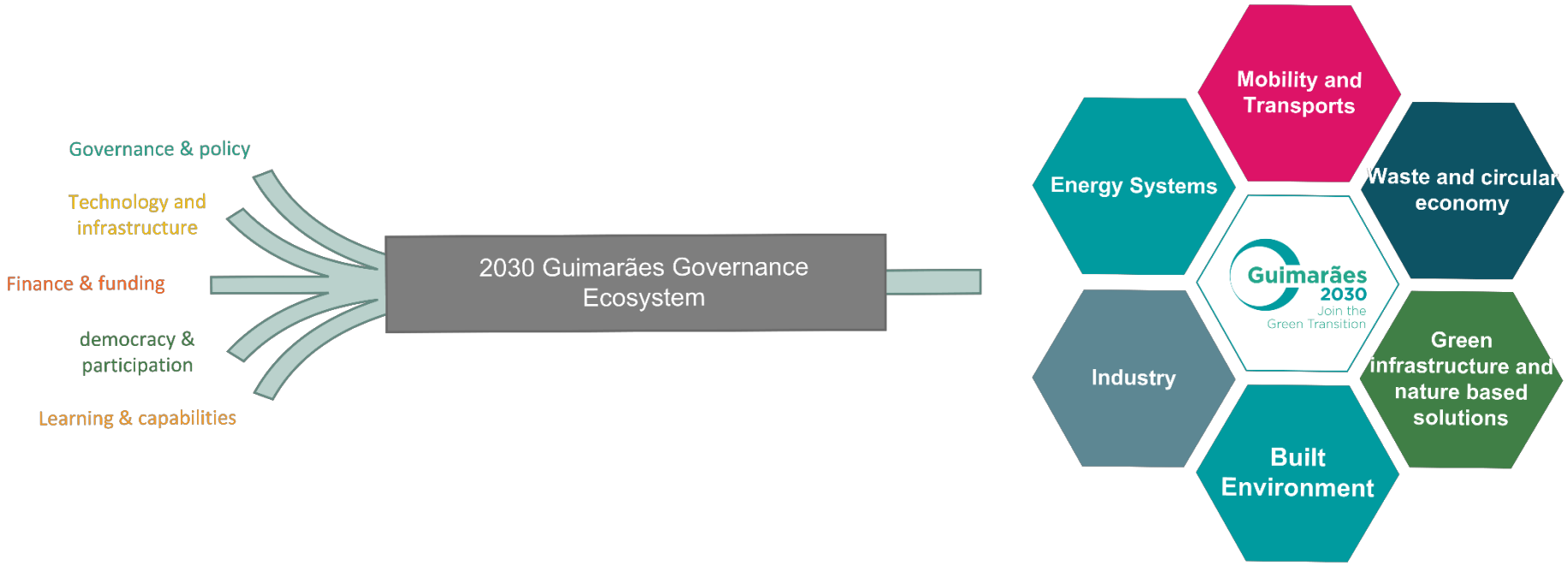
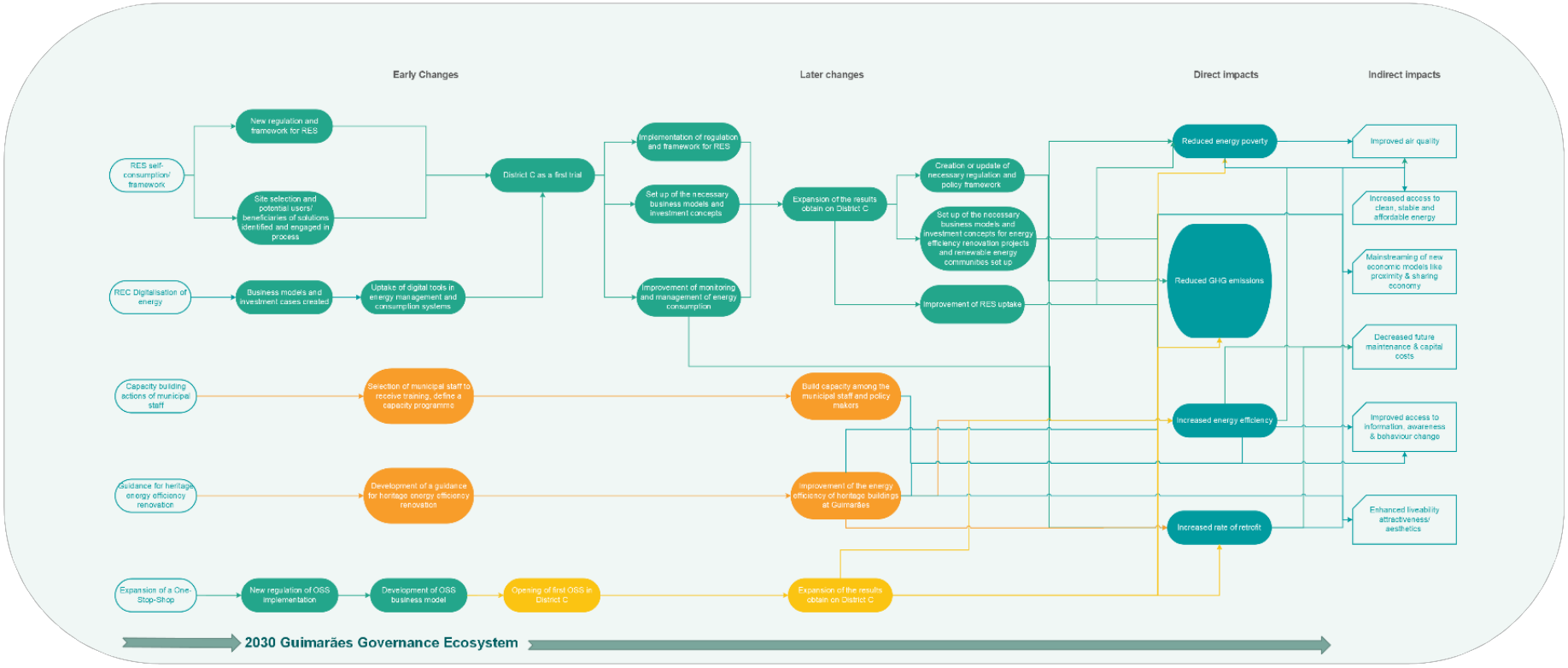


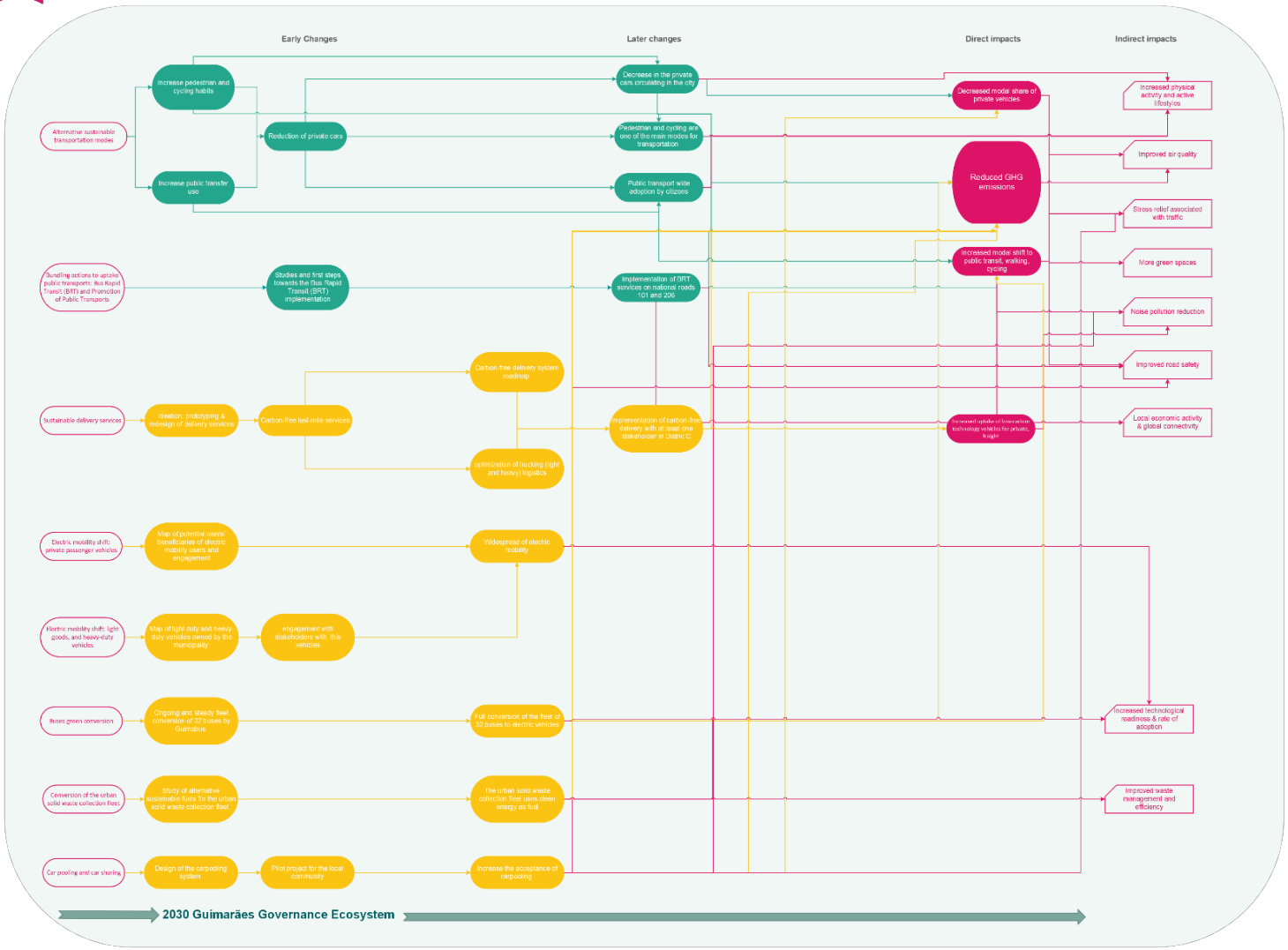
Figure 25. Guimarães' Theory of Change

Energy Systems



Governance and policy | Technology/ infrastructure | Learning and capabilities | Financing and funding

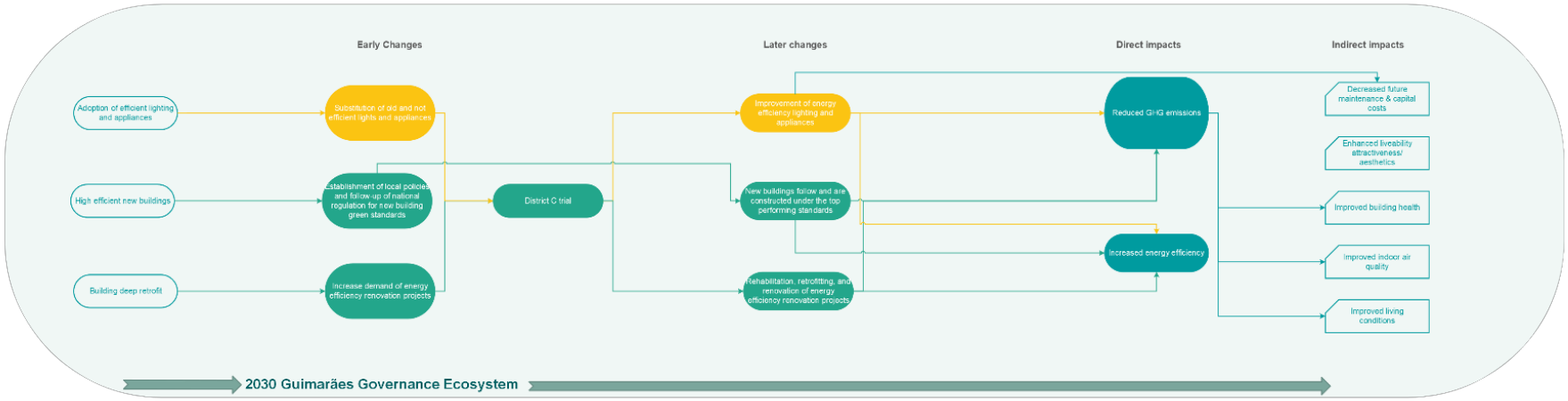
Mobility & Transport



Governance and policy

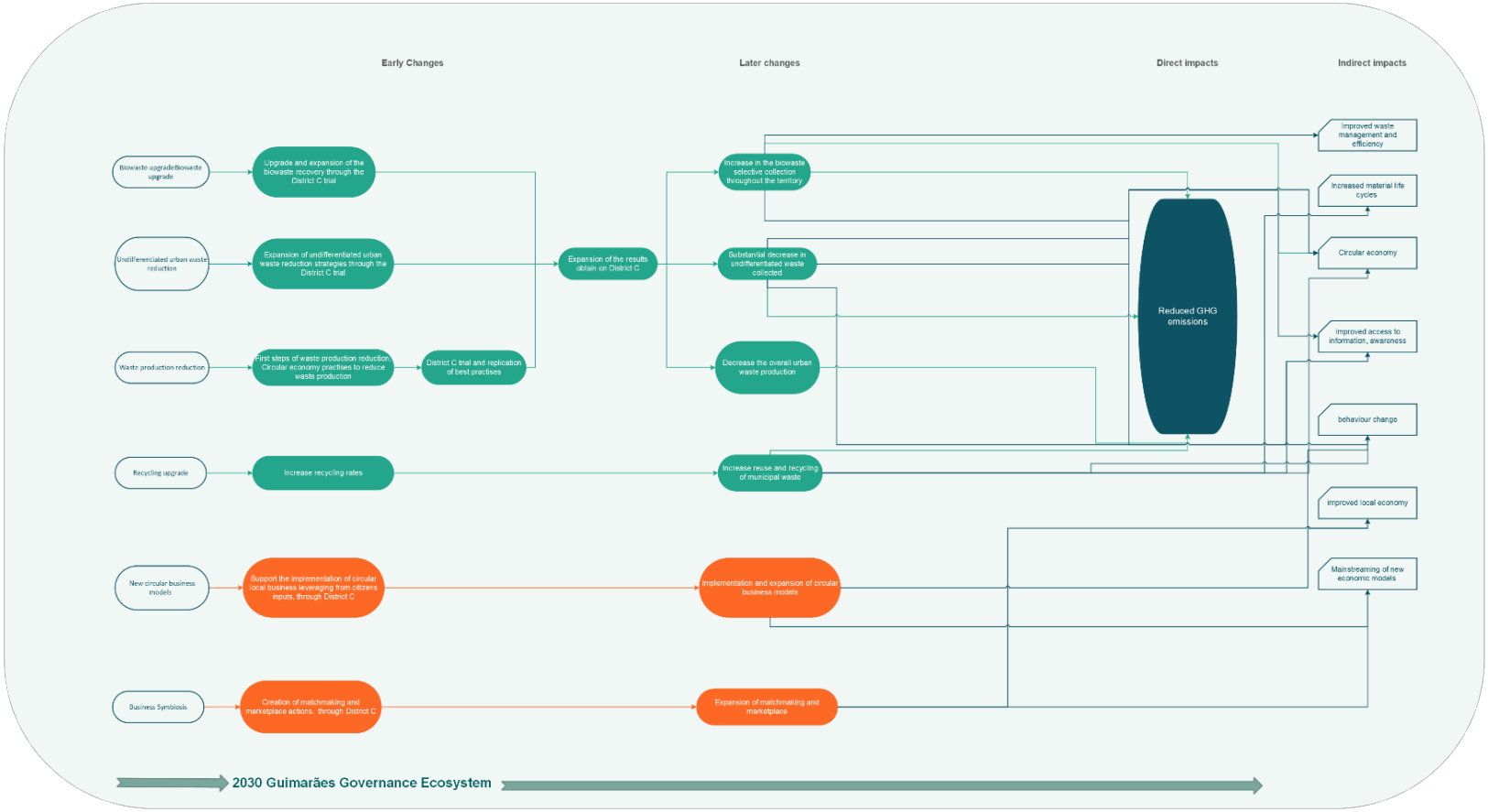
Technology/ infrastructure

Built Environment



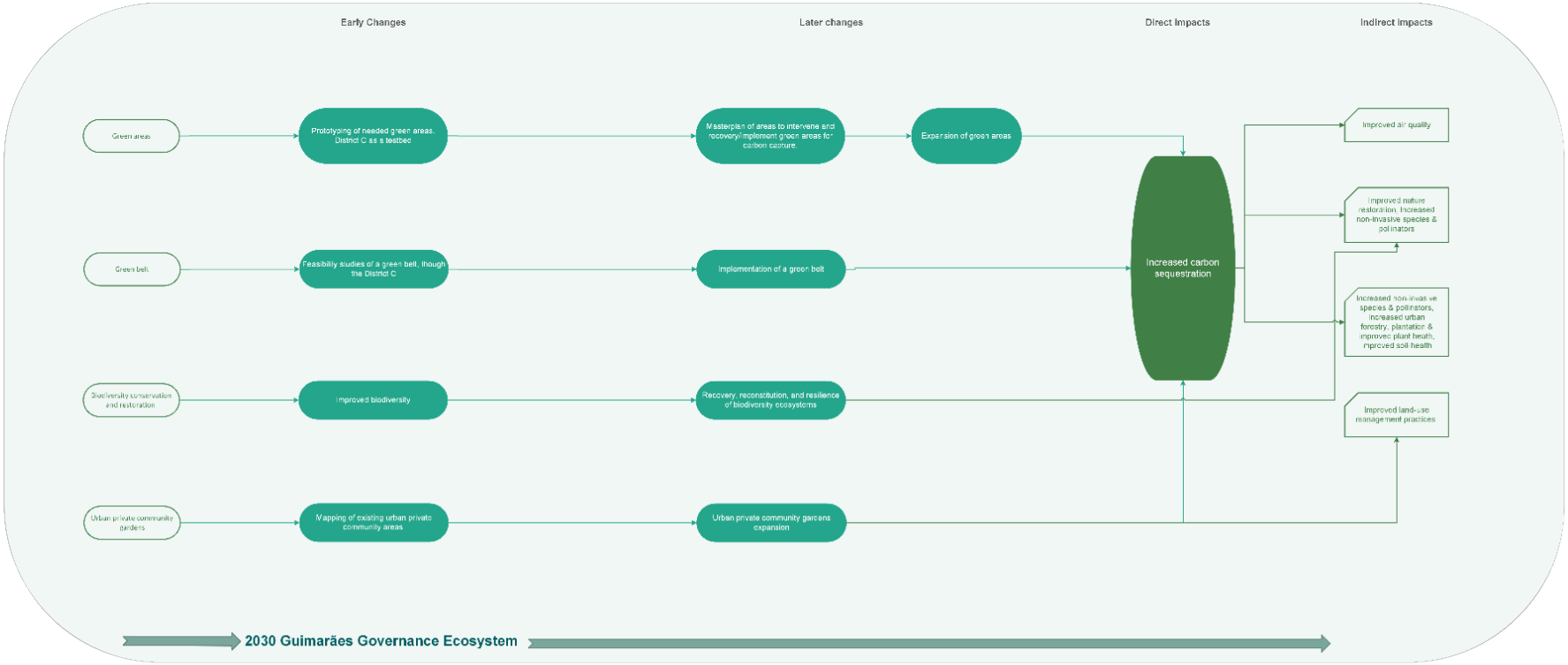
Governance and policy | Technology/ infrastructure | Learning and capabilities | Financing and funding

Waste and Circular economy



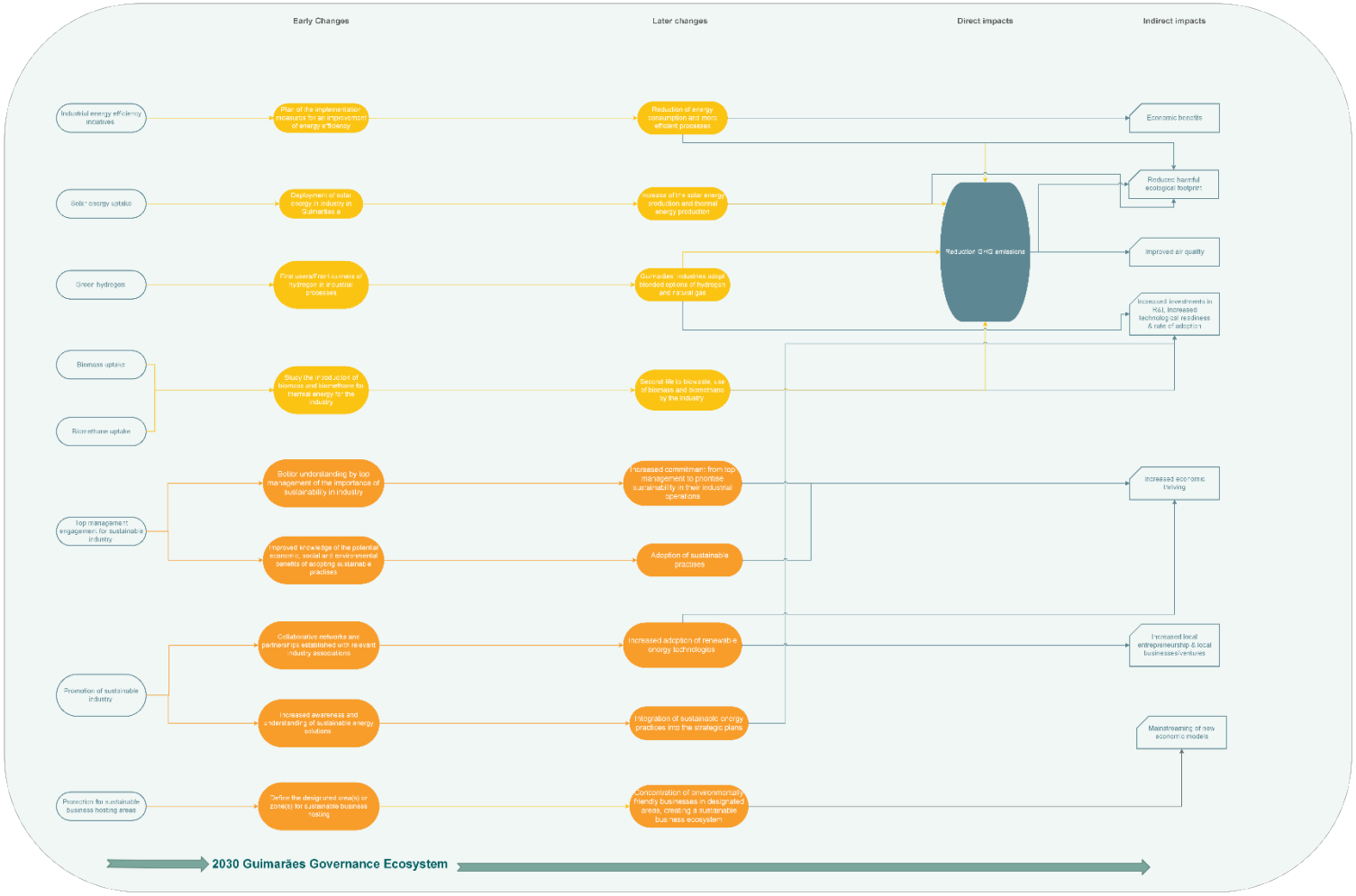
Governance and policy | Technology/ infrastructure | Learning and capabilities | Financing and funding

Green infrastructure & nature-based solutions



Governance and policy | Technology/ infrastructure | Learning and capabilities | Financing and funding

Industry



Governance and policy | Technology/ Infrastructure | Learning and capabilities | Financing and funding

B-1.2: Description of Guimarães' impact pathways

The Municipality of Guimarães has the intent to unravel its systemic levers and create a portfolio of actions, putting the citizen at the heart of change, and involving different stakeholders to implement the actions and the lead the transformative change.

Guimarães approach to the NZC TOC (NetZeroCities Theory of Change) intends to expose through the several emissions domains (energy systems; mobility and transport; waste and circular economy; green infrastructure and nature-based solutions; built environment; Industry) the early changes, later outcomes, and impacts (direct and indirect) that are expected to occur due to the implementation of the actions on the Guimarães' Climate City Contract (CCC).

It is worth noting that it was done a blend approach to the application of the NZC TOC concerning the ambition of Guimarães towards climate neutrality by 2030 through the CCC as well the ambition of the municipality with its pilot project – District C – from the NZC Pilot Cities Programme. Guimarães considers that is beneficial and it makes complete sense to integrate all the current projects and ambitions regarding the common goal, having a cohesive and harmonious strategy.

Given that, the NZC TOC diagram (Figure 26) means to be a visual representation of how Guimarães impact pathways are expected to happen, through a story-telling diagram with associated risks and assumptions.

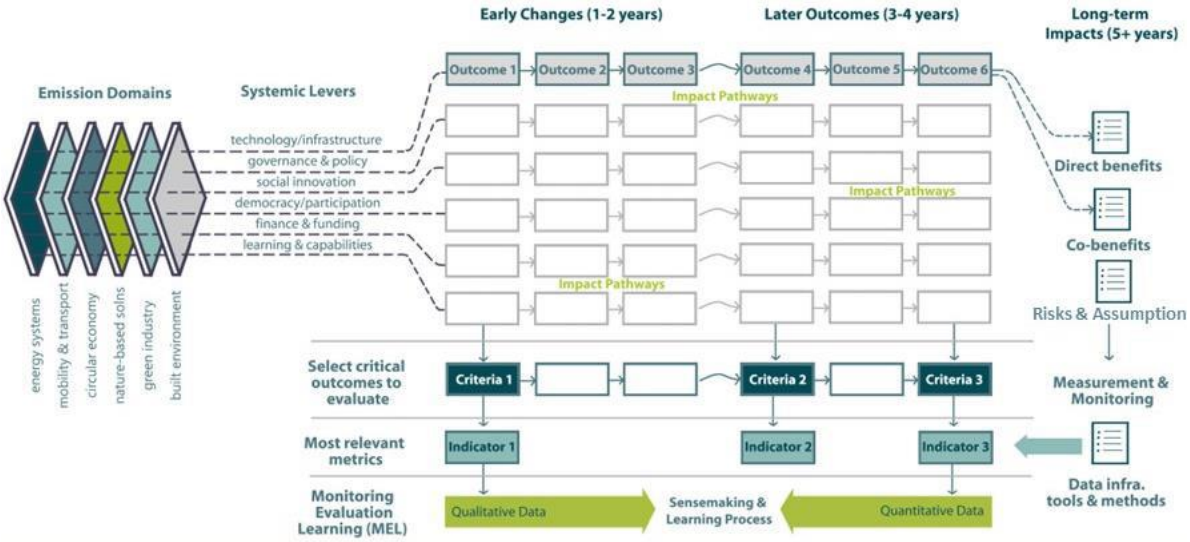


Figure 26. NZC Theory of Change

1. Guimarães' approach and application of the NZC Theory of Change

Firstly, the NZC Theory of Change (TOC), as also known as "impact logic" allowed Guimarães to draw an approach to the impact pathways based on the intersections trigger by the planned actions, starting with early changes (EC), followed by later outcomes (LO), ending on direct and indirect impacts. It is important, before dive into in the Guimarães impact pathways, to briefly contextualise this set of concepts, and how Guimarães approached them:

- **Entry points (EP)**: For the Municipality of Guimarães the entry points correspond to the concrete actions based on the update of the current actions and plans (making them more ambitious to achieve carbon neutrality by 2030). In addition, the activities of the pilot city in District C will be used as a testbed for the interventions and then adapted to be expandable and replicable in time and space. Finally, new actions will be taken by the municipality and the

different stakeholders in the region, stemming from the need to close the current emissions gap.

- **Early changes (EC)**: Consist of the pre-conditions needed to implement the planned actions for the first years (1-2 years). The ECs identified by Guimarães set the tone for the long-term impacts, focusing on the quick wins obtained from the portfolio of actions, and the necessary build up to turn possible the implementation of the actions. Guimarães can establish a relationship between the action, the outcomes, who is affected by the intervention, who needs to be engaged, and the associated impact and costs.

- **Later outcomes (LO):** The later outcomes correspond to the emergence of the later changes that arose from the early results, the impact that the early results had at the level of the whole territory (2-3 years). The intention of the LOs is that Guimarães can learn from the successful first implementation phase of the measures and achieve an approximation of the expected impacts and co-benefits.

- **Direct impacts**: Consists of the reduction of GHG emissions through the implementation of an action. Direct impacts include climate mitigation impacts (e.g., reduced GHG emissions; reduced energy poverty) and climate adaptation impacts (e.g., reduced risk to natural/climate disasters or hazards; increased carbon sequestration through NBS). It is worth to mention that some direct GHG emissions reduction were able to determine (kt CO_2e) with the help from the NZC economic model (here).

- **Indirect impacts**: Refers to the co-benefits and positive effects generated by an action. Indirect impacts accommodate public health and environmental impacts; social inclusion, democracy, and cultural impacts; economic development impacts; resource efficiency impacts; and biodiversity impacts.

It is worth noting that direct and indirect impacts can be achieved through the same action, e.g., the transition from combustion buses for electric ones, increase modal shift to sustainable mobility modes and have an impact on GHG emission reductions (direct impact) as well on air quality (indirect impact).

The NZC TOC applied to Guimarães can assume two important purposes, as it can be used as a communication tool (e.g., it can be simplified and turn it visual appealing) and as a framework for tracking progress through monitoring and evaluation, to further exploit the MEL (Monitoring, Evaluation, and Learning) procedures of the CCC. Since the NZC TOC consists of an on-going process, that shall be frequently updated, to mirror new initiatives developed over time, the current Guimarães approach to NZC TOC is prone to suffer changes through the interactions of the CCC.

There is also a relation between the TOC and the MEL methodology, concerning the fact that through the finding of the impact pathways, direct and indirect impacts, Guimarães is able to pin-down at an early stage the expected impacts of the measures on the 2030 Climate Neutrality Action Plan, that can feed the monitoring, evaluation and learning (MEL) processes.

Regarding the assumptions and risks associated with the development of Guimarães TOC, various assumptions were made to try to materialise EC and LO, as well impacts from the implementation of the planned actions. These assumptions and risks can be internal (e.g., resources available – human, capital, technological, financial, expertise; support and endorsement from the mayor and vice-presidency) or external, e.g., support and engagement from stakeholders; European and global economic context.

Therefore, some of the assumptions and risks of Guimarães are the following, having in mind that these are going to be explored in more detail on the MEL analysis (Module B-3 Indicators for Monitoring, Evaluation and Learning):

Assumptions:

- Coordination between the municipal departments and staff is harmonious and collaborative.

- Support and guidance from the high-level and leadership members of municipality.
- Guimarães citizens are aligned with 2030 climate neutrality vision.
- Guimarães citizens and stakeholders will be willingly involved in the deployment of the Climate City Contract.

Risks:

- Political fluctuations and dynamics change.
- Lack of human resources within the municipality and/or their technical know-how.
- Guimarães ability to achieve the needed finance and funding, through the combination of municipality budget, private actors and partnerships, private leverage of public funds, national and European funding opportunities.
- Duplication and overlapping of reduced energy efficiency.

To mitigate the political fluctuations and dynamics change the Guimarães Climate City Pact is a way to the municipality to show its commitment towards the CCC and its ambition no matter how the political dynamic might change overtime. Also, due to the varies local, national, and European commitments that Guimarães is already involve and the communication of its involvement allows to stabilize this mission.

Regarding the second point, the CCC also accounts for indirect actions, such as capacity building within the municipality, giving the necessary tools and expertise to deal with technical issues and a harmonious implementation and monitoring of the process.

The 2030 Climate Neutrality Investment Plan, an important piece of the CCC puzzle, helps the municipality to establish the path on how can be possible to finance the planned actions towards the 2030 Guimarães vision. Since it will require, not only investment from the municipality, but also from the stakeholders, e.g., citizens, industry, Guimarães intends to express and intensify to the national government the commitment of Guimarães and the support that the municipality needs from the government to leverage the necessary investments.

The municipality has been doing its own emissions assessments (energy efficiency cabinet/department) by some time now, and report to CDP (Carbon Disclosure Project) and to Com (Covenant of Mayors), given the municipality the know-how on how to perform such process. It is important to note that Guimarães obtained the second highest classification on the evaluation scale from the CDP, entering the top 10% of the best ranked cities in the world (here).

Do No Significant Harm principles are embedded in the design and implementation of portfolio actions with mitigate/avoid negative impacts. Guimarães when designing the actions, it took on consideration the EU Taxonomy Regulation (Article 17), to guarantee that eventual side effects/negative impacts would be noticed and tackle if manifested.

2. Guimarães' impacts pathways

From the previous analysis, contextualisation, and explanation is possible to infer the steps that lead to the outline of the impact pathways, describing the Guimarães process to expose the existing pathways that influence the city towards climate neutrality.

Impact pathways correspond to the series of causal relationships between an action's entry points as inputs, early changes, and later outcome as outputs, and ultimately leading to the desired impact (direct and indirect).

Impact pathways are crucial to plan and evaluate the Guimarães' portfolio of actions because they allow to make informed decisions based on how an entry points evolves to an early change, later outcome, and further to the desired impact. Impact pathways for Guimarães will function as a story telling, starting from the introduction of the action, how the story evolves during time (early and later outcomes), and the ending (impacts and co-benefits).

To build an Action Plan that is achievable and aligned with the work done so far and the current projects and strategies of the Municipality of Guimarães and stakeholders, the actions will be anchored on:

1. District C as a testbed for a city-wide implementation.
2. Uptake of actions and strategies with stakeholders' collaboration.

This ensures that the 2030 Climate Neutrality Action Plan is viable, feasible, and tangible not only for the municipality but also for all the involved stakeholders, having a solid foundation to be built upon.

Guimarães' impact pathways outline the specific steps and assumptions necessary for an action to achieve its intended impact. The impact pathways based on the Guimarães approach to the NZC TOC are the following, grouped by their correspondent field of action:

Field of action: Energy systems

1. **District C as a testbed for a city-wide implementation**

- **Renewable Energy Sources (RES) acceleration framework**: By establishing regulations that require a certain percentage of electricity to come from renewable energy sources, the municipality can promote the production of clean energy in Guimarães, leading to the creation of the necessary framework to make this a reality in the municipality. This impact pathway ends with positive effects on the reduction of GHG emissions, clean and affordable energy, and an improvement in air quality.

- **Renewable Energy Communities (REC) and digitalisation of energy**: Business models and investment scenarios can create financial incentives to leverage public funds and private sector investment and encourage the adoption of sustainable and energy-efficient practises. Early change evolves through the impact pathway to a later outcome, namely market transformation through the creation of demand for energy efficiency retrofit projects and the establishment of renewable energy communities. This would ideally lead to a reduction in greenhouse gas emissions, a reduction in energy poverty and indirect impacts related to the adoption of new economic models for REC and the digitalisation of energy.

- **Capacity building actions of municipal staff:** It is expected that the training programme will improve the knowledge and skills of municipal staff in relation to energy efficiency projects, and climate change in general, leading to an improved ability to identify and meet the needs of the community, resulting in more efficient and retrofitting of buildings concerning energy related projects, which in turn will have an impact on the overall performance and effectiveness of municipal staff and on the number of projects.

- **Guidance for heritage energy efficiency renovation**: It is expected that an increase in expertise on heritage conservation and energy efficiency will be achieved at an early stage, which will later translate into an improvement in the energy efficiency of the historic buildings of Guimarães, a challenge faced by the municipality. The impact is to improve the resilience of the historic buildings to climate change and future energy challenges, set a positive example for other cities, promote sustainable practises, and strengthen cultural identity and appreciation for heritage conservation and sustainable development.

2. **Uptake of actions and strategies with stakeholders' collaboration.**

- **RES self-consumption: households, industry, companies, institutions**: The introduction and expansion of photovoltaic solutions among a wide range of stakeholders is essential to ensure clean and reliable access to renewable energy sources. This requires getting citizens (household owners), industry and public organisations, and institutions on board, starting with site selection and mapping of potential users. This situation will lead to an increase in

photovoltaic installations, which will result in a reduction of GHG emissions, in addition to some co-benefits such as lower energy bills and improved air quality.

Field of action: Mobility and transport

1. **District C as a testbed for a city-wide implementation**

- **Alternative sustainable transportation modes**: If people use private cars less frequently or choose alternative modes of transportation, such as public transport, use of bicycles, or walking, there will be a reduction in the number of private cars on the roads. As for the impacts, it is expected that the later outcome translates into an increase on physical activity and active lifestyles, improved air quality, and road safety. This would translate into a modal shift towards public transport and more clean mobility modes, as well stress relief associated with traffic, and more availability for green areas spaces.

- **Sustainable delivery services**: As an early stage it will be idealised and designed the of the delivery services for the delivery and distribution services in Guimarães. The municipality will start to see some change in the long run through the engagement of delivery stakeholders for a carbon delivery system, expanding the results obtained on the trial on District C. It would lead eventually to a reduction of GHG emissions, and co-benefits such as improved air quality and noise pollution.

2. **Uptake of actions and strategies with stakeholders' collaboration.**

- **Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports**: Through the uptake of public transportation to the detriment of the private car, citizens in Guimarães will potentiate the wide spread of public transport modes, having an impact on GHG emissions reduction, as well road safety, and reduction on noise pollution.

- **Electric mobility shift: private passenger vehicles**: The conversion of citizens in Guimarães to electric vehicles (conversion of private combustion vehicles to electric vehicles) will have a long-term impact when electric mobility is the new norm. This will lead to a reduction in greenhouse gas emissions, and as side effects there will be an improvement in air quality and an increase in the acceptance of electric vehicles.

- **Electric mobility shift: light goods, and heavy-duty vehicles**: The introduction of light and heavy-duty electric vehicles will initially be mapped by the municipality, and stakeholders with fleets of this type of vehicle will also be involved. In the long term, it is expected that the spread of electric vehicles in the municipality will lead to a reduction in GHG emissions and an improvement in air quality, as technological acceptance of this type of vehicle will increase if this is achieved.

- **Buses green conversion**: This action is already ongoing, consisting of the fleet conversion of 32 buses by Guimabus company (public transports company of Guimarães). The outcome would be the full conversion of this fleet, aiming for a reduction of GHG emissions, improved air quality, and the widespread of the technological adoption of electric buses.

- **Conversion of the urban solid waste collection fleet:** Is intended to explore the possibility to use alternative fuels for the urban solid waste collection fleet. After the study and feasibility analyses, is expected that the fleet will run on an alternative fuel (electricity, biomethane). The uptake of renewable energy, improvement of circular economy (biofuels), and improved waste management and efficiency, encompass a reduction of GHG emissions on mobility and transports sector.

- **Carpooling and car sharing**: Carpooling and car sharing makes it possible to reduce the number of single-occupancy vehicles, so the introduction of carpooling and car sharing as a viable transport option in Guimarães leads to less congestion, noise and air pollution, lower greenhouse gas emissions and improved overall transport efficiency.

Field of Action: Waste and circular economy

1. District C as a testbed for a city-wide implementation

- **Biowaste recovery**: Through the biowaste recovery, Guimarães will be able to repurpose it, and to do a selective collection. This will result in GHG emissions reduction, create green jobs, as well as improve waste management and efficiency.

- **Undifferentiated urban waste reduction**: Not only the recovery and management of waste is important to complement the GHG emission reduction of Guimarães, but it is also important to reduce the consumption to reduce the waste production itself. This results in the decrease of the overall urban waste in Guimarães, having positive impacts on public health, economic benefits, and circular economy deployment.

- **Waste production reduction**: The municipality intends to reduce overall waste production, an action that is linked to the other waste and circular economy measures. In the long term, it is expected that the practises achieved in District C will be expanded and it should be possible to reduce the total municipal waste production.

- **Recycling upgrade**: By increasing the rate of waste that is recycled and reused, Guimarães inputs a second life on waste, putting in practice on of the components of circular economy. It is expected along the impact pathway towards the later outcomes and impacts, to have a reduction on waste produced, GHG emissions reductions, and public and economic benefits.

- **New circular business models:** As a first change, it is expected that local circular business models will be developed, enabling the identification of circular business opportunities based on research and citizen input, ideas and concepts for circular business models developed by citizens, partnerships between entrepreneurs, businesses, and relevant stakeholders, tested circular business models in the local community (District C) and, as a later outcome, their expansion to the whole community. This will lead to the creation of new circular businesses, and local entrepreneurship and local businesses, more green and skilled jobs, and a reduction of the ecological footprint.

- **Business symbiosis**: The creation of a matching and marketplace for business symbiosis in the circular economy sector, initially as part of a pilot in District C, will lead as a later outcome to increased synergies and symbiotic relationships between local businesses leading to more efficient use of resources, to the growth and expansion of circular economy activities and start-ups in the local economy, to the reduction of waste and the increase of the circular economy through the exchange of secondary materials and services, and to an improved circular economy ecosystem with more opportunities for innovation and entrepreneurship.

Field of Action: Green infrastructure and nature-based solutions

1. District C as a testbed for a city-wide implementation

- **Green areas**: Green areas are essential to achieve the climate neutrality goal of Guimarães. This should not be overlooked, so as an early change Guimarães intends to prototype the green spaces to be implemented and recovered, as in the long run to turn the city climate resilient and able to sequester carbon emissions.

- **Green belt**: The green belt is an ambition of Guimarães' municipality, not only present in the CCC, but also in NZC Pilot Cities Programme – District C. It is expected as a later outcome

that the green belt is implemented on Guimarães surroundings, providing a cooling effect, capture carbon emissions, as well restoring biodiversity and be an important urban greening asset.

- **Biodiversity conservation and restoration**: Improving biodiversity in Guimarães allows for the reconciliation of flora and fauna various species on the territory, improving the resilience of the biodiversity ecosystems as a late outcome. As positive impacts, it can be named an improvement of nature restoration, and decease of non-invasive species and enhancement of pollinators.

- **Urban private community gardens**: This action includes, in a first phase, the mapping of private communal areas for gardens where the community can grow their own vegetables and derivatives. This action links the social and environmental dimensions, as it contributes to social cohesion and creates sustainable and ecological food sources for the community. In terms of impact, urban private community gardens help with improving land use management practices have as side effects the greening of the city and an improved sense of belonging and social integration.

Field of Action: Built environment

2. Uptake of actions and strategies with stakeholders' collaboration.

High efficient new buildings: Setting guidelines and standards for new buildings is a first step that the municipality intends to take, and if it works, it will translate into newly constructed buildings that follow the most efficient standards in the long run, resulting in lower GHG emissions and better overall quality and aesthetics of the buildings.

Building deep retrofit: The increase in demand for building retrofitting and energy efficiency measures will lead to an increase in requests, which will have a long-term impact on retrofitting and renovation projects. If this development occurs, it will lead to a reduction in GHG emissions, an increase in efficiency and renovation rates, and economic benefits.

- **Adoption of efficient lighting and appliances:** Will allow a widespread adoption of energy efficient lighting systems and appliances by citizens, leading to a significant reduction in electricity consumption (share of renovations producing around 40% efficiency improvement), as well the retrofitting of street lighting through a tender launch by the municipality. These can revolve on lower energy bills, and a positive environmental impact through reduced carbon emissions. As a latter impact will improve energy efficiency, reduced strain on the power grid, and cost savings for consumers.

Field of Action: Industry

2. Uptake of actions and strategies with stakeholders' collaboration.

- **Industrial energy efficiency initiatives:** The adoption of energy efficiency initiatives by the industrial sector both on the energy production, and on thermal energy and electricity usage, allow for a reduction of energy consumption and for an enhanced overall operational performance, thus allowing economic benefits from the savings on energy bills, resulting in a reduction in GHG emissions.

- **Solar energy uptake:** The use of solar energy for thermal energy production in the industrial sector (e.g., pre-heating processes) contribute to reduce the carbon footprint of the industries that opt for fossil fuels' substitution, increasing the use of endogenous resources, resulting in a reduction in GHG emissions.

- **Green hydrogen for Guimarães' industry**: This is an ambitious measure consisting in the injection of green hydrogen, locally produced with renewable electricity through electrolysers,

into the natural gas industrial pipelines. The use of this renewable gas, both for thermal needs and for energy production, will be taken up by the pioneers of industry in Guimarães (early adopters) in a first phase and leading afterwards to a wider acceptance, resulting in a reduction in GHG emissions.

- **Biomass uptake:** The adoption of biomass as an alternative renewable energy source for thermal energy in the industrial sector, through the promotion of local-scale energy generation based on residual biomass (installation of small decentralised thermal power plants) along with the promotion for collection and storage biomass facilities, ensuring adequate management of forest, agriculture, livestock, food industry and other organic waste, providing a second life to biowaste and resulting in a reduction in GHG emissions.

- **Biomethane uptake:** The use of biomethane in replacement of fossil fuels for thermal energy and energy production, injected into the natural gas industrial pipelines, allows a decarbonisation of the industrial processes. In an early stage, the possibility to produce biomethane (technological readiness and rate of adoption) in Guimarães, and in the long run to have a greener industry in Guimarães, resulting in a reduction in GHG emissions.

- **Top management engagement for sustainable industry:** If the top management of industry in Guimarães starts to engage in sustainability practises, leadership and commitment to sustainability and climate action is established, leading to the application of sustainable practises in industry, which in turn leads to an increase in economic growth and new technological applications.

- **Promotion of sustainable industry in partnership with relevant industry associations:** If industry comes together in partnership with business and industry associations and promotes sustainable practises in industry, it will be possible to see an increase in sustainable and energy efficient practises, a possible development of networks between stakeholders and ultimately an increase in entrepreneurship and economic growth.

- **Promotion for sustainable business hosting areas:** If the industrial sector, with the support of the municipality, participates in the development of a hub focused on sustainable businesses, these actors will connect with each other and build relationships and symbioses that will have an impact on increasing the visibility of these actors, the role of the municipality in validating green businesses and the possibility of new business and economic models.

Field of Action: Cross-cutting (energy systems and built environment)

1. **District C as a testbed for a city-wide implementation**

- **Expansion of a one-stop-shop (OSS):** After the One-Stop-Shop (OSS) was initially introduced on a trial basis in District C, the lessons learnt from the pilot project will serve as a catalyst for introducing the OSS in other parishes in Guimarães and expanding its services to cover more users and project requests. If this happens as planned, it will lead to an increase in energy efficiency and retrofitting rates, as well as improved access to information and behavioural change.

Field of Action: Cross-cutting (all field domains)

- **Digital twin:** If the municipality, with the involvement of stakeholders, explores the possibility of implementing a digital twin system, this will lead to close cooperation between the smart systems department of the municipality and these stakeholders to create a digital twin to support the decision-making process in the municipality, which will ultimately increase the technological readiness of this system to support climate action.

- **Sustainable tourism:** If the tourism industry obtains certification for sustainable practises that are linked to the specifics of the sector, this will allow for the creation of guidelines in the short

term to obtain this certification and start implementing some sustainable practises, leading to more certified sustainable tourism businesses that contribute to the overall economic upliftment of the community.

Relating impact pathways from NZC TOC with MEL procedures, the impact pathway allows Guimarães to visualise the steps necessary to achieve an impact, and can be used to guide action planning, implementation, and evaluation.

In a nutshell, Guimarães' impact pathways help the municipality to design the portfolio of actions with a clear focus on outcomes and impacts, rather than just outputs. They enable the identification and prioritization of the most effective interventions, and to measure and track progress toward desired outcomes over time.

4.2 Module B-2 Climate Neutrality Portfolio Design

Module B-2 "Climate Neutrality Portfolio Design" contains an action description, including interventions by local businesses and industry, according to the template B-2.1, including actions targeted at enhancing carbon sinks to address residual emissions. The Municipality of Guimarães has a diverse and integrative action portfolio that covers all field domains, that build on the deployment of the 2030 Guimarães vision towards climate neutrality.

The definition of priorities for the actions (first and second priority) was defined by the Transition Team together with the policy makers and based on the results of the RME (Rapid Mass Engagement). Additionally, the available funding opportunities and the policy environment/landscape was taken into consideration.

In developing the action portfolio, the Municipality of Guimarães drew inspiration from the RME workshops to get inputs on the design of the actions, as well as from sectoral meetings with different departments of the Municipality. Actions to be tested first and then extended from District C (NZC pilot city project) were also considered, as well as actions to be taken by stakeholders, e.g., from industry.

The municipality also received the support from the consortium to develop of the NZC economic model (here), which helped building on the actions planned by the Municipality for the Guimarães 2030 vision.

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
Energy systems	**1. Renewable Energy Sources (RES) acceleration framework**	This action entails the development of a legislative framework and incentives schemes based on the national legislation with a set of guidelines and policies to encourage the adoption of renewable energy sources within Guimarães jurisdiction, hoping to replace the share of fossil fuels electricity production with renewable sources. Guimarães has set ambitious targets for renewable energy adoption to ensure a sustainable and low-carbon future. These targets, aligned with National and European targets, aim to create the pathway to replace the share of fossil fuel electricity production with renewables by 2030. It also implies the identification of suitable areas for renewable energy development, and how to use and upgrade the historical and heritage buildings for this purpose. To encourage renewable energy investments, the municipality can offer various incentives and subsidies, such as tax deduction, grants, and subsidies for renewable energy projects.

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		This action will have its first trial under District C (Guimarães pilot project).
Energy systems	**2. Renewable Energy Communities (REC) and digitalisation of energy**	The Municipality of Guimarães intends to implement Small Scale and Community Renewable Energy via the implementation of Renewable Energy Communities (REC) first in small scale through the District C, and then to a larger area. This action will focus first on explore the necessary business models and investment concepts for the REC application and its expansion on the municipality. This action encompasses: 1. stakeholder engagement and education toward the REC concept; 2. identification of suitable projects; 3. development of REC legal structures; 4. business model development; 5. technical assistance including funding and financial support, regulatory support, and technical support; 6. development of collaboration and partnerships and 7. monitoring and evaluation. The goal as for the other actions under the energy systems domain is to prompt the renewable energy in the territory over the non-renewable energy sources. In District C, the introduction of digital metering systems in public buildings will be a priority. The data collected by these systems will be made publicly available through various data sharing platforms described in this pilot project. In addition, the digitisation in RES will be supported through the One-Stop-Shop (OSS) initiative. This will facilitate the tracking, management, and security of energy consumption from RES. The use of modern technologies, such as information and communication technologies (ICT) together with advanced sensors, big data, artificial intelligence (AI), and the Internet of Things is in line with the European Green Deal strategy and the EU's efforts to get ready for the digital age.
	3. RES self-consumption: households, industry, companies, institutions	This action intends to supress the energy demand of Guimarães inhabitants (on apartments and individual), of the tertiary sector, public institution, and industry, through the of energy from photovoltaic panels and other sources of renewable energy, e.g., micro-wind turbines in self-consumption where the implementation of community projects is not viable. Like the previous measure, the digitalisation will be promoted. Guimarães will promote self-consumption in all sectors and organisations including with a tailored approach for industry given the associated demand and capacity for production. It entails the substitution of the portion of electricity generation derived from fossil fuels with renewable sources.
	4. Capacity building actions of municipal staff	This action aims to develop and implement a tailor-made training programme for the municipal staff. The aim is to promote collaboration in the development of new regulations and governance within the municipality and related agencies, while enhancing their capacity to effectively implement clean energy policies. To achieve this, it is intended to develop the necessary educational materials and introduce different training models, such as peer meetings, workshops, and lectures. This intervention is foreseen on District C and it is expected to, after testing it internally in the municipality, scale up to other relevant organisations in the municipality.
	5. Guidance for heritage energy	The aim of this action is to produce a comprehensive guide for improving energy efficiency in historic buildings. Using science-based innovative solutions, this action will develop guidelines based on

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
	efficiency renovation	research to promote energy efficiency while preserving the historic and local identity of District C and the Guimarães urban area, recognised as a World Heritage Site at UNESCO. Therefore, this action is in line with the New European Bauhaus Initiative, which promotes a link between science, technology, art, culture, and climate goals, such as circular economy, zero pollution and biodiversity. The guide will prioritise the preservation of aesthetics and ensure the involvement of all citizens in the process of sustainable development.
Energy systems	Together with these individual actions on the energy systems domain can interact with each other, leveraging synergies among them, mainly through: • Integration (technology/infrastructure lever): Promote the integration of photovoltaic systems within the different layers of the society: citizens, services and companies, public and private sector. • Local energy systems: Foster collaboration between renewable energy and communities' driven projects to create localised energy systems that optimise energy production, consumption, and storage. • Knowledge sharing (learning and capabilities lever): Facilitate knowledge exchange and collaboration among stakeholders involved in these interventions to learn from each other's experiences, share best practices, and identify opportunities for joint projects or partnerships. • Policy alignment (governance and policy lever): Ensure that regulatory frameworks and incentives support the simultaneous implementation of self-consumption, green hydrogen, or renewable energy communities, enabling a cohesive approach to emission reduction. By implementing these interventions as a portfolio of actions on the energy domain, and in relation with the other domains, and leveraging their synergies, the municipality can achieve a significant reduction in emissions across different sectors highlighting the potential to decarbonise all sectors including industrial processes, empowering communities, and facilitating a streamlined transition to sustainable energy solutions.	
Mobility and transport	**6. Alternative sustainable transportation modes**	This action intends to expand the use of alternative sustainable transportation modes, focusing on increasing use of the public transports, and sustainable modes namely walking and use of bicycle to consequently reduce the use of private cars. The Municipality of Guimarães already offers free public transport to several younger and elderly citizens. Using the District C as a testbed, the municipality plans to take a further step by testing the concept of providing free transportation for citizens visiting the local market. This initiative aims not only to promote the use of public transport but also to support and boost the local market, including local farmers. The goal is to increase the use of these alternative transportation models throughout the territory. In addition, education and awareness play a crucial role in fostering public understanding of the reasons behind these transformations. One effective approach is to provide real-life examples that demonstrate the benefits of certain policies, even those that may initially face resistance. The aim of this action is to empower citizens and municipality staff in the safe and responsible use of bicycles and scooters. These training sessions will provide practical knowledge and will be accessible through Guimarães digital platform, ensuring widespread availability of pedagogical materials. In parallel, the municipality will continue to promote sustainable mobility across the city with tailored actions such as Metrominute.

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
Mobility and transport	**7. Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports**	Through this action, Guimarães aims to improve access routes to the national roads EN101 and EN206, due to the existing congestion at the main entry/exit points of the city. In parallel, and to promote the use of public transports, the municipality is exploring the feasibility of electric Bus Rapid Transit (BRT) system, which will contribute to reducing emissions compared to traditional bus transportation. The Municipality of Guimarães already conducted a Decision Support Study to assess the connectivity between the city and the future High-Speed railway station in Braga. The objective is to establish a dedicated corridor for public and collective transport, enabling residents to travel to the High-Speed station without relying on private cars. To ensure the success of this action and considering the investment volumes and the impacts of the actions, Guimarães is collaborate with regional and national stakeholders on this process, since this inter-regional effort requires coordination and cooperation among various actors involved in the project. The action also entails the reduction un car passenger due to the uptake of public transport as public buses.
	8. Sustainable delivery services	This action aims to drive policy, governance, and regulation changes to discourage or prohibit the use of fossil-fuelled vehicles in last-mile deliveries. The goal is to exclusively promote last-mile urban logistics services using eco-friendly modes such as walking and cycling or e-cargo fleet. The action will be piloted in District C, with plans for city-wide coverage under the Climate City Contract execution.
	9. Electric mobility shift: private passenger vehicles	This action entails the shift from combustion vehicles to electric vehicles (EV) in Guimarães concerning the private vehicles owned by the citizens. For this, the Municipality will continue a set of initiatives that include, among others, the exception from parking payment of electrical vehicles, the increase of municipal fleet to promote the electrical mobility and the increase of charging (slow and fast) stations across the municipality.
	10. Electric mobility shift: light goods, and heavy-duty vehicles	This action is similar to the previous one, focusing on light-duty and heavy-duty vehicles. The goal is to lead the path to convert around 100% of the light-duty vehicles by 2030 and 88% of the heavy-duty vehicles by 2040 to electrical. For this, the municipality will start from its own fleet reconversion and, in parallel, with the promotion of electrical mobility initiatives.
	11. Buses green conversion	Guimabus, the company responsible for the collective passenger transport service in the municipality of Guimarães, has a fleet of 80 buses of which 22 are electric and the rest are diesel buses. This action entails the conversion of 32 diesel buses to electric ones and in parallel a work with other mobility stakeholders, such as intermunicipal operator, to promote the adoption of electrical buses. A key point to explore is the success story of Guimabus' electrical mobility as a shining example for other stakeholders.
	12. Conversion of the urban solid waste collection fleet	According to the Guimarães 2030 Bio-Waste Management Plan, by 2030 it is expected that the emissions from the waste collection fleet drops from 17,4 $kgCO_2$/ton to 8,97 $kgCO_2$/ton. It is considered by the same plan that the total amount of emissions from selective collection of biowaste is below 13,0 $kgCO_2$/ton.

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		There is already a thermal hydrolysis of WWTP sludge project that will be executed in 2024/2026. The sludge production will have potential for agricultural use and biogas production, thus contributing to a reduction in GHG and to the climate-neutrality strategy. The investment will be € 14 million. Considering the reediness level of this solution the municipality is also studying the use of electrical vehicles for the waste collection. Thus, Guimarães is exploring several scenarios to be considered. Under this action, a 50% conversion for electric trucks and a 50% conversion for biomethane scenario is to be considered. With this action the municipality intends to explore the potential of converting sludge from wastewater treatment plants (currently disposed to landfill) to produce biogas (bio-methane). This new source of fuel for Guimarães would feed the waste collection trucks from the municipality' fleet, creating a circular economy approach: the collected waste (sludge) would be transformed into fuel that would feed the municipal fleet, ending the cycle. It is foreseen to achieve a global reduction of 1,0 kton, equivalent to a reduction of 0,4% of the transport sector emissions.
	13. Carpooling and car sharing	This action aims to promote carpooling and car sharing to reduce the number of private passengers per vehicle, allowing for more efficient use of private vehicles. Sharing the same vehicle is expected to reduce traffic congestion and stress associated with road transport, as well as reduce greenhouse gas emissions. For this, Guimarães intends to study alternatives and revitalise programmes, such as the Guimarães à Boleia that promotes carpooling and car sharing.
Mobility and transport	The interventions respecting the mobility and transport domain make up the portfolio of actions that will enable systemic change for the Municipality of Guimarães on a domain that is responsible for a considerable amount of the emissions. These interactions can trigger leverage synergies by: • Modal shift (governance and policy lever): By promoting alternative modes of transport, such as cycling and walking and providing a reliable and efficient BRT system, the municipality can reduce the number of single-occupancy vehicles on the roads, resulting in lower transport emissions. • Charging infrastructure (technology and infrastructure lever): The development of charging infrastructure for electric vehicles can be used for both private cars and electric delivery vehicles, facilitating the adoption of electric mobility in different sectors. • Green delivery services (technology and infrastructure lever): Sustainable delivery services, such as electric cargo bikes, can support the transition to electric mobility while reducing emissions from delivery operations. • Public transport integration (governance and policy lever): Integrating sustainable mobility options such as cycling and walking into the BRT system can provide seamless and convenient transport options for residents, encouraging more people to use public transport and reducing the use of private vehicles. • Citizen engagement (learning and capabilities lever): Engaging citizens in sustainable mobility initiatives can raise awareness, build support, and encourage	

B-2.1: Description of the action portfolio			
Fields of action	Portfolio description		
	List of actions	Descriptions	
	behavioural changes that favour emission reduction and support the implementation of sustainable transport projects. Also, important to mention that Guimarães strategy also considers that: • Transport modes such as walking or cycling work together with BRT to reduce car use and improve accessibility to public transport reducing citizens costs on mobility. • The transition to electric mobility complements sustainable transport modes and reduces both direct and indirect emissions. • Electric buses benefit from both BRT infrastructure and the transition to electric mobility. • The conversion of the waste collection fleet using biomethane and other fuel sources provide a second life to biowaste, and improves the technology readiness, as well reduce emission associated with the collection waste routes. • Sustainable delivery services reduce congestion and emissions and increase the effectiveness of public transport improvement. • Citizen engagement creates an enabling environment for all measures and encourages participation and behaviour change, such as carpooling and car-sharing. By incorporating these interventions into a comprehensive portfolio of actions and leveraging their synergies, the Municipality of Guimarães can accelerate the transition to electric mobility, reduce emissions from transportation, improve air quality, and create a more sustainable and efficient public transport system.	
Waste and circular economy	**14. Biowaste upgrade**	This action entails the expansion of the biowaste recovery throughout the Guimarães territory, starting with a first trial on limited area (District C). The aim is to expand the collection infrastructure of biowaste, support for composting and organic, waste treatment collaboration with local institutions, monitoring and data collection, as well continuous evaluation, and improvement. From the action implementation, it is expected an increase of biowaste on the District C area and reduced GHG emissions.	
	15. Undifferentiated urban waste reduction	By implementing an action of reduction of undifferentiated urban waste, the Municipality of Guimarães can effectively promote waste separation, reduce undifferentiated waste, and contribute to a more sustainable and environmentally conscious municipality. This action entails the improvement of the waste collection infrastructure, strengthened enforcement collaboration with waste management companies (e.g., Resinorte, VITRUS) enhanced recycling infrastructure, community engagement and involvement, encouraging composting and organic waste management incentives for waste reduction, data monitoring and evaluation and finally continuous improvement and collaboration.	
	16. Waste production reduction	Waste production reduction enables the Municipality of Guimarães to effectively reduce overall urban waste production, promote sustainable waste management practices, and create a cleaner and more environmentally friendly municipality. The municipality can achieve this by doing a first test through the District C and the replicate to an extended area. This implies encouragement of source reduction (promote source reduction	

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		practices among residents, businesses, and institutions), sustainable lifestyles, collaboration with businesses, promotion of recycling and composting, and data monitoring and evaluation as well continuous improvement and collaboration (as usual for every action).
	17. Recycling upgrade	To increase recycling at the Municipality of Guimarães, this action is being considered to increase the recycling rate. It consists of improving infrastructure (more bins, easy access), promoting reuse (reuse centres, reusable packaging, reusable shopping bags, as has been done for the local market in the municipality), creating recycling facilities that can efficiently process and sort recyclable materials, working with recycling companies to build partnerships and promote the development of a circular economy, and finally monitoring and evaluating.
	18. New circular business models	This intervention aims to extend the lifespan of products and foster circular business models in District C and its posterior expansion, while implementing a digital approach for businesses This will involve exploring concepts like the repair café, renting tools and appliances as service models, establishing second-hand and thrift shops and markets, and other relevant circular initiatives.
	19. Business symbiosis	Under this intervention, waste generated by one company can be transformed into a valuable resource for others, thereby creating a closed-loop system that stimulates the local economy. The goal is to encourage collaboration among businesses, where they can exchange resources, develop innovative products and services, and collectively drive sustainability. To support businesses in this endeavour, matchmaking and marketplace actions will be implemented in conjunction with other engagement efforts. These actions will facilitate networking opportunities for businesses, allowing them to connect with potential partners and access financing opportunities for their circular initiatives.
	In the domain of waste and circular economy, the planned measures represent a sectoral portfolio that interacts within the sector, but also with the mobility and transport sector, for example, the possibility of converting Guimarães' waste collection. Even if this sector is not one of those that contribute most to greenhouse gas emissions, it has a non-negligible impact, also because of its importance for the circular economy and behavioural change away from a linear economic approach. Synergy effects can be achieved through these interactions: • Waste reduction cascade (governance and policy lever): The reduction of waste production, undifferentiated urban waste, and improved recycling can complement each other, creating a waste reduction cascade that lowers the overall waste generation and its environmental impact. • Circular economy approach (financing and funding): Implementing circular business models and business symbiosis will lead to a more sustainable use of resources and minimize waste generation. By promoting circular practices, businesses can also find new revenue streams and cost savings. • Electric fleet and emissions reduction (technology and infrastructure lever): Converting the waste collection fleet to low-emission or electric vehicles not only reduces emissions from waste management but also serves as an example of sustainable transportation practices that can inspire other sectors.	

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
	• Public engagement (learning and capabilities lever): Engaging the public in waste separation, recycling, and circular initiatives will create a culture of sustainability, leading to higher participation rates and behavioural changes that amplify the impact of these interventions. • Resource efficiency (governance and policy lever): By integrating waste reduction, recycling, and circular economy practices, the municipality can optimize resource use and reduce the extraction of raw materials, resulting in lower carbon emissions and a more sustainable local economy. By implementing these interventions as a portfolio of actions and leveraging their synergies, the municipality can achieve significant emissions reductions by maximizing the use of waste resources, promoting sustainable waste management practices, and fostering a circular economy mindset, also having an impact on cultural behavioural.	
Green infrastructure and nature-based solutions	**20. Green areas**	This action includes some initial activities that will be carried out in District C (mapping of suitable areas) and is expected to be extended to other areas of the municipality. Green spaces include urban afforestation to increase tree cover in the municipality, preference for native tree species, biodiversity restoration and conservation, forest restoration, green infrastructure e.g., green roofs, and education and awareness raising.
	21. Green belt	A detailed feasibility study for the green belt is being conducted as part of the District C pilot city project. Implementation includes land acquisition and protection, biodiversity conservation (ecological assessments, habitat restoration and management plans, involvement of local environmental organisations and volunteers in habitat restoration), recreation and public access (recreational activities, information points), buffer zone management (responsible land use and development within the buffer zone around the green belt) and monitoring and review of green belt implementation.
	22. Biodiversity conservation and restoration	The aim of this action is to improve the overall biodiversity in the area. This action is also foreseen for District C. It consists of biodiversity assessment, habitat restoration, native planting programmes, protected areas and green corridors, environmental education and awareness, collaboration, and partnerships, and monitoring and evaluation.
	23. Urban private community gardens	This action includes some initial steps that will take place during the implementation of District C, such as mapping existing private common land where urban agricultural practises can be implemented. Moving forward, the goal is to expand the urban private community gardens to other areas of the municipality. This includes land allocation and permits, design and infrastructure. Community engagement and management, allocation of garden plots, training, and support, and monitoring and evaluation.
	The interventions regarding the green infrastructure and nature-based solutions can interact on: • Carbon sequestration (technology and infrastructure lever): Green areas, green belts, and biodiversity conservation efforts contribute to carbon sequestration by increasing vegetation cover and preserving natural habitats. • Ecosystem services (technology and infrastructure lever): The creation of green areas and green infrastructure provides multiple benefits, such as improved air and water quality, reduced energy consumption, and enhanced biodiversity, contributing to overall sustainability goals.	

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		• Community engagement (learning and capabilities lever): Engaging the community through education and participation in green area initiatives and community gardens can foster a sense of ownership, promote sustainable behaviour, and increase community resilience. By implementing these measures as a portfolio of actions and harnessing their synergies, the municipality can achieve emission reductions by increasing carbon sequestration, improving ecosystem services, promoting biodiversity conservation, and engaging the community in sustainable practises.
	24. High efficient new buildings	This measure focus on the application of top-level standards and regulations towards the new building stock. It embraces the promotion and ensures that all new construction projects in the municipality meet the highest standards of energy efficiency, sustainability, and environmental performance. By doing so, the municipality aims to minimise energy consumption, reduce GHG emissions, and improve the overall quality and longevity of buildings.
	25. Building deep retrofit	The aim of this measure is to reduce energy consumption by increasing energy efficiency together with RES (see energy measures). Energy efficiency projects include a range of measures and strategies to optimise energy consumption and improve the overall performance of buildings and systems, such as retrofitting the building envelope, improving lighting, improving the HVAC system, integrating RES, upgrading appliances and equipment, and building automation and controls. Building retrofits include insulating walls, roofs and floors to minimise heat transfer and improve thermal comfort, upgrading to energy efficient windows and doors, installing reflective or cool roofing materials that reflect sunlight and absorb less heat, sealing gaps, retrofitting HVAC systems, replacing incandescent or fluorescent light bulbs with energy-efficient LED, upgrading water heaters with more efficient models, installing solar panels, installing air barriers, caulking and weatherstripping to seal gaps and reduce air infiltration. Introducing smart thermostats, occupancy sensors and advanced control systems to optimise energy. These initiatives aim to improve the performance of existing buildings, reduce energy waste and lower carbon emissions. With the deployment of District C, it will be possible in a trial phase, to create the innovative financial schemes and business models that will allow the implementation of such measures, leading to building retrofitting and energy efficiency projects.
	26. Adoption of efficient lighting and appliances	This action entails the assessment of the extent to which energy efficient lighting systems and appliances are used in the building sector. It focuses on the use of energy saving lighting technologies and high efficiency appliances to reduce electricity consumption and promote sustainable energy practises. In parallel the municipality will launch a public tender for the retrofit of all street lighting fixtures based on a ESCO model. This approach aims to improve the quality and reduce the energy consumption of street lighting, promote the adoption of efficient lighting by the citizens

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		and test the use of alternative financing models, such as Energy Performance Contracting.
	The combination of these measures contributes to a significant reduction in emissions by addressing different aspects of energy consumption, transport, and resource use. • Building efficiency and lighting/appliances (technology and infrastructure lever): Efficient buildings benefit from efficient lighting and appliances, together with street lighting improvements leading to an overall reduction in energy consumption and emissions. The implementation of these actions collaboratively would lead to an emissions reduction strategy that tackles multiple fronts, leading towards a more sustainable and climate neutral municipality.	
Industry	**27. Industrial energy efficiency initiatives**	This measure aims to improve energy efficiency in the industrial sector following the objectives, goals and strategies defined on PNEC 2030 (35%) and in-line with the potentialities identified on the territory. It aims to improve energy efficiency in the industrial sector by implementing strategies to reduce energy consumption, both in terms of thermal energy use and electricity, while exploring opportunities for cleaner and more efficient energy production (see energy measures). The main objective is to minimise the environmental impact of industrial activities while improving overall operational performance. This encompasses energy audits and assessment, equipment and technology upgrades, process optimisation, heat recovering, energy efficient motors and compress air, heating and colling systems, and renewable energy integration.
	28. Solar energy uptake	This action focuses on the incorporation of solar energy technologies by the industrial sector for thermal energy production (pre-heating processes) to substitute fossil fuels consumption and reduce GHG emissions in accordance with PNEC 2030 objectives, goals, and strategies, aiming to contribute with 10% of the total thermal energy needs in industry. It focuses on the incorporation of solar energy technologies by the industrial sector. The main goal is to use solar energy, both in the form of thermal energy and photovoltaic panels, to improve the industry's energy portfolio while reducing its carbon footprint. The key components would include solar thermal systems, PV panels, hybrid systems, onsite power generation, energy storage, and process optimisation.
	29. Green hydrogen for Guimarães' industry	The European Commission, through the EU strategy on hydrogen, intends to uptake this renewable energy source to decarbonise the energy consumption over the European countries. In Portugal, the National Strategy for Hydrogen has the goal to ensure, in the long run, the decarbonisation of the natural gas networks and also power plants. Guimarães wants to be in the frontline of this revolution. Therefore, since industry sector is responsible for a great share of the city emissions, this ambitious measure consists in the injection of green hydrogen, locally produced with renewable electricity through electrolysers, into the natural gas industrial pipelines, achieving a blending ratio of 20% of this renewable gas. Portugal developed a National Strategy for Hydrogen, with the goal to ensure, in the long run, the decarbonisation of the gas consumption

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		associated manly with heating systems and energy production. By implementing this action, industries in Guimarães would be able to decrease emissions and reduce the dependence on fossil fuels. This action will also promote the development of a new green business opportunity for companies working on hydrogen industrial cluster.
	30. Biomass uptake	This action consists in the use of biomass as an alternative renewable energy source to generate thermal energy for the industrial sector, also including local-scale energy generation based on residual biomass (installation of small decentralised thermal power plants) along with collection and storage biomass facilities, thus ensuring adequate management of forest, agriculture, livestock, food industry and other organic waste, and provide a second life to biowaste. The use of biomass for heating represents an efficient utilization of natural resources through the maximisation of the potential energy from organic matter that would otherwise be discarded.
	31. Biomethane uptake	Biomethane can be produced from the anaerobic digestion of organic waste and agricultural residues, offering a versatile and environmentally friendly alternative to replace conventional natural gas in various applications, e.g., in industrial processes, heating, energy production and even as a fuel in transportation. This action resides on the last step to decarbonise the industrial processes and consists in the strategic introduction of biomethane as a clean and renewable energy source into the natural gas industrial pipelines. In an early stage, through the production of biomethane from endogenous resources, such as organic waste and agricultural residues (technological readiness and rate of adoption). In the long run, within the incorporation of biomethane from other sources to have a greener industry in Guimarães. It is foreseen to reach a substitution of 50% of the remaining natural gas consumption. This action relates to the related one on the waste sector.
	32. Top management engagement for sustainable industry	This action focus on the engagement of the top leadership of the industrial sector in Guimarães to drive sustainable practises and policies that are consistent with climate neutrality goals. Recognising that leadership commitment and active participation are critical to effective change, this action aims to foster a culture of sustainability in the highest ranks of industrial companies namely considering that Guimarães has a lot of SMEs with a lack of knowledge from the top management on sustainability. It is important to mention that Guimarães Municipality is already working very closely with industry namely under Guimarães Marca and other initiatives.
	33. Promotion of sustainable industry in partnership with relevant industry associations	The focus of this action is to foster collaboration between industries in Guimarães and relevant industry associations to drive the growth and adoption of sustainable solutions and practises within the industries. The aim is to create an enabling environment for the development and deployment of sustainable in sector so relevant as textile or cutlery.
	34. Promotion for sustainable business hosting areas	This action aims to proactively promote and develop designated areas that host sustainable businesses and industries. The intent is to create a supportive ecosystem and infrastructure. This initiative also aims to attract, promote, and enhance the growth of businesses that prioritise sustainability and contribute to a greener economy.

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		The Municipality of Guimarães already has a plan for the expansion of 40 000 m^2 of the Parque Industrial de Ponte consisting of the adoption of a new management model, the re-functionalisation of the park, with the creation of rest areas and a functional support structure for truck drivers, new parking spaces, the construction of an auditorium for conferences and training actions, as well as charging points for electric vehicles. The connection to the junction of the future access roundabout to AvePark, as well as the creation of a peripheral road that will improve the connection to other roads is also planned. Finally, the municipality also established a plan to develop an eco-industrial park to be built in the area of the parishes of Moreira de Cónegos, Guardizela and Gandarela to be expected in 2021.
	The 2030 National Energy and Climate Plan (PNEC 2030) specifies that "the energy transition in Portugal will undoubtedly involve the reinforcement of renewable energies through the increase in electrification and the development of a system based on renewable gases (whether renewable hydrogen or biomethane)". The need for more innovation in the industrial sector is also highlighted as it is "very aware of issues of resource efficiency, energy efficiency, and competitiveness and innovation", being also highlighted the "increasing electrification with greater use of biomass and combination with other forms of renewable energy, such as solar thermal". Given the national guidelines, the municipality, and the industry in Guimarães are aware that a reinforcement and implementation of ambitious measures regarding the inclusion of renewable energy sources, e.g., biomass, hydrogen, and the electrification of this sector is crucial for the climate neutrality pathway and decarbonisation of the industry. Through a combination of these measures, the industrial sector in Guimarães can reduce its emissions and promote a sustainable and environmentally conscious business landscape. • Energy efficiency and renewable energy integration (technology and infrastructure lever): Energy efficiency initiatives in industry can be complemented by the integration of renewable energy sources such as solar energy, biomass and biomethane, further reducing emissions. • Green hydrogen and industry engagement (learning and capabilities lever): Engagement of industry leaders promotes the introduction of innovative solutions such as green hydrogen, which require top-level support for successful implementation. • Industry associations and business sectors (governance and policy): Industry and business associations can work with sustainable business districts to promote the adoption of clean energy and emission reduction strategies. The combination of these measures, together with other relevant sector action such as waste or energy, leads to joint efforts to lower emissions, improved energy efficiency and the adoption of sustainable practises within the industry.	
Cross-cutting (energy systems and built environment)	**35. Expansion of a one-stop-shop (OSS)**	This action encompasses the implementation of a one-stop-shop (OSS) after the feasibility studies and trial tests on District C. The OSS will integrate services (citizens, businesses and organisations can access a wide range of energy efficiency and renewable energy services), energy assessments, renewable energy solutions, financial guidance, training, data and monitoring, collaboration with stakeholders, and marketing and communication.
Cross-cutting (all field domains)	**36. Digital twin**	The digital twin action entails the study and therefore the possibility of adoption a digital twin technological approach in the municipality, consisting of a virtual representation of processes, systems, e.g., traffic patterns to predict how changes may affect the real context.

B-2.1: Description of the action portfolio		
Fields of action	Portfolio description	
	List of actions	Descriptions
		This tool for improving allows a more efficient and predictable decision-making, optimising resource management, and promoting sustainable development in various sectors. For example, Guimarães can use a digital twin to monitor its energy use to plan for extreme weather.
	37. Sustainable Tourism	The municipality is committed to promoting sustainability in the tourism industry, which includes restaurants, hotels, cafés and more. The aim is to encourage businesses to adopt more environmentally friendly practises by facilitating the introduction of sustainability certificates. This support includes helping businesses to identify viable options, establish contacts with certification bodies and make the procedural changes required for certification. The municipality will serve as a central hub that facilitates interaction between certification organisations and local businesses. This collaboration not only facilitates the integration of greener and energy-efficient practises, but also enables the collection of data for a more accurate assessment of the environmental impact of the tourism sector in the city.

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Renewable Energy Sources (RES) acceleration framework
	Action type	Other interventions: regulation
	Action description	This action aims to expand the use of renewable energy sources (RES) in the territory of Guimarães. To do this, the current legal framework must first be updated to better support this type of intervention. This action includes the development of a legal framework that is in line with national regulations and includes guidelines and measures to promote the use of renewable energy sources in the municipality's jurisdiction. By creating a supportive legislative framework, identifying suitable areas for development, and create strategies to its implementation, the municipality aims to drive renewable energy investments and ensure a sustainable energy future for the District C and the wider community.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Implementation of regulation and framework for RES. Expansion of the results obtained on District C. • Creation or update of necessary regulation and policy framework for facilitating energy efficiency and renewable energy communities.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. - Energy efficiency department Renewable energy developers and companies Landowners and property owners Academic and Research Institutions:

B-2.2: Individual action outlines		
1st priority action		
		- University of Minho NGOs and environmental groups Industry associations
	Action scale and addressed entities	Action scale: this action intends to be first tested on District C and implemented and then expanded to the territory. Addressed entities: Local community; Industry; Public and private associations; schools and academia.
	Involved stakeholders	Energy and Environmental Agencies Renewable energy developers and companies Landowners and property owners Academic and Research Institutions: - University of Minho NGOs and environmental groups Industry associations
	Comments on implementation	This is an action to promote the use of renewable energy sources in the community. It aims to facilitate the rehabilitation of historic buildings in the historic city centre of Guimarães, promote the development of renewable energy communities and increase the overall use of renewable energy sources.
Impact and cost	Generated renewable energy (if applicable)	Electricity
	Removed/substituted energy, volume or fuel type	Increase renewable energy local production
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 126 kt tonCO_2e (in total conjugation with the actions Renewable Energy Communities (REC) and digitalisation of energy, RES self-consumption: households, industry, companies, institutions)
	Total costs and costs by CO_2e unit	Total costs: € (72) M (in total conjugation with the all the actions from the energy systems domains)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Renewable Energy Communities (REC) and digitalisation of energy
	Action type	Other interventions: business models
	Action description	This action focuses on exploring business models and investment concepts for REC within the community. The focus is on developing business models and investment concepts that enable the use of REC. To this end, the Municipality of Guimarães will conduct feasibility studies and implement a pilot activity through District C, monitor progress and, in a later phase, continuously improve and scale the key findings. This action will include the previously mentioned steps, stakeholder engagement (to ensure they are aligned with local community goals and values. Engage key stakeholders, including community members, local businesses, energy providers, financial institutions, and relevant organisations to understand their needs, interests, and concerns),

B-2.2: Individual action outlines		
		identify appropriate renewable energy technologies, build legal and organisational structures, develop business models and revenue streams, access financing and investment opportunities, foster partnerships, and collaborations, develop a communication and outreach strategy. The Municipality of Guimarães also seeks to enhance energy efficiency, promote renewable energy integration, and create a more transparent and data-driven approach to energy management through the digitalisation of energy. This forward-thinking approach aligns with the broader sustainability objectives outlined in the European Green Deal and contributes to building a greener and digitally enabled city.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Set up of the necessary business models and investment concepts for energy efficiency renovation projects and renewable energy communities set up. Expansion of the RES throughout the territory.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. - Energy efficiency department - Municipal works division. Department of Culture, Economy, and Innovation: - Intelligent Systems Development Division
	Action scale and addressed entities	Action scale: this action will be first tested on District C and then expand to other location on Guimarães. Addressed entities: local communities, social housing neighbours, one-stop-shop (OSS), companies and industry, public and private associations, and organisations.
	Involved stakeholders	Energy Agencies (National, Regional) Community organisation and association Financial institutions Renewable energy developers and technology providers (companies) Distribution system operators Energy services companies Information and communication technology (ICT) companies Community members
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	Electricity
	Removed/substituted energy, volume or fuel type	Substituted energy: • Electric energy over fossil fuels.
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 126 kt tonCO_2e (in total conjugation with the actions Renewable Energy Communities (REC) and digitalisation of energy, RES self-consumption: households, industry, companies, institutions)
	Total costs and costs by CO_2e unit	Total costs: € (72) M (in total conjugation with the all the actions from the energy systems domains)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	RES self-consumption: households, industry, companies, institutions
	Action type	Technical interventions
	Action description	This action concerns the transition to more clean sources of energy for households, institutions (private and public), companies and industry. The Municipality of Guimarães leads the national ranking of production unit for self-consumption, according to recent data provided by E-REDES. In total, there are 3 650 installations of solar panels. Guimarães intends to take advantage of this phenomenon and stimulate the implementation of photovoltaic panels.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Increased existence of PV systems on households, industry, companies, and institutions
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory Environment and Climate Action. - Energy efficiency cabinet/department. ESCOs. Industry and Companies Citizens Institutions
	Action scale and addressed entities	Action scale: Guimarães intends to deploy this action throughout the whole territory and to reach out to different types of stakeholders. Addressed entities: households, industry, companies, institutions.
	Involved stakeholders	Citizens E-REDES EDP ESCOs Companies from “Guimarães Marca” Industry
	Comments on implementation	This action can be more challenging to implement in the centre city of Guimarães, due to its UNESCO heritage classification.
Impact and cost	Generated renewable energy (if applicable)	Electricity
	Removed/substituted energy, volume or fuel type	Substituted energy: electric energy (solar energy over fossil fuels)
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 126 kt tonCO_2e (in total conjugation with the actions Renewable Energy Communities (REC) and digitalisation of energy, RES self-consumption: households, industry, companies, institutions)
	Total costs and costs by CO_2e unit	Total costs: € (72) M (in total conjugation with the all the actions from the energy systems domains)

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Capacity building actions of municipal staff
	Action type	Other interventions
	Action description	This initiative aims to develop and implement a tailor-made training programme. The main objectives of the programme are to promote the joint development of new regulations and management practises within the municipality and its affiliated bodies, and to improve competence in implementing clean energy policies.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• Build capacity among the municipal staff and policy makers.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. - Energy efficiency department - Municipal works division.
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expanded to the territory. Addressed entities: municipal staff, and other human resources that may benefit from the capacity building actions.
	Involved stakeholders	Experts on energy efficiency, buildings retrofitting, renewable energy Municipality of Guimarães Landscape Laboratory of Guimarães
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (72) M (total combined with the all the actions from the energy systems domains)

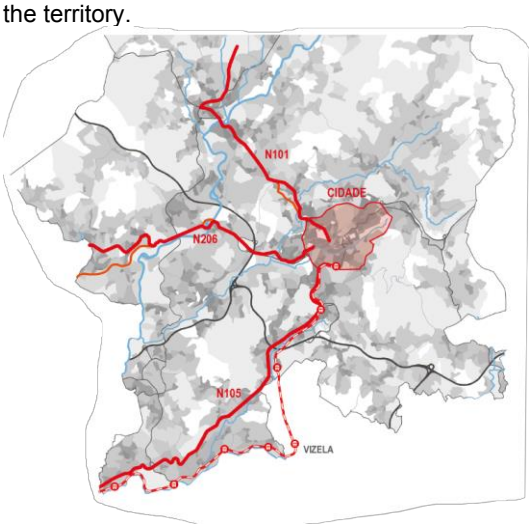
B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Guidance for heritage energy efficiency renovation
	Action type	Other interventions
	Action description	This intervention seeks to strike a balance between preserving aesthetics and promoting energy efficiency. This approach allows the city to integrate cutting-edge research into strategies to improve the energy efficiency of listed buildings without compromising their historical significance, thus contributing to a sustainable and harmonious urban environment.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• Improvement of the energy efficiency of heritage buildings at Guimarães
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. - Energy efficiency department - Municipal works division.

B-2.2: Individual action outlines		
2nd priority action		
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expand to the territory. Addressed entities: historic buildings and the entities involved on that subject.
	Involved stakeholders	Urban planning and heritage authorities Historic preservation NGOs Architects and engineers Business owners and investors Energy efficiency experts and consultants
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (72) M (total combined with the all the actions from the energy systems domains)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Alternative sustainable transportation modes
	Action type	Physical/ spatial interventions
	Action description	This action focuses on promoting and encouraging the adoption of a more sustainable transportation options, with a primary objective of reducing the reliance on private cars. The action aims to shift towards eco-friendly modes of transportation, such as walking, cycling, and public transport, to enhance the overall sustainability and liveability of the community. It also entails as a complement the engagement of the citizens into real-life examples of alternative and sustainable modes, to turn feasible the change towards this type of clean mobility.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Decrease in the private cars circulating in the city. • Pedestrian and cycling are one of the main modes for transportation (besides public and shared transports) • Public transport wide adoption by citizens.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. - Mobility division. - Urban Management Division - Transport Authority Office Guimabus CIM do Ave Landscape Laboratory of Guimarães
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expand to the territory. Addressed entities: citizens and community in general
	Involved stakeholders	Citizens Local businesses, e.g., with increased pedestrian and cycling habits, local businesses, especially those

B-2.2: Individual action outlines		
		located in pedestrian-friendly areas or close to cycling routes, would likely experience increased foot traffic and customer visits. Public transport operators, e.g., Guimabus, CIM do Ave Companies, e.g., Brisa, Get Green Local Government and Municipality of Guimarães Environmental organizations Urban planners and transportation experts
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 26 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € 0

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports
	Action type	Physical/ spatial interventions
	Action description	This action encompasses the promotion of public transport (public buses) as well the deployment of the Bus Rapid Transit service, with the intention to reduce the use of private cars by up taking the use of public transport. The Bus Rapid Transit (BRT) consists of a high-quality bus transit system that offers fast, comfortable, and cost-effective urban mobility. The BRT moves through dedicated lanes and has a fast operation with high frequency. Cities in Portugal, such as Coimbra, have already implemented this type of mobility system, financed by national funds, and Braga will be on its way to have it. Guimarães intends to improve the access to the national roads EN101 and EN206 (the congestion on the main entering points of the city – EN206 and EN101 – is notorious) taking advantage of the intention to implement a BRT system close to the municipality. To this end, it is intended to study the possibility of a BRT system being electric and the reduction of emissions associated with the use of improved public transport (traditional bus versus BRT solution). In this context, Guimarães Municipality did a Decision Support Study for the interconnectivity of the city with the future railway station of High-Speed station in Braga, thereby seeking connection through a public and collective transport, in a dedicated corridor, so that its citizens can travel to the High-

B-2.2: Individual action outlines		
		Speed station without having to use their private car to get there. Guimarães intends to articulate this action with regional and national actors, since it this action deals with a variety of stakeholders and is inter-regional.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Studies and first steps towards the Bus Rapid Transit (BRT) implementation. • Implementation of BRT services on national roads 101 and 206.
Implementation	Responsible bodies/person for implementation	National Ministry of Infrastructure and Housing Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Energy efficiency department - Municipal works division. - Mobility division. Public Transports of Braga
	Action scale and addressed entities	Action scale: this action will encompass the Guimarães municipality, parishes around the municipality, as well Braga municipality, since is an interregional measure that embraces a vast area of the territory.  Addressed entities: citizens, Municipality of Guimarães and Braga, CIM do Ave e do Cávado
	Involved stakeholders	Citizens Municipality Guimarães and Municipality of Braga National Ministry of Infrastructure and Housing CIM do Ave e do Cávado
	Comments on implementation	It is important to emphasise that this is a long-term action, that involves regional and national actors. Guimarães intends to explore the opportunities to improve the mobility and transportation systems that will connect the municipality with the future High-Speed station in Braga. The Municipality of Guimarães, in collaboration with TRENMO (a spin-off company from University of Porto), emitted studies to support the decision for the interconnectivity of Guimarães with the network High-Speed railway. (For more information about the

B-2.2: Individual action outlines		
		study: Public transport study in dedicated road in Guimarães).
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 14 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (56) M (to Guimarães)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Sustainable delivery services
	Action type	Physical/ spatial interventions
	Action description	This activity intends to improve a greener approach on the deliver services at Guimarães. The goal is to have a carbon-free delivery services, last-mile services, and to optimization the trucks logistics regarding the reduction in total trucking kilometres.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Carbon-free delivery system roadmap developed and implemented with key stakeholders. • Implementation of carbon-free delivery with at least one stakeholder in tested area, e.g., District C.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Mobility division. Delivery services companies
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expand to the territory. Addressed entities: citizens, delivery services operators
	Involved stakeholders	Citizens Municipality of Guimarães Delivery services companies, e.g., DPD, UPS Mobility and transportation related companies, e.g., Get Green
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Substituted energy: Gasoline, GPL, diesel by electricity
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 23 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € 0 Values to be refined with delivery and transportation stakeholders

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Electric mobility shift: private passenger vehicles
	Action type	Technical interventions
	Action description	This initiative involves transitioning from traditional combustion-engine vehicles to electric vehicles (EVs) in Guimarães, specifically targeting privately-owned vehicles belonging to the city's residents.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Widespread of electric mobility. Conversion of diesel and gasoline vehicles to electric ones: Combustion passenger vehicles
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. - Mobility division. Citizens
	Action scale and addressed entities	Action scale: this action will cover the territory of Guimarães, including private car owners. Addressed entities: citizens
	Involved stakeholders	Citizens Brisa E-REDES Charging infrastructure providers
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Substituted energy: Gasoline, GPL, diesel by electricity
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 11 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (88) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Electric mobility shift: light goods, and heavy-duty vehicles
	Action type	Technical interventions
	Action description	This action centres on both light-duty and heavy-duty vehicles within the municipality. The objective is to pave the way for the conversion of approximately 100% of light-duty vehicles by 2030 and around 88% of heavy-duty vehicles by 2040.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	Widespread of electric mobility. Conversion of diesel and gasoline vehicles to electric ones: - Light goods vehicles (100%) - Heavy goods vehicles (88%)
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Mobility division. Companies, e.g., fleet
	Action scale and addressed entities	Action scale: this action will cover the territory of Guimarães, light goods vehicles, and heavy-duty vehicles.

B-2.2: Individual action outlines		
1st priority action		
		Addressed entities: companies, industry/companies that have vehicles.
	Involved stakeholders	Brisa E-REDES Companies Electric vehicle manufacturers Fleet owners and operators Energy providers Charging infrastructure providers
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Gasoline, GPL, diesel by electricity
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 20 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (157) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Buses green conversion
	Action type	Technical interventions
	Action description	Conversion of 32 buses from the Guimabus company to electric ones.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Full conversion of the fleet of 32 buses to electric vehicles
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Mobility divison - Transport Authority Office Guimabus
	Action scale and addressed entities	Action scale: this action will cover the buses fleet of the Guimabus company, responsible for the public transport in the municipality. Addressed entities: Guimabus, citizens, Municipality of Guimarães
	Involved stakeholders	Municipality of Guimarães Guimabus Citizens
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Gasoline, GPL, diesel by electricity
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 3 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (4) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Conversion of the urban solid waste collection fleet
	Action type	Technical interventions
	Action description	This action is an innovative one, because it implies the conversion of the municipal waste collection fleet. Guimarães municipality can do this through a mix of different options, namely turn the municipal fleet into electric vehicles, use biogas/biomethane as fuel, and explore different combinations that better suit Guimarães. Given the current Guimarães context, the municipality considers the conversion of 11 vehicles to electricity and 11 vehicles to biomethane, of a total of 22 vehicles from the municipality' fleet. The implementation of this actions constitutes an opportunity to close the cycle of disposal and treatment of biowaste, creating a new product that can be used to fuel the municipal fleet and turn the management and collection of waste cleaner and more sustainable for the municipality. This measure has the capacity to act on circular economy and clean and renewable energy.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• The urban solid waste collection fleet uses clean energy as fuel.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment Urban Services Division: - Mobility division. Tratave. Resinorte VITRUS
	Action scale and addressed entities	Action scale: cover the waste collection routes on the municipality. Addressed entities: municipality, waste fleet collection of Guimarães
	Involved stakeholders	Municipality of Guimarães Resinorte VITRUS Tratave
	Comments on implementation	The implementation of this action implies the support from the Tratave since it is the entity responsible for the management and operation of the public drainage, purification, and destination of industrial and domestic wastewater from the municipalities of Guimarães, Vizela, Vila Nova de Famalicão, Santo Tirso and Trofa. As such, Tratave would be in charge to create an installation for an aerobic digestion of sludge in wastewater treatment plants. In Portugal the Dourogás company took already the first steps to introduce biomethane (a gas produced from a renewable source that can replace natural gas) and injected into the Portugal gas network. Also, regarding the environmental policy in waste, Portuguese regulations, policies, and plans, (e.g., Roadmap to Carbon Neutrality 2050, and the

B-2.2: Individual action outlines		
1st priority action		
		National Energy and Climate Plan 2030) claims for the progressive reduction of its deposition in landfills and the increase of its recovery (e.g., to produce biogas), to fulfil European and national targets in this matter. The present action represents a considerable investment since it implies the creation of an installation for aerobic digestion does not exist in Guimarães territory, representing the necessity to invest and gather the crucial entities to deploy this procedure.
Impact and cost	Generated renewable energy (if applicable)	Biomethane
	Removed/substituted energy, volume or fuel type	3 965 MWh (diesel)
	GHG emissions reduction estimate (total) per emission source sector	Removed emissions: 1 k tonCO_2e/year
	Total costs and costs by CO_2e unit	Total costs: € (5) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Carpooling and car sharing
	Action type	Other interventions
	Action description	Carpooling and car sharing intend to optimise transport and reduce emissions associated with the use of individual vehicles. Carpooling involves coordinating journeys to common destinations, reducing the number of vehicles on the roads by increasing the average number of passengers per car, and minimising congestion. Car sharing, on the other hand, is a service that aims to provide Guimarães' citizens short-term access to shared vehicles. This approach promotes a shift from car ownership to car access, encouraging citizens to use vehicles only when needed and to opt for more sustainable transport options where possible. By providing an easily accessible fleet of shared vehicles, this action aims to reduce the overall number of cars on the road and reduce GHG emissions.
Reference to impact pathway	Field of action	Learning and capabilities
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Increase the acceptance of carpooling by the community and workers who work in the same area. The system is already in place and has led to a reduction in the use of private cars.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Mobility division Citizens and private cars owners
	Action scale and addressed entities	Action scale: throughout the territory of Guimarães Addressed entities: citizens
	Involved stakeholders	Experts on sustainable mobility modes Citizens

B-2.2: Individual action outlines		
1st priority action		
		Businesses and employers Community organizations and platforms, e.g., groups on social media. Technology providers Vehicle rental companies
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 8 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € 0

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Biowaste upgrade
	Action type	Technical interventions
	Action description	The proposed action involves expanding biowaste recovery across the entire territory of Guimarães. The aim is to enhance the collection infrastructure for biowaste, provide support for composting and organic waste treatment, collaborate with local institutions, monitor, and gather data, and continually evaluate and improve the process.
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Increase in the biowaste selective collection throughout the territory.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment Urban Services Division Resinorte VITRUS
	Action scale and addressed entities	Action scale: trial on District C and continuing to expand the ongoing biowaste collection that already took place in some areas of Guimarães. Addressed entities: citizens, commercial areas (shopping centers, supermarkets), companies, restaurants, schools, other private and public entities, Brigadas Verdes, Pegadas programme
	Involved stakeholders	Resinorte VITRUS Citizens Local businesses, e.g., restaurants Schools and academia Public and private entities
	Comments on implementation	It will be done a pilot trial in a small area on District C. The Municipality of Guimarães already has biowaste collection. The intention is to upgrade and to expand to other areas of the municipality and to explore the possibility to use it as a possible source of fuel.
Impact and cost	Generated renewable energy (if applicable)	N/A

B-2.2: Individual action outlines		
1st priority action		
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 10 kt tonCO2e (total combined with the actions: Undifferentiated urban waste reduction, Waste production reduction, Biowaste upgrade)
	Total costs and costs by CO_2e unit	Total costs: € (1) M (total combined with the all the actions from the waste and circular economy domain)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Undifferentiated urban waste reduction
	Action type	Technical interventions
	Action description	Through this action, the Municipality of Guimarães can effectively promote waste separation, decrease undifferentiated waste, and contribute to a more sustainable and environmentally conscious municipality. Through the implementation of this action plan, it is expected to achieve a significant reduction of undifferentiated urban waste in Guimarães.
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Substantial decrease in undifferentiated waste collected.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment: Urban Services Division: - Mobility division. Resinorte VITRUS
	Action scale and addressed entities	Action scale: this action will cover the territory of Guimarães, having District C also as trial. Addressed entities: citizens, commercial areas (shopping centres, supermarkets), companies, Brigadas Verdes, Pegadas programme
	Involved stakeholders	Resinorte VITRUS Tratave
	Comments on implementation	It is important to notice that the Municipality of Guimarães already has undifferentiated urban waste collection. The intention is to upgrade and to expand to other areas of the municipality.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 10 kt tonCO2e (total combined with the actions: Recycling upgrade Undifferentiated urban waste reduction, Waste production reduction, Biowaste upgrade)
	Total costs and costs by CO_2e unit	Total costs: € (1) M (total combined with the all the actions from the waste and circular economy domain)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Waste production reduction
	Action type	Technical interventions
	Action description	This action will enable the Municipality of Guimarães to reduce overall urban waste. It includes the following actions that will enable successful implementation: reduce waste at source, the municipality will promote waste source reduction practises among residents, businesses and institutions, promote sustainable lifestyles in the municipality, encourage individuals to adopt practises that minimise waste generation, work with local businesses to promote waste reduction measures in their operations, promote recycling and composting as essential waste management practises, monitor and analyse waste generation data to track progress and identify areas for improvement, continuous improvement approach with ongoing collaboration between stakeholders.
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Decrease the overall urban waste production.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment: Urban Services Division.
	Action scale and addressed entities	Action scale: trial on District C and expansion to other areas of Guimarães Addressed entities: citizens, commercial areas (shopping centers, supermarkets), companies, public and private entities, Brigadas Verdes, Pegadas programme
	Involved stakeholders	Resinorte VITRUS
	Comments on implementation	The Municipality of Guimarães already has waste reduction practices and actions ongoing. The aim of this action is to push further and expand the overall waste reduction throughout the territory.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 10 kt tonCO_2e (total combined with the actions: Recycling upgrade, Undifferentiated urban waste reduction, Waste production reduction)
	Total costs and costs by CO_2e unit	Total costs: € (1) M (total combined with the all the actions from the waste and circular economy domain)

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Recycling upgrade
	Action type	Technical interventions
	Action description	By implementing this action, the Municipality of Guimarães aims to increase the recycling rate and foster a sustainable waste management system. This approach will encourage residents, businesses, and institutions to actively participate in recycling efforts, reduce waste generation, and contribute to the development of a circular economy within the municipality. The action involves the following key elements: continuous awareness and education, infrastructure improvement, promotion of reuse, establishment of efficient recycling facilities, a strong collaboration with recycling companies monitoring and evaluation.
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Increase reuse and recycling of municipal waste.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment Urban Services Division Resinorte VITRUS
	Action scale and addressed entities	Action scale: this action will cover District C and the expand to other areas of Guimarães. Addressed entities: citizens, commercial areas (shopping centres, supermarkets), companies, public and private entities, Brigadas Verdes, programa Pegadas
	Involved stakeholders	Municipality of Guimarães Resinorte VITRUS
	Comments on implementation	To enhance recycling practices in the Municipality of Guimarães, an action plan is being proposed to increase the recycling rate.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 10 kt tonCO_2e (total combined with the actions: Undifferentiated urban waste reduction, Waste production reduction, Biowaste upgrade)
	Total costs and costs by CO_2e unit	Total costs: € (1) M (total combined with the all the actions from the waste and circular economy domain)

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	New circular business models
	Action type	Other interventions: business models
	Action description	This intervention aims to promote new circular business models and extend the lifespan of products within District C, and then to the entire territory. This will involve exploring ideas, such as establishing repair cafes, which have already been successful in another area of Guimarães. Additionally, options like tool and appliance rental services, second-hand and thrift shops, and the creation of a local marketplace for circular products will be considered.
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Financing and funding
	Outcome (according to module B-1.1)	• Implementation and expansion of circular business models, e.g., repair caffe concept renting of tools/appliances, second-hand and thrift shops, and markets.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment Urban Services Division: - Department of Culture, Economy, and Innovation Economic Development Division Local commerce in Guimarães Industry
	Action scale and addressed entities	Action scale: first, a pilot project is being tested on behalf of District C, which will then be transferred to the entire area. Addressed entities: citizens, commercial areas, companies.
	Involved stakeholders	Municipality of Guimarães Resinorte VITRUS Local market of Guimarães
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (1) M (total combined with the all the actions from the waste and circular economy domain)

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Business symbiosis
	Action type	Other interventions
	Action description	This action focuses on transforming waste generated by one business into valuable resources for other businesses, promoting a closed loop system that strengthens the local economy. The aim is to encourage cooperation between businesses so that they can share resources, develop innovative products and services and work together to achieve sustainability goals.

B-2.2: Individual action outlines		
2nd priority action		
		To support businesses in this endeavour, matchmaking and marketplace activities will be implemented alongside other engagement strategies. These activities provide platforms for networking, connect businesses with potential collaborative partners and provide opportunities to secure funding to support their circular economy initiatives.
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Financing and funding
	Outcome (according to module B-1.1)	• Expansion of matchmaking and marketplace
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Department of Urban Services and Environment: Urban Services Division: - Department of Culture, Economy, and Innovation Economic Development Division Local commerce in Guimarães Business incubator of Guimarães Industry
	Action scale and addressed entities	Action scale: first, a pilot project is being tested on behalf of District C, which will then be transferred to the entire area. Addressed entities: citizens, commercial areas, companies, start-ups
	Involved stakeholders	Municipality of Guimarães Local commerce Companies Start-ups
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (1) M (total combined with the all the actions from the waste and circular economy domain)

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Green areas
	Action type	Nature-based solutions
	Action description	The focus of this action is on the enhancement of green spaces. It includes mapping of suitable areas, urban afforestation and tree planting, biodiversity restoration and protection, forest restoration, green infrastructure, education, and awareness raising. This action is essential to ensure that carbon neutrality is achieved holistically, considering the need to support natural carbon sinks in the area and to conserve animal and plant species so that they can thrive in their habitats.

B-2.2: Individual action outlines		
2nd priority action		
Reference to impact pathway	Field of action	Green infrastructure and nature-based solutions
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Masterplan of areas to intervene and recovery/implement green areas for carbon capture. Expansion of green areas.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Division of Green Structure and Biodiversity - Territory Development Department - Urban Management Division Landscape Laboratory of Guimarães
	Action scale and addressed entities	Action scale: District C as a testbed for the implementation of the action, with the intention to expand the green areas throughout Guimarães. Addressed entities: citizens, local NGOs, and environmental organisations, Brigadas Verdes, Pegadas programme.
	Involved stakeholders	Local community and citizens Environmental and conservation organizations Landowners and property developers Educational organisations Brigadas Verdes Pegadas programme. Business and industry, e.g., as partners, sponsors, implementers
	Comments on implementation	District C will encompass, as a first step of implementation of the action, the prototyping of needed green areas. Then is expected in the long term the development of a masterplan and the deployment of the green areas.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (24) M

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Green belt
	Action type	Nature-based solutions
	Action description	The green belt action aims to create a natural green corridor around the urban area of Guimarães to improve carbon sequestration, increase biodiversity, improve the leisure time of the population, reduce stress, and increase general well-being. The action includes a feasibility study, ecological assessments, habitat restoration, recreational opportunities within the greenbelt, the establishment of a buffer zone around the greenbelt to manage land use and development in a responsible way, and continuous monitoring and regular review of the implementation of the greenbelt to assess its effectiveness and make necessary adjustments.

B-2.2: Individual action outlines		
2nd priority action		
Reference to impact pathway	Field of action	Green infrastructure and nature-based solutions
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Implementation of a green belt
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Division of Green Structure and Biodiversity - Territory Development Department - Urban Management Division Landscape Laboratory of Guimarães
	Action scale and addressed entities	Action scale: District C as a testbed for the implementation of the action, with the intention to expand the green areas throughout Guimarães. Addressed entities: citizens, local NGOs, and environmental organisations, Brigadas Verdes, Pegadas programme.
	Involved stakeholders	Local community and citizens Environmental and conservation organizations Landowners and property developers Educational organisations Brigadas Verdes Pegadas programme. Business and industry, e.g., as partners, sponsors, implementers
	Comments on implementation	A feasibility study under the District C will be conducted before the actual implementation of the green belt. In the long run, the Municipality of Guimarães intends to have it implemented until 2030.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (10) M

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Biodiversity conservation and restoration
	Action type	Nature-based solutions
	Action description	This action aims to enhance the overall biodiversity in the area, restore and protect important habitats, and raise environmental awareness among the community. It will entail native planting programmes, protected areas and green corridors, environmental education and awareness, collaboration, and partnerships, and monitoring and evaluation.
Reference to impact pathway	Field of action	Green infrastructure and nature-based solutions
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Recovery, reconstitution, and resilience of biodiversity ecosystems.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action:

B-2.2: Individual action outlines		
2nd priority action		
		- Division of Green Structure and Biodiversity - Territory Development Department - Urban Management Division Landscape Laboratory of Guimarães
	Action scale and addressed entities	Action scale: a first test will be run on District C with the intention to expand to the territory. Addressed entities: citizens, local NGOs, and environmental organisations, Brigadas Verdes, Pegadas programme.
	Involved stakeholders	Local community and citizens Environmental and conservation organisations Landowners and property developers Educational organisations Brigadas Verdes Pegadas programme. Business and industry, e.g., as partners, sponsors, implementers
	Comments on implementation	The Municipality of Guimarães has ongoing actions and strategies to support local biodiversity and its conservation. This action intends to enhance what is been done already and continue to act upon it.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (2) M

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Urban private community gardens
	Action type	Nature-based solutions
	Action description	This action aims to enhance small private green spaces, including backyards and flowerbeds in multifamily buildings, by promoting subsistence and leisure agriculture. The municipality will provide necessary supplies such as season-appropriate seeds, compost, and composters to interested participants. Furthermore, free agriculture courses will be developed and offered to build capacity and promote sustainable practices among residents. The effectiveness of this action will be evaluated through multiple approaches. Citizen feedback and inquiries will be considered, providing valuable insight into the impact of the initiative. Additionally, the assessment will consider the utilization of potential green areas and the implementation of actions in targeted locations. Additionally, the initiative aims to boost organic waste composting and reduce emissions through self-sufficiency practices.
Reference to impact pathway	Field of action	Green infrastructure and nature-based solutions
	Systemic lever	Governance and policy

B-2.2: Individual action outlines		
2nd priority action		
	Outcome (according to module B-1.1)	• Urban private community gardens expansion.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Division of Green Structure and Biodiversity - Territory Development Department - Urban Management Division Landscape Laboratory of Guimarães
	Action scale and addressed entities	Action scale: District C as a pilot project, and its expansion to other areas of the municipality Addressed entities: citizens, Municipality of Guimarães
	Involved stakeholders	Local community and citizens Environmental and conservation organizations Landowners and property developers Educational organisations Brigadas Verdes Pegadas programme. Business and industry, e.g., as partners, sponsors, implementers
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (2) M

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	High efficient new buildings
	Action type	Physical/ spatial interventions
	Action description	This initiative focuses on the implementation of strict standards and regulations for new building stock. It promotes and guarantees that all upcoming construction projects within the municipality adhere to the highest standards of energy efficiency, sustainability, and environmental friendliness. In this way, the municipality aims to curb energy consumption, reduce GHG emissions and improve the overall quality and durability of the buildings constructed. The action would entail integrate standards into building codes and streamlined permitting process.
Reference to impact pathway	Field of action	Built environment
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• New buildings follow and are constructed under the top performing standards
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Territory Development Department - Urban Management Division - Works and Buildings Division

B-2.2: Individual action outlines		
2nd priority action		
	Action scale and addressed entities	Action scale: District C as a trial and expansion throughout the territory. Addressed entities: Building stock on Guimarães
	Involved stakeholders	Municipality of Guimarães Citizens Urban Planners and architects Construction companies Real Estate developers Energy consultants Environmental Agencies Building material suppliers Financial Institutions Utility companies Local businesses National Government Regulatory Agencies
	Comments on implementation	The city centre of the Municipality of Guimarães is considered a heritage site of international interest by UNESCO, which includes several historic buildings. This imposes some restrictions on the retrofitting of this type of buildings, such as the installation of photovoltaic panels on the roofs and energy efficiency measures. Therefore, the action "Guidance for heritage energy efficiency renovation" is linked to this action as they complement each other in terms of retrofitting buildings and the implementation of energy efficiency measures. On the other hand, legislation, and policies for the construction of new buildings with sustainable criteria already exist at national level and should be applied. The Decree Law n.º101-D/2020 establishes the requirements to improve the energy performance of buildings and regulates the Energy Certification System for Buildings (SCE), the Order n.º 6476-E/2021 defines new minimum requirements for thermal comfort and energy performance of buildings, both for new buildings and renovations, and also the new General Building Code (GCE) is under revision. The national policy and regulations define that new buildings must have near-zero energy emissions. It is the intention of the municipality to apply, within its means, the best criteria for sustainable construction to the construction of new buildings that comply with national (and therefore European) standards.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 2 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (25) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Building deep retrofit
	Action type	Other interventions: business models
	Action description	The objective of this action is to remove the financial obstacles encountered by Municipality of Guimarães in implementing energy efficiency projects and building retrofits at a systemic level. The action includes the use of financial incentives and subsidies to promote energy efficiency initiatives and retrofit projects and encourage collaboration and leverage resources. The action also promotes public-private partnerships. By working with private companies, the municipality can access expertise, funding and technology while sharing the costs and risks associated with energy efficiency projects. It will explore the use of energy performance contracts as a mechanism for financing energy efficiency projects. The action embraces the concept of energy efficiency aggregation, where multiple projects or buildings are combined to achieve economies of scale. Recognising the need for technical expertise and knowledge, the action emphasises the provision of technical assistance and capacity building support.
Reference to impact pathway	Field of action	Built environment
	Systemic lever	Finance and funding
	Outcome (according to module B-1.1)	• Rehabilitation, retrofitting, and renovation of energy efficiency renovation projects
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Energy efficiency department - Municipal works division.
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expand to the territory. Addressed entities:
	Involved stakeholders	Energy Agency Financial institutions Public-Private Partnerships (PPP) Energy Service Companies (ESCOs)
	Comments on implementation	This action has the goal to build the ground for energy efficiency and renewable energy projects in Guimarães. It is a complementary but necessary action to support other energy related actions and projects. May not have a direct impact on emissions reductions as other actions on the Action Plan.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Substituted energy: • Renewable energy sources over non-renewable energy sources (fossil fuels)
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 11 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (168) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Adoption of efficient lighting and appliances
	Action type	Technical interventions
	Action description	This initiative is about assessing the diffusion of energy efficient lighting systems and appliances in the building sector. Its main objective is to promote the use of energy-saving lighting technologies and high efficiency appliances. It is also intended by the municipality to launch a public tender on improving efficiency of street lightning. In this way, it aims to reduce electricity consumption, promote sustainable energy practises, and contribute to the overall improvement of energy efficiency in buildings.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Improvement of energy efficiency lighting and appliances.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Energy efficiency department Citizens.
	Action scale and addressed entities	Action scale: municipality Addressed entities: public buildings and facilities, citizens, one-stop-shop (OSS)
	Involved stakeholders	Building owners and managers Energy Service Companies (ESCOs) Consumers and building residents Community and NGOs Local businesses Utilities and energy providers
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 18 kt tonCO_2e
	Total costs and costs by CO_2e unit	Total costs: € (100) M

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Industrial energy efficiency initiatives
	Action type	Technical interventions
	Action description	This action aims to improve energy efficiency in the industrial sector through the implementation of measures aimed at reducing energy consumption, both for thermal energy and electricity, while exploring ways to produce energy more cleanly and effectively. The main objective is to reduce the impact of industrial activities on the environment while increasing operational efficiency. This encompasses energy audits and assessment, equipment, and technology upgrades and/or substitution, process optimisation, efficient lighting and HVAC systems, among others, following the objectives, goals and strategies defined on

B-2.2: Individual action outlines		
1st priority action		
		PNEC 2030 (35%) and in-line with the potentialities identified on the territory: 25% reduction on thermal energy consumption; 35% reduction on electricity consumption; 10% reduction on energy production subsector.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Reduction of energy consumption and more efficient processes
Implementation	Responsible bodies/person for implementation	Industry Government Agencies and Regulatory Bodies Local Government and Municipality Technology Providers Utilities and Grid Operators
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry. Addressed entities: Industrial companies in Guimarães
	Involved stakeholders	Municipal Directorate for Intervention Territory, Environment and Climate Action. "Guimarães' Brand". Guimarães industry. Government Authorities Energy Service Providers Research and Development institutions Financial institutions Energy Regulatory Authorities Technology providers Utilities and energy providers Business Association of Guimarães.
	Comments on implementation	This action should be implemented by the industry. The Municipality of Guimarães is merely a facilitator and does not have authority to obligate industries to implement this action since industries are private entities. The goal is to demonstrate the journey that needs to be done to achieve climate neutrality by 2030, including such an important sector for Guimarães that is the industry.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Thermal energy: 135 070 MWh Electricity: 121 847 MWh Energy production: 59 486 MWh
	GHG emissions reduction estimate (total) per emission source sector	Removed emissions: 66 k tonCO_2e GHG emissions reduction: 27,5%
	Total costs and costs by CO_2e unit	Total costs: € (89) M Costs by CO_2e unit: € 1,34 M / ktonCO_2e

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Solar energy uptake
	Action type	Technical interventions
	Action description	This action focuses on the integration of solar energy solutions in the industrial sector. The main objective is to use solar energy, which includes both thermal applications and photovoltaic panels, to improve the industry's energy mix and reduce its environmental

B-2.2: Individual action outlines		
1st priority action		
		impact. The core elements of this approach include thermal solar systems, photovoltaic modules, hybrid systems that synergistically combine thermal and photovoltaic technologies, local power generation, energy storage and process optimisation. It focuses on the incorporation of solar energy technologies in the industrial sector for thermal energy production (pre-heating processes) to substitute fossil fuels consumption in accordance with PNEC 2030 objectives, goals, and strategies, aiming to contribute with 10% of the total thermal energy needs in industry through the installation of approximately 25 000 solar panels (over 60 000 m^2).
Reference to impact pathway	Field of action	Industry
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Increase of the solar energy production and thermal energy production
Implementation	Responsible bodies/person for implementation	Industry Government Agencies and Regulatory Bodies Local Government and Municipality Technology Providers Utilities and Grid Operators
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry. Addressed entities: industry in Guimarães
	Involved stakeholders	National Government Government Agencies and Regulatory Bodies Local Government and Municipality Renewable Energy Providers, e.g., EDP Financial Institutions Technology Providers Utilities and Grid Operators “Guimarães’ Brand”. Guimarães industry. Business Association of Guimarães.
	Comments on implementation	This action should be implemented by the industry. The Municipality of Guimarães is merely a facilitator and does not have authority to obligate industries to implement this action since industries are private entities. The goal is to demonstrate the journey that needs to be done to achieve climate neutrality by 2030, including such an important sector for Guimarães that is the industry.
Impact and cost	Generated renewable energy (if applicable)	47 672 MWh
	Removed/substituted energy, volume or fuel type	25 425 solar panels and 40 521 MWh
	GHG emissions reduction estimate (total) per emission source sector	Removed emissions: 8 k tonCO_2/year GHG emissions reduction: 3,4%
	Total costs and costs by CO_2e unit	Total costs: € (11) M Costs by CO_2e unit: € 1,32 M / kton CO_2

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Green hydrogen for Guimarães' industry
	Action type	Technical interventions
	Action description	This action consists in the injection of green hydrogen, locally produced with renewable electricity through electrolysers (approximately 40 MW of peak power), producing over 45 000 tons of H_2/year and achieving a blending ratio of 20% of this renewable gas into the natural gas industrial pipelines.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Guimarães' industries adopt blended options of hydrogen and natural gas.
Implementation	Responsible bodies/person for implementation	National Government Government Agencies and Regulatory Bodies Local Government and Municipality Renewable Energy Providers, e.g., EDP Financial Institutions Technology Providers Utilities and Grid Operators "Guimarães' Brand". Guimarães industry. Business Association of Guimarães.
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry. Addressed entities: industry in Guimarães
	Involved stakeholders	Municipal Directorate for Intervention Territory, Environment and Climate Action. "Guimarães' Brand". Guimarães industry. Business Association of Guimarães.
	Comments on implementation	This action should be implemented by the industry. Guimarães municipality is merely a facilitator and does not have authority to obligate industries to implement this action since industries are private entities. This measure would require national government involvement due to its political contours and implications, as it is also a national goal to decarbonise natural gas grids and power plants through hydrogen. This requires not only investment from industry, but also financial support from the government.
Impact and cost	Generated renewable energy (if applicable)	Electricity
	Removed/substituted energy, volume or fuel type	40,6 MW of electrolyser (electric power) and 180 012 MWh
	GHG emissions reduction estimate (total) per emission source sector	Removed emissions: 37 k tonCO_2/year. GHG emissions reduction: 15,1%
	Total costs and costs by CO_2e unit	Total costs: € (53) M Costs by CO2e unit: € 1,77 M / kton CO_2

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Biomass uptake
	Action type	Technical interventions
	Action description	This action consists in the use of biomass as an alternative renewable energy source to generate thermal energy for the industrial sector, for example, for the pre-heating processes necessary by the textile industry, along with collection and storage

B-2.2: Individual action outlines		
1st priority action		
		biomass facilities that might also include the promotion of local-scale energy generation based on residual biomass (installation of small decentralised thermal power plants). Guimarães, due to its location, can take advantage of the waste biomass from the region to produce local biofuel, thus ensuring adequate management of forest, agriculture, livestock, food industry and other organic waste, and provide a second life to biowaste. However, to ensure a secure supply, and harnessing the potential of biomass as a renewable energy source to meet the thermal energy needs of industries, long-term contracts with suppliers will be needed. It is foreseen to reach a substitution of 50% of the remaining fossil fuels consumption for thermal energy in industrial sector, equivalent to the installation/substitution of approximately 40 MW of steam boilers. This measure focuses on harnessing the potential of biomass as a renewable energy source to meet the thermal energy needs of industries.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Second-life to biowaste, use of biomass by the industry.
Implementation	Responsible bodies/person for implementation	National Government Government Agencies and Regulatory Bodies Local Government and Municipality Biomass providers Financial Institutions Technology Providers Utilities and Grid Operators “Guimarães’ Brand”. Guimarães industry. Business Association of Guimarães.
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry. Addressed entities: industry of Guimarães, Biomass suppliers
	Involved stakeholders	Resinorte VITRUS Tratave CVR (Waste Valorisation Center) Guimarães industry National Government Municipality of Guimarães
	Comments on implementation	This action should be implemented by the industry. The Municipality of Guimarães is merely a facilitator and does not have authority to obligate industries to implement this action since industries are private entities. Guimarães seeks to inspire industries to explore clean and sustainable energy sources, because industry has a considerable share on the municipality’ emissions. To use biogas (and biomethane) would require several investments that would have to be financially

B-2.2: Individual action outlines		
1st priority action		
		supported by the national government to make this measure a reality, as the municipality and the industry cannot act alone. The municipality is on the board of the CVR (Waste Valorisation Centre), so the participation of this institution is important to implement this action and to cooperate in the production of biogas and biomethane.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	145 876 MWh
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 30 k tonCO_2/year GHG emissions reduction: 12,4%
	Total costs and costs by CO_2e unit	Total costs: € (44) M Costs by CO_2e unit: € 1,47 M/ ktonCO_2

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Biomethane uptake
	Action type	Technical interventions
	Action description	This action resides on the last step to decarbonise the industrial processes and consist in the strategic introduction of biomethane as a clean and renewable energy source into the natural gas industrial pipelines. In an early stage, through the production of biomethane from endogenous resources, such as organic waste and agricultural residues (technological readiness and rate of adoption). In the long run, within the incorporation of biomethane from other sources to have a greener industry in Guimarães. It is foreseen to reach a substitution of 50% of the remaining natural gas consumption in industrial sector.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Second-life to biowaste, adhesion to biomethane by the industry.
Implementation	Responsible bodies/person for implementation	National Government Government Agencies and Regulatory Bodies Local Government and Municipality Biomass providers Financial Institutions Technology Providers Utilities and Grid Operators “Guimarães’ Brand”. Guimarães industry. Business Association of Guimarães.
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry. Addressed entities: industry of Guimarães, Biomass suppliers
	Involved stakeholders	Resinorte VITRUS Tratave CVR (Waste Valorisation Center)

B-2.2: Individual action outlines		
1st priority action		
		Guimarães industry National Government Municipality of Guimarães
	Comments on implementation	This action should be implemented by the industry. Guimarães municipality is merely a facilitator and does not have authority to obligate industries to implement this action since industries are private entities. Guimarães seeks to inspire industries to explore clean and sustainable energy sources, because industry has a considerable share on the municipality' emissions. This action is also connected with the action "Conversion of the urban solid waste collection fleet", so that the production of biomethane could also be used to fuel the waste collection fleet of Guimarães. To use of biomethane would require several investments that would have to be financially supported by the national government to make this measure a reality, as the municipality and the industry cannot act alone. The municipality is on the board of the CVR (Waste Valorisation Centre), so the participation of this institution is important to implement this action and to cooperate in the production of biogas and biomethane.
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	287 087 MWh
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 58 k tonCO_2/year GHG emissions reduction: 24,1%
	Total costs and costs by CO_2e unit	Total costs: € (90) M Costs by CO2e unit: € 1,54 M / kton CO_2

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Top management engagement for sustainable industry
	Action type	Learning and capabilities
	Action description	This action aims to bring change in industrial practises of the Guimarães' industry by engaging and supporting executives and top management through their sustainable industrial pathway. These leaders play a critical role in steering the direction of their companies and organisations and influencing decisions that impact environmental and social sustainability.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• Increased commitment from top management to prioritise sustainability in their industrial operations. • Adoption of sustainable practises, such as energy efficiency measures, waste reduction and resource optimisation, at the organisational level.

B-2.2: Individual action outlines		
2nd priority action		
Implementation	Responsible bodies/person for implementation	"Guimarães' Brand". Guimarães industry. Business Association of Guimarães.
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry, with the support of the municipality. Addressed entities: industry of Guimarães
	Involved stakeholders	Guimarães industry Municipality of Guimarães
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total cost	Total costs: € (35) m

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Promotion of sustainable industry in partnership with relevant industry associations
	Action type	Other interventions
	Action description	The action focuses on building strategic partnerships between local industry and business and industry associations in Guimarães to promote sustainable energy practises. The aim is to pool expertise, resources, and networks to accelerate the transition to cleaner and more efficient energy sources.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• Increased adoption of renewable energy technologies and practices within the industrial sector. • Integration of sustainable energy practices into the strategic plans of industry.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães "Guimarães Marca" Guimarães industry Business Association of Guimarães
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry, with the support of the municipality. Addressed entities: industry of Guimarães
	Involved stakeholders	Guimarães industry Municipality of Guimarães
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs	Total costs: € (35) m

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Promotion for sustainable business hosting areas
	Action type	Other interventions
	Action description	This action focuses on the strategic identification and development of an area within the municipality for attracting businesses with a strong commitment to sustainability. This area would serve as a hub where sustainable practises, innovation and economic growth come together, with a focus on business that have sustainability at its core.
Reference to impact pathway	Field of action	Industry
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• Concentration of environmentally friendly businesses in designated areas, creating a sustainable business ecosystem.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães "Guimarães' Brand" Guimarães industry Business Association of Guimarães
	Action scale and addressed entities	Action scale: this action intends to be implemented by the Guimarães industry with the support of the municipality. Addressed entities: industry of Guimarães.
	Involved stakeholders	Guimarães industry National Government Municipality of Guimarães
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (400) m

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Expansion of a one-stop-shop (OSS)
	Action type	Other interventions
	Action description	The expansion of the one-stop-shop (OSS) from District C to the territory of Guimarães will offer a centralised hub where stakeholder, e.g., citizens, can access a variety of energy efficiency and renewable energy services. These services may include energy assessments, technical advice, project planning, and support throughout the implementation process. It will also provide renewable energy solutions, financial guidance, and training and education.
Reference to impact pathway	Field of action	Cross-cutting (energy systems and built environment)
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• OSS is successfully implemented and embraces more citizens and territories on Guimarães.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Energy efficiency department - Municipal works division.

B-2.2: Individual action outlines		
2nd priority action		
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expand to the territory. Addressed entities: local community, several entities that may benefit from the OSS services.
	Involved stakeholders	Financial institutions Community associations and organisations Technology providers and service companies
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	Promotion of renewable energy sources over non-renewable energy (energy from fossil fuels)
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs and costs by CO_2e unit	Total costs: € (200) m

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Digital twin
	Action type	Other interventions
	Action description	The action of the digital twin aims to provide the aspect of technological simulation for the community to be able to predict and plan the response to actions and system implementations before applying solutions in the field. The intention is to use a digital and virtual image that enables data integration, virtual image creation, real-time monitoring, simulation, urban planning and resource management.
Reference to impact pathway	Field of action	Cross-cutting (energy systems and built environment)
	Systemic lever	Learning and capabilities
	Outcome (according to module B-1.1)	• Collaboration with experts, data collection, and technology integration. Creation of a digital twin model, data integration, simulation, and accessibility.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Energy efficiency department Department of Culture, Economy, and Innovation: - Intelligent Systems Development Division
	Action scale and addressed entities	Action scale: territory of Guimarães Addressed entities: Municipality of Guimarães
	Involved stakeholders	IT and smart cities companies Technology providers and service companies Research and Academic Institutions, e.g., University of Minho City planners Data and analytics experts
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs	Total costs: € (300) m

B-2.2: Individual action outlines		
2nd priority action		
Action outline	Action name	Sustainable tourism
	Action type	Other interventions
	Action description	This action is to be linked to the activity on District C, which aims to promote environmental responsibility and sustainable practises in the tourism industry in Guimarães. It aims to encourage tourism industry actors, such as restaurants and hotels, to engage in more sustainable practises and to involve these actors in acquiring a certificate that will allow them to demonstrate their past achievements in the field of sustainability. It enables the promotion of more sustainable practises in terms of energy efficiency and the calculation of the carbon footprint of establishments by collecting the necessary data.
Reference to impact pathway	Field of action	Cross-cutting (all field domains)
	Systemic lever	Governance and policy
	Outcome (according to module B-1.1)	• Certified sustainable tourism businesses recognized for their commitment to environmental and social responsibility
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action. Local tourism businesses Tourism certification bodies
	Action scale and addressed entities	Action scale: this action intends to be implemented on District C and then expand to the territory. Addressed entities: tourism industry.
	Involved stakeholders	Environmental and conservation organizations Tourists and travellers Cultural and heritage organizations, Guimarães Historical centre Guimarães Tourism Point Tourism boards and destination marketing organisations Media and marketing agencies
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	N/A
	Total costs	Total costs: € (125) m

B-2.3: Summary strategy for residual emissions

Guimarães has set a 20% level of residual GHG emissions.

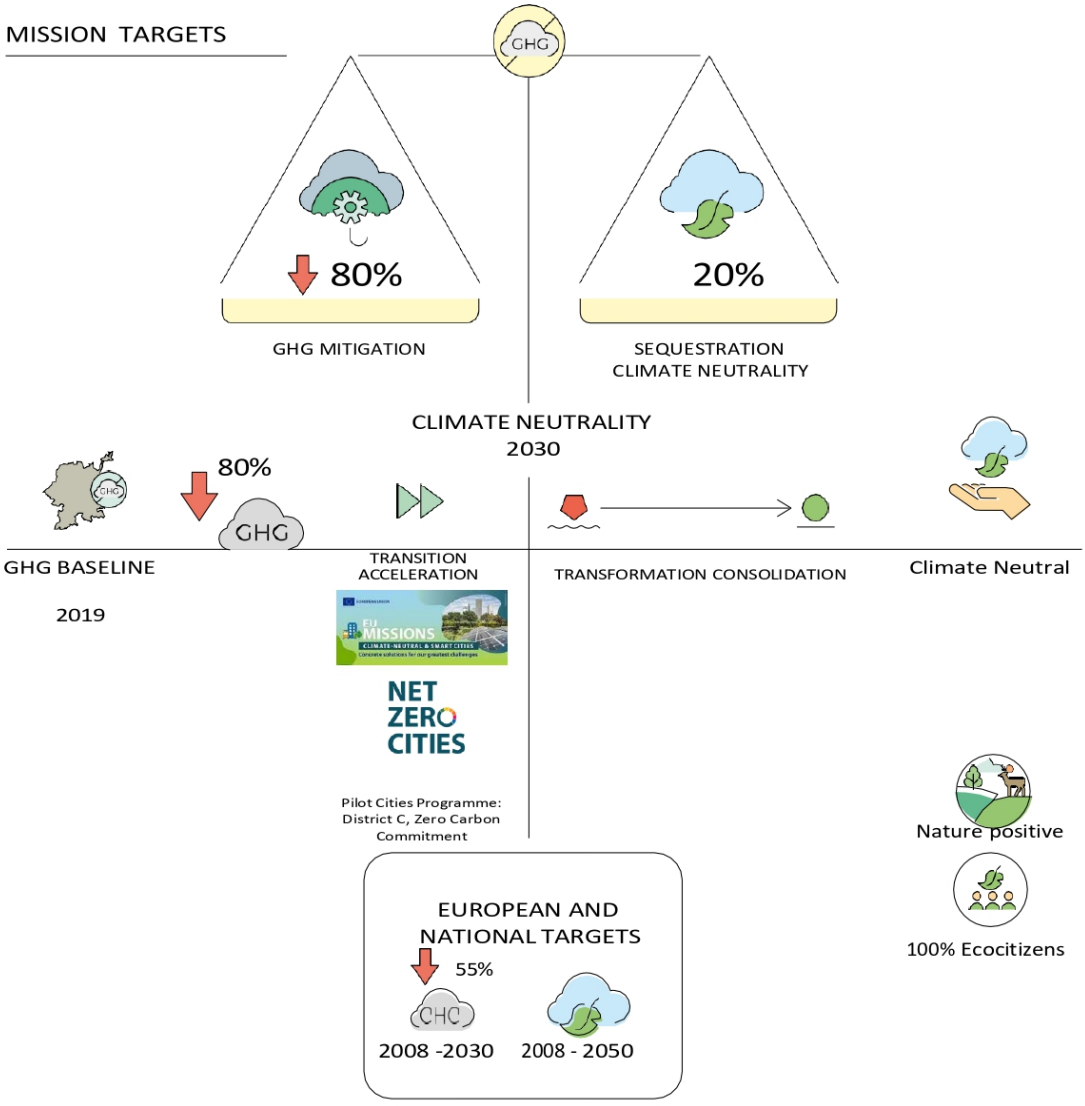


Figure 27 – Adapted from Guimarães European Green Capital candidacy, cycle 2025

Guimarães Networking System: local, regional, national, and international cooperation promoting green-growth, knowledge-transfer and reinforcing innovation in public services.

Several factors contribute to the 20% residual greenhouse gas (GHG) emissions expected across various sectors by 2030. These factors encompass technological limitations, a gradual transition to clean technologies, economic constrains, limited policy frameworks, infrastructure gaps, consumer behaviour, government cooperation, and financial constraints (Figure 27).

Achieving total decarbonization is ambitious and depends on the emissions balance rather than an absolute removal of emissions.

Natural systems, such as forests, have the potential to absorb more carbon than they emit. Currently, the management of terrestrial ecosystems, primary forests, remains the primary means to remove GHG from atmosphere and thereby balance GHG emissions.

Over a significant period, forest and agricultural soils have predominantly shaped the landscape of Guimarães. Presently, Guimarães is predominantly covered by forest (45,5%) and agricultural land (29,6%).

Guimarães actively participated in a three-year initiative to calculate the municipality's ecological footprint, led by ZERO, a prominent environmental non-governmental organization in Portugal, in collaboration with the Global Footprint Network and the University of Aveiro. The utilization of the Ecological Footprint is a pivotal component of our strategy, aiding in the mapping and comprehension of local environmental challenges while steering changes in habits and policies.

The results of Guimarães' ecological footprint analysis indicate that the greatest pressure is exerted on forest carbon sequestration capacity, accounting for nearly 57% of the footprint (*Assessing the Ecological Footprint and biocapacity of Portuguese cities: Critical results for environmental awareness and local management* – scientific paper). In terms of biocapacity, forests (70% of functional biocapacity) and agricultural areas (26%) emerge as the principal ecological assets of the Municipality of Guimarães. All other categories contribute less than 1%.

A separate study aimed at quantifying the carbon stored in Guimarães' living biomass concludes that the Land Use, Land-Use Change, and Forestry (LULUCF) sector, a necessary aspect for future inclusion in the base inventory, is responsible for sequestering 120 548,129 tonCO_2 annually (approximately 18% of the total baseline inventory and roughly 19% of the total emissions in the economic model). This is predominantly facilitated by the forested areas (*Contribution to the carbon neutrality of the Municipality of Guimarães* – scientific paper).

While Guimarães' strategy primarily revolves around ecosystem services for carbon sequestration and has empirically established its potential, the current stage of the Action Plan adopts a conservative approach and does not yet include AFOLU-LULUCF in the emissions inventory. However, future prospects indicate that carbon sequestration in Guimarães, particularly within forested lands, could be a robust strategy for addressing residual emissions.

Furthermore, though not yet internally assessed for its carbon sequestration potential, Guimarães boasts an urban tree canopy of 1 130,8 hectares, owing in part to the annual planting of 2 000 trees. Between 2010 and 2021, the municipality expanded its green infrastructure by 195,1 hectares, approximately 20,9%.

Based on previous work outcomes, there is a firm belief that upon completion of the calculation of the total GHG emissions balance, the natural assets within the territory, encompassing both rural and urban areas, will prove capable of mitigating Guimarães' residual emissions.

4.3 Module B-3 Indicators for Monitoring, Evaluation and Learning

The Municipality of Guimarães has defined indicators to monitor, evaluate and achieve learning outcomes for each planned action.

These indicators were selected from: (1) NZC Indicator domains for the CCC Action Plan; (2) the indicator set NZC PCP of the NZC Pilot Cities Programme; (3) the indicators that are relevant considering the proposed actions. To better reflect the reality in Guimarães, the municipality decided to compile this indicator set according to the planned actions. It also considered the desire to extend these actions to the whole territory while still using appropriate indicators.

These indicators are intended to measure direct impacts, e.g., GHG emissions, and/or indirect impacts (co-benefits), depending on the purpose of the action.

B-3.1: Impact Pathways						
Entry Points (Actions)	Action/ project	Indicator No.	Indicator name (unit.)	Target values		
				2025	2027	2030
Energy systems						
Renewable Energy Sources (RES) acceleration framework	Pilot project - District C | Renewable Energy Sources (RES) acceleration framework	1	Change in the total energy consumption per year (%)	50%	70%	90%
Renewable Energy Communities (REC) and digitalisation of energy	Pilot project - District C | Renewable Energy Communities (REC) and digitalisation of energy	2	Local renewable energy production (kWh in %)	15%	30%	45%
RES self-consumption: households, industry, companies, institutions	RES self-consumption: households, industry, companies, institutions	3				
Capacity building actions of municipal staff	Pilot project - District C | Capacity building actions of municipal staff	4	Increased capacity of municipal staff (number of delivered capacities actions)	40	60	100
Guidance for heritage energy efficiency renovation	Pilot project - District C | Guidance for heritage energy efficiency renovation	5	Booklet guide on heritage energy efficiency renovation (number of booklets)	1	1	1
Mobility and transport						
Alternative sustainable transportation modes	Pilot project - District C | Alternative sustainable	6	Modal share of green transport modes and public transporting (%)	7,5%	15%	30%

B-3.1: Impact Pathways						
Entry Points (Actions)	Action/ project	Indicator No.	Indicator name (unit.)	Target values		
				2025	2027	2030
	transportation modes					
Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports	Bus Rapid Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports	7	GHG emission from transport (kt CO_2 equivalent)	3,5	7	14
		8	N. of passengers per km per day (number)	25%	50%	75%
Sustainable delivery services	Pilot project - District C | Sustainable delivery services	9	GHG emission from delivery services (ktCO_2 equivalent)	8	12	23
Electric mobility shift: private passenger vehicles	Electric mobility shift: private passenger vehicles	10	GHG emission from private vehicles (ktCO_2 equivalent)	2	6	13
		11	N. of private electric vehicles	1%	18%	36%
Electric mobility shift: light goods, and heavy-duty vehicles	Electric mobility shift: light goods, and heavy-duty vehicles	12	GHG emission from light goods, and heavy-duty vehicles (ktCO_2 equivalent)	9	15	20
Buses green conversion	Buses green conversion	13	GHG emission from public buses (ktCO_2 equivalent)	31%	50%	100%
Conversion of the urban solid waste collection fleet	Conversion of the urban solid waste collection fleet	14	GHG emission from waste collection fleet (ktCO_2 equivalent)	0,2	0,3	1
Carpooling and car sharing	Carpooling and car sharing	15	GHG emission from carpooling and car sharing (ktCO_2 equivalent)	1	1,5	3
Alternative sustainable transportation modes	Pilot project - District C | Alternative sustainable transportation modes	16	N. of private vehicles crossing the city (number)	N/A	N/A	N/A
Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports	Bus Rapid Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports			N/A	N/A	N/A
Carpooling and car sharing	Carpooling and car sharing			1,4	1,4	1,5
Waste and circular economy						
Biowaste recovery	Pilot project - District C |	17	Biowaste collection rate (%)	20%	40%	60%

B-3.1: Impact Pathways						
Entry Points (Actions)	Action/ project	Indicator No.	Indicator name (unit.)	Target values		
				2025	2027	2030
	Biowaste upgrade					
Undifferentiated urban waste reduction	Pilot project - District C | Undifferentiated urban waste reduction	18	Undifferentiated urban waste rate (%)	55%	75%	95%
Waste production reduction	Pilot project - District C | Waste production reduction	19	Waste production amount (%)	20%	40%	60%
Recycling upgrade	Pilot project - District C | Recycling upgrade	20	Recycling rate (%)	65%	80%	95%
Biowaste recovery	Pilot project - District C | Biowaste upgrade	21	GHG emissions from waste per year ($ktCO_2$ equivalent)	5	8	10
Undifferentiated urban waste reduction	Pilot project - District C | Undifferentiated urban waste reduction					
Waste production reduction	Pilot project - District C | Waste production reduction	22				
Recycling upgrade	Pilot project - District C | Recycling upgrade	23				
New circular business models	Pilot project - District C | New circular business models	24	New circular city start-ups (number of contracts signed)	65	80	110
Business symbiosis	Pilot project - District C | Business symbiosis	25	Matchmaking (record of matchmaking activities/pitches)	50	100	150
Green infrastructure and nature-based solutions						
Green areas	Pilot project - District C | Green areas	26	Negative emissions through natural sinks[1]	N/A	N/A	N/A
Green belt	Pilot project - District C | Green belt			N/A	N/A	N/A
Biodiversity conservation and restoration	Biodiversity conservation and restoration	27	Change in the n. of fauna and flora native species in the city (km restored riparian corridors)	1	35	65

[1] The Municipality of Guimarães is in the process of determining with more accuracy the appropriate targets for the years 2025, 2027, and 2030 for the indicators associated with green infrastructure and nature-based solutions actions. As well to infer the best methodology to access negative emissions through natural sinks.

B-3.1: Impact Pathways						
Entry Points (Actions)	Action/ project	Indicator No.	Indicator name (unit.)	Target values		
				2025	2027	2030
Urban private community gardens	Pilot project - District C | Urban private community gardens	28	Urban private gardens in use (ha)	0,5	4,3	7,2
Built environment						
High efficient new buildings	High efficient new buildings	29	Share of new high efficient new buildings per year	20%	30%	45%
Building deep retrofit	Pilot project – District C | Building deep retrofit	30	Share of buildings renovated per year (%)	1%	2%	2%
High efficient new buildings	High efficient new buildings	31	GHG emissions from stationary energy ($ktCO_2$ equivalent)	0,7	1,3	2
Building deep retrofit	Building deep retrofit			4	7	11
Adoption of efficient lighting and appliances	Adoption of efficient lighting and appliances			9	12	18
Industry						
Industrial energy efficiency initiatives	Industrial energy efficiency initiatives	32	GHG emissions from industrial stationary energy (tCO_2 equivalent)	20%	30%	50%
Solar energy uptake	Solar energy uptake	33	Industrial renewable energy production (kWh/year)	20%	30%	50%
Green hydrogen for Guimarães' industry	Green hydrogen for Guimarães' industry	34	Energy use by hydrogen from industry (kWh/year)	10%	20%	70%
Biomass uptake	Biomass uptake	35	Energy use by biomass from industry (kWh/year)	20%	30%	50%
Biomethane uptake	Biomethane uptake	36	Energy use by biomethane from industry (kWh/year)	10%	20%	70%
Top management engagement for sustainable industry	Top management engagement for sustainable industry	37	N. of top leadership involvement in co-development of sustainable industry actions (number)	150	300	600
Promotion of sustainable industry in partnership with relevant industry associations	Promotion of sustainable energy industry in partnership with relevant industry associations	38	N. partnerships with industry associations (number)	80	100	145
Promotion for sustainable business hosting areas	Promotion for sustainable business hosting areas	39	N. of new businesses establishments in the sustainable hosting areas (number)	40	50	70
Cross-cutting (energy systems and built environment)						
Expansion of a one-stop-shop (OSS)	Pilot project - District C | Expansion of a	40	Energy efficiency projects' requests (number)	1 000	1 250	1 810

B-3.1: Impact Pathways							
Entry Points (Actions)	Action/ project	Indicator No.	Indicator name (unit.)		Target values		
					2025	2027	2030
	one-stop-shop (OSS)						
Cross-cutting (all field domains)							
Digital twin	Digital twin	41	Digital twin model data input (number of model digital twin)		0	1	1
Sustainable Tourism	Pilot project - District C | Sustainable Tourism	42	N. of tourism businesses with a sustainability label (number of tourism establisments)		5	20	45

B-3.2: Indicator Metadata	
Action name	Renewable Energy Sources (RES) regulation and framework
Indicator Name	Change in the total energy consumption per year
Indicator Unit	kWh/year
Definition	This indicator is taken from the NZC PCP indicator set from the NZC pilot city programme. Since this activity correspond to an intervention to be undertaken through District C, the Municipality of Guimarães considered reasonable to maintain the presupposed indicator, in order to maintain consistency and trackability. This indicator refers to the annual variance in the amount of energy consumed, measured in kWh, that is directly associated with the utilisation of renewable energy sources for various stakeholders and sectors that desires to have PV solutions on its installations. It quantifies the year-to-year shift in energy consumption patterns, considering the transition towards renewable sources and the overall impact on the energy system.
Calculation	To calculate this indicator is necessary to measure the difference in total energy consumption before and after implementing energy efficiency improvement measures. Energy efficiency improvement and energy performance labelling (ex-ante and ex-post)
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Energy systems
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes

B-3.2: Indicator Metadata	
If yes, which NZC impact pathway is it relevant for?	By establishing regulations that require a certain percentage of electricity to come from renewable energy sources, the municipality can promote the production of clean energy in Guimarães, leading to the creation of the necessary framework to make this a reality in the municipality. This impact pathway ends with positive effects on the reduction of GHG emissions, clean and affordable energy, and an improvement in air quality (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Energy regulators and authorities, electricity providers, energy consumption and production statistics, renewable energy installations.
Expected availability	monthly
Suggested collection interval	monthly
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
	Renewable Energy Communities (REC) and digitalisation of energy
Indicator Name	Local renewable energy production
Indicator Unit	% in kWh
Definition	This indicator assesses the amount of renewable energy generated within the renewable energy community. It quantifies the proportion of energy consumption that is met through locally produced renewable sources. It refers to the total amount of renewable energy (kWh) generated within the renewable energy community.
Calculation	The percentage of local renewable energy production is calculated as the share of renewable energy generated locally compared to the total energy consumption of the locality or community.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Energy systems
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes

B-3.2: Indicator Metadata	
If yes, which NZC impact pathway is it relevant for?	Business models and investment scenarios can create financial incentives to leverage public funds and private sector investment and encourage the adoption of sustainable and energy-efficient practises. Early change evolves through the impact pathway to a later outcome, namely market transformation through the creation of demand for energy efficiency retrofit projects and the establishment of renewable energy communities. This would ideally lead to a reduction in greenhouse gas emissions, a reduction in energy poverty and indirect impacts related to the adoption of new economic models for REC and the digitalisation of energy (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data from the renewable energy communities' proprieties, energy supply companies, community, local energy providers and utilities, renewable energy facilities, energy regulators, energy production records, grid operators, renewable energy certificates
Expected availability	monthly
Suggested collection interval	semesterly
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	RES self-consumption: households, industry, companies, institutions

B-3.2: Indicator Metadata	
Action name	RES self-consumption: households, industry, companies, institutions
Indicator Name	Local renewable energy production
Indicator Unit	% in kWh
Definition	Percentage increase in the share of local renewable energy due to the renewable intervention related in the deployment of photovoltaic (PV) solutions
Calculation	The percentage of increase in local renewable energy production as a result of the deployment of photovoltaic (PV) solutions is calculated as the difference between the annual renewable energy production associated with the intervention before and after completion of the intervention (or the difference between the annual renewable energy production associated with the project compared to business as usual). The result is divided by the total annual energy consumption associated with the intervention and then multiplied by 100 to express the result as a percentage.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Energy systems
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The introduction and expansion of photovoltaic solutions among a wide range of stakeholders is essential to ensure

B-3.2: Indicator Metadata	
	clean and reliable access to renewable energy sources. This requires getting citizens (household owners), industry and public organisations, and institutions on board, starting with site selection and mapping of potential users. This situation will lead to an increase in photovoltaic installations, which will result in a reduction of GHG emissions, in addition to some co-benefits such as lower energy bills and improved air quality (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Local users of the PV solutions, local energy providers and utilities, renewable energy facilities, energy regulators, energy production records, grid operators, renewable energy certificates
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Renewable Energy Communities (REC) and digitalisation of energy

B-3.2: Indicator Metadata	
Action name	Capacity building actions of municipal staff
Indicator Name	Increased capacity of municipal staff
Indicator Unit	# capacity building activities
Definition	The indicator serves as a measure of the municipality's commitment to building a knowledgeable and skilled workforce capable of effectively implementing energy efficiency measures, sustainable building practises and climate change mitigation and adaptation strategies. By providing continuous training and learning opportunities, the municipality aims to improve the overall competence of the staff, thereby promoting the successful implementation of its sustainability goals and initiatives.
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved access to information, awareness and behaviour change
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	It is expected that the training programme will improve the knowledge and skills of municipal staff in relation to energy efficiency projects, and climate change in general, leading to an improved ability to identify and meet the needs of the community, resulting in more efficient and retrofitting of buildings concerning energy related projects, which in turn will have an impact on the overall performance and effectiveness of municipal staff and on the number of projects (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	

B-3.2: Indicator Metadata	
Expected data source	Inquiries to municipal staff
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Deliverables associated with NZC pilot city programme – District C

B-3.2: Indicator Metadata	
Action name	Guidance for heritage energy efficiency renovation
Indicator Name	Booklet guide on heritage energy efficiency renovation
Indicator Unit	# booklet
Definition	The indicator refers to the quantification of listed buildings that have undergone a comprehensive energy retrofit as part of the guidance for heritage energy efficiency renovation built on District C. This indicator accounts the creation of the booklet guide for historical buildings regarding energy efficiency practices.
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved access to information, awareness and behaviour change
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	It is expected that an increase in expertise on heritage conservation and energy efficiency will be achieved at an early stage, which will later translate into an improvement in the energy efficiency of the historic buildings of Guimarães, a challenge faced by the municipality. The impact is to improve the resilience of the historic buildings to climate change and future energy challenges, set a positive example for other cities, promote sustainable practises, and strengthen cultural identity and appreciation for heritage conservation and sustainable development (see Module B-1 Climate Neutrality Scenarios and Impact PathwaysModule B-3 Indicators for Monitoring, Evaluation and Learning).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Municipality of Guimarães, publication records, heritage sites
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Deliverables associated with NZC pilot city programme – District C

B-3.2: Indicator Metadata	
Action name	Alternative sustainable transportation modes
Indicator Name	Modal share of green transport modes and public transporting
Indicator Unit	%
Definition	This intervention is also present on District C, having the goal to encourage the use of sustainable transportation alternatives, aiming to decrease the dependence on private cars. The focus is on promoting eco-friendly modes of travel like walking, cycling, and public transportation, to improve the community's overall sustainability and quality of life. Regarding the pilot project, the municipality defined the following indicators: Increase in use of public transports for daily commutes (Uptake of public transportation) and raise number of citizens circulating on foot on other active mobility mode in daily commutes (Increase pedestrian and cycling habits). The indicator “Modal share of green transport modes and public transporting” measures the proportion or percentage of people using environmentally friendly modes of transport such as walking, cycling and public transport compared to the total number of people using all modes of transport. It provides information on the acceptance and effectiveness of sustainable modes of transport and shows the extent to which the community is reducing its dependence on private cars in favour of greener alternatives.
Calculation	(Green Transport Modal Share / Total Modal Share) * 100
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Increased physical activity and active lifestyles
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	If people use private cars less frequently or choose alternative modes of transportation, such as public transport, use of bicycles, or walking, there will be a reduction in the number of private cars on the roads. As for the impacts, it is expected that the later outcome translates into an increase on physical activity and active lifestyles, improved air quality, and road safety. This would translate into a modal shift towards public transport and more clean mobility modes, as well stress relief associated with traffic, and more availability for green areas spaces (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Surveys and questionnaires, transportation agencies and authorities, census public data, transport records, bicycle and pedestrian counts, transportation apps and services.
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Deliverables associated with NZC pilot city programme – District C

B-3.2: Indicator Metadata	
Action name	Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports
Indicator Name	GHG emission from transport
Indicator Unit	kt CO_2 equivalent
Definition	Greenhouse gas emissions from the operations of vehicles. More concretely, the operations of the bus rapid transit.
Calculation	First, estimate the annual GHG emissions from the operation of a conventional bus system for the same routes as the proposed BRT system. Estimate of annual GHG emissions from the operation of the electric BRT system. This includes emissions from electricity consumption (if the source of electricity isn't carbon neutral). Finally, subtract the estimated annual emissions from the BRT system from the emissions from the conventional bus system. This gives the reduction in greenhouse gas emissions achieved by the introduction of the BRT system. The convert the reduction in GHG emissions into a standard unit such as metric tonnes of CO_2 equivalent (CO_2e).
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Through the uptake of public transportation to the detriment of the private car, citizens in Guimarães will potentiate the wide spread of public transport modes, having an impact on GHG emissions reduction, as well road safety, and reduction on noise pollution (see Module B-1 Climate Neutrality Scenarios and Impact PathwaysModule B-3 Indicators for Monitoring, Evaluation and Learning).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data from TRENMO, public transportation of Braga, National Ministry of Infrastructure and Housing, CIM do Ave e do Cávado
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Electric buses conversation

B-3.2: Indicator Metadata	
Action name	Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports
Indicator Name	# of passengers per km per day
Indicator Unit	Number
Definition	This indicator also serves to monitor the uptake of public transports in Guimarães, assessing the number of people that use public transports by accounting the number of passengers.
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes

If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Through the uptake of public transportation to the detriment of the private car, citizens in Guimarães will potentiate the wide spread of public transport modes, having an impact on GHG emissions reduction, as well road safety, and reduction on noise pollution (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Data from the Municipality of Guimarães and Braga, transportation authorities
Expected availability	daily
Suggested collection interval	daily
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Sustainable delivery services
Indicator Name	GHG emission from delivery services
Indicator Unit	$ktCO_2$ equivalent
Definition	This intervention is also present on the pilot city District C, and the goal is to start a carbon-free last mile delivery system, first at a small scall and then expand throughout the territory. The municipality for this intervention will involve the most representative delivery and transportation companies and businesses of the municipality to co-develop a delivery system roadmap. At District C, the municipality defined indicators for the initial pilot phase: “Framework, procedures of carbon-free delivery system roadmap developed with key stakeholders’ indicator” (Carbon-free delivery strategy) and “Implementation of carbon-free delivery with at least one stakeholder in tested area - District C” (Carbon-free delivery performance). The indicator greenhouse gas emissions from transport refers to the measurement of GHG emissions resulting from the transport of goods, especially in relation to last mile delivery within the municipality area. It assesses the environmental impact of the delivery process and focuses on the emissions generated by the vehicles used to transport goods from distribution centres to the delivery point.

B-3.2: Indicator Metadata	
Calculation	First is necessary to determine the total number of deliveries or parcels transported within the municipality (test on District C) during a given period (e.g., one year) and collect information on the vehicles used for the deliveries and the associated emission factors. Then proceed to calculate the total emissions for each type of delivery vehicle (fossil fuel vehicles, bicycles, e-delivery vehicles, by 2030 is expected that all these delivery vehicles are zero-emissions) by multiplying the total distance travelled for the deliveries by the emission factor associated with the respective vehicle type. Finally, it is necessary to compare the calculated emissions for the different delivery types to assess the emissions impact of each type.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	As an early stage it will be idealised and designed the of the delivery services for the delivery and distribution services in Guimarães. The municipality will start to see some change in the long run through the engagement of delivery stakeholders for a carbon delivery system, expanding the results obtained on the trial on District C. It would lead eventually to a reduction of GHG emissions, and co-benefits such as improved air quality and noise pollution (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Delivery records, local transportation authority, logistics and delivery companies, electricity consumption data, collaboration with stakeholders, online databases
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Deliverables associated with NZC pilot city programme – District C

B-3.2: Indicator Metadata	
Action name	Electric mobility shift: private passenger vehicles
Indicator Name	GHG emission from private vehicles
Indicator Unit	kt CO_2 equivalent
Definition	The indicator measures the reduction in GHG emissions resulting from the conversion of private combustion vehicles to electric vehicles (EVs).
Calculation	To calculate the reduction in GHG emissions resulting from the conversion of private vehicles with internal combustion engines to electric vehicles, the emissions of the conventional internal combustion vehicles are compared with the emissions of the electric vehicles. To achieve that, is necessary to determine the post-conversion emissions The resulting value represents the reduction in GHG emissions achieved by converting private combustion vehicles to electric vehicles.

B-3.2: Indicator Metadata	
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The conversion of citizens in Guimarães to electric vehicles (conversion of private combustion vehicles to electric vehicles) will have a long-term impact when electric mobility is the new norm. This will lead to a reduction in greenhouse gas emissions, and as side effects there will be an improvement in air quality and an increase in the acceptance of electric vehicles (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Data from the Municipality of Guimarães, DGEG, vehicle registrations, fuel consumption data, electricity consumption data
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Electric mobility shift: private passenger vehicles
Indicator Name	# of private electric vehicles
Indicator Unit	Number
Definition	This indicator aims to capture the number of electric bicycles (EV) adopted by citizens in Guimarães, linked to the previous indicator: "GHG emission from private vehicles". They complement each other, as the adoption of EVs has the potential to significantly reduce GHG emissions compared to conventional vehicles.
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The conversion of citizens in Guimarães to electric vehicles (conversion of private combustion vehicles to electric vehicles) will have a long-term impact when electric mobility is the new norm. This will lead to a reduction in greenhouse gas emissions, and as side effects there will be an improvement in air quality and an increase in the acceptance of electric vehicles (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No

B-3.2: Indicator Metadata	
Data requirements	
Expected data source	Data from the Municipality of Guimarães, EV purchases in Guimarães
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Electric mobility shift: light goods, and heavy-duty vehicles
Indicator Name	GHG emission from light goods, and heavy-duty vehicles
Indicator Unit	kt CO_2 equivalent
Definition	The indicator measures the reduction in GHG emissions resulting from the conversion of light goods, and heavy-duty vehicles to electric vehicles.
Calculation	To calculate the reduction in GHG emissions resulting from the conversion of private vehicles with internal combustion engines to electric vehicles, the emissions of the conventional internal combustion vehicles are compared with the emissions of the electric vehicles. To achieve that, it is necessary to determine the post-conversion emissions: Emission reduction = baseline emissions - post-conversion emissions The resulting value represents the reduction in GHG emissions achieved by converting private combustion vehicles to electric vehicles with internal combustion engines to electric vehicles, the emissions of the conventional internal combustion vehicles are compared with the emissions of the electric vehicles.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The introduction of light and heavy-duty electric vehicles will initially be mapped by the municipality, and stakeholders with fleets of this type of vehicle will also be involved. In the long term, it is expected that the spread of electric vehicles in the municipality will lead to a reduction in GHG emissions and an improvement in air quality, as technological acceptance of this type of vehicle will increase if this is achieved (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the Municipality of Guimarães, DGEG, vehicle registrations, fuel consumption data, electricity consumption data, companies, and industry fleet data
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Buses green conversion
Indicator Name	GHG emission from public buses
Indicator Unit	kt CO_2 equivalent
Definition	Greenhouse gas emissions from the operations of vehicles. This indicator refers to the decrease of GHG emissions associated with the conversion of the municipality fleet to electric buses.
Calculation	Calculate the greenhouse gas emissions associated with the electricity consumption of the electric buses. To do this, it is necessary to know the emission factor for the electricity. Calculate the reduction in GHG emissions by subtracting the emissions from the electric buses from the baseline emissions (from the conventional buses).
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	This action is already ongoing, consisting of the fleet conversion of 32 buses by Guimabus company (public transports company of Guimarães). The outcome would be the full conversion of this fleet, aiming for a reduction of GHG emissions, improved air quality, and the widespread of the technological adoption of electric buses (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, Guimabus
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Bus Rapid Transit (BRT) implementation

B-3.2: Indicator Metadata	
Action name	Conversion of the urban solid waste collection fleet
Indicator Name	GHG emission from waste collection fleet
Indicator Unit	kt CO_2 equivalent
Definition	This indicator is related with GHG emissions from the operations of vehicles concerning the waste collection fleet. This indicator should provide the reduction of emissions associated with the conversion of the urban solid waste collection fleet by introducing biofuels to replace fossil fuels. This entails a more sustainable operation for the collection collecting, aiming to use biofuels that can come from the waste treatment station of Guimarães.
Calculation	The calculation of this indicator involves assessing the GHG emissions associated with the waste collection vehicles before and after the conversion to a more environmentally friendly fleet.
Indicator Context	

B-3.2: Indicator Metadata	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	It is intended to explore the possibility to use alternative fuels for the urban solid waste collection fleet. After the study and feasibility analyses, it is expected that the fleet will run on an alternative fuel (electricity, biomethane). The uptake of renewable energy, improvement of circular economy (biofuels), and improved waste management and efficiency, encompass a reduction of GHG emissions on mobility and transports sector (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, VITRUS, Resinorte, Tratave
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Carpooling and car sharing
Indicator Name	GHG emission from transport
Indicator Unit	kt CO_2 equivalent
Definition	The indicator assesses the reduction of GHG emissions resulting from the introduction of carpooling and car-sharing. It quantifies the emissions reduction resulting from the shared use of vehicles by several people, which contribute to a reduction in emissions compared to the ownership and use of single vehicles.
Calculation	To calculate the reduction in GHG emissions resulting from the introduction of carpooling and carsharing involves comparing emissions from individual vehicles with emissions from vehicles used in carpooling or carsharing scenarios. The resulting value represents the reduction in GHG emissions achieved by implementing carpooling and car sharing practices.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Mobility and transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes

B-3.2: Indicator Metadata	
If yes, which NZC impact pathway is it relevant for?	Carpooling and car sharing makes it possible to reduce the number of single-occupancy vehicles, so the introduction of carpooling and car sharing as a viable transport option in Guimarães leads to less congestion, noise and air pollution, lower greenhouse gas emissions and improved overall transport efficiency (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, citizens, companies, schools' inquiries
Expected availability	monthly
Suggested collection interval	monthly
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Alternative sustainable transportation modes, bundling actions to uptake public transports: Bus Rapid Transit (BRT) and promotion of public transports, Carpooling and car sharing
Indicator Name	# of private vehicles crossing the city
Indicator Unit	Number
Definition	This is a common indicator for all the above measures, as they all have the potential to reduce the number of private villas in the city of Guimarães.
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	The impact pathways designed for each mentioned action.
Can the indicator be used for monitoring impact pathways?	no
If yes, which NZC impact pathway is it relevant for?	N/A
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Inquiries and surveys for the citizens, traffic sensors, public transports data, e.g., Guimabus, CIM do Ave
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

-3.2: Indicator Metadata	
Action name	Biowaste recovery
Indicator Name	Biowaste collection rate
Indicator Unit	%
Definition	This indicator comes from the pilot city project - District C, more specifically the District C Impact Framework, NZC Pilot Cities Programme. This intervention comes from the District C pilot project of the Municipality of Guimarães, which consists of expand the biowaste recovery that has been ongoing on the municipality. This entails the expansion of the areas at the territory where the biowaste is being collected and the use of the biowaste. To maintain coherence between the CCC and the NZC Pilot Cities Programme, the municipality decided to keep the selected indicator in this case. It assesses the progress and effectiveness of the collection of biowaste in Guimarães aimed at improving the collection of biowaste from the waste stream. As bio-waste is organic and decomposable, it can be kept out of landfills and recovered through composting or recycling processes, as well to produce biofuels.
Calculation	To calculate this indicator is necessary to take a reference year (baseline) and access the increase of biowaste collection in the subsequent years.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved waste management and efficiency
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Through the biowaste recovery, Guimarães will be able to repurpose it, and to do a selective collection. This will result in improved waste management and efficiency, create green jobs, as well reduce GHG emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, VITRUS, Resinorte
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	Undifferentiated urban waste reduction, Waste production reduction, Recycling upgrade

B-3.2: Indicator Metadata	
Action name	Undifferentiated urban waste reduction
Indicator Name	Undifferentiated urban waste rate
Indicator Unit	%
Definition	The intervention involves expanding the collection areas for undifferentiated urban waste reduction within the territory and optimising its utilisation. This expansion aims to increase the coverage and efficiency of undifferentiated urban waste reduction and maximise its potential for resource recovery. By maintaining consistency between the CCC and the NZC Pilot Cities Programme, the municipality has chosen to retain this indicator as part of their monitoring and evaluation framework.
Calculation	To calculate this indicator, it is necessary to take a reference year (baseline) and access the reduction of undifferentiated waste production in the subsequent years.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved waste management and efficiency
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Not only the recovery and management of waste is important to complement the GHG emission reduction of Guimarães, but it is also important to reduce the consumption to reduce the waste production itself. This results in the decrease of the overall urban waste in Guimarães, having positive impacts on waste management and efficiency, public health, economic benefits, and circular economy deployment (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, VITRUS, Resinorte
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	Biowaste recovery, Waste production reduction, Recycling upgrade

B-3.2: Indicator Metadata	
Action name	Waste production reduction
Indicator Name	Waste production amount
Indicator Unit	tonnes
Definition	This indicator intends to determine over the years the reduction of overall waste production due to the increase of circular economy practices, lifestyles changes, recycling, among other planned actions towards the waste reduction.
Calculation	To calculate this indicator is necessary to take a reference year (baseline) and access the reduction of undifferentiated waste production in the subsequent years.
Indicator Context	

B-3.2: Indicator Metadata	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved waste management and efficiency
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The municipality intends to reduce overall waste production, an action that is linked to the other waste and circular economy measures. In the long term, it is expected that the practises achieved in District C will be expanded and it should be possible to reduce the total municipal waste production (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, VITRUS, Resinorte
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	Biowaste recovery, Undifferentiated urban waste reduction, Recycling upgrade

B-3.2: Indicator Metadata	
Action name	Recycling upgrade
Indicator Name	Recycling rate
Indicator Unit	%
Definition	This intervention is embedded on the District C pilot project of the Municipality of Guimarães, which consists of upgrading the recycling rates and the use of the output in a sustainable and useful way. This entails the expansion of the areas at the territory where the recycling is being collected and the use of the outputs from the recycling process. To maintain coherence between the CCC and the NZC Pilot Cities Programme, the municipality decided to keep the selected indicator.
Calculation	To calculate this indicator is necessary to take a reference year (baseline) and access the amount of waste recycled in the subsequent years.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved waste management and efficiency
Can the indicator be used for monitoring impact pathways?	yes

B-3.2: Indicator Metadata	
If yes, which NZC impact pathway is it relevant for?	By increasing the rate of waste that is recycled and reused, Guimarães inputs a second life on waste, putting in practice on of the components of circular economy. It is expected along the impact pathway towards the later outcomes and impacts, to have a reduction on waste produced, waste management and efficiency, reduction of GHG emissions and public and economic benefits (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, VITRUS, Resinorte
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	Biowaste recovery, Undifferentiated urban waste reduction, Waste production reduction

B-3.2: Indicator Metadata	
Action name	Biowaste recovery, Undifferentiated urban waste reduction, Waste production reduction, Recycling upgrade
Indicator Name	GHG emissions from waste (per year)
Indicator Unit	t CO_2 equivalent
Definition	This indicator comes from the pilot city project - District C, more specifically the District C Impact Framework, NZC Pilot Cities Programme. This indicator intends to access the GHG emissions from waste treatment, waste incineration and landfills, with a focus on biowaste, undifferentiated urban waste, and recycling. It combines the GHG emissions from the waste sector.
Calculation	The indicator measures the amount of GHG emissions associated with the treatment of biowaste, undifferentiated urban waste, waste production, and recycling, often related to waste management practises. This indicator assesses the level of GHG emissions generated annually from the treatment of different types of waste.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	no
If yes, which NZC impact pathway is it relevant for?	N/A
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data bases from the Municipality of Guimarães, VITRUS, Resinorte
Expected availability	annually

B-3.2: Indicator Metadata	
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	New circular business models
Indicator Name	New circular city start-ups
Indicator Unit	# of contracts signed
Definition	The indicator measures the effectiveness of financial mechanisms and business models used to support and promote the growth of circular economy focused companies and start-ups.
Calculation	The determination of this indicator encompasses the count of financial instruments/business models or contracts set up to support circular economy companies and start-ups.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Increased local entrepreneurship and local businesses /ventures
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	As a first change, it is expected that local circular business models will be developed, enabling the identification of circular business opportunities based on research and citizen input, ideas and concepts for circular business models developed by citizens, partnerships between entrepreneurs, businesses, and relevant stakeholders, tested circular business models in the local community (District C) and, as a later outcome, their expansion to the whole community. This will lead to the creation of new circular businesses, and local entrepreneurship and local businesses, more green and skilled jobs, and a reduction of the ecological footprint (see Module B-1 Climate Neutrality Scenarios and Impact PathwaysModule B-3 Indicators for Monitoring, Evaluation and Learning).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Circular economy companies and organisations, business associations, annual reports from companies, surveys and questionnaires, local business network, public announcements
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Business symbiosis
Indicator Name	Matchmaking
Indicator Unit	Record of matchmaking activities/ pitches
Definition	The indicator measures the effectiveness of facilitating linkages between smaller businesses that can work together in a circular economy. It quantifies the number of matchmaking activities that aim to foster partnerships where waste from one business becomes a resource for another business, thereby promoting local economic growth through the development of innovative products and services. Matchmaking activities identify and connect businesses that generate waste or by-products that can serve as valuable resources for other businesses. This approach promotes collaboration, waste reduction and the creation of new products or services.
Calculation	The indicator involves tracking the number of matchmaking activities initiated to bring smaller businesses together for collaboration in the circular economy. The methodology to access this indicator could be identify the matchmaking activities through the assessment of the documented successful partnerships, identification of matchmaking activities and access the matchmaking activities with successful partnerships.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Mainstreaming of new economic models like proximity and sharing economy
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The creation of a matchmaking and marketplace for business symbiosis in the circular economy sector, initially as part of a pilot in District C, will lead as a later outcome to increased synergies and symbiotic relationships between local businesses leading to more efficient use of resources, to the growth and expansion of circular economy activities and start-ups in the local economy, to the reduction of waste and the increase of the circular economy through the exchange of secondary materials and services, and to an improved circular economy ecosystem with more opportunities for innovation and entrepreneurship (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Organizational records, event registrations, matchmaking platforms, business surveys, local business associations, and media coverage
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Deliverables associated with NZC pilot city programme – District C

B-3.2: Indicator Metadata	
Action name	Green areas
Indicator Name	Negative emissions through natural sinks
Indicator Unit	t CO_2 equivalents / year
Definition	This intervention is also from the pilot city project District C, NZC pilot city programme. It is important to note that the Municipality of Guimarães, for the interventions under the Greenhouse Gas domain, and more specifically from the Carbon Capture and Residual Emissions sub-domain, will opt for a different indicator from the one that was selected for the pilot city project (NZC Pilot Cities Programme Indicator Set). This is because the green areas, green belt, biodiversity conservation and restoration, and urban private community gardens are interventions that fit into the definition of "negative emissions through natural sinks" indicator instead of the "amount of permanent sequestration of GHG within city boundary" (the one that was chose at the time of the refinement of the District C). At the time, it was not available this indicator (negative emissions through natural sinks) to choose from the set list. This indicator will account for negative emissions through the enlargement and enhancement of natural sinks within the territory to address residual emission. The Municipality of Guimarães intends to recovery/implement green areas for carbon capture.
Calculation	To calculate this indicator is necessary to estimate the amount of carbon dioxide absorbed by green areas such as forests, which contributes to carbon sequestration. It would involve the assessment and calculation of carbon sequestration rate, calculate the total carbon sequestration, and convert to CO_2 equivalent.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Green infrastructure and nature-based solutions
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Green areas are essential to achieve the climate neutrality goal of Guimarães. This should not be overlooked, so as an early change Guimarães intends to prototype the green spaces to be implemented/recovered, as in the long run to turn the city climate resilient and able to sequester carbon emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data from the Landscape Laboratory of Guimarães
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	Green belt, Biodiversity conservation and restoration, Urban private community gardens

B-3.2: Indicator Metadata	
Action name	Green belt
Indicator Name	Negative emissions through natural sinks
Indicator Unit	t CO_2 equivalents / year
Definition	This intervention is also from the pilot city project District C, NZC pilot city programme. It is important to note, that the Municipality of Guimarães for the interventions under the Greenhouse Gas domain, and more specifically from the Carbon Capture and Residual Emissions sub-domain will opt for a different indicator from the one that was selected for the pilot city project (NZC Pilot Cities Programme Indicator Set). This is due to the fact that the green areas, green belt, biodiversity conservation and restoration, and urban private community gardens are interventions that fit into the definition of "negative emissions through natural sinks" indicator instead of the "amount of permanent sequestration of GHG within city boundary" (the one that was chose at the time of the refinement of the District C). At the time, it was not available this indicator (negative emissions through natural sinks) to choose from the set list. This indicator will account for negative emissions through the deployment of a green belt around the surroundings of the city.
Calculation	To calculate this indicator is necessary to estimate the amount of carbon dioxide absorbed by the green belt which contributes to carbon sequestration. It would involve the assessment and calculation the carbon sequestration rate and convert to CO_2 equivalent.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Green infrastructure and nature-based solutions
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The green belt is an ambition of Guimarães' municipality, not only present in the CCC, but also in NZC Pilot Cities Programme – District C. It is expected as a later outcome that the green belt is implemented on Guimarães surroundings, providing a cooling effect, capture carbon emissions, as well restoring biodiversity and be an important urban greening asset (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data from the Landscape Laboratory of Guimarães
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	Green areas, Biodiversity conservation and restoration, Urban private community gardens

B-3.2: Indicator Metadata	
Action name	Biodiversity conservation and restoration
Indicator Name	Change in the n. of fauna and flora native species in the city
Indicator Unit	km restored riparian corridors
Definition	It measures the diversity and abundance of native plant and animal species within the ecosystems in Guimarães through the restored riparian corridors.
Calculation	To determine this indicator is necessary to define the specific ecosystem, habitat, and geographical area for which the municipality intends to identify the indicator. Then conduct an initial assessment or survey of the native animal and plant species present in the target area. Develop a monitoring plan that specifies the frequency and methods for ongoing data collection. Compile all data collected over time to create a comprehensive inventory of native animal and plant species in the target area and the increased of kilometres of restored riparian corridors (that will have an impact on the fauna and flora conservation). Proceed to regular monitoring, data analysis, and reporting.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved nature restoration, Increased non-invasive species and pollinators
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Improving biodiversity in Guimarães allows for the reconciliation of flora and fauna various species on the territory, improving the resilience of the biodiversity ecosystems as a late outcome. As positive impacts, it can be named an improvement of nature restoration, and decease of non-invasive species and enhancement of pollinators (see Module B-1 Climate Neutrality Scenarios and Impact PathwaysModule B-3 Indicators for Monitoring, Evaluation and Learning).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Data from the Landscape Laboratory of Guimarães
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Urban private community gardens
Indicator Name	Urban private gardens in use
Indicator Unit	Record of registered areas (ha) / community gardens (ha)
Definition	This indicator measures the number and use of private urban gardens established or expanded as part of a broader urban agriculture/farm initiative among the community in Guimarães.
Calculation	To determine this indicator is necessary to identify and map the existing urban private gardens and the expansion of this area according to the action. Identify potential garden and urban farms sites, conduct surveys and data collection on the area used to this purpose.

B-3.2: Indicator Metadata	
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved land-use management practices
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	This action includes, in a first phase, the mapping of private communal areas for gardens where the community can grow their own vegetables and derivatives. This action links the social and environmental dimensions, as it contributes to social cohesion and creates sustainable and ecological food sources for the community. In terms of impact, urban private community gardens help with improving land use management practices have as side effects the greening of the city and an improved sense of belonging and social integration (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the Landscape Laboratory of Guimarães, records from Municipality of Guimarães, inquiries to citizens, community associations.
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	High efficient new buildings
Indicator Name	Share of new high efficient new buildings per year
Indicator Unit	% of new efficient buildings (in the building stock)
Definition	The indicator measures the proportion of new buildings constructed within a given period that meet high efficiency standards. It assesses the rate at which energy efficient and environmentally friendly buildings are developed within a given year.
Calculation	To calculate this indicator is necessary to have the data on the number of high efficiency buildings constructed each year and the total number of new buildings constructed in the same period. Then calculate the share of new efficient buildings by dividing the number of high efficiency buildings by the total number of new buildings constructed in the same year.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Built environment
Does the indicator measure indirect impacts (i.e., co- benefits)?	N/A
If yes, which co-benefit does it measure?	no
Can the indicator be used for monitoring impact pathways?	yes

B-3.2: Indicator Metadata	
If yes, which NZC impact pathway is it relevant for?	Setting guidelines and standards for new buildings is a first step that the municipality intends to take, and if it works, it will translate into newly constructed buildings that follow the most efficient standards in the long run, resulting in lower GHG emissions and better overall quality and aesthetics of the buildings (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	
Expected data source	Energy bills and consumption data, local utility companies, building management systems, energy certifications
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	Building deep retrofit, Adoption of efficient lighting and appliances

B-3.2: Indicator Metadata	
Action name	Building deep retrofit
Indicator Name	Share of buildings renovated per year
Indicator Unit	% of buildings renovated per year
Definition	This indicator measures the proportion of existing buildings that have been renovated within a given year. It assesses the rate at which building renovations take place and reflects efforts to improve building performance, energy efficiency, safety, and aesthetics.
Calculation	To calculate this indicator, it is necessary to have the number of existing buildings renovated each year and the total number of existing buildings within the same area in Guimarães. It is necessary to determine the number of existing buildings that have been renovated, determine the total number of existing buildings in the same area, and divide the number of renovated buildings by the total number of existing buildings within the same category or area.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Built environment
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The increase in demand for building retrofitting and energy efficiency measures will lead to an increase in requests, which will have a long-term impact on retrofitting and renovation projects. If this development occurs, it will lead to a reduction in GHG emissions, an increase in efficiency and renovation rates, and economic benefits (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	yes
Data requirements	

B-3.2: Indicator Metadata	
Expected data source	Data from the energy efficiency department and construction work department of the Municipality of Guimarães, and if possible, from the stakeholders that intervene in energy efficiency and building retrofitting projects. Energy bills and consumption data, local utility companies, building management systems, energy audits.
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

B-2.2: Individual action outlines		
1st priority action		
Action outline	Action name	Adoption of efficient lighting and appliances
	Action type	Technical interventions
	Action description	This initiative is about assessing the diffusion of energy-efficient lighting systems and appliances in the building sector. Its main objective is to promote the use of energy-saving lighting technologies and high-efficiency appliances. In this way, it aims to reduce electricity consumption, promote sustainable energy practises, and contribute to the overall improvement of energy efficiency in buildings.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	• Improvement of energy efficiency lighting and appliances.
Implementation	Responsible bodies/person for implementation	Municipality of Guimarães: - Municipal Directorate for Intervention Territory, Environment and Climate Action: - Energy efficiency department Citizens.
	Action scale and addressed entities	Action scale: municipality Addressed entities: public buildings and facilities, citizens, one-stop-shop (OSS)
	Involved stakeholders	Building owners and managers Energy Service Companies (ESCOs) Consumers and building residents Community and NGOs Local businesses Utilities and energy providers
	Comments on implementation	N/A
Impact and cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	GHG emissions reduction: 18 kt tonCO_2e
	Total costs and costs by CO_2e unit	€ (119) M

B-3.2: Indicator Metadata	
Action name	High efficient new buildings, Building deep retrofit, Adoption of efficient lighting and appliances
Indicator Name	GHG emissions from stationary energy
Indicator Unit	tCO_2 equivalent
Definition	This indicator measures the amount of GHG emissions caused by the energy consumption of buildings that have undergone a comprehensive retrofit, and energy efficiency measures. The focus is on quantifying the emissions resulting from the energy consumption of buildings after they have been upgraded to improve energy efficiency. This indicator provides information on the effectiveness of comprehensive building retrofit and energy efficiency initiatives (including public lighting) in reducing energy related GHG emissions. It is a valuable benchmark for assessing the environmental benefits of retrofitting buildings to improve energy efficiency.
Calculation	To calculate this indicator is necessary to determine the energy consumption of the buildings, then proceed to calculate the emissions by multiplying the energy consumption of each energy source, and then convert to tCO_2 emissions.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Built environment
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Setting guidelines and standards for new buildings is a first step that the municipality intends to take, and if it works, it will translate into newly constructed buildings that follow the most efficient standards in the long run, resulting in lower GHG emissions and better overall quality and aesthetics of the buildings. The increase in demand for building retrofitting and energy efficiency measures will lead to an increase in requests, which will have a long-term impact on retrofitting and renovation projects. If this development occurs, it will lead to a reduction in GHG emissions, an increase in efficiency and renovation rates, and economic benefits. Will allow a widespread adoption of energy efficient lighting systems and appliances by citizens, leading to a significant reduction in electricity consumption (share of renovations producing around 40% efficiency improvement), as well the retrofitting of street lighting through a tender launch by the municipality. These can revolve on lower energy bills, and a positive environmental impact through reduced carbon emissions. As a latter impact will improve energy efficiency, reduced strain on the power grid, and cost savings for consumers (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	

B-3.2: Indicator Metadata	
Expected data source	Data from the energy efficiency department and construction work department of the Municipality of Guimarães, and if possible, from the stakeholders that intervene in energy efficiency and building retrofitting projects. Energy bills and consumption data, local utility companies, building management systems, energy audits.
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	High efficient new buildings, Building deep retrofit, Adoption of efficient lighting and appliances,

B-3.2: Indicator Metadata	
Action name	Industrial energy efficiency initiatives
Indicator Name	GHG emissions from industrial stationary energy
Indicator Unit	tCO_2 equivalent
Definition	This indicator measures the amount of GHG emissions produced by industrial facilities and processes that rely on stationary energy sources.
Calculation	Data on GHG emissions from stationary industrial energy sources are collected by the industry in Guimarães. These data may include direct measurements, emission factors or calculations based on energy consumption and emission coefficients, with the indicator reported annually or for a specified period to track changes in GHG emissions from stationary industrial energy use.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Industry
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The adoption of energy efficiency initiatives by the industrial sector both on the energy production, and on thermal energy and electricity usage, allow for a reduction of energy consumption and for an enhanced overall operational performance, thus allowing economic benefits from the savings on energy bills, resulting in a reduction in GHG emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the industry; emission inventories, monitoring systems, energy consumption records, energy efficiency reports, environmental impact assessments, regulatory authorities, third-party audits and assessments, renewable energy certificates
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Solar energy uptake
Indicator Name	Industrial renewable energy production
Indicator Unit	kWh/year
Definition	This indicator measures the amount of renewable energy produced by industrial plants within a certain period, focusing on the use of solar energy. It assesses the extent to which industrial sectors include solar energy sources in their operations.
Calculation	To calculate this indicator, it is necessary to know the amount of renewable energy generated by industrial facilities, particularly solar energy, within a specific period of time. It encompasses the determination of the solar energy production, the access the proportion of energy production that comes from solar sources. Then detremine the amount of energy produced from solar sources by the total energy production from all sources.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Industry
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The use of solar energy for thermal energy production in the industrial sector (e.g., pre-heating processes) contribute to reduce the carbon footprint of the industries that opt for fossil fuels' substitution, increasing the use of endogenous resources, resulting in a reduction in GHG emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the industry; industrial energy consumption records, utility bills and metering data, renewable energy certificates and guarantees of origin, environmental impact reports, solar energy monitoring systems, energy audits and assessments, renewable energy project documentation, third-party energy consultants
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Green hydrogen for Guimarães' industry
Indicator Name	Energy use by hydrogen from industry
Indicator Unit	kWh/year
Definition	This indicator measures the quantity of energy consumed by industrial processes and operations that involve the usage of hydrogen. It quantifies the extent to which the industrial sector relies on hydrogen for energy related purposes.

B-3.2: Indicator Metadata	
Calculation	To calculate this indicator is required to collect data on the amount of hydrogen consumed by the industrial sector during a given period. This data should include information on how much hydrogen is used and for what purpose. Then convert the amount of hydrogen into energy units, and calculate the total energy consumption of hydrogen
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Industry
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	This is an ambitious measure consisting in the injection of green hydrogen, locally produced with renewable electricity through electrolysers, into the natural gas industrial pipelines. The use of this renewable gas, both for thermal needs and for energy production, will be taken up by the pioneers of industry in Guimarães (early adopters) in a first phase and leading afterwards to a wider acceptance, resulting in a reduction in GHG emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the industry; Data from the industry; industrial energy consumption records, utility bills and metering data, renewable energy certificates and guarantees of origin, environmental impact reports, monitoring systems, energy audits and assessments, renewable energy project documentation, third-party energy consultants
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Biomass uptake
Indicator Name	Energy use by biomass from industry
Indicator Unit	kWh/year
Definition	This indicator measures the amount of energy consumed by the industry that use biomass as an energy source. It quantifies the extent to which the industrial sector relies on biomass, which can include organic materials such as wood, agricultural residues, and waste, as an energy source.

B-3.2: Indicator Metadata	
Calculation	To the calculate this indicator involves quantifying the amount of energy consumed by industry that utilise biomass as an energy source. It involves the collection of data on the amount of biomass consumed by industrial processes during a given period. The data should include information on how much biomass is used for what purpose. The energetic content of biomass can vary depending on the type of waste and moisture content of the biomass. Then, it is necessary to multiply the amount of biomass consumed by the energy content of the respective biomass type to calculate the total energy consumption from biomass in the industrial sector.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Industry
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The adoption of biomass as an alternative renewable energy source for thermal energy in the industrial sector, through the promotion of local-scale energy generation based on residual biomass (installation of small decentralised thermal power plants) along with the promotion for collection and storage biomass facilities, ensuring adequate management of forest, agriculture, livestock, food industry and other organic waste, providing a second life to biowaste and resulting in a reduction in GHG emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the industry; Industrial energy consumption records, biomass suppliers and purchases, utility bills and metering data, emission inventories, regulatory authorities, energy audits and assessments, industry reports, bioenergy certificates and documentation, energy suppliers and biomass providers, energy monitoring systems
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Biomethane uptake
Indicator Name	Energy use by biomethane from industry
Indicator Unit	kWh/year
Definition	This indicator measures the amount of energy consumed by the industry using biomethane as an energy source. It quantifies the extent to which the industrial sector relies on biomethane, as a renewable energy source.

B-3.2: Indicator Metadata	
Calculation	To calculate this indicator, it is necessary to determine the biomethane consumption of the industrial sector. Then the amount of biomethane must be converted into energy units and finally, the total energy consumption from biomethane must be calculated, e.g., by multiplying the amount of biomethane consumed by the energy content of the specific biomethane to calculate the total energy consumption from biomethane.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it impact?	Industry
Does the indicator measure indirect impacts (i.e., co- benefits)?	no
If yes, which co-benefit does it measure?	N/A
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	The use of biomethane in replacement of fossil fuels for thermal energy and energy production, injected into the natural gas industrial pipelines, allows a decarbonisation of the industrial processes. In an early stage, the possibility to produce biomethane (technological readiness and rate of adoption) in Guimarães, and in the long run to have a greener industry in Guimarães, resulting in a reduction in GHG emissions (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the industry; Industrial energy consumption records, biomass suppliers and purchases, utility bills and metering data, emission inventories, regulatory authorities, energy audits and assessments, industry reports, bioenergy certificates and documentation, energy suppliers and biomass providers, energy monitoring systems
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Top management engagement for sustainable industry
Indicator Name	# of top leadership involvement in co-development of sustainable industry actions
Indicator Unit	Number
Definition	This indicator measures the level of commitment and involvement of executives and top managers within an industrial company in the joint development of initiatives and strategies to promote sustainability in the industrial sector. It quantifies the extent to which top management is actively involved in shaping and supporting sustainable industry actions.
Calculation	It implies the identification and counting of the leaders who are actively involved in co-developing sustainability initiatives in the industrial sector.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no

B-3.2: Indicator Metadata	
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Increased economic thriving
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	If the top management of industry in Guimarães starts to engage in sustainability practises, leadership and commitment to sustainability and climate action is established, leading to the application of sustainable practises in industry, which in turn leads to an increase in economic growth and new technological applications (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Internal records and documentation, internal surveys, and feedback
Expected availability	bi-monthly
Suggested collection interval	bi-monthly
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Promotion of sustainable industry in partnership with relevant industry associations
Indicator Name	# of partnerships with industry associations
Indicator Unit	Number
Definition	This indicator assesses the extent to which an organisation works with relevant industry associations to promote and advance sustainability initiatives within the industry sector. This indicator highlights the industries' efforts to engage with stakeholders, e.g., industrial associations in Guimarães and others to leverage industry expertise and drive collective action on sustainable industry practises.
Calculation	It implies the identification and counting the formal partnerships and/or collaborations that exist between the industrial sector and industry associations related to promoting sustainable industry practises.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Increased local entrepreneurship and local businesses/ventures
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	If industry comes together in partnership with business and industry associations and promotes sustainable practises in industry, it will be possible to see an increase in sustainable and energy efficient practises, a possible development of networks between stakeholders and ultimately an increase in entrepreneurship and economic growth (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).

B-3.2: Indicator Metadata	
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Partnership agreements, press releases and public announcements, websites and online platforms, interviews and surveys
Expected availability	bi-monthly
Suggested collection interval	bi-monthly
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Promotion for sustainable business hosting areas
Indicator Name	# of new businesses establishments in the sustainable hosting areas
Indicator Unit	Number
Definition	This indicator measures the quantity of newly established businesses operating within designated sustainable hosting areas.
Calculation	It involves monitoring and counting of enterprises newly established in certain sustainable host areas during a defined reporting period.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Mainstreaming of new economic models like proximity and sharing economy
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	If the industrial sector, with the support of the municipality, participates in the development of a hub focused on sustainable businesses, will make these actors connected with each other and build relationships and symbioses that will have an impact on increasing the visibility of these actors, the role of the municipality in validating green businesses and the possibility of new business and economic models (see **Erro! A origem da referência não foi encontrada.**).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Business registration record, business licensing, public records and announcements, survey and interviews, business associations
Expected availability	bi-monthly
Suggested collection interval	bi-monthly
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Expansion of a one-stop-shop (OSS)
Indicator Name	Energy efficiency projects' requests
Indicator Unit	Number of requests / Number of projects
Definition	This intervention refers to the implementation of a first one-stop-shop (OSS) to serve as testbed for the municipality though the pilot project, and its service expansion throughout the territory until 2030. This indicator measures the number of requests received by the One-Stop-Shop for energy efficiency projects during a given period. It reflects the level of interest and engagement of stakeholders, e.g., citizens, institutions, in implementing energy saving projects and seeking support or information through the One-Stop-Shop. It also intends to measure the number of actual implement projects in households, and other type of building.
Calculation	It includes the count of applications, requests submitted to the OSS for energy efficiency projects during a given reporting period and identifying the implementation of projects due to the OSS.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Improved access to information, awareness and behaviour change
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	After the One-Stop-Shop (OSS) was initially introduced on a trial basis in District C, the lessons learnt from the pilot project will serve as a catalyst for introducing the OSS in other parishes in Guimarães and expanding its services to cover more users and project requests. If this happens as planned, it will lead to an increase in energy efficiency and retrofitting rates, as well as improved access to information and behavioural change (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Data from the OSS
Expected availability	monthly
Suggested collection interval	bi- monthly (semesterly)
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Digital twin
Indicator Name	Digital twin model data input
Indicator Unit	Data inserted
Definition	This indicator assesses the quantity and quality of data inserted in the digital twin model. A digital twin is a virtual representation of a physical system or asset, and the data entered is essential for its accurate representation and effective use.
Calculation	N/A

B-3.2: Indicator Metadata	
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Increased technological readiness and rate of adoption
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	If the municipality, with the involvement of stakeholders, explores the possibility of implementing a digital twin system, this will lead to close cooperation between the smart systems department of the municipality and these stakeholders to create a digital twin to support the decision-making process in the municipality, which will ultimately increase the technological readiness of this system to support climate action (see Module B-1 Climate Neutrality Scenarios and Impact Pathways).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Sensor data, IoT devices, operational data, maintenance records, data bases, machine learning models, remote monitoring systems, environmental data, users' inputs
Expected availability	daily
Suggested collection interval	monthly
References	
Deliverables describing the indicator	N/A
Other indicator systems using this indicator	N/A

B-3.2: Indicator Metadata	
Action name	Sustainable tourism
Indicator Name	Number of tourism businesses with a sustainability label
Indicator Unit	Number
Definition	This indicator quantifies the number of tourism related businesses that have received a recognised sustainability label or certification documenting their commitment to environmentally and socially responsible practises in the tourism industry.
Calculation	It involves identifying and counting tourism related businesses in Guimarães that have received recognised sustainability seals or certifications.
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	no
If yes, which emission source sectors does it impact?	N/A
Does the indicator measure indirect impacts (i.e., co- benefits)?	yes
If yes, which co-benefit does it measure?	Local economic activity and global connectivity
Can the indicator be used for monitoring impact pathways?	yes

If yes, which NZC impact pathway is it relevant for?	If the tourism industry obtains certification for sustainable practises that are linked to the specifics of the sector, this will allow for the creation of guidelines in the short term to obtain this certification and start implementing some sustainable practises, leading to more certified sustainable tourism businesses that contribute to the overall economic upliftment of the community (see Module B-1 Climate Neutrality Scenarios and Impact PathwaysModule B-3 Indicators for Monitoring, Evaluation and Learning).
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	no
Data requirements	
Expected data source	Sustainability certification bodies, local tourism authorities, tourism associations, tourism websites, reporting by businesses, local media, and news reports
Expected availability	annually
Suggested collection interval	annually
References	
Deliverables describing the indicator	Deliverables associated with NZC pilot city programme – District C
Other indicator systems using this indicator	N/A

5 Part C – Enabling Climate Neutrality by 2030

Part C "Enabling Climate Neutrality by 2030" aims to outline the actions that the Municipality of Guimarães has already undertaken in terms of organisational, governance and social innovation.
This is an area of expertise of the municipality, in collaboration with the Landscape Laboratory of Guimarães, which plays an essential role in turning the commitments and portfolio actions into reality and achieving climate neutrality by 2030.

5.1 Module C-1 Organisational and Governance Innovation Interventions

Module C-1 "Organisational and Governance Innovation Interventions" consists of a summary table of the organisational and governance interventions that the municipality is already implementing.

The Municipality of Guimarães serves a comprehensive overview of the organisational and governance interventions that are strategically designed to shape the conditions that influence and stimulate social behaviour. They aim to reduce existing barriers and to remove potential obstacles that could hinder progress.

A key objective of these interventions is to combat the "silo mentality" that often leads to fragmentation within the governance structure of a municipality, which is not the case of the Municipality of Guimarães due to this set of interventions, e.g., 2030 Guimarães governance ecosystem. These interventions involve active collaboration with key stakeholders, and by involving them in the development, implementation and monitoring of the Climate City Contract, the municipality is working to create a more inclusive and participatory approach to tackling climate change and related challenges.

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
2030 Guimarães Governance Ecosystem	Establishes a governance structure and a network among the municipality, stakeholders, municipality owned entities, sectors, and regional, national, and European actors towards a sustainable development	Municipality of Guimarães	Landscape Laboratory of Guimarães, Fibrenamics, Instituto Design de Guimarães, University of Minho, United Nations University, University of Trás-os-Montes and Alto Douro, Polytechnic Institute of Cávado and Ave (IPCA), Euro Cities, ICLEI, URBACT, Global	The 2030 Guimarães Governance Ecosystem enables climate neutrality through its integrative, multidisciplinary, and participatory approach. By adopting this holistic and participatory governance model, the Guimarães Governance Ecosystem promotes sustainable policies,	Sectoral collaboration

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
			Footprint Network, Green City Accord, Energy Cities, Circular Cities Declaration, Global Covenant of Mayors for Climate and Energy, Portuguese Pact for Plastic (Network of Historic Cities Against Plastic Waste), BioPlastics Europe, adapt Local, Resinorte, Turismo Porto e Norte, Sol do Ave, Águas do Norte, Intermunicipal Community Of Ave (CIM do Ave), CCDRn (North Regional Coordination and Development Commission), private sector, businesses and Citizens	engages stakeholders, influences citizen behaviour, and contributes to the overall quality of life. It recognises the importance of local actions in driving global transformation, and its initiatives have gained recognition both at the national and international levels.	
Creation of a digital Platform	Engagement, transparency, and accountability	Municipality of Guimarães	Municipality of Guimarães, Citizens	Develop and implement an online platform to and from the citizens. This is an intervention planned on District C, that will be integrated into CCC as well. This platform, as to aggregate	Improved Data Collection and Analysis, Improved sense of belonging and social inclusion

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				the information in one place instead of having it spread across different platforms, can be integrated on the website of Guimarães Climate Pact. The platform is intended, not just to collect data from the citizens, but also to share all the actions developments under the CCC and results accurately and transparently. It is also a way for citizens to keep track on the results and the municipality be accountable for progress.	
Regulation and policy update	New municipal regulatory frameworks and policies to increase sustainability, energy efficiency and renewable energy uptake, for instance by making it mandatory to have a sustainable building certificate, or an environmental life cycle analysis.	Municipality of Guimarães	Municipality of Guimarães Companies from the energy and, Construction sectors	By implementing these municipal regulatory frameworks and policies, the Municipality of Guimarães will create a supportive environment that drives sustainable practices, energy efficiency, and renewable energy adoption. These measures contribute to reducing greenhouse gas emissions,	Reduction of energy bills, Improved sense of belonging and social inclusion, Fight energy poverty

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				improving resource efficiency, and ultimately enable the transition towards climate neutrality.	
Innovative financing mechanisms	New financing models, and public-private partnerships (to mobilise private investment and drive sustainable development)	Municipality of Guimarães	Public sector Private sector Companies Financial intuitions	Through the pilot city District C, the Municipality of Guimarães will test new approaches to financial models towards sustainable development. The goal is to learn from these experiences and to transfer the gained knowledge to a larger area. Having financial instruments and mechanisms is key to deploy intervention on climate change. Financing and funding requirements and opportunities. Financing building renovation through the OSS, Innovative business models development. Financing Matchmaking and Marketplace.	Economic benefits Job creation Green growth with increased investments/capital

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
Data-driven decision-making	Data and technology to monitor and track	Municipality of Guimarães	Municipality of Guimarães	Data-driven decision-making helps achieve climate neutrality by providing the necessary information and insights to inform effective planning and implementation of actions aimed at reducing GHG and promoting sustainability. It is also possible to track progress, adjust strategies as needed, and measure the impact of their efforts.	Sectoral collaboration Improved Data Collection and Analysis
Operational coordination and management	Engagement, transparency, and accountability	Municipality of Guimarães	Municipality of Guimarães Companies Citizens Landscape Laboratory of Guimarães	Consists of the operational management of the CCC, considering also risk and quality assessment. Guimarães already has a core team dedicated to the NZC Mission (the Transition Team) and a steering Committee.	Improved Data Collection and Analysis Improved sense of belonging and social inclusion
Continuous impact measurement and quality optimisation	Engagement, transparency, and accountability	Municipality of Guimarães	Municipality of Guimarães Companies Citizens Landscape Laboratory of Guimarães	Ensures the continued impact evaluation of the actions under the CCC, including training, communication, dissemination, information, and	Improved Data Collection and Analysis Improved sense of belonging and social inclusion

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				engagement activities on the different stakeholder groups. Supports the data-driven decision-making.	

C-1.2: Description of organisation and governance interventions – textual and visual elements

The Municipality of Guimarães has a strong cohesion within its departments, being able to formulate projects that link different divisions and disciplines. The Transition Team formed for the mission "100 climate-neutral and smart cities by 2030" is an example of this. It includes members from the energy efficiency department of the city administration, as well as from the transport and mobility, environmental and circular economy, intelligent systems, and the economic and territory development. The team also includes members from the Landscape Laboratory of Guimarães, a long-standing partner of the municipality with many years of experience in climate change, environmental education, and biodiversity, being the coordinator of Guimarães Mission Structure 2030. This is also the case with other projects, such as the European Green Capital Award application and other local, national, and European projects.

The Municipality of Guimarães has set targets to improve the effectiveness and efficiency of multi-level governance for climate neutrality by maintaining and implementing action plans at the local level that are aligned with national and EU decarbonisation targets. Guimarães will continue to engage in European and national networks (e.g., Adapt.local, Climate Alliance, Energy Cities, Eurocities, Intelligent Cities Challenge) to share best practises and knowledge. Regular dialogue with national and EU decision-makers will ensure that community needs and perspectives are considered in high-level decision-making processes.

The governance measures outlined in the 2030 Climate Neutrality Action Plan include the governance initiatives from the NZC Pilot Cities Programme (District C) and the successful initiatives already implemented in the municipality of Guimarães that have demonstrated their positive impact on the local community.

The adoption of the 2030 Guimarães Governance Ecosystem allows the municipality of Guimarães to build a network of linkages between local, national, and European actors that allows for a networked and rapid response to sustainable community projects and strategies. It ensures that the municipality has a governance structure that puts sustainability at the centre of its priorities.

Through the implementation of District C, the municipality intends to establish a digital platform to keep citizens and the wider community informed about the goals achieved and progress made in the pilot city project. To keep the information related to the 100 neutral and smart cities in one place and facilitate access and management, this digital platform may also include the updates for the Guimarães Climate City Contract.

The Municipality of Guimarães intends to test the updating of regulations and measures related to energy efficiency and renewable energy in buildings by the District C project. As a new framework is

available for testing in a small area of the municipality, the intention is to transfer this measure to a larger area and extend its impact to the whole territory.

The Municipality of Guimarães also intends to further strengthen cross-sectoral cooperation between the Municipality and stakeholders (citizens, businesses, universities, organisations and associations, NGOs) in the region. The aim is to involve as many stakeholders as possible on the 2030 vision, foment new alliances, connections, and synergies between stakeholders towards climate neutrality. To achieve this, Guimarães will continue the RME sessions to maintain engagement and ongoing actions and interventions.

Innovative and sustainable financing mechanisms are a measure that the Municipality of Guimarães wants to take and that will be tested first in District C. The aim is to explore public-private partnerships, impact investing and business models to combine public investment with private investment to finance climate change.

Data-driven decision-making is another activity planned from District C, to improve linking different data sources and inputs and tracking the results achieved in reducing greenhouse gas emissions. This relates to the Guimarães Climate City Contract, as the MEL (Monitoring, Evaluation and Learning) methodology which will also be implemented for monitoring, tracking, and producing lessons learned from the implementation of actions in the area.

Operational coordination and management are another governance measures at the municipal level, consisting of the operational management of the Climate City Contract, ensuring that stakeholders are promoted in a continuous process, that the planned actions are implemented smoothly and that the financial plan is consistent with the implementation of the 2030 Climate Neutrality Action Plan. District C will also follow this approach so that lessons learned from the operational coordination and management of a smaller project can be applied to the whole area.

Operational coordination and management are another governance intervention at the municipal level, that consists of the operational management of the climate city contract, ensuring that the stakeholders are nurtured on a continuous process, the planned actions are smoothly implemented, and the financial plan is accurately in line with the deployment of the 2030 Climate Neutrality Action Plan. District C will also follow this line of action, so lessons acquired from the operational coordination and management of a smaller scale project can be translate to the whole territory.

Finally, continuous impact measurement and quality optimisation ensures the evaluation of the impact of the measures implemented within the 2030 Climate Neutrality Action Plan towards climate neutrality by 2030. For this purpose, the MEL approach will be used to identify improvements, but also obstacles and unforeseen difficulties in the implementation of the measures, as to evaluate the results achieved and, above all, to learn from the measures implementation and to determine what worked smoothly and when and what can be improved. District C will also follow this type of approach in the planned pilot activities. The municipality will continue to invest in participatory and co-creative strategies, especially through the implementation of the zero-footprint mobility plan. A new monitoring system for air quality and noise will be implemented, aiming to reduce air pollution to the levels recommended by WHO (World Health Organisation).

5.2 Module C-2 Social and Other Innovation Interventions

Module C-2 “Social and Other Innovation Interventions” consists of a summary table of the social interventions that the Municipality of Guimarães in partnership with the Landscape Laboratory of Guimarães.

The municipality focuses on the interventions that fit into the following categories: entrepreneurial, social economy, social awareness and mobilization, and social cohesion and solidarity.

This set of social innovations guarantee that the climate neutrality goal is a just transition, that includes different layers of the community in Guimarães, such as youth and elders.

It gathers a vast range of stakeholders that collaborate in the deployment of these interventions, focusing on the local capacity to address decarbonisation challenges, as well co-creation interventions.

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
Participatory budget	Bottom-up systemic initiatives/ projects	Municipality of Guimarães	Municipality of Guimarães Citizens NGOs Landscape Laboratory of Guimarães Mission Structure 2030	Involvement of citizens in the process of deciding how to spend public money. Citizens, whether individuals, groups, communities, or non-profit organisations, can present their projects to the city, which will then be voted on after an eligibility check. The projects that receive the most votes receive a certain amount of money from the city budget. This intervention enables climate neutrality as a method of social innovation that gives the community the power to choose the projects that best fit community needs and climate issues.	Improved sense of belonging and social inclusion Sectoral collaboration Economic benefits
Community Climate Challenge	Empowerment and inclusion Change in social behaviour	Municipality of Guimarães Landscape Laboratory of Guimarães	Municipality of Guimarães Citizens Associations Schools Universities	Challenge to award a group of citizens with remarkable social and environmental behaviour and initiatives. The prize is a community action of the winners' choice, e.g., an electric vehicle charging station, a playground, participation in a renewable energy community, etc. Similar to the Participatory Budget, through the community climate challenge climate can assist the achievement of climate neutrality by introducing a bottom-up	Improved sense of belonging and social inclusion Entrepreneurship Fight energy poverty Sectoral collaboration Economic benefits

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				approach that enable the implementation of clean and sustainable interventions (like the ones mentioned above).	
Placemaking	Empowerment and inclusion Change in social behaviour	Municipality of Guimarães Landscape Laboratory of Guimarães	Municipality of Guimarães Citizens Associations	A series of actions and sessions for citizens' assemblies to jointly develop solutions for climate neutrality and improving quality of life. Citizens' assemblies can also adopt the format of distributed dialogue and citizens' meetings, which allows for a decentralised approach and gives citizens the power to organise the discussion sessions.	Improved sense of belonging and social inclusion Sectoral collaboration Economic benefits
Deployment of the Citizen Pact	Empowerment and inclusion Top-down systemic initiatives	Municipality of Guimarães	Municipality of Guimarães Citizens Associations Organization Universities Companies, business, and industry Schools	Citizens are encouraged to sign the pact and actively participate in the systemic change towards climate neutrality. The Guimarães Climate Pact has already been signed by more than 80 companies who have committed to climate neutrality and alignment with the Guimarães Vision 2030 and to action.	Improved sense of belonging and social inclusion, Local economic activity, and connectivity
Co-creation process – citizens auscultation	Empowerment and inclusion Skills and capacity building bottom-up systemic initiatives/ projects	Municipality of Guimarães Landscape Laboratory of Guimarães	Stakeholders Residents Workers	The goal is to involve citizens in co-creating solutions for climate neutrality and improving quality of life first in District C, and then replicate towards a larger area of Guimarães. Through co-creation processes, a sustainability matrix will	Improved sense of belonging, Improved social cohesion

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				be developed to guide systemic change. Citizens' parliaments will be established in each parish to facilitate direct communication between policymakers, decision-makers, and citizens. Discussions in the parliaments will focus on identifying local actions, climate measures, and adaptation strategies suitable for the communities and territories. Fruitful ideas generated from these discussions can be considered for the participatory budgeting process. Various methods will be employed to promote citizen participation, including live sessions, surveys, and campaigns to gather ideas.	
Immersive Experiences	Change in social behaviour	Municipality of Guimarães Landscape Laboratory of Guimarães Mission Structure 2030	Stakeholders Citizens	To foster a greater sense of belonging, digital experiences will be created, including both remote and in-person immersive events, starting with the implementation of District C. These experiences will provide insights into the territory evolution and highlight its positive changes. Additionally, data collected from various activities will be shared during these events to promote transparency,	Improved climate issues awareness Enhanced citizen and communities' participation

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				encourage critical awareness, and empower individuals to take more active roles in driving systemic change. By providing access to relevant information, these actions seek to engage participants in a deeper understanding of the territory progress and inspire them to contribute to its ongoing transformation.	
Climate neutral cultural events	Changes in social behaviour Regulation and support	Municipality of Guimarães Landscape Laboratory of Guimarães	Stakeholders (entities that desire to organise an event in Guimarães), citizens	Ensure that all events, regardless of their direct relation to climate awareness, adhere to climate neutrality principles. This will start with the test on District C, aiming to preserve the historical area. This means that climate neutrality plans will be mandatory for all events and must encompass the entire event lifecycle, including preparation, delivery, and post-event activities. Data pertaining to energy consumption, energy sources, waste production and management, water usage, and other relevant metrics will be collected to support the effectiveness of these measures. In addition, a handbook outlining best practices for hosting environmentally friendly and climate-neutral cultural events will be developed.	Sectoral collaboration Economic benefits Local economic activity, and connectivity

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				To ensure its relevance and applicability to the local context, extensive consultations and engagements with cultural stakeholders will be conducted to improve and tailor the guidelines accordingly.	
Community gardens	Change in social behaviour Empowerment and inclusion	Municipality of Guimarães Landscape Laboratory of Guimarães	Municipality of Guimarães Landscape Laboratory of Guimarães Citizens	Community garden intervention is consistent with climate neutrality goals by promoting local food production, reducing food-related emissions, improving carbon sequestration, mitigating the urban heat island effect, and promoting sustainable practises and community engagement. These gardens contribute to a more resilient, sustainable and climate neutral urban environment. Community gardens contribute to local food production, reduced food miles (associated with the transport of food), carbon sequestration, urban heat island effect, soil health, waste reduction, biodiversity education and awareness, community engagement, reduced consumption, local resilience, and green infrastructure.	Enhanced citizen and communities' participation Local economic activity, and connectivity Improved sense of belonging Improved social cohesion Sustainable and resilient food production and supply systems Increased production, and consumption locally grown food
Memória 65+	Empowerment and inclusion	Landscape Laboratory of Guimarães	Municipality of Guimarães Elderly population	This intervention contributes to active and healthy ageing by connecting the elderly community with nature. Consists of a series of	Improved sense of belonging Improved social cohesion

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
			Resinorte Cor de Tangerina Museu da Agricultura de Fermentões Quinta das Manas Social Institutions	initiatives that combine memory sharing and knowledge transfer to promote intergenerational, sensory, experimental, and creative activities that stimulate older people's cognitive functioning and community engagement. This intervention involves the older community in climate change, a part of society that is so often left behind.	Improved climate issues awareness
Desporto Zero	Change in social behaviour	Municipality of Guimarães Landscape Laboratory of Guimarães	Xico Andebol All 55 clubs' sports of Guimarães Tempo livre (municipal company concerning physical activity and sports) Vimágua Vitrus Resinorte	Sport as a mean to accelerate climate change. A project involving 55 clubs and 7 231 athletes aims to align municipal investment and support policies for sport with the achievement of sustainability goals. It also includes environmental management software developed specifically for this purpose, which enables clubs to monitor the development of individual sustainability plans and decide what they need to improve as part of that plan.	Enhanced citizen and communities' participation Increase resource efficiency Economic benefits
PEGADAS Programme	Changes in social behaviour Skills and capacity building	Landscape Laboratory of Guimarães Municipality of Guimarães	Private and public schools Casa da Juventude Collaboration with several local, national, and European partners Academia	PEGADAS is the ecological programme of Guimarães for learning sustainable environmental development. Several activities are proposed within the eight key areas of the Reference for Environmental Education for Sustainability developed by the	Enhanced citizen participation and social capacities Increased awareness of social and environmental issues Improved access to information,

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
			STOL – Science through our lives Ave - association for ecology Green Brigades and parishes Vimágua Vitrus Resinorte EDP	Ministry of Education: sustainability, ethics and citizenship, sustainable production and consumption, territory and landscape, climate change, biodiversity, energy, water, and soils. So far, 20 000 students, 1 780 teachers, 579 actions and 39 partners have been reached. The involvement of the young community is essential to ensure the permanence and continuity of action on climate change, as they are the generation that most likely will have to deal and endure with the harmful effects of climate change.	awareness, and behaviour change Increase resource efficiency, Increase biodiversity impacts
Poliniza-te	Skills and capacity building	Landscape Laboratory of Guimarães	Citizens Schools Green Brigades and parishes	The Poliniza-te project aims to increase knowledge about pollinators and promote biodiversity and ecosystems. It aims to raise awareness of the challenges currently facing the pollinator species using environmental education and research measures. The planned actions include a series of theoretical and practical trainings, actions to promote and conserve pollinators, and the development of tools to help improve knowledge on the subject in the Municipality of Guimarães. Giving the crucial role of pollinators, like bees, in mitigating climate change, through	Improve awareness and on climate and biodiversity issues Increase biodiversity impacts

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				pollination, plant diversity, habitat restoration, carbon sequestration, and agroecosystems, enabling the young community with skills and capacities on pollinators is a way to contribute to climate neutrality.	
Rural Base Incubator	Regulation and support Top-down systemic initiatives	Municipality of Guimarães Landscape Laboratory of Guimarães	Municipality of Guimarães Farmers Agrobusinesses	The Rural Base Incubator intends to support the creation and development of businesses involved in rural initiatives, such as agriculture, agroindustry, and forestry. It supports all entrepreneurs who have an idea or business plan for a rural economic activity and want to implement it in Guimarães. It is preferably aimed at young farmers and entrepreneurs, residents of the municipality, unemployed people and farmers dedicated to organic production. To help to deploy nature-based solutions and entrepreneurship is to contribute to achieve climate neutrality, due to its importance on carbon sequestration and biodiversity.	Entrepreneurship Increased urban forestry Rural adaptation to climate change Improved land-use and management practices Increased access to green jobs and skill development opportunities
Biodiversity Go!	Bottom-up systemic initiatives Skills and capacity building	Landscape Laboratory of Guimarães	Municipality of Guimarães, University of Minho, University of Trás-Os-Montes and	A mobile application (APP) that helps catalogue trees and animal species and raises awareness of the region's flora and fauna in a fun and engaging way. This programme	Increased ecological awareness Increased non-invasive species and pollinators

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
			Alto Douro (UTAD), E-Leclerc of Lordelo (supermarket), Citizens, Schools, Green Brigades and Parishes	embraces a user-friendly approach to develop a database of biodiversity through community inputs at APP. The fact that it is an APP creates a stronger engagement with the youth of Guimarães.	
360.come	Change in social behaviour Skills and capacity building	Landscape Laboratory of Guimarães	Private and public schools Fundo Ambiental (Environmental Fund) ENEA 2020 (National Environmental Education Strategy) To-Be Green Municipality of Guimarães Restaurants	The project integrates the components of environmental education, research, and development. It focuses on the development of plant kits made from used textiles, training on waste and circular economy, and awareness-raising activities in schools. It also includes mapping local products to create a database accessible to companies, hotels, and the community, and assessing the chemical safety of food produced in school and/or community gardens. Using innovative education and communication strategies, the aim is to demonstrate that healthy eating, food waste, environmentally friendly consumption are issues that should be addressed in a holistic and interconnected way to promote behaviour change.	Improved awareness on circular economy Increased ecological awareness Increased deployment of circular material cycles Sustainable and resilient food production and supply systems Increased production, and consumption locally grown food

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
Sem Invasoras	Skills and capacity building	Landscape Laboratory of Guimarães	Private and public schools General community Environmental Fund, Ministry of Environment and Climate Action	This project has three dimensions: (1) researching and testing methods to control and eradicate invasive species; (2) educating and raising awareness of the ecological, social, and economic impacts of invasive species on ecosystems and preventing their spread (3) disseminating and communicating. It endorses climate neutrality by supporting biodiversity conservation, carbon sequestration, ecosystems restoration, and pressure alleviation on vulnerable ecosystems.	Increased non-invasive species and pollinators Increased ecological awareness
Portfolio of activities	Empowerment and inclusion Regulation and support Top-down and bottom-up systemic initiatives/ projects Skills and capacity building Change in social behaviour	Landscape Laboratory of Guimarães	Variety of stakeholders according with the aim of the activity: Private and public schools Associations Universities	Landscape Laboratory has a wide range of activities for and with the community, covering a variety of sustainable and environmental issues. Apart from the interventions/ programmes already mentioned, the Guimarães Landscape Laboratory has other projects that should be mentioned: - Know the SDGs (Sustainable Development Goals) - Ecological Footprint - Generation without garbage - Botanical print on fabrics - Magnifying glass labels: sustainable consumption	Due to the diversity of activities, the co-benefits are expandable to diverse dimensions. Since the social intervention focus on the environmental (and social) thematic: Improved sense of belonging and social inclusion, Economic benefits, Improved climate issues awareness, Enhanced citizen and communities' participation

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
				- Ecological painting - Know the seeds - Scientist for a day - The secret life of Penha creatures - Urban riverside ecosystems - Nest box construction workshop - Aroma gardens - The senses of water Through the diversity of social innovation activities and interventions that the Landscape Laboratory of Guimarães has been developing and continues to innovate, it creates a deep sense of awareness on environmental, social, and sustainability issues, as well a sense to act against climate change.	

C-2.2: Description of social innovation interventions – textual and visual elements

The social innovation interventions mentioned earlier have a crucial role on achieving climate neutrality due to its community unifying power towards a common goal, involving also different stakeholders.

The Landscape Laboratory of Guimarães apart from the Municipality of Guimarães, is the main responsible for the development and implementation of these interventions. It has several years of experience in promoting social innovation actions linked to environmental and sustainability issues, with a strong component in environmental education.

To embrace all layers of the society, the Municipality of Guimarães aims its social interventions to be opened to all citizens, despite social and economic background, to ensure a just transition, where the most vulnerable citizens are also part of the systemic change towards climate neutrality, since most often these are the citizens that suffer the most the harms of climate change.

Social innovation can play a crucial role in the transition to climate neutrality by promoting new and innovative solutions to reduce greenhouse gas emissions and address the impacts of climate change.

The Municipality of Guimarães also intends to empower the community and citizens through these actions by actively participating in the energy transition and climate neutrality, e.g., through participation in renewable energy communities, clean mobility habits, energy democracy and energy justice. As mentioned above, all citizens should be included in the processes and actions, regardless of their economic status, gender, religious beliefs, and age. To fight energy poverty, social justice must be strengthened, because a just climate transition implies also a just social transition.

The social innovation interventions for the 2030 Climate Neutrality Action Plan encompass the social innovation interventions from the NZC pilot city programme (District C) and the ones that are already implemented in Guimarães, having a proved record on its impact on the community.

These interventions can be grouped into the following main categories (even if the interventions are assigned to one category, they can also belong to more than one):

Entrepreneurship:

- Community Climate Challenge: This is a new activity that Municipality of Guimarães intends to implement through the District C, and in 2025 expand to a larger area of the municipality. This intervention will reinforce the goals for 2030 by providing an incentive to the community based on the good practises and efforts towards a greener municipality.
- Climate neutral cultural events: The Municipality of Guimarães intends to test the concept of climate-neutral cultural events first in District C. The municipality hosts numerous cultural events throughout the year, so it makes perfect sense to make them more environmentally friendly, considering the entire chain of events from preparation to follow-up. This measure will help to achieve the climate goals by ensuring that all cultural events are climate neutral by 2030.
- Rural Base Incubator: This activity has been already implemented by the municipality, and the goal is to support the rural business and initiatives to deploy greener agricultural practises, and nature base-solutions. Supporting the rural areas is crucial to empower a community that sometimes is placed in a second plan for not be considered as part of a city-centre. The Rural Base Incubator helps to engage all citizens and business towards climate neutrality goals.
- Community gardens: Spaces where citizens and associations can grow plants and vegetables. These gardens promote sustainable practises, strengthen the sense of community, provide access to fresh produce, and encourage outdoor activities and education. They are also a place to interact with neighbours and prevent isolation.

Social Economy:

- Participatory Budgeting (PB): This is a well-known intervention on the social intervention's domains, applied already by many cities. The Municipality of Guimarães will test the PB with the District C pilot, and then replicate it to a large audience. As the municipality has a record to engage with citizens and put them at the heart of the change, a PB is a good opportunity to change the traditional budgeting of the municipality. It provides the chance for the community to engage on how and where the public budget should be applied, putting in practice a bottom-up approach. To achieve the 2030 goals, so often are the citizens that really know their climate and environment struggles of the daily bases (e.g., public transports) so these interventions allow for a more in-depth output collection of the necessities and hardships of the community.
- Co-creation process – citizens auscultation: The Municipality of Guimarães expects that this pilot activity in District C will test citizen consultation procedures that will lead to the development of a sustainability matrix. This 'bottom-up' intervention is intended to inspire and empower the local community to build on actions towards climate neutrality. Citizens' parliaments will be one of the methods to ensure that every community in Guimarães has a voice and that the co-design processes reach every single community. As mentioned earlier, climate neutrality cannot be

achieved by the municipality alone, so these types of actions are a must to the 2030 for Guimarães vision.

Social awareness and mobilisation:

- Deployment of the Citizen Pact: Guimarães has already deployed an informal, voluntary, and non-binding pact – Guimarães Climate Pact. This pact embraces all kind of entities, not only citizens, who also want to express their alignment with 2030 Guimarães vision. This intervention is defined on NZC pilot programme District C as a pact for the citizens signalling their commitment with 2030 Guimarães vision. Guimarães anticipated this intervention by developing a pact to all interested parties.
- Immersive Experiences: This intervention is another example of a broader application of a pilot activity that is being tested in district C. The aim is to show how a particular planned action unfolds in a real context in Guimarães. Through lived experience, it is possible to create a sense of transparency and security before the moment of implementation. This can be particularly important when the municipality wants to implement a new and disruptive measure that may initially cause discomfort and resistance among the population due to its novelty in the region.
- Memória 65+: As the population ages, it becomes imperative to find strategies that promote active ageing. The Landscape Laboratory, in collaboration with Guimarães City Council and partner institutions, offers a range of free activities focused on environmental sustainability to more than four dozen institutions in the municipality. These activities connect a part of the society that sometimes is left behind on the climate transition journey, connecting generations, promoting a healthy aging, and a more cohesive and solitary territory.

Figure 28. Activities from the Memory 65+ programme within the Guimarães community.

Source: Projeto 65+ Ambiente Portefólio de Atividades

- Desporto Zero: Sport is an activity that connects a community regardless of the background of the participants. Therefore, combining the environmental and sustainability component with activities that closely involve the community is a great strategy to engage people in climate transition.
- PEGADAS Programme: The Municipality of Guimarães believes that to achieve climate neutrality by 2030, every layer of the community should be involved on the transition, and that the young generation is a fundamental key to mobilise towards this cause. PEGADAS is an emblematic environmental education programme on Guimarães, an example of good practise of the Blue Flag Association of Europe (ABAE) and has been recognised as a Friend of the International Year for Global Understanding (IYGU), an initiative of the International Geographical Union (IGU) that addresses the way humans reshape and shape nature and the impact of the global of their everyday behaviour.

- Poliniza-te: A programme aimed at raising awareness of the importance of pollinator conservation. By highlighting the role of pollinators through theoretical and practical activities, the municipality of Guimarães expects to support the nature-based solutions envisaged in the 2030 Climate Neutrality Action Plan, the restoration and maintenance of biodiversity in the region. In addition, researchers from the Landscape Laboratory assess and monitor pollinators in Guimarães, while pollinator-friendly policies and practises are implemented.

Figure 29. Activities from the Poliniza-te programme within the Guimarães community.

Source: Poliniza-te

- Biodiversity Go!: This intervention is led by biologists through the flora and fauna of Guimarães. Participants are invited to install the APP Biodiversity GO! developed by the Landscape Laboratory, free of charge, to photograph local biodiversity and contribute to the Guimarães biodiversity database with their observations and records. For the climate neutrality goals, this activity contributes to create awareness on the local biodiversity, enduring its preservation and conservation, and to help to provide inputs to monitoring and categorisation.

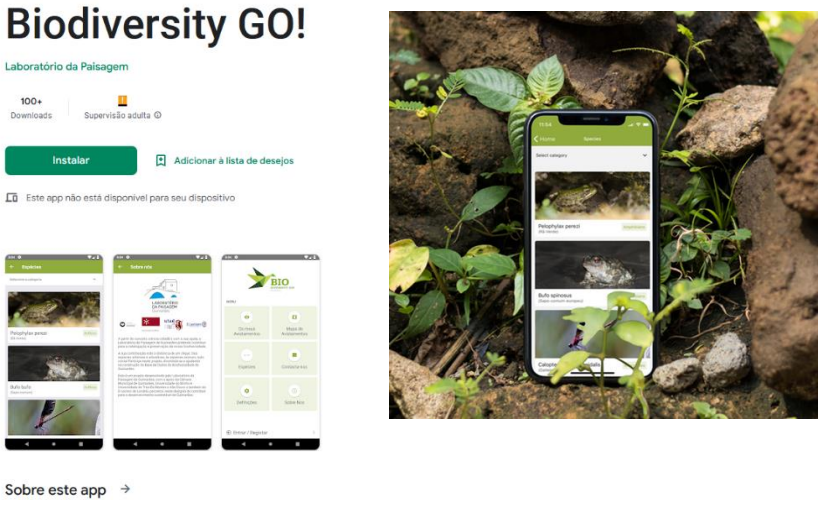


Figure 30. Biodiversity Go! APP.

Source: Biodiversity GO! Google App.

- 360.come: This programme focuses on waste, circular economy, and food sustainability, allowing the development of more sustainable and healthy lifestyles. This is a key element for behaviour change, a necessary factor for a consist and effective climate neutrality journey for Guimarães.

Figure 31. Experiences and microvegetables cultivation kit.

Source: 360.come Programme.

- Sem Invasoras: This programme by consolidating three important dimensions – researching and testing; education and awareness; dissemination and communication – enables social awareness and the community mobilisation towards native species, a resilient and adaptable territory to climate change.

Figure 32. Fieldwork during Sem Invasoras activity.

Source: Sem Invasoras Programme.

Social cohesion and solidarity:

- Placemaking: This is an intervention that is planned on the District C pilot city project, that the Guimarães City Council expects to test and then apply on a larger area. Placemaking, as the Participatory Budget, is an intervention that is well-known on the social economy domain, applied in several European cities already. For the Municipality of Guimarães, it will consist of topic-driven open discussions in public spaces for public actions. This implies engagement activities with citizens, e.g., citizen juries or citizen assemblies, as a mean to get citizens feedback and evolve from a "bottom-up" approach. Putting the Guimarães' community at the heart of a co-creative process to shape healthier, more resilient, and more equitable public spaces lasting for the future will help to achieve the 2030 climate goals.

In conclusion, the Municipality of Guimarães, together with its partner, the Landscape Laboratory of Guimarães, has a solid record of social interventions that will continue to enable the municipality to engage its community, from the young to the older generation, and from different socio-economic backgrounds.

These social interventions are hugely important for climate neutrality by 2030, as they help lay the foundations for systemic change that starts with the community and stakeholders' involvement.

5.3 Module C-3 Financing of Action Portfolio

Module C-3 "Financing of Action Portfolio" is a summary of the portfolio of actions, and the organisational, governance and social interventions of the Municipality of Guimarães, regarding the responsible entity to implement the action, the expected impact (direct and/or indirect impact) as well the total cost estimated.

The total cost of the interventions from the portfolio of action is € 1 004 m^2. These interventions are also unpacked in more detail on the Investment Plan.

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
Mobility and transport				
Alternative sustainable transportation modes	Municipality of Guimarães Guimabus CIM do Ave	2020-2030	26	€ 0
Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and Promotion of Public Transports	Municipality of Guimarães Guimabus CIM do Ave National Ministry of Infrastructure and Housing Municipality of Guimarães Public Transports of Braga		14	€ (56) M
Carpooling and car sharing	Municipality of Guimarães Citizens and private cars owners		8	€ 0
Electric mobility shift: private passenger vehicles	Municipality of Guimarães Citizens		11	€ (88) M
Buses green conversion	Municipality of Guimarães Guimabus		3	€ (4) M
Conversion of the urban solid waste collection fleet	Municipality of Guimarães Tratave. Resinorte VITRUS		1	€ (5) M
Sustainable delivery services	Municipality of Guimarães Delivery services companies		23	€ 0
Electric mobility shift: light goods, and heavy-duty vehicles	Municipality of Guimarães Companies, e.g., fleet	2020-2040	20	€ (157) M
Built environment				
Building deep retrofit	Municipality of Guimarães	2020-2030	11	€ (168) M
High efficient new buildings	Municipality of Guimarães		2	€ (25) M
Adoption of Efficient Lighting and Appliances	Municipality of Guimarães Citizens		18	€ (100) M
Energy systems				
Renewable Energy Communities	Municipality of Guimarães	2020-2030	126	€ (72) M

[2] Total investment cost (CAPEX)(MEUR - NPV 2020-2030)

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
(REC) and Digitalisation of energy				
RES self-consumption: households, industry, companies, institutions	Municipality of Guimarães ESCOs Industry and Companies Citizens Institutions			
Renewable Energy Sources (RES) acceleration framework	Municipality of Guimarães Renewable energy developers and companies Landowners and property owners Academic and Research Institutions: University of Minho NGOs			
Capacity building actions of municipal staff	Municipality of Guimarães		Improved access to information, awareness and behaviour change	
Guidance for heritage energy efficiency renovation	Municipality of Guimarães			
Waste and circular economy				
Recycling upgrade	Municipality of Guimarães Resinorte VITRUS	2020-2030	10	€ (1) M
Undifferentiated urban waste reduction	Municipality of Guimarães Resinorte VITRUS			
Waste production reduction	Municipality of Guimarães Resinorte VITRUS			
Biowaste upgrade	Municipality of Guimarães Resinorte VITRUS			
Business symbiosis	Municipality of Guimarães Local commerce in Guimarães Industry		Mainstreaming of new economic models like proximity and sharing economy	
New circular business models	Municipality of Guimarães Local commerce in Guimarães Business incubator of Guimarães Industry		Increased local entrepreneurship and local businesses/ ventures	
Green infrastructure and nature-based solutions				
Green areas	Municipality of Guimarães Landscape Laboratory of Guimarães	2020-2030	Improved air quality Improved nature restoration	€ (24) M

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
			Increased non-invasive species and pollinators Increased urban forestry, plantation and improved plant heath Improved soil-health	
Green belt	Municipality of Guimarães Landscape Laboratory of Guimarães		Improved air quality Improved nature restoration, Increased non-invasive species and pollinators Increased urban forestry, plantation and improved plant heath Improved soil-health	€ (10) M
Biodiversity conservation and restoration	Municipality of Guimarães Landscape Laboratory of Guimarães		Improved nature restoration Increased non-invasive species and pollinators	€ (2) M
Urban private community gardens	Municipality of Guimarães Landscape Laboratory of Guimarães		Improved land-use management practices	€ (2) M
Industry				
Industrial energy efficiency initiatives	Industry Government Agencies and Regulatory Bodies Local Government and Municipality Technology Providers Utilities and Grid Operators	2020-2030	66	€ (89) M
Solar energy uptake	Industry Government Agencies and Regulatory Bodies Local Government and Municipality Technology Providers Utilities and Grid Operators		8	€ (11) M

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
Green hydrogen for Guimarães' industry	National Government Government Agencies and Regulatory Bodies Local Government and Municipality Renewable Energy Providers, e.g., EDP Financial Institutions Technology Providers Utilities and Grid Operators "Guimarães' Brand". Guimarães industry. Business Association of Guimarães.		37	€ (53) M
Biomass uptake	National Government Government Agencies and Regulatory Bodies Local Government and Municipality Biomass providers Financial Institutions Technology Providers Utilities and Grid Operators "Guimarães' Brand". Guimarães industry. Business Association of Guimarães.		30	€ (44) M
Biomethane uptake	I National Government Government Agencies and Regulatory Bodies Local Government and Municipality Biomass providers Financial Institutions Technology Providers Utilities and Grid Operators "Guimarães' Brand" Guimarães industry Business Association of Guimarães		58	€ (90) M
Top management engagement for sustainable industry	"Guimarães' Brand". Guimarães industry Business Association of Guimarães		Increased economic thriving	€ (35) m
Promotion of sustainable industry in partnership with relevant industry associations	Municipality of Guimarães "Guimarães' Brand" Guimarães industry Business Association of Guimarães		Increased local entrepreneurship and local businesses/ventures	€ (35) m
Promotion for sustainable business hosting areas	Municipality of Guimarães "Guimarães' Brand" Guimarães industry Business Association of Guimarães		Mainstreaming of new economic models like proximity and sharing economy	€ (400) m
Cross cutting action (energy systems and built environment)				

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
Expansion of a one-stop-shop (OSS)	Municipality of Guimarães	2020-2030	Improved access to information, awareness and behaviour change	€ (200) m
Cross cutting action (all fields of action)				
Digital twin	Municipality of Guimarães	2020-2030	Increased technological readiness and rate of adoption	€ (300) m
Sustainable tourism	Municipality of Guimarães Local tourism businesses Tourism certification bodies		Local economic activity and global connectivity	€ (125) m
TOTAL (portfolio of actions)			**473**	**€ (1 004) M**
Organisational and governance interventions				
2030 Guimarães Governance Ecosystem	Municipality of Guimarães	On going	Sectoral collaboration	N/A
Creation of a digital Platform	Municipality of Guimarães	2025	Improved Data Collection and Analysis, Improved sense of belonging and social inclusion	€ (25) m
Regulation and policy update	Municipality of Guimarães	2024	Reduction of energy bills Improved sense of belonging and social inclusion Fight energy poverty	€ (20) m
Innovative financing mechanisms	Municipality of Guimarães	On going	Economic benefits Job creation Green growth with increased investments/capital	€ (40) m
Data-driven decision-making	Municipality of Guimarães	On going	Sectoral collaboration Improved Data Collection and Analysis	€ (75) m
Operational coordination and management	Municipality of Guimarães	On going	Improved Data Collection and Analysis, Improved sense of belonging and social inclusion	€ (75) m

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
Continuous impact measurement and quality optimisation	Municipality of Guimarães	On going	Improved Data Collection and Analysis Improved sense of belonging and social inclusion	€ (120) m
Social and other innovation Interventions				
Participatory budget	Municipality of Guimarães	On going	Improved sense of belonging and social inclusion Sectoral collaboration Economic benefits	€ (550) m
Community Climate Challenge	Municipality of Guimarães Landscape Laboratory of Guimarães	2024	Improved sense of belonging and social inclusion, Entrepreneurship, Fight energy poverty, Sectoral collaboration, Economic benefits	
Placemaking	Municipality of Guimarães Landscape Laboratory of Guimarães	On going	Improved sense of belonging and social inclusion, Sectoral collaboration, Economic benefits	
Deployment of the Citizen Pact	Municipality of Guimarães	2023	Improved sense of belonging and social inclusion, Local economic activity, and connectivity	
Co-creation process – citizens auscultation	Municipality of Guimarães, Landscape Laboratory of Guimarães	On going	Improved sense of belonging, Improved social cohesion	
Immersive Experiences	Municipality of Guimarães, Landscape Laboratory of Guimarães Mission Structure 2030	On going	Improved climate issues awareness Enhanced citizen and	

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
			communities' participation	
Climate neutral cultural events	Municipality of Guimarães, Landscape Laboratory of Guimarães	On going	Sectoral collaboration Economic benefits Local economic activity, and connectivity	
Community gardens	Municipality of Guimarães, Landscape Laboratory of Guimarães	On going	Enhanced citizen and communities' participation Local economic activity, and connectivity, Improved sense of belonging Improved social cohesion Sustainable and resilient food production and supply systems Increased production, and consumption locally grown food	€ (3,5) M
Memória 65+	Landscape Laboratory of Guimarães	On going	Improved sense of belonging Improved social cohesion Improved climate issues awareness	€ (65) m
Green Brigades	Municipality of Guimarães, Landscape Laboratory of Guimarães		Enhanced citizen and communities' participation Improve awareness and on climate and biodiversity issues	€ (500) m
Desporto Zero	Municipality of Guimarães Landscape Laboratory of Guimarães		Enhanced citizen and communities' participation	€ (250) m

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
			Increase resource efficiency Economic benefits	
Pegadas Programme	Municipality of Guimarães, Landscape Laboratory of Guimarães		Enhanced citizen participation and social capacities Increased awareness of social and environmental issues Improved access to information, awareness, and behaviour change Increase resource efficiency Increase biodiversity impacts	€ (600) m
Poliniza-te	Landscape Laboratory of Guimarães		Improve awareness and on climate and biodiversity issues, Increase biodiversity impacts	€ (100) m
Rural Base Incubator	Municipality of Guimarães Landscape Laboratory of Guimarães		Entrepreneurship, Increased urban forestry Rural adaptation to climate change Improved land-use and management practices Increased access to green jobs and skill	€ (75) m

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO$_2$e / co-benefit)	**Total cost estimated**[2]
			development opportunities	
Biodiversity Action Plan	Landscape Laboratory of Guimarães		Increased ecological awareness Increased non-invasive species and pollinators	€ (500) m
360.come	Landscape Laboratory of Guimarães		Improved awareness on circular economy Increased ecological awareness Increased deployment of circular material cycles Sustainable and resilient food production and supply systems Increased production, and consumption locally grown food	€ (225) m
Sem Invasoras	Landscape Laboratory of Guimarães		Increased non-invasive species and pollinators Increased ecological awareness	€ (125) m
Citizen engagement Events	Landscape Laboratory of Guimarães		Due to the diversity of activities, the co-benefits are expandable to diverse dimensions. Since the social intervention focus on the environmental (and social) thematic: Improved sense of belonging and social inclusion, Economic benefits,	€ (750) m

C-3.1: Summary of interventions with cost implication				
Action	**Responsible entity and person**	**Start/end date**	**Impact** (GHG reduction in kt tonCO_2e / co-benefit)	**Total cost estimated**[2]
			Improved climate issues awareness, Enhanced citizen and communities' participation	

6 Outlook and next steps

This section draws the plans of the Municipality of Guimarães for the following iterations of the Climate City Contract, focusing on the Action Plan next steps.

Plans for next CCC and Action Plan iteration
The Municipality of Guimarães intends to continue to improve and refine the Climate City Contract over the years and, in next iterations to add more stakeholders and their commitments and actions towards climate neutrality. The municipality considers the CCC as a "living" document that needs to be constantly updated to reflect the reality of Guimarães and its variations in an ever-changing environment. It is also the intention of the municipality to unbright the design and layout of the Guimarães' Climate City Contract to match the design of the Guimarães Climate City Pact and the vison Guimarães 2030: Join the Green Transition. The involvement of stakeholders in the development and design of the CCC is a very important aspect for the municipality, which has already taken the first steps to engage with them, especially through the Guimarães Climate Pact and the first round of RME (Rapid Mass Engagement) workshops. The municipality intends to continue these types of sections, each time involving more stakeholders and diversifying the target group; it has already planned a possible bootcamp for youth level engagement in the CCC. With this in mind, the Municipality of Guimarães has planned the second round of RME workshops, which will derive and build on the findings and feedback from the previous round. During the development of the CCC, the municipality was also supported by experts from the NZC Consortium in formulating strategies to engage Guimarães' industry in the process, as industry is a key player in Guimarães and a major contributor to the municipality's emissions. It is the municipality's desire to work with this group of experts to deepen the relationship between the municipality and industry actors. The municipality aims to continue to engage with stakeholders for the implementation of the actions as well as the National government. The support and advocacy of the National government is important to support some of the actions, e.g., Bus Rapid Transit, production of biogas, and introduction of hydrogen. The municipality intends to continue to work at a political level to demonstrate the leadership and efforts that Guimarães has made towards climate neutrality and to be a lighthouse for other municipalities in Portugal. Furthermore, the Municipality of Guimarães intends to refine its approach to the NZC economic model, as the original model does not consider industry as an isolated sector/field of action (this is an

important sector for Guimarães), and to further improve the interactions with the model (inputs and outputs).

Finally, the municipality intends to decipher the 'citizen' as a stakeholder group and explore the different levels and dimensions that these stakeholders have on the transition pathway, as they can involve families, different socio-economic levels, and backgrounds, so it would be a next step to explore this dimension in depth and understand how the different stakeholders can be involved and influence the implementation of the CCC.

7 Annexes

In the Annex is possible to find the outputs from the RME workshop sessions held by the Municipality of Guimarães and the Landscape Laboratory of Guimarães, and the table B-1.1: Impact Pathways.

Outputs from the Workshops for the CCC

Figure 33 shows one of the two canvases used for the first round of RME workshops on energy, mobility, waste, and circular economy. The tables below show the ideas that the participants wrote on post-its.

Figure 33. Ideas canvas for the first round of workshops.

Energy workshop

Table 1. Outputs from the Ideas Canvas from the energy workshop.

	Large scale renewables	Small and community scale renewables	Energy innovation	Substitution of gas	Energy efficiency
Down-to-earth ideas	Reduce the bureaucratic processes. Identification of the potential to have small scale renewables. Improve knowledge and know-how on the subject.	Installation of PV panels. Industry cluster for energy production. Small scale wind turbines on industry. Electric vehicle (also electric bicycle) charging points. Increase the self-consumption of energy.	Upcycling of batteries. Industrial processes update. Electric agricultural machinery.	Gas price increase. Upgrade of the schools' cafeterias (other energy source than gas). Transition from gas to thermal energy. Substitute the current energy used for heating. Upgrade, for example, to biomass.	Use less electronic devices. Uptake of public transports. Substitution of domestic equipment's for more efficient ones. Efficiency of the industrial equipment's. Capacity building on energy efficiency.
Heavenly ideas	Small scale hydric stations. Hydrogen storage. Financial incentives for the uptake of renewable energy sources.	PV panels for schools, kindergartens. PV panels on every new building construction. Renewable energy communities (industry and residential). Financial aid/bonus from the national government for the industries that achieve the goal of energy reduction consumption.	Investment on hydrogen. Capacity to storage energy, electric energy. Conversion of equipment fuel by gas to hydrogen. Solar parks. Smart monitoring systems of demand/supply of energy.	Biofuels for public transports. Biogas production (instead of gas). Biofuels for the waste fleet collection. Solar thermal renewable energy. Increase the capacity of the energy network distribution. Electrification of the residential sector.	Use energy on the peak hours of production. Smart energy monitoring systems. Financial support to implement energy efficiency measures.

				Rehabilitate the gas generated in landfills.	
Ideas from another planet	A portion of the generated renewable energy should be allocated to social sectors. Development of renewable energy sources that contribute to preserve local biodiversity.	Sport facilities and gymnasiums that produce energy from the physical activity. More renewable and ecological batteries for electric energy at zero cost. Storage of hydrogen and heat. Panels capable of production energy at nighttime. Every residential house, and building at the historical centre of Guimarães has a REC. Cars with solar panels built on the roof of the car.	Management systems of equipment with Artificial Intelligence. Electrification of the industry. Zero fossil fuels. Carbon capture storage technologies.	Transition to hydrogen in the industry. Penalties for the companies that produce gas.	Mandatory the requirement of nZEB for buildings. REC throughout the Guimarães – industry, public sector, citizens, and community.

Mobility workshop

Table 2. Outputs from the Ideas Canvas from the mobility workshop.

	Commuting	Transport of materials/resources	Fleet management and outsourcing
Down-to-earth ideas	Telework/Home office, when possible. More supply of electric public transport. Kindergartens in companies. Free tickets for company employees. Availability of bicycles for employees. Ride sharing system. Platform where company employees can communicate and promote car sharing.	Group goods and only proceed with distribution when the lorry is full. Establish a study body for the mobility of materials - Study Observatory. Transport raw materials only with a capacity of no more than 80%. Creation of transport routes for raw materials that are shared by companies. Increase the autonomy of electric transport vehicles. Use local raw materials whenever possible.	Outsourcing - look for partners who meet sustainability criteria. Promote a platform for the use of transport. Logistical approach of the companies. Promote more efficient vehicle fleets. Last mile delivery. Inter-company vehicle sharing system.
Heavenly ideas	Offer public transport tickets together with wages. Financial incentives for using more sustainable transport. Availability of public night transport.	Use of drones. Collective transport of materials on specific days. Grouping of materials in a single transport. Pick-up points.	The entire fleet uses clean energy (electric and hydrogen). Ban on vehicles with internal combustion engines (in the city). Disclosure in a simple way the routes available in the centre. Creation of an infrastructure for mobility and bicycles in the city centre. Community workshop for donation, repair, and exchange.
Ideas from another planet	Development of a public transport network for workers. Hyperloop in Guimarães.	Create transport tunnels. Dedicated roads. Electrification of transport (heavy duty trucks, etc).	Hydrogen powered fleets. National government finance transition to hydrogen.

Waste and circular economy workshop

Table 3. Outputs from the Ideas Canvas from the waste and circular economy workshop.

	Waste prevention	Food waste	Waste or by-products - circular economy	Recycle more - increase recycling rates
Down-to-earth ideas	Reusable shopping bags. Bottle refill stations.	Composting. Food donation programs.	Community swaps. Second-hand and thrift shops.	Education campaigns. Plastic recycling initiatives.
Heavenly ideas	Repair cafés. Cultural waste free events. Upcycled art installations.	Production of energy using food waste.	Textile recycling bins. Companies and industries share on platform the by-products that they have and can be trade-off.	Recycled playground equipment. Tire recycling.
Ideas from another planet	Waste Art.	Zero waste in restaurants and food related establishments.	Full circular economy companies.	Recycling rates near 100%.

Table 4. Impact Pathways of the Municipality of Guimarães (Table B-1.1)

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
Energy systems	Governance and policy	EP: Renewable Energy Sources (RES) acceleration framework	EC: New regulation and framework for RES. District C as a first trial.	LO: Implementation of regulation and framework for RES. Expansion of the results obtain on District C.	I: Reduced energy poverty, Reduced GHG emissions, Increased access to clean, stable, affordable energy	126 kt CO_2e	I: Improved air quality
				LO: Creation or update of necessary regulation and policy framework for facilitating energy efficiency and renewable energy communities.			
		EP: Renewable Energy Communities (REC) and Digitalisation of energy	EC: Business models and investment cases created. First application on District C.	LO: Set up of the necessary business models and investment concepts for energy efficiency renovation projects and renewable energy communities set up. Expansion of the REC throughout the territory.	I: Reduced energy poverty, Increased access to clean, stable, affordable energy		I: Mainstreaming of new economic models like proximity and sharing economy
			EC: Uptake of digital tools in energy management and consumption	LO: Improvement of monitoring and management of energy consumption	I: Increased energy efficiency or rate of retrofit, Reduced energy demand, needs, or consumption		I: Decreased future maintenance and capital costs

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
			systems, through District C.				
		EP: RES self-consumption: households, industry, companies, institutions	EC: Site selection and potential users/beneficiaries of solutions identified and engaged in process	LO: Increased photovoltaic (PV) systems: -Houses -Apartments -Industry -Institutions	I: Reduced GHG, Increased access to clean, stable, affordable energy		I: Improved air quality
	Learning and capabilities	EP: Capacity building actions of municipal staff	EC: Selection of municipal staff to receive training, define a capacity programme	LO: Build capacity among the municipal staff and policy makers.	N/A	N/A	I: Improved access to information, awareness and behaviour change
		EP: Guidance for heritage energy efficiency renovation	EC: Development of a guidance for heritage energy efficiency renovation	LO: Improvement of the energy efficiency of heritage buildings at Guimarães	I: Increased energy efficiency or rate of retrofit (including district heating)	N/A	I: Improved access to information, awareness and behaviour change, decreased future maintenance and capital costs, Enhanced liveability attractiveness/ aesthetics (align with New EU Bauhaus Goals)
Mobility and transport	Governance and policy	EP: Alternative sustainable transportation modes	EC: Reduction of private cars	LO: Decrease in the private cars circulating in the city	I: Reduced GHG emissions, Decreased modal share of private vehicles	26 kt CO_2e	I: Increased physical activity and active lifestyles, Improved air quality, Stress relief associated with

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
							traffic, more green spaces, Reduction of noise pollution, Road safety
			EC: Increase pedestrian and cycling habits	LO: Pedestrian and cycling are one of the main modes for transportation (besides public and shared transports)	I2.2: Reduced GHG emissions, increased modal shift to public transit, walking, cycling		I: Increased physical activity and active lifestyles, Improved air quality, Reduction of noise pollution, Increased road safety, Increased physical activity and active lifestyles
			EC: Increase public transport use	LO: Public transport wide adoption by citizens	I: Reduced GHG emissions, increased modal shift to public transit, walking, cycling	14 kt CO_2e	I: Increased physical activity and active lifestyles, Improved air quality, Reduction of noise pollution, Increased road safety
		EP: Bundling actions to uptake public transports: Bus Rapid Transit (BRT) and Promotion of Public Transports	EC: Studies and first steps towards the Bus Rapid Transit (BRT) implementation	LO: Implementation of BRT services on national roads 101 and 206	Reduced GHG emissions, increased modal shift to public transit, walking, cycling		I: Improved air quality, Reduction of noise pollution, Increased road safety, Local economic activity and global connectivity

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
	Technology/ infrastructure	EP: Sustainable delivery services	EC: Ideation, prototyping and redesign of delivery services. Carbon-free last-mile services.	LO: Carbon-free delivery system roadmap developed and implemented with key stakeholders. Also involves the optimization of trucking (light and heavy) logistics. LO2.5: Implementation of carbon-free delivery with at least one stakeholder in tested area, e.g., District C.	I: Reduced GHG emissions, Increased uptake of low-carbon technology vehicles for private, freight, public transport	23 kt CO_2e	I: Improved air quality, Reduced noise pollution
		EP: Electric mobility shift: private passenger vehicles	EC: Map of potential users/beneficiaries of electric mobility users and engagement.	LO: Widespread of electric mobility. Conversion of diesel and gasoline vehicles to electric ones: - Combustion passenger vehicles	I: Reduced GHG emissions	11 kt CO_2e	I: Improved air quality, Reduced noise pollution, Increased technological readiness and rate of adoption
		EP: Electric mobility shift: light goods, and heavy-duty vehicles	EC: Map of light duty and heavy-duty vehicles owned by the municipality and create engagement with stakeholders that	LO: Widespread of electric mobility. Conversion of diesel and gasoline vehicles to electric ones: - Light goods vehicles (100%) - Heavy goods vehicles (88%)	I: Reduced GHG emissions	20 kt CO_2e	I: Improved air quality, Reduced noise pollution, Increased technological readiness and rate of adoption

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
			have this type of vehicles.				
		EP: Buses green conversation	EC: Ongoing and steady fleet conversion of 32 buses by Guimabus company	LO: Full conversion of the fleet of 32 buses to electric vehicles	I: Reduced GHG emissions, Decreased modal share of private vehicles, Increased uptake of low-carbon technology vehicles for private, freight, public transport	3 kt CO_2e	I: Improved air quality, Reduced noise pollution, Increased technological readiness and rate of adoption
		EP: Conversion of the urban solid waste collection fleet	EC: Study of alternative sustainable fuels for the urban solid waste collection fleet (electricity, biofuels, among other possibilities)	LO: The urban solid waste collection fleet uses clean energy as fuel	I: Reduced GHG emissions	1 kt CO_2e	I: Improved waste management and efficiency, Increased investments in RandI, Increased technological readiness and rate of adoption
		EP: Carpooling and car sharing	EC: Design of the carpooling system for Guimarães, starting as a pilot project for the local community.	LO: Increase the acceptance of carpooling by the community and workers who work in the same area. The system is already in place and has led to a reduction in the use of private cars.	I: Reduced GHG emissions	8 kt CO_2e	I: Reduced noise pollution, Improved air quality, Increased technological readiness and rate of adoption

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
Waste and circular economy	Governance and policy	EP: Biowaste upgrade	EC: Upgrade and expansion of the biowaste recovery through the District C trial.	LO: Increase in the biowaste selective collection throughout the territory.	I: Reduced GHG emissions	10 kt CO_2e	I: Improved waste management and efficiency, Increased deployment of material cycles and circular economy, Improved access to information, awareness and behaviour change
		EP: Undifferentiated urban waste reduction	EC: Expansion of undifferentiated urban waste reduction strategies through the District C trial.	LO: Substantial decrease in undifferentiated waste collected.	I: Reduced GHG emissions		I: Increased deployment of material cycles and circular economy, Improved waste management and efficiency Improved access to information, awareness and behaviour change
		EP: Waste production reduction	EC: First steps of waste production reduction. Circular economy practises to reduce waste production. District C trial and replication of best practises.	LO: Decrease the overall urban waste production.	I: Reduced GHG emissions		I: Increased deployment of material cycles and circular economy, Improved access to information, awareness and behaviour change

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
		EP: Recycling upgrade	EC: Increase recycling rates.	LO: Increase reuse and recycling of municipal waste.	I: Reduced GHG emissions		I: Public health, Economic benefits, Increased deployment of material cycles and circular economy
	Financing and funding	EP: New circular business models	EC: Support the implementation of circular local business leveraging from citizens inputs, through District C.	LO: Implementation and expansion of circular business models, e.g., repair caffe concept renting of tools/appliances, second-hand and thrift shops, and markets	N/A	N/A	I: Increased local entrepreneurship and local businesses/ventures, Increased deployment of material cycles and circular economy, Mainstreaming of new economic models like proximity and sharing economy, , Increased number of skilled jobs and rate of employment, Reduced harmful ecological footprint
		EP: Business symbiosis	EC: Creation of matchmaking and marketplace actions, to promote local business symbiosis and start-ups,	LO: Expansion of matchmaking and marketplace	N/A	N/A	I: Mainstreaming of new economic models like proximity and sharing economy, Increased local entrepreneurship and local

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
			leveraging in the city's strategy for circularity, through District C.				businesses/ Increased number of skilled jobs and rate of employment
Green infrastructure and nature-based solutions	Governance and policy	EP: Green areas	EC: Prototyping of needed green areas. District C as a testbed.	LO: Masterplan of areas to intervene and recovery/implement green areas for carbon capture. Expansion of green areas.	I: Increased carbon sequestration	N/A	I: Improved air quality, Improved nature restoration, increased non-invasive species and pollinators, Increased urban forestry, plantation and improved plant heath, Improved soil-health
		EP: Green belt	EC: Feasibility studies of a green belt, though the District C.	LO: Implementation of a green belt	I: Increased carbon sequestration, Enhanced stability of urban infrastructure	N/A	I: Improved air quality, Improved nature restoration, increased non-invasive species and pollinators, Increased urban forestry, plantation and improved plant heath, Improved soil-health
		EP: Biodiversity conservation and restoration	EC: Improved biodiversity.	LO: Recovery, reconstitution, and resilience of biodiversity ecosystems.	I: Increased carbon sequestration	N/A	I: Improved nature restoration, Increased non-invasive species and pollinators

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
		EP: Urban private community gardens	EC: Mapping of existing urban private community areas in which urban agricultural practices can be promoted. District C as a testbed.	LO: Urban private community gardens expansion.	I: Increased carbon sequestration	N/A	I: Improved land-use management practices
Built Environment	Governance and policy	EP: High efficient new buildings	EC: Establishment of local policies and follow-up of national regulation for new building green standards.	LO: New buildings follow and are constructed under the top performing standards.	I: Reduced GHG emissions, Increased energy efficiency or rate of retrofit	2 kt CO_2e	I: Enhanced liveability attractiveness/ aesthetics (align with New EU Bauhaus Goals)
	Finance and funding	EP: Building deep retrofit	EC: Increase demand of energy efficiency renovation projects. District C as a trial.	LO: Rehabilitation, retrofitting, and renovation of energy efficiency renovation projects	I: Reduced GHG emissions, Increased energy efficiency or rate of retrofit.	11 kt CO_2e	I: Increased economic thriving, increased local entrepreneurship and local businesses/ventures, mainstreaming of new economic models like proximity and sharing economy Improved living conditions
	Technology/ infrastructure	EP: Adoption of efficient lighting and appliances	EC: Substitution of old and not efficient lights and appliances	LO: Improvement of energy efficiency lighting and appliances, as well street lighting.	I: Reduced GHG emissions	18 kt CO_2e	I: Decreased future maintenance and capital costs

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
Industry	Technology/ infrastructure	EP: Industrial energy efficiency initiatives	EC: Plan of the implementation measures for an improvement of energy efficiency	LO: Reduction of energy consumption and more efficient processes	I: Reduced GHG emissions	66 kt CO_2e	I: Economic benefits, Reduced harmful ecological footprint, Improve air quality
		EP: Solar energy uptake	EC: Deployment of PV panels for industry in Guimarães and thermal energy production through solar collectors	LO: Increase of the solar energy production and thermal energy production	I: Reduced GHG emissions	8 kt CO_2e	I: Economic benefits, Reduced harmful ecological footprint, Improve air quality
		EP: Green hydrogen for Guimarães' industry	EC: First users/Front-runners of hydrogen in industrial processes	LO: Guimarães' industries adopt blended options of hydrogen and natural gas	I: Reduced GHG emissions on the industry sector, Increased access to clean, stable, affordable energy	37 kt CO_2e	I: Improved air quality, Increased investments in RandI, Increased technological readiness and rate of adoption
		EP: Biomass uptake	EC: Study the introduction of biomass for thermal energy for the industry.	LO: Second life to biowaste, use of biomass by the industry.	I: Reduced GHG emissions	30 kt CO_2e	I: Improved air quality, Increased investments in RandI, increased technological readiness and rate of adoption, Increased technological readiness and rate of adoption

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
		EP: Biomethane uptake	EC: Study the introduction of biogas by the industry for thermal energy and energy production.	LO: Second life to biowaste, use of biomethane by the industry.	I: Reduced GHG emissions	58 kt CO_2e	I: Improved air quality, Increased investments in RandI, increased technological readiness and rate of adoption, Increased technological readiness and rate of adoption
	Learning and capabilities	EP: Top management engagement for sustainable industry	EC: Better understanding by top management of the importance of sustainability in industry.	LO: Increased commitment from top management to prioritise sustainability in their industrial operations.	N/A	N/A	I: Increased economic thriving
			EC: Improved knowledge of the potential economic, social, and environmental benefits of adopting sustainable practises.	LO: Adoption of sustainable practises, such as energy efficiency measures, waste reduction and resource optimisation, at the organisational level.			
		EP: Promotion of sustainable industry in partnership with relevant industry associations	EC: Collaborative networks and partnerships established with relevant industry associations.	LO: Increased adoption of renewable energy technologies and practices within the industrial sector.	N/A	N/A	I: Increased local entrepreneurship and local businesses/ventures

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
			EC: Increased awareness and understanding of sustainable energy solutions among industry stakeholders.	LO: Integration of sustainable energy practices into the strategic plans of industry.	N/A	N/A	
		EP: Promotion for sustainable business hosting areas	EC: Define the designated area(s) or zone(s) for sustainable business hosting.	LO: Concentration of environmentally friendly businesses in designated areas, creating a sustainable business ecosystem.	N/A	N/A	I: Mainstreaming of new economic models like proximity and sharing economy
Cross cutting (energy systems and built environment)	Finance and funding	EP: Expansion of a one-stop-shop (OSS)	EC: Deployment and start of the OSS operation	LO: OSS is successfully implemented and embraces more citizens and parishes on Guimarães	N/A	N/A	I: Improved access to information, awareness and behaviour change
Cross-cutting (all field domains)	Technology/ infrastructure	EP: Digital twin	EC: Study of the integration of digital twin.	LO: Collaboration with experts, data collection, and technology integration. Creation of a digital twin model, data integration, simulation, and accessibility.	N/A	N/A	I: Increased technological readiness and rate of adoption
	Governance and policy	EP: Sustainable Tourism	EC: Established guidelines and best practices for	LO: Certified sustainable tourism businesses	N/A	N/A	I: Local economic activity and global connectivity

B-1.1: Impact Pathways							
Fields of action	**Systemic levers**	**Entry Point**	**Early changes (1-2 years)**	**Late outcomes (3-4 years)**	**Direct impacts**	**Direct impacts (Emission reductions if applicable)**	**Indirect impacts (co-benefits)**
			sustainable tourism within the municipality. District C as a testbed.	recognized for their commitment to environmental and social responsibility.			

NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

Climate City Contract

2030 Climate Neutrality Commitments

Climate Neutrality Commitments of Guimarães

Guimarães 2030
Join the Green Transition

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This ambitions and our Climate City Contract, was possible because Guimarães as implemented an integrated management system including a multidisciplinary interdepartmental team, affiliated entities, a Mission Structure, a Landscape Laboratory, and other institutions.

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Over 80 pivotal stakeholders from various industries, services, and other significant organizations that have pledged their commitment by signing the Guimarães Climate Pact. We eagerly anticipate your collaboration in the CCC in the upcoming year.

- The enthusiastic participants and attendees of our capacity-building sessions, including the Rapid Mass Engagement Workshops.
- NetZeroCities, especially our dedicated City Advisor, for their unwavering support and for imparting invaluable knowledge and experience sharing.
- The experts who, with commendable effort, shaped the Economic Case's development.
- The specialists in industry and mobility who tailored measures and actions fitting our local context.

A heartfelt thank you to each and every one of you that supported us at the start of this journey!

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1 Introduction

The Guimarães' pathway towards climate neutrality

Guimarães is known as the "birthplace of Portuguese nationality" and the city strives to honour its proud heritage by becoming Portugal's most sustainable city in the future – "be more than green". Guimarães has a long history of climate action and involves citizens in its actions, especially in relation to culture and environment.

Before being selected to be one of the EU 100 Climate Neutral Cities Mission, Guimarães was already strongly committed to reduce CO_2 emissions, as a signatory of the Covenant of Mayors for Energy and Climate, since 2013. Guimarães expects to achieve tangible results with its mission of 100 Climate Neutral and Smart Cities by 2030 and to be an example of what the future green cities will look like - as Guimarães' slogan "Join the Green Transition" states. This is not just about decarbonising the urban area, but also about integrating a sustainable, holistic approach to tackling climate change, e.g., circular economy, reducing inequality, sustainable mobility, energy poverty and much more.

For Municipality of Guimarães, the participation in the EU's mission 100 Climate Neutral and Smart Cities by 2030 mission allows the further development of innovative policies and projects that accommodate clean mobility, energy efficiency, renewable energy, waste management, circular economy, and green urban planning, as well as the support of a large community of experts and the opportunity to network with other cities facing the same challenges.

For the Mayor of Guimarães [1] "*the fact that Guimarães is one of the three Portuguese cities selected (...) is a clear indicator that the path of environmental sustainability taken in 2014 was a clear vision that the cities of the future cannot ignore the challenges that climate change represents for sustainable development and the quality of life that goes with it*".

The Municipality of Guimarães through the Pilot Cities Programme, a part of EU mission 100 Climate Neutral and Smart Cities by 2030, developed the District C - A zero Carbon Commitment. It consists of an integrated approach to energy, mobility, waste, and land use, focused on behavioural change, social innovation, culture, policy, green technologies, sustainable finance and new business models. All actions to be developed rely on the strong involvement of citizens, local actors, and other stakeholders, as well as innovative communication strategies and dissemination activities and the promotion of financing models.

The Municipality of Guimarães was one of the 25 applications selected from a total of 159, being the only Portuguese municipality selected. This recognition of Guimarães' strategy and pioneering spirit in decarbonisation is both a responsibility and a catalyst for the city, as decarbonisation is only possible with the participation of different actors, namely the municipality itself, businesses and industry, the public sector and, above all, the citizens.

In parallel, the Municipality of Guimarães is also a part of the Twinning Programme, a 20-month programme for knowledge sharing and transfer of good practices between Twin Cities, and the cities that were selected to join the NetZeroCities' Pilot Cities Programme. Guimarães is one of the cities that will be paired with one (or more) twin cities, and will participate in various learning activities, such as personalised online meetings, workshops, and field visits, in order to understand each other's challenges and discover joint solutions.

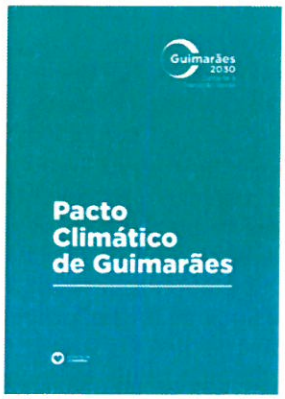

Figure 1 Guimarães' Climate Pact.

The Municipality of Guimarães has launched the Guimarães' Climate Pact as a first step towards the climate neutrality goal with the intention to bring alongside stakeholders that are aligned with Guimarães mission and want to be a part of the change. It is important to note that signing the Guimarães' Climate Pact is voluntary and non-binding. The pact signing does not automatically mean that stakeholders must also sign the Climate City Contract (CCC). The municipality aims to involve and work with the various stakeholders and citizens to deploy strategies and goals that can be aligned with the vision of Guimarães and poured on the CCC. Finally, it should be noted that the Climate City Contract is a living instrument that allows the municipality to revise the documents, update them and involve more stakeholders as the mission evolves.

Finally, the 2030 Governance Ecosystem (published as a scientific paper) shows how enabling connection between city's various stakeholders and the community is critical to accelerate the way to climate neutrality.

Guimarães Municipality Governance system is also based on promoting citizen participation and has of top priority the inclusion of citizens assemblies to promote sustainable development and building the city for the future. This idea of involving citizens in urban planning and transformation is a major strategy to promote a just transition towards a climate resilient city. Citizen engagement strategies (including children and young people) are driven by discussions and actions related to Climate and the Environment in the context of urban planning, policy-making, and collective action. This action started in 2013, where Guimarães made a commitment to transition towards a greener and more sustainable territory, society, and economy that is better prepared for future challenges under the building blocks of the European Green Deal.

As demonstrated in Figure 2, the governance ecosystem and climate policy of Guimarães is a key tool that allows Guimarães to strive on its sustainability journey:

- Interdepartmental municipal team that gathers different backgrounds and know-how.
- The Municipality of Guimarães as a boarding member of key stakeholders, such as Landscape Laboratory of Guimarães, Instituto Design Guimarães (Guimarães' Design Institute), CVR – Centro para Valorização de Resíduos (Centre For Waste Valorisation), PIEP-Pólo de Inovação em Engenharia de Polímeros, Fibrenamics, Centro de Computação Gráfica.
- Relevant stakeholders, as universities and academia (Minho University, UTAD, IPCA and UNU e-GOV).
- Municipal own entities, such as Vimágua (water and sanitation company of Guimarães and Vizela), Vitrus (company responsible for waste collection, urban cleaning, and parking management in Guimarães), allowing a close relationship and a faster track upon activities towards the city climate ambitions.
- Mission structure for sustainable development (2030 Governance Ecosystem), which includes a consultant committee of 400 members, an external advisory committee, a political commission, and multidisciplinary groups.
- Cooperation and network: gather European partners (ICLEI, URBACT, Energy Cities, Green City Accord, etc); National (Adapt Local, Portuguese Pact for Plastics, etc); and Regional (Ave Intermunicipal Community, Resinorte, etc).
- Funding: European Cohesion Policy Funds; Horizon Europe; European Investment Bank financing; National and Regional funds, and Municipal budget.

Guimarães includes in the governance ecosystem key players to promote citizen engagement towards a sustainable future. One of the key local stakeholders involved in this task is the Landscape Laboratory - Association for the Promotion of Sustainable Development. It is a research and environmental education institution that originated in 2014 as a result of a relationship among the Guimarães Municipality, the University of Minho, and the University of Trás-os-Montes e Alto Douro. It is a private, non-profit association that also includes a consortium of partners from civil society, aiming to contribute to sustainable development. The organization engages in research, development, innovation, and technical and scientific consulting in the fields of Biodiversity, Water Resources, Circular Economy, Green Areas, and Climate, as well as activities related to education and environmental awareness. Focused on public participation the Landscape Laboratory works in the creation of local groups such as the "Brigadas Verdes" (see below) and local projects that promote and engage local transformations towards the transition. In parallel, other stakeholders such as CVR, PIEP, Fibernamics promote knowledge and technological transfer from academia to the economic sector while local universities and academia build knowledge to be applied in the territory.

The 2030 Guimarães Governance Ecosystem is also mentioned in more detail on 2030 Climate Neutrality Action Plan (Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality).

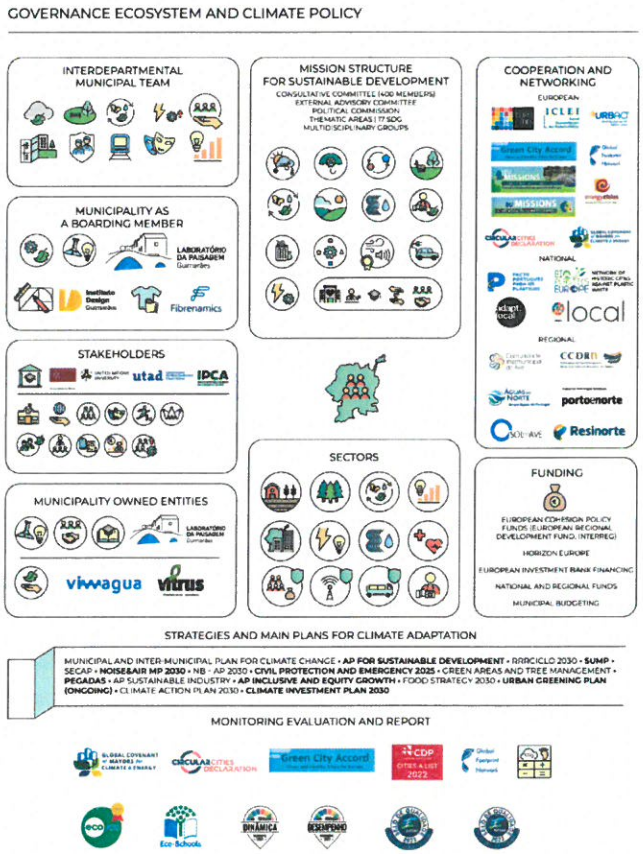

Figure 2: 2030 Guimarães Governance Ecosystem (source: Candidacy Guimarães to Green Capital Award 2025)

The Municipality of Guimarães has already committed to climate action throughout the last decades, having accumulated several experiences and initiatives.

The following topics are able to demonstrate all the work done (and ongoing), initiatives, and partnerships achieve by the municipality in an effort to fight climate change, create a sustainable city, and a social and just society.

Main achievements:

Commitment/Awards	Description
Signed Covenant of Mayors for Climate and Energy 2030	2013
Signed Green City Accord	2021
Winner of other City Awards	• UNESCO World Heritage (2001) • European Capital of Culture (2012) • European City of Sport (2013) • Best European City of Sports – ACES (2014) • Green Project Award 2014 – Original Written Work Category - PAYT Project • The Plan AWARD 2015: International Center of Arts José de Guimarães • **Green Project Award** 2016 – Social Innovation Category – EcoPontas and PapaChicletes Project • **Municipality of the Year** - UM CIDADES Award – PAYT Project (2017) • **Green Project Award** 2017 – Agriculture and Forestry Category – Rural-based Incubator Project • EcoXXI – The Most Sustainable Portuguese Municipality (2017, 2018 and 2019) • Agir Award REN 2021 - Prochild Colab 2nd place • Sustainability National Award (2020) • Green Flag Award - Monte Latito Gardens (2020-2021) • North Municipality of the Year 2021 - UM CIDADES Award - "District C" project • Municipality of the Year Award 2021 – Guimarães Marca; EcoParliament and Schools' Participatory Budget

	• Green Cities Award – Biocultural Corridor Project (2021) • Carbon Disclosure Project (CDP) - A List (2018, 2019, 2020, 2022) • EU Mission 100 Cities: Climate-Neutral and Smart Cities (2022) • National Urban Rehabilitation Award 2022 - Social Impact Category - Rehabilitation of Jordão Theatre building – District C • ERSAR quality label (2022) – Waste and Water Management • "Living in Equality" Award for (2022/2023) • National Sustainability Award 2023 – "Preservation of Natural Capital" Category – River Wardens
Other commitments at European level	• Alborg letter (2002) • Local Agenda 21 (2004) • Basque Declaration (2016) • Eurocities Plastics Declaration (2019) • European Pact for plastics • European Circular Cities Declaration (2021) • Paris Agreement (2021) • Pact for Skills (2021) • EU Digital Cities Challenge (2021) • Stockholm+50 (2022) • Zero Waste Certification (2022) • Circular Cities and Regions Initiative Pilot (2022) • EU Mission 100 Cities: Climate-Neutral and Smart Cities: Climate Neutrality by 2030 (2022)

	• EU Mission: Adaptation to Climate Change (2023) • Tree Billion Trees Pledge (2023)

Main developments:

- In 2014, the Municipality of Guimarães elaborated its first **Sustainable Energy and Climate Action Plan** (SECAP), with the goal to reduce by 20% its Greenhouse Gas (GHG) emissions. A new SECAP, in 2016, introduced the aim to reduce a 40% of GHG emissions by 2040. Finally, to be aligned with the European and national targets, the municipality renewed its goal to be carbon-neutral by 2030, since it successfully applied to the Climate Neutral and Smart Cities by 2030. Until 2020, the Municipality of Guimarães reduced its emissions by 20%, compared to the base year of 2008, but there is still room to improve.

- The Municipality of Guimarães is also part of the **Carbon Disclosure Project** (CDP), for which annually CO_2 emissions are inventoried and reported. In 2022, Guimarães was awarded with the highest classification (A).

- In 2017, Municipality of Guimarães joined the **Network of Municipalities for Adaptation to Climate Change** and created the Local Council for Monitoring Climate Change (a member of the Advisory Council on the Environment and Environmental Sustainability).

- The concentrations of the three air pollutants (NO_2, SO_2, and PM10) when combined through the air quality index, CityAir, show that, the **Municipality of Guimarães quality indexes are mostly Good and Very Good**.

Currently, the municipality of Guimarães has 1 377 km of water networks, which represents 98,1% service coverage, in terms of public water supply. In 2022, all analyses performed to the drinking water, complied with the European Directive with a rate of 100%. These outcomes result from implementing a water quality monitoring plan that uses continuous monitoring and a safety plan according to the recommendations of WHO[1] and IWA[2], thus ensuring the protection of public health.

- Given the excellent results so far, in 2022 the **PAYT** (**Pay As You Throw**) system is already being extended to the city, encompassing 12000 users. Since its implementation in 2016 PAYT system successfully reduced mixed waste to 172 kg per capita/year, increasing to 115 kg per capita/year recycling packaging waste, and reduced 17kg per capita/year of waste production, in opposition to national projections.

- Municipality of Guimarães is committed to protecting and restoring biodiversity, in alignment with the EU Biodiversity Strategy 2030. The Local Action Plan for Biodiversity 2030 has facilitated the implementation of biodiversity and habitat monitoring programs that gather scientific information to support natural resource management in both urban and rural environments. In 2022, the 16,5 km cycling network was expanded with an additional 35 km (almost concluded), with 0,7 km currently under construction.

- Thanks to the planting of 2 000 trees annually, Municipality of Guimarães has an urban tree coverage of 1 130,8 ha, representing a percentage of 18% of tree canopy. In addition, the city plants an autochthonous tree for any new birth and has committed to planting three billion

[1] WHO: World Health Organization
[2] IWA: International Water Association

trees as part of the EU Forest Strategy. Between 2010-2021 increased its green infrastructure by 195.1ha (approximately 20.9%).

- The reduction in total emissions per year in Municipality of Guimarães (-23,3% from 2008 to 2017) follows the trend in the country and is in agreement with the international climate policies that Portugal has adopted.

- In transport-related per capita CO_2 emissions, there is also a downward trend (-10,6% from 2008 to 2017).

- In local authority buildings, the goal was to reduce energy consumption in 30% by 2020. A 10% reduction in energy-related costs has already been achieved in local authority buildings (2016-2018).

Promoting public participation and citizen engagement:

Based on the will to create a sustainable city in the future Guimarães developed an education action plan and several actions that empower citizens knowledge and participation. Citizen engagement has been and will be key towards a sustainable and climatically neutral future in Guimarães. Some initiatives mentioned below demonstrate the effort to include different levels of participation across several major subjects addressing climate transition.

Environmental and sustainability education:

- **The PEGADAS Programme**: is promoted by the Landscape Laboratory and the Guimarães City Council in collaboration with a set of local, national, and European partners. It is based on the sustainable development strategy for the municipality and the promotion of environmentally friendly and inclusive policies. This is a comprehensive program dedicated to environmental education, serving as a fundamental factor in promoting community practices based on ecologically sustainable principles, aiming to initiate a paradigm shift in people's behavior and way of life. The program targets mainly educational activities for the 98 schools in the territory covering over 20,000 students, although the program by itself is open to all age classes and private and public organizations. Around 55% of the environmental and sustainability program is directed to children (under 12), 40.8% to youth (under 18). More than 500 hundred activities are performed per year.

- **Eco Afonsinho:** is an electronic game developed to help children to test hot to generate direct and constructive effects on the city's environment. This immersive game aims to make the children of Guimarães active agents of ecological change.

Democracy and just transition:

- **Eco Parliament:** is the flagship activity of the PEGADAS program that promotes local youth debate on sustainable development. Teams of young participants identify environmental challenges and propose sustainable solutions through debate sessions. Eco Parliament is accompanied by various technical visits to the school environment to monitor progress. More than 200 students involved every year.

- **Brigadas Verdes:** are volunteer groups dedicated to activities related to environmental preservation and promoting sustainability, usually in their residential parish. These brigades can perform various tasks, such as cleaning natural areas, tree planting, promoting proper waste management, conserving biodiversity, and other environmentally related activities. The main goal is to promote environmental awareness. There are 38 Brigadas Verdes across 48 parishes in the territory that were involved in 150 Actions from 2016 to 2022.

- **Mobility**

- **Educabicla:** is an activity aimed at promoting the use of mechanical and electric bicycles as an alternative mode of transportation in the city. More than 9,354 citizens were already involved including students and general public at public events.

- **Metro Minuto:** is an urban strategy to promote planetary health, individual health, and instill a new lifestyle. MetroMinuto's main focus is to reduce excessive car traffic in city centers and encourage walking, thereby improving air quality in the city and, consequently, the quality of life.

Tourism

- **GreenTour:** was a European project under the scope of Circular Economy and Sustainable Tourism that aimed to improve the management of natural and cultural heritage through the implementation of networks and joint experimentation, developing methodologies and actions to promote the circular economy in the tourism sector.

Climate change

E-missão 0: aims to raise awareness of the urgency of adapting to climate change, as we face profound damages and losses as temperatures rise and impacts intensify. It aims to involve students in a collaborative, dynamic, and participatory analysis towards climate neutral actions. So far involved 32 actions and around 150 participants.

Air and noise quality

- **Limp.Ar:** is a CitiMeasure initiative, aimed to promote the improvement of air quality and noise in Urban Centre, encouraging implementation of urban forest and raise awareness of the commuting impact. Integrate education, training and awareness actions for citizens, participatory co-creation actions, interventions in urban spaces. The project includes education, capacity-building, and awareness-raising actions for citizens, participatory co-creation activities, interventions in urban spaces, and air and noise quality assessment actions in various contexts. Around 14 different actions were performed with around 205 participants.

Biodiversity and Green areas

- **Miyawaki Forest:** involved the creation of a new Urban Forest covering an area of approximately 800 m^2 that aimed to connect greenways. It was created with the help of the Guimarães community, especially students. Several dozen students from high schools, along with members of the "Brigadas verdes", local private companies' employees, and anonymous citizens, assisted in the action. In total, 300 trees and 700 shrubs of 12 different species were planted.

- **Biodiversity Patrollers**: the goal is to engage the entire community, especially the school community, in monitoring the fauna and flora of the municipality through training actions that allow for the correct recording of different species, using a field support guide and the free Biodiversity Go! app provided by the Landscape Laboratory. It involved around 10 actions and more than 300 participants.

- **Guimarães + Forest:** aims to raise awareness of native forests and the importance of their preservation, with a focus on thematic areas such as nature, biodiversity, green spaces, air quality, noise, climate change, landscape, and agroforestry techniques, as well as areas related to civic rights for the protection and creation of a more diverse, healthy, and harmonious natural environment. Under the scope of this project more than 10000 trees were planted in the territory including general public, schools and the private sector.

Engagement with global and European initiatives:

- **Circular PSP:** Guimarães was selected as a pilot city for the Circular Cities and Regions Initiative. Under the framework of the Governance Ecosystem Guimarães 2030, which links the City Hall, academia, citizens and private business, a task force was set to integrate three domains: innovation; waste and resources; citizens' awareness and mobilisation. It is Horizon Europe that aims to improve the access to innovative circular solutions, to facilitate investment and innovation through better use of available public budgets, innovative financing schemes and sourcing the local potential.

- **Let's Go Circular and BiodiverCity:** As part of the URBACT, Municipality of Guimarães intends to develop a digital platform, or APP, to test the viability of a virtual solution to promote sustainable urban development. The project develops with the interaction between various areas of municipal intervention, namely between the Municipal Divisions of Social Action, Environmental and Economic Development and Intelligent and Information System, in 2023 Municipality of Guimarães has been selected to two Action Planning Networks: Let's Go Circular and BiodiverCity.

- **DISTENDER**: H2020 project aims to achieve a better understanding on the links between climate change impacts and risks, mitigation, and adaptation options. It will deliver an integrated analysis of climate change impacts and risks, mitigation pathways and adaptation strategies, into a single framework heling understand and quantify their interactions. The outputs will provide further assistance in decision making towards climate neutrality. The Municipality of Guimarães is a case study where the developments of the project are to be tested in.

- **EUCF:** grant supports the Municipality of Guimarães to create an investment concept to finance to efficient public lighting, renewable energy communities and mitigation of energy poverty in the region.

- **Greentour**: INTERREG Sudoe project - aims to improve natural and cultural heritage management methods through the implementation of networks and joint experimentation, developing methodologies and actions to promote the circular economy in the tourism sector.

- **SW-UP Sport for Women in Urban Places**: mission to complement the initiatives that are underway all over Europe and that promote women participation in sport and physical activity but will pay special attention to the barriers that women face, namely in the design of more accessible, safe, and friendly urban environments to sports practice.

- **CCRI Circular Cities Regions Initiative**: In 2022, the Municipality of Guimarães joined the Circular Cities and Regions Initiative as a Pilot to inspire cities in their transition to the circular economy. Guimarães is prioritizing the implementation of circular systemic solutions, which includes promoting the Bioeconomy - an area that holds significant importance within their local context. In June 2023, the first roadmap was completed using the CCRI Methodology, providing valuable policy and decision guidance to accelerate the development and implementation of Circular Systemic Solutions at the local level.

Key local programmes:

- Action Plan for Sustainable Development 2020.
- Municipal Platform of Sustainable Development Goals.
- Municipal Strategy for Adaptation to Climate Change.
- Action Plan for Energy and Climate Sustainability.

- Municipal Strategy for Air Quality Improvement.
- Action Plan for Biodiversity 2030.
- Action Plan for Water Circularity 2023.
- Municipal Plan for Equality and non-discrimination.
- Forest fire defence Plan.
- Waste tariff system - PAYT (Pay As You Throw).
- RRRCICLO – Guimarães Circular Economy Strategy.
- Biowaste Plan for Guimarães 2030.
- Flood management plan.
- Water loss reduction management Plan.
- Manual of best practices for the industry.
- Zero Carbon Sports program.
- Brigadas Verdes: communities of volunteers self-created to develop projects for the protection of the environment.
- PEGADAS: environmental education programme.

Strategies and partnerships:

Figure 3: Guimarães partnerships (source: Candidacy Guimarães to Green Capital Award 2020)

Relevant processes:

- **Guimarães Sustainable Mobility Plan**: focus on soft modes, public transport, construction and qualification of intermodals, the integration of ticketing and road safety to comply with the environmental goals for reducing CO_2 emissions. The plan also focused on removal of transport infrastructure intrusive to the urban environment and a particular focus on policies beyond transport, such as health and urban regeneration. So far, attending to the baseline of 2008, the Municipality of Guimarães reduced 15% of emissions in the transportation sector in 2018.

- **Management Plan of Biowaste Guimarães 2030**: It has a time horizon of 2030, integrating a component of the Mission Structure 2030 for Development Sustainable 2030. The plan establishes strategies to expand and optimise biowaste leading to its recovery, either through the implementation of a selective biowaste collection network, either through separation and recycling at source through the implementation of domestic or community composting, The plan foresees that in 2030 100% of the population will have all types of biowaste collection service. In 2023, 35% of the population is expected to be covered by the separate collection of biodegradable municipal waste.

- **Requalification of social housing buildings**: Improvement of energy performance - using thermal insulation, replacement of frames, and installing solar heating equipment and photovoltaic systems.

- **Improve the public lightning energy efficiency**: Upgrade luminaires to LEDs. 66% replaced by 2023. Reduction in GHG emissions - 30-40% per unit. Since 2017 - 12.2% less energy consumption in 2018.

- **European Green Capital Award**: in 2017 Guimarães applied for this award. In 2023, Guimarães applied again to be the European Green Capital in 2025.

The Municipality of Guimarães also has a whole series of projects that demonstrate the city's commitment to climate action in the different dimensions of climate neutrality, avoiding a carbon tunnel vision, helping Municipality of Guimarães to move towards a sustainable and just transition. The actions and initiatives are detailed in the 2030 Climate Neutrality Action Plan.

Participation in the EU City Mission is an opportunity to continue and expand the city's work to date. Participating in the mission is a great opportunity for Municipality of Guimarães to act as a beacon in Portugal, to inspire other cities (at national and European level) to follow the city's steps and be inspired by the best practices, as well as to network with like-minded cities across Europe.

It also represents an opportunity to create national visibility on the climate change action, and the eventual possibility of national investment and funding for the planned actions.

Finally, it also allows the involvement of different stakeholders, from the public to the private sector, associations, NGOs, ENGOs, schools and academia, national and regional government actors, in the commitment to achieve climate neutrality by 2030, through a comprehensive participation and co-design process.

In summary, Municipality of Guimarães expects that the EU Mission "100 climate-neutral and smart cities by 2030" can support the city to strengthen its ambitions and strategic priorities to achieve climate neutrality by 2030 and fulfil the commitment to climate neutrality.

2 Goal: Climate neutrality by 2030

Municipality of Guimarães goal: climate neutrality by 2030

As a signatory of the Aalborg Commitments, the Covenant of Mayors for Climate and Energy, the Basque Declaration, the Paris Agreement and Local Agenda21, and as a member of the Network of Municipalities for Climate Change, the Municipality of Guimarães is committed, among other goals, to becoming a more than "green municipality". The municipality has also applied to be one of the 112 Climate Neutral and Smart Cities by 2030 and has been selected with the official support of the mayor to achieve the climate neutrality targets for 2030. The mayor has also made public statements to endorse his support for this goal.

According to the Cities Mission Expression of Interest (EoI), the Municipality of Guimarães is strengthening its goal of climate neutrality by 2030. The mayor has signed the Expression of Interest as a representative of the municipality to express the strong commitment to the goal of carbon neutrality by 2030, as defined in the mission.

The Municipality of Guimarães wants to continue working on its goals, so the CCC (Climate City Contract) refers to a climate neutrality target for the whole municipality in 2030, which is in line with the EoI target. The Sustainable Energy and Climate Action Plan (SECAP) has been revised to align it with the 2030 climate neutrality target, as in the 2014 version of the SECAP Guimarães had committed to reduce its carbon emissions by 40% by 2030 (referring to 2008 as the baseline year).

As far as exclusion sectors are concerned, GHG emissions are quantified in CO_2 equivalents (CO_2, CH_4 and NO_2), according to the Expression of Interest of the Mission for Climate Neutral and Smart Cities. The lack of other GHG quantifications is due to the Industrial Processes and Product Use (IPPU) sector. It is pointed out that it is difficult to collect data on IPUU, due to the lack of experts and technicians, disclosure information from industry, and the lack of inventories.

Agriculture, forestry, and other land use (AFOLU) is another sector for which Guimarães did not provided data yet. However, the data is currently being analysed and the city hopes to be able to report it soon.

As mentioned above, the 2030 climate neutrality target is supported by the mayor and other relevant stakeholders. It is worth noting that the transport sector and industry are the largest sources of emissions (2019), so the municipality wants to include these sectors because of their importance to the climate neutrality pathway.

However, the Municipality of Guimarães is aware that a diverse group of stakeholders, including the private and public sectors, organisations, associations, and citizens, is an essential factor to achieve the goal of climate neutrality by 2030.

In this sense, the Municipality of Guimarães will involve different groups of stakeholders, which will be described in more detail in the 2030 Climate Action Plan, as it is a "living document" that the municipality intends to improve over time and expand the circle of signatories and allies.

Finally, regarding co-benefits, Municipality of Guimarães continues to work on a holistic approach to the transition to sustainability. There are four main categories where co-benefits are most important: economic, social, public health and environmental.

Regarding the economic aspect, job creation, operating cost reductions revenue generation through more ambitious policies are examples of expected benefits. Regarding the social dimension, it is expected that the implementation of the measures in the portfolio, revised to meet the 2030 climate neutrality target, will lead to improvements in the sense of democracy and well-being, energy poverty, mobility, and access, as well as social inclusion, and improved health. In the area of public health, improvements in air quality and mental well-being are expected.

Finally, the co-benefits related to the environmental dimension are climate change resilience, reduction of dependence on fossil fuels and external sourced, green space improvement, water and soil quality, and biodiversity and ecosystem services.

3 Key priorities and strategic interventions

Guimarães' strategic priorities

Grounded on the available data (2019), the Municipality of Guimarães has analysed the state of current affairs and identified three key priorities sectors that needs to be urgently addressed to achieve 2030 climate neutrality goal: mobility and transports; industry and the built environment.

This first systemic priority related to transport will focus on electric mobility, assuming the conversion from fossil combustion engine vehicles to electric vehicles across the private, municipal, and public vehicle sectors. Linked to this, there are other actions that will be explored in more detail as part of the 2030 Climate Neutrality Action Plan. These include macro-mobility solutions such as the introduction of BRT (Bus Rapid Transit), the conversion of 32 diesel buses to electric buses by the Guimabus company, and the possibility of refuelling waste collection vehicles with biogas/biomethane produced by an eventual installation of an anaerobic digestion station.

Regarding the second systemic priority, even though the Municipality of Guimarães is not directly responsible for the emissions from the industry sector, these emissions represent a significant part of the emissions in Guimarães. As the Climate City Contract (CCC) aims to involve as many different stakeholders as possible to join and engage with the vision of Guimarães, the inclusion of industry is an important step for the municipality, due to its impact on the region's emissions.

The Municipality of Guimarães intends to continue and strengthen the relationships of collaboration with the industrial sector, since a climate successful plan depends on how the industry and the municipality can work together to stimulate a dynamic, creative, and sustainable growth. It is important to mention that a set of specific actions is present in the 2030 Climate Neutrality Action Plan, in order to ensure a stronger involvement of this key stakeholder.

The introduction of green hydrogen in industry as a substitute for natural gas would reduce emissions. In addition to this action, the electrification of industrial processes (to switch from natural gas to renewable energy sources) is a way to improve the carbon footprint of Guimarães' industry, accompanied by energy efficiency.

The third systemic strategic priority mentioned relates to emissions generated by energy consumption in buildings. To address this problem, the Municipality of Guimarães intends to increase the share of energy from renewable sources in all sectors and areas, e.g., households, businesses, institutions, and industry, and explore the retrofit of buildings according to the highest building renovation standards.

These significant changes are the starting point for the systemic change needed in the municipality to move closer to climate neutrality by 2030. It is possible to infer on the annexed 2030 Climate Neutrality Action Plan that industry, transport, and buildings are the main contributors to greenhouse gas emissions in Guimarães. In this sense, it is expected that the upcoming changes will affect all the mentioned sectors and will have a significant impact.

However, it is worth mentioning that these measures alone will not bring the Municipality of Guimarães close to its neutrality target. The previously mentioned actions need to be complemented with other medium-sized measures in the portfolio (see Module B-2 Climate Neutrality Portfolio Design of the 2030 Climate Neutrality Action Plan). These types of measures are very effective in combination,

address emissions that are not covered by the three main measures mentioned above, and include sectors other than industry, transport, and buildings.

With the proposed systemic strategic priorities, the municipality aims to set ambitious targets that will bring real, measurable change and reduce greenhouse gas emissions. Although these actions appear ambitious when combined with the other actions identified in the 2030 Climate Neutrality Action Plan, they are well planned and thought out, and ensure that Guimarães is committed to achieving climate neutrality, but on a path that is feasible and sustainable for the municipality and the involved stakeholders.

Another important piece of the puzzle on the road to climate neutrality is stakeholder engagement. The municipality is aware that it is impossible to successfully complete this journey alone. Therefore, during the co-creation process of the Climate City Contract, Guimarães brought together all kinds of stakeholders, from universities and colleges, associations, and organisations, NGOs, businesses, and industries to citizens.

Guimarães has carried out several activities during the development of the CCC, endure on several activities aimed to raise awareness of the city's carbon neutrality and to engage stakeholders along the way. To name a few of the activities carried out by the municipality of Guimarães:

- Formal presentation of the Guimarães' Climate Pact on 5th of June. Consisted of the celebration of the signatory of the pact by the stakeholders and the Mayor of Guimarães.
- Session focused on the industry and companies with the goal to present the Guimarães' Climate Pact and Climate City Contract initiative. It was an important moment to start to involve these stakeholders on the Guimarães 2030 climate neutrality vision.
- First presentation of the Guimarães' Climate Pact [2] to various stakeholders on 22nd of May – with the aim to present the vision of Guimarães on the pathway towards climate neutrality by 2030, identify the possible front-runners, and create the space for stakeholders to express their interest to work alongside Guimarães.
- Rapid Mass Engagement workshop sections Energy on 22nd of June; Mobility on 7th of Jully; Circular Economy on 20th of Jully, and to community in scheduling

A current statement by the municipality, is that none of these changes can have a real and practical impact unless the community and stakeholders are involved or empowered to embrace this path together with Guimarães.

With this in mind, the Municipality of Guimarães has developed information sessions, workshops and events to promote Guimarães' goal of becoming climate neutral by 2030. Given the decades of close collaboration with the community, universities, associations, and other stakeholders, the municipality is able to raise awareness of this challenge in a coherent and meaningful way. As part of this plan Guimarães aims to foster citizen engagement to co-create an inclusive methodological framework that enhances the democratic participation of citizens in environmental policy making and urban transformation. This framework aims to foster social cohesion (across gender, age, background, and cultures) in the collaborative identification, recognition and planning of climate-adaptive and climate-change-mitigating public spaces through co-creation and co-design actions with support of participatory democracy with an emphasis on just transition.

Finally, having the community and relevant stakeholders on Guimarães' side is a key factor in involving all actors in the green and social change that the Municipality of Guimarães is collectively striving for.

For a more detailed explanation of the three systemic priorities, as well as the other planned actions, the 2030 Climate Neutrality Action Plan examines all the interventions and how the Municipality of Guimarães intends to implement them.

4 Principles and process

Guimarães climate neutrality principles

Municipality of Guimarães intends to involve as many stakeholders as possible within the framework of the Climate City Contract and enable co-creation, in order to join forces to work towards the main goal - climate neutrality in 2030.

One of the key principles of the CCC is that decision-makers (collectively and individually) take **responsibility** for their actions. These decisions are reported, explained and open to discussion, which also ensures the dimension of transparency.

Regarding **transparency**, Municipality of Guimarães will publicly inform about the decisions to redesign and create actions, implementation measures and results to ensure that all citizens and stakeholders are informed and can contribute to the goal of climate neutrality 2030.

Regarding the **diversity of participants**, representativeness must allow all citizens to participate in the actions (age, gender, education, place of residence, socio-economic status). Inclusion should also be ensured so that all interested people can participate without restrictions. Finally, ensuring that any form of discrimination and harassment is avoided through the democratic deliberative process and that all participants can freely and safely take part in the implementation of individual and collective actions.

The process will involve **various stakeholders**, such as transport operators, waste management actors, universities and schools, national actors, and the industrial sector. As the transport and mobility sector, as well as industry, are the main contributors to emissions in Guimarães, the city has made sure to include them in the assessment of measures to close the existing gap between what has already been done and what still needs to be done to achieve climate neutrality in 2030. This took the form of technical meetings with sector leaders/representatives and dynamic sessions (some of which have already taken place and others are planned) where innovative approaches can be developed to inspire systemic and demand-driven actions to close the above-mentioned gap.

Guimarães has a long tradition of involving citizens in the democratic process of co-designing the city they want to live in. Based on scientific literature and research, climate goals can be achieved through the active participation of citizens, working with local government, and co-creating systemic change, rather than through technological and policy measures alone. In this sense, the Municipality of Guimarães is empowering its municipality to meet the 2030 Climate Neutrality Agenda by creating points of contact between citizens and local government actors, fostering a sense of belonging and responsibility for the climate.

The monitoring and joint learning components are essential to ensure that the actions in the portfolio are on track, although this is a complex task due to the different actors involved and some of the actions focus on individuals and companies, making monitoring difficult. In addition, the civic participation measures should also include underrepresented groups and take into account age, gender, ethnicity, religious beliefs and minorities.

In terms of joint learning, it's a way to share knowledge on important issues between stakeholders and the community. It's also a way to discuss how the CCC process is working, learn lessons from its implementation and move forward in developing and improving policies to achieve climate neutrality by 2030.

1. Finally, the **NZC Climate Transition Map** helps to line the process phases of the CCC: **Build a Strong Mandate:**

- To ensure a consistent CCC process, the transition team met weekly to coordinate work, distribute tasks and discuss next steps and actions.

- Each participating city department and partner is responsible for coordinating and implementing the activities in his/her area of responsibility: Office of Energy Efficiency, Department of Smart Systems and IT, Department of Urban Services, Department of Mobility and Transport, Department of Economic Development, Department of Green Spaces. Each individual department is embedded in the sustainable transformation of Guimarães and contributes accordingly to its specifications.

- Through the "Guimarães Branding" initiative, promoted by the Economic Development Department, the Municipality of Guimarães maintains a close relationship with companies that respect social, inclusive, and sustainable commitments. Regarding citizens, another important stakeholder group, the dynamic between the municipality and its citizens was previously demonstrated, reflecting Guimarães' commitment to the fight against climate change.

- The Municipality of Guimarães is perfectly aligned with all the European regulation, such as the EU Green Deal, RePower-EU, Fit for 55, as well as with the national pathway of carbon neutrality: National Climate Law (Law n. 98/2021), which targets neutrality by 2050. Guimarães has an even tighter timeline, as neutrality is to be reach until 2030; and the National Low Carbon Roadmap and National Energy and Climate Plan - the proposed actions are aligned with the vision defined in these strategies, as they are expected to support the 2050 national targets for emission reduction, renewable energy, energy efficiency and security through the envisaged behavioural change. By adhering to the national decarbonisation and sustainability targets, a relationship of mutual understanding has been created between the municipality and national stakeholders. And also, between the EU actors, as Guimarães has a long experience of participation in different projects and initiatives of the European Commission (see chapter 1 of this document).

2. **Co-design a Portfolio**:

- By accessing the current actions for decarbonisation and climate neutrality of Guimarães, it was possible to identify the actions that are most relevant for emission reduction and revitalise them as needed (e.g., by introducing a wider scope, a more ambitious target or involving more actors), as well as develop new actions to complement the current ones. This process has already started and will be revised as the actions are monitored and feedback is received from the different actors involved.

- There are different approaches depending on the stakeholder group. For citizens, through democratic and participatory processes, such as a digital platform or citizens' meetings. For business, hearings and meetings provide a focal point to build on interventions based on mutual feedback and expectations of what needs to be developed and created. As for other stakeholders such as organisations, associations and universities, a public hearing and questionnaires (online and/or offline) are examples of how Guimarães engages with these groups.

3. **Take Action:**

- As a result of the CCC, the following measures are to be implemented (some of them can be adapted to the measures already underway in Guimarães, for more details see the Action Plan – Part B).

4. **Learn & Reflect:**

- In terms of the monitoring process, metrics and processes will be used to measure progress in closing the existing gap, within the municipality's capacity, as some of the reporting indicators (from the industry side, it would be an indirect assessment, as Guimarães doesn't directly control their monitoring and reporting). Guimarães will monitor the level of engagement of citizens, organisations, academia, and other stakeholders; track engagement in actions against the criteria and defined scope; set targets; assign responsibility and

accountability; track and analyse results; report on results and present new initiatives; review the metrics regularly.

- The CCC will be revised as new stakeholders join the contract and periodically (once or twice a year as needed) as Guimarães evolves on its path to 2030 carbon neutrality.

5. **Make it a New Normal:**

- As new approaches and innovations emerge, the municipality consults the key stakeholders involved in the CCC to share how best to integrate them into the CCC to keep it up to date, as it's a "living document". The municipality informs the stakeholders involved in the CCC and the public about the new interactions (e.g., through a newsletter, a digital platform or an online/offline session).