



Climate City Contract

2030 Climate Neutrality Action Plan

2030 Climate Neutrality Action Plan of the City of Porto

Porto.





Executive Summary

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The Porto's Climate Neutrality Action Plan presents a holistic strategy for achieving carbon neutrality by 2030, emphasizing collective action, systemic approaches, and inclusivity. **The city targets an 85% reduction in greenhouse gas (GHG) emissions from 2019 levels, with the Porto Climate Pact driving citizens and organizations (currently, it has 538 individual subscribers and 228 institutional subscribers) to action and to create a large community of learning, sharing, and mutual support.** Despite challenges in attracting private investment and stimulating substantial behavioural and habit changes, the City Executive believes that a common vision and goal for decarbonization can help all stakeholders move in the same direction.

This Action Plan begins with an evaluation of the city's current state of climate action, including a **detailed GHG baseline inventory managed by Agência de Energia do Porto (AdEPorto). In 2019, Porto emitted 937 ktCO₂eq, primarily from buildings, followed closely by transports, and then waste.** Unlike industrial territories, Porto's emissions from Industrial processes and product use (IPPU) are relatively low. Despite over one-third of the city being urban green areas, recent studies indicate that Porto has a notable capacity for carbon sequestration. Knowing where the city stands in terms of energy consumption and GHG emissions is decisive to develop a solid Climate Neutrality Action and Investment Plans considering the actions being promoted by both the Municipality and by other city stakeholders.

Responding to the climate emergency, Porto, recognized as one of the 100 European carbon-neutral Mission Cities, launched the Porto Climate Pact in January 2022. Within this framework, a pivotal step was taken to consolidate the city decarbonization efforts with the creation of Porto's Transition Team, formed by 11 entities including municipal departments, companies, agencies and private entities, with a formalized commitment through the agreement "Towards Carbon Neutrality 2030". This collaborative effort emphasizes breaking down silos, fostering interdisciplinary cooperation, and addressing multifaceted challenges to achieve carbon neutrality by 2030.

Acknowledging governance barriers and multilevel governance hurdles, **Porto actively participates in a national network to align local objectives with central government policies.** Systemic barriers across sectors are identified, and a collaborative approach, including initiatives like the **Porto Climate Pact Talk Series dedicated to discussing carbon neutrality issues through a series of sessions addressing the challenges faced by the city of Porto,** is adopted to enhance understanding and participation.

In line with Porto's 2030 Climate Neutrality Commitments, **the Action Plan clearly identifies the impact pathways and strategic portfolio of actions which prioritize expanding green infrastructure, enhancing mobility options, adopting clean energy, and promoting circular practices.** Actions include doubling garden and park areas for carbon sequestration, reducing motorized transportation, promoting shared mobility and electrifying vehicles, emphasizing sustainable transportation goals. The energy system focuses on clean energy sourcing, renewable generation, and energy efficiency, while waste and circular economy actions target increased recycling and efficient processes.

Overall, Porto is committed to an 85% emissions reduction target by 2030. This means that the percentage of emissions reduction previously planned through other Action Plans already in progress represents 35% of this target, while the rest of the emissions reduction expected through this CCC Action Plan represents 50%. **Therefore, 416 ktCO₂eq represents the emissions gap which will be**



addressed through the comprehensive portfolio of actions defined in these CCC Action Plan. Residual emissions represent 121 ktCO_{2eq} coming mainly from transport and waste sectors. The plan emphasizes collaboration between municipal and private stakeholders through the Porto Climate Pact, reflecting a continuous and inclusive engagement in the climate neutrality process.

Regarding monitoring and evaluation of the Climate City Contract (CCC) and its Action Plan, **a comprehensive set of key indicators are identified and a robust plan to track progress is developed establishing a baseline (2019), a plan for carrying out routine monitoring (on a yearly basis), and mid-term (2025 and 2027) and final (2030) evaluations.** These indicators measure the outcome(s) or impact(s) of one or more of the actions in this Action Plan and show how close an action is to the desired pathway and targets.

In terms of governance, Porto's model is centred around the Porto Climate Pact and managed by the Transition Team, demonstrating a collaborative and inclusive effort involving citizens and various stakeholders, both public and private, to achieve carbon neutrality. **Beyond the goal of decarbonization, Porto also aspires to ensure a fair transition that actively engages its citizens** with several different projects and other initiatives related to Porto Climate Pact. However, challenges arise at the national level, impacting regulations, funding, and alignment with central government policies.

In its determination to **build a city that is resilient in the face of challenges, socially inclusive in its opportunities, and environmentally conscious in its development, Porto's social innovation projects and interventions are essential.** They mainly incorporate entrepreneurship incubators, awareness campaigns, and circular economy initiatives, as a forward-thinking, community-centric model for urban development.

Looking ahead, Porto plans a thorough review of the CCC in the next two years, outlining steps for climate strategy refinement, stakeholder engagement and a tailored monitoring strategy. **These steps aim to align actions, enhance citizens and stakeholder involvement, ensure effective monitoring, and adapt the CCC to Porto's unique climate journey.** Through this iterative process, Porto seeks to attract resources, monitor progress, and achieve its vision for a sustainable and resilient future by 2030.

March 2024



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Abbreviations and acronyms

Abbreviations and acronyms	Definition
ADENE	Portuguese Energy Agency
AdEPorto	Porto Energy Agency (Agência de Energia do Porto)
AE FEUP	Students Association of Porto's Engineering Faculty
AEFEP	FEP Student Association
AFOLU	Agricultural, Forestry and Land Use
ANCV	National Green Roofs Association (Associação Nacional de Coberturas Verdes)
ANI	National Agency for Innovation



BaU	Business-as-Usual
BE	Built Environment
BREAM	Building Research Establishment Environmental Assessment Method
BRT	Bus Rapid Transit
CCC	Climate City Contract
CCUS	Carbon Capture, Utilization and Storage
CDP	Disclose Insight Action (previous Carbon Disclosure Project)
CDW	Construction and Demolition Waste
CEIIA	Centre of Engineering and Product Development
CH ₄	Methane
CIRIS	City Inventory Reporting and Information System
CITTA	The Research Centre for Territory, Transports and Environment (Centro de Investigação do Território Transportes e Ambiente)
CNAP	Climate Neutrality Action Plan
CNIP	Climate Neutrality Investment Plan
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
dB	Decibel
DGEG	Directorate General for Energy and Geology
DSO	Distribution System Operator
EC	European Commission
ELPCPE PT	National Long-Term Strategy to Fight Energy Poverty
ELPRE PT	Long-Term Strategy for Building Renovation in Portugal
ENAAAC	National Strategy for Adaptation to Climate Change
EN-H ₂	National Strategy for Hydrogen
EOI	Expression of Interest
EPC	Energy Performance Contracting
eq	Equivalent
ES	Energy Systems
EU	European Union
EUCF	European City Facility
EU-SILC	EU statistics on income and living conditions
EV	Electric Vehicles
EY	Ernest & Young
FDI	Foreign Direct Investment
FEP	Faculty of Economics of the University of Porto
FEUP	Faculty of Engineering of the University of Porto (Faculdade de Engenharia da Universidade do Porto)
GDP	Gross Domestic Product
GEMINI	Greening European Mobility through cascading innovation INItiatives
GHG	Greenhouse Gases
GI	Green Infrastructure & Nature-based Solutions
GPC	Global Protocol for Community-scale GHG Emission
GWh	Gigawatt hour
GWP	Global Warming Potential
H ₂	Hydrogen
H2020	Horizon 2020
ha	Hectare



HORECA	Food Service and Hotel Industries
HVAC	Heating, Ventilation, and Air Conditioning
ICESD	Domestic Energy Consumption Survey
ICLEI	International Council for Local Environmental Initiatives
ICT	Information and Communications Technology
IDC	International Data Corporation
IMI	Municipal Property Tax
IN+	Center for Innovation, Technology and Policy Research
INEGI	Institute of Science and Innovation in Mechanical and Industrial Engineering (Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial)
inhab.	Inhabitants
IoT	Internet of Things
IP	Infraestruturas de Portugal
IPCC	Intergovernmental Panel on Climate Change
IPO	Instituto Português de Oncologia
IPPU	Industrial Processes and Product Use
ISEP	Superior Engineering Institute of Porto
kg	Kilograms
km	Kilometres
kt	Kilotonnes
kWp	Kilowatts-peak
LBC	Portuguese Climate Law
Lden	Day-evening-night Noise Indicator
LED	Light-emitting Diode
LEED	Leadership in Energy and Environmental Design
LIPOR	Association of Municipalities for the Sustainable Waste Management of Porto
Lnight	Night-time Noise Indicator
LPG	Liquefied Petroleum Gas
M&E	Monitoring & Evaluation
M&T	Mobility & Transport
M€	Million Euros
MaaS	Mobility as a Service
MAP	Mercado Abastecedor do Porto
MEL	Monitoring, Evaluation and Learning
MOBI.E	Portuguese Electric Mobility Management Entity
MSW	Municipal Solid Waste
MW	Megawatts
MWh	Megawatts-hour
MWp	Megawatts-peak
N ₂ O	Nitrous Oxide
NGOs	Non-Governmental Organizations
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
NZC	NetZeroCities
NZEB	Nearly Zero-Emission Building
O ₃	Ozone
P-3AC	Programme of Action for Adaptation to Climate Change
PAMUS	Porto's Sustainable Urban Mobility Plan
PAPERSU	Municipal Action Plan for Urban Waste Management



PART	Public Transport Fare Reduction Support Program
PCED	Positive Clean Energy District
PDIP	Porto Public Lighting Master Plan
PDM	Municipal Master Plan
PEER	Porto Energy Elevator
PERSU	Urban Waste Strategic Plan
PIH	Porto Innovation Hub
PLUS	Plan for Sustainable Logistics
PM10 or PM2.5 particles	Particles with a diameter equal to or less than 10 µm and 2.5 µm
PNEC	National Energy and Climate Plan
PNGR	National Waste Management Plan
PNPOT	National Spatial Planning Policy Program
POSEUR	Operational Program Sustainability and Resource Use Efficiency (Programa Operacional Sustentabilidade e Eficiência no Uso de Recursos)
PQAP	Porto Fifth Façade Project (Projeto Quinto Alçado do Porto)
PV	Photovoltaic
REC	Renewable Energy Communities
RNC2050	2050 Roadmap to Carbon Neutrality
RNT	Non-Technical Summary
RRF	Resilience and Recovery Funds (Plano de Recuperação e Resiliência)
SEAP	Sustainable Energy Action Plan
SMOS	Sistema de Monitorização da Ocupação do Solo
SO2	Sulfur Dioxide
STCP	Public Transport Company of Porto (Sociedade de Transportes Coletivos do Porto)
t	Tonnes
T&D	Transmission and Distribution
TIC	Campanhã Intermodal Terminal (Terminal Intermodal de Campanhã)
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCI	Via de Cintura Interna
WAKE UP!	Wider Approach to Keep Engaged citizens on sustainable Urban Policies
WCE	Waste & Circular Economy
WWTP	Wastewater Treatment Plants



1 Introduction

Introduction

The stability of the global climate system is at risk as a result of the high concentration of Greenhouse Gases (GHG) in the global atmosphere. Mitigating these emissions is urgently needed to avoid unpredictable consequences on the natural, economic, and social systems. The European Union (EU) has been leading the way: Member States should set a target of 55% reduction in 2030 and neutrality in 2050. At a national level, the Portuguese Climate Law sets a reduction in emissions of at least 55% by 2030, 65% to 75% by 2040, and 90% by 2050. **Indeed, in parallel with the drafting of its Climate City Contract, as a Mission City, Porto is also drafting its Municipal Climate Action Plan to respond to the national Climate Law, seeking to align both documents and showing a higher ambition than the national one.** Reducing GHG emissions to reach carbon neutrality requires bold measures and high public and private investment as well as a comprehensive engagement of all city stakeholders, from the Municipality to the private sector, academia, NGOs, and citizens. At the same time, this city transformation represents an opportunity for competitiveness, employment, and social justice.

Driven by its determination to lead by example and become a reference in climate neutrality, **Porto committed to accelerate carbon neutrality by 2030, reducing its greenhouse gas (GHG) emissions by 85%, compared to 2019.** This ambition was firstly expressed in 2021 in the Expression of Interest (EOI) to the '100 Climate neutral and Smart Cities' Mission and since then, the city has been diligently working on this commitment.

-85%

Porto's ambition to
reduce GHG
emissions by 2030
(compared to 2019)

Porto is the epicentre of a region with more than 1,7 million inhabitants – the Metropolitan Area of Porto, being the 4th most populous Portuguese Municipality and the 3rd most densely populated in the country. Porto city, which is the entire Municipality of Porto, is small compared to its metropolitan area, with an estimated population of just 231 800 people (in 2021) in a Municipality with only 41,42 km². Located along the Douro River estuary in northern Portugal, Porto is one of the oldest European centres, its historic centre was proclaimed a World Heritage Site by UNESCO in 1996, and the western part of its urban area extends to the coastline of the Atlantic Ocean.

In the last few decades, the city is getting more attractive for living, studying, and hosting businesses. Indeed, one in every five startups nationwide are in Porto and the city's connection to academia and research centres contributed to the creation of a hub known for generating, attracting, and retaining knowledge. Also, over the last few years, Porto has experienced significant tourism increase, which may be partly linked to the Ryanair hub at Francisco de Sá Carneiro Airport, located in the vicinity of the city. Indeed, Porto won the European Best Destination 2012, 2014 and 2017 awards and several other prizes in the World Travel Awards.

Since 2009, when it became the first Portuguese city to subscribe to the Covenant of Mayors (and one of the first five European cities), Porto has been designing a transformative way to develop a low-carbon, sustainable and inclusive city, leading by example and setting the standards for other national and European cities, while putting citizens and local stakeholders at the centre of this city transformation. This way of working and thinking has led to Porto, the second Portuguese city and the capital of the country's northern region, being selected to be part of the group of European cities that aim to achieve carbon neutrality by 2030.



This Climate City Contract is directly in line with Porto's Sustainable Energy Action Plan (SEAP), developed under the scope of the EU Covenant of Mayors, and whose goal was to achieve a GHG reduction of 60% by 2030, compared to 2004. By increasing the reduction target, the measures foreseen in the city SEAP (and included in this action plan) were revised and further strengthened. **Also, this Action Plan is fully aligned with the Municipal Climate Action Plan** in development under the scope of the National Climate Law whereas the Climate Neutrality Investment Plan builds partially on the Investment Concept developed by Porto under the scope of the European City Facility (EUCF) initiative. Also, to ensure the city's systemic change, **Porto's Climate City Contract builds on the Porto Climate Pact**, a central piece of the city strategy towards neutrality and the merging element boosting all agents to act in favour of carbon neutrality.



Figure 1. Link between CCC components and Porto's strategic plans.

By having a clear idea of how energy is used in the city and how emissions are evolving in the territory over time (the city inventory of GHG emissions cover the entire administrative territory, sectors, sources and scopes, excepting AFOLU (Agriculture, forestry, and other land use) as Porto is a purely urban area, without agricultural activity, **Porto knows that the path towards carbon neutrality in Porto is demanding and calls for collective action and demands a systemic approach where all city elements must act collaboratively, realizing the interdependencies and synergies between them and the city government.** Also, Porto realized that no matter how aligned and committed the Executive may be with this objective, it cannot drive this transformation alone. Therefore, the diversity of Porto's ecosystem should be invited to participate and act in the city transformation. In this sense, to activate and foster an inclusive climate transition, in 2022, the Municipality launched the **Porto Climate Pact with a clear rationale: The path towards carbon neutrality is demanding and calls for collective action.** The City Executive believes that a common vision and goal for decarbonization can help all stakeholders move in the same direction. Therefore,



Figure 2. Porto Climate Pact launch event.

the Porto Climate Pact intends to involve citizens and organizations to action and to create a large community of learning, sharing, and mutual support. The signing of the Pact is voluntary, non-binding, free of charge and everyone is invited to join in and, currently, it has [228 institutional subscribers](#) and [538 individual subscribers \(citizens\)](#).

In 2022, within the framework of the Porto



Climate Pact, a pivotal step was taken to consolidate the city decarbonization efforts. **An internal team, comprising diverse entities, from various municipal departments, municipal companies, and agencies, formally coalesced to spearhead the city's decarbonization strategy.** This collaborative effort, now known as **Porto's Transition Team**, had been informally collaborating for years, but now solidified their partnership through a formal agreement titled "[Towards Carbon Neutrality 2030](#)". This landmark agreement, signed by 11 entities, underscores a commitment to allocate human resources towards a shared vision of sustainability governance. This team encompasses therefore core competencies geared towards achieving carbon neutrality by 2030 and integrates:

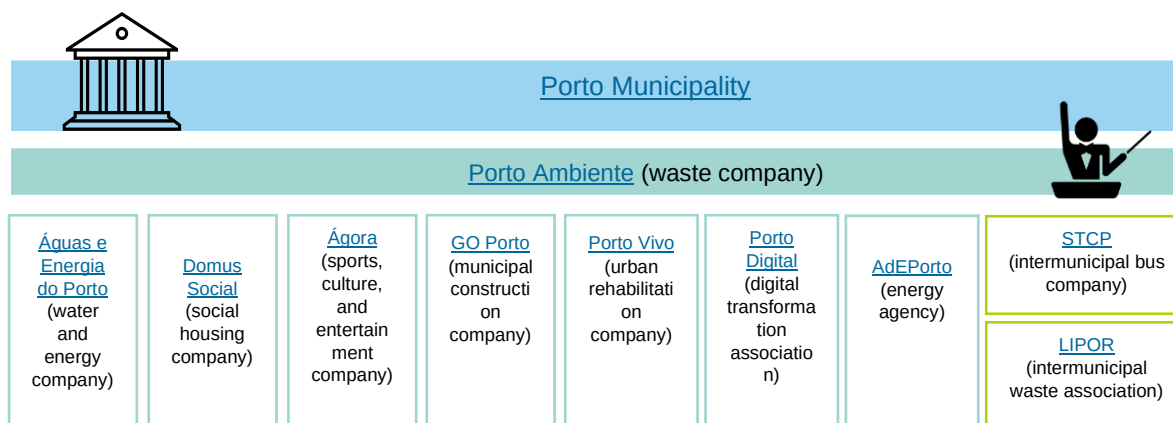


Figure 3. Porto Transition Team structure.

This initiative showcases not only the direct involvement of various Porto Municipality Departments but also strong engagement from municipal companies/agencies and private companies responsible for the city decarbonization efforts. These include the energy agency, water and energy management, waste collection and management, digital transition and transformation, public transport, social housing, and municipal buildings management, among others. **This collaborative effort emphasizes the importance of breaking down silos and fostering interdisciplinary cooperation across sectors to ensure a holistic approach to the city's transition and effectively address the multifaceted challenges of achieving carbon neutrality by 2030.**

To support this agreement, the Porto Municipal Assembly approved a formal mandate to Porto Ambiente to orchestrate the municipal efforts towards carbon neutrality. With a dedicated team to coordinate these efforts, there is a **Carbon Neutrality Department** to align these activities under the political portfolio and leadership of Mr. Filipe Araújo, Vice-Mayor of Porto, the main sponsor of Porto Climate Pact. This ensures a strong political alignment and commitment to make carbon neutrality by 2030 a reality and, especially, to ensure its importance and relevance for the future.

This integrative and growing dynamic of the Porto Climate Pact maintains continuous communication with its network of subscribers, **primarily using the Porto Climate Pact website as the main contact point and information dissemination medium.** This website features a section that is consistently updated with news from the numerous subscribers, aiming to disseminate and publicize results and best practices that can engage the community and create contagious dynamics of knowledge within the broader community. This constantly updated section can be accessed at the [Pact website](#) in both Portuguese and English versions.



One of the first priorities of this team was to map the universe of city actors with an impact on decarbonization, identifying its protagonists, their roles, and interrelations. This mapping allows the creation of lasting relationships between city actors and the design of co-creation processes between such entities in a fertile environment for new ideas and experimentation, allowing the development of a shared vision of the city. In fact, several of the biggest city energy and sustainability projects resulted from collaborations between different city entities (see Box 1 and Box 2).

To strengthen the climate transition mandate, the full city ecosystem of actors needs to be positively engaged and, although there is currently a clear idea of the roles and relationships between everyone, it is necessary to involve citizens and make them active actors in the city transformation. In this domain, Porto has developed structural processes that aim to involve citizens in decision-making and in the implementation of public policies to achieve a fairer and more sustainable city. Regarding citizen participation, Porto has been promoting the creation of various mechanisms for consultation and dialogue with citizens, mainly through the creation of events for public participation. In this way, it seeks to foster citizen co-responsibility in the management of the city, and to promote transparency and accountability. **Accordingly, Porto has been developing several citizen-centred approaches, promoting the integration of different profiles.** The following three examples reflect the identification of challenges and the strategies that have been created as opportunities to include everyone:

BOX 1: Collaborative projects

Porto Solar: Resulted from the idea developed collaboratively between the Municipality and Domus Social, with the technical support from the AdEPorto and which resulted in the installation of 1MW_p of photovoltaic energy in 29 public facilities.

BOX 2: Collaborative projects

ASCEND project: With the participation of Águas e Energia do Porto, Porto Digital Association, AdEPorto and Serralves Foundation, the HORIZON EUROPE ASCEND project will develop the first positive clean energy district in the city.

- In a broader approach, it became necessary to create a joint effort, combined with the sense of community that is so characteristic of Porto. This is how the Porto Climate Pact came about, integrating everyone in this joint effort and which, in addition to institutions, already has more than 500 individuals as signatories who are now more aware of the environmental cause and the need for action. The Porto Climate Pact maintains continuous communication with its network of subscribers, primarily using the Porto Climate Pact website as the main contact point and information dissemination platform. This website features a section that is consistently updated with news from the numerous subscribers, aiming to disseminate and publicize results and best practices that can engage the community and create contagious dynamics of knowledge within the broader community.
- The Transition Team also realized the need for a more personalized approach. For this reason, the [Porto Climate Pact Talk Series](#) was design to bring citizens and experts together



to debate ten essential topics for the climate transition. For nearly three months, the carbon neutrality issue was discussed in a talk series that debated the themes of climate change and the challenge of decarbonizing the city of Porto. These sessions, held weekly, at the Porto Innovation Hub, brought together more than 500 participants and 40 speakers. In each of the 10 sessions, the formula was constant: a moderator led a conversation between several guest speakers, experts on different topics, in a healthy sharing of good practices, ideas and ambitions about the topic of the session that inspired those present and gave clues about the way forward for the future. [Decentralized and clean energy](#), [sustainable mobility](#), [decarbonization of construction](#), [the circularity of the food system](#), [community involvement](#), [carbon sequestration](#), [the challenges of a just transition](#), [the importance of data](#), [financing](#) and [nature-based solutions](#) were the motto of the different sessions that convened figures from academia, the business sector, public organizations, and industry associations for discussion. The sessions, open to the public, were guided by the dynamics of interaction between speakers and audience, always challenged to make suggestions, questions, or make comments on the topics addressed. The interest shown by those present demonstrates the importance of the topic for civil society and is evident in the growing number of subscribers to the Pact. The Talk series discussions are available on the [Porto Climate Pact website](#), with videos of the sessions, written highlights as well as in podcast format on the main platforms. These sessions, held on [Porto Innovation Hub](#) (PIH), the innovation heart of the city, were key to engage citizens in the city decarbonization process, and to show them the set of projects being developed in Porto. Indeed, the success of these sessions inspired the Transition Team to consider this tool as one of the axes for promoting citizen participation in the city's decarbonization process during the next years. Similarly, training and co-creation sessions are planned in the Municipality's parish councils, promoting a community approach to the issue, the search for solutions based on the reality experienced locally and benefiting from everyone's participation due to the geographical proximity and the positive pressure everyone can exert on their neighbours to raise awareness and increase participation.

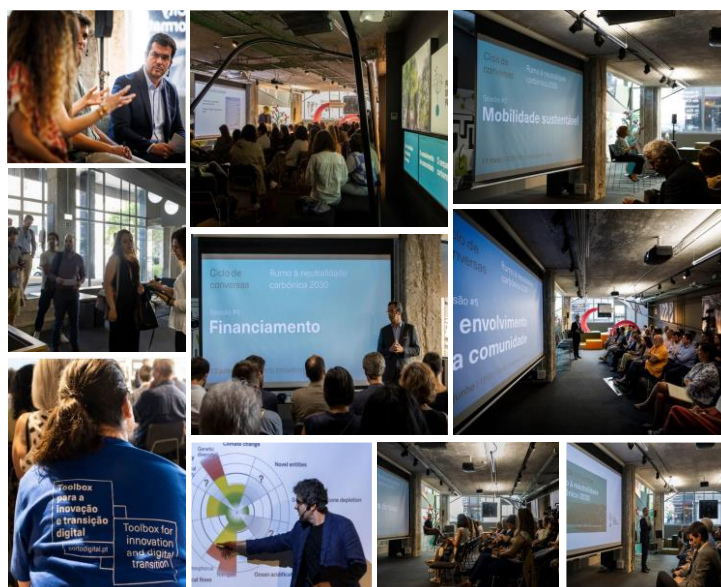


Figure 4. Porto Climate Pact Talk Series.

- To further continue this effort of engaging citizens in the city decarbonization path, Porto aims now to start to build an integrated approach merging technology and information to place citizens at the centre of the city climate action. This aim was applied to the [NetZeroCities Pilot Cities Programme](#) and the project "WAKE UP!" (Wider Approach to Keep Engaged citizens on sustainable Urban Policies) will now develop a digital engagement tool. [WAKE UP!](#) aims to develop a broader set of services provided by multiple city partners whilst raising citizens awareness and promoting the adoption of sustainable-friendly behaviours. The overall idea is to use an app associated with [Card Porto](#), to allow citizens to track their carbon footprint



and access tips to reduce it while being rewarded for sustainable behaviours. This idea was submitted and approved to the [NZC Pilot Cities Programme Cohort 2](#) and is understood as a key initiative to engage citizens and promote the so-desired behavioural change in the local population. Porto's city management model also prioritizes people, especially vulnerable groups, involving them in the sustainable development journey. Looking globally, it is clear that the most vulnerable populations are typically those who suffer the most from climate change, and in large urban centres this reality persists.

For a fair climate transition where no one is left behind and equitable access to opportunities are provided, Porto's strategies include increasing literacy and supporting citizens in mitigation but also in adaptation measures. Aligned with this, examples of mitigation measures are:

- The substantial investments in the renovation of social housing that have been made to enhance the quality and the energy efficiency of residential buildings. The Municipality of Porto has allocated more than 150 million euros in the last decade to fund these renovation projects. By upgrading social housing, Porto not only improves living conditions for its residents but also contributes to a reduction in energy consumption and environmental impact.
- Another noteworthy measure in Porto's climate mitigation strategy involves providing free public transport passes to Porto Card users under the age of 18, since 2019 until 2023. In 2024, this initiative will be financially supported by the national government taking on the funding responsibility. By offering free transportation to young residents, Porto encourages the use of public transit, reducing reliance on individual vehicles and, consequently, lowering carbon emissions. From 2024 onwards, the municipality's budget will provide 22 free public transport trips to all Porto Card users, a new incentive for urban transport in the city.

Interventions related to adaptation to climate change for the most vulnerable citizens are also relevant to guarantee a fair and just climate transition. Related to adaptation two concrete examples of measures that aim to reduce the impacts of climate change, are presented as follows:

- The homeless population is the most exposed to extreme weather conditions, phenomena that have been occurring more frequently in the city. With this in mind, Porto has developed a Cold Weather Contingency Plan for Homeless People which guarantees shelter and overnight stays in closed, heated spaces.
- Also, heavy rainfall events have become increasingly frequent in Porto, leading to disturbances in the city. During one of these events, part of the eastern area of the city, in "Ilha dos Moinhos – Fontainhas" has been particularly affected forcing the evacuation of families. The Municipality has found an effective solution to the problem by having relocated the families, acquired the land and developing a green area in which nature-based solutions will be implemented to absorb abundant rainfall water.



These are some examples of measures that are also being reflected in the Municipal Climate Action Plan, which is currently being developed alongside with the update of the Municipal Climate Change Adaptation Strategy.

Also, Porto focus on the engagement of vulnerable people during the city decarbonization.

One example of citizen involvement that the Municipality has been working on is the **URBiNAT project**, in which Porto is one of the participating cities and which seeks to create "healthy corridors"

in the parish of Campanhã, one of the city's most vulnerable areas. In the scope of this project, this area has been targeted by several investments with a view to improve the liveability of three social housing neighbourhoods through the deployment of cocreation processes involving the citizens who work and live in the parish of Campanhã, organisations and schools. These moments came in various formats, such as awareness-raising activities, talks, workshops, digital contents, and games, with around 150 participants. A set of immaterial and material initiatives were co-developed. That includes a four-hectare green park is now under construction in the location (Park Alameda de Cartes included in Porto's Action Plan) and which will incorporate nature-based solutions, complemented by educational, environmental, and socio-economic initiatives, all co-designed and co-developed by the local community.



Figure 5. Co-creation sessions with citizens in the scope of the URBiNAT project.

As part of the **Porto Orgânico project**, which aims to improve the collection and management of biowaste in the city, Porto created two community composting islands that are available for citizens to dispose of their organic waste. The two islands are located in different housing neighborhoods in the city and everyone who lives nearby can participate. The project provides initial knowledge on organic waste separation and a kit with a bucket for collecting food waste, a key to access the composter, a vertical garden and a rucksack. Participants can count on the support of technicians on the field, who oversee and monitor the entire composting process. The result is a 100 % natural organic compost, which is made available to project members. In less than two years, 151 families have contributed to the project, which has enabled more than 7,6 tonnes of biowaste to be recovered, resulting in more than 2 tonnes of compost distributed to the participating families.



This project is the result of a collaboration between [LIPOR](#) and the municipal company [Porto Ambiente](#). The implementation of these two community composting sites stems from the work carried out as part of the [City Loops](#) project, funded by the Horizon 2020 (H2020) research and innovation framework programme. Community composting has emerged as a solution for the local treatment of biowaste, making it possible to reduce costs and also reduce the associated environmental impacts. This is a project that actively involves citizens in the management of their own waste, boosts the circularity of these resources and allows for the reduction of the individual environmental impact.



Figure 6. Community composting island.

Also under development is the **"ComECO" project**, which has emerged as a quest for greater citizen involvement, with the aim of involving and training entry managers from the city's social housing neighbourhoods to promote sustainable practices in vulnerable communities, with an emphasis on literacy for sustainability. This project has the potential to positively impact part of the approximately 950 entry managers, spread across the 44 social housing groupings, as part of [Domus Social's ConDomus](#) programme, which aims to involve tenants in the management processes of the common spaces in municipal buildings, similar to what happens in a conventional building complex. One of the goals of this initiative is to develop a playbook, which will be the result of a close collaboration with municipal organisations specialising in a wide range of areas, to promote more responsible, conscious, and greener knowledge and practices. This document will empower entry managers, providing them with the necessary skills for a more positive impact and for passing on knowledge to their peers.

Actions such as practical and interactive workshops will be organised, covering topics such as waste-free cooking, reuse and the circular economy, energy, and water efficiency, for example. The experience will be gamified, establishing a closer relationship between the community and the Municipality, facilitating learning and the adoption of sustainable practices. This project aims to create a direct relationship between the economic and environmental aspects associated with sustainability, while also making a clear contribution to the social pillar. By correlating the economy and the environment, the aim is to encourage more sustainable behaviours, showing that conscious attitudes positively influence not only the individual's environmental impact, but also the city's quality of life. The project establishes an essential synergy between the Municipality and vulnerable communities, recognising the intrinsic interconnection between the city's ecosystems. By empowering these communities, not only environmental resilience is boosted, but also a direct positive impact on economic conditions is expected. These actions will be able to create proximity between the various stakeholders, benefiting the Municipality by receiving crucial data, allowing communities to actively participate in the climate transition and move closer to municipal opportunities. It shows that everyone is an integral part of a movement for sustainability, promoting a just transition towards this common goal: carbon neutrality by 2030.



By having a culture of innovation and co-creation settled in the city, to start to draft the portfolio of key actions to be included in the Porto's Climate City Contract, city stakeholders were invited to participate in a joint workshop organized together with the Net Zero Cities team

in April 2023 (Figure 7) in which, for three days, municipal entities and partners of the Porto Climate Pact worked together on this topic. Dedicated to the strategic alignment between partners, the first day included the sharing of results achieved and objectives of several entities, including the Municipality of Porto, Misericórdia do Porto, Sociedade Transportes Colectivos do Porto (STCP), Centro Hospitalar Universitário São João, Fundação de Serralves, REN Portgás, LIPOR, Futebol Clube do Porto, Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial (INEGI), SONAE, Elergone Energia and Centro de Investigação do Território Transportes e Ambiente (CITTA)/ Faculdade de Engenharia da Universidade do Porto (FEUP). The remaining sharing moments were dedicated to identifying and assessing the city's diverse climate needs, especially focused on concrete measures to be developed, with a view to carbon neutrality by 2030. This event resulted in the creation of liaison points between the different stakeholders who have since established synergies. The workshop involved also the dynamization of actions related with the [ASCEND project](#), one of the first projects financed by the [HORIZON-MISS-2021-CIT-02-04 - Positive Clean Energy Districts](#), and which will boost the deployment of the first positive clean energy district in Porto.

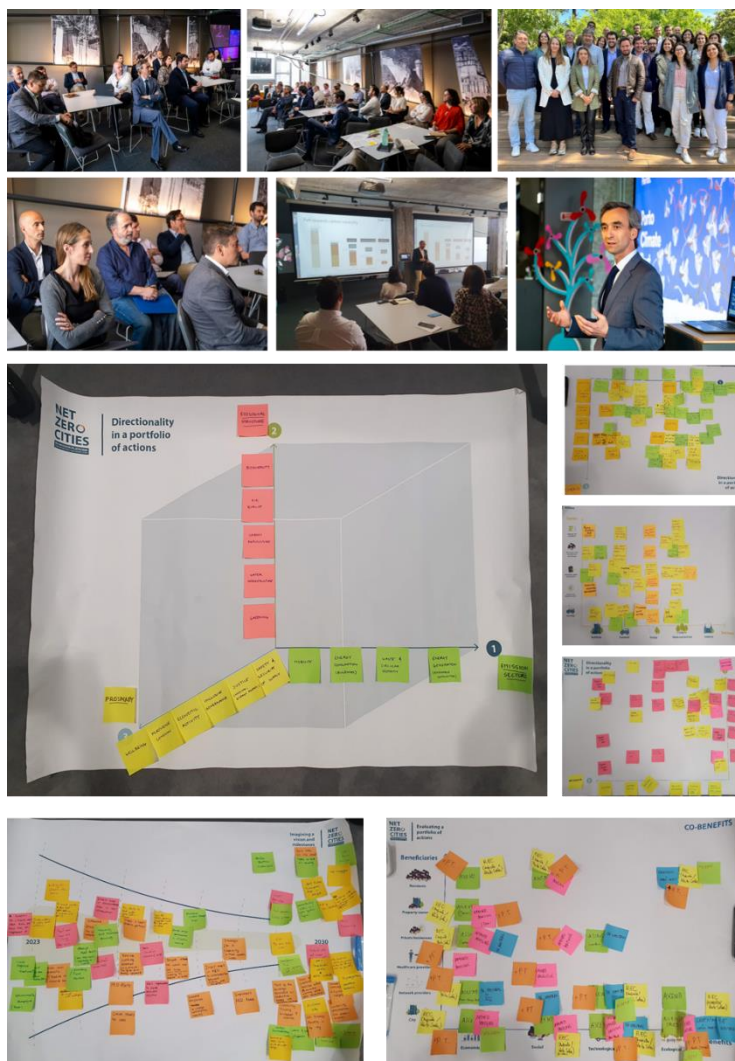


Figure 7. Workshop with stakeholders.



Also, directly in the scope of the Cities Mission participation, **to further strengthen Porto's climate mandate and since the city has an anchor role in the Porto Metropolitan Area, Porto has been participating in a network of Portuguese cities that aim to be carbon neutral.** Although only taking the first steps, this network is expected to encourage the exchange of experiences and good practices from a collaboration and mutual aid perspective. **The network was launched under the name "Network of Portuguese Cities and Regions for Climate Neutrality" and has already secured funding for its operation in 2024**

from the Environmental Fund of the Ministry of Environment and Climate Action. This network includes Portuguese cities and regions committed to the transition to climate neutrality. By taking on this leadership role, these cities and regions aim to implement climate actions, strengthen internal capabilities, and collaborate with stakeholders in order to move towards a sustainable and resilient society. The network currently comprises 21 cities and regions, and its initial selection was based on all Portuguese cities and regions that applied to the "100 climate-neutral and smart cities", even if they were not selected. The network currently has a technical secretariat provided by IN+ (Center for Innovation, Technology and Policy Research), which will serve the cities and regions that make up the Network to assist them with developing measures that contribute to climate neutrality, through knowledge, tools, and training. This network stems from good benchmark examples observed in other member states regarding the interaction between different cities working towards a common goal. Among these, we would highlight citiesES due to its proximity to Spain as a constituent country of the Iberian Peninsula and for participating in previous joint actions.

Under the organization of **CapaCITIES: Advancing national support for climate-neutral cities**, Porto is also involved in a closer national collaboration with the Mission Hub Policy Group, an initiative developed by the ANI (National Agency for Innovation), involving all the relevant public organizations within the ministries that deal with the relevant policy instruments that support the country and the cities to become carbon neutral. There is a cities' group to share experience, know-how and learnings in their work to achieve the goals of Cities Mission with these national and regional relevant stakeholders. National partner supporting the Cities Mission is the DGEG (Directorate General for Energy and Geology).

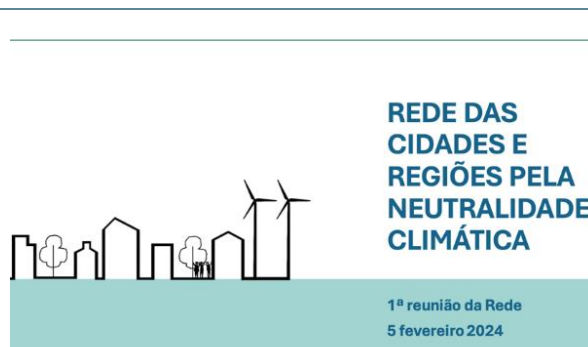


Figure 8. First formal presentation of the Portuguese Network of Cities and Regions towards Carbon Neutrality.

Table I-1.1: Climate Neutrality Target by 2030

Sectors	Scope 1	Scope 2	Scope 3
Stationary energy	Included	Included	Included
	No exclusions	No exclusions	No exclusions
Transport	Included	Included	Included
	No exclusions	No exclusions	No exclusions
Waste/wastewater	Included	Not applicable	Included
	No exclusions	Not applicable	No exclusions
IPPU	Included	Not applicable	Not included
	No exclusions	Not applicable	Not included
AFOLU	Sources not included (positive emissions)		
	Sinks included (negative emissions)		
Other	Not included	Not applicable	Not included
Geographical boundary	Same as city administrative boundary		

Map



Figure 9. Porto location.



2 Part A – Current State of Climate Action

2.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

GHG Emissions Baseline inventory

Reporting to 2004, established as the baseline year for GHG emissions in Porto's SEAP, **the city reduced its emissions in 38% by 2019 and 42% by 2021** (Erro! A origem da referência não foi encontrada.). This reduction trend has been steady over the years and is mainly driven by the

electrification of energy use in buildings (residential and commercial) and the decarbonization of the national power system. Also, this overall reduction is reflected into a significant reduction in the per capita figures which decreased 33% from 2004 to 2019 and 37% in 2021, compared to 2004. With this inventory as a basis for decision support, **the city is aware of the need to intervene on the decarbonization of buildings (stationary energy) and transports since these are the main GHG emitters, representing 51% and 42% of the total GHG emissions in 2019, respectively.** Moreover, this methodology allows the city to understand its direct (scopes 1 and 2) and indirect (scope 3) weight in emissions, which makes it possible to prioritize direct actions and to establish partnerships with other municipalities to act on the territory in a holistic way. AFOLU (Agriculture, forestry, and other land use) accounting is not included in Porto's GHG emissions inventory as no agricultural activities are developed in the city, which is a purely urban area.

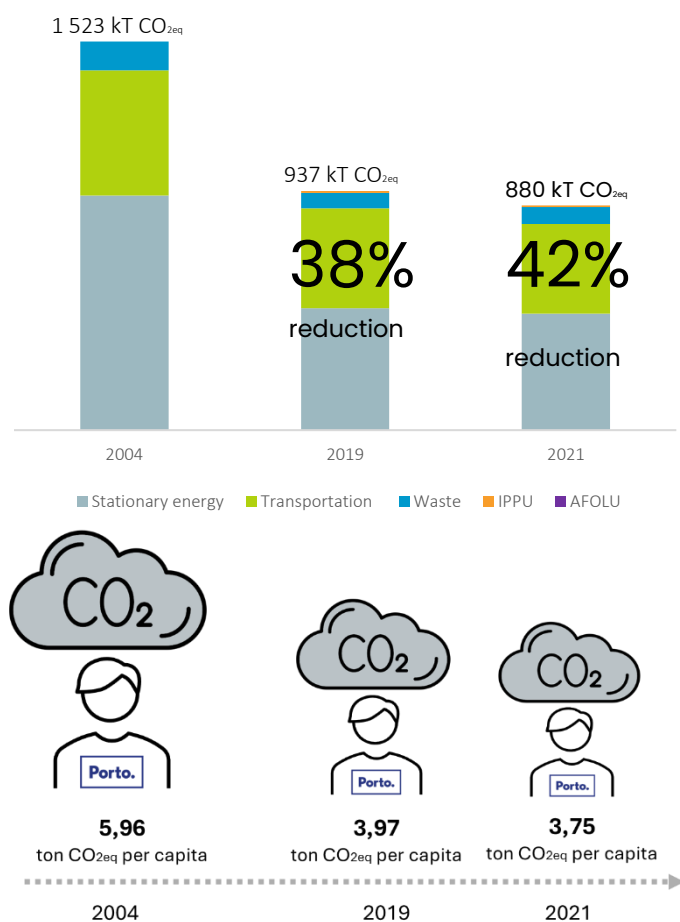


Figure 10. GHG emissions evolution (total and per capita).

The city's annual inventory is the basis for most of the city's strategies (e.g., SEAP and Municipal Climate Action Plan) and allows a clear identification of the gaps to achieve carbon neutrality in Porto: **Despite the positive evolution in terms of electrification, a considerable effort in building renovation (municipal facilities, social housing and incentives for privates) and a huge investment in sustainable mobility options (electrified bus fleet, new metro lines, free public transport), Porto still has a long way to go in terms of buildings and transports.** The strong local and national political will, as well as the existence of funding options (both from the Municipality and from funding programs as the Recovery and Resilience Plan) and a local Transition Team used to work collaboratively from some years are important enablers for Porto's decarbonization path. However, the need to massify private participation in the city climate action, both to raise awareness



and leverage private investment (crucial for building renovation, for instance) as well as the need for a profound behavioural and habit change regarding private transport and waste recycling rates are important barriers that Porto need to overcome in the coming years.

This inventory is annually updated by AdEPorto and has been carried out since 2009, endowing Porto with a detailed annual record of energy and GHG, which is key to periodical reports to initiatives such as the Covenant of Mayors¹ – subscribed by Porto in 2008 and updated in 2019 – and the CDP - Disclosure Insight Action – in which Porto has been awarded with class A in 2020, 2021 and 2022. This knowledge is crucial for the city as establishing an intelligible baseline is key to designing city policies and understanding how to act. Knowing where the city stands in terms of energy consumption and GHG emissions is decisive to develop a solid Climate City Contract Action and Investment Plans considering the actions being promoted by both the Municipality and by other city stakeholders.

BOX 3: Improvements to consider

This annual inventory is mostly based on data provided by national (i.e., DGEG) and metropolitan entities (Porto Metropolitan Area), but also on data from local actors (i.e., Metro do Porto, STCP, etc.). By being dependent on national and regional entities for data provision, the city GHG inventories have a delay of two years (i.e., data from 2019 were only made available in 2021 and so on). This issue occurs for the whole territory and an effort has been made to work with national entities to accelerate the access to consumption data. Another point to improve is related to mobility and transports. The information that allows measuring the modal split, as well as the origin-destination matrices results from a metropolitan mobility survey carried out over a period of 10 years (the last survey date of 2017). In this sense, and as a way of improving this crucial information, the municipality of Porto is discussing this issue at a metropolitan level so that the survey is carried out with a greater regularity. Finally, it should be noted that municipalities do not have a detailed characterization of how energy is consumed in buildings, especially in residential ones. Assumptions are made considering a National Household Consumption Survey - a national survey carried out every ten years and which can mischaracterize energy consumption in a purely urban environment, as is the case in Porto, since a large part of the Portuguese territory is semi-rural.

In an effort to improve these gaps in future iterations of the CCC, Porto hopes that, through its participation in the National Network of Cities and Regions for Carbon Neutrality (Figure 8), the sharing of technical knowledge (data, models and tools) and collaborations between and with interested parties, particularly with providers of crucial data, will allow the existing methodology to be improved. At the same time, members of the Transition Team, namely AdEPorto, will continue to work with national entities, such as ADENE, to also try to unlock and facilitate access to some data necessary for the local energy and emissions inventory.

Also, as the city has currently a consolidated characterisation of its direct emissions (scope 1 and 2) and since Porto is a purely urban territory, the Transition Team will now focus on assessing consumption-based emissions, namely the emissions produced by the consumption of goods and services (such as food, clothing, electronic equipment, etc.) by Porto residents. This area was not yet exploited by the team and represents the next logic step to have a better understanding of the city impact.

Since 2008, when Porto subscribed to the Covenant of Mayors, the city has been working on monitoring energy consumption and GHG emissions, developing and refining an assessment methodology. **Recently, to cover all GHG emission domains, the city updated its approach and adopted the City Inventory Reporting and Information System (CIRIS), developed by C40 Cities, as monitoring tool.** CIRIS is an accessible, easy-to-use, and flexible Excel-based tool for managing and reporting city GHG inventory data based on the Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) standards. The tool facilitates and harmonizes the reporting of emissions for five sectors, namely: a) Stationary energy; b) Transportation; c) Waste; d) Industrial processes and product use (IPPU) and e) Agriculture, forestry, and other land use (AFOLU).

The methodology adopted is detailed in Annex 1 – Energy and GHG inventory methodology and the results are presented in Tables A-1.1 and A-1.3.

¹ <https://www.globalcovenantofmayors.org/cities/european-union-and-western-europe/portugal/porto/>



A-1.1: Final energy use by source sectors			
Base year	2019		
	Scope 1	Scope 2	Scope 3
Buildings	711,18	1 202,52	140,68
Electricity (GWh/year)		1 202,52	137,84
Natural gas (GWh/year)	405,59		2,84
Liquefied natural gas (GWh/year)	73,30		
Residual fuel oil (GWh/year)	131,48		
Diesel (GWh/year)	21,25		
Lubricants (GWh/year)	0,42		
Biomass (GWh/year)	51,61		
Solar thermal (GWh/year)	20,48		
Photovoltaic (GWh/year)	7,05		
Waste and Wastewater	0,33	17,17	-
Natural gas (GWh/year)	0,33		
Electricity (GWh/year)		17,17	
Liquefied petroleum gas (GWh/year)	0,000000086		
Liquefied natural gas (GWh/year)	0,000000248		
Industrial Process and Product Use (IPPU)	27,27	-	-
Lubricants (GWh/year)	26,61		
Bitumen (GWh/year)	0,06		
Solvents (GWh/year)	0,60		
Agricultural, Forestry and Land Use (AFOLU)	-	-	-
*	-	-	-
Transports	891,97	25,61	554,55
Electricity (GWh/year)		25,61	
Liquefied petroleum gas (GWh/year)	5,97		3,98
Liquefied natural gas (GWh/year)	60,05		
Gasoline (GWh/year)	207,08		138,05
Diesel (GWh/year)	618,87		412,52
Total	1 630,75	1 245,30	695,23

* Porto is a purely urban Municipality without agricultural and forestry activities.

Figure 11 and Figure 12 detail the energy consumption in Porto, per sector and energy vector. In 2019, the Municipality of Porto was directly responsible for the consumption of 3 430,60 GWh of final energy, a 28% reduction compared to 2004, the base year defined by the city in its SEAP and official reporting processes. In addition to this consumption, indirect consumption due to losses in the electricity transmission and distribution networks (137,84 GWh) and fugitive emissions resulting from the natural gas distribution infrastructure (2,84 GWh) should be considered, **totalling the 3 571,28 GWh presented in Table A-1.1.** Being a densely urbanized territory, stationary energy (consumption in buildings) and the transport sector are large energy consumers (1 913,7 GWh and 1 472,1 GWh, respectively²). Compared to 2004, these sectors have decreased their final energy consumption by 32% and 22% respectively, translating the increased efficiency of energy consumption in buildings and transports, the electrification of energy uses (such as electric water heating and cooking) and the modernization of mobility services, because of urban mobility policies. On the other hand, as a low-industrialized territory where solid waste is treated outside the city limits, energy consumption in

² Only Scope 1 and 2.



(IPPU) (27,3 GWh) and the collection and treatment of waste and wastewater (17,5 GWh) is not very significant.

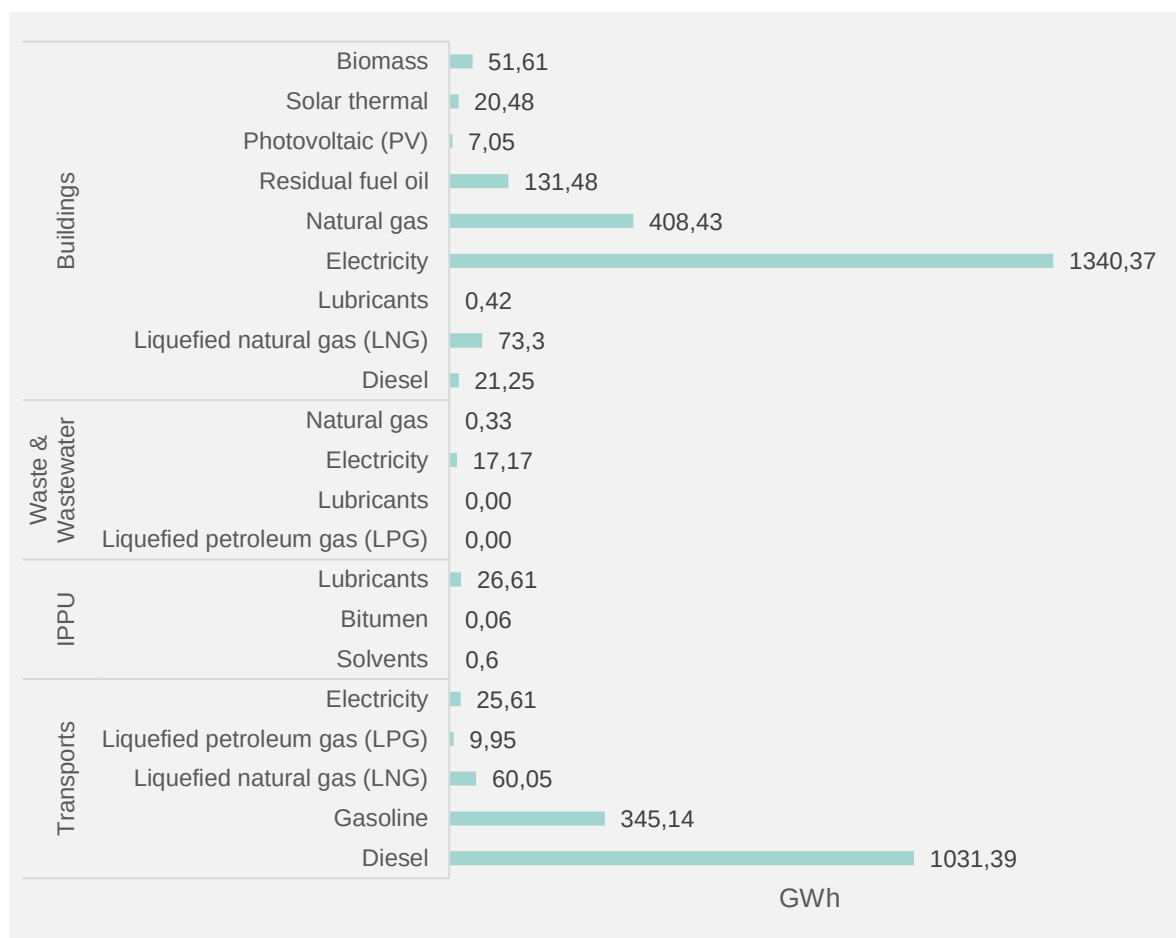


Figure 11. Energy consumption in Porto, per sector and vector, in 2019.

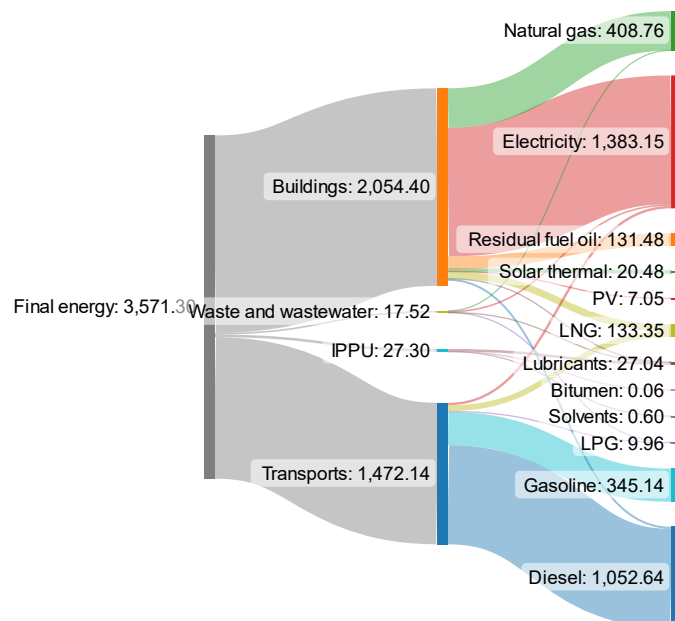


Figure 12. Sankey diagram of energy consumption in Porto, 2019.

In terms of energy vectors, those that contribute most to the overall final energy consumption in the Porto territory come from the stationary energy and transport sectors, due to the growing electrification of the former, and the weight of on-road transport in the Municipality's mobility. Thus, due to its predominance in buildings, electricity is the most used vector in the Municipality, followed by diesel. This is in fact a good starting point, as the decarbonization of the buildings sector is facilitated by the high level of electrification already taking place. However, the overwhelming dominance of diesel in the transport sector reveals the challenge of decarbonizing this sector.

Electricity is, therefore, the most used energy vector in the Municipality (39%), especially in Buildings (65% of the energy consumed in Porto's buildings is electric). Natural gas is the second most used vector in buildings (19,9%), and the third most consumed at municipal level (11%), as a result of its still widespread use for cooking and heating purposes (both hot water and spaces). Renewable sources, including biomass, solar thermal and solar photovoltaic energy, still account for only about 2% of the total energy consumed by of Porto's buildings. At the municipal scale, and because of the weight of the transport sector, diesel is the second most consumed vector in the territory (29%). Sectorally, diesel represents 70% of the energy consumption of on-road transports, followed by gasoline (23%). The consumption of natural gas in public transport (mainly due to the consumption of STCP buses) makes this vector the third most consumed in terms of road transport (4%), followed by electricity (2%), due to the existing rail transport (train and metro) network and the increasing electrification of road transport. The remaining sectors (Waste and Wastewater and IPPU), represent low energy consumption in Porto (0,5% and 0,8%, respectively), due to the low industrial presence in the city and the fact that Porto's waste is treated outside the city boundaries.

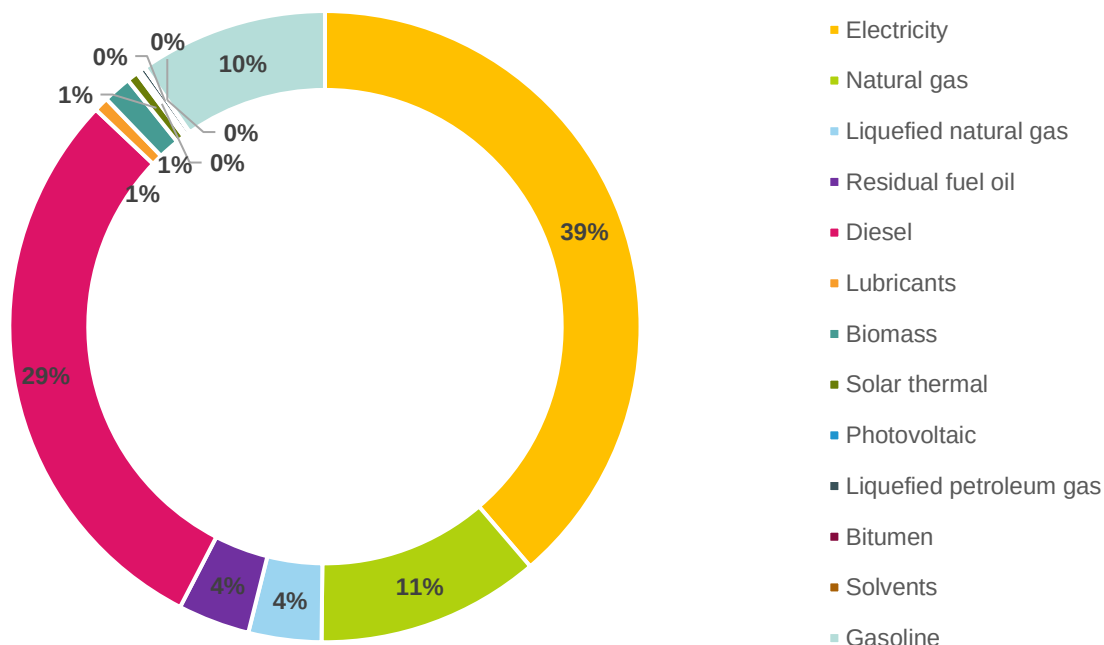


Figure 13. Energy consumption in Porto, per vector, in 2019.

After collecting the energy data, both the Global Warming Potential (GWP) and the emission factors were defined in CIRIS. For the GWP, the values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2014) were considered as they reflect the most recent and advanced state of knowledge concerning the science of climate change. As for the emission factors, a mixed country-specific and local approach was used. For grid-supplied electricity, the annual carbon intensity factor of the national power system was assumed. This factor is annually provided by ADENE, the Portuguese Energy Agency, and available in the Portuguese [Energy Observatory](#). In 2019, this value was 253 tCO_{2eq}/GWh. In turn, for the remaining energy vectors, the national Order 17313/2008 ([Despacho n.º 17313/2008](#)) establishes the Carbon Intensity factors for the emission of greenhouse gases, expressed in kilograms of CO₂ equivalent (kgCO_{2eq}). These emission factors are the ones presented in section A-1.2. Finally, for waste, the local emission factors calculated by LIPOR, the managing entity responsible for waste collection for treatment in Porto, were used.

A-1.2: Emission factors applied

Sector	Primary energy/ energy source	Carbon Dioxide Equivalent (CO _{2eq})
Overall	Electricity (tCO _{2eq} /GWh)	253,00
	Diesel (tCO _{2eq} /GWh)	266,38
	Natural gas (tCO _{2eq} /GWh)	201,95
	LNG/LPG (tCO _{2eq} /GWh)	201,95
	Fuel oil (tCO _{2eq} /GWh)	278,28
	Lubricants (tCO _{2eq} /GWh)	263,88
	Paraffins (tCO _{2eq} /GWh)	258,48
	Gasoline (tCO _{2eq} /GWh)	249,12
	Bitumen (tCO _{2eq} /GWh)	290,16
	Biological treatment (waste) (tCO _{2eq} /tonne)	0,17
	Incineration (waste) (tCO _{2eq} /tonne)	0,53
	Wood/biomass (tCO _{2eq} /GWh)	0,00



	Photovoltaic (tCO _{2eq} /GWh)	0,00
	Solar thermal (tCO _{2eq} /GWh)	0,00
Transports-specific	Passenger cars + motorcycles (g/km)	154,00
	Buses (g/km)	618,00
	Light duty trucks (<3.5 t) (g/km)	633,00
	Heavy duty trucks (>3.5 t) (g/km)	1168,00
Building-specific	Heat production (district heating) (g/kWh)	200,00
	Heat production (local heating) (g/kWh)	207,00

Regarding GHG emissions, in 2019, the Municipality was responsible for the emission of 937,010 tCO_{2eq}, an overall reduction of 38% compared to 2004 (Table A-1.3 and Figure 14). Table A-1.4 presents additional relevant data used to compute the city GHG emissions.

A-1.3: GHG emissions by source sectors

Base year		2019				
Unit		tCO _{2eq}				
		Scope 1	Scope 2	Scope 3	Total	% of Total
Buildings		138 572	304 239	34 874	477 685	51,1%
Transport		240 567	6 479	145 083	392 128	41,9%
Waste		8 257	-	51 477	60 004	6,4%
Industrial Process and Product Use (IPPU)		7 193	-	-	7 193	0,8%
Agricultural, Forestry and Land Use (AFOLU)	Sources (positive emissions)	-	-	-	-	-
	Sinks (negative emissions)				-1 355	0,1%
Total		394 859	310 717	231 433	937 010	100%

A-1.4: Activity by source sectors.

Base year		2019		
		Scope 1	Scope 2	Scope 3
Buildings & Heating				
Heating demand in residential and commercial buildings (space heating + domestic hot water) (GWh/year)		694		
Transport				
Transport need – passenger cars + motorcycles (Mkm/year)		481		321
Transport need – buses (Mkm/year)		26		
Transport need – train/metro (Mkm/year)		7		
Transport need – light duty trucks (<3.5t) (Mkm/year)		18		12
Transport need – heavy duty trucks (>3.5t) (Mkm/year)		74		49
Waste				
Collected paper and cardboard within city boundaries (tonnes)		14 643,03		
Collected metal within city boundaries (tonnes)		2 508,49		
Collected plastics within city boundaries (tonnes)		19 247,33		
Collected glass within city boundaries (tonnes)		10 952,25		
Collected organic waste within city boundaries (tonnes)		52 680,66		



Collected other waste (e.g. textiles, rubble, wood, etc.) within city boundaries (tonnes)	46 296,45		
Solid waste disposal – Waste sent to landfills (tonnes)			2 665
Biological treatment – Organic waste valorisation (tonnes)			12 127
Incineration – Waste incinerated (tonnes)			90 103
Electricity			
Electricity demand within city boundaries (GWh/year)		1383,1	

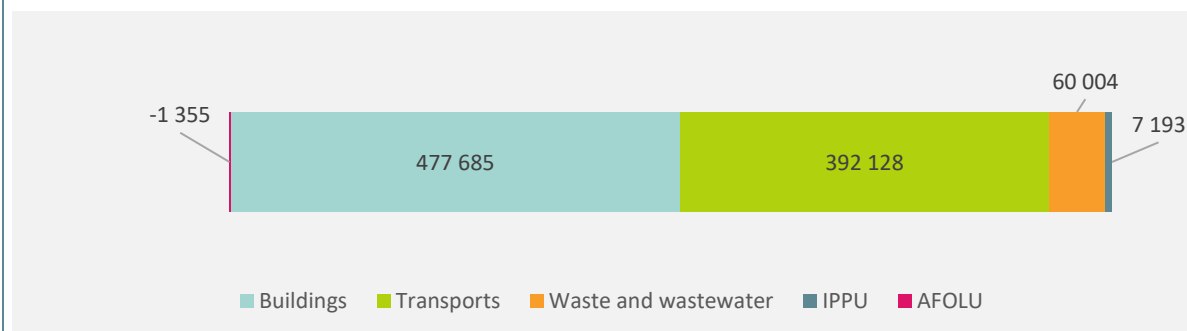
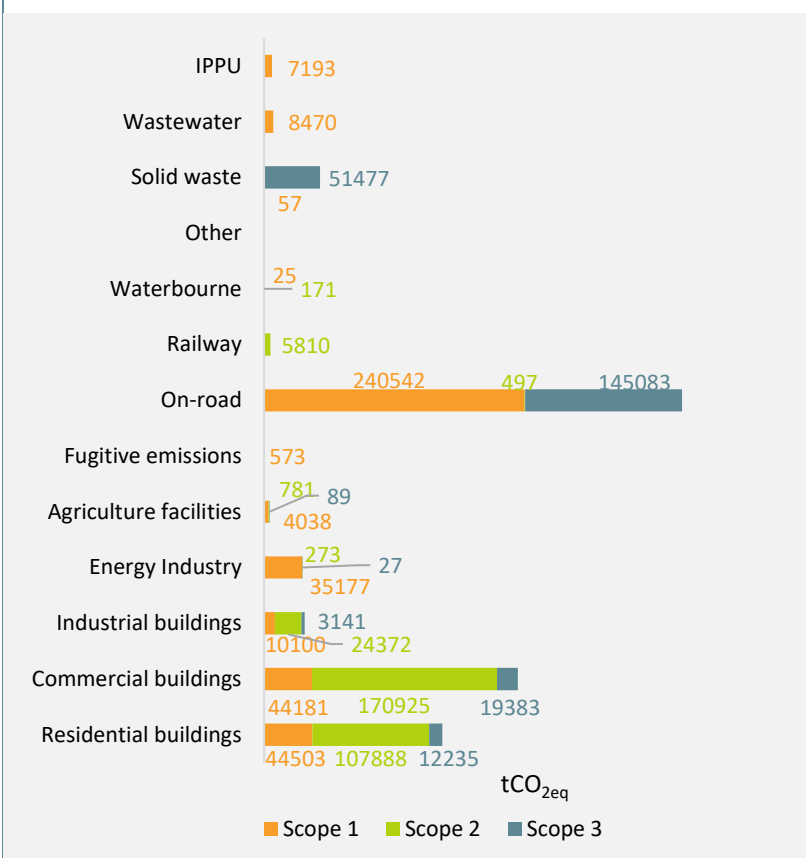


Figure 14. GHG emissions in Porto, 2019.



As the most intensive sector in terms of energy consumption, buildings (stationary energy) are also the main source of GHG emissions in Porto (477 685 tCO_{2eq}), closely followed by transports (392 128 tCO_{2eq}) and waste (60 004 tCO_{2eq}). As explained above, Porto is not an industrial territory, which is clearly reflected in the GHG emissions associated to IPPU. In addition, Porto is a densely built-up area, and although urban green areas cover more than 1/3 of Porto's surface, recent studies³ estimate that the tree cover corresponding to the green area has a carbon sequestration potential of around 650 kg/ ha/year, which corresponds to a carbon sequestration capacity of around 1 355 tons/ year.

³ Graça, M., et al., Assessing how green space types affect ecosystem services delivery in Porto, Portugal, Landscape and Urban Planning, Volume 170, 2018, pp. 195-208, <https://doi.org/10.1016/j.landurbplan.2017.10.007>



Figure 15. GHG emissions in Porto, by subsector and scope, 2019.

By examining the matrix of emissions by scope, the dichotomy between scope 1 (emissions occurring within the city) and scope 3 (emissions occurring outside, but by action of the city) in road transport stands out. This dichotomy characterizes the daily commuting movement to and from the city. Additionally, the significant electrification of energy uses in residential, commercial, and industrial buildings and facilities is represented by the preponderance of scope 2 emissions in these subsectors (Figure 15).



2.2 Module A-2 Current Policies and Strategies Assessment

A-2.1: Description & assessment of policies

There are multiple levels of policies, strategies, programs, and regulations that impact, directly and/or indirectly, Porto's 2030 climate neutrality ambition. These documents, as well as their relationship are displayed in Figure 16 and detailed as follows.

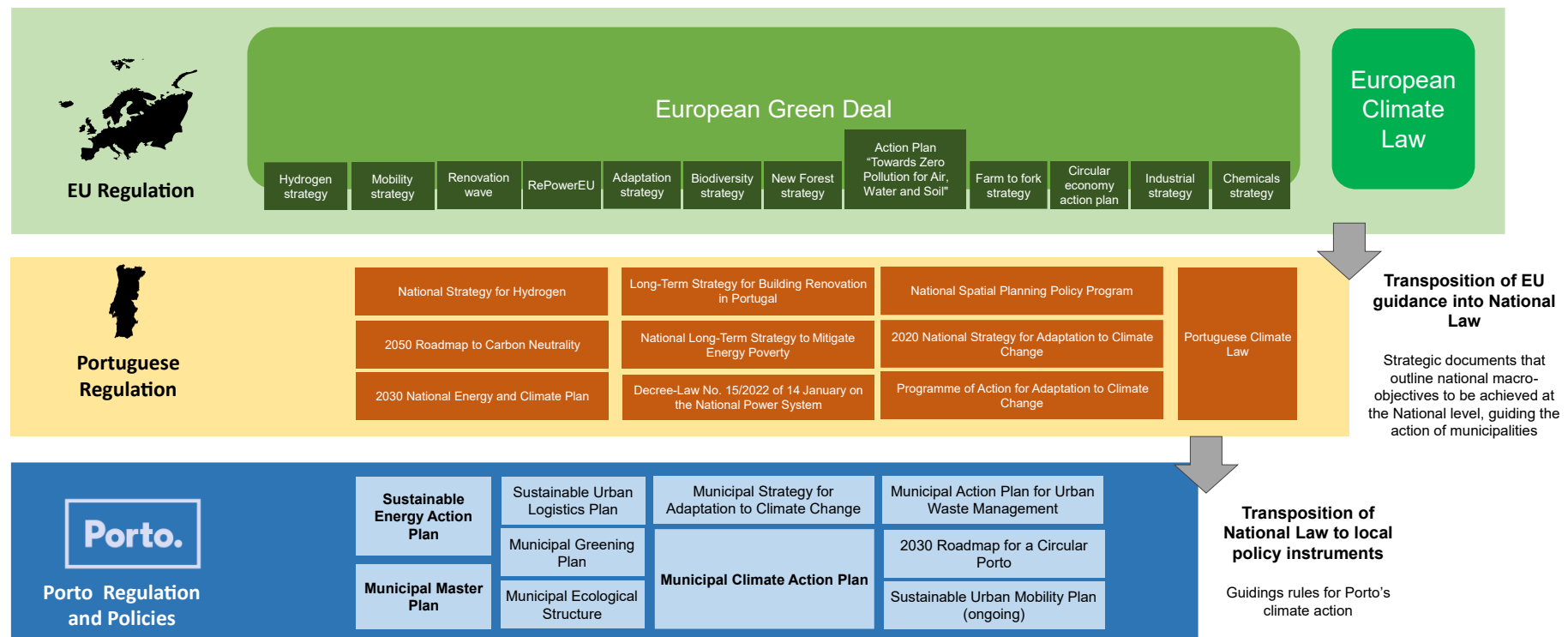


Figure 16. Existing policies and strategies affecting Porto's climate neutrality ambition and link between them.



At the **European level**, the [European Green Deal](#) and the [European Climate Law](#) pushed by a policy crisis, characterized by the interplay between the COVID-19 pandemic, the invasion of Ukraine, the energy crisis, the housing affordability crisis and the climate crisis, are the main drivers for the EU climate agenda. In line with these two documents and proposed under the scope of the Green Deal, the following complementary strategies and regulations must be considered as they set targets for different carbon-related dimensions:

- The [2030 EU Biodiversity strategy](#) (May 2020) seeks to make our societies more resilient to future threats, such as the effects of climate change, forest fires, food insecurity and disease outbreaks (particularly focusing on wildlife protection and combating its illegal trade).
- The [Farm to Fork Strategy](#) (May 2020) has food security as a priority and sets main objectives to ensure affordable and nutritious food within the limits of the planet production capacity.
- The [European industrial strategy](#) (March 2020, updated May 2021) supports the twin transition to a green, sustainable, digital, and resilient economy, making EU industry more competitive globally, and enhancing Europe's open strategic autonomy.
- The [Circular economy action plan](#) (March 2020) aims to accelerate the transition of the EU economy to a model in which economic activities are not dependent on the extraction of raw materials and the production of waste, but which promotes the re-use of materials within the EU itself and seeks to reduce external dependency on materials.
- The [EU Hydrogen Strategy](#) (July 2020) aims to develop clean, renewable hydrogen, produced using mainly wind and solar energy as the most compatible option with the EU's climate neutrality goal in the long term.
- The [Chemicals strategy](#) (October 2020) is part of the EU's zero pollution ambition and aims to better protect citizens and the environment from harmful chemicals and boost innovation by promoting the use of safer and more sustainable chemicals.
- The [Renovation wave](#) (October 2020) seeks to improve the energy performance of buildings across the EU, promoting energy efficiency and sustainability.
- The [Mobility Strategy](#) (December 2020) is a comprehensive strategy to meet a target to reduce transport-related greenhouse gas emissions by 90% by 2050 and ensure that the EU transport sector is fit for a clean, digital and modern economy.
- The [EU Adaptation Strategy](#) (February 2021) sets out how the EU can adapt to the unavoidable impacts of climate change and become resilient to climate change by 2050. The strategy has four main objectives: to make adaptation smarter, faster, and more systemic, and to strengthen international action for climate resilience.
- The [EU Action Plan "Towards Zero Pollution for Air, Water and Soil"](#) (May 2021) is a key deliverable of the European Green Deal, to better prevent, remedy, monitor and report on air, water, soil, and consumer products pollution.



- The [New Forest strategy 2030](#) (July 2021) aims to increase the size and quality of Europe's forests and improve their resilience to challenges such as climate change, while supporting communities whose livelihoods depend on forestry.
- The [REPowerEU](#) (May 2022) is helping the EU save energy, produce clean energy, and diversify its energy supply sources and is focused on the continued delivery of new national REPowerEU chapters under the updated Recovery and Resilience Facility; boosting industrial decarbonization; sign-off and implementation of new legislation for faster renewables roll-out; investments in energy infrastructure and interconnections; regulatory measures to increase energy efficiency; a modern regulatory framework for hydrogen, and a hydrogen accelerator.
- The [EU Solar energy strategy](#) (May 2022) is a relevant part of the REPowerEU plan as it aims to bring online over 320 GW of solar photovoltaic by 2025 (more than doubling compared to 2020) and almost 600 GW by 2030.

In addition to the Green Deal strategies and regulations, other important European initiatives include:

Smart Cities and Communities Initiative

Promotes the development of smart, sustainable urban areas by integrating technology and data to enhance efficiency and reduce environmental impact.

Covenant of Mayors for Climate and Energy

A voluntary commitment by local and regional authorities to exceed the EU's climate and energy targets.

European Climate Pact

Engages citizens, communities, and organizations in climate action, fostering collaboration and sharing best practices.

At the **national level**, Portugal has declared a state of climate emergency and has set objectives for the adoption of a mature and assertive climate policy, strengthening the principles of sustainability, cooperation, information, participation, prevention, and accountability, with the right to climate balance being enshrined as a constitutional right, where everyone has the right to a human, healthy and ecologically balanced living environment. The [National Spatial Planning Policy Program \(PNPOT\) 2020](#) identifies climate change and risks as one of the 18 land-use planning problems.

The exercise of the right to climate balance confers the power to require public and private entities to comply with the duties and obligations to which they are subject in relation to climate issues, namely regarding GHG emission reduction targets set out in the [Portuguese Climate Law \(LBC\)](#). As currently drafted, LBC establishes the need to mitigate the impacts of climate change (promoting the adoption of adaptation measures and increasing resilience to climate change) and to achieve decarbonization targets, without considering the contribution of land use and forests to offset emissions. According to the LBC, Portugal must decrease its GHG emissions by at least 90% by 2050, with interim targets of at least 55% by 2030 and 65-75% by 2040, compared to 2005. In line with the climate goals and decarbonization targets, Portugal has been developing climate policies with a view to climate balance since 2018, when it developed its [2030 National Energy and Climate Plan \(PNEC 2030\)](#). This strategic document has become the country's main energy and climate policy instrument, proposing guidelines for 2030 by focusing on renewable energy and energy efficiency as tools for decarbonizing the economy and the energy transition. The PNEC 2030 sets a target of up to 47% renewables in the energy mix, aiming to make more and better use of endogenous resources and diversify energy sources to achieve greater energy independence for the country. The sun, wind, rivers, waves, and biomass are natural resources that can and should become cheaper and more accessible forms of energy production, helping to reduce costs



and increase competitiveness for businesses and household budgets. Promoting vehicle electrification, strengthening active, soft, shared, and connected mobility, and improving the supply and quality of public transport are all important in reducing emissions by improving mobility. Also, the PNEC 2030 is based on a fair, democratic and cohesive model of transition, ensuring that opportunities are available and enjoyed by all in an equitable and inclusive manner, and that the most vulnerable are defended and protected. These assumptions are essential for the development of a decarbonized, more competitive, and fairer economy capable of generating jobs, wealth, and prosperity in line with the national goal of achieving carbon neutrality by 2050.

Indeed, in 2019, Portugal published its [2050 Roadmap to Carbon Neutrality \(RNC2050\)](#), which sets out the long-term strategy for a sustainable, zero-carbon economy by 2050. The RNC2050 brings together a range of energy and mobility policies that can reduce GHG emissions by around 85 per cent compared to 2015 and increase carbon sequestration by expanding and strengthening the ecosystem services provided by land use and forestry to offset the 15 per cent of remaining emissions.

For the decade 2021-2030, the entry into force of the following strategies and regulations leading to decarbonization in Portugal should also be highlighted:

- [National Strategy for Hydrogen \(EN-H2\)](#) - Promotes the use of hydrogen in the various sectors of the economy, creating the necessary conditions for the establishment of a true hydrogen economy in Portugal.
- [Long-Term Strategy for Building Renovation in Portugal \(ELPRE PT\)](#) - Aims to promote the energy efficiency of existing buildings with a view to transforming them into Nearly Zero Energy Buildings (nZEB).
- [National Long-Term Strategy to Fight Energy Poverty \(ELPCPE PT\)](#) - Aims to reinforce the importance of achieving the indicative targets for the decades 2030, 2040 and 2050, which aim to address issues related to energy poverty and improve the quality of life of citizens.
- [Decree-Law No. 15/2022 of 14 January](#) - Regulates the operation of the national electricity system in accordance with the European Union directives on the internal electricity market and the promotion of renewable energy. This law incorporates the provisions on renewable self-consumption (and repeals Decree-Law no. 162/2019, of 25 October) and establishes the regulatory framework for the creation of renewable energy communities, citizen energy communities and renewable self-consumption projects.

Regarding climate adaptation, the [2020 National Strategy for Adaptation to Climate Change \(ENAAC\)](#) was launched in 2015 and will run until 2025. It establishes the model for the implementation of adaptation solutions for different sectors of activity and defines the objectives of adaptation as improving knowledge on climate change, implementing adaptation measures, and promoting the integration of adaptation in sectoral policies and instruments. In order to complement and systematize the results of the ENAAC, the [Programme of Action for Adaptation to Climate Change \(P-3AC\)](#) has been developed, one of the aims of which is to achieve the second objective of the ENAAC, i.e. to implement adaptation measures, particularly with regard to physical interventions that have a direct impact on the territory. In this context, the P-3AC identifies and brings together a series of actions that are considered priority to reduce the vulnerability of the national territory and to increase the resilience of natural and human systems, with a view to promoting the well-being of the population, especially the most vulnerable groups.



The decarbonization of the Portuguese power system foreseen in the RNC2050 has a significant impact on GHG emissions reduction expected by 2030. Alongside, the penetration of green hydrogen in the natural gas distribution network forecasted in the National Strategy for Hydrogen has also a considerable impact on the city decarbonization. Together, these two measures are expected to avoid the emission of over 289 ktCO_{2eq} by 2030. Also, the sociodemographic scenarios of the 2050 Roadmap to Carbon Neutrality as well as its assumptions regarding consumption trends in buildings (including industry) and transports, as well as waste management estimates, were used to compute a Business-as-Usual (BaU) scenario for Porto in 2030. This BaU is used for target setting and the assumptions considered (population, gross value added, etc.) are not double counted in further estimations.

At the **local level**, in the specific context of climate change mitigation, the Municipality of Porto signed the **Aalborg Charter** (2006) and the **Covenant of Mayors** (2008), an initiative launched in Europe in 2008 with the aim of bringing together local governments voluntarily committed to meet and exceed the EU's climate and energy targets. The Municipality committed to reduce the city's GHG emissions by 45% between 2004 and 2020, implementing common approaches to decarbonization and adaptation to climate change. In 2019, Porto, as part of a group of 12 European cities, once again signed the **Covenant of Mayors for Climate and Energy**, this time committing to voluntarily reduce carbon emissions by 60% by 2030. In line with the Covenant of Mayors commitment, in 2021, Porto approved its **SEAP** which details the relevant actions to mitigate climate change, both on the initiative of the Municipality and other stakeholders, which together will contribute to the objective of reducing GHG emissions. Also, since 2016, the Municipality has in place its **Municipal Strategy for Adaptation to Climate Change**. This strategy includes 52 adaptation measures, most of which are already underway. Porto's commitment to these issues is also reflected in its membership to the CDP - Disclosure Insight Action, which provides companies and cities with the world's largest information system for measuring, disclosing, and managing their environmental impacts and strategies resulting from actions taken to mitigate, decarbonize and adapt to climate change. Porto has been recognized as a CDP A-List city for 2020, 2021 and 2022. Currently, to answer the national Climate Law requirements and update its climate goals, the **Municipal Climate Action Plan** is under development and will be aligned with this Action Plan to ensure a comprehensive guidance towards carbon neutrality.

To ensure an integrated view of the city and a comprehensive spatial planning, reference should also be made to the **Municipal Master Plan** (PDM) of Porto, approved in June 2021 and already in implementation, focuses on five guiding axes:



Environment and Quality of Life: This component of the plan includes:

- The definition of the environmental city system considering the existing natural risks, the “green” and “blue” structures of the territory and the acoustic zoning.



Figure 17. Porto's SEAP (above) and Municipal Climate Change Adaptation Strategy (below).



- The valorisation of the municipal ecological structure as a fundamental element of the territory, defined considering the green areas with public access, the green areas with high ecological value, the green corridors along the existing water lines, the alluvial areas and the network of ecological connection providing green corridors along the city's main canal spaces.
- The densification of the city's green structure, including:
 - Doubling the green area of public access through the creation, expansion or requalification of public parks and gardens;
 - The definition of the green system including spaces associated with urbanizations, publicly or privately owned, with public access;
 - The afforestation of the city's structuring streets;
 - The creation of incentives with reduced fees for operations that vacate the interior of blocks, making them permeable green spaces;
 - The creation of incentives with reduced fees for operations that promote the public use of private spaces in the central area of the city;
 - The creation of an incentive system that positively discriminates against operations that contribute to the Municipality's environmental policy.

Within this scope, the **Municipal Ecological Structure** has as its main objective the improvement of the urban space through the preservation and integration of green and natural spaces, recognized as an essential tool to promote the resilience of the territory in the face of climate change. In turn, the **Municipal Greening Plan**, presented on 17 May 2023, is a strategic document whose main objective is to improve the sustainable public greening of the city of Porto, created with the aim of materializing and implementing, at a finer and more programmatic scale, the vision of the municipal ecological structure included in the PDM revision process. Urban greening, in this case through trees, is particularly important because of the bioclimatic benefits - regulation of thermal and hydrological cycles, release of oxygen, carbon sequestration, trapping of pollutants, etc. - and the opportunities for maximizing biodiversity that it offers.



Figure 18. Porto's Greening Plan.



Building and Housing: This component of the plan focuses on:

- Functional balance and territorial cohesion, through mitigating the excessive concentration of activity in the city centre by distributing urban loads, as well as strengthening the network of collective facilities.
- The expansion of areas with type-morphological criteria for buildability.



- Strategic densification, through the adjustment of building rates, increased for the construction of accessible or social housing and also with the creation of new areas of economic activity.
- The creation of inclusive zoning, which provides those urban operations with a relevant building area, located in the city centre, allocates a percentage of their area to affordable housing.

To accelerate the renovation of buildings and transform them into renewable energy hubs, Porto has launched several initiatives. The city has in place several municipal incentives, both for [housing renovation](#) - exemption from municipal taxes in the case of improving the energy efficiency of housing - and for renewable energy production (regulation in public consultation).



Mobility and Transport: This component of the plan includes:

- Reinforcing the focus on public transport, with the definition of a structuring network consisting of high-quality bus lanes, circular corridors and radial axes.
- Changing the current paradigm in private parking policy, introducing maximum sizing criteria for non-residential uses in the Historic Centre, Downtown and in the areas influenced by existing and planned metro stations.
- The creation of “Zones XXI”, where the aim is to progressively eliminate parking in public spaces and along streets, replaced by parking for residents in existing or upcoming collection garages.
- The definition of the fundamental structure of the circulation network intended for smooth modes.
- The creation of pedestrian zones in the Historic Centre of Porto.

Within this scope, the [Sustainable Urban Logistics Plan \(PLUS\)](#), approved in November 2021 and already in implementation, is a relevant integrated strategic plan that defines an integrated strategy for regulating logistics activities in the city of Porto.



Figure 19. Porto's Sustainable Urban Logistics Plan.



Economy and Employment: This component of the plan provides:

- The creation of areas of economic activity defined in the land qualification charter, corresponding to new areas of work and urban identification.
- The strategic densification of specific areas of the city.
- The reduction of urban taxes on operations that promote street commerce.



- The enhancement of the role of university campuses as catalysts for territorial transformation.



Identity and Heritage: This component of the plan, with great value for the city given its tourist nature, foresees:

- The promotion of the Historic Centre and central areas as major references for the urban development of the metropolitan agglomeration.
- The creation of a systematized database of protected properties to be preserved, consisting of a set of more than 1000 sites.
- The preservation of the identity of urban places, in addition to individual properties, considering the urban fronts, forms of coverage, physical geography, elements of urban identification, vegetation cover, among others. To this end, specific rules were created for areas of urban and architectural interest, for complexes and properties with heritage value and for historic centres and places.
- Strengthening the protection of protected areas, with a more geographically contained delimitation but with a more densified identification of the values to be protected and more objective and concrete protection criteria.
- The incorporation of the protection of stores, establishments and entities recognized within the scope of the municipal program “Porto de Tradição”.

The objectives for each PDM main topic are detailed in a dedicated [website](#), which also provides all documentation related to the review process.

Urban waste management and the cleaning of public spaces are essential public services for the population, being directly related to the defence of the environment, public health, collective security, economic development and, in general, improving the quality of life of citizens residing in the city of Porto. Transposing a set of European directives into the national law, ambitious targets regarding the reuse and recycling of waste, new obligations regarding the selective collection of bio-waste and other fractions, as well as other equally relevant measures such as the banning of waste that could be recycled or recovered to landfill, are being discussed. Committed to achieving the objectives set by the legislator, including in the National Waste Management Plan approved in March 2023, the Municipality is also now preparing its **Municipal Action Plan for Urban Waste Management (PAPERSU)**. Finally, Porto also has a long-lasting tradition in circular economy, which is one of the key themes in the medium and long-term municipal strategy for Porto's environment. The city wants to increasingly contribute to the regeneration of ecosystems, to the recycling and reducing of waste, to the reuse of by-products as a resource for other processes (for example, treated wastewater), to the involvement of companies, consumers, and other actors in the sector in reflecting on the steps that each one must take in this direction. Porto has been putting a substantial part of its effort into very concrete actions, some of which are reflected in the [2030 Roadmap for a Circular Porto](#), drawn up in 2017. This document, prepared with the collaboration of several active people and organizations in the city, highlights the main practices and projects taking place while proposes a long-term vision and identifies opportunities and concrete actions to transform Porto into a circular city in 2030.



The climate emergency has fuelled the city's desire to achieve even bolder goals and in 2021 Porto announced its willingness to become carbon neutral by 2030. This motivation derived the selection of Porto as one of the 100 European carbon neutral Mission Cities. Achieving climate neutrality by 2030 and forestalling the national and European targets by 20 years has become Porto's new goal. To assist the carbon neutrality journey, on 31 January 2022, Porto launched the [Porto Climate Pact](#). This initiative is based on the principle that the path to carbon neutrality in Porto is demanding and requires collective action for collective benefit. Carbon neutrality in Porto can only be achieved through concrete actions by all actors, regardless of their size, past actions, or legal personality. Porto believes that a common vision and goal for decarbonization can help all actors move in the same direction to achieve a common goal. That is why the Porto Climate Pact aims to stimulate action among citizens and organizations, creating a large community of learning, sharing and mutual support.

Currently, Porto Climate Pact is managed by the city Transition Team and works as an umbrella for all neutrality-related actions occurring in the city, meaning that all the progresses being made in the plans presented previously are followed, supported, and monitored by this team. Thus, the portfolio of measures proposed in this Action Plan are aligned with the city current guiding documents, namely its SEAP, the Sustainable Urban Logistics Plan, the Municipal Master Plan, the Municipal Greening Plan, and the Municipal Action Plan for Urban Waste Management.

Together, these measures are expected to avoid the emission of over 416 ktCO_{2eq}, as presented in table A-2.1. Considering as starting point the BaU baseline emissions and the emissions reduction achieved through national policies (namely the decarbonization of the national power system as well as the penetration of hydrogen in the natural gas distribution network forecasted by the [2050 Roadmap to Carbon Neutrality \(RNC2050\)](#) and the [National Strategy for Hydrogen](#), respectively), bold emission reduction targets were set up for buildings (-98%), transport (-78%) and waste (-40%). Also, a 140% increase target was set up for carbon sinking. Although ambitious due to the reduced available area for green spaces in the city, this carbon sink target is still insufficient to compensate residual emissions.

Overall, Porto is committed to an 85% emissions reduction target by 2030. As presented below in table A-2.1, this means that the percentage of emissions reduction previously planned through other Action Plans in progress represents 35% of this target, while the rest of the emissions reduction expected through this CCC Action Plan represents 50%. **Therefore, 416 ktCO_{2eq} represents the emissions gap which will be addressed through the comprehensive portfolio of actions defined in the CCC.** Still, a 123 ktCO_{2eq} of unavoidable residual GHG emissions are estimated by 2030 mainly due to the difficulty of provoking a deep change in the way people use transports – Porto is a large urban centre (for Portugal) and is one of the most congested cities on the Iberian Peninsula – and the difficulty of sequester carbon due to the highly urbanised territory.



A-2.1: City emission gap and residual emissions											
	(1) Baseline emissions	(2) Emissions Reduction Target 2030		(3) Emission reduction through other Action Plans		(4) Emissions Gap		(5) Emissions reduction through the CCC Action Plan to address the Gap		(6) Residual emissions	
	Business-as-Usual 2030 scenario	The emissions reduction target defined by Porto for 2030 is 85%.		The effects of the decarbonization of the national power system (as forecasted in 2050 Roadmap to Carbon Neutrality (RNC2050)), the injection of green hydrogen in the natural gas distribution network (as projected by the National Strategy for Hydrogen) as well as the city greenification (already ongoing) as predicted by the Municipal Greenification Plan are considered in this column. These actions are not accounted in the action portfolio in section B neither in the BAU scenario modelling.		(4) = (2) – (3)		This column presents the quantified emission reduction associated with the action portfolios outlined in module B-2.		(6) = (1) – (2)	
	(absolute) (tCO _{2eq})	(absolute) (tCO _{2eq})	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)
Buildings	435 309	426 549	98%	278 759	64%	147 790	34%	147 790	34%	8 760	2%
Transport	328 078	256 306	78%	6 974	2%	249 332	76%	249 332	76%	71 772	22%
Waste	58 842	23 600	40%	3 870	7%	19 730	34%	19 730	34%	35 243	60%
Industrial Process and Product Use (IPPU)	7 193	0	0%		0%	0	0%		0%	7 193	100%
Agricultural, Forestry and Land Use (AFOLU)	-1 355	-1 895	140%	-1 381	102%	-514	38%	514	38%	540	-40%
Total	828 067	704 559	85%	288 222	35%	416 337	50%	416 337	50%	123 507	15%

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

A-3.1: Description of urban systems, systemic barriers, and opportunities

Due to its intricate urban nature, achieving climate neutrality in Porto involves a multifaceted approach that encompasses various systems (technological/infrastructural, institutional/regulatory, organizational, financial, political, social, and behavioural), that play different roles in the city GHG ecosystem. Also, **these systems involve different stakeholders which play key roles in the city (as presented in Figure 20 and which resulted from the [N2C workshop in Porto](#))**. The extensive listing of stakeholders as well as their influence and interest in Porto's climate neutrality ambition is further described in Table A-3.2.

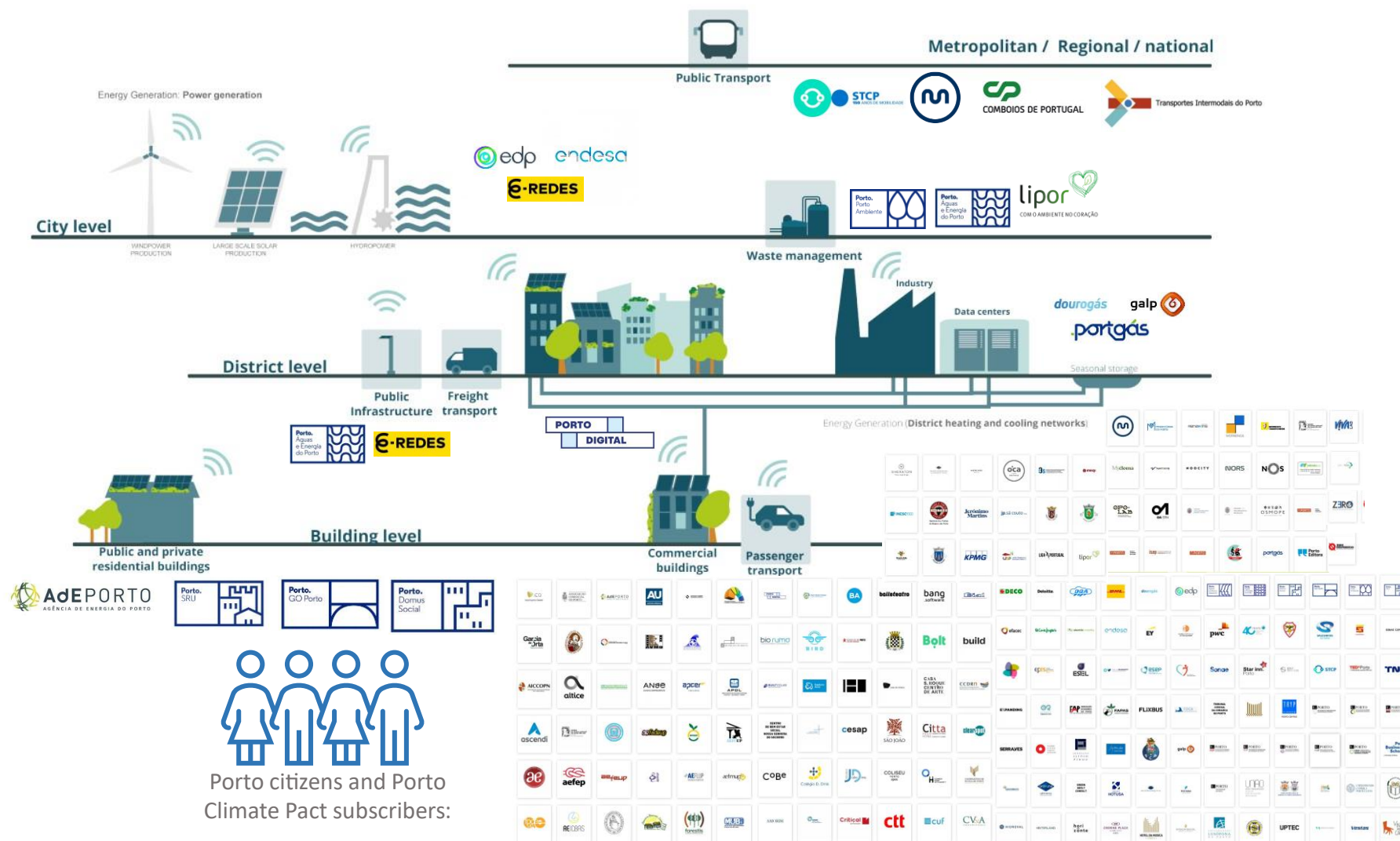


Figure 20. Porto's stakeholder mapping.



A-3.2: Systems & stakeholder mapping			
System	Stakeholders	Influence on the city's climate neutrality ambition	Interest in the city's climate neutrality ambition
Technological/ Infrastructural	Public transport companies (STCP , Metro do Porto , CP - Comboios de Portugal , Transportes Intermodais do Porto , etc.)	Decarbonization of public transport. Level of influence Low Medium High   	Better service and less congested city. Level of interest Low Medium High   
	E-REDES (Portuguese electric DSO), Portgás (natural gas DSO) and ICT companies	Smart metering infrastructure and digital transition. Level of influence Low Medium High   	Data and digitalization of the energy systems. Optimization of energy flows and reduction of energy losses. Level of interest Low Medium High   
	Electricity and gas retailers and renewable energy technology providers	Decarbonization of energy supply (electricity and gas). Level of influence Low Medium High   	Supply of renewable electricity and renewable energy technologies. Supply of decarbonized natural gas. Level of interest Low Medium High   
	Construction companies	Decarbonization and increased thermal comfort in buildings. Level of influence Low Medium High   	Extensive buildings' renovation market and improved services. Level of interest Low Medium High   
	Waste management companies (e.g., LIPOR)	Reduction of GHG emissions related to waste. Level of influence Low Medium High   	Develop new services and products related with waste management. Level of interest Low Medium High   
	Municipal companies (Porto Ambiente, Águas e Energia do Porto, GoPorto, etc.).	Implementation of decarbonization measures. Level of influence Low Medium High   	Optimization of processes and 'sense of belonging'. Level of interest Low Medium High   
Institutional/ regulatory/ political	Porto Municipality	Decision on local policies. Level of influence Low Medium High   	Create guidelines and regulations for local projects to be implemented and achieve local targets. Level of interest Low Medium High   
		Decision on metropolitan policies. Level of influence Low Medium High   	Create guidelines and regulations for metropolitan projects to be implemented and achieve regional targets. Level of interest Low Medium High   
	Porto Metropolitan Area	Decision on local policies. Level of influence Low Medium High   	Create guidelines and regulations for local projects to be implemented and achieve local targets. Level of interest Low Medium High   
		Decision on metropolitan policies. Level of influence Low Medium High   	Create guidelines and regulations for metropolitan projects to be implemented and achieve regional targets. Level of interest Low Medium High   



	Portuguese Government	Decision on national policies and on public procurement rules.	Create guidelines and regulations for national projects to be implemented and achieve national targets.
		Level of influence LowMediumHigh	Level of interest LowMediumHigh
	DGEG (Energy Directorate) and ERSE (Portuguese Energy Regulator)	Decision on key licencing processes (e.g., renewable production).	Optimize and facilitate licencing processes and rules.
		Level of influence LowMediumHigh	Level of interest LowMediumHigh
	Financial	Porto Municipality	Decision on municipal budget to allocate to carbon neutrality.
Level of influence LowMediumHigh			Level of interest LowMediumHigh
Energy Service Companies (ESCOs) and banks		Leverage of non-municipal investment.	Interesting and high IRR investment opportunities.
		Level of influence LowMediumHigh	Level of interest LowMediumHigh
Privates (citizens and companies)		Leverage of private investment.	Opportunity to participate in the city transition and take advantage of economic savings.
		Level of influence LowMediumHigh	Level of interest LowMediumHigh
Organisational, behavioural, and social	Citizens, companies, and Porto Climate Pact subscribers	Awareness and participation are key to achieve the city goals.	'Sense of belonging' to a sustainable and decarbonized city and better quality of life.
		Level of influence LowMediumHigh	Level of interest LowMediumHigh
	Research/ Academia	To explore innovative solutions of smart cities, mobility, energy production and efficiency, environmental surveillance, water and waste handling, public health, and governance models.	To access real-world data to perform better research and to test in a real-world testbed.
		Level of influence LowMediumHigh	Level of influence LowMediumHigh

In addition to municipal entities and local companies, stakeholders mapping highlights the weight of the role of citizens in Porto's path towards carbon neutrality. Besides a fair and economically viable city decarbonization, the Municipality has the transversal objective of



investing in participatory innovation to support the development of new projects, focused on improving the quality of life of citizens and increasing the efficiency of services. This was the motto for the creation of the **Porto Innovation Hub (PIH)**, which aims to demonstrate the potential of innovation in transforming cities, presenting the direct impact of this relationship on improving the quality of life of citizens, contributing to the creation of qualified jobs, and the potential for cities to reach new levels of development. PIH and its social innovation character will be key in engaging citizens in the decarbonization process, functioning as a space to facilitate open and co-creation activities and discussions between citizens, employees, and managers of the Municipality. Through the various ongoing initiatives (including **City Café**, **In-House Innovation sessions** and **Stepping Out Innovation sessions**), PIH proposes the creation of new scenarios and opportunities for innovation and sustainability on an urban scale, contributing to the city's culture of innovation and encouraging citizens to assume the role of drivers of innovation and decarbonization. Additionally, initiatives such as the **Porto Climate Pact Talk Series** (in which representatives of civil society and citizens may be invited not only as participants, but also as speakers), and tools under development such as the one to be developed within the scope of **WAKE UP!** are effective ways of motivating and involving the population over time. These principles of continuous stakeholder engagement with a special focus on citizens will be emphasized while implementing the Action Plan, by stressing the role they may play as positive proactive actors of the city's carbon neutrality journey.

By having a clear idea of the critical emission areas which Porto needs to tackle, a more comprehensive mapping of Porto's GHG ecosystem was drafted, based on the knowledge of the different entities composing the City Transition Team (Figure 21). **This complex mapping of the city's GHG emissions does not focus only on buildings and transport (the main GHG emitters), but rather represents the comprehensive ecosystem of the city, including all its main GHG emissions sources, the relationships established between them, the synergies that can be established and which originate relevant actions included in Porto's actions portfolio.**

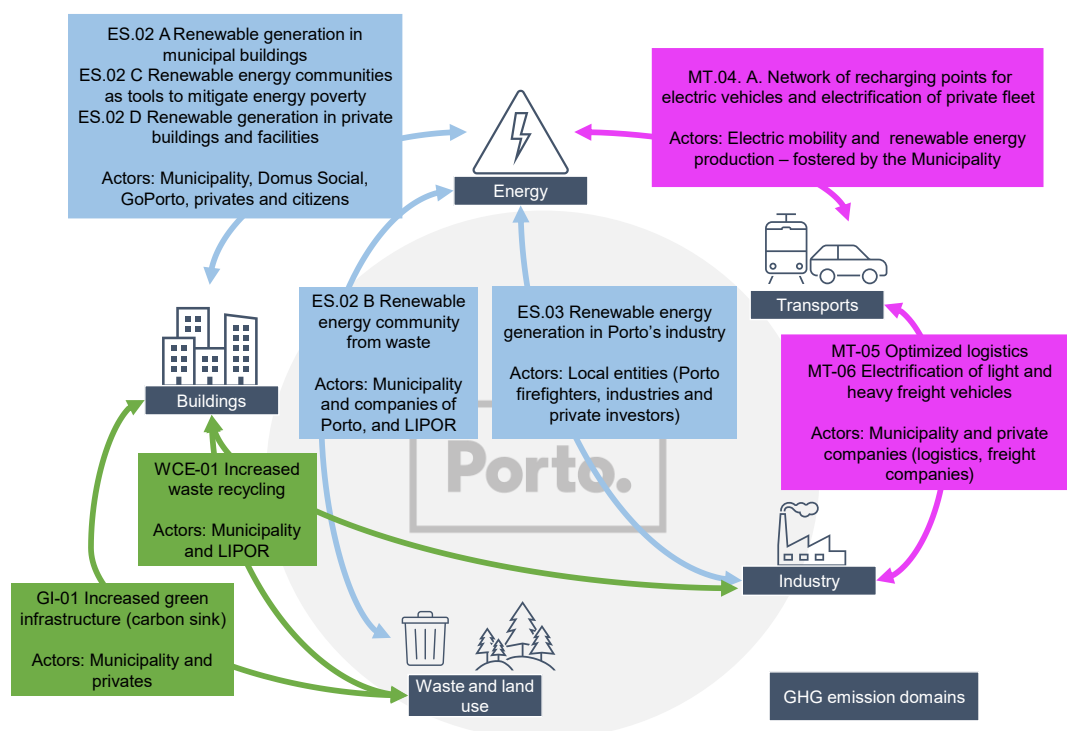


Figure 21. Synergies and resulting actions.



As previously mentioned, **there is a strong political system and commitment to climate action and carbon neutrality targets at the local level.** Porto's leading entities prioritize sustainable policies and engage with higher levels of the national government to influence metropolitan, regional, national, and even international policies to boost climate action. Indeed, the Porto Climate Pact as well as the ambition to bring forward carbon neutrality in Porto are one of the banners of the Porto Municipal Executive which has [discussed these goals](#) and all ongoing measures to achieve these objectives with the Municipal Assembly. So far, the Municipal Assembly has generally unanimously approved the proposed strategies, plans and initiatives related to climate neutrality. The most recent is the property tax exemption mechanism for renewable energy producers. It is also worth mentioning the Municipality's commitment to incentivize public transport with continuous incentives through ticketing: Porto will channel the approximately three million euros per year with which it financed free public transport passes to users up to the age of 18 to offer trips free to [Porto Card](#) users, now that the Government itself finances this measure.

Shortly after the creation of the Porto Climate Pact and the selection of Porto to the 100 EU cities to become climate neutral and smart by 2030, the Municipality established its Transition Team for engagement of the city's main actors in this project. Since then, members of this team have been working and discussing Porto's carbon neutrality, developing skills and deepening their knowledge on this topic. **At the same time, together with Lisbon and Guimarães, the two other Portuguese Mission cities, periodic meetings were organized to share the ongoing activities, and discuss barriers and challenges, as well as good practices and opportunities. These meetings also partially served to debate the relevance of the national network of cities aiming to reach carbon neutrality, as well as establishing the three Portuguese Mission cities as leaders of this network.** At an international level, Porto's long-lasting participation as [Chair of Eurocities Environment Forum](#) (from 2018 to 2022) as well as on the [Board of Directors of Energy Cities](#), allows the city to be at the forefront of carbon neutrality and discuss this topic with European front-runner cities.

Also, Porto enjoys a leadership position in the Porto Metropolitan Area. **By being a pioneer in the implementation of several projects related to carbon neutrality (e.g., [Asprela + Sustentável](#)), Porto has set the pace for many neighbouring municipalities being aligned with the ambition to accelerate carbon neutrality.** Proof of this is the expression of interest in participating in the Climate-Neutral and Smart Cities EU Mission from neighbour municipalities (e.g., Maia and Matosinhos) and their public commitment to [reach carbon neutrality by 2030](#). This positioning allows Porto to work with neighbouring municipalities and at a metropolitan level on larger-scale intra-municipal and regional projects with significant impact, particularly in terms of mobility (e.g., metro lines and metropolitan transport strategies).

Having covered the **political will/ leadership and policy advocacy** requirements, for reaching the Porto climate neutrality target, the first systems that come to mind are **technological/infrastructural**, namely the need to: 1) invest in and expand the use of **renewable energy sources and infrastructure such as solar power**; 2) implement technologies and practices that enhance energy efficiency in buildings, transportation, and industrial processes; and 3) develop intelligent energy distribution systems - **smart grids** - to optimize energy use and integrate renewable energy sources. This political will is key to get things done. The maintenance of strategic partnerships with entities as [E-REDES](#), the Portuguese Distribution System Operator (DSO), through initiatives as the [Energy Transition Centre](#) has enabled Porto to reinforce its smart grids infrastructure over the last few years. At the moment, Porto has one of the most extensive national smart metering infrastructure, covering almost all electrical installations. This collaboration has allowed the Municipality to develop several pioneering projects in terms of digitalization and the application of advanced smart grid concepts, such as real-time monitoring and demand side management ([Asprela + Sustentável](#)). Also, the



continuous investments made over the last few years in public transport, housing and renewable production constitute currently a strong and robust support for the implementation of this plan, both due to the infrastructure already implemented and the internal technical capacity acquired. As an example, **the city has in place several municipal incentives, both for housing renovation and for renewable energy production.** However, these incentives do not appear to be sufficient to massively accelerate investment in building renovation, and although the city centre currently has a large stock of renovated buildings due to growing tourism pressure and a sustainable local housing strategy, the outskirts of the city still have many buildings in serious need of renovation. As a way of supporting people in the process of renovating their homes, the city has had the [Porto Energy Hub](#) since September 2022. Developed as part of the EU-funded Porto Energy ElevatoR project, the Porto Energy Hub is a physical and virtual one-stop-shop to help citizens implement energy efficiency and renewable energy production in their homes. In addition, over the last few decades, Porto has made significant investments in the renovation of social housing managed by the city. In total, Porto has invested more than 150 million euros in these buildings.

Institutional/regulatory systems are no less important. Establish and implement **climate action plans**, as the city SEAP, that outline strategies, goals, and actions for reducing GHG emissions at the same time as a city transformation is boosted is vital, as well as to rigorously enforce regulations on energy efficiency, renewables, transports, etc. In turn, adopting **zoning regulations and land use policies** that encourage sustainable urban development, energy-efficient buildings, and green spaces should not be underplayed. Spatial planning is often called the 'framework' for implementing mitigation and adaptation measures at the local and regional level. In this setting, the city **Master Plan** is a key policy tool. In addition, to promote sustainable **transportation choices and encourage sustainable consumption patterns**, the **behavioural system** is also addressed in Porto as a way of prioritizing public transit, cycling, and walking, as well as the use of energy-efficient appliances and eco-friendly products. This system is closely linked to the **social system**, which can be strengthened by **increasing public awareness and education** about climate change, sustainable practices, and the benefits of acting on climate change from a young age. **This behavioural change is key in what concerns transport as a major shift in the city's mobility strategy is needed if Porto is to achieve its carbon neutrality goals.** Major investments have been made in the urban transport sector in recent years (reflecting the long-lasting city work on this topic):

Metro Line expansion	Decarbonization of public on-road vehicles (municipal fleet)	Free access to public transport modes
- As part of the Recovery and Resilience Program, Porto will have three new metro lines (extension of the yellow line, new pink and ruby lines) and a BRT [Bus Rapid Transit], with a total investment of over 908 million euros. - Note: All the works on both the several metro lines and the BRT already started.	A municipal investment of around 10 million euros has recently been made in the acquisition of more sustainable equipment and vehicles for the municipal company that operates in the field of urban cleaning and waste collection, in addition to the rental contract for light electric and plug-in hybrid vehicles in the municipality, which from 2017 will allow Porto to save money as well as reducing CO₂ emissions into the atmosphere.	Bus and metro tickets are free for the elderly, children and young people (up to 18 years). More and more young people are taking part in this measure, which is proving to be effective, and it is financially supported by the city council at a cost of over 17 million euros (until 2030).

Figure 22. Example of actions taken to improve Porto's mobility.

Figures show that the number of passengers using public transport is increasing - in 2022, Metro do Porto exceeded 65 million validations and in 2023 the value surpassed 79 million validations, the best result the company has ever achieved. In the same direction, the number of passengers transported



by the city's main bus operator in 2022 increased by 35% compared to 2021 and 7,5% in 2023 compared to 2022. Despite the increases in buses, STCP still have 96,3% of the 2019 passengers (the best result before COVID-19). Still, national and metropolitan statistics also show that the share of people travelling by private car on a daily basis remains constant (and is even increasing). Thus, despite the efforts, the city needs to do more in this area. Porto is currently developing a more ambitious strategy for mobility in the city - continuing to invest in public transport, promoting soft mobility and establishing a new parking policy. **These are key objectives of the city Master Plan to improve accessibility and mobility conditions in the city, while reducing GHG emissions.**

Community engagement is also important, by involving citizens in decision-making processes and encouraging community-led initiatives. **Therefore, the organizational system should foster collaboration and partnerships among local governments, businesses, NGOs, and community groups to implement joint climate initiatives and build/strengthen the capacity of local government and organizations to plan, implement, and monitor climate actions effectively.**

Finally, regarding the **financial system**, it is important to develop **green financial mechanisms** to support climate-friendly projects, including subsidies, and incentives, and attract private investment in sustainable infrastructure and technologies and engage in **public-private partnerships**. Also, due to its privileged location and economic development in the recent years, **Porto can currently be considered a magnet to attract funding, both public and private.** The most recent Ernest & Young (EY) study on Portugal's attractiveness in terms of Foreign Direct Investment (FDI) was presented in [September 2023](#), which confirms the country's upward trajectory, with Porto at the forefront. EY highlights the city's "upward trajectory", reflected in the more than 2250 foreign companies based in the region, "including technology centres and IT services from around the world such as Natixis, Euronext, Kantar, TeamViewer, Maersk or Critical Techworks. **Indeed, the city created InvestPorto, an investment promotion agency founded by Porto City Council to promote, win and support investments in key areas for a more sustainable and competitive future. Also, the city has extensive experience in applying for both National and Regional Operational Programs, namely Norte 2030, and the Recovery and Resilience Program.** The Municipality and its municipal entities are qualified to prepare and execute projects. Furthermore, the Municipality and the Transition Team have mapped out a series of international financing opportunities in strategic areas such as climate science and solutions, energy supply, energy systems and grids, buildings in energy transition, communities and cities, clean, safe, and accessible transport and mobility, smart mobility, circular economy, sustainable waste management, etc. New opportunities within the scope of the New European Bauhaus (due to Porto's goal of creating a more sustainable, inclusive, and beautiful environment for its citizens), LIFE and Horizon Europe programs.

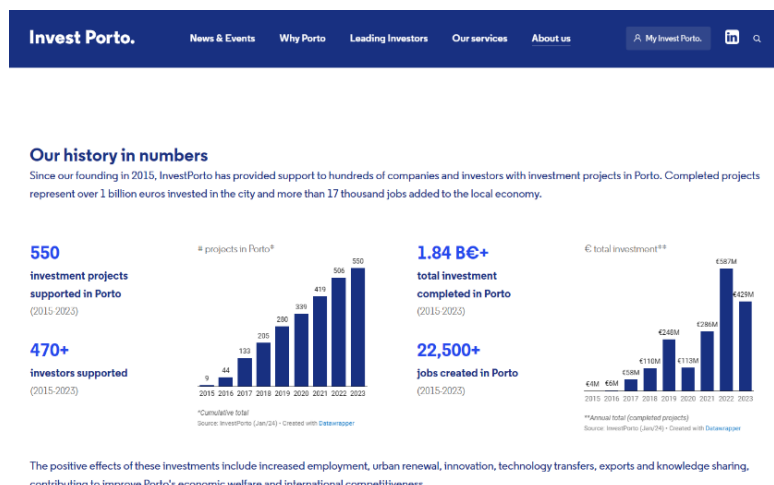


Figure 23. InvestPorto figures.

The discussions held on the 2023 April's joint workshop were essential for the local Transition Team to map potential barriers to implementation and levers of change (Figure 24). A first draft of this list of barriers and levers of change was made in the framework of the [Porto Energy \(R\)Evolution 2030](#) Investment



Concept developed and approved in 2022 for the [European City Facility](#) program, which was now revised and updated.

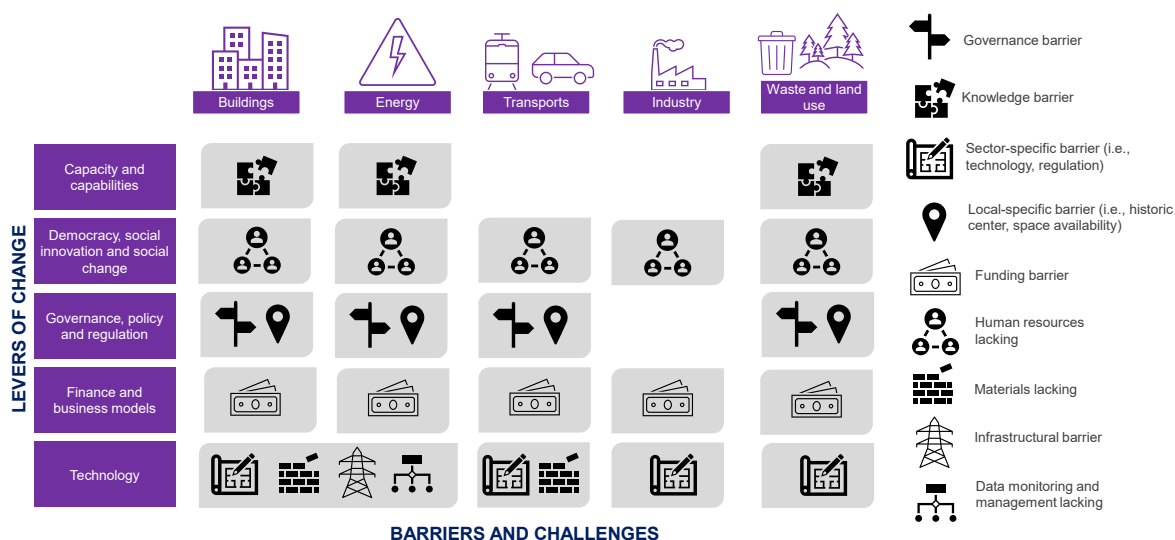


Figure 24. Listing of barriers, challenges and required levers of change.

Regarding barriers, the following have been identified:

- **Governance barriers** are common to all emission sectors (except industry, which has its own characteristics) and are mainly related to the need to articulate and involve the various internal departments of the Municipality, the municipal entities, and the main stakeholders of the city around a common goal. This barrier has been overcome through the creation of a Transition Team, coordinated by the Directorate of Carbon Neutrality of Porto, an internal unit of the municipal company Porto Ambiente, created specifically with the purpose of guiding the city's entities to work in the same direction.
- **Multilevel governance:** Also, from a governance perspective, the city still faces challenges in aligning local goals with central government and national targets. There are several examples where the scope of the city's executive action goes far beyond the Municipality's remit (e.g., structural roads that cross the city and worsen the mobility in the city), making government support essential for achieving local climate neutrality. To mitigate this challenge,



BOX 4: Multilevel alignment

Despite being autonomous about the actions to be implemented in its territory, the Municipality depends on external actors when it comes to:

- **Transport** - Strategic decisions such as the construction of new metro lines have to be taken at central state level due to the required investment. In turn, due to the existence of metropolitan public transport solutions (such as public bus), decisions that affect these joint services have to be taken at the metropolitan council level.
- **Roads and strategic infrastructures** - The municipality of Porto is crossed by the Via de Cintura Interna (VCI), a fast road with the profile of a motorway that loops around the central area of the urban centres of Porto and Vila Nova de Gaia, in an extension of 21 km. VCI is considered the transversal problem of traffic in Porto, as result of intense traffic and congestion that sometimes extends for long kilometres. The intensification of the traffic problem in recent years was the reason for the creation of a working group that includes representatives from three municipalities - Porto, Matosinhos and Maia -, Infraestruturas de Portugal (IP) and specialist technicians, with a view to carrying out a survey of existing problems and the definition of a strategy for VCI. The medium and short-term conclusions were announced in April 2021, with the working group meetings resulting in 27 measures aimed at to improve VCI circulation. However, action depends on the consensus of the three municipalities and the Government's decision, without which measures cannot be implemented. In this sense, in order to implement effective solutions, a joint front and the support from the Government is necessary to resolve the biggest congestion problem in the city of Porto.
- **National goals, funding and regulations:** The expected decarbonization of the electricity sector and natural gas supply, with the increase in renewable production capacity and the introduction of hydrogen or other renewable gases into natural gas supply networks, essential for the decarbonization of the country and municipalities, are dependent on national policies and investments. Additionally, the formulation of key regulations as well as the easing of permitting processes for the massification of renewable energy communities, energy certification, construction of NZEB buildings, etc., as well as the release of community funds channelled through the Government, hinder the action of the municipality and its actors.

Porto's participation in the National Network of Cities and Regions for Carbon Neutrality (Figure 8) is expected to contribute to the development of a closer and facilitated relationship with several key entities, among which, the Government, which has a crucial role in the local decarbonization.

and as discussed previously, Porto is participating in a national network of Portuguese cities that aim to accelerate carbon neutrality and discuss this issue directly with the central government, decreasing the dependence of external entities.

▪ **Barriers resulting from the specificities of each sector:** In the Energy sector, the physical characteristics of the electrical system can hinder the injection of distributed photovoltaic production; in Buildings, the demanding nearly zero-emission building (NZEB) requirements for new buildings can pose difficulties; in Industry, the low flexibility and specificity of production processes can hinder the shifting of used energy vectors or the use of non-energy products; in Transport, the still limited storage capacity of vehicles (especially for public transport) and the difficulty of converting existing fossil-fuel vehicles to sustainable ones; and in Waste, the difficulty of reducing and managing organic matter or improving recycling rates. These are just a few examples of sector-specific barriers that affect the transformative change required in Porto. To these must be added the barriers imposed by the characteristics of the city: mobility and the availability of green spaces in Porto are largely influenced by its geography and land use, while the classification of the historic centre as a UNESCO World Heritage Site restricts energy efficiency

interventions in buildings (which must maintain the original design, which affects the thermal insulation of external facades and interventions in glazing) and the installation of rooftop renewable production systems, both for electricity production and water heating. These restrictions must be overcome both through increased knowledge and innovation, and through technological progress with the emergence of alternative energy systems and construction technique.

- **Knowledge and literacy barriers**, whether in technical terms, available financing mechanisms or in terms of legal frameworks/licensing procedures, have also been identified as barriers to the implementation of energy efficiency measures and renewable energy production in buildings (residential, commercial, and local/public administration), as well as more sustainable practices in terms of waste management and use of water resources. In



order to reduce these barriers, initiatives such as the Porto Energy Hub and the Porto Climate Pact Talk Series have been implemented to disseminate information and increase the capacity of the population to adopt more efficient behaviours and practices. In addition, at a technical level, the Municipality often draws on the support and advice of the local scientific and academic ecosystem, as well as the AdEPorto (Porto Energy Agency), to increase the capacity of its internal staff.

- **Access to funding and leveraging of private financing** to implement urban transformation is also a barrier that cuts across all sectors. This barrier is overcome both by taking advantage of the available funding programs (operational programs, Recovery and Resilience Program (Next Generation EU Funds), structural funds, etc.) and by exploring alternative business models that leverage private investment to accelerate city transition.
- Additionally, the generalized **shortage of human resources** (across all sectors), both at the technical and implementation levels, which can be particularly worrying in the building (e.g. renovation works) and transport (e.g. construction of new metro lines) sectors, is also a relevant obstacle to consider, as it can have a significant impact on the implementation of projects. This scarcity of human resources can lead to significant social changes, both in terms of the quality of life of the population and in the local economy, with implications for (un)employment and wealth creation. In addition to the shortage of labour, there is also a shortage of materials (e.g. components for photovoltaic systems) due to the pandemic crisis and the war situation in Europe, which has a negative impact on the execution time and cost of projects.
- Also noteworthy are the **barriers to digitization**, both due to the lack of a massive roll-out of smart metering in buildings and sophisticated information and communications technology (ICT) infrastructures that allow real-time monitoring and management of energy data (consumption and production), and the infrastructural barriers that delay the massification of distributed photovoltaic production and electric mobility. Both barriers can only be overcome with massive investment in electrical and communication infrastructures and the development of appropriate technologies for monitoring and managing big data.
- **Social barriers** should also be considered. On the one hand, both economic and energy poverty are relevant social risks at the city level. According to [municipal data](#), more than 28 thousand residents currently live in social housing complexes owned by the Municipality (around 12% of the total resident population). Of these, more than 28% are retired and 8% are isolated elderly people. The vision of Porto Executive is that no one should be left behind in the decarbonization process. Thus, in addition to the investments in energy efficiency and improvement of thermal comfort conditions in these buildings made over the last few years and to continue in the coming years, to which must be added the foreseen municipal investments in renewable production, the Municipality has now the ambition to reinforce the engagement of the most vulnerable segment of the population through targeted campaigns and sessions (similar to the ones developed under the scope of the [URBiNAT](#) project), which allow citizens to have a say in the city carbon neutrality plans. On the other hand, experiences and initiatives as the [Porto Energy Hub](#) reveal that, even the citizens with the necessary capacity to make investments (whether in the rehabilitation of their homes, in the replacement of equipment or in renewable energy production), they usually do not know how and need suitable support to carry out these interventions. In this sense, the Municipality intends to reinforce this service through parishes and other nearby entities, in order to reach more citizens.



Despite these challenges, one thing is clear: **A collective understanding of the carbon neutrality task requires a collaborative and inclusive approach.** Several strategies can and will be used to foster collective understanding and ownership, as well as to incorporate different viewpoints in addressing the complexity of climate action for neutrality in Porto. These are based on the fostering of multidisciplinary discussions, as the ones occurred during 2023 in the [Porto Climate Pact Talk Series](#), including experts from different fields such as urban planning, environmental science, economics, sociology and engineering, and sectors such as government, industry, academia and civil society.

The strategies are summarized as follows:



Stakeholder Engagement

- **Inclusive Processes:** Engage a diverse range of stakeholders, including local residents, businesses, community organizations, academic institutions, and governmental agencies.
- **Participatory Decision-Making:** Involve stakeholders in the decision-making process to ensure that a variety of perspectives are considered.
- **HOW TO DO IT?** Through sessions as the Porto Climate Pact Talk Series in which guest speakers and experts from different topics share good practices, ideas and ambitions on topics relevant to the city and where assistance is challenged to make suggestions, questions and provide comments on the topics covered. The large number of citizens participating in this municipal initiative demonstrates the effectiveness of the approach and the importance of the carbon neutrality topic for civil society, reflected in the growing number of citizens signing the Pact at the personal level. Also, the lessons learned from initiatives as URBiNAT, ConDomus and Porto Orgânico will also be used to foster stakeholders engagement.

Data Sharing and Transparency

- **Open Data Platforms:** Create platforms for sharing relevant data openly, allowing various stakeholders to access and analyze information.
- **Transparency in Decision-Making:** Ensure transparency in decision-making processes, providing stakeholders with insights into the factors considered.
- **HOW TO DO IT?** Porto has currently an open-data platform which includes daily data, such as traffic intensity, public transport use, internet use on public buses, NO₂ emissions and noise levels. This platform aims to support decision making and urban management and will be shortly updated with energy data and other relevant information. Developed by Porto Digital, in partnership with NOVA Information Management School, the platform was presented at the International Data Corporation (IDC) Future of Digital Innovation, in Lisbon, and at the Smart City Expo World Congress, in Barcelona.

Community-Based Research

- **Local Knowledge Integration:** Recognize and integrate local knowledge and expertise from community members who have insights into specific challenges and opportunities.
- **Community-Led Initiatives:** Support and amplify community-led research and initiatives that address climate issues from the ground up.
- **HOW TO DO IT?** Through the fostering of local academia and research outcomes and the use of the city as a living lab for smarter cities, thus creating the conditions for future research and development in areas such as sustainability, mobility, urban planning and information and communication technology (e.g., Asprela+Sustentável project).

Scenario Planning

- **Future Scenario Development:** Utilize scenario planning exercises and digital twinning tools to explore different possible futures and their implications.
- **Stakeholder Workshops:** Conduct workshops to involve stakeholders in the creation and exploration of alternative scenarios.
- **HOW TO DO IT?** The city is taking the first steps on the development of a digital twin for a specific area of the city, under the scope of the ASCEND project. This tool, which allows for simulate alternative scenarios, will be expanded for other parts of the city and included in Porto's urban data platform. This process will be informed by local stakeholders. The city has experience with the organization of citizen engagement sessions and focus groups, as shown by the Porto Climate Pact Talk Series.

Feedback Mechanisms

- **Continuous Feedback Loops:** Establish mechanisms for continuous feedback from stakeholders throughout the planning and implementation processes.
- **Adaptive Management:** Be willing to adapt strategies based on feedback and changing circumstances.
- **HOW TO DO IT?** The continuous monitoring of municipal facilities' consumption through the Energy Observatory provided by the AdEPorto as well as the new engagement and feedback tool to be developed under the scope of the WAKE UP! pilot are expected to foster consecutive feedback loops which are key to inform future energy decisions.

Communication Strategies

- **Effective Communication Channels:** Use various communication channels to disseminate information about climate action initiatives and engage diverse audiences.
- **Clear and Accessible Language:** Ensure that communication materials are presented in clear, accessible language to reach a broad audience.
- **HOW TO DO IT?** Use city platforms as preferred communication channels (e.g., Porto Card, WAKE UP! app, etc.) and the Porto Climate Pact brand as umbrella for the development of a coherent and unified communication strategy.

Education and Awareness

- **Educational and training Programs:** Implement educational programs to increase awareness of systemic issues related to climate action.
- **HOW TO DO IT?** By taking advantage of the structure responsible for the activity of education for sustainability in the Municipality and municipal companies and increasing their skills and competencies, as well as areas of activity.

Figure 25. Strategies to mitigate implementation barriers.



3 Part B – Pathways towards Climate Neutrality by 2030

3.1 Module B-1 Climate Neutrality Scenarios and Impact Pathways

B-1.1: Impact Pathways						
Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
Energy systems (ES)	ES.01 Purchase of 100% certified renewable energy	- Technology/ infrastructure. - Governance & policy. - Learning & capabilities.	- Positioning of the City as a 'leader by example'. - Adoption and enforcement of policies mandating 100% certified renewable energy use.	- Development of expertise and skills in Sustainable Public Procurement (as detailed in the 2022 City Sustainable Development Report). - Replication by other city entities (ex. STCP signed a 100% renewable electricity supply contract).	16 500 tCO _{2eq}	- Improved air quality, human health, and quality of life. - Attraction of investments for innovative sustainable projects.
	ES.02 Renewable energy generation in municipal and private facilities and buildings	- Technology/ infrastructure. - Governance & policy. - Social innovation. - Learning & capabilities.	- Implementation of renewable energy sources and necessary infrastructure in municipal and private facilities. - Production of energy by the Municipality and citizens. - Increased energy independence (from the grid) and change in the role played by traditional energy consumers. - Adoption and enforcement of policies mandating renewable energy production in public and private buildings: Implementation of the Porto city tax exemption for renewable producers. - Growth of renewable energy companies. - New skills from the shift from consumer to prosumer.	- Improved smart grid-level infrastructure – Growing role of the city Energy Transition Accelerator. - Higher shares of renewable energy. - Scalability and transformation of the current power system business model. - Reinvestment in energy or community projects. - Updated city data platform – monitoring and control of photovoltaic (PV) assets. - Updated competences of the municipal company Águas e Energia do Porto as manager of the city PV assets.	30 729 tCO _{2eq}	- Improved air quality, human health, and quality of life. - Lower energy costs. - Emergence of new renewable business models and creation of jobs. - Increased property values. - Just climate transition by reducing energy poverty. - Enhanced city capabilities in renewable energy projects.



B-1.1: Impact Pathways						
Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
	ES.03 Renewable energy generation in Porto's industry	- Technology/ infrastructure. - Social innovation. - Finance & funding.	- Implementation of renewable energy generation infrastructure. - Establishment of a partnership with local Volunteer Firefighters /Performance-based contract - 10% Profit share for local Firefighters.	- Full operation of renewable energy communities (REC) (e.g. technological integration, supply chain sustainability). - Potential growth of the REC membership. - Profitability of the REC - Continued profit share for local Firefighters.	25 000 tCO _{2eq}	- Improved air quality, human health, and quality of life. - Potential replication of this business case at a national level.
	ES.04 100% LED street lighting equipped with monitoring system	- Technology/ infrastructure. - Governance & policy. - Learning & capabilities.	- Implementation of 100% LED street lighting and remote management control system. - Integration of smart traffic lighting. - Skill development in smart infrastructure management.	Full operation and maintenance of state-of-the-art smart lighting infrastructure.	4 747 tCO _{2eq}	- Improved air quality, health, and quality of life. - Reduced light pollution. - Increased safety and improved accessibility, through enhanced visibility in critical traffic points. - Knowledge transfer to urban planners. - Savings for the city budget.
	Sub-total				76 975,6 tCO _{2eq}	
Mobility & transport	MT.01 Reduced motorized passenger transportation need	- Technology/ infrastructure. - Governance & policy. - Social innovation. - Learning & capabilities.	- Expansion of cycling infrastructure - Establishment of pedestrian zones. - Shift in urban planning focus from car driven policies to proximity city principles.	- Progressive elimination of on-street parking. - Decrease in private parking alternatives. - Shift in travel and car use patterns. - Cultural change towards sustainable mobility.	47 991 tCO _{2eq}	- Time saving by avoiding traffic jams, closeness to facilities and teleworking. - Improved air quality. - Noise reduction. - Enhanced public transport connectivity through soft mobility integration. - Increased health and well-being through sustainable urban lifestyle adoption. - Just social transition that does not link mobility and accessibility to the ownership of a car. - Reclaimed public space for people fruition and soft mobility.



B-1.1: Impact Pathways

Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
	MT.02 Reduced pkm traveled by car - shift to public and electric transport	- Technology/ infrastructure. - Governance & policy.	- Decarbonization and electrification of STCP fleet. - Creation of dedicated Bus Lanes and other infrastructure changes (e.g., Bus Rapid Transit line, development of charging stations). - Free access to public transport for 22 trips to Porto Card users	- Expanded and improved public transport fleet. - Increased network of charging stations for the STCP Fleet. - Continuation of free 22 trips for Porto Card users until at least 2025. - Improved comfort and sustainability in public transport. - Increased public transport quality and frequency. - Changes in urban planning. - Increased revenues by higher adoption of public transport. - OPEX reduction.	117 120 tCO _{2eq}	- Time savings by avoiding traffic jams. - Improved air quality, human health, and well-being through sustainable urban lifestyle adoption. - Noise reduction. - Enhanced public transport connectivity through sustainable mobility integration. - Just social transition that does not link mobility and accessibility to the ownership of a car. - Increased capacity of reinvestment. - Creation of jobs in transportation related sectors.
	MT.03 Increased shared mobility and MaaS options	- Technology/ infrastructure. - Social innovation.	- Creation and marketing of carpooling platforms. - Improved regulatory framework for Mobility as a Service (MaaS) services. - Establishment of Public-Private Partnerships.	- Increased number of users of shared mobility. - Enhanced last-mile journey automation (FABULOS). - Formulation of policies supporting shared mobility. - Maturation of the market. - Establishment of an innovation ecosystem.	7 080 tCO _{2eq}	- Improved air quality, health, and well-being. - Noise reduction. (Academic) community building. - Increased knowledge and skills in MaaS implementation and development of digital services and solutions.
	MT.04 Electrification of vehicles (cars and motorcycles)	- Technology/ infrastructure. - Governance & policy.	- Installation of charging infrastructure at key locations in the city. - Transition of 100% of municipal vehicles to electric models. - Implementation of supportive policies and regulations for electric vehicles (EV) adoption (e.g. incentives for private EV owners).	- Expanded charging infrastructure coverage. - Integration of smart technologies for efficient charging and energy management. - Increased social acceptance and positive perception of EV.	31 790 tCO _{2eq}	- Improved air quality, health, and well-being. - Noise reduction. - Shift in societal norms towards sustainable transportation choices. - Emergence of new business models and services related to EV. - Creation of jobs.



B-1.1: Impact Pathways						
Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
	MT.05 Optimized logistics	- Technology/ infrastructure. - Governance & policy.	Implementation of the Plan for Sustainable Logistics (PLUS).	- Establishment of smart logistics ecosystem. - Continued collaboration between the Municipality and businesses in refining and implementing sustainable logistics solutions.	30 364 tCO _{2eq}	- Improved air quality, health, and quality of life. - Noise reduction. - Emergence of innovative business models in the logistics sector.
	MT.06 Electrification of light and heavy freight vehicles	- Technology/ infrastructure. - Governance & policy.	- Introduction of electric charging infrastructure for freight vehicles. - Adoption of EV technology by logistics companies. - Potential establishment of emission reduction targets for freight transport.	- Expansion and optimization of charging infrastructure/ Development of smart charging solutions and grid integration. - Vehicle replacement programs. - Potential incentive programs, for businesses to adopt sustainable logistics practices and invest in eco-friendly vehicle fleets.	14 988 tCO _{2eq}	- Improved air quality, human health, and well-being. - Noise reduction. - Emergence of new business models for electric freight and mobility services. - Creation of jobs.
	Sub-total				249 332,0 tCO _{2eq}	
Waste & circular economy	WCE.01 Increased waste recycling	- Technology/ infrastructure. - Governance & policy. - Social innovation.	- Implementation of the ReBOOT project. - Implementation of Dose Certa and Embrulha projects. - Implementation of Orgânico initiative. - Implementation of the Good Food Hubs pilot project. - Collaboration on the City Loops project. - Increase recycling rates - Increase the number of recycling containers in the city	- Improvement and expansion of waste collection and separation infrastructure. - Enhanced recycling goals, awareness, and behavioural change (7R's policy). - Development of a reuse center network in the city	17 982 tCO _{2eq}	- Improved ecosystem health. - Emergence of new green business models and creation of jobs. - Long-term behavioural change towards more sustainable waste management practices, indicating a growing sense of responsibility and commitment to achieving "landfill 0" goals.



B-1.1: Impact Pathways						
Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
	WCE.02 Optimized processes and efficiency in wastewater treatment facilities	- Technology/ infrastructure. - Learning & capabilities.	- Optimization of the water pumping system. - Installation of an energy management system. - Allocation of budget for implementing optimization measures at the Sobreiras waste water treatment plant (WWTP). - Implementation of wastewater reuse project.	- Production of renewable energy for self-consumption. - Resilience and optimization of Freixo WWTP, enhancing the efficiency of the wastewater treatment process. - Energy and cost savings.	1 748 tCO _{2eq}	- Improved water quality and water ecosystem health. - Emergence of new business models and creation of jobs. - Transfer of knowledge and best practices in wastewater treatment to other municipalities. - Increased public awareness of the benefits of reclaimed water reuse, contributing to a more informed and environmentally conscious community.
	Sub-total				19 729,5 tCO _{2eq}	
Green infrastructure & nature-based solutions	GI.01 Increased green infrastructure (GI) (carbon sink)	- Technology/ infrastructure. - Learning & capabilities.	- Mapping of the green infrastructure. - Full operation of Asprela Central Park, São Roque Park, and Oriental Park. - Progress in Alameda de Cartes Park execution. - Expansion of the City Park. - Promotion of "If You Have a Garden, We Have a Tree for You" Program, 100,000 Trees project and Living Tree Beds initiative. - Establishment of Public-Private Partnerships. - Completion of Lapa Urban Park.	- Advancement in Porto BioSpots Network. - Positive public perception and interaction with new green spaces. - Increased community participation in green initiatives. - Long-term success of FUN Porto - Native Urban Forests Project. - Mechanisms for fostering citizens participation (e.g. Porto's collaborative budget⁴). - Sustainable investment attraction and scaling up of GI.	-514 tCO _{2eq} *	- Improved air and water quality. - Improved ecosystem health and climate resilience (temperature regulation, flood prevention, etc.). - Increased human health and well-being. - Creation of jobs. - Increased property values. - Just transition by democratising the ecosystem services provided by nature-based solutions. - Enhanced city capabilities in green infrastructure management.
	Sub-total				-514 tCO _{2eq} * (as in table A-2.1, carbon removal is represented with a negative sign)	

⁴ Porto City Council provides funding annually through parishes to support the implementation of projects in its territorial areas. For 2022, the value of 150 thousand euros was set for each parish council. This mechanism, called collaborative budgeting, aims to be an instrument of participatory democracy of proximity, through which citizens are given the possibility of submitting investment proposals, choosing the projects they wish to see implemented. The proposals to be supported within the scope of the collaborative budget must be concerned with promoting sustainability as a whole.



B-1.1: Impact Pathways						
Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
Built environment (Buildings & Heating)	BE.01 Renovation of existing buildings (envelope)	- Technology/infrastructure. - Governance & policy.	- Implementation of renovation projects in municipal and private buildings. - Implementation of the Municipal Tax Exemptions Regulation. - Operation of the Porto Energy Hub.	- Implementation of LiderA Certification. - Enhanced thermal comfort in social housing. - Achievement of a high renovation rate (2,5% per year until 2030). - Increased energy literacy, fostered by the ongoing operation of the Porto Energy Hub.	9 090 tCO _{2eq}	- Improved (indoor) air quality, human health, and well-being, because of increased comfort. - Reduced energy poverty. - Emergence of new business models and creation of jobs. - Increased property values. - Reduction of local budget energy costs.
	BE.02 Construction of new energy-efficient buildings (NZEB standards)	- Technology/infrastructure. - Governance & policy. - Finance & funding. - Learning & capabilities.	- Adoption of integrated renewable energy sources in buildings (solar panels, biomass, etc.). - Enforcement of NZEB standards for all new construction projects. - Development and implementation of the Environmental Index to assess new construction's holistic impact. - Potential financial incentives for builders and developers meeting or exceeding NZEB standards.	- Integration of energy storage solutions to optimize energy consumption. - Stronger regulatory frameworks to enforce and expand building standards. - Enhanced transparency in the construction sector, with public access to environmental performance data. - Attraction of private investments in green building projects.	801 tCO _{2eq}	- Improved (indoor) air quality, human health, and well-being, because of increased comfort. - Emergence of new business models (e.g., green building technologies and materials) and creation of jobs in the green building sector and associated industries. - Increased property values and market demand for sustainable buildings.
	BE.03 Efficient lighting and appliances	- Technology/infrastructure. - Learning & capabilities.	- Implementation of efficient lighting and appliances. - Operation of Porto Energy Hub.	Increased community awareness of the advantages of efficient lighting and appliances.	16 323 tCO _{2eq}	- Improved air quality, human health, and well-being, because of increased comfort. - Energy and costs savings. - Emergence of new business models (e.g., efficient technologies and materials) and creation of jobs.
	BE.04 Digitalization, literacy, and awareness	- Technology/infrastructure. - Social innovation. - Learning & capabilities.	- Implementation of smart grid and digitalization solutions. - Operation of Porto Energy Hub, and implementation of portfolio of sustainability education actions. - Increased energy literacy.	- Engagement of the community, contributing to a sense of shared responsibility for the city's decarbonization. - Further increased energy literacy.	18 128 tCO _{2eq}	- Improved air quality, human health, and well-being. - Emergence of new business models (e.g., innovative solutions) and creation of jobs. - Empowerment of the community, capable of taking informed energy decisions.



B-1.1: Impact Pathways						
Fields of action	Actions	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions by 2030)	Indirect impacts (co-benefits)
	BE.05 Decarbonized space and water heating generation	- Technology/ infrastructure. - Learning & capabilities.	- Increased use of heat pumps. - Upgrade of infrastructure to support decarbonized heating solutions. - Development of regulatory support (e.g., incentives or subsidies). - Operation of Porto Energy Hub.	- Widespread adoption of decarbonized heating equipment. - Potential widespread implementation of government and private sector incentive programs.	26 471 tCO _{2eq}	- Improved air quality, human health, and well-being. - Emergence of new business models (e.g., decarbonized heating) and creation of jobs. - Behavioural shift in societal norms, promoting a culture of sustainability and environmental responsibility.
	Sub-total				70 817,3 tCO _{2eq}	



B-1.2: Description of impact pathways

Knowing the city's ecosystem, the potential barriers to implementation and the levers that can be developed to circumvent them, the Transition Team was ready to start drafting the carbon neutrality vision for the city in 2030 (Figure 26). **This vision of the city was co-created together with the city's stakeholders in the workshop held in April 2023.** The collected ideas transversally cover all sectors, apart from industry, which does not have a significant presence in the city, and several levers of change. The focus on the green structure and the economic and social prosperity of the city also revealed central in this co-creation process (Figure 27).

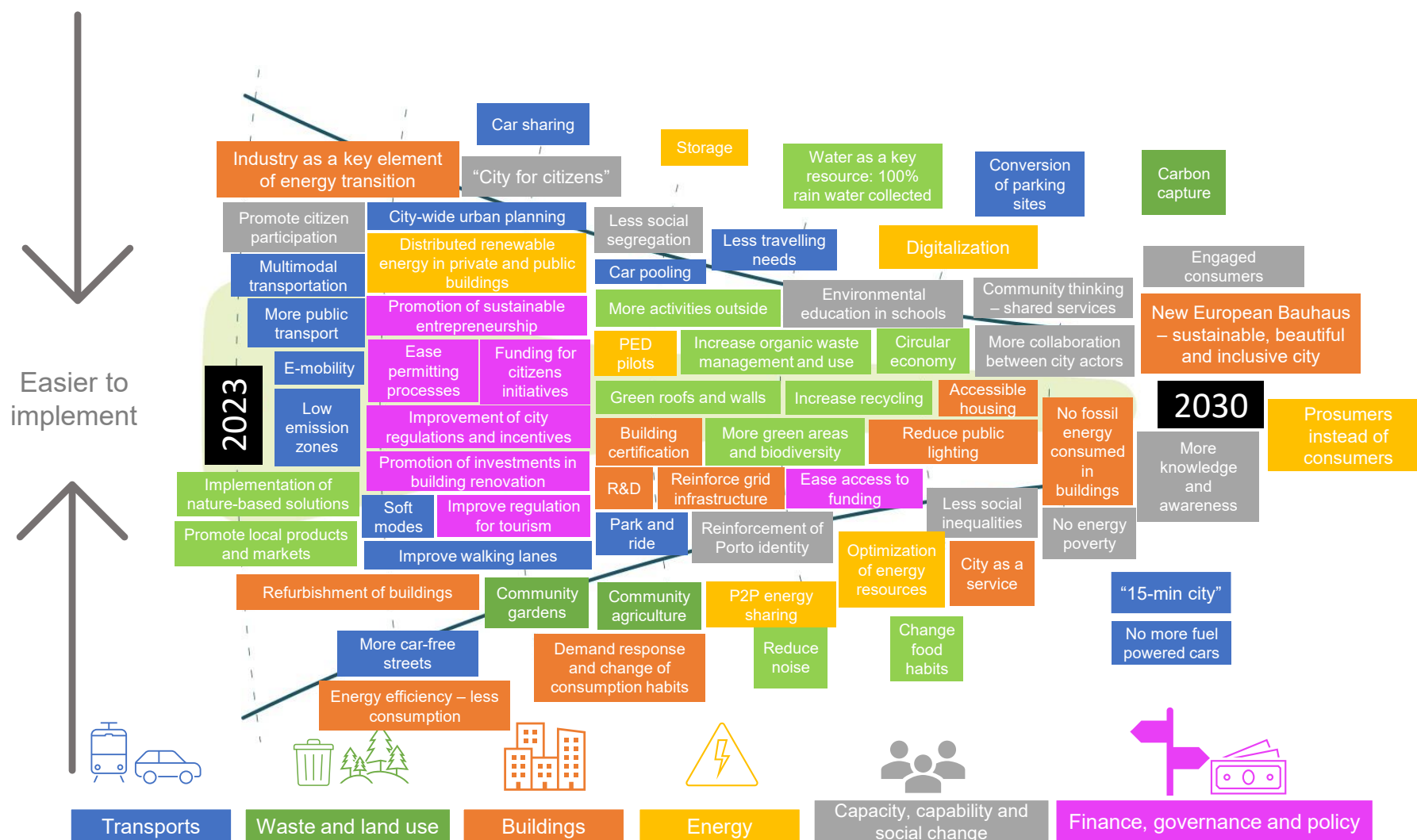


Figure 26. Porto stakeholders' vision towards carbon neutrality (results from the joint workshop held in April 2023 with the NZC team).

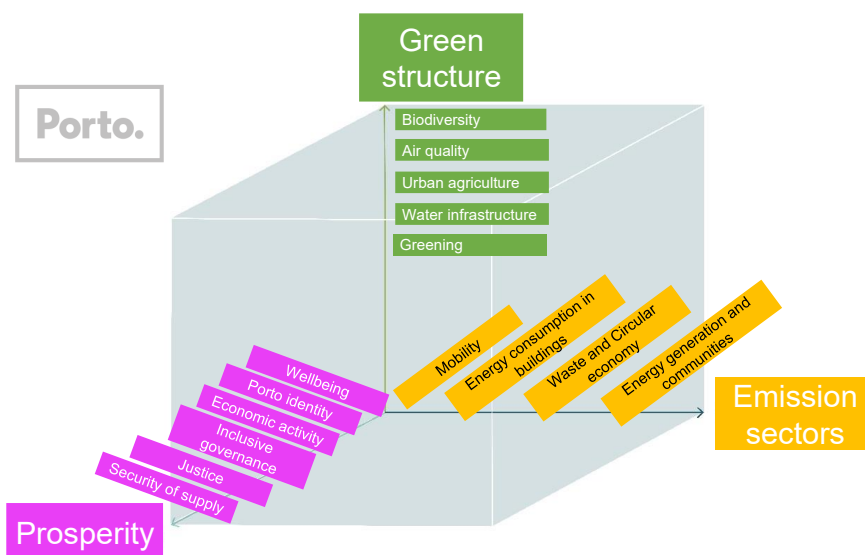


Figure 27. Priority areas of the portfolio of actions of Porto (results from the joint workshop held in April 2023 with the NZC team).

Considering the outputs of these exercises, the portfolio of actions undertaken and to be undertaken by the city was refined to include both actions based on readily available technology (e.g., building renovation, renewable energy production) and new projects based on technologies and systems still in experimental stages (e.g., incorporation of hydrogen in natural gas networks), creating space for innovation labs and regulatory sandboxes in the city. Indeed, Porto is known for its innovative spirit. In 2021, for instance, the publication 'Urban Future with a Purpose' highlighted Porto City Council's commitment to improving the urban life of its citizens, with work in areas such as mobility, environment, government, and security. The study praises the city's drive for innovation and creativity. For example, in the chapter dedicated to digital innovation ecosystems, Porto is cited as a good example, alongside the cities of Espoo (Finland) and New York (United States). "In 2016, Porto began to position itself as a city of innovation and creativity. It created what is currently known as Porto Innovation Hub, an innovation aggregator in which the city functions as a living laboratory, bringing together businesses, entrepreneurs, citizens, and the Municipality to promote problem solving", noted the Deloitte team. The study also mentions that "Porto was chosen as a mentor city in the European Commission's 100 Intelligent Cities Challenge program. This decision was a recognition of the digitalization effort and scalability potential. The city stood out in 2020, when it won first place in Monocle magazine's ranking of the best small cities to live in, for its environmental ambition, business-friendly environment, inclusion, and accessibility". Currently, the city of Porto was chosen again as a mentor city in the Intelligent Cities Challenge 2.0 edition.

The proposed actions derive from the pipeline of projects underway by different municipal companies and the city's main partners until 2030. These actions comprise concrete and soft interventions which have been quantified in terms of both carbon impact and investment required, as the city aims to achieve carbon neutrality in a financially viable way. Stakeholders have also been mapped to help identify and build synergies. This mapping of projects and initiatives also allowed the Transition Team to better consider social, economic and governance co-impacts, both positive (such as the increase in economic activity in pedestrianized streets in the historic centre, etc.) and negative (such as the impact on quality of life and economic activity resulting from the long duration of construction of new metro and Bus Rapid Transit lines).



The impact pathways listed in Table B-1.1 are tailored to the proposed actions and derive from the experience already gathered through the implementation of some projects in the city (and being monitored, e.g., renewable energy production in social housing) and the indicators proposed for their measurement and evaluation over time, which allow a comprehensive understanding of their systemic effects for the city (e.g., improved air quality, noise reduction, etc.). The knowledge gathered from the deployment of the Investment Concept developed under the scope of the EUCF program was also key for defining Porto's impact pathways.

The effects of the listed impact pathways should be monitored taking into account the target values proposed in Module B-3 Indicators for Monitoring, Evaluation and Learning, together with the respective metadata sheets, which will allow for an adequate assessment of progress and the evolution towards climate neutrality at the same time that the effects on society and the economy are analysed. Therefore, the rationale for choosing the long-term and short-term impact pathways are presented below. Also, the priority of each impact pathway as well as the indicative implementation chronogram are presented as follows.

ES.01 Purchase of 100% certified renewable energy directly contributes to achieving carbon neutrality by ensuring that the energy consumed in municipal buildings is sourced from renewable sources, eliminating carbon emissions from conventional energy. • Short-term effect: Immediate reduction of carbon emissions. • Long-term effect: Establish a sustainable energy procurement model to be followed by the city. • Priority: High • Chronogram of implementation: 2020-2023* *To be renewed	ES.02.A Renewable generation in municipal buildings promotes on-site renewable energy and energy resilience, reducing carbon emissions associated with municipal energy use. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Exploit new renewable-based business models. Impact on public perception. • Priority: Medium • Chronogram of implementation: 2020-2030	ES.02.B Renewable energy community from waste conversion into renewable energy, addressing carbon emissions from waste disposal and contributing to a circular economy. • Short-term effect: Immediate reduction of emissions through waste-to-energy, energy consumption and costs. • Long-term effect: Exploit new business models related with the sustainable waste management. Impact on other market players. • Priority: High • Chronogram of implementation: 2024-2030
ES.02.C Renewable energy communities as tools to mitigate energy poverty ensure inclusive access to renewable energy, addressing energy poverty and promoting a low-carbon energy transition. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Alleviating energy poverty and integrating socially vulnerable communities into renewable initiatives.	ES.02.D Renewable generation in private buildings and facilities encourages private sector engagement in renewable energy, contributing to a broader carbon-neutral energy landscape. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Widespread integration of renewable solutions in the private sector. • Priority: Medium	ES.03 Renewable energy generation in Porto's industry targets emissions from the industrial sector, fostering a transition to renewable energy sources. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Scaling up renewable energy adoption and replicate new business streams. • Priority: High • Chronogram of implementation: 2024-2030



• Priority: High • Chronogram of implementation: 2023-2030	• Chronogram of implementation: 2023-2030	
ES.04 100% LED street lighting equipped with control and monitoring system enhances energy efficiency, reducing carbon emissions from street lighting. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Continuous optimization and maintenance for sustained energy efficiency. • Priority: Medium • Chronogram of implementation: 2023-2030	MT.01 Reduced motorized passenger transportation need reduces overall transport emissions by promoting alternative, non-motorized modes. • Short-term effect: Implementation of infrastructure for non-motorized transport (i.e., cycling and pedestrian lanes). • Long-term effect: Establishing a culture of reduced reliance on motorized transport. • Priority: High • Chronogram of implementation: 2019-2030	MT.02 Reduced pkm traveled by car - shift to public and electric transport shifts to low-carbon and electric transport modes, reducing emissions. • Short-term effect: Improving public transport offer. • Long-term effect: Comprehensive offer of low-carbon public transport and increase in public transport rates. • Priority: High • Chronogram of implementation: 2019-2030
MT.03 Increased shared mobility and MaaS options optimizes vehicle use, reducing the overall number of vehicles and associated emissions. • Short-term effect: Immediate reduction of carbon emissions and private traffic. • Long-term effect: Normalization of shared mobility options. • Priority: Low • Chronogram of implementation: 2023-2030	MT.04 Electrification of private vehicles (cars and motorcycles) shifts to electric vehicles, reducing reliance on fossil fuels. • Short-term effect: Immediate reduction of carbon emissions. • Long-term effect: Widespread adoption of electric vehicles. • Priority: High • Chronogram of implementation: 2019-2030	MT.05 Optimized logistics enhances efficiency in logistics transport, reducing emissions. • Short-term effect: Decreased logistic traffic and carbon emissions. • Long-term effect: Sustainable urban logistics in Porto. • Priority: High • Chronogram of implementation: 2021-2030
MT.06 Electrification of light and heavy freight vehicles shifts freight transport to electric modes, reducing emissions. • Short-term effect: Reduction of carbon emissions. • Long-term effect: Widespread adoption of electric freight vehicles. • Priority: Medium • Chronogram of implementation: 2021-2030	WCE.01 Increased waste recycling promotes circularity, reducing emissions associated with waste production. • Short-term effect: Increase recycling rates. • Long-term effect: Improving recycling infrastructure and citizens awareness. • Priority: Medium • Chronogram of implementation: 2019-2030	WCE.02 Optimized processes and efficiency in wastewater treatment facilities enhances efficiency in wastewater treatment, minimizing energy and carbon-intensive processes. • Short-term effect: Reduce energy consumption, costs, and carbon emissions. • Long-term effect: Sustainable and low-emission wastewater treatment practices. • Priority: Medium • Chronogram of implementation: 2020-2030



GI.01 Increased green infrastructure (carbon sink) expands carbon sinks through increased green spaces. • Short-term effect: Doubling green spaces and provide more leisure areas to citizens. • Long-term effect: Maximize Porto's carbon sinking capacity. • Priority: Medium • Chronogram of implementation: 2019-2030	BE.01 Renovation of existing buildings (envelope) improves energy efficiency, reducing emissions from existing buildings. • Short-term effect: Improve thermal conditions and energy efficiency in buildings. • Long-term effect: Achieving a significant reduction in carbon emissions from buildings. • Priority: High • Chronogram of implementation: 2019-2030	BE.02 Construction of new energy-efficient buildings (NZEB standards) ensures new construction standards with high energy efficiency performance. • Short-term effect: Implement NZEB standards. • Long-term effect: All new buildings meeting or exceeding NZEB standards. • Priority: Low • Chronogram of implementation: 2024-2030
BE.03 Efficient lighting and appliances promotes energy-efficient lighting and appliances, reducing overall energy consumption. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Full integration of energy-efficient solutions. • Priority: High • Chronogram of implementation: 2019-2030	BE.04 Digitalization, literacy, and awareness enhances awareness, supports decision making and promotes energy efficient behaviours. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Establishing a culture of energy-conscious behaviour and informed decision making. • Priority: High • Chronogram of implementation: 2019-2030	BE.05 Decarbonized space and water heating generation shifts conventional technologies to low-carbon and renewable heating solutions. • Short-term effect: Immediate reduction of carbon emissions, energy consumption and costs. • Long-term effect: Widespread adoption of decarbonized heating technologies. • Priority: High • Chronogram of implementation: 2019-2030

The portfolio of actions presented in this Action Plan includes a mix of immediate actions that Porto is already implementing and long-term strategies the Municipality is currently drafting, reflecting a comprehensive approach to achieving sustained carbon neutrality in the city. Due to the carbon emission reduction, they represent and the potential effect they may have on local population (especially in the vulnerable one), some of these measures are considered as priority. As most of these priority actions (ES.01, ES.02.A, ES.04, MT.01, MT.05) are solely dependent on the Municipality, the implementation of these actions is facilitated as the City Executive is committed to carbon neutrality and has budget dedicated for this purpose. In turn, actions as ES.02.B, MT.02.B, MT.04.A, although not dependent on the Municipality, they will be implemented by entities that work closely with the Municipality, such as STCP, Metro do Porto, LIPOR, among others, which also facilitates implementation as it gives them greater visibility and relevance. In addition, some of these measures, although implemented and dependent on private action, such as BE.03, BE.04 and BE.05, are facilitated by the action of the Municipality, through for instance the Porto Energy Hub service and the digital infrastructure already existing in the city. Lastly, actions as ES.03 which are only reliant on private actors, are facilitated and fostered by the engagement of these agents within the Porto Climate Pact as it allows them to share best practices and discuss challenges with other entities implementing similar projects.



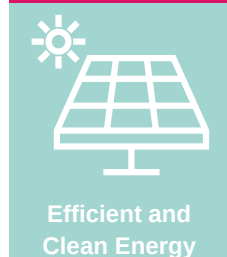
Additionally, the Transition Team ensured that **the identified impact pathways are well-aligned with Porto's 2030 Climate Neutrality Commitments, highlighting the strategic priorities of achieving a greener environment, better mobility options, increased use of clean energy, and promoting circular and sustainable practices across the different fields of action.**



Actions in the field of Green Infrastructure & Nature-Based Solutions (GI) directly contribute to the commitment of doubling the area of gardens and urban parks, using nature-based solutions. Specifically, **GI.01 Increased green infrastructure (carbon sink)** focuses on expanding green spaces, contributing to carbon sequestration and the overall well-being of the city.



Mobility and Transport actions are closely aligned with the commitment to better mobility. **MT.01 Reduced motorized passenger transportation needs** and **MT.03 Increased shared mobility and MaaS options** (as well as **MT.05**) encourage more sustainable and efficient transportation options, promoting active and shared mobility and reducing the dependency of private transportation needs. In turn, **MT.02 Reduced pkm traveled by car - shift to public and electric transport**, **MT.04 Electrification of private vehicles**, and **MT.06 Electrification of light and heavy freight vehicles** contribute to the goal of decarbonized mobility.



Energy Systems actions strongly align with the commitment to more clean energy. **ES.01 Purchase of 100% certified renewable energy** ensures clean energy sourcing, while **ES.02.A to ES.02.D** and **ES.03** involve renewable energy generation in various sectors, including municipal and private buildings, and industry. These actions contribute to decentralizing renewable energy production and fostering local energy sharing, promoting sustainability in energy consumption. **ES.04 100% LED street lighting equipped with control and monitoring system**, **BE.01 Renovation of existing buildings**, **BE.03 Efficient lighting and appliances** and **BE.04 Digitalization, literacy and awareness** and **BE.05 Decarbonized space and water heating generation** are also directly aligned with the strategic energy efficiency priorities.



Waste and Circular Economy actions address the commitment to greater circularity. **WCE.01 Increased waste recycling**, **WCE.02 Optimized processes and efficiency in wastewater treatment facilities**, and actions in the Built Environment field, including **BE.01 Renovation of existing buildings** and **BE.02 Construction of new energy-efficient buildings**, contribute to reducing unnecessary resource consumption and promoting circular practices, including in construction. Additionally, **BE.04 Digitalization, energy literacy, and awareness** support sustainability in energy consumption.

At this stage it will not be possible to accurately quantify or provide numerical estimates for all co-benefits resulting from the identified impact pathways listed above, either due to their typology or due to the difficulty in collecting data for this assessment. However, the main co-benefits can be estimated over the 2030 horizon as presented in Table B-3.1. The monitoring of these co-benefits will be done according to the methodology and data described in the indicators' metadata sheets presented in Module B-3 Indicators for Monitoring, Evaluation and Learning.

Monitoring, Evaluation and Learning (MEL) is a critical process in the context of Porto's Action Plan. At present, Porto can identify a **selection of indicators to monitor and evaluate progress along the defined impact pathways and wider fields of action described in Module B-1**, together with a **preliminary Monitoring & Evaluation (M&E) plan (B-3.1 and B-3.2)**, that offers **milestones and a timeline (2025, 2027 and 2030)**. In addition, a **checklist for the development of a MEL plan is presented**, as the learning part of MEL, the process by which information generated by M&E is reflected upon and deliberately used to continuously improve a project's ability to achieve results, is



the one most at risk of being disregarded. Therefore, both the MEL cycle and MEL planning are almost fully covered. There are several MEL tools that can help to visually represent impact pathways and related indicators. The **Theory of Change** has been used, but others, such as the Weaver's Triangle⁵ and the Log Frame⁶, can allow an action to be presented in a logical way, helping to assess the extent to which the actions identified are working towards climate neutrality.

For Porto, MEL planning included establishing a baseline (2019), a plan for carrying out routine monitoring (on a yearly basis), and mid-term (2025 and 2027) and final (2030) evaluations, as mentioned above, described throughout this document, and summarized in B-3.1 and B-3.2. **During the CCC period, monitoring will be therefore an ongoing process and a significant effort will be put on MEL activities, including detailed staff work plans and regular reviews to be scheduled with partners** (members of the Transition Team, targeted Porto Climate Pact subscribers, or others considered relevant for data gathering) to ensure that monitoring is taking place.

The mid-term evaluation will allow the city to take stock of where Porto's CCC stands and whether the city is on track and on target, not only in terms of early changes, but also in terms of late outcomes and direct impact. By 2030, a final evaluation will be carried out in collaboration with city partners to determine whether, in addition to early changes, late outcomes and the direct impact of reducing carbon emissions, actions have made a real difference in Porto's communities and to assess if the city suffered a systemic transformation as foreseen - indirect impacts.

The indicators identified in the next sections measure the outcome(s) or impact(s) of one or more of the actions in this Action Plan and show how close an action is to the desired pathway and targets. As observable and measurable characteristics, they can be used to show the progress an action is making towards achieving a specific target. Targets were determined considering baseline data, collected from two sources: primary data collected directly from target areas/communities (most of it already collected by the city) and secondary data from written records and national statistics.

Once the final evaluation has been completed, Porto should take time to review it and take note of any lessons learned from challenges, failures and take aways to adjust approaches and improve future initiatives. This stage provides an opportunity to use these learnings to inform decision-making and strategy refinement, identify successful interventions and best practices that can be scaled up or replicated, as well as an input for new action ideas.

Table 1. MEL planning checklist

<i>How data will be collected and analysed?</i>	✓
<i>Where data will be collected from?</i>	✓
<i>When data will be collected (baseline, routine MEL, mid-term evaluation, final evaluation)?</i>	✓
<i>Who has responsibility for collecting the data?</i>	✓
<i>How the information generated will be used?</i>	✓
<i>What resources will be needed to carry out MEL activities (only M&E)?</i>	✓
<i>How the project will be accountable to stakeholders in the process?</i>	✓

⁵<https://evaluationsupportscotland.org.uk/resources/weavers-triangle/>

⁶<https://documents.worldbank.org/en/publication/documents-reports/documentdetail/783001468134383368/the-logframe-handbook-a-logical-framework-approach-to-project-cycle-management>

How and when the learning procedure will be implemented?	-	Porto's MEL plan will be a working document produced to guide the city on how and when to implement MEL activities. In the context of CCC, this plan will be continuously refined and improved over time (i.e., regularly reviewed and updated with more comprehensive monitoring mechanisms and indicators).
Who will be involved in the learning procedure?	-	
How will the documentation of processes and reports and appropriate storage of MEL outputs be implemented?	-	
How will successes, lessons learned, and areas for improvement be communicated and to whom?	-	

more comprehensive monitoring mechanisms and indicators).

Although there is a clear notion of the necessity of reflecting on information and learning from it to improve the CCC performance, detailed planning on how to go about it can be further demonstrated in a MEL plan. For Porto, this plan will be created and put into practice right after the submission of the CCC. Often there is an additional risk that the learning stays with the people directly involved in these processes and lost if those people leave, if not properly shared. **It is therefore necessary to ensure that there is appropriate documentation of processes and reports and adequate storage of MEL outputs to keep the learning within the Municipality and the partners when key staff leave or members of the Transition Team change.**

The specific data required to monitor the progress of Porto's Climate City Contract implementation analysis will vary depending on the goals and strategies adopted. Nevertheless, the following stand out:



Energy and GHG emissions data

- **What to collect:** Energy consumption (per activity sector); Waste produced and collected; Wastewater treated; Population; Data on carbon sequestration and removal activities, such as urban forests and green spaces; Information on renewable energy sources and energy efficiency measures.
- **To what end:** Emission inventories and monitoring tools to quantify and track GHG emissions; Analyze emission trends over time to assess the effectiveness of mitigation measures; Evaluate energy consumption patterns and identify opportunities for efficiency improvements; Assess the impact of renewable energy projects on the city's overall energy mix.

Infraestructure data

- **What to collect:** Information on the development and implementation of sustainable infrastructure, including green and NZEB buildings, smart grids, use of public transportation systems, installed renewable capacity, etc.
- **To what end:** Assess the adoption and performance of sustainable infrastructural projects in terms of energy efficiency, emissions reduction, and overall environmental impact.

Regulatory and Policy Compliance

- **What to collect:** Data on the implementation and enforcement of climate-related regulations and policies.
- **To what end:** Evaluate the degree of compliance with established standards and regulatory frameworks.

Public Engagement and Behavioral Data

- **What to collect:** Surveys and feedback on public awareness, attitudes, and energy use and sustainable behavior.
- **To what end:** Analyze survey results to understand public perceptions, identify areas for improvement, and tailor communication strategies.

Financial Data

- **What to collect:** Financial data related to climate projects, investments, potential revenues and expenditures.
- **To what end:** Assess the financial viability and impact of climate initiatives. Track the allocation of funds to different projects and evaluate the return on investment.

Collaboration and Partnership Data

- **What to collect:** Information and mapping of collaborative initiatives, partnerships, and engagement with stakeholders.
- **To what end:** Evaluate the effectiveness of collaborations in achieving shared climate goals. Measure the impact of partnerships on the success of climate initiatives.

Community Engagement Data

- **What to collect:** Participation rates in community events, workshops, and educational programs.
- **To what end:** Assess the level of community engagement and identify strategies to enhance participation.

Political Support Data

- **What to collect:** Statements, policies, and actions from political leaders supporting climate initiatives.
- **To what end:** Evaluate the strength of political commitment and identify areas for improvement.

Figure 28. Monitoring data required to track Porto's CCC evolution.



3.2 Module B-2 Climate Neutrality Portfolio Design

B-2.1: Description of action portfolios		
Fields of action	Portfolio description	
	List of actions	Descriptions
Energy systems (ES)	ES.01 Purchase of 100% certified renewable energy	Since 2020, all the electricity purchased by the Municipality of Porto (and its municipal companies) for its municipal buildings and public use is renewable. The electricity is classified through guarantees of origin that prove the source of the energy supplied.
	ES.02 Renewable energy generation in buildings	ES.02.A Renewable generation in municipal buildings: The city is actively working towards the production of decentralized energy, both for self-consumption and in community projects, engaging in a variety of projects to achieve this goal. This activity involves the use of municipal public buildings for energy production, taking advantage of the existing rooftop areas for self-consumption renewable energy generation. ES.02.B Renewable energy community from waste: The municipalities that constitute LIPOR (Association of Municipalities for the Sustainable Waste Management of Porto), are discussing the creation of an intermunicipal energy community - the first in the country - to capitalize on the surplus electricity produced through the incineration of domestic waste. The objective is to optimize the 170 thousand MWh of electrical energy generated annually for the benefit of municipal entities, companies, and citizens in the region, transforming waste into a valuable energy resource. ES.02.C Renewable energy communities as tools to mitigate energy poverty: Porto owns a considerable number of residential buildings targeted at social housing. Porto City Council manages a housing stock made up of around 50 municipal neighbourhoods, with around 13 000 dwellings, where around 28 000 people live. The Municipality is, therefore, the largest landlord in the city, responsible for around 13% of the built stock. Considering the available rooftop area and the contribution that cheaper renewable energy may have on energy poverty alleviation, Porto has in place an ambitious roadmap to create renewable energy communities (REC), including social housing and nearby municipal facilities as schools and administrative buildings. Porto has already implemented the first REC in the Agra do Amial neighbourhood and is now taking diligences to replicate the process across the city. Indeed, this municipal ambition created the scene for the development of the first positive energy district in the Municipality, currently under development as part of the ASCEND project and which focuses on a particular area of the city with a large concentration of social housing and buildings under municipal management. ES.02.D Renewable generation in private buildings and facilities: Following the steps of the city executive, local businesses and companies operating in the city are also taking the first steps to produce renewable energy, taking advantage of their rooftops. Among these entities are the Hospital de São João, the University of Porto and the Porto Polytechnic Institute, STCP, among other. The interest of privates with renewable production is even expected to increase with a new city tax incentive for reducing Municipal Property Taxes to private owners (both residential, commercial, or industrial) who install PV systems in their buildings and facilities.



B-2.1: Description of action portfolios

Fields of action	Portfolio description	
	List of actions	Descriptions
	ES.03 Renewable energy generation in Porto's industry	EnergyCon , an energy service company, is implementing a REC, in the industrial area of Porto, in partnership with the local Volunteer Firefighters. This REC, which will be developed by the company, will involve an investment of over 25 million euros, and has a social nature as the company will give up 10% of the REC's profitability for the local firefighters. The company estimates that the REC will bring together more than 60 members and be almost finished by 2026. Also, according to the company estimates, the full-operating REC will avoid the emission of around 25 thousand tons of carbon dioxide.
	ES.04 100% LED street lighting equipped with control and monitoring system	Porto is currently finishing the replacement of its street lighting infrastructure (26 000 luminaires) for LED technology at the same time as it is implementing a remote management control system. The smart and centralized control of the street lighting infrastructure will make it possible to better respond to the effective lighting needs of different urban contexts, implement routines for greater energy efficiency, and optimize equipment availability rates, also contributing to improve the security and mobility in the city. This system is complemented by a smart traffic lighting feature capable of actively control traffic lights in accordance with data received by the city Traffic Management video surveillance system (a network of traffic controllers spread across the city).
Mobility & transport (MT)	MT.01 Reduced motorized passenger transportation need	Porto's Master Plan promotes the enhancement of accessibility and mobility conditions, with a new approach to public transport modes, a focus on the structure dedicated to soft mobility and a new parking policy. This component of the program includes: ▪ The reinforcement of the focus on public transport, with the definition of a structuring network consisting of high-quality bus lanes, circular corridors, and radial axes. ▪ A deep change in the current private parking policy, introducing criteria for non-residential uses in the Historic Centre, Downtown and in the areas influenced by existing and planned metro stations. ▪ The creation of "Zones XXI", where the aim is to progressively eliminate parking in public spaces and along streets, replaced by parking for residents in existing or upcoming parking lots. ▪ The definition of the network intended for smooth modes (more cycling lanes, e-scooters and bicycles sharing and parking enhanced across the city). ▪ The creation of pedestrian zones in the Historic Centre of Porto (four restricted motor vehicle access zones implemented and seven more planned and Network 20 program).
	MT.02 Reduced km traveled by car - shift to public and electric transport	MT.02.A Encouraging the use of public transport through ticketing: Porto is actively fostering public transport use through several initiatives. The free access to public transport was granted within the scope of the measures of the Public Transport Fare Reduction Support Program (PART), launched in 2019, in the Porto Metropolitan Area and which guarantees fare reduction for the entire population and free of charge public transport until the age of 12. In this context, Porto went further and extended the free provision up to 15 years. The success of the measure led to the Municipality extending the free public transport ticketing initiative in the 2020/2021 school year up to 18 years old, thus making it coincide with the national mandatory education age. Additionally, in January 2024 a new measure was announced: all Porto Card users will be



B-2.1: Description of action portfolios

Fields of action	Portfolio description	
	List of actions	Descriptions
		entitled to 22 free trips per year, either on the city's public buses or on the metro. The application of this measure was possible due to the entry into force, at the beginning of the year, of intermodal passes for students up to the age of 23 covered by the Government, meaning that the Porto City Council no longer had an annual expenditure of around three million of euros with the under-18 pass, being able to use this money to generate the creation of new public transport demand. Furthermore, this year, the Municipality is going to implement the extension of the existing on-demand transport model to the general population, reaching areas where public transport is not yet effective. MT.02.B Encouraging the use of public transport through new and better offer: Increasing the quality and quantity of public transport, namely buses and metro, is also a priority to attract users to public transport. In this sense, the main city transport companies, namely, STCP and Metro do Porto have joined forces to reinforce and improve the quality of the service provided, whether through the reinforcement of structuring routes or through more comfortable and sustainable vehicles. STCP has been decarbonizing its fleet, discontinuing diesel buses, and replacing them with electric or natural gas buses, where the penetration of green hydrogen is also a hypothesis under evaluation. Currently, STCP's fleet consists of 434 vehicles, 77 % of which run on natural gas (11.5 % of this gas is biomethane), 5% on electricity (100 % electric vehicles) and 18 % on diesel. The electrification of the fleet is going to continue, aiming to achieve 43% of the fleet electric by the end of 2027, and discontinuing diesel entirely from the city bus fleet by then. In this sense, in the coming years, STCP has planned to invest almost 100 M€ to renew the fleet. Additionally, the offer of the Metro do Porto is also being expanded through the construction of two new lines (Pink and Ruby lines) and the design and construction of the Bus Rapid Transit (BRT) Line which is expected to be completed by the end of 2023. This integrated approach is also facilitated by intermodal infrastructures, such as the new Campanhã Intermodal Hub (TIC), opened on July 20, 2022, a single terminal with connection to the Metro, urban buses and train, car park and bicycle rack for park-and-ride. TIC was built according to Leadership in Energy and Environmental Design (LEED) standards (waiting for certification) and can be the first terminal in Europe with this important sustainability certification. The São João intermodal hub is also a central piece of the public transports offer of Porto as it covers the Asprela area, where the city universities and the main city hospital are located.
	MT.03 Increased shared mobility and MaaS options	A key strategy to increase mobility efficiency and reduce its effects is the percentage increase in the average number of passengers per car/motorcycle in the coming years due to differentiated services such as <i>carpooling</i> and <i>car-sharing</i>, as well as other mobility-as-a-service (MaaS) products. In this context, different urban mobility projects and concepts are currently being piloted in Porto, which includes, for example, the shared e-scooters available in the city for public use, during short periods, and whose sharing points are identified by blue markings on the pavement complemented by the Municipality's online mapping. The Gemini project, with the participation of Porto entities, is also an important project in this scope as it aims to develop and test new mobility solutions and services with significant impact on environmental sustainability, with financial viability and effective user adoption and based on digital services and solutions that combine the use of public transport with micromobility and shared mobility. Porto is one of GEMINI's eight Mobility Living Labs. At the



B-2.1: Description of action portfolios

Fields of action	Portfolio description	
	List of actions	Descriptions
		same time, the city also participates in the FABULOS project, which, by using Public Procurement Innovation approaches, aims to find market solutions for the supply and management of automated public transport for the last-mile journey, as part of the existing transport system. The Porto pilot, to be implemented in the Asprela area, will test new vehicles that should improve the level of service and bring substantial cost savings. Also noteworthy is the "USHARE by AEFEP" app, a carpooling mobile application, which could reach 40 thousand users from the entire academic community in Porto.
	MT.04 Electrification of vehicles (cars and motorcycles)	MT.04.A Network of recharging points for electric vehicles and electrification of private fleet: To promote the adoption of electric vehicles and motorcycles at the private level, the Municipality has several projects in the pipeline associated with, for example, the expansion of charging stations across the city. Since January 2021, electric charging stations operating on public spaces are available. This measure results from a decision by Porto City Council which, by the end of 2019, announced the installation of electric vehicle charging stations on municipal property. These charging points are now spread in car parks across the city and the executive enforced the mandatory installation of charging infrastructure in new and renovated parking facilities. Also, to facilitate electric vehicles' users to identify charging points, a digital map of the locations displaying their availability was created by the city and made available in its website. In turn, the municipal company Águas e Energia do Porto currently has a park of 68 charging points installed on its facilities for its own fleet of electric and hybrid vehicles. In total, the Municipality of Porto currently has around 300 electric charging stations, for the exclusive use of municipal entities that are managed by this company. MT.04.B Electrification of the municipal vehicle fleet: As a way of leading by example, since 2018, 70% of the light diesel vehicles in the municipal fleet have been replaced by electric or plug-in hybrid ones, totalizing 390 vehicles. Currently it accounts with 75%. The municipal fleet, operated under the first and largest leasing contract in the country, had covered more than 4 million kilometres in electric mode by the end of 2020, contributing to a significant reduction in its carbon footprint. More recently, the fleet of urban solid waste collection vehicles (from the Porto Ambiente company) was also renewed through the acquisition of 26 new natural gas-powered vehicles. Currently, new electric sweepers are at the beginning of their duties, and soon some more vehicles will arrive to reinforce the waste collection more sustainable fleet.
	MT.05 Optimized logistics	Based on the National Carbon Neutrality Roadmap, a significant shift in the logistics transport is required so that the carbon neutrality goal is possible. In this sector, the increased digitalization of supply chains (more online shopping, more reverse logistics) increases the demand for the mobility of goods, also increasing the pressure exerted on this sector. Thus, in order to improve its efficiency, it is necessary to: 1) increase the load factor of heavy and light goods vehicles; 2) increase the fleet autonomy and 3) foster the replacement rate of vehicles. The decarbonization of short and long-distance freight transport, promoting a logistics chain with a modal distribution that minimizes the carbon and energy intensity of the transport system is, therefore, a priority especially in a highly tertiary context such as Porto. With a view to reducing pollution caused by vehicle traffic associated with urban logistics, reducing the level of CO₂ emissions associated with urban logistics



B-2.1: Description of action portfolios

Fields of action	Portfolio description	
	List of actions	Descriptions
		through increasing the efficiency of loading and unloading operations and mitigating mobility constraints caused by operations and the circulation of logistic vehicles, Porto developed in 2021 its Plan for Sustainable Logistics (PLUS) . This plan introduces a set of 15 recommendations that aim to improve logistical transport in the city. To support the implementation of an ambitious plan such as PLUS, the Municipality of Porto, supported by Porto Digital, has a detailed digital mapping on the location of municipal car parks, loading and unloading spaces, soft mode sharing points, among others. This data is made available through the city's Urban Platform and its Open Data Portal. This work was made under the scope of the C-Streets initiative whose main objectives are the sharing of data, the development of MaaS solutions, the promotion of effective and accessible public intermodal transport, the reduction of accidents, as well as the evolution of the concept of sustainability and decarbonization in transport.
	MT.06 Electrification of light and heavy freight vehicles	Still at the freight transport level, the National Carbon Neutrality Roadmap global narrative regarding mobility foresees the emergence of new energy vectors, such as the green hydrogen - identified as an important decarbonization vector in sectors with limited alternative technological options, such as heavy passenger and freight transport. According to estimates of this structural document, it is expected that in the 2030s, green hydrogen and electricity will ensure 70% and 88% of the demand for heavy goods mobility in the country, respectively. The implementation of these solutions will depend on the development of structural infrastructure, whose investment and operating costs are still subject to a high degree of uncertainty given the limited pilot projects underway. However, the electrification of heavy transport is already a reality for passenger vehicles (electric buses) and is also beginning to be an option for the freight transport. As an example, reference is made to the experience of the transport companies DHL Express and DPD , with a great presence in the city and which are electrifying their logistic fleets.
Waste & circular economy (WCE)	WCE.01 Increased waste recycling	The Urban Waste Strategic Plan, with a time horizon until 2030 (PERSU 2030), and the National Waste Management Plan (PNGR 2030) establish a national urban waste management policy which promotes the prevention of waste production, the reuse, recycling, and other forms of recovery, encouraging the reduction of consumption of raw materials, and contributing, in a generic way, to a more sustainable lifestyle. The targets defined for the reuse and recycling of waste are set at 55%, 60% and 65% for 2025, 2030 and 2035, respectively. Additionally, the prevention target is set at a reduction of 5% and 15%, in 2025 and 2030, respectively, compared to the production of solid waste in 2019, whose production per inhabitant reached 511 kg/inhabitant.year at national level. In Porto, in 2022, around 42% of solid waste resulted from selective collection (multimaterial and biowaste), with each resident separating, on average, about 80 kg/inhabitant.year of selective waste. Therefore, municipal action should continue this path to achieve even better results.
	WCE.02 Optimized processes and efficiency in wastewater treatment facilities	An important contribution to GHG emissions in the Municipality comes from the operation of the Freixo and Sobreiras wastewater treatment plants (WWTP). The Aqualitrans cross-border project, in which Águas e Energia do Porto is a partner, aims to develop an efficient and sustainable energy model for the WWTPs in the Municipality, but also for some other municipalities in the north of Portugal and Galicia. Within the scope of this project, the municipal company



B-2.1: Description of action portfolios

Fields of action	Portfolio description	
	List of actions	Descriptions
		implemented several measures with a positive impact in the city wastewater network. Another contribution is the SUPREMAS project, currently under development - modular gasification units for renewable energy production from multiple wastes and for different applications. The goal is to promote the development of decentralized synthesis gas production systems from by-products of various origins, thus contributing to the energy transition and environmental sustainability. It aims to provide circular value chains, in which different types of waste can be used to produce electricity, thermal energy, and new materials. Porto will test this technology through the installation of a mobile modular unit at the Freixo WWTP. This unit will use the sludge produced in the anaerobic digestion stage for gasification (either alone or in combination with other raw materials), producing synthesis gas (syngas), which will be valorised through a cogeneration system. The system will also include a gas purification module for use in solid oxide fuel cells (SOFC), allowing the highly efficient generation of electric power and heat with zero emissions to the atmosphere.
Green infrastructure & nature-based solutions (GI)	GI.01 Increased green infrastructure (carbon sink)	Porto's Master Plan sets the goal of doubling the Municipality's green areas by 2030, with the aim of not only combating climate change and fostering sustainability, but also contributing to a better quality of life of the citizens. Therefore, a set of interventions have been planned and implemented as a way of meeting the objective outlined in the PDM, with an estimated total investment of over 11,6 M€.
Built environment (BE)	BE.01 Renovation of existing buildings (envelope)	According to the latest available data (2021), of the approximately 39 thousand buildings in Porto, around 4 800 require medium repairs and more than 2 100 are in urgent need of renovation. Of the existing buildings, only 16% were built after 1990, the date of the first buildings' thermal performance regulation in Portugal, which allows to foresee a poor thermal quality of the building stock. In fact, of the more than 87 thousand energy certificates issued in buildings in the Municipality, only 44% have a performance level higher than C (on a scale from A+ to F, where A+ represents superior energy performance). In this context, Porto has several actions in place. BE.01.A Private buildings: This action foresees the renovation of the existing residential building stock, at a rate of 2,5%/year until 2030. The renovation focuses on deep interventions (needed in 70% of the building stock), capable of reducing up to 60% of the heating needs. BE.01.B Municipal buildings and facilities: Municipal buildings (including administrative buildings, schools and sports complexes) have also been targeted by the city executive. The city is investing in deep interventions, aimed at enhancing their use and liveability, at the same time as their energy efficiency is optimized, with significant savings for the Municipality. BE.01.C Social housing: One of the Municipality's largest projects is the improvement of the living conditions in municipal neighbourhoods. Social housing in Porto accounts for 13% of the city's-built housing, corresponding to around 13 000 dwellings, where around 28 000 people live. This number of dwellings and population justifies the more than 150 M€ invested in improving these buildings over the last few decades. Energy efficiency, thermal comfort



B-2.1: Description of action portfolios

Fields of action	Portfolio description	
	List of actions	Descriptions
		and savings are the direct results of this commitment, which was recognized by the European Commission (EC) as a good practice in the application of EC funds.
	BE.02 Construction of new energy-efficient buildings (NZEB standards)	In terms of new construction, the Municipality has been developing the Environmental Index, a composite index that assesses the performance and energy-environmental impact of new construction projects in the city. In addition to strict energy requirements (NZEB requirements), this index also assesses the expected impact of a new building in terms of water efficiency, existence of green areas, energy efficiency, circularity of materials used, etc. The index has been discussed with bioclimatology, landscaping, water management, energy, noise, designs, refurbishment, and real estate players and is expected to establish the criteria for new buildings in the city by imposing standards for more sustainable and energy-efficient construction, serving as a guidebook for urban developers which, in turn, may benefit from appealing construction exemptions and incentives fostered by the city.
	BE.03 Efficient lighting and appliances	In a residential environment, lighting and electric equipment spend a significant amount of electricity (20% and 35%, respectively). In this sense, during home renovation or simply due to equipment natural wear, appliances and bulbs will tend to be replaced by more efficient technologies (class A+ or higher and LED technology). In this scope, this measure considers the replacement of lighting technology and appliances in residential dwellings, with energy savings of around 40%.
	BE.04 Digitalization, literacy and awareness	For Porto, education for sustainability is a crucial tool to involve people in the transition process to a greener and carbon-free city and change energy behaviours. The Municipality understands that environmental and energy problems persist because there is still a gap between the way nature (and the city) works and the way people think (and consequently act). This alignment is therefore fundamental. In this scope, Porto has a long-lasting experience in developing environmental education activities so that citizens can: 1) understand environmental and energy processes; 2) develop collective environmental awareness; 3) know solutions and options; 4) acquire skills that are important in their daily life; and 5) can collaborate in concrete actions with positive consequences. Also, the digital transition is expected to follow the energy transition in order to support the development of value-added services and products.
	BE.05 Decarbonized space and water heating generation	According to the 2021 Domestic Energy Consumption Survey (ICESD 2021) , space heating corresponds to the second largest domestic use of energy in the residential setting. The main source of energy used for heating purposes is biomass (81,2%), followed by electricity (7,6%), heating diesel (4,6%), LPG (Liquefied petroleum gas) (3,2 %) and natural gas (2,7%). In what concerns water heating, gas (both natural gas and LPG) is used in around 3/4 of homes: natural gas is used in 35,6% of homes, followed by bottled LPG (32,9%) and piped LPG (7,0%). As there is no detailed characterization at the municipal level, it is assumed that Porto follows the national trend in terms of energy use for space and water heating, and therefore, there is still a long improvement journey until decarbonized space and water heating services.

B-2.1: Description of action portfolios - Summary

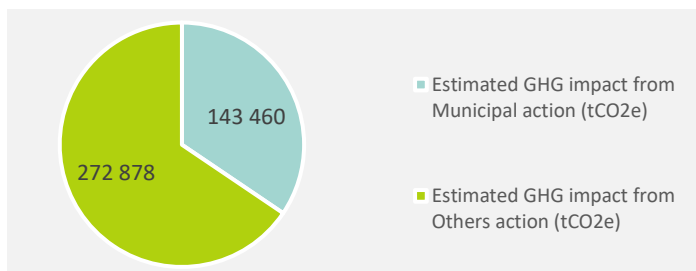


Figure 29. GHG expected impacts per promoter.

Although with a strong focus on municipal action, Porto's portfolio of actions depends heavily on the action of other entities, such as transport operators, citizens and companies. In fact, more than 65% of the reduction in emissions necessary for the decarbonization of the territory is in the hands of other entities, which reflects the relevance of engaging and motivating these stakeholders over time, given their relevance to this city's purpose.

Table 2 presents the estimated GHG impacts from both municipal and other actions, per field of action and action. Also, the table reveals the gap of each action and field of action as of January 2024, showing that, there is still a long way to go in what concerns Mobility & Transport (85% gap) and Energy Systems (73% gap). The gap in Transports will be shortened due to the investments which are only expected to occur during the coming years. In turn, the slow adoption of renewables is expected to increase in the coming years due to the easing of the permitting processes. The remaining fields of action are in a more advanced stage of development.

Table 2. Summary of estimated GHG impacts from both municipal and other actions.

Fields of Action	Action / Indicator	Estimated GHG impact from Municipal action (tCO2e)	Estimated GHG impact from Other action (tCO2e)	% covered (as of January 2024)
Energy systems (ES)	ES.01 Purchase of 100% certified renewable energy	16 500	0	100%
	ES.02 Renewable energy generation in buildings			-
	ES.02.A Renewable generation in municipal buildings	623	0	56%
	ES.02.B Renewable energy community from waste		21 399	0%
	ES.02.C Renewable energy communities as tools to mitigate energy poverty	3 661	0	6%
	ES.02.D Renewable generation in private buildings and facilities	0	5 045	6%
	ES.03 Renewable energy generation in Porto's industry	0	25 000	0%
	ES.04 100% LED street lighting equipped with control and monitoring system	4 747	0	74%
Sub-total		25 532	51 444	27%
Mobility & transport (MT)	MT.01 Reduced motorized passenger transportation need	40 793	7 198	31%
	MT.02 Reduced pkm traveled by car - shift to public and electric transport			-
	MT.02.A Encouraging the use of public transport through ticketing	110	0	28%



	MT.02.B Encouraging the use of public transport through new and better offer	3 923	113 087	3%
	MT.03 Increased shared mobility and MaaS options	0	7080	100%
	MT.04 Electrification of vehicles (cars and motorcycles)			-
	MT.04. A. Network of recharging points for electric vehicles and electrification of private fleet	21 000	4 286	8%
	MT.04. B Electrification of the municipal vehicle fleet	6 504	0	100%
	MT.05 Optimized logistics	26 034	4 330	0%
	MT.06 Electrification of light and heavy freight vehicles	0	14 988	30%
Sub-total		98 363	150 969	15%
Waste & circular economy (WCE)	WCE.01 Increased waste recycling	12 240	5 742	42%
	WCE.02 Optimized processes and efficiency in wastewater treatment facilities			47%
		1 748	0	
Sub-total		13 987	5 742	42%
Green infrastructure & nature-based	GI.01 Increased green infrastructure (carbon sink)			98%
		-504	-10	
Sub-total		-504	-10	98%
Built environment (BE)	BE.01 Renovation of existing buildings (envelope)			-
	BE.01.A Private buildings	0	4 855	42%
	BE.01.B Municipal buildings	268	0	53%
	BE.01.C Social housing	3 966	0	94%
	BE.02 Construction of new energy-efficient buildings (NZEB standards)	446	355	0%
	BE.03 Efficient lighting and appliances	0	16 323	42%
	BE.04 Digitalization, literacy and awareness	1 401	16 727	77%
	BE.05 Decarbonized space and water heating generation	0	26 471	42%
Sub-total		6 082	64 732	53%
Total		143 460	272 878	25%

B-2.2: Individual action outlines

Field of Action: Energy Systems (ES)

Action outline	Action name	ES.01 Purchase of 100% certified renewable energy
	Action type	Technical intervention
	Action description	In 2020, the Porto City Council awarded the company ENDESA the supply of electricity for all municipal infrastructures for a period of 3 years. The electricity supply contract imposed that the electricity supplied is 100% generated through renewable energy sources.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Learning & capabilities.
	Outcome	- Improved air quality, human health, and quality of life. - Attraction of investments for innovative sustainable projects.



Implementation	Responsible bodies for implementation	Porto City Executive
	Action scale	City scale
	Involved stakeholders	Porto Executive, Águas e Energia do Porto and Endesa
	Comments on implementation	The implementation is assessed through billing. Currently, the contract is being renewed.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	45 GWh
	GHG emissions reduction estimate (total) per emission source sector	16 500 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	6 562 357,61 €
	Costs by CO _{2eq} unit	397,72 €/ton CO _{2eq}
Action outline	Action name	ES.02 Renewable energy generation in buildings ES.02.A Renewable generation in municipal buildings
	Action type	Technical intervention
	Action description	Installation of PV systems in municipal buildings and facilities, namely: Porto Solar I: 1 MWp in 29 municipal buildings, 24 of which are schools. The project, concluded in 2023, results in the production of up to 1,4 GWh per year of renewable electricity, and a 27% reduction in the use of electricity from the grid, representing a total decrease in the city bill of around 150 thousand euros per year. Porto Solar II: Additional 301 kWp of PV capacity are being planned for four municipal buildings, namely the Post Office Building, the Rivoli Theatre, the Campo Alegre Theatre and the Montebelo School. Freixo Wastewater Treatment powerplant (WWTP): The Freixo WWTP has now a 133 kWp PV system responsible for an annual production of 178 MWh. The system is able to reduce the WWTP energy consumption from the grid by approximately 4%, becoming more efficient and reducing its carbon footprint. City Water Pavilion: A new 70-module PV production unit has been installed on the city Water Pavilion rooftop. The 31,8 kWp system is able to produce around 48 MWh of renewable energy for self-consumption in the facilities. City Park administrative facilities: A 40,1 kWp PV system was installed in the administrative facilities of the City Park, producing 60,4 MWh of renewable energy for self-consumption. Porto Ambiente and GoPorto headquarters: A new 90 kWp PV system is being planned to reinforce the already existing PV installation in Porto Ambiente and GoPorto headquarters. Trindade parking lot: A 50 kWp PV system is also currently being tendered to be installed in one of the most emblematic parking lots in the city, near the city hall and in which a considerable share of the city electric fleet is parked.
Reference to	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Social innovation. - Learning & capabilities.



	Outcome	- Improved air quality, human health, and quality of life. - Lower energy costs. - Emergence of new renewable business models and creation of jobs. - Increased property values. - Just climate transition by reducing energy poverty. - Enhanced city capabilities in renewable energy projects.
Implementation	Responsible bodies for implementation	Águas e Energia do Porto
	Action scale & addressed entities	City scale
	Involved stakeholders	Águas e Energia do Porto, Domus Social, AdEPorto, Porto Ambiente, GoPorto, E-REDES, and Energy Directorate.
	Comments on implementation	Porto Solar I, Freixo, Water pavilion and City Park facilities' installations are complemented and operating. The city has an online platform in which real time PV generation data is displayed and which is used to monitor performance. The Trindade parking lot procedure is in tendering while Porto Solar II and Porto Ambiente/GoPorto headquarters' installations are still being planned.
Impact & cost	Generated renewable energy	2,46 GWh/year
	Removed/substituted energy, volume, or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	623,09 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	1 546 281,55 € (CAPEX) + 1 241 841,36 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit (CAPEX)	4 474,67 €/ton CO _{2eq}
Action outline	Action name	ES.02 Renewable energy generation in buildings ES.02.B Renewable energy community from waste
	Action type	Technical intervention
	Action description	LIPOR produces electrical energy both from its Waste Energy Recovery Unit and from other units, such as the Ermesinde landfill biogas powerplant, totalling around 170 GWh per year. Part of this energy currently enjoys a remuneration regime with the application of a guaranteed tariff, ending in 2024. Once the current transitional period has ended, LIPOR intends to put this energy at the service of its universe of associates and other members that may join. By delivering the energy it produces to municipalities on a self-consumption basis, they benefit from cheaper and cleaner energy. In this sense, LIPOR intends to establish an intermunicipal Renewable Energy Community (REC) with a strategic interest in the use of the energy produced. As an integral member, Porto showed from the first moment its interest in participating in this innovative project, as did other entities in the Porto universe, such as the Superior Engineering Institute of Porto (ISEP), STCP,



Figure 30. Presentation of LIPOR's renewable energy community.



		the city bus company, and São João Hospital . In total, 84,6 GWh of renewable electricity produced by LIPOR could be acquired from these members, with great benefits in terms of costs and GHG emissions ⁷ .
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Social innovation. - Learning & capabilities.
	Outcome	- Improved air quality, human health, and quality of life. - Lower energy costs. - Emergence of new renewable business models and creation of jobs. - Enhanced city capabilities in renewable energy projects.
Implementation	Responsible bodies for implementation	LIPOR
	Action scale	Regional scale
	Involved stakeholders	Porto City Council, Águas e Energia do Porto, Porto Ambiente, Domus Social, Go Porto, Ágora, São João Hospital and STCP, E-REDES, and Energy Directorate.
	Comments on implementation	The process is being studied and planned and was officially announced in January 2023. The legal constitution of the REC is expected to advance in the coming months.
Impact & cost	Generated renewable energy	84,6 GWh/year
	Removed/substituted energy, volume, or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	21 398,74 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	TBD
	Costs by CO _{2eq} unit	TBD
Action outline	Action name	ES.02 Renewable energy generation in buildings ES.02.C Renewable energy communities as tools to mitigate energy poverty
	Action type	Technical intervention
	Action description	The creation of renewable individual or collective self-consumption projects in social housing buildings and including other nearby facilities (i.e., schools) is a Municipality plan which is two-fold. On the one hand, local energy production is intended to reduce energy costs for residents, with positive impacts on alleviating potential energy poverty situations. On the other hand, the Municipality takes advantage of the extensive available rooftop areas to reduce the city GHG emissions, sending a positive sign to potential private investors. The first city REC including the Agra do Amial social housing complex and the local Agra school is being concluded within the scope of the Asprela+Sustentável project. In total, 114 kWp of photovoltaic systems were installed, coupled with storage systems, and connected to electric vehicle charging points.

⁷ <https://www.porto.pt/pt/noticia/porto-associa-se-a-nova-comunidade-energetica-renovavel-da-lipor>



		In the city, a potential of 9,5 MWp of photovoltaic potential was mapped, including social housing and nearby buildings. The goal is now to replicate the lessons from Agra do Amial to the remaining city. In fact, the first positive clean energy district (PCED) in Porto, to be developed within the scope of the ASCEND project, is being created in an area of the city with a large concentration of social housing and buildings under municipal management.	
	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Social innovation. - Learning & capabilities.	
	Outcome	- Improved air quality, human health, and quality of life. - Lower energy costs. - Emergence of new renewable business models and creation of jobs (collaboration with Porto's Energy Transition Accelerator). - Increased property values. - Just climate transition by reducing energy poverty. - Enhanced city capabilities in renewable energy projects.	
Implementation	Responsible bodies for implementation	- Águas e Energia do Porto - AdEPorto	
	Action scale	City scale	
	Involved stakeholders	Porto City Council, Águas e Energia do Porto, Domus Social, AdEPorto, E-REDES, and Energy Directorate.	
	Comments on implementation	The Agra do Amial REC is now finishing the licensing process, but the installation is concluded. The replication process will be started shortly.	
Impact & cost	Generated renewable energy	14,47 GWh/year	
	Removed/substituted energy, volume, or fuel type	-	
	GHG emissions reduction estimate (total) per emission source sector	3 661,47 tons of CO _{2eq}	
	GHG emissions compensated	-	
	Total costs	11 121 413,01 € (CAPEX) + 7 288 664,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)	
	Costs by CO _{2eq} unit (CAPEX)	5 028,06 €/ton CO _{2eq}	
Action outline	Action name	ES.02 Renewable energy generation in buildings ES.02.D Renewable generation in private buildings and facilities	
	Action type	Technical intervention	
	Action description	Private entities are following the positive signs sent by the Municipality of Porto and investing in renewable production in their own facilities. Due to the still low maturity of the permitting procedures on collective energy sharing projects, most of these projects are uniquely for self-consumption. Several city companies, and subscribers of the Porto Climate Pact, as SONAE and Futebol Clube do Porto are taking steps to produce renewable energy in their	

Figure 31. ASCEND's PCED boundaries in Porto.



		facilities. Still, due to their most advanced maturity stage, the following projects are highlighted: ▪ Mercado Abastecedor do Porto (MAP): the market that supplies the entire North region with fresh products and essential goods is finalizing the contract for the installation of 1.5 MWp of photovoltaic production.	
	Systemic lever	▪ Porto Appeal Court : The city Appeal Court signed recently a partnership to install a 43 kWp PV system, making this the first court to invest in renewable production in the country. ▪ Porto's Superior Engineering Institute (ISEP) and Students Association of Porto's Engineering Faculty (AEFEUP): These two education entities are installing 586 kWp and 35 kWp of PV production, correspondingly. ▪ Still in the area of the city where the universities are located, São João Hospital, the Porto University and the Polytechnic Institute of Porto are planning to install more than 5,3 MWp and to share the renewable energy produced in a renewable energy community. ▪ Ordem da Trindade and Santa Casa da Misericórdia do Porto : Two of Porto's main social entities are also investing in PV capacity with planned 73 and 350 kWp systems. ▪ STCP : Porto's bus company also has plans to install a 5,6 MWp PV system in their facilities. The renewable energy produced is expected to supply the electric bus fleet and the company facilities.	Figure 32. PV simulation of MAP's installation.
	Outcome	▪ Improved air quality, human health, and quality of life. ▪ Lower energy costs. ▪ Emergence of new renewable business models and creation of jobs. ▪ Increased property values. ▪ Just climate transition by reducing energy poverty. ▪ Enhanced city capabilities in renewable energy projects.	
Implementation	Responsible bodies/person for implementation	▪ Private entities (MAP, Appeal Court, ISEP, AEFEUP, São João Hospital, Porto University, Polytechnic Institute of Porto, Ordem da Trindade, Santa Casa da Misericórdia do Porto, STCP, Futebol Clube do Porto and SONAE)⁸	
	Action scale & addressed entities	City scale	
	Involved stakeholders	Private entities (MAP, Appeal Court, ISEP, AEFEUP, São João Hospital, Porto University, Polytechnic Institute of Porto, Ordem da Trindade, Santa Casa da	

⁸ The Mercado Abastecedor do Porto (MAP) and Ordem da Trindade do not currently subscribe to the Porto Climate Pact and the CCC Commitments. Recognizing the importance of broad participation in achieving climate neutrality goals, the Porto municipality will undertake efforts to collaborate closely with the MAP and Ordem da Trindade to ensure their subscription and commitments in addressing climate challenges and contributing to the city's carbon neutrality objectives.



		Misericórdia do Porto, STCP, Futebol Clube do Porto and SONAE), E-REDES and Energy Directorate.
	Comments on implementation	The mentioned projects have technical assessment projects performed and some of them have already tendering procedures in an advanced stage.
Impact & cost	Generated renewable energy	19,94 GWh/year
	Removed/substituted energy, volume, or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	5 045,29 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs (CAPEX)	12 138 300,00 € + 10 080 720,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit (CAPEX)	4 403,91 €/ton CO _{2eq}
Action outline	Action name	ES.03 Renewable energy generation in Porto's industry
	Action type	Technical intervention
	Action description	EnergyCon , a company specialized in photovoltaic energy performance contracting (EPC), is moving forward with the creation of a Renewable Energy Community, in Ramalde, in the industrial area of Porto. The company will invest 25 million euros in the project which will reduce the emission of 25 thousand tons of GHG emissions. The project is currently looking for nearby members, who want to benefit from the energy produced. This REC has a social responsibility nature – a percentage of the annual profitability will benefit the Porto Volunteer Firefighters Association .
Reference to impact	Systemic lever	- Technology/ infrastructure. - Social innovation. - Finance & funding.
	Outcome	- Improved air quality, health and well-being. - Potential replication of this business case at a national level.
Implementation	Responsible bodies for implementation	EnergyCon⁹
	Action scale	Local scale
	Involved stakeholders	EnergyCon, Porto Volunteer Firefighter Association, E-REDES and Energy Directorate.
	Comments on implementation	The project was already publicly presented and is now taking the first implementation steps.
Impact & cost	Generated renewable energy	98,8 GWh/year
	Removed/substituted energy, volume, or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	25 000 tons of CO _{2eq}

⁹ EnergyCon does not currently subscribe to the Porto Climate Pact and the CCC Commitments. Recognizing the importance of broad participation in achieving climate neutrality goals, the Porto municipality will undertake efforts to collaborate closely with EnergyCon to ensure its subscription and commitments in addressing climate challenges and contributing to the city's carbon neutrality objectives.



	GHG emissions compensated	-
	Total costs	25 000 000,00 € (CAPEX) + 44 505 928,85 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	2 780,24 €/ton CO _{2eq}
Action outline	Action name	ES.04 100% LED street lighting equipped with control and monitoring system
	Action type	Technical intervention
	Action description	Porto is replacing its street lighting infrastructure (more than 26 000 luminaires) by LED technology. Street lighting represents an asset of great importance for Municipalities, having a relevant impact in energy use, GHG emissions and operating costs. Additionally, a centralized technical supervision platform and the necessary sensing, control and communication equipment is currently in the contracting phase for a smart and centralized control of this new public lighting infrastructure. Alongside and coupled with the street lighting network, the Municipality of Porto operates a traffic supervision system that includes the use of video cameras installed in public places. The main purposes of the traffic supervision system are the real-time detection of disturbances in circulation in the city's road network, the real-time detection of road accidents and other incidents with implications for road circulation and mobility in general, the assessment of traffic flows and/or pedestrian circulation flows, and the monitoring of light signalling infrastructures. This system is also being updated to provide a better service.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Learning & capabilities.
	Outcome	- Improved air quality, health, and quality of life. - Reduced light pollution. - Increased safety and improved accessibility, through enhanced visibility in critical traffic points. - Knowledge transfer to urban planners. - Savings for the city budget.
Implementation	Responsible bodies/person for implementation	- Águas e Energia do Porto - Municipal Department of Information Systems of Porto Municipality
	Action scale & addressed entities	City scale
	Involved stakeholders	Águas e Energia do Porto, AdEPorto, Porto Digital and Municipal Department of Information Systems of Porto Municipality.
	Comments on implementation	The project is already in implementation.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	18,76 GWh
	GHG emissions reduction estimate (total) per emission source sector	4 747 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	14 356 414,00 € (CAPEX) + 507 200,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit (CAPEX)	3 131,16 €/ton CO _{2eq}



Field of action: Mobility & Transport (M&T)

Action outline	Action name	MT.01 Reduced motorized passenger transportation need
	Action type	Technical intervention
	Action description	Reducing transport needs through urban planning and changing work and use patterns of and in the city is a key action for the Municipality's mobility. In addition, having a solid circulation network dedicated to soft mobility modes and in which motorized transport is not prioritized is one of the aims of the recent Municipal Master Plan (PDM). This document is in line with Porto's Sustainable Urban Mobility Action Plan (PAMUS) and focuses on key strategies discussed as follows. Soft mobility: Porto intends to move forward with a pioneering project to rescue public space, which includes, among others, the installation of more cycling lanes, adding to the already existing 35 km of cycle paths, distributed throughout the Asprela, Prelada, Frente Marítima/Marginal, Parque da Pasteleira, Parque da Cidade, Avenida da Boavista and Avenida Gustavo Eiffel areas. The Municipality also imposed conditions for operators of sharing services (bikes and scooters), defining and mapping the parking sites across the city. In the car parks managed by the Municipality there are 130 supervised bicycle parking spaces (free of charge) and 210 bicycle and scooter sharing points in the city. There are also additional 72 bicycle racks with capacity for 520 parking spaces across the city. Pedestrian zones in the city Historic Centre: In line with other European cities, reserving arteries in the historic centre for pedestrians and prohibiting the entry of cars is a key measure foreseen in the city PDM. Currently, four restricted motor vehicle access zones exist in the city and seven more are planned. Updated parking rules: Porto's PDM also introduces new developments regarding parking, particularly concerning the change (reduction) of the current paradigm in private parking policy, which means a smaller available share of parking in public spaces (on street). The PDM wants to contribute, whenever possible, to the progressive elimination of parking along streets and public spaces, proposing alternatives in covered parking (off street) (Zone XXI initiative). - Lastly, within the scope of the Network 20 program, a set of priority routes for soft mobility were established covering almost 30 kilometres of streets. These routes only allow the circulation of vehicles at reduced speed (20 km/h), fostering a shared public space concept between vehicles and soft modes. Together, these measures are estimated to reduce the motorized passenger transportation in the city centre by around 25%.
Reference to impact	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Social innovation. - Learning & capabilities.
	Outcome	- Time saving by avoiding traffic jams, closeness to facilities and teleworking. - Improved air quality. - Noise reduction. - Enhanced public transport connectivity through soft mobility integration. - Increased health and well-being through sustainable urban lifestyle adoption.



		- Just social transition that does not link mobility and accessibility to the ownership of a car. - Reclaimed public space for people fruition and soft mobility.
Implementation	Responsible bodies for implementation	Municipal Mobility Department
	Action scale	City scale
	Involved stakeholders	Municipal Mobility Department, Municipal Department of Public Space, Municipal Division of Environmental Inspection and Intervention on Public Space, Municipal Department of Urban Planning
	Comments on implementation	The activities are currently under implementation. The creation of pedestrian zones in the Historic Centre is however in a more advanced stage.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	181,69 GWh
	GHG emissions reduction estimate (total) per emission source sector	47 990,54 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	47 331 769,42 € (CAPEX) + 672 000,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	1 000,28 €/ton CO _{2eq}
Action outline	Action name	MT.02. Reduced km travelled by car – Shift to public and electric transport MT.02.A Encouraging the use of public transport through ticketing
	Action type	Technical intervention
	Action description	The Public Transport Fare Reduction Support Program (PART), launched in 2019 in the Porto Metropolitan Area, manifested itself most visibly in Porto through the fare reduction for the entire population and the free public transport up to 12 years old. That same year, Porto extended the free access up to 15 years old, creating the Andante Porto.13-15 pass for young people living in Porto and allowing access to the Metro, STCP and Funicular dos Guindais services. The title, available throughout the 2019/2020 academic year, was supported by the Porto City Council, which guaranteed in full the costs of using the monthly passes. In that first academic year, around 45% of students residing in Porto, aged between 13 and 15, were able to use the public transport system free of charge. In the following academic year, the initiative was extended to 18 years old. Even in the pandemic context, at the beginning of the academic year, more than 5,000 students residing in Porto had valid Andante Porto.13-18 subscriptions. The Andante Porto.13-18 can be associated with the Porto Card, the city card that gives free access to the City Museum, 50% discounts on shows at the Teatro Municipal do Porto, access to municipal swimming pools, allows the free use of the Guindais Funicular, in addition to other advantages that will be associated over time. To be inclusive, this physical card comes wrapped in a digital experience that aims to aggregate services and benefits from different areas, facilitating interaction between the Municipality and its citizens. For example, citizens who subscribe to the card are informed of interventions and restrictions in



Figure 33. Porto Card.



		the street they live in, as well as weather warnings and information relating to Municipal Civil Protection actions. In 2023, more than 7 300 young people, aged between 13 and 18, used the Andante “Porto.13-18” intermodal system free of charge. This clear adherence to the free transport ticket by young people is a strong indicator that the Porto City Council's work in encouraging the use of public transport, with a special focus on young people, is producing positive effects. In the 2019/2020 academic year, the cost was 718,9 thousand euros and more than 1,2 million euros in the 2020/2021 academic year. In 2022, the Municipality had a budget allocation of more than 1,5 million euros for this program. Additionally, in January 2024 a new measure was announced: all Porto Card users will be entitled to 22 free trips per year, either on the city's public buses or on the metro. The application of this measure was possible due to the entry into force, at the beginning of the year, of intermodal passes for students up to the age of 23 covered by the Government, meaning that the Porto City Council no longer had an annual expenditure of around three million of euros with the under-18 pass, being able to use this money to generate the creation of new public transport demand. Furthermore, the Municipality is studying the possibility of extending the existing on-demand transport model to the general population, reaching areas where public transport is not yet effective.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Governance & policy.
	Outcome	- Time savings by avoiding traffic jams. - Improved air quality, human health, and well-being through sustainable urban lifestyle adoption. - Noise reduction. - Enhanced public transport connectivity through sustainable mobility integration. - Just social transition that does not link mobility and accessibility to the ownership of a car. - Increased capacity of reinvestment. - Creation of jobs in transportation related sectors.
Implementation	Responsible bodies for implementation	Porto City Council
	Action scale	Region scale, as the Andante passes allow to travel in the Porto Metropolitan Area.
	Involved stakeholders	Porto City Council, Porto Metropolitan Area, Metro do Porto and STCP
	Comments on implementation	The measure is in implementation and is expected to continue, at least until 2025.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	0,43 GWh
	GHG emissions reduction estimate (total) per emission source sector	109,93 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	17 575 667,20 € (CAPEX)
	Costs by CO _{2eq} unit	159 880,53 €/ton CO _{2eq}



Action outline	Action name	MT.02. Reduced km travelled by car – Shift to public and electric transport MT.02.B Encouraging the use of public transport through new and better offer
	Action type	Technical intervention
	Action description	STCP, Porto's public bus company, has an ambitious investment roadmap in order to enhance the quality and sustainability of its fleet. The company intends to acquire 171 electric buses over the next five years, corresponding to two-fifths of the current fleet. By 2027, the company aims to acquire 171 electric vehicles, both to replace and add to the current fleet of 420 units, 80% of which is currently powered by natural gas. For 2023, a public tender of around 20 million euros was launched, corresponding to the acquisition of 48 electric vehicles, 24 of which for fleet expansion and 24 for replacing diesel vehicles. In 2024, it is planned to acquire 20 standard electric buses, in an investment of 8,4 million euros to replace 20 natural gas vehicles, and eight midi electric buses (larger than a minibus but smaller than a standard), in an investment of 2,9 million euros to replace eight current diesel minibuses. For 2025, STCP plans to acquire 40 electric buses, 20 of which are standard (for 8,4 million euros, to replace the same number using natural gas) and 20 articulated (for 14,4 million euros, to replace 10 standard and 10 articulated natural gas fuelled). In 2026, the company will acquire more 40 articulated electric buses, estimating an investment of 28,8 million euros to replace 20 natural gas and 20 diesel articulated buses, as well as 15 batteries (2,6 million euros). Finally, in 2027 it is planned to purchase 15 double-decker electric buses, costing 11,6 million euros, to replace 15 buses of the same type, but running on diesel. In 2023 and 2024, investments were also planned to acquire two electrical substations for charging buses, for a total investment of four million euros. The company intends therefore to invest around 100 million euros to provide a better and decarbonized service to the city by 2030. The city bus service is also facilitated through the creation of dedicated lanes, as the Fernão de Magalhães high quality bus corridor. In addition to the bus fleet renewal, there are also investments in intermodal platforms in the city, namely the Terminal Intermodal de Campanhã (TIC) which foster the use of public transport. TIC is part of the city's mobility policy, which is based on the articulation between the different transport subsystems and the promotion of a multimodal citizen culture. The Campanhã hub was built in full compliance with the international LEED standards and has, since 2022, eight boarding docks for buses in rotation and 30 parking spaces. The infrastructure totals a gross construction area of around 24 thousand square meters and includes utility areas, car park, bus terminal, connection to the metro and train, service station, kiss & ride stops, bicycle park and park taxi areas, complementary public support areas, administrative areas, as well as essential technical areas, serving around five million passengers (July 2022 to June 2023). Additionally, the renovated transport terminals of Camélias, in Batalha, and Asprela, which include the interfaces of the Hospital de S. João and the University Centre, also stand out. The renovation of these hubs aims to provide better accessibility conditions, comfort, and safety, both for operators and passengers.



Figure 34. STCP bus fleet.



At the Asprela Hub, Metro, STCP, and other bus services coexist to connect Porto hospitals and universities to other surrounding municipalities.

The company [Metro do Porto](#) is also increasing mobility offerings and services in the city through three structuring projects, namely:

- The new **Metrobus** line is currently being built in the city to add quality, speed and flexibility to the transport network. The two lines, Boavista – Praça do Império and Boavista - Anémona (Matosinhos), will combine the efficiency, punctuality and reliability of the Metro with the flexibility and comfort of the latest generation of hydrogen buses. With priority over all other modes of transport (through an intelligent traffic light system), an exclusive lane and integrated into the Andante ticketing system, the Porto Metrobus will be in operation in 2024. The great competitive advantage of Metrobus is its speed and reliability; the Boavista – Império connection will take just 12 minutes and the journey between Boavista – Anémona will take 17 minutes. The global investment in this work is 66 million euros and includes the construction of the two lines, the supply and maintenance of the fleet of 12 vehicles, the construction and equipment of the hydrogen factory and the fuelling stations. All investment is financed by the European Union's Recovery and Resilience and Next Generation Program. The entire Metrobus project is being carried out by Metro do Porto.

- The new metro [Pink Line](#) that will connect Boavista to the city centre, connecting the Blue, Red, Green, Violet and Orange lines, at Casa da Música, and the Yellow Line, at S. Bento Station, will serve important health, teaching, culture and arts centres, and reaching, within walking distances, the Palácio de Cristal, Avenida Miguel Bombarda and the Campo Alegre faculties.



Figure 35. New metro lines in construction.

This new line represents an extension of 2.7 kilometres and should be completed in 2025. At the same time, the [Yellow Line](#), which connects Porto and Gaia since 2005, will grow three kilometres in Gaia, facilitating the connection between the two cities. The global investment in the two lines is 407 million euros - including expropriations, projects, inspection, equipment and exploration support systems -, with financing from the Environmental Fund and European funds from the Operational Program Sustainability and Resource Use Efficiency (POSEUR).



Reference to impact pathway		The new Ruby Line will connect Casa da Música, in Porto, to Santo Ovídio, in Vila Nova de Gaia. In between, six stations and a bridge over Douro River, on a route of more than six kilometres that adds quality and alternatives to the mobility of citizens in the Porto Metropolitan Area. The Ruby line starts in Porto, connecting to the Blue (A), Red (B), Green (C), Violet (E), Orange (F) and Pink (G) lines. From there, the Metro makes its way in a tunnel to the very popular Campo Alegre area, from where it then heads towards the surface, crossing the Ferreirinha Bridge which provides the connection to the city of Gaia. In Gaia, the first stronghold in this new connection takes place in Arrábida. Immediately afterwards, the metro heads towards VL8, traveling along this avenue until they reach Candal station. The next stopping point is what, perhaps, also promises to be one of the most iconic on the Ruby Line: the Rotunda station, also located on the VL8 and which includes an underground car park, with capacity for 500 vehicles and a green park intended for culture and leisure. For the last part of this journey, a buried route is reserved to the Devesas and Soares dos Reis stations, located in a very residential area, in the parish of Mafamude. The journey ends one kilometre further south, in Santo Ovídio, where an underground station will be built parallel to the current one and which serves the Yellow Line (D). According to estimates by the company Metro do Porto, one million people will be directly covered on this route between the main entrance to Porto and the coastal area of Gaia, which should attract more than 12 million new customers per year and 1,7 thousand million euros in benefits of various types. The consignment contract for the project was signed in January 2024 for more than 379,5 million euros. The global investment value of the new line is 435 million, an investment financed by the Recovery and Resilience Funds (RRF). In total, these investments are expected to provoke a shift in the number of people using private vehicles in a daily basis, by reducing 35% of the passenger kilometres travelled by car and which shift to electric public transport.
	Systemic lever	- Technology/ infrastructure. - Governance & policy.
	Outcome	- Time savings by avoiding traffic jams. - Improved air quality, human health, and well-being through sustainable urban lifestyle adoption. - Noise reduction. - Enhanced public transport connectivity through sustainable mobility integration. - Just social transition that does not link mobility and accessibility to the ownership of a car. - Increased capacity of reinvestment. - Creation of jobs in transportation related sectors
	Responsible bodies for implementation	Porto City Council, STCP, Metro do Porto
Implement	Action scale	Regional scale



	Involved stakeholders	Porto City Council, STCP, Metro do Porto, contracted companies
	Comments on implementation	As large construction works are considered, especially in the construction of new metro lines and a bridge across the river, delays may happen. Still, the expectation is that all the works are completed by 2026.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	443,97 GWh
	GHG emissions reduction estimate (total) per emission source sector	117 009,85 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	1 050 071 443,88 € (CAPEX) + 223 386 376,46 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	10 883,34 €/ton CO _{2eq}
	Action name	MT.03. Increased mobility and MaaS options
Action outline	Action type	Technical intervention
	Action description	Also, within the scope of the city's mobility strategy, Porto aims to increase the number of passengers per car and motorcycle by 2030, through shared mobility solutions such as carpooling or car sharing. In addition to the implementation of projects with pilot actions on shared, autonomous and micro mobility, such as Greening European Mobility through cascading innovation INItiatives (GEMINI) or FABULOS, and the soft mobility sharing system (bikes and e-scooters) with sharing and parking points spread across the city, the carpooling platform developed within the Faculty of Economics of the University of Porto (FEP) should be highlighted due to the size it can acquire and the environment in which it is located, where more than 40 thousand people, including students, teachers and collaborators may be involved. The USHARE by AEFEP app, launched in April 2023, was created and developed in a partnership between AEFEP (FEP Student Association) and the junior company of the Faculty of Engineering of the University of Porto, JuniFEUP, and is a carpooling approach that allows the use of private vehicles to share trips between different users, helping to reduce greenhouse gas emissions. The application promotes the concept of shared economy, making travel more accessible and economical, contributing to reducing the number of vehicles in circulation.  USHARE appears as a restructuring of an old FEP habit – FEPian rides – in which students arranged rides with each other through a Facebook page. Maintaining the same concept, now using a more elaborate platform, AEFEP launches this solution that aims not only to improve urban mobility, but also to constitute a social experience. To use “USHARE by AEFEP”, it is necessary to register in the application, using the University of Porto's institutional email and, from there,

Figure 36. USHARE platform.



		search for and/or provide rides to a specific destination. After finding a viable option for the driver and passenger, contact is established to arrange route details: time, departure location, costs, etc. The app is available for download on the Google Play Store and the App Store.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Social innovation.
	Outcome	- Improved air quality, health, and well-being. - Noise reduction. (Academic) community building. - Increased knowledge and skills in MaaS implementation and development of digital services and solutions.
Implementation	Responsible bodies/person for implementation	AEFEP¹⁰
	Action scale	Local scale
	Involved stakeholders	AEFEP, JuniFEUP and Porto City Council.
	Comments on implementation	The city is interested in replicating this concept through Porto. Card Therefore, this initiative may have a broader action scope.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	27,74 GWh
	GHG emissions reduction estimate (total) per emission source sector	7 080,37 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	251 580,00 € (CAPEX) + 134 400,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	54,51 €/ton CO _{2eq}
Action outline	Action name	MT.04. Electrification of vehicles (cars and motorcycles) MT.04. A. Network of recharging points for electric vehicles and electrification of private fleet
	Action type	Technical intervention

¹⁰ Associação de Estudantes da Faculdade de Economia da Universidade do Porto (AEFEP) have not signed yet the CCC Commitments but has already subscribed the Porto Climate Pact. Recognizing the importance of broad participation in achieving climate neutrality goals, the Porto municipality will undertake efforts to collaborate closely with AEFEP to ensure its commitments in addressing climate challenges and contributing to the city's carbon neutrality objectives.



	Action description	Porto was one of the 25 national municipalities that formed the MOBIE-E national consortium, whose mission is to develop and implement a network of universally accessible, interoperable, and user-centric electric vehicle charging stations across the country. In this sense, and to promote electric mobility in Porto, the city Executive made municipal spaces available for the installation of public charging points, as a way of encouraging the expansion of this market. This increase in the network of electric charging comes as a way of encouraging the acquisition of electric vehicles by private individuals, with 35% of electric and hybrid vehicles expected to be incorporated into the private car fleet in circulation in 2030, in line with the predictions of the 2050 National Roadmap for Carbon Neutrality. Additionally, to charge the municipal electric and hybrid fleet, the Municipality have around 300 electric vehicle chargers on the municipal network, guaranteeing an effective response to the increase in this type of mobility. All these chargers are managed by the municipal company Águas e Energia do Porto.
		 Figure 37. Águas e Energia's charging park.
Reference to impact of pathway	Systemic lever	- Technology/ infrastructure. - Governance & policy.
	Outcome	- Improved air quality, health, and well-being. - Noise reduction. - Shift in societal norms towards sustainable transportation choices. - Emergence of new business models and services related to EV. - Creation of jobs.
Implementation	Responsible bodies for implementation	Porto City Council
	Action scale	City scale
	Involved stakeholders	Porto City Council, MOBIE.E, Águas e Energia do Porto, electric vehicles network operators.
	Comments on implementation	The implementation is undergoing.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	83,67 GWh
	GHG emissions reduction estimate (total) per emission source sector	25 285,5 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	6 242 027,27 € (CAPEX) + 16 324 980,69 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	892,49 €/ton CO _{2eq}
Action	Action name	MT.04. Electrification of vehicles (cars and motorcycles) MT.04. B Electrification of the municipal vehicle fleet
	Action type	Technical intervention



	Action description	In 2018, 70% of light vehicles in the municipal fleet (diesel) were replaced by electric or plug-in hybrid vehicles, for a total of 390 vehicles. It is estimated that these vehicles have covered more than 4 million kilometres in electric mode by the end of 2020, contributing to a significant reduction in their carbon footprint, due to the reduction in the consumption of fossil fuels. In addition to the advantages related to the reduction of GHG emissions, there was an important contribution to improving air quality in the city, as well as reducing noise pollution. At stake is the acquisition of 390 vehicles, 241 of which are targeted to the Municipality and the rest for municipal companies, from housing to public works, environment, and leisure. The vehicles will replace existing diesel vehicles at the end of the lease contract, in areas such as urban cleaning, municipal works, policing, employee transport, etc. Nowadays, the municipal fleet accounts with 75% of electric or plug-in hybrid vehicles. Additionally, Porto invested around 10 million euros in the acquisition of more sustainable equipment and vehicles, at the service of Porto Ambiente, to be used in daily urban cleaning and waste collection activities in the city. In total, more than six million are allocated to new solutions, mostly electrical, to support the activity of cleaning public spaces, namely sweeping equipment. Regarding waste collection, the value exceeds three million euros allocated to modernizing the fleet, replacing old trucks with new vehicles powered by natural gas.
Reference to impact of non-financial	Systemic lever	- Technology/ infrastructure. - Governance & policy.
	Outcome	- Improved air quality, health, and well-being. - Noise reduction. - Shift in societal norms towards sustainable transportation choices. - Emergence of new business models and services related to EV. - Creation of jobs.
Implementation	Responsible bodies for implementation	Porto City Council
	Action	City scale
	Involved stakeholders	Porto City Council, Porto Ambiente, Águas e Energia do Porto
	Comments on implementation	The action is implemented.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	25,48 GWh
	GHG emissions reduction estimate (total) per emission source sector	6 504 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	13 896 627,21 € (CAPEX)
	Costs by CO _{2eq} unit	2 136,63 €/ ton CO _{2eq}
Action outline	Action name	MT.05. Optimized logistics
	Action type	Technical intervention
	Action description	Transporters and distributors are the visible face of urban logistics, especially in cities that generate many trips for goods delivery. Cities are characterized by constrained public space (which may lead to friction and conflicts between the various users) and logistic operations tend to have a greater visibility due to the size of the vehicles and/or the duration of operations. Urban logistics causes,



		therefore, several impacts, from increased congestion and occupation of public roads and parking spaces, to increased atmospheric emissions and noise, and reduced road safety. European studies show that goods vehicles are responsible for 20 to 30% of emissions in urban areas and this is also the case for Porto, as expressed in its Sustainable Urban Logistics Plan (PLUS), which intends to promote : ▪ The reduction of pollution caused by vehicle traffic associated with urban logistics. ▪ The reduction in the level of GHG emissions associated with urban logistics by increasing the efficiency of loading and unloading operations and other activities. ▪ The mitigation of mobility constraints caused by the operations and circulation of vehicles transporting goods and providing services and contributing to increasing road safety. The freight transport and logistics sectors are intrinsically related to the region's economic activity. The growth of e-commerce (Porto is not only a place for delivering e-commerce but also where a growing number of local economic activities sell online); in tourism and local accommodation (Porto has particularly benefited from the growth of this sector, which leads to a significant increase in the consumption of goods and services, namely in the HORECA channel and in commerce); the digitalization of the economy (with the emergence of platforms such as Uber Eats, Glovo or Deliveroo). In this setting, Porto's PLUS presents a set of fifteen measures that are divided into: 1. Infrastructure (included in the city PDM regarding mobility): ▪ Adaptation of the built environment to logistic operations. ▪ Relocation and sizing of loading and unloading places. ▪ Adaptation of the logistics infrastructure. ▪ Resizing of loading and unloading locations. 2. Regulations and Incentives: ▪ Awareness campaigns among store owners and traders. ▪ Time restricted access. ▪ Adjustment of time windows to the real dynamics of the sector. ▪ Adjust loading and unloading times to the different types of operators. ▪ Access restriction (based on vehicle volume). ▪ Increased supervision to avoid deviations. 3. Operational Management: ▪ Helpdesk for urban logistics (supported by tools as Porto's traffic management tool); ▪ Logistics micro-platforms. ▪ Creation of collection points. ▪ Circulation of logistic vehicles on BUS routes. It is estimated that the implementation of the measures proposed in this plan will allow a 10% reduction in the distance (kilometres) covered by logistical (trucking) vehicles in and due to city action.
Reference to impact	Systemic lever	▪ Technology/ infrastructure. ▪ Governance & policy.
	Outcome	▪ Improved air quality, health, and quality of life. ▪ Noise reduction. ▪ Emergence of innovative business models in the logistics sector.
Implement ation	Responsible bodies for implementation	▪ Porto City Council – Mobility Department
	Action scale	City scale
	Involved stakeholders	Porto City Council – Mobility Department, Logistic companies, and owners of commercial spaces.



	Comments on implementation	PLUS was concluded and formally approved at the end of 2021 and is now taking its first steps with the joint implementation of actions included in the Municipal Master Plan.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	118,96 GWh
	GHG emissions reduction estimate (total) per emission source sector	30 363,9 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	5 385 100,00 € (CAPEX) + 268 800,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	186,20 €/ ton CO _{2eq}
Action outline	Action name	MT.06. Electrification of light and heavy freight vehicles
	Action type	Technical intervention
	Action description	In addition to the optimization of logistic services, the renewal of the combustion engines freight fleet to electric or hydrogen fuelled vehicles is key to decarbonize the freight sector. According to the National 2050 Carbon Neutrality Roadmap , and in line with Porto's Sustainable Mobility Action Plan and Sustainable Urban Logistics Plan, in a transitional phase, advanced biofuels will play a key role especially in heavy long-distance road intercity transport of passengers and freight. However, as time goes by, it is expected that biofuels may become neglected due to the increased competitiveness and cost-effectiveness of electric traction and other energy vectors such as hydrogen. In the case of heavy vehicles, the possibility of introducing new fuels such as hydrogen (H2) or new dynamic propulsion technologies (e.g., overhead contact lines or induction systems) is expected. However, the implementation of these solutions will depend on the development of core infrastructures, and their investment and operating costs are still subject to a high degree of uncertainty, given the small number of pilot projects underway. These two energy vectors are expected to account for almost all heavy passenger and freight mobility by 2050, while 100% of light duty trucks (<3,5tones) are expected to be electric by 2030. This trend is being followed by companies in the territory, as DHL Express Portugal , which in December 2023 acquired 44 new electric vehicles. The company will fully convert 60% of its last mile fleet by 2030 at its terminals in Porto, Viseu, Covilhã, Leiria, Lisbon, Loulé, Funchal and Ponta Delgada. With this fleet conversion in mind, the expansion work on the DHL Express air cargo terminal at Francisco Sá Carneiro Airport, in Porto, prepares the building with charging stations for electric vehicles, to respond to new demands. The company DPD , with a strong presence in the domestic express transport market, also began the second phase of decarbonization of the distribution fleet in 2022, with the immediate placement of over 70 electric vehicles and chargers in various parts of the country. After starting the process of electrifying its fleet in Lisbon in 2019 (with 55 electric vehicles), the company decided to extend the measure to other parts of the country, including Porto, where the company currently has more than 46 electric vehicles.
Reference to impact	Systemic lever	- Technology/ infrastructure. - Governance & policy.
	Outcome	- Improved air quality, human health, and well-being. - Noise reduction. - Emergence of new business models for electric freight and mobility services.



		Creation of jobs.
Implementation	Responsible bodies for implementation	Private freight companies
	Action scale	Regional scale
	Involved stakeholders	Private freight companies
	Comments on implementation	
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	56,27 GWh
	GHG emissions reduction estimate (total) per emission source sector	14 987,92 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	38 399 570,46 € (CAPEX) + 268 800,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	2 579,97 €/ ton CO _{2eq}

Field of action: Waste & Circular economy

Action outline	Action name	WCE.01. Increased waste recycling
	Action type	Technical intervention
	Action description	Porto has been steadily improving in terms of waste management. In 2022, it surpassed all recycling targets as each Porto inhabitant separated, on average, around 80 kg/year of packaging waste, an increase of 10 kg compared to 2021. The rate of preparation for recycling also grew compared to 2021 (39,3%), reaching 42,2%. Lastly, selective waste collection also recorded an increase of around 5 500 tons in 2022, an increase of around 20% compared to 2021. These targets contribute to the zero landfill policy the city is committed to and are the result of a set policies and initiatives implemented by Porto, such as: <u>Dose Certa and Embrulha</u>: Two projects implemented together with LIPOR concerning the reduction of food waste; <u>Orgânico</u>: An initiative promoted by Porto Ambiente with the aim of reducing food waste, while contributing to a more circular economy. It consists of distributing a kit to separate organic waste for subsequent deposit in the respective container. <u>Good Food Hubs</u>: A pilot project started in 2020 with the aim of facilitate the access to organic, local and healthy food. <u>City Loops</u>: A project started in 2019 and led by ICLEI which is based on the collaboration between a set of partners to implement actions aimed at increasing circularity in the use of materials, focusing on construction and demolition waste and the organic matter.



Figure 38. Orgânico project.



	• ReBOOT Porto: A project launched in 2023 and organized by the Municipality of Porto aiming at to recover computing equipment and to deliver it to entities with social projects and have specific needs for this type of equipment. The positive results achieved on waste recycling are also due to the efforts of city entities and partners in: • Raising awareness: In 2019, a pioneering service in which awareness teams travel daily around the city to identify non-compliances related with waste disposal and packaging rules was started. When repeated problems are detected, Environmental Training sessions are prescribed, instead of issuing fines. The goal is to educate instead of punishing and to raise awareness on citizens and business owners. • Provide the enabling conditions: The city has around 4ha (13 gardens scattered across the city) of area occupied with municipal gardens used to organic farming. These slots have also 400 composters used to produce 120 tons/year of organic matter to be reused in the municipal gardens. In addition, Porto citizens have two community composting islands at their disposal, funded under the City Loops project, in which they may deposit their organic waste. From this process, a 100% organic compost is produced to be used by both participants and by the city, in green areas. Porto also implemented a door-to-door collection system for green waste (from citizens and entities), in collaboration with LIPOR, with the consequent transformation of this waste into an organic agricultural amendment used in the Municipality's green areas. BOX 6: LIPOR - New automatic packaging sorting line In September 2023, LIPOR opened the largest automatic packaging sorting line in the Iberian Peninsula. Located in the municipalities of Gondomar and Valongo, the investment was around nine million euros and was supported by European funds, through POSEUR. The new infrastructure, which uses artificial intelligence, allows monitoring all stages of the operation in real time, ensuring greater efficiency in the separation of materials and, consequently, an increase in the recycling rate. The sorting line has a minimum nominal capacity of 8 tons per hour and can annually process between 14 600 tons in one shift and 29 200 tons in two shifts. This progress meets the objectives established by the National Waste Management Plan, PERSU 2030.
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		BOX 7*: LIPOR - Enlargement of the Organic Valorisation Plant To expand the biowaste treatment capacity already installed, plans are underway to build an Anaerobic Digestion Plant with the capacity to treat 60 000 tonnes of biowaste a year using wet anaerobic digestion technology, with the potential to produce biomethane for use as an energy source. This project is estimated to be able to reduce emissions by 16 000 tonnes CO_{2eq}/year, plus an indirect impact of 11 000 tonnes CO_{2eq}/year. This expansion is expected to cost around 58 M€ and to be implemented in the time frame 2026-2029. * The implementation of this measure depends on the decision of LIPOR's Board of Directors, the Government itself, as well as the existence of financing lines.	Also, in order to foster waste recycling, the Municipality has collective waste collection in the city 24 hours a day, door-to-door collection in homes and commercial facilities, and a complete and updated mapping of recycling sites, ecocentres, and other waste collection equipment, which provides city inhabitants and users with an integrated waste disposal network.
		BOX 8*: LIPOR - New line of energy recovery from domestic waste LIPOR also aims to install a third energy recovery line for domestic waste at its Maia Plant, offering a real possibility for all municipalities and mayors in the Northern Region to stop sending their waste to landfill and start producing green energy. This plant will be an important support for the municipalities served by LIPOR, including Porto, to achieve their "zero landfill" objectives. This new line is expected to be built in the period 2030-2035, requiring an investment of around 230 M€. * The implementation of this measure depends on the decision of LIPOR's Board of Directors, the Government itself, as well as the existence of financing lines.	To promote the Circular Economy, the Municipality is also creating the Centre for Circular Economy of the City of Porto, which includes the construction of a space dedicated to the reception of objects/equipment/materials with the potential to be reused by carrying out small restoration interventions/repairs, promoting the city's environmental literacy through training/workshops and making the space available to all who wish to repair/transform their materials. The objective is to change behaviours regarding waste production and will be implemented at the Prelada ecocentre. In the first phase, the centre will repair electrical and electronic equipment and small furniture. After experience in dynamizing the centre and history of circularity indicators, the centre will evolve to another type of materials/products/objects. It should be noted that the objects will be donated, with no associated costs and an app will advertise the objects for donation available to residents, as well as to social solidarity institutions.
Reference to impact pathway	Systemic lever	- Governance & policy. - Social innovation. - Technology/ infrastructure.	
	Outcome	- Improved ecosystem health. - Emergence of new green business models and creation of jobs. - Long-term behavioural change towards more sustainable waste management practices, indicating a growing sense of responsibility and commitment to achieving "landfill 0" goals.	
Implementation	Responsible bodies for implementation	Porto Ambiente	
	Action scale	City scale	
	Involved stakeholders	Porto Ambiente, Porto City Council, LIPOR	
	Comments on implementation	The measures were already implemented.	



Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	5 668,58 tonnes of waste reduced
	GHG emissions reduction estimate (total) per emission source sector	17 982 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	22 437 412,50 € (CAPEX) + 6 720 000,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	1 621,48 €/ ton CO _{2eq}
Action outline	Action name	WCE.02. Optimized processes and efficiency in wastewater treatment facilities
	Action type	Technical intervention
	Action description	Águas e Energia do Porto, the municipal company responsible for water and energy infrastructures in the city, through the learning of the Aqualitrans project, implemented several measures in the Sobreiras WWTP. One of the implemented measures was the optimization of the initial lifting system, which led to the replacement of existing pumps allowing an increase in pumping efficiency and a reduction in consumption by 15% - savings of around 452 000 kWh/year. Another measure implemented following the Aqualitrans project was the optimization of the energy management system, which was implemented in the highest consumption equipment, where controllers were installed to measure consumption and identify areas of intervention to reduce consumption. The estimated energy savings are around 330 000 kWh/year, which corresponds to a reduction in GHG emissions of approximately 155 tCO₂/year. It should be noted that the implementation of these two measures had an associated budget of less than 50 000 €. Also, the Águas e Energia do Porto municipal company has ongoing plans to expand the Freixo WWTP, as well as interconnect it to two current WWTPs. To achieve this, it is planned to make the necessary changes to the drainage network. Additionally, it is planned to automate the Freixo WWTP and optimize biological treatment. This operation aims to increase the resilience of the treatment process and its optimization. In addition, Porto has other measures in place to reduce water consumption. For instance, the city has since 2023 a project to reuse reclaimed water for cleaning public spaces, watering gardens, cleaning containers and streets, etc., thereby saving potable water. Also, a smart irrigation infrastructure is being implemented across the city in gardens and parks. This measure has ensured water savings of around 15%.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Learning & capabilities.
	Outcome	- Improved water quality and water ecosystem health. - Emergence of new business models and creation of jobs. - Transfer of knowledge and best practices in wastewater treatment to other municipalities. - Increased public awareness of the benefits of reclaimed water reuse, contributing to a more informed and environmentally conscious community.
Implementation	Responsible bodies for implementation	Águas e Energia do Porto



Impact & cost	Action scale	City scale
	Involved stakeholders	Águas e Energia do Porto
	Comments on implementation	The measures were already implemented.
	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	17,67 GWh
	GHG emissions reduction estimate (total) per emission source sector	1 747,5 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	36 050 000,00 € (CAPEX) + 2 016 000,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	21 783,12 €/ ton CO _{2eq}

Field of action: Green infrastructure & nature-based solutions (GI)

Action outline	Action name	GI.01 Increased green infrastructure
	Action type	Technical intervention
	Action description	Among the planned investments for Porto's greenification, the following are highlighted: • Asprela Central Park: Completed in 2022, it allowed the creation of 5,5 ha of green area, adding 900 planted trees and the preservation of more than 700 trees and shrub plantations. The project, developed in partnership with the University of Porto, adopts nature-based solutions using the "sponge city" concept, which significantly reduces the occurrence of floods through the stabilization of the riverbeds and the increase in the permeability of the soil. • Alameda de Cartes Park: This park emerged as a response to the community's appeal and covers around 4 ha of area, creating around 1,5 km of new pathways for soft modes and linking three social housing neighbourhoods, a communal vegetable garden, a municipal sports field, a municipal swimming pool and the city's eastern park. The project is currently in the execution phase and scheduled for completion in 2024. It totals a municipal investment of 2,2 million euros. • Lapa Urban Park. The Lapa urban park is also in the execution phase and scheduled for completion in 2024. In the first phase, it will create 1,7 ha of green area and the restoration of a river. In a second phase, it will allow the creation of an additional 2,5 ha of green area. This investment comes through a public-private partnership with the Renaissance Hotel Group, which is responsible for the work in exchange for the non-payment of municipal taxes. The project includes nature-based solutions, serving as sponge during periods of high rainfalls. • São Roque Park. Completed in 2022, it added 1,2 ha of new green area in an investment of 1,4 million euros. The investment allowed for an expansion of green areas, recovered paths, rest areas and the preservation and renovation of viewpoints. With a current area of 5,2 ha, this park is strategic to the city due to its central location to host several cultural and leisure events.



		• Porto City Park: The expansion of the city park (more 6 500 square meters) adds around 2 800 new trees and shrubs, in a municipal investment of over 2,6 million euros. • Oriental Park: The requalification and expansion (from 8 to 18 ha) of the Oriental Park and its pedestrian routes, allowed to the park to become one of the main “green lungs” of the city. Regular venue for sports and entertainment activities, the intervention was completed in 2019.  Figure 39. Oriental park. In addition to interventions related to new green areas, the Municipality also has a set of actions that aim to increase carbon sequestration. The FUN Porto - Native Urban Forests project, started in 2016, includes a set of initiatives implemented in the Municipality's environmental strategy and contributing to the mitigation and adaptation to climate change, of which the following stand out: • “If you have a garden, we have a tree for you.” This program allows the acquisition of native trees and shrubs by citizens who want to plant them in their gardens. It aims to promote biodiversity, as well as increase the quantity and quality of the city's private backyards and gardens, which make up around 8% of the city's green coverage. The goal is to foster the plantation of 10 000 native trees and shrubs. • 100 000 trees project: It aims to ecologically rehabilitate burnt, degraded, or underutilized areas of the Porto Metropolitan Area through adequate vegetation management and the planting and maintenance of trees and shrubs native to the region. • Porto BioSpots Network: Network of urban forest areas (dominantly autochthonous) created to promote biodiversity, ecosystem services, adaptation to climate change and landscape mitigation. It started as a protocol between Porto and Infraestruturas de Portugal and focus on 14 areas distributed along the city main traffic routes (junctions, embankments, lateral green areas). The goal is to plant 10 000 trees which will be able to store approximately 50 tons of carbon per year, while save around 25 thousand euros of maintenance costs for the city. • Living tree beds: The project, which includes 719 tree beds, totalling 300 m², was implemented in different city streets to control invasive species and boost biodiversity, by attracting pollinating insects. • Mapping of the green infrastructure: The city owns a detailed mapping and ledger of all urban trees which are adequately identified and georeferenced, allowing for a real-time management. In line with these projects, Porto has a plan for the rehabilitation of water lines aiming to promote the protection and valorisation of the city's rivers and streams, with a view to better adapting to the effects of climate change, as well as reducing the territory's vulnerability to these effects. This local adaptation measure is aligned with the Municipal Strategy for Adaptation to Climate Change of the Municipality of Porto and the new Municipal Climate Action Plan.
Re for	Systemic lever	■ Technology/ infrastructure. ■ Learning & capabilities.



	Outcome	- Improved air and water quality. - Improved ecosystem health and climate resilience (temperature regulation, flood prevention, etc.). - Increased human health and well-being. - Creation of jobs. - Increased property values. - Just transition by democratising the ecosystem services provided by nature-based solutions. - Enhanced city capabilities in green infrastructure management.
Implementation	Responsible bodies for implementation	Porto City Council
	Action scale	City scale
	Involved stakeholders	Águas e Energia do Porto, Porto Ambiente, Porto City Council – Department of Environment
	Comments on implementation	Some measures were already implemented while others are in current implementation.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	-
	GHG emissions compensated	514 tons of CO _{2eq}
	Total costs	14 077 000,00 € (CAPEX) + 49 593 600,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit (CAPEX)	123 872,76 €/ ton CO _{2eq}

Field of action: Built Environment (BE)

Action	Action name	BE.01 Renovation of existing buildings BE.01.A Private buildings
	Action type	Technical intervention



	Action description	To promote interventions and leverage private investment, in its Municipal Tax Exemptions Regulation, Porto has provided for different municipal property tax exemptions targeting urban buildings subject to renovation. In addition to these municipal incentives, since September 2022, the Municipality has operated the Porto Energy Hub, a one-stop shop to support Porto citizens in implementing energy efficiency and renewable production measures in their homes, providing technical and legal support and helping people applying to available financing options. This service, provided for free and funded under the Porto Energy ElevatoR (PEER) project, also aims to increase energy literacy by supporting diagnosis. In one year of operation (September 2022- September 2023), over 400 homeowners were supported by this service. Together, these actions are expected to boost a 2,5% renovation rate/year until 2030 in residential buildings and foster deep renovations with a significant energy performance enhancement. Although the scope of the Porto Energy Hub has been restricted to the residential sector, it is expected that after the end of European funding, the OSS business model will also include the commercial sector, expanding the scope of the support given to this sector with a large presence in the city.	
Reference to impact	Systemic lever	- Technology/ infrastructure. - Governance & policy.	
	Outcome	- Improved (indoor) air quality, human health, and well-being, because of increased comfort. - Reduced energy poverty. - Emergence of new business models and creation of jobs. - Increased property values.	
Implementation	Responsible bodies for implementation	Private homeowners	
	Action scale	City scale	
	Involved stakeholders	Porto City Council – Department of Urban Planning and Construction and Department of Urban Management, AdEPorto, building owners, state developers	
	Comments on implementation	The tax exemption regulation exists since 2018 and the Porto Energy Hub one-stop-shop is implemented since September 2022.	
Impact & cost	Generated renewable energy	-	
	Removed/substituted energy, volume, or fuel type	19,19 GWh	
	GHG emissions reduction estimate (total) per emission source sector	4 855,03 tons of CO _{2eq}	
	GHG emissions compensated	-	
	Total costs	60 493 440,70 € (CAPEX) + 14 081 400,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)	
	Costs by CO _{2eq} unit	15 360,33 €/ ton CO _{2eq}	
Action	Action name	BE.01 Renovation of existing buildings BE.01. B Municipal buildings	
	Action type	Technical intervention	



Action description	Among the interventions carried out by Porto in its municipal buildings, the following are highlighted due to their relevance and visibility: Falcão school and Alexandre Herculano high school : The renovation works were completed at the beginning of 2023 and, together, totalled more than 10 M€ of municipal investment. The interventions aimed a deep improvement of the schools' equipment and their expansion, also improving their functionality. The project also included the introduction of natural-based solutions on the Falcão school roof, through the implementation of green roofs on the building, a green wall and the creation of a pond that allows rainwater to be used for use in the community garden "Horta da Oliveira". Additionally, the Falcão school is part of the Porto Solar project, and therefore it is equipped with a photovoltaic installation for self-consumption.  Figure 41. Renovated Falcão school. The emblematic renovations of the Cinema Batalha and the Mercado do Bolhão are emphasized as these are two charismatic spaces in the city which were returned to its citizens, after high municipal investments in their rehabilitation. The city has also renovated the current headquarters of Porto Ambiente and GoPorto municipal companies according to the best sustainability practices, being internationally recognized through the LEED rating system standards, in a municipal investment of around 4 million euros. In the new facilities of the municipal companies GO Porto and Porto Ambiente, sustainability is a priority. The building was completely renovated, with environmental and efficiency considerations, involving an investment of around four million euros. The building presented a wide range of pathologies, which resulted in a significant state of degradation from age and lack of maintenance. The intervention included the partial demolition of some elements, as well as occasional expansion and construction of vertical components, to adapt to the functional needs and to obey to the applicable legislation. The environmental merit of this renovation came in the form of a LEED certification: the new headquarters of GO Porto and Porto Ambiente are the first public building in Portugal, the first rehabilitation intervention and the first building with natural ventilation to obtain this certification. All solutions were considered to maximize benefits: a sophisticated natural ventilation system, including a careful sizing of window areas and an occupant notification system which alerts whenever it is convenient to open windows (with air quality control sensors); 40% energy savings compared to a  Figure 42. Go Porto and Porto Ambiente's renovated headquarters.
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		reference building (heating, ventilation, and air conditioning equipment and energy-efficient lighting with light sensors, natural ventilation, photovoltaic panels); 40% water savings (water heating system using solar panels, taps and sanitary equipment with flow control and timing). Likewise, the facilities are equipped with a flat and two inclined green roofs. The executive is also fostering the reconversion of the old city slaughterhouse, deactivated for over 20 years, into a new multipurpose business and leisure space. The investment of over 40 M€ supported by the construction company which won the tender is expected to be finished by mid-2025. Interventions in the city's different theatres and cultural spaces (Teatro Campo Alegre, Campus Paulo Cunha e Silva, Teatro Rivoli and Teatro Municipal do Porto), as well as in some administrative (Ágora - Cultura e Desporto headquarters) and sports buildings (municipal swimming pools, with the replacement of sand filters, implementation of centralized technical management systems, lighting replacement, etc.), are also planned for the coming years, as a result of the availability of funds through the NORTE 2030 Program. This action is complemented by a wide-range energy audits program carried out by the Municipality covering 200 municipal buildings and facilities.	
Reference to	Systemic lever	- Technology/ infrastructure. - Governance & policy.	
	Outcome	- Increased property values. - Reduction of local budget energy costs.	
Implementation	Responsible bodies for implementation	GO Porto	
	Action scale	City scale	
	Involved stakeholders	Porto City Council, GO Porto, Ágora, Porto Ambiente, Águas e Energia do Porto	
	Comments on implementation	Part of the renovation works were already implemented (GO Porto/Porto Ambiente headquarters, Cinema Batalha, Mercado do Bolhão, Falcão and Alexandre Herculano schools, city slaughterhouse), while others are in tendering phase (Teatro Campo Alegre, Campus Paulo Cunha e Silva, Teatro Rivoli, Teatro Municipal do Porto, Ágora headquarters, swimming pools).	
Impact & cost	Generated renewable energy	-	
	Removed/substituted energy, volume, or fuel type	1,06 GWh	
	GHG emissions reduction estimate (total) per emission source sector	268,48 tons of CO _{2eq}	
	GHG emissions compensated	-	
	Total costs	94 007 151,88 € (CAPEX) + 2 148 480,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)	
	Costs by CO _{2eq} unit	358 148,21 €/ ton CO _{2eq}	



Action outline	Action name	BE.01 Renovation of existing buildings BE.01.C Social housing	
	Action type	Technical intervention	
	Action description	Energy efficiency interventions in social housing focus mainly on thermal insulation of external walls and roofs, installation of more suitable glazing and, in some cases, the installation of solar thermal collectors or photovoltaic technologies. Of the total of 50 neighbourhoods in Porto, since 2019, 16 have been intervened (3 947 dwellings) and the Master Plan continues to allocate a significant share of its budget to the Municipal Social Housing Renovation Program, to be invested in the coming years. Energy audits reveal that these interventions produced reductions in energy consumption of around 47%, and emissions, of approximately 50%. Also, the implementation of LiderA certification will be applied in some pilots (e.g., renovation of the Lomba housing), with the aim of fostering sustainable construction by reducing the impact of the used materials, promoting the reuse of rainwater for irrigation, the production of renewable energy and the increase of biodiversity by planting native species.	
Reference to impact	Systemic lever	- Technology/ infrastructure. - Governance & policy.	
	Outcome	- Improved (indoor) air quality, human health, and well-being, because of increased comfort. - Reduced energy poverty. - Emergence of new business models and creation of jobs.	
Implementation	Responsible bodies for implementation	GO Porto	
	Action scale	City scale	
	Involved stakeholders	Porto City Council, GO Porto, Ágora, Porto Ambiente, Águas e Energia do Porto	
	Comments on implementation	Part of the renovation are undergoing.	
Impact & cost	Generated renewable energy	-	
	Removed/substituted energy, volume, or fuel type	15,68 GWh	
	GHG emissions reduction estimate (total) per emission source sector	3 966,41 tons of CO _{2eq}	
	GHG emissions compensated	-	
	Total costs	76 500 000,00 € (CAPEX) + 5 173 608,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)	
	Costs by CO _{2eq} unit	20 591,32 €/ ton CO _{2eq}	
Action outline	Action name	BE.02 Construction of new energy efficient buildings (NZEB standards)	
	Action type	Technical intervention	
	Action description	Even though Porto is already a densely urbanized territory and the needs and opportunities for rehabilitation are clearly greater than those for new construction, the Municipality considers crucial to ensure that the new buildings are constructed by principles of energy efficiency and sustainability above market standards.	



		For this purpose, Porto is concluding its Environmental Index which fosters urban developers to build top performing building in exchange of very appealing construction. The index assesses the existence of green areas, water and energy efficiency, renewable production, circularity of materials and processes, etc., going beyond standard energy efficiency levels. This index is expected to result in around one in every four new buildings being constructed in Porto by 2030 has a top performing standard. The city itself will continue to invest in new and more efficient affordable housing. Lordelo, Monte Pedral, and Monte Bela housing developments will be expanded either through 100% municipal funding or through public-private partnerships, attracting external private investors. These projects will be developed according to the current Portuguese energy performance standards which requires NZEB levels.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Governance & policy. - Finance & funding. - Learning & capabilities.
	Outcome	- Improved (indoor) air quality, human health, and well-being, because of increased comfort. - Emergence of new business models (e.g., green building technologies and materials) and creation of jobs in the green building sector and associated industries. - Increased property values and market demand for sustainable buildings.
Implementation	Responsible bodies for implementation	Urban developers and GO Porto
	Action scale	City scale
	Involved stakeholders	Porto City Council, GO Porto, Urban developers
	Comments on implementation	The Environmental Index is being finished.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	3,17 GWh
	GHG emissions reduction estimate (total) per emission source sector	801,43 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	96 300 000,00 € (CAPEX) + 7 862 400,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	129 970,68 €/ ton CO _{2eq}
Action outline	Action name	BE.03 Efficient lighting and appliances
	Action type	Technical intervention
	Action description	As a way of advising citizens on the selection of the most efficient and adequate technologies for each household, Porto has, since September 2022, the Porto Energy Hub service available to citizens. Implemented through a partnership between the Municipality and the AdEPorto , this advisory service is physically installed in the Municipality's Office and provided for free. At this desk, technical, legal, and financial advice is provided to citizens and housing management



		entities (public and private) looking for energy efficiency solutions, including equipment and lighting. This measure foresees that by 2030, a 40% energy efficiency improvement is achieved in Porto's dwellings due to the replacement of existing lighting technology by LED and equipment by A+ appliances.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Learning & capabilities.
	Outcome	- Improved air quality, human health, and well-being, because of increased comfort. - Energy and costs savings. - Emergence of new business models (e.g., efficient technologies and materials) and creation of jobs.
Implementation	Responsible bodies for implementation	Homeowners
	Action scale	City scale
	Involved stakeholders	Citizens, Porto City Council, AdEPorto
	Comments on implementation	The Porto Energy Hub service is available since September 2022.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	64,52 GWh
	GHG emissions reduction estimate (total) per emission source sector	16 324 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	4 930 109,36 € (CAPEX) + 1 680 000,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	404,95 €/ ton CO _{2eq}
Action outline	Action name	BE.04 Digitalization, literacy, and awareness
	Action type	Technical intervention
	Action description	In addition to the Porto Energy Hub, which provides effective support in implementing energy projects, Porto has a portfolio of different sustainability education actions targeting different populations (e.g., Integrated Education Plan for Sustainability, Virtual Education for Sustainability Programme, R'circular project, Educational vegetable gardens, Eco Agenda Porto, Porto Hackacity). Additionally, the city executive has been pushing for a city digital transition: almost the entire city is covered by smart electricity metering infrastructure due to a collaboration between the city executive, E-REDES (the Portuguese DSO) and AdEPorto. Porto has also a comprehensive network coverage of free Wi-Fi, which encourages the development of smart grid and innovative digitalization solutions. This service allows the development of products as the Porto Card, a card that allows citizens to benefit from special conditions of access to experiences and municipal services in the city. These already existing platforms are key for the implementation of the WAKE UP! –



Figure 45. R'circular project.



		Wider Approach to Keep Engaged citizens on sustainable Urban Policies pilot initiative which has a strong focus on citizen participation through engaging advice provided by an app that uses gamification to encourage widespread adoption of sustainable practices. Together, these activities are expected to boost a behavioural change in how citizens and local companies use energy and resources, producing an increased awareness and long-lasting sustainable practices.
Reference to impact pathway	Systemic lever	- Technology/ infrastructure. - Social innovation. - Learning & capabilities.
	Outcome	- Improved air quality, human health, and well-being. - Emergence of new business models (e.g., innovative solutions) and creation of jobs. - Empowerment of the community, capable of taking informed energy decisions.
Implementation	Responsible bodies/person for implementation	Porto Digital, Department of Environment of Porto Municipality, Porto Ambiente
	Action scale & addressed entities	City scale
	Involved stakeholders	Associação Porto Digital, Department of Environment of Porto Municipality, Porto Ambiente
	Comments on implementation	The activities are carried out from several years.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	78,79 GWh
	GHG emissions reduction estimate (total) per emission source sector	18 128,2 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	18 926 543,85 € (CAPEX) + 268 800€ (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	1 058,87 €/ ton CO _{2eq}
Action outline	Action name	BE.05 Decarbonized space and water heating generation
	Action type	Technical intervention
	Action description	Besides lighting and appliances, space and water heating efficiency must also improve so that the decarbonization objectives of the buildings sector are possible. The Porto Energy Hub one-stop shop has also been playing an important role in advising citizens on energy efficiency, particularly in space and water heating solutions. Indeed, a considerable number of technical meetings held under the OSS are related with the acquisition of highly efficient heat pumps, used cumulatively for space and water heating. In this setting, and in line with national policies, this action foresees the installation of heat pumps in 75% of Porto's dwellings by 2030, being the remaining space and water heating demand supplied by biomass-based systems.
Reference to impact	Systemic lever	- Technology/ infrastructure. - Learning & capabilities.
	Outcome	- Improved air quality, human health and well-being. - Emergence of new business models (e.g., decarbonized heating) and creation of jobs.

		Behavioural shift in societal norms, promoting a culture of sustainability and environmental responsibility.
Implementation	Responsible bodies for implementation	Homweowners
	Action scale	City scale
	Involved stakeholders	Citizens, AdEPorto, technology suppliers
	Comments on implementation	The Porto Energy Hub service is available since September 2022.
Impact & cost	Generated renewable energy	-
	Removed/substituted energy, volume, or fuel type	37,94 GWh
	GHG emissions reduction estimate (total) per emission source sector	26 471 tons of CO _{2eq}
	GHG emissions compensated	-
	Total costs	100 980 261,09 € (CAPEX) + 1 680 000,00 € (OPEX from 2023-2030 as presented in section B-1.1 of the Investment Plan)
	Costs by CO _{2eq} unit	3 878,18 €/ ton CO _{2eq}



B-2.3: Summary strategy for residual emissions

Applying all the measures listed in the portfolio of actions presented in Section B-2.1 and which represent an 85% reduction in Porto's GHG emissions, to achieve carbon neutrality, a residual amount of 121 ktCO_{2eq} remain, which must be compensated through other means than greenification, as these actions are already covered. Porto's main residual emissions by 2030 are expected to stem from Transport (over 71,8 ktCO_{2eq}), despite the great efforts focused on this sector and large ongoing investments, and Waste (over 33,9 ktCO_{2eq}), which is expected to reduce significantly after implementing the different LIPOR projects presented in Boxes 6, 7 and 8.

Given that Porto is not an industrial city – which hinders direct carbon sequestration in large emission sources - Carbon Capture, Utilization and Storage (CCUS) technologies are not an option. Porto's GHG emissions are diffuse (transport and buildings), which would require capturing carbon from the atmosphere, ensuring its compression, transport, transformation, and storage in deep geological formations. These technologies still face major challenges in terms of maturity and economic viability, so **Porto will remain attentive to these options and to the concrete study of possible solutions for the city, but it does not count on them in the short term to the sequestration of its residual emissions.** Indeed, the city has been gaining capacity and acquiring knowledge on this topic through the creation of collaborations with the academia and experts in this field, as was the case of the sixth session of the Porto Climate Pact Talk Series, held on June 22, 2023, on the topic "[Carbon Capture](#)" (Figure 46).

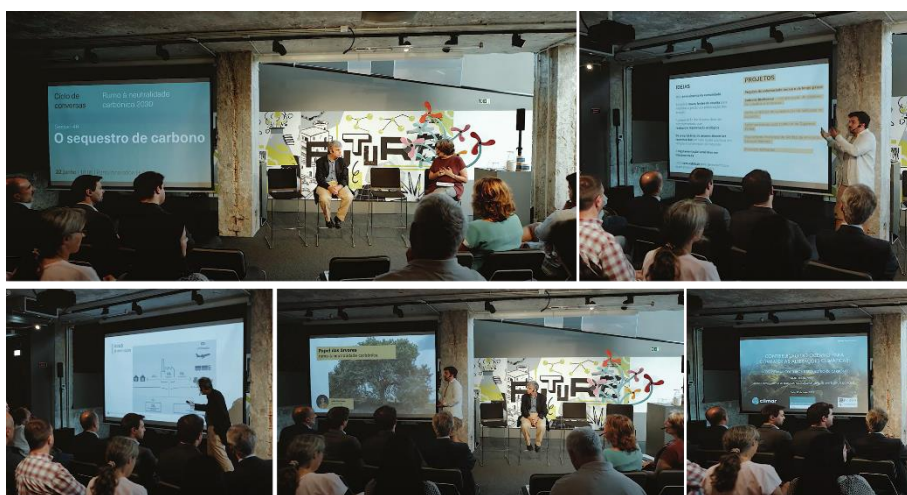


Figure 46. Porto Climate Pact Talk Series on Carbon Capture.

has some actions in place to extend the existing green areas and to ecologically recover them. However, the city acknowledges that this percentage may not increase significantly by 2030: **Assuming that the 65 000 trees mapped in the city sequester an average of 50 kg/CO₂/year** (conservative average value and estimated based on the carbon sequestration potential of the different tree species existing in the city, adjusted to the Portuguese reality), **the city greenification plan and the actions listed in this plan together reach an overall carbon sinking of over 3 kt of CO₂.**

Although these figures are not promising in terms of carbon sequestration, **the Municipality intends to study in a more systematic way (with the appropriate scientific institutions) the carbon sequestration potential of its soils, trees and water bodies (fresh and marine) and apply the**

A study on the global carbon capture potential carried out in Porto¹¹ demonstrates that the city's green spaces capture annually (on average) 1 355 ton CO₂/year, which represents around 1% of the carbon to be captured by 2030. This carbon capture service may increase as Porto

¹¹ Graça, M., et al., Assessing how green space types affect ecosystem services delivery in Porto, Portugal, Landscape and Urban Planning, Volume 170, 2018, pp. 195-208, <https://doi.org/10.1016/j.landurbplan.2017.10.007>.



necessary measures to make the most of these carbon reservoirs. It is worth highlighting that Porto is a coastal city and physically constrained by the estuary of one of the largest Iberian rivers: there is, therefore, potential for using water masses for carbon sequestration through marine plants (which has not yet been studied).

However, it should also be noted that Porto is a city with a very limited territory (42km²) and very densely urbanized (historic city and world heritage site), which limits carbon offsetting within its territorial limits, despite efforts to enhance nature-based solutions in all their aspects and on all possible surfaces. **Therefore, the main solution that the city intends to use to offset most of its residual emissions is the Voluntary Carbon Market¹² (in Portugal) established very recently by Law n.º 4/2024, of January 5th and which opens up the possibility of establishing carbon offsetting projects in the national territory.** These projects aim of using nature-based solutions for carbon sequestration, simultaneously providing important benefits for the protection of biodiversity and natural capital, to the regulation of different natural cycles, for landscape design and intervention

in territories, especially the most vulnerable, also contributing to adaptation to climate change by increasing the resilience of the national territory. **This Law must still be subject to specific regulation, but it is of great interest to cities as Porto that wish to offset their carbon emissions while also hoping to have the most positive impact on the surrounding territory (the North region of Porto).** Thus, the city will exploit this new regulation and develop a comprehensive strategy based on it, expecting more developments in the next CCC iterations.

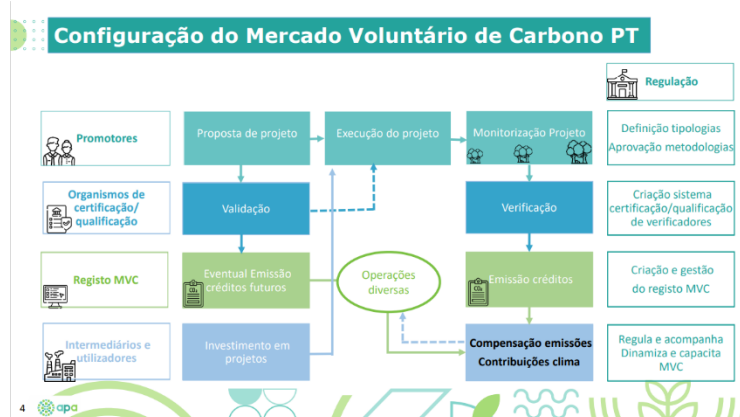


Figure 47. Voluntary Portuguese Carbon Market operation as proposed by Law 4/2024

¹² apambiente.pt



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

B-3.1: Impact Pathways							
Category	Outcomes/ impacts addressed	Action/ project	Indicator No.	Indicator name	Target values		
					2025	2027	2030
Public Health and Environment	Reduction of GHG emissions from baseline	All actions in Action Plan	IND.01	GHG Emissions	65%	75%	85%
	Air quality		IND.02	Air quality	Very good	Very good	Very good
	Noise pollution		IND.03	Population exposed to night-time noise (Lnight) over 50 dB	19%	15%	10%
			IND.04	Population exposed to average day-evening-night noise levels (Lden) over 55 dB	27%	25%	20%
	Liveability of the city	GI.01 Increased green infrastructure (carbon sink)	IND.05	Green areas	2,2 ha / 1000 inhab	2,4 ha / 1000 inhab	2,7 ha / 1000 inhab
	Energy poverty	ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.02.D Renewable generation in private buildings and facilities BE.01.A Renovation of existing private buildings BE.01.C Renovation of existing social housing BE.02 Construction of new energy- efficient buildings (NZEB standards)	IND.06	Percentage of people stating thermal comfort conditions in homes in summer and winter	70%	75%	80%
Social inclusion, innovation and democracy	Inclusion of vulnerable people in climate neutrality projects	ES.02.C Renewable energy communities as tools to mitigate energy poverty	IND.07	Inhabitants of social housing with access to renewable energy	90%	95%	100%
	Capacity building	All actions in Action Plan	IND.08	Capacity building targeted at city staff (target group: staff of the municipal companies and municipal departments closely related with climate actions)	40%	45%	50%



	Behavioural change towards low carbon practices – Modal share of green transport modes (biking, walking and public transport)	MT.01 Reduced motorized passenger transportation need MT.02.A Encouraging the use of public transport through ticketing MT.02.B Encouraging the use of public transport through new and better offer	IND.09	Modal share of public and soft modes	50%	55%	60%
Digitalisation and Smart Urban Technology	Smart metering infrastructure	BE.04 Digitalization, literacy and awareness	IND.10	Share of buildings with electric smart metering infrastructure	100%	100%	100%
Finance and Investment	Capital invested in climate action projects	ES.01 Purchase of 100% certified renewable energy ES.02.A Renewable generation in municipal buildings ES.02.B Renewable energy community from waste ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.04 100% LED street lighting equipped with control and monitoring system MT.01 Reduced motorized passenger transportation need MT.02.A Encouraging the use of public transport through ticketing MT.02.B Encouraging the use of public transport through new and better offer MT.04.A Network of recharging points for vehicles MT.04.B Electrification of the municipal vehicle fleet MT.05 Optimized logistics WCE.01 Increased waste recycling	IND.11	Capital invested by the Municipality in specific climate actions (cumulative)	314,3 M€ (2019-2025)	89,8 M€ (2026-2027)	134,7 M€ (2028-2030)



		WCE.02 Optimized processes and efficiency in wastewater treatment facilities GI.01 Increased green infrastructure (carbon sink) BE.01.B Renovation of existing municipal buildings and facilities BE.01.C Renovation of existing social housing BE.02 Construction of new energy-efficient buildings (NZEB standards) BE.04 Digitalization, literacy and awareness					
	Capital invested in climate action projects	ES.02.B Renewable energy community from waste ES.02.D - Renewable generation in private buildings and facilities ES.03 Renewable energy generation in Porto's industry MT.01 Reduced motorized passenger transportation need MT.02.B Encouraging the use of public transport through new and better offer MT.03 Increased shared mobility and MaaS options MT.04.A Network of recharging points for electric vehicles and electrification of private fleet MT.06 Electrification of light and heavy freight vehicles GI.01 Increased green infrastructure (carbon sink) BE.01.A Renovation of existing private buildings BE.02 Construction of new energy-efficient buildings (NZEB standards) BE.03 Efficient lighting and appliances	IND.12	Capital invested by other entities in specific climate actions (cumulative)	842,3 M€ (2019-2025)	240,7 M€ (2026-2027)	360,9 M€ (2028-2030)



		BE.04 Digitalization, literacy and awareness BE.05 Decarbonized space and water heating generation					
Economy	Jobs creation	All actions in Action Plan	IND.13	Number of jobs created	960	1 150	1 450
	Adoption of renewable technologies	ES.02.A Renewable generation in municipal buildings ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.02.D Renewable generation in private buildings and facilities ES.03 Renewable energy generation in Porto's industry	IND.14	PV installed capacity in Porto	20 MWp	22,5 MWp	25 MWp
Resource Efficiency	Recycling rate of municipal waste	WCE.01 Increased waste recycling	IND.15	Share of recycled municipal waste.	37%	48%	63%



B-3.2: Indicator Metadata

Public Health and Environment

Indicator Name	GHG emissions
Indicator Unit	Tonnes of CO _{2eq}
Definition	Reduction in GHG emissions per year, translated in tonnes of CO _{2eq} .
Calculation	Detailed assessment by sector and yearly monitoring through the Observatório de Energia (Energy Observatory) made available by AdEPorto .
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Emission source sectors according to GHG inventory format – Module A-1 (Buildings, Transport, Waste, AFOLU).
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	All actions in Action Plan.
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Observatório de Energia (Energy Observatory) made available by AdEPorto
Is the data source local or regional/national?	Local
Expected availability	Yearly
Suggested collection interval	Yearly
References	
Deliverables describing the indicator	Annual reports provided by the Observatório de Energia (Energy Observatory) .
Other indicator systems using this indicator	ISO 37110:2022 Sustainable cities and communities
Planned monitoring approach	Monitoring entails detailed sector-specific assessments of CO ₂ eq emissions, with yearly tracking facilitated by the Energy Observatory provided by AdEPorto. Targets for 2025, 2027, and 2030 aim to reduce emissions, fostering sustainability in Porto.
Indicator Name	Air quality
Indicator Unit	-
Definition	The air quality index translates in an easy and understandable way the state of air quality. In Portugal, thresholds are established for short-term (hourly and/or daily) and long-term (annual) air quality levels regarding relevant pollutants. The QualAR index, which includes data collected in the city is recommended by Porto's Environmental Department , and presents a classification based on the concentration of pollutants recorded at monitoring stations. The results are translated into a colour scale divided into five classes, from "Very Good" to "Bad".
Calculation	The calculation is carried out based on the arithmetic averages of pollutants measured at air quality stations according to the following criteria: • Zones - it is mandatory to measure the pollutants ozone (O₃) and PM10 or PM2.5 particles (particles with a diameter equal to or less than 10 µm and 2.5 µm); • Agglomerations - it is mandatory to measure the pollutants nitrogen dioxide (NO₂) and PM10 or PM2.5 particles. When available, the pollutant SO ₂ is also measured.

Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No.
If yes, which emission source sectors does it measure?	NA.
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes.
If yes, which co-benefit does it measure?	Air quality.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	All actions in Action Plan.
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No.
Data requirements	
Expected data source	QualAR platform complemented by Urban Dynamic Indicator .
Is the data source local or regional/national?	The data source is local. The Municipality of Porto is part of the Porto Litoral Agglomeration and has two stations: 1) The Sobreiras Station which was installed in December 2007 and measures NO ₂ , NO _x , CO, O ₃ , PM10, PM 2.5 and SO ₂ ; and 2) The Antas Station, which operates since October 2000 and measures NO, NO ₂ , NO _x , CO, O ₃ and PM10. Nevertheless, the QualAR is a national platform.
Expected availability	Daily
Suggested collection interval	Yearly
References	
Deliverables describing the indicator	Reports provided by the QualAR platform and complemented by the Urban Dynamic Indicator .
Other indicator systems using this indicator	The regime for evaluating and managing air quality is defined by Portuguese Law 102/2010, of September 23rd in its current wording.
Planned monitoring approach	Monitoring utilizes the QualAR index, translating air quality into five color-coded classes. Targets for 2025, 2027, and 2030 aim to improve air quality, aligning with established thresholds for relevant pollutants, ensuring a healthier environment for Porto's residents.
Indicator Name	Population exposed to night-time noise (L_{night}) over 50 dB
Indicator Unit	%
Definition	This indicator represents the annual average period of exposure to noise at night.
Calculation	Estimated number of people residing in Porto exposed to a level greater than 50 dB, at a height of 4 meters and on the “most exposed facade”, including all sound sources, over the total number of people, as estimated in the Non-Technical Summary (RNT) that supports the Strategic Noise Map of the Municipality of Porto.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No.
If yes, which emission source sectors does it measure?	NA.
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes.
If yes, which co-benefit does it measure?	Noise pollution reduction.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	MT.01 Reduced motorized passenger transportation need MT.02.A Encouraging the use of public transport through ticketing MT.02.B Encouraging the use of public transport through new and better offer MT.03 Increased shared mobility and MaaS options

	MT.04.A Network of recharging points for electric vehicles and electrification of private fleet MT.04.B Electrification of the municipal vehicle fleet MT.05 Optimized logistics MT.06 Electrification of light and heavy freight vehicles
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No.
Data requirements	
Expected data source	Urban Dynamic Indicator and periodic updates to the Strategic Noise Map of the Municipality of Porto.
Is the data source local or regional/national?	The data source is local and gathered through the noise sensors implemented across the city.
Expected availability	Daily
Suggested collection interval	Yearly
References	
Deliverables describing the indicator	Reports provided by the Urban Dynamic Indicator .
Other indicator systems using this indicator	Starting in 2004 and successively in 2008, 2010, 2014, 2018 and 2020, the Municipality of Porto has been promoting revisions and/or updates of both the Strategic Noise Map and the respective Municipal Noise Reduction Plan (Action plan). The most recent version is from 2022. These are the main documents that guide this topic in the city and establish limits.
Planned monitoring approach	Monitoring utilizes local noise sensors to collect data on night-time noise levels (L _{night}). Targets for 2025, 2027, and 2030 aim to decrease the population exposed to levels exceeding 50 dB, ensuring quieter nights for residents.
Indicator Name	Population exposed to average day-evening-night noise levels (L_{den}) over 55 dB
Indicator Unit	%
Definition	This indicator represents the average noise level to which citizens are exposed during the day, evening and night periods of one year.
Calculation	Estimated number of people residing in Porto exposed to a level greater than 55 dB, at a height of 4 m and on the “most exposed facade”, as estimated in the Non-Technical Summary (RNT) that supports the Strategic Noise Map of the Municipality of Porto.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No.
If yes, which emission source sectors does it measure?	NA.
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes.
If yes, which co-benefit does it measure?	Noise pollution reduction.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	MT.01 Reduced motorized passenger transportation need MT.02.A Encouraging the use of public transport through ticketing MT.02.B Encouraging the use of public transport through new and better offer MT.03 Increased shared mobility and MaaS options MT.04.A Network of recharging points for electric vehicles and electrification of private fleet MT.04.B Electrification of the municipal vehicle fleet MT.05 Optimized logistics MT.06 Electrification of light and heavy freight vehicles
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No.
Data requirements	



Expected data source	Urban Dynamic Indicator and periodic updates to the Strategic Noise Map of the Municipality of Porto.
Is the data source local or regional/national?	The data source is local and gathered through the noise sensors implemented across the city.
Expected availability	Daily
Suggested collection interval	Yearly
References	
Deliverables describing the indicator	Reports provided by the Urban Dynamic Indicator .
Other indicator systems using this indicator	Starting in 2004 and successively in 2008, 2010, 2014, 2018 and 2020, the Municipality of Porto has been promoting revisions and/or updates of both the Strategic Noise Map and the respective Municipal Noise Reduction Plan (Action plan). The most recent version is from 2022. These are the main documents that guide this topic in the city and establish limits.
Planned monitoring approach	Monitoring entails utilizing noise sensors across the city to gather local data on average day-evening-night noise levels (Lden) exposure. Targets for 2025, 2027, and 2030 aim to reduce the population exposed to levels over 55 dB, ensuring a quieter environment.
Indicator Name	Green areas
Indicator Unit	Hectares
Definition	Increase in the city green area (hectares) per 1 000 inhabitants.
Calculation	Data extracted from internal and online land use databases as SMOS (Sistema de Monitorização da Ocupação do Solo) (dgterritorio.gov.pt) and Árvores do Porto (arcgis.com)
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	AFOLU
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Reduction in GHG emissions; Improvement in air quality; Improvement in quality of life.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	GI.01 Increased green infrastructure (carbon sink)
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Land use databases, internal and SMOS (dgterritorio.gov.pt) , a city platform which maps the green areas in Porto.
Is the data source local or regional/national?	National and local.
Expected availability	Information in SMOS is provided every 12 years. However, the GIS platform that maps the city's green areas is updated annually.
Suggested collection interval	Biannual
References	
Deliverables describing the indicator	Information in the city website.
Other indicator systems using this indicator	-
Planned monitoring approach	The monitoring involves data extraction from online land use databases like SMOS and Árvores do Porto to track the increase in city green area per 1,000 inhabitants, aligning with targets set for 2025, 2027, and 2030.
Indicator Name	Percentage of people stating thermal comfort conditions in homes during summer and winter
Indicator Unit	Percentage

Definition	Share of Porto residents who declare that their homes are thermally comfortable in winter (not too cold) and summer (not too hot).
Calculation	Surveys and results displaying in Porto's energy poverty platform.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it measure?	NA
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Energy poverty reduction; Improvement in quality of life by increased thermal comfort; Energy and costs reduction.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.02.D Renewable generation in private buildings and facilities BE.01.A Renovation of existing private buildings BE.01.C Renovation of existing social housing BE.02 Construction of new energy-efficient buildings (NZEB standards)
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Surveys' results displayed in Energy poverty platform
Is the data source local or regional/national?	Local
Expected availability	Periodic
Suggested collection interval	Biannual
References	
Deliverables describing the indicator	Reports on the evolution of energy poverty indicators discussing the surveys outputs.
Other indicator systems using this indicator	National statistics on energy poverty available at Energy Poverty Advisory Hub platform
Planned monitoring approach	The approach includes surveys, that can be supplemented by temperature data collection, to assess thermal comfort in homes during summer and winter. Targets for 2025, 2027, and 2030 aim to improve comfort conditions.

Social inclusion, innovation, and democracy

Indicator Name	Inhabitants of Porto's social housing with access to renewable energy
Indicator Unit	Percentage
Definition	Share of Porto's social housing and affordable housing with access to locally produced renewable energy used for self-consumption.
Calculation	Number of dwellings of social and affordable housing with access to renewable energy over the total amount of dwellings of social and affordable housing.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Buildings.
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Inclusion of vulnerable people in Porto's climate neutrality projects.

Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.02.D Renewable generation in private buildings and facilities BE.01.A Renovation of existing private buildings BE.01.C Renovation of existing social housing BE.02 Construction of new energy-efficient buildings (NZEB standards)
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Surveys' results displayed in Energy poverty platform
Is the data source local or regional/national?	Local
Expected availability	Periodic
Suggested collection interval	Biannual
References	
Deliverables describing the indicator	Reports on the evolution of energy poverty indicators discussing the surveys outputs.
Other indicator systems using this indicator	National statistics on energy poverty available at Energy Poverty Advisory Hub platform
Planned monitoring approach	Monitoring involves assessing renewable energy access in social housing, collaborating with Domus Social, and reporting progress towards targets for 2025, 2027, and 2030, ensuring equitable energy distribution.
Indicator Name	Capacity building targeted at city staff
Indicator Unit	Percentage
Definition	Share of Porto's municipal staff engaged in training sessions, workshops and/or communication activities related with the city carbon neutrality initiative.
Calculation	Share of city staff involved in capacity building activities.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No.
If yes, which emission source sectors does it measure?	NA.
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Increased capacity in municipal staff.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	All actions in Action Plan.
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Attendance lists.
Is the data source local or regional/national?	Local
Expected availability	Periodic
Suggested collection interval	Annual
References	
Deliverables describing the indicator	Reports on the capacity sessions performed.
Other indicator systems using this indicator	-



Planned monitoring approach	The approach includes training needs assessments, workshops, and evaluations to enhance city staff capacity, aiming to meet targets for 2025, 2027, and 2030 in alignment with organizational goals.
Indicator Name	Modal share of public and soft modes
Indicator Unit	Percent
Definition	Increase in share of trips done by public transport (bus) and non-motorized means (e-Scooter trips, biking, and walking)
Calculation	The number of trips done by bus and e-scooter is monitored through the city Urban Dynamic Indicator platform which is able to assess the number of validations in these services in near real-time. Biking and walking practices must be assessed through surveys.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Transport.
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Behavioural change towards low carbon practices.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	MT.01 Reduced motorized passenger transportation need MT.02.A Encouraging the use of public transport through ticketing MT.02.B Encouraging the use of public transport through new and better offer
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes.
Data requirements	
Expected data source	Urban Dynamic Indicator platform and mobility surveys.
Is the data source local or regional/national?	Local
Expected availability	Real-time and periodic (surveys on soft mobility).
Suggested collection interval	Annual
References	
Deliverables describing the indicator	Reports from the city Urban Dynamic Indicator platform.
Other indicator systems using this indicator	Reports from STCP and other public transport providers.
Planned monitoring approach	Monitoring involves regular surveys, data collection from transportation authorities, and collaboration with stakeholders to track the modal share of public and soft modes, aligning with targets for 2025, 2027, and 2030.

Digitalisation and Smart Urban Technology

Indicator Name	Share of buildings with electric smart metering infrastructure
Indicator Unit	Percent
Definition	Proportion of electric infrastructure (buildings and facilities) endowed with smart meters, gauging the possibility of more advanced smart grid services.
Calculation	Number of smart meters installed by E-Redes, the Portuguese DSO in the Municipality, over the total amount of electricity contract points.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Stationary energy (buildings).



Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Smart metering/ grid infrastructure.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	BE.04 Digitalisation, literacy and awareness.
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No.
Data requirements	
Expected data source	Opendata platform from E-REDES
Is the data source local or regional/national?	Local
Expected availability	Monthly
Suggested collection interval	Annual
References	
Deliverables describing the indicator	Reports from the Opendata platform from E-REDES
Other indicator systems using this indicator	
Planned monitoring approach	The approach includes assessing the installation of electric smart metering infrastructure in buildings, collaborating with utility providers, and reporting progress toward targets set for 2025, 2027, and 2030.

Finance and investment

Indicator Name	Capital invested by the Municipality in climate actions
Indicator Unit	Euro (€)
Definition	Municipal budget allocated to energy and sustainable projects.
Calculation	Detailed budget executions of municipal companies and departments.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions)?	Yes
If yes, which emission source sectors does it measure?	Emission source sectors according to GHG inventory format – Module A-1 (Buildings, Transport, Waste, AFOLU).
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes.
If yes, which co-benefit does it measure?	Capital invested in climate action.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	ES.01 Purchase of 100% certified renewable energy ES.02.A Renewable generation in municipal buildings ES.02.B Renewable energy community from waste ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.04 100% LED street lighting equipped with control and monitoring system MT.01 Reduced motorized passenger transportation need MT.02.A Encouraging the use of public transport through ticketing MT.02.B Encouraging the use of public transport through new and better offer MT.04.A Network of recharging points for vehicles MT.04.B Electrification of the municipal vehicle fleet MT.05 Optimized logistics WCE.01 Increased waste recycling WCE.02 Optimized processes and efficiency in wastewater treatment facilities

	GI.01 Increased green infrastructure (carbon sink) BE.01.B Renovation of existing municipal buildings and facilities BE.01.C Renovation of existing social housing BE.02 Construction of new energy-efficient buildings (NZEB standards) BE.04 Digitalization, literacy and awareness
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No.
Data requirements	
Expected data source	Detailed city budgets.
Is the data source local or regional/national?	Local
Expected availability	Annual
Suggested collection interval	Annual
References	
Deliverables describing the indicator	Detailed financial reports available in the city webpage .
Other indicator systems using this indicator	News from the city and from municipal companies.
Planned monitoring approach	Monitoring involves regular audits, financial reports, and collaboration with relevant departments to track municipal investments in climate actions, specifically detailed municipal budgets aligning with targets for 2025, 2027, and 2030.
Indicator Name	Capital invested by other entities in climate actions
Indicator Unit	Euro (€)
Definition	Private and other public entities investment allocated to energy and sustainable projects in Porto.
Calculation	Investment (CAPEX and OPEX) carried out in energy and sustainability projects.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Emission source sectors according to GHG inventory format – Module A-1 (Buildings, Transport, Waste, AFOLU).
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Capital invested in climate action.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	ES.02.B Renewable energy community from waste ES.02.D - Renewable generation in private buildings and facilities ES.03 Renewable energy generation in Porto's industry MT.01 Reduced motorized passenger transportation need MT.02.B Encouraging the use of public transport through new and better offer MT.03 Increased shared mobility and MaaS options MT.04.A Network of recharging points for electric vehicles and electrification of private fleet MT.06 Electrification of light and heavy freight vehicles GI.01 Increased green infrastructure (carbon sink) BE.01.A Renovation of existing private buildings BE.02 Construction of new energy-efficient buildings (NZEB standards) BE.03 Efficient lighting and appliances BE.04 Digitalization, literacy and awareness BE.05 Decarbonized space and water heating generation
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	

Expected data source	Public news on media, data provided by Porto Climate Pact subscribers and InvestPorto figures.
Is the data source local or regional/national?	Local, regional, and national
Expected availability	Periodic
Suggested collection interval	Periodic
References	
Deliverables describing the indicator	Public news and information annually provided by Porto Climate Pact subscribers.
Other indicator systems using this indicator	
Planned monitoring approach	The approach entails tracking investments in climate actions via financial reports, surveys, and collaboration with stakeholders, aiming to meet targets by 2025, 2027, and 2030.

Economy

Indicator Name	Number of jobs created
Indicator Unit	Number
Definition	Number of jobs created by investments made on the category "Mobility, energy and environment" through InvestPorto.
Calculation	InvestPorto estimations.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Emission source sectors according to GHG inventory format – Module A-1 (Buildings, Transport, Waste, AFOLU).
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Jobs creation and local economy development.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	All actions in Action Plan.
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	InvestPorto figures.
Is the data source local or regional/national?	Local
Expected availability	Annual
Suggested collection interval	Annual
References	
Deliverables describing the indicator	InvestPorto reports.
Other indicator systems using this indicator	-
Planned monitoring approach	The monitoring involves periodic surveys, data collection from employers, and government records to track job creation trends, aiming to meet targets set for 2025, 2027, and 2030.
Indicator Name	Photovoltaic installed capacity in Porto
Indicator Unit	kWp installed
Definition	Increase in share of photovoltaic capacity installed
Calculation	The capacity installed of photovoltaic in the Municipality translates the share of local renewable electricity. These figures are estimated by E-REDES based on the approved permitting processes.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes



If yes, which emission source sectors does it measure?	Stationary energy (buildings).
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Adoption of renewable technologies.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes.
If yes, which action and impact pathway is it relevant for?	ES.02.A Renewable generation in municipal buildings ES.02.C Renewable energy communities as tools to mitigate energy poverty ES.02.D Renewable generation in private buildings and facilities ES.03 Renewable energy generation in Porto's industry
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes.
Data requirements	
Expected data source	Open data from E-REDES platform
Is the data source local or regional/national?	National
Expected availability	Quarterly
Suggested collection interval	Annual
References	
Deliverables describing the indicator	Reports from the Open data from E-REDES platform.
Other indicator systems using this indicator	Observatório Fotovoltaico and statistics from DGEG .
Planned monitoring approach	The approach involves tracking installed photovoltaic capacity through local utilities, conducting regular assessments, and reporting progress to stakeholders to meet targets by 2025, 2027, and 2030.

Resource efficiency

Indicator Name	Waste recycling share
Indicator Unit	Percentage
Definition	Proportion of waste generated in Porto that is recycled.
Calculation	This indicator is assessed through information collected from Porto Ambiente and Observatório LIPOR which is based on the quantification of waste inputs/outputs from the different types and the values from weighing systems.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Increased recycling rate.
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	WCE.01 Increased waste recycling
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Porto Ambiente and Observatório LIPOR
Is the data source local or regional/national?	Local and regional
Expected availability	Annual
Suggested collection interval	Annual

References	
Deliverables describing the indicator	Reports from LIPOR and Porto Ambiente (PAPERSU 2030)
Other indicator systems using this indicator	-
Planned monitoring approach	The planned approach includes setting targets, collecting data from waste facilities, analysing recycling rates, and reporting progress to stakeholders regularly.



4 Part C – Enabling Climate Neutrality by 2030

4.1 Module C-1 Governance Innovation Interventions

C-1.1: Description or visualisation of the participatory governance model for climate neutrality

The described governance structure for Porto's climate action, particularly the creation of the Porto's Transition Team and the establishment of a formal mandate for Porto Ambiente, reflects a comprehensive and collaborative approach to achieving carbon neutrality by 2030. Below are described the key components of this participatory governance model:

1. Porto Climate Pact:

The Porto Climate Pact, launched in 2022, represents a collective multi-stakeholder commitment to deal with climate change and achieve carbon neutrality by 2030 in the city of Porto. This ground-breaking agreement involves the formal collaboration of various entities, including the Porto Municipality, waste and energy companies, urban rehabilitation and construction entities, academia, digital transformation associations, public and private organizations and it has 228 institutional subscribers and more than 500 individual subscribers (citizens). The pact sets out a comprehensive strategy, encapsulated in the "Towards Carbon Neutrality 2030" agreement, which outlines the shared responsibilities and goals of the signatory entities. Led by the Vice-Mayor of Porto and supported by a dedicated Transition Team, this commitment symbolizes a concerted effort to address climate challenges through collaborative governance, emphasizing the significance of coordinated action and a unified approach to sustainable development. It exemplifies a strategic and structured initiative to propel the city towards its ambitious climate goals.



Figure 48. Formal presentation of the Porto Climate Pact in September 2022.

Porto Climate Pact has Porto's Transition Team as a managing team that includes a technical leadership in Porto Ambiente to orchestrate the municipal and to monitor the non-municipal efforts. Currently, the Directorate for Carbon Neutrality in Porto maintains permanent contact with its signatories through very different channels: physical and online meetings, group and bilateral meetings, workshops, informal moments, e-mail, phone calls. In this kind of networks, proximity is key, so there is a very aligned treatment with lots of technical representatives of these organizations. Moreover, since the beginning, this closer articulation enabled several perspectives on the work that has been done in the city. Different programmes, conferences, new plans and projects, lots of different initiatives and new commitments arose from these contacts, in both ways, among different subscribers of Porto Climate Pact. The Climate Neutrality Commitments 2030 presents a huge list of more ambitious commitments, some of them directly results from this closer interaction and some of them are inspired or at least aligned with Porto's carbon neutrality goal.

Formally, hundreds of institutions were invited to subscribe the Pact, mainly in the launch of the initiative. After that, there were dozens of organizations that did it on their own initiative. Recently, we also partnered with our colleagues from Porto Ambiente's awareness-raising teams, that are helping us to disseminate the project on the field, helping us in the expansion of the network of subscribers



and consequently increasing the potential for creating synergies and community impact in reducing greenhouse gas emissions.

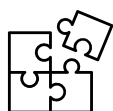
There has also been significant work in the approach to bring closer and involve citizens in this Pact. There is a Porto Climate Pact's activation stand used at local events to engage citizens to subscribe the Pact, explaining them the importance of the topic and how can be part of this wave of behavioural change. After that, we keep them engaged with a dedicated newsletter and invitations to other events, as well with new strategies we are developing, some of them related to WAKE UP! Pilot Project funded by NetZeroCities Pilot Programme Cohort 2, and other strategies to be developed specially related to the development and implementation of new climate policies.

As has been the case with other initiatives, the Transition Team is planning future work based on co-creation between the several different stakeholders, under the umbrella of the Porto Climate Pact. We intend to continue providing moments of consultation and development in the city, not just with experts and academics, but with everyone who contributes to urban dynamics. The work carried out under the Climate City Contract is an asset for the way in which it has been possible to gather and work on the various projects developed in the Municipality, organise the necessary investments and the consultation and commitment of current and new partners. This will be an iterative process that will support decision-making and stakeholder involvement and it is already based on an excellent working framework, but always learning from other cities' best practices and the support of NetZeroCities consortium.

During 2024, using the Climate City Contract as a reference, we plan to organize the Pact's subscribers into thematic clusters of interest, given that there is already a critical mass for this. The goal is to contribute synergies to accelerate the implementation of defined measures and commitments, and, possibly, to raise the bar on new commitments that allow for the acceleration of climate objectives. Some cluster topics will be decentralized clean energy production, energy efficiency measures, mobility and transport, sustainable construction, community engagement, food and circular economy, and carbon capture projects.

It is important to reinforce, at this level, the strong commitment of the political representatives of the city, with particular emphasis to the Mayor and the Vice-Mayor of Porto. The Porto's climate neutrality targets are often highlighted, and they are a way to create additional pressure on relevant political topics to assure a positive climate transition in the city such as more investment for public mobility and transports.

2. Porto's Transition Team:



Composition

The development of activities and actions to achieve the objectives outlined by the Porto Climate Pact and the European Mission "Smart and Climate-Neutral Cities" requires the participation and cooperation of various structures within the municipal sphere. The Transition Team is composed by various organic units of the Porto City Council, as well as municipal companies and affiliated entities.



Entities included

Porto Municipality, Porto Ambiente (waste company), entity that assumes the coordination and management functions of the project, Águas e Energia do Porto (water and energy company), Domus Social (social housing company), Ágora (sports, culture, and entertainment company), GO Porto (municipal construction company), Porto Vivo (urban rehabilitation company), Porto Digital (digital transformation association), AdEPorto (energy agency), STCP (intermunicipal bus company), and LIPOR (intermunicipal waste management association).



Formalization

The team was officially created under the umbrella of the Porto Climate Pact to strengthen the city's climate transition. A formal agreement, titled "Towards Carbon Neutrality 2030," was signed in August 2022 by the 11 participating entities, committing to allocate human resources to this sustainability governance model. This formalization provides a clear framework and mandate for entities involved and enhances accountability, ensuring the entities have the necessary authority and resources to fulfil their roles.



Competences

The governance model includes entities with diverse competencies, such as waste management, water management, urban rehabilitation, digital transformation, and energy efficiency. The main goals of this team are:

- Achieve carbon neutrality in the city of Porto by 2030;
- Actively participate in the objectives of the Mission "Smart and climate-neutral cities" for which Porto was selected to be one of the 100 cities chosen by the European Commission;
- Dynamize and actively contribute to the community of partners resulting from the "Porto Climate Pact" initiative;
- Contribute to the development of an innovation community and experimentation that enhances the development of new solutions and services for cities, with a high potential for replication.

The team's responsibilities span various sectors, reflecting a holistic and interdisciplinary approach to climate action and decarbonisation. This collective involvement and diversity enhance the city's capacity to address a broad spectrum of climate-related challenges and complexities.



Collaboration

The creation of the Porto's Transition Team brings together diverse entities, including units of the Porto City Council, municipal companies, and affiliated entities, fostering collaboration and shared decision-making. The collaborative institutions defined a set of general commitments, namely:

- Designate employees who should contribute and collaborate in the development of activities to be carried out within the scope of this Strategic Partnership;
- Contribute to the preparation of an annual work plan that describes the activities, goals and results achieved or to be achieved within the scope of the implementation of this Protocol;
- Provide data, technical and documentary support within the scope of the activities to be developed;
- Ensure the sharing of information on investments and actions that contribute positively to the objectives to be achieved within the scope of this Protocol.

Additionally, specific commitments stand out in accordance with the responsibility of each entity in the Porto Transition team. The collective approach ensures that multiple perspectives are considered in the formulation and implementation of climate strategies. The entities within the team have been collaborating for several years, even before this formalization. The agreement and formalization strengthen the alignment of efforts, ensuring a coordinated approach to the city's decarbonization strategy. The Porto Climate Pact and the involvement of various municipal companies/agencies also highlights the establishment of partnerships and networks. These collaborations with the Municipality leverage the expertise and resources of different entities, creating a municipal collective force to address climate challenges.



3. Porto Ambiente's Mandate:

- **Lead and Coordinate Efforts:** The Municipal Assembly approved a formal mandate in July 2022 for Porto Ambiente to lead and coordinate municipal efforts over the years 2022 to 2025 to ensure the management of the measures and actions necessary to guarantee the carbon neutrality of the city of Porto by 2030, in compliance with the objectives outlined in the Porto Climate Pact and the European Mission "Smart Cities with a Neutral Impact on the Climate". Porto Ambiente plays a central role in aligning and overseeing activities related to decarbonization. The activity related to the management, coordination, implementation and operationalization of the Porto Climate Pact and the European Mission "Smart Cities with a Neutral Impact on the Climate" is supported through the allocation of an exploration subsidy for the years 2022 to 2025, with a global value of more than 837 thousand euros. The organizational performance of Porto Ambiente is measured through indicators referring to the degree of execution of the annual operating budget and the rate of fulfilment of the annual activity plan.
- **Dedicated Team:** A dedicated Carbon Neutrality Department has been established within Porto Ambiente to coordinate efforts effectively. The department focuses on aligning activities under the political portfolio and leadership of Mr. Filipe Araújo, Vice-Mayor of Porto and the main sponsor of the Porto Climate Pact.

4. Political Alignment and Commitment:

- **Vice-Mayor's Leadership:** Mr. Filipe Araújo, Vice-Mayor of Porto, is the main sponsor of the Porto Climate Pact, providing political leadership and commitment. The Carbon Neutrality Department aligns activities under his political portfolio, ensuring strong political support for achieving carbon neutrality by 2030.
- **Formal Mandate Approval:** The Municipal Assembly's formal approval of the mandate to Porto Ambiente demonstrates the commitment of the city's legislative body to support and prioritize carbon neutrality efforts.
- **Multi-level political engagement:** Intermunicipal collaboration involves entities like STCP (intermunicipal bus company) and LIPOR (intermunicipal waste management association), demonstrating political engagement at multiple levels.



Figure 49. Discussion of the Porto Climate Pact concept at Municipal Environment Council

5. Alignment Across Sectors:

- **Cross-Sectoral Representation:** The governance structure incorporates entities from various sectors, contributing to a multi-level and cross-sectoral approach to climate action. Cross-sectoral collaboration addresses the interconnected nature of climate challenges.
- **Regional Collaboration:** Involvement of intermunicipal bus and waste management companies (STCP and LIPOR) reflects a regional perspective, emphasizing collaboration beyond the city's boundaries. This multi-level approach acknowledges the regional impact of climate actions and the need for coordinated efforts.
- **Collaborative Transition:** The involvement of municipal companies/agencies dealing with various aspects of decarbonization ensures a collaborative transition in sectors such as water and



energy, waste management, digital transition, public transport, social housing, and municipal buildings management.

6. Inclusive Approach:

- **Citizen Engagement:** The governance model emphasizes mechanisms for citizen involvement, including public consultations, workshops, digital engagement platforms, and community-based initiatives. Inclusivity ensures that residents have a voice in shaping climate policies and fosters a sense of community ownership.
- **Community Forums and Councils:** The establishment of community forums or councils further underscores the inclusive nature of the governance structure. Involving citizens in decision-making processes enhances the representation of diverse perspectives and local knowledge. Civil society is regularly consulted through the facilitation of the Municipal Environmental Council (existing since 2003), in which the academic community, political decision-makers, representatives of civil society, among others, are represented. This demonstrates a longstanding commitment to engaging civil society in environmental matters, facilitating regular consultations to gather input, feedback, and insights from diverse perspectives, and improving transparency and inclusivity in decision-making processes related to environmental policies. Moreover, the establishment of a cross-functional committee and regular meetings indicate a commitment to continuous evaluation, strategy refinement, and agile decision-making in the pursuit of carbon neutrality.
- **Education and Awareness:** The focus on education and awareness programs indicates an inclusive approach to ensuring that residents are informed about climate change and sustainable practices. Inclusivity extends to education, empowering citizens with the knowledge to contribute to the city's climate goals.

BOX 9: Joint workshop with the Net Zero Cities

One of these initiatives that is worth highlighting was the joint workshop organized together with the Net Zero Cities team and which occurred in April 2023. With the ambition of leading the territory's climate transition, the city developed a three-day working session to start working on the actions to include in Porto's Climate City Contract. The workshop included the participation of several entities from the municipal ecosystem and some partners from the Porto Climate Pact, highlighting their active participation and strong network coordination to keep the city at the forefront of the decarbonization process. Dedicated to the strategic alignment between partners, the first day included the sharing of results achieved and objectives of several entities, including the Municipality of Porto, Misericórdia do Porto, STCP, Centro Hospitalar Universitário São João, Fundação de Serralves, REN Portgás, LIPOR, Futebol Clube do Porto, INEGI, SONAE, Elergone Energia and CITTA/FEUP. The remaining moments of sharing were dedicated to identifying and evaluating the city's climate needs, especially focused on concrete measures to be developed, with a view to achieving carbon neutrality by 2030.

BOX 10: Talk series - Porto Towards Carbon Neutrality by 2030

In 2023, the Porto City Council has organized the "Talk series – Porto Towards Carbon Neutrality by 2030" which included 10 clarification and debate sessions related to the theme of sustainability and decarbonization (from 4 May to 20 July) aimed at thinking, reflecting, and discussing the future of the city and the goal of carbon neutrality in 2030, in line with the Porto Climate Pact and the Cities Mission. Approaching these challenges from a broader perspective allowed Porto to create and promote a series of public sessions involving various city entities (starting from the base of the Signatories of the Porto Climate Pact), engage citizens and other stakeholders who are relevant to the development of the considered topics.

7. European Collaborations and Partnerships:

Porto boasts extensive experience and active engagement in various international initiatives, showcasing its commitment to global collaboration on climate and sustainability. The city's involvement in key networks and participation in European research, technological development,



demonstration, and innovation projects are instrumental in shaping and implementing effective strategies for environmental sustainability.

Porto's participation in several European networks highlights its commitment to addressing climate change on a global scale. Porto actively collaborates with other European cities to share knowledge, best practices, and innovative solutions to address climate change. Porto contributes to collective efforts aimed at reducing greenhouse gas emissions, implementing sustainable urban policies, and fostering resilience in the face of climate challenges.



Porto's involvement in the Covenant of Mayors underscores its dedication to achieving ambitious climate and energy goals. By being part of this covenant, the city commits to implementing sustainable and inclusive actions to mitigate climate change and enhance energy efficiency. Porto likely develops and implements initiatives such as climate action plans, energy efficiency measures, and renewable energy projects to align with the covenant's objectives.



Porto's engagement in the Eurocities network, especially serving as the Chair of the Environment Forum since 2018, highlights its leadership role in shaping European urban environmental policies. The city actively collaborates with other European cities, contributing its experiences and learning from the best practices of peers. Porto participates in the development of European policies related to the environment, climate, and sustainability contributing to climate ambition initiatives (e.g., Fit for 55 Package¹³) and fostering dialogue and cooperation with cities across the continent.



The commitment of the city of Porto to environmental and sustainability issues is also reflected in its participation in the CDP – Disclosure Insight Action (previous Carbon Disclosure Project), a global disclosure system that allows companies, cities, and states to manage their environmental impacts.

Porto has been included in the A-list of global cities distinguished for their environmental action and transparency in 2020, 2021 and 2022.



Porto engages in numerous projects and partnerships facilitated by ICLEI, contributing directly and indirectly to climate action (e.g., Urban Agenda for the EU¹⁴, CityLoops¹⁵, URBiNAT¹⁶, LIFE-mybuildingisgreen¹⁷).



Porto is a partner of the Ellen MacArthur Foundation, integrating a network of cities and companies with an ambition for the circular economy.

¹³ <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/>

¹⁴ <https://www.urbanagenda.urban-initiative.eu/>

¹⁵ <https://cityloops.eu>

¹⁶ <https://urbinat.eu/>

¹⁷ <https://life-mybuildingisgreen.eu/en/home/>



The Vice-Mayor of Porto was recently elected as a member of Energy Cities. The election, which took place during the association's annual conference and gave Filipe Araújo the highest number of votes among all peers, highlights the recognition and trust that the councillor for the Environment and Climate Transition gained among his European colleagues, being seen as a central figure in developing policies and strategies for a more sustainable and resilient future in European cities. Energy Cities also recognizes the role of the AdEPorto in the energy transition, within the scope of associated municipalities. This network brings together hundreds of representatives from local authorities, including leaders and newcomers to the energy transition, as well as municipal officials and technical experts.



Porto has joined the EU Mission Adaptation to Climate Change, aligning with the EU's goal to make 150 communities resilient by 2030. This effort aims to transform challenges into innovative solutions for climate and biodiversity crises, protecting the population, ecosystems, and infrastructure. The mission promotes research, knowledge sharing, and citizen engagement, emphasizing nature at the heart of urban decisions. It reflects Porto's commitment to environmental leadership and sustainability, proactively responding to global challenges.

8. Academic partnerships:

Porto's partnerships with CEIIA (Centre of Engineering and Product Development), the Portuguese Catholic University, and the University of Porto illustrates a multifaceted approach to addressing climate challenges. These collaborations not only focus on sustainable mobility and urban forestry, but also extend to ambitious global initiatives, showcasing Porto's commitment to comprehensive, innovative, and impactful solutions for a sustainable future. Moreover, Porto's ongoing projects with various research centres in landscape architecture, biology, geography, among others, demonstrate the city's diverse and interdisciplinary approach to climate-related challenges. These collaborations underscore the importance of scientific research in informing and implementing effective climate strategies.



Be.Neutral Agenda with CEIIA

Supported by the Recovery and Resilience Funds (RRF), this Agenda aims to accelerate the transition to neutrality by 2030 through the development of interoperable mobility products, connectivity devices, and service platforms. With the participation of 44 entities, including industry, academia, the scientific and technological sector, and the involvement of eight cities in the northern part of the country (Porto, Matosinhos, Vila Nova de Gaia, Braga, Guimarães, Vila Nova de



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Native Urban Forest (FUN Porto) project with the Portuguese Catholic University

Production of native trees and shrubs for strategic planting in the city, citizen involvement in private spaces, and export for ecological restoration in surrounding regions. The initiative is designed to offset a significant amount of CO₂ (at least 9 877 tons/year) through strategic tree planting, contributing to urban greenery and ecological restoration.



Famalicão, Viana do Castelo, and Oliveira de Azeméis), the consortium aims to create the first Carbon-Neutral Region in Europe, with the cities in the North region serving as living labs to test and demonstrate the developed practices, products, and services. These partnership with CEIIA where they will be the main interlocutor with the involved cities, reflects a commitment to innovation in sustainable mobility, with a focus on quantifying and incentivizing carbon reduction. The development of this CCC can contribute and inspire other cities involved to step up their ambition to make their territories carbon neutral. The various contributions are fundamental for a coherent alignment with the defined goals.

COMMON HOME OF HUMANITY

[Collaboration with the University of Porto - Common Home of Humanity project](#)

Ambitious project aiming to designate the climate as a world heritage and establish a global legal framework for climate. The collaboration signifies Porto's role in contributing to global initiatives that transcend local boundaries, showcasing leadership in addressing climate change at a broader scale.

In summary, the described **governance model demonstrates a concerted effort involving various entities, both public and private, to tackle the complex challenge of achieving carbon neutrality in Porto**. The formalization of the Porto's Transition Team, the mandate given to Porto Ambiente, and the strong political leadership indicate a commitment to a coordinated, multi-sectoral, and well-supported approach to climate action towards carbon neutrality.

Nevertheless, **Porto recognizes that the national level plays a key role, namely in setting regulations and opportunities for funding, which poses a significant challenge in aligning local climate goals with central government policies and national targets**. The city of Porto faces hurdles in implementing its climate initiatives when certain aspects of governance, such as the scope of executive action, extend beyond the Municipality's jurisdiction. Therefore, the need for alignment and collaboration with the central government is essential to ensure that national regulations, funding opportunities, and supportive policies are conducive to Porto's climate goals.

To mitigate this challenge, **Porto is proactively engaging in a national network of Portuguese cities and regions committed to the transition to climate neutrality**. The network was launched under the name "Network of Portuguese Cities and Regions for Climate Neutrality" and has already secured funding for its operation in 2024 from the Environmental Fund of the Ministry of Environment and Climate Action. **This collaborative platform currently comprising 21 cities and regions aims to accelerate carbon neutrality and directly address the coordination issues with the central government. The objective is to create a more streamlined and cooperative framework that decreases dependence on external entities and fosters a more cohesive and integrated approach to climate action at the national and municipal levels**. By participating in this network, Porto seeks to overcome systemic barriers and enhance the coordination between local and national climate initiatives.



C.1.2: Relations between governance innovations, systems, and impact pathways					
Intervention name	Description	Systemic barriers / opportunities addressed	Leadership and stakeholders involved	Enabling impact	Co-benefits
Porto Climate Pact	A collaborative and strategic framework to guide the city's efforts towards achieving climate neutrality by 2030. It involves a formalized agreement and a coordinated approach among organizations and citizens.	▪ Governance barriers: The complexity of coordinating efforts across multiple sectors and entities may lead to fragmented decision-making, slowing down the implementation of cohesive climate actions. The reliance on national policies, regulations, and funding opportunities also introduces an additional layer of complexity, as Porto's climate actions are intertwined with overarching national strategies. ▪ Sector specific barriers: The specific barriers faced by different sectors are diverse and may include infrastructure challenges, existing regulation, technological adoption, technical and digital literacy, resistance to change. ▪ Opportunities: Public awareness and collaboration among stakeholders, availability of funding for climate action projects, and existence of supportive national climate policies.	National Government, Porto Municipality, Porto's Transition Team (Porto City Council, municipal companies and affiliated entities), a diverse range of other entities from the public, private, social and civil society sectors (local businesses, industry leaders, universities, research institutions, technology providers), and citizens. In total it has gathered 228 institutional subscribers and more than 500 individual subscribers (citizens).	The Porto Climate Pact plays a pivotal role in enabling climate neutrality for the city by providing a structured and collaborative framework that aligns various stakeholders, resources, and strategies to reduce carbon emissions by 85% by 2030 (compared to 2019)	▪ Behavioural shift in societal norms: The pact's initiatives promote a culture of sustainability and environmental responsibility and encourages community involvement and empowerment in the city's climate journey. ▪ Enhanced quality of life: The pact's initiatives contribute to a more sustainable and liveable city environment, improving air and water quality, green spaces, and overall urban well-being. ▪ Economic benefits and green jobs: The transition to climate neutrality stimulates economic growth by fostering innovation and creating opportunities for green businesses and jobs in sectors such as renewable energy, waste management, and sustainable transportation.



Porto's Transition Team	A formal team created to coordinate and drive the city's efforts towards carbon neutrality by 2030. It represents a collaborative and cross-sectoral approach, bringing together 11 entities within the municipal ecosystem to work collectively on the city's decarbonization strategy.	▪ Governance barriers: Articulating efforts across the municipal ecosystem towards a common goal may face challenges due to differences in priorities, decision-making processes, and institutional structures. Also, the national dependency barrier highlights the need for alignment between local climate goals and central government policies. ▪ Resource constraints: Limited financial resources, technical expertise, and human capital can hinder the implementation of ambitious climate initiatives, especially in a city-wide context. ▪ Opportunities: Public engagement and awareness to support policies, technology advancements to leverage innovation solutions, strong collaborations and partnerships with businesses, academic institutions and other cities	Porto Municipality, Porto Ambiente, Águas e Energia do Porto, Domus Social, Ágora, GO Porto, Porto Vivo, Porto Digital, AdEPorto, STCP, and LIPOR	The inclusion of representatives from key municipal companies/agencies in the Transition Team ensures that multiple sectors, such as water and energy, waste management, and public transport, are actively involved in shaping and implementing strategies. This diversity of perspectives enhances the effectiveness of actions taken towards climate neutrality.	▪ Enhanced collaboration and knowledge sharing: The involvement from various municipal departments and entities fosters knowledge exchange and shared expertise among the Transition Team, creating a collective force to address climate challenges. ▪ Innovation and economic benefits: Collaboration within the Transition Team stimulates innovation by combining the strengths of various entities. This can result in the development of new solutions for carbon reduction and brings economic benefits, such as the creation of green jobs and the promotion of sustainable business practices.
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Porto Ambiente's Mandate	Porto Ambiente's mandate establishes a dedicated and politically empowered entity to lead the city's environmental efforts, setting the stage for strategic, coordinated, and accountable actions towards climate neutrality.	▪ Financial constraints: Limited financial resources can impede the implementation of ambitious environmental initiatives. Porto Ambiente may face challenges in securing funding for large-scale projects, cutting-edge technologies, and ongoing operational costs. ▪ Policy and regulatory challenges: Navigating complex regulatory frameworks and aligning policies across various departments or levels of government can pose challenges and hinder the mandate execution. The potential misalignment between Porto's priorities and national regulations may impede the city's ability to implement cohesive and effective climate actions. ▪ Opportunities: Embrace innovation and leverage technological advancements, build strategic partnerships with government agencies, private sector and academia, engage with policymakers for supportive frameworks.	Porto Municipality, Porto Ambiente, Carbon Neutrality Department under the political portfolio and leadership of Mr. Filipe Araújo (Vice-Mayor of Porto and the main sponsor of the Porto Climate Pact)	The formal mandate assigns to Porto Ambiente the leadership to coordinate carbon neutrality efforts, providing clear political support and direction for the implementation of impactful climate initiatives.	▪ Global recognition and reputation: Successful initiatives for climate neutrality led by Porto Ambiente can enhance Porto's global standing as a sustainable and forward-thinking city. ▪ Economic benefits and job creation: Recognition for environmental achievements can attract investments, tourism, and partnerships on an international scale, stimulating economic growth and job creation.
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European Collaborations and Partnerships (e.g., Covenant of Mayors, Eurocities Network, ICLEI, CDP, Ellen MacArthur Foundation, EU Mission Adaptation)	Porto's participation in collaborative platforms involves engaging with multiple cities, organizations, and stakeholders across Europe, to share knowledge, best practices, and resources addressing environmental challenges.	▪ Coordination and communication challenges: Effective communication and coordination among numerous cities can be challenging with language barriers, diversity of priorities, and local contexts. ▪ Resource and capacity disparities: Some cities may have more financial, technological, or human resources than others, creating potential imbalances in the ability to contribute and implement collaborative initiatives. ▪ Opportunities: Knowledge exchange and learning, pooling of resources, both financial and intellectual can collectively influence regional and European policies.	European Commission, National Governments, Porto Municipality, Member cities from Mayor from the Covenant of Mayors for Climate and Energy, Member cities from Eurocities Network, Representatives and member cities from ICLEI and CDP – Local Governments for Sustainability, Representatives and common stakeholders from the Ellen MacArthur Foundation	European collaborations and partnerships enable climate neutrality by fostering cooperation, knowledge exchange, and coordinated efforts among cities, contributing to the journey towards carbon emissions reduction.	▪ Synergy and innovation acceleration: The collaboration fosters synergy and accelerates innovative practices, technologies, and policies as cities exchange ideas and solutions. ▪ Enhanced visibility and economic benefits: Participation in collaborative networks enhances the visibility and recognition of individual cities, attracting positive attention and potential funds and partnerships.
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Academic partnerships (e.g., CEIIA, Portuguese Catholic University, University of Porto)	Formal collaborations for R&I to solve climate challenges, offering a dynamic and knowledge-rich environment, and leveraging the expertise of educational institutions to drive innovation, research, and education for sustainable urban development.	▪ Financial constraints: Access to funding to invest in R&I projects, and joint initiatives. Budget constraints or competition for funding can impede the scalability and impact of collaborative efforts. ▪ Administrative challenges: Collaboration between academic institutions and municipal entities may face administrative obstacles, such as navigating complex bureaucratic processes, which can slow down the implementation of joint initiatives. ▪ Opportunities: Leverage interdisciplinary expertise, bringing together diverse fields of study, skill enhancement from municipal staff, access to cutting-edge research and innovations.	Porto Municipality, CEIIA, Portuguese Catholic University, University of Porto, Polytechnic of Porto	Partnerships with academic institutions enable the Municipality to test and have access to innovative solutions in renewable energy, urban planning, and other relevant fields. Integrating these innovations into municipal practices accelerates the transition towards climate neutrality.	▪ Knowledge exchange and innovation: Collaborative efforts with academic institutions create a platform for knowledge sharing, between academic research, and real-city applications, fostering a culture of continuous innovation. ▪ Educational programs for the community: These academic partnerships can lead to educational programs and initiatives aimed at raising awareness about climate issues within the community.
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4.2 Module C-2 Social Innovation Interventions

C.2.1 Relations between social innovations, systems, and impact pathways					
Intervention name	Description	Systemic barriers / opportunities addressed	Leadership stakeholders involved	Enabling impact	Co-benefits



Entrepreneurship Incubators	Entrepreneurship incubators provide support and resources for startups and social enterprises, offering incubation, acceleration, and access to funding to empower individuals from diverse backgrounds to become entrepreneurs and address societal challenges and promote sustainable practices and positive social change.	▪ Financial constraints: Many aspiring entrepreneurs face challenges in accessing funding for financial support, mentorship, and networking opportunities, which can hinder the development of their startups. ▪ Lack of skills and knowledge: Limited entrepreneurial skills and knowledge can be a barrier for individuals looking to start their own businesses, particularly those from non-business backgrounds. ▪ Opportunities: Emergence of innovative ideas that, when translated into sustainable actions, can create value for society, causing a positive impact on the environment. Networking opportunities that allow the development of new partnerships and more robust projects.	Porto Municipality, Municipal departments, Start-ups, Entrepreneurs, Investors, Educational institutions, Non-profit organizations, Local businesses, Large corporations, Industry experts, International organizations, Community representatives	By fostering a culture of innovation and creativity, entrepreneurship incubators encourage the development of environmentally conscious and sustainable business models, indirectly contributing to the reduction of carbon emissions and the overall environmental impact of the local business community.	▪ New business models and economic growth: Emergence of new business models that foster a culture of innovation and leverage private investment for innovative and sustainable projects to accelerate the city's transition, stimulate economic activity, and generate employment. ▪ Knowledge and skills development: Incubators facilitate knowledge exchange and skills development among entrepreneurs, through valuable insights from mentors, peers, and industry experts, contributing to a workforce capable of driving innovation and competitiveness.
Social Economy Initiatives	The city promotes social economy initiatives, supporting businesses and organizations designed to address societal challenges, foster economic inclusivity, and promote sustainable development.	▪ Financial constraints: Access to public or private financing to invest in new social projects. Budget restrictions for financing can impede the development of initiatives and consequently negatively impact the city's economy. ▪ Knowledge and literacy barriers: Lack of opportunities to access education, poor dissemination of information and lack of population capacity to adopt more efficient behaviours and practices. ▪ Opportunities: Contributes to the cultural and social vitality of the city, while leveraging investments in businesses that prioritize social and environmental progress	Porto Municipality, Municipal departments, Municipal entities, Social economy enterprises (e.g., cooperatives, fair trade enterprises, and community-based projects), Civil society organizations, Educational institutions, Community representatives	By innovating in economic practices that prioritize social and environmental outcomes, these initiatives serve as catalysts for positive change and community sustainable development and end up contributing to the city's efforts to achieve climate neutrality.	▪ Behavioural shift in societal norms: Social economy initiatives raise awareness and promote a culture of sustainability and environmental responsibility, encouraging social involvement and empowerment in the city's climate journey. ▪ Job creation and economic resilience: By fostering economic opportunities at the local level in sectors that prioritize sustainability and social impact, these initiatives contribute to job creation and to build economic resilience within the community.



Social Awareness Initiatives	Social awareness initiatives in Porto encompass a range of programs and campaigns aimed at educating and mobilizing the community on various social and environmental issues. These initiatives leverage creative communication strategies to engage citizens and foster consciousness about critical topics, including climate change, sustainability, and social responsibility.	▪ Behavioural inertia: Encountering resistance to behavioural change is a common barrier, as citizens may be accustomed to existing practices and may be hesitant to adopt new, sustainable behaviours. ▪ Knowledge and literacy barriers: Lack of opportunities to access education, poor dissemination of information and lack of population capacity to adopt more efficient behaviours and practices. ▪ Opportunities: Encourage citizens' thinking, reflection and discussion about the future of the city. Involvement in environmental and climate decisions promotes a sense of responsibility and awareness.	Porto Municipality, Municipal departments, Municipal entities, Environmental organizations, Educational institutions, Private companies, Financial institutions, Civil society organizations, Community representatives	Social awareness initiatives contribute to climate neutrality by influencing and empowering citizens to participate in climate neutral actions and engage in sustainable practices, contributing to a more climate-conscious mindset and a culture of environmental responsibility.	▪ Behavioural shift in society: Social awareness initiatives encourage individuals to adopt sustainable practices, leading to a collective shift in behaviour towards more environmentally friendly choices. ▪ Improved public health: Social awareness initiatives often extend to promoting healthier and more sustainable lifestyles, encouraging active transportation, healthier dietary choices, and overall well-being, leading to improved public health outcomes.
Social Cohesion Programs	Social cohesion programs in Porto encompass various initiatives, including community-building projects, cultural events, and neighbourhood engagement programs, aiming to fortify community ties, tackle social obstacles, and enhance resilience against climate impacts.	▪ Resource allocation: Adequate funding and resources are essential for organizing and sustaining social cohesion programs. ▪ Inclusivity: Ensuring the inclusion of diverse community members and overcoming potential exclusivity challenges. ▪ Opportunities: Strength community ties, through social networks, cultural exchange and acceptance of diversity among different groups of civil society, contributing to enhanced resilience against climate-related challenges.	Porto Municipality, Municipal departments, Municipal entities, Cultural organizations, Civil society organizations, Community representatives	These programs contribute to climate neutrality by fostering and encouraging the community and its residents to adopt environmentally friendly practices, creating a foundation for collaborative action.	▪ Social inclusion and collective well-being: These programs promote social inclusion and a sense of belonging among residents, strengthening social ties and impacting in a positive way the overall well-being of community members.



Circularity initiatives	Circularity Initiatives in Porto focus on closing material cycles and increasing the circularity of resources within the urban environment. They introduce novel approaches and practices that go beyond conventional economic and environmental models.	▪ Financial and infrastructure constraints: Access to funding and city infrastructures to implement urban transformation and adopt circular business models. ▪ Regulatory barriers: Lacking policies that support a circular economy transition and the need to adapt existing regulations to incentivize circular initiatives. ▪ Opportunities: Access to European funding programmes to support the transition to a circular economy, establish Porto as an innovation hub for circular economy practices, and drive sustainable growth through the development of circular business models.	Porto Municipality, Municipal departments, Municipal entities, Environmental organizations, Research institutions, Local businesses and industries, Civil society organizations, Community representatives	These initiatives contribute to climate neutrality by implementing sustainable water practices, reducing food waste and ecological impact through local sourcing, enhancing waste separation for increased recycling, encouraging sustainable consumption patterns, and fostering in general a circular economy that helps to the reduction of greenhouse gas emissions.	▪ Resilient urban systems: Circular practices enhance urban resilience by promoting sustainable resource management, with less resource depletion and waste. ▪ New business models and job creation: Emergence of new green business models that can generate employment in green and sustainable sectors.
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C-2.2: Description of social innovation interventions

The diverse array of actions outlined below collectively exemplifies Porto's proactive approach towards fostering a city that is not only environmentally sustainable but also socially inclusive and resilient. **These initiatives underscore Porto's commitment to addressing systemic challenges and seizing opportunities for innovative and sustainable solutions. By implementing these measures, Porto is actively shaping a future that transcends traditional urban development paradigms.** The city's commitment to sustainability is evident through a multifaceted strategy that spans entrepreneurship incubators, social economy initiatives, social awareness campaigns, social cohesion programs, and circular economy initiatives. **These actions are not isolated endeavours, but interconnected components of a comprehensive strategy aimed at creating positive impacts across various facets of urban life.**

Actions Supporting Social Innovation Initiatives

- **Entrepreneurship Incubators:** Porto has established entrepreneurship incubators, providing support and resources for startups and social enterprises. These incubators foster innovation in business models, encouraging sustainable practices and social impact.
 - **UPTEC** (Science and Technology Park of the University of Porto) <https://uptec.up.pt/> is considered an entrepreneurship incubator established by the city. Developed by the University of Porto, UPTEC provides support for startups and social enterprises, offering resources, mentorship, and a collaborative environment. It encourages innovation in business models, including those with a focus on sustainable practices and social impact.
- **Social Economy Initiatives:** The city promotes social economy initiatives, supporting citizens, businesses and organizations with a social mission. Examples include cooperatives, fair trade enterprises, and community-based projects, innovating in economic models that prioritize social and environmental outcomes.
 - **"Porto Solidário"** <https://www.domussocial.pt/projetos-domus/porto-solidario-16> is a Municipal Emergency Social Fund designed to assist individuals or families facing economic difficulties and severe housing emergencies. This municipal initiative aligns with the legally assigned responsibilities of local authorities in housing and social action, established through a municipal regulation approved by local governing bodies. Currently managed by Domus Social, as delegated in the contractual agreement with the Porto City Council, the program focuses on providing financial aid for rent and banking obligations. The 2 editions of 2023 have a budget of more than 3 M€.
 - **Good Food Hubs** <https://goodfoodhubs.pt/> is an initiative that aims the connection between food producers from all the Porto Metropolitan Area and consumers in the city of Porto, mainly in food markets organized in Asprela University Campus. This program serves as a platform to support local farmers, growers and small food producers by making their products more accessible to the local population. Bringing producers closer to consumers stimulates the local economy and could promote more sustainable dietary habits.
 - The **"WAKE UP!"** pilot project – NetZeroCities Pilot Programme Cohort 2 can also be an asset in this area, valuing and benefiting more sustainable behaviours and sustainable choices on the consumer's side and, consequently, supporting the promoters of these choices.
- **Social Awareness Initiatives:** Porto has implemented social awareness initiatives and campaigns to educate and mobilize the community on climate issues. These campaigns



leverage creative communication strategies to engage citizens in sustainable practices, contributing to a climate-conscious mindset.

- The **Porto Climate Pact** <https://pactoparaoclima.porto.pt/> is the Municipality's biggest initiative in this regard, seeking to involve all stakeholders, not only from a perspective of awareness-raising and capacity-building, but also of city planning and development with citizens and focusing on citizens.
- **Porto towards carbon neutrality 2030 talk series** was launched by the city to maintain engagement with signatories of the Porto Climate Pact, interact with residents, and encourage dialogue. This series of sessions had the goal of encouraging thought, reflection, and discussion about the future of the city within different groups, aiming to align the city's future with sustainability, decarbonisation, and achieving carbon neutrality by 2030. For nearly three months, from May to July 2023, the carbon neutrality issue was highlighted, within the scope of the Porto Climate Pact and the Cities Mission, in a cycle of 10 sessions that debated the themes of climate change and the challenge of decarbonizing the city of Porto, held weekly, at the Porto Innovation Hub, which brought together more than 500 participants and 40 speakers.
- The **"Eco-Escolas"** (Eco Schools) program <https://ecoescolas.abaae.pt/> is a national social awareness initiative applied in Porto's schools and at a national level, being part of the international program "Foundation for Environmental Education" implemented in Portugal by ABAE (Blue Flag Association for the Environment and Education). It engages students and educators in environmental and climate-related projects, fostering a sense of responsibility and awareness. The program uses creative campaigns to educate the younger generation on sustainability. In scholar year 2023/2024, 48 Eco-Schools in the Municipality are participating in the project with municipal financial support to enrol all these participants. This funding covers various aspects of Eco-Escolas' operations, including administration, training, flags, certificates, materials, and on-site activities.
- **Social Cohesion Programs:** Initiatives fostering social cohesion include community-building projects, cultural events, and neighbourhood engagement programs. These aim to strengthen community bonds, addressing social barriers and building resilience against climate impacts through shared networks.
 - The **"Aconchego"** program <https://coesaosocial.cm-porto.pt/pessoas-idosas/aconchego> is an inter-generational initiative in Porto fostering companionship between elderly residents and university students. It addresses social isolation, offering students housing in exchange for companionship and support, being a mutually beneficial model based on a partnership between the Porto City Council and the FAP (Porto Academic Federation). Since the beginning of the program in 2004, 278 seniors and as many university students have participated. For this academic year (2023/2024) there were 13 enrolment processes.
 - **Porto Energy Hub** <https://portoenergyhub.pt/> is a one-stop-shop created with the aim of providing citizens with the essential information to reduce their energy consumption and the associated costs, through the implementation of energy efficiency measures and decentralised renewable energy production.
 - The **"ComEC0"** project aims to promote cohesion and equity in access to information about more sustainable habits, empowering entry managers of social housing groupings to adopt more sustainable behaviours and replicate the knowledge in their own communities.
- **Circularity initiatives:** In Porto, several circular initiatives with significant social impact have been implemented, contributing to both environmental sustainability and social innovation.



- **“Zero Desperdício”** project, awarded the 1st prize in the "Support for the development of ecological markets and resource efficiency" category at the European Enterprise Promotion Awards¹⁸, stands as a beacon of circularity with profound social and climate objectives. In partnership with LIPOR, the intermunicipal waste management association, the initiative, championed by the Municipality of Porto, has successfully recovered approximately 350 tons of food. Launched in 2016 and gaining momentum in 2017 through the "Parcerias para o Impacto" program, the project expanded its reach across the intermunicipal territories. This collaborative effort has not only combat food waste but has also prevented over 300 tons of food from turning into waste, benefitting 35 000 recipients by the end of Q3 2020. The project serves as a model for circular, social, and sustainable practices, aligning with the principles of the circular economy, creating positive social impacts, and contributing significantly to climate resilience.
- **Municipal vegetable gardens’** project <https://ambiente.cm-porto.pt/solucoes-inspiradas-na-natureza/hortas-urbanas> in Porto is a transformative initiative converting idle spaces into cultivable land, providing citizens the opportunity to engage in organic farming, allocating plots to individuals interested. Across four hectares and 13 dispersed locations in the city, 500 small areas each one with a composter facilitate the return of 120 tons of organic matter to the soil annually. Aligned with Porto's commitment to environmental consciousness, the Municipality invests in an ongoing sustainability education program to instigate generational behaviour change and citizen engagement. The strategy involves expanding the network of municipal gardens to enhance food security with minimal public resource utilization. Through partnerships with public and private entities, the City of Porto, acting as a mediator and technical supporter, delegates management responsibilities to the partner organization LIPOR in its broader project **“Horta à Porta”**. Alongside the plot, participants receive training in organic farming and composting. The produce is for personal consumption, and participants are provided with water, a communal tool storage area, and an individual composter. After receiving a plot, monthly monitoring by LIPOR ensures compliance with organic farming practices, with annual recycling of the training. This project represents a significant step towards sustainable urban agriculture, education, and community engagement in Porto.
- **Community Composting Islands** is a project implemented in Porto through Porto Ambiente, which has created 2 pilot community composting spaces. There are already 151 families making a fundamental contribution to the success of these spaces, which are estimated to have enabled more than 7,6 tonnes of bio-waste to be recovered. The commitment of these participants has made it possible to produce 2,05 tonnes of compost, which has been distributed to the participating families. In addition to the circularity promoted by this project, there is a clear community involvement around environmental issues that brings citizens closer together and valorises their contribution.
- The **Center for Circularity** project will develop a reuse centre in the ecocentre of Prelada and it will promote the recovery and reuse of old equipment increasing its lifetime value and use.
- The **ReBOOT** <https://reboot.porto.pt/> is an initiative that aims to contribute to a circular, fair and responsible economy in Porto. The initiative intends to demystify the difficulty of repairing and recovering computers and give users the skills and tools they need to extend the useful life of their computer equipment. Under the slogan "Repair your computer. Transform the world", ReBOOT is a computer recovery, repair and sharing initiative with the aim of saving money and natural resources, as well as sharing knowledge and promoting access to digital environments while at the same time being able to support some Porto's social institutions with this recovered equipment.

¹⁸<https://www.porto.pt/pt/noticia/projeto-zero-desperdicio-recebe-primeiro-premio-da-comissao-europeia-para-eficiencia-de-recursos>



Social innovation initiatives in Porto play a crucial role in addressing systemic barriers on the journey towards carbon neutrality. They often involve a collaborative governance model where various stakeholders, including municipal departments, private entities, and community representatives, work together. This promotes effective communication, coordination, and decision-making, **addressing governance barriers.** Moreover, these social initiatives incorporate participatory processes that involve citizens in decision-making. This fosters transparency, accountability, and ensures that governance structures align with the needs and expectations of the community.

The type of social innovation initiatives identified also encourage collaboration between different sectors, enhance the exchange of knowledge and resources, breaking down silos and **addressing challenges that arise from sector-specific approaches.**

The social awareness campaigns and educational programs mentioned are integral components of social innovation initiatives and they aim to **address knowledge and literacy barriers** promoting the spread of knowledge about climate issues, sustainable practices, and the benefits of specific projects. By empowering individuals to actively participate in and contribute to projects related to sustainability, these initiatives also contribute to **enhance community skills** regarding climate-conscious practices.

By participating in international initiatives and networks, Porto's social innovation projects may access grant opportunities provided by European and global organizations, **mitigating financial constraints.** Entrepreneurship incubators and innovation hubs often explore innovative financing models, including public-private partnerships and crowdfunding. These models can help **overcome traditional funding barriers** by diversifying funding sources.

Collaborations with technology companies and startups can bring expertise in digitization and the development of technologies. Such partnerships contribute to **overcoming technological barriers and ensuring effective implementation.**

By addressing these barriers, social innovation initiatives showcase Porto's determination to build a city that is resilient in the face of challenges, socially inclusive in its opportunities, and environmentally conscious in its development. **Porto is not merely responding to the present needs but is strategically planning for a future where innovation and sustainability go hand in hand, creating a model for urban development that is both forward-thinking and community centric.**



5 Outlook and next steps

Plans for next CCC and CCC Action Plan iteration

Porto's Climate City Contract (CCC) is set for a comprehensive review in the next two years, reflecting the city's commitment to ongoing climate action initiatives. The ensuing steps outline the city plans to refine and elevate the Action Plan within the CCC framework in future iterations:

1. Climate Strategy Refinement

Identify and define the various actions, initiatives, and projects outlined in Porto's Action Plan, aligning them closely with the city's carbon neutrality objectives. The goal is to have a detailed understanding of each initiative, including its financial requirements, to ensure seamless implementation and effective progress tracking.

2. Stakeholder Continuous Engagement Plan

Porto aims to cultivate ongoing stakeholder engagement within the framework of the CCC in parallel with the extensive work that has been developed with the Porto Climate Pact as a collaborative platform, uniting diverse stakeholders, including government bodies, businesses, communities, and non-profit organizations. So far 228 institutional signatories of the Pact have been gathered to support Porto's climate neutrality ambition, actively contributing to the city's efforts and aiding in achieving its goal of climate neutrality by 2030. Regarding the signatories who are committing to this CCC, the number and relevance of signatories' commitments is likely to increase over time. However, for both the Pact and the CCC it is necessary to develop a comprehensive plan with specific actions and timelines to keep securing more formal commitments from diverse entities and organizations within Porto. The plan should emphasize the importance of Letters of Commitment, fostering a dynamic and participatory environment through regular communication channels, periodic stakeholder meetings, and interactive workshops. Additionally, recognizing and rewarding stakeholders for outstanding contributions is crucial for maintaining enthusiasm and commitment, and providing transparent and comprehensive reports on CCC progress is very important to maintain accountability and build trust among stakeholders.

3. Interdepartmental Collaboration

Broadening interdepartmental collaboration to advance the implementation of the Action and Investment Plans is also fundamental. This entails promoting greater collaboration among different departments and work areas involved in the CCC's implementation to enhance overall coordination and effectiveness. The focus is on increasing the number of individuals engaged within municipal companies, the Municipality, and the transition team, fostering a more aligned approach and maybe to have closer collaborations with the Transition Team.

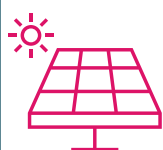
4. Tailored Monitoring Strategy

Creating a detailed Monitoring and Evaluation Plan tailored to Porto's climate challenges is essential. This involves identifying key indicators relevant to the city's context, specifying data collection methods, and defining reporting requirements. Effectively communicating the plan to participating actors and entities, along with providing guidance on data collection aligned with Porto's needs, ensures a robust and context-specific monitoring and evaluation process.

5. Iterative CCC Review



Following the evaluation process, Porto will review its CCC based on the results. This includes assessing the effectiveness of the monitoring and evaluation process within the city's context and identifying areas for improvement. The review aims to align the CCC with Porto's distinct climate journey, ensuring that the contract remains a dynamic and adaptive tool for advancing the city's climate goals. After this extensive work, Porto is more focused to take action and to accelerate the work that has been done. In this context, the city must work to attract and secure the necessary financial, human and knowledge resources to carry out real actions, while at the same time monitoring the outputs and changes in the city. This analysis of the city's progress will allow Porto to confirm the city's strategy or, if necessary, to correct the course of action in a positive, iterative process. This process will end when a new "normal" is reached, i.e., when the city's vision for 2030 is achieved:



Porto 2030 is a city that is moving towards energy self-sufficiency, where public and private buildings are mostly renovated and use more locally generated renewable energy (photovoltaic and solar thermal). Residences and businesses will come together to produce surplus energy resources, promoting sharing and storage, and creating positive energy districts. Equipment and lighting are fully efficient, thanks to a continuous process of incentives for their replacement and investment in new green technology.



The use of public, shared and zero-emission transport will be the "new normal", anchored in a mobility system powered by electricity and renewable gases, with a robust charging network. The citizen of Porto 2030 will be an active user of soft modes of transport and will have a strengthened and interconnected intermodal offer of metro, metrobus and electric buses, which will tend to be free. To this end, the city will continue to simplify fares and extend free transport to more groups of citizens, ensuring quality of service and contributing to the attractiveness of public transport.



In Porto, circular city 2030, water is supplied without energy consumption and the reuse of treated wastewater is promoted. Solid waste will be reused through a comprehensive and effective process of selective separation, recovery of organic matter and, at the end of the line, energy recovery. The food system will be in a process of decarbonization, facilitated by shorter distribution chains in which local producers will play a growing role.



In the field of urban logistics, a strategic plan capable of regulating and electrifying it will be crucial to the decongestion of Porto. Porto 2030 will have the most competitive companies due to reduced energy costs, whose investments will pay off. Climate change and decarbonization are opportunities for businesses, creating new green jobs, economic dynamism and social justice.

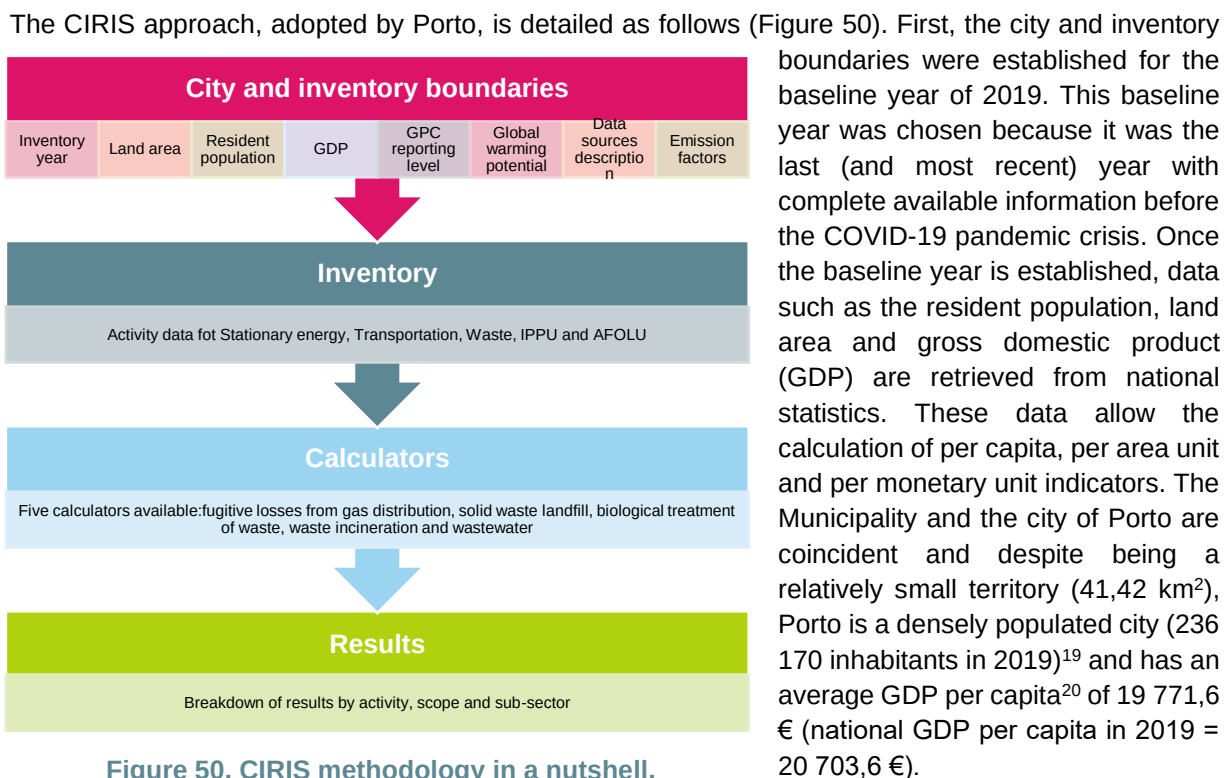


Porto in 2030 will be anchored on a strong component of digitization and dematerialization of services, aligning policy-based decisions on data shared by different organizations, loaded on an urban platform that promotes better management and consequent significant energy savings (e.g. access to real-time data on energy consumption, due to increasing sensing and smart metering as key to effective behaviour change). Porto will continue to benefit from the strong relationship and collaboration with the business ecosystem, research and associative centres in the implementation of decarbonization actions, and at the same time will play an active role in sharing its experiences and good practices in European networks.



6 Annexes

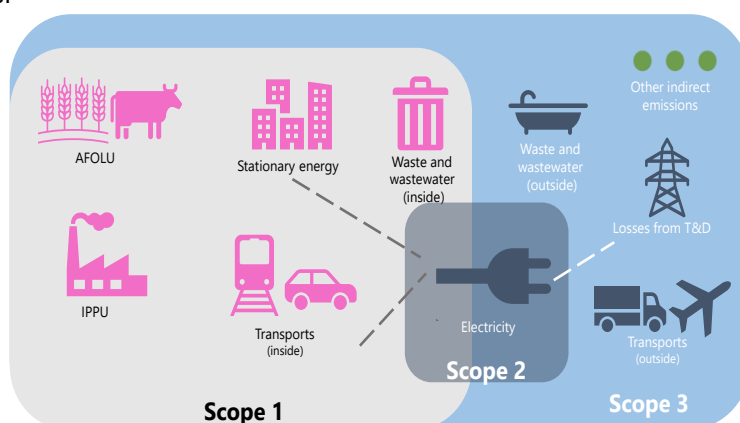
6.1 Annex 1 – Energy and GHG inventory methodology



Regarding the level of detail and depth of the inventory (GPC reporting level), the CIRIS platform allows the selection of different options ranging from a more simplified approach (BASIC) to a more detailed one (BASIC +). For the city of Porto, the BASIC+ option was selected, which includes the activities and scopes presented in Figure 51, covering all the relevant sectors and sources of GHG.

The next stage was to record activity data for the different sectors: Stationary energy, Transportation, Waste, IPPU (Industrial processes and product use) and AFOLU (Agriculture, forestry, and other land use).

Stationary energy refers to the energy consumed in buildings and facilities, through direct fuel combustion (e.g., natural gas) within the city boundary – scope 1, indirect use of grid-supplied electricity or heat (district heating/cooling systems are not a current practice in Portugal) within the city boundary – scope 2, and transmission and distribution losses from



¹⁹ <https://www.pordata.pt/municipios/populacao+residente+total+e+por+grandes+grupos+etarios-390>

²⁰ [https://www.pordata.pt/municipios/pib+per+capita+\(base+2016\)-896](https://www.pordata.pt/municipios/pib+per+capita+(base+2016)-896)

grid-supplied energy – scope 3. The Portuguese Directorate of Energy and Geology (DGE)²¹ publishes annual data on electricity, natural gas consumption and fossil fuels sales at the municipal level and segmented by economic activity. These data make it possible to assess how much energy is sold/consumed in each Municipality and by whom (residential buildings, industries, commercial buildings, transports, etc.), providing a comprehensive database for characterizing consumption and GHG emissions. In addition, local PV installed capacity is assessed from an open-data platform provided by the Portuguese distribution system operator (DSO) E-Redes²² and data from REN, the Portuguese transport system operator (TSO)²³, was used to assess the transmission and distribution (T&D) losses from grid-supplied electricity (scope 3)²⁴. According to the technical studies released by REN, T&D power network losses amounted to 11,3% in 2019. This source was also used to assess the fugitive emissions from natural gas networks. In this case, the losses are only around 0,7%.

For Transports, due to the lack of better information, a top-down fuel-sales approach has been adopted. For on-road transportation, all emissions from fuels sold within the city boundaries are considered as scope 1. Therefore, data retrieved from the DGE database are used. Public reports of the city bus company (STCP)²⁵ and private records of the municipal fleet were then used to categorize the data according to the fleet type into public (buses), municipal (municipal feet) or private (the remaining). In the case of private transportation, information from the Porto's Metropolitan Area Mobility Survey²⁶ was also used to estimate the share of daily trips made in private vehicles within and outside the city: in Porto, around 60% of daily trips in private vehicles are for travels within the city. This information was used to distinguish between scope 1 (emissions from fuel combustion that occur within the city) and scope 3 (emissions from transboundary journeys that occur outside the city). Scope 2 refers to grid-supplied energy consumed in the city for on-road transportation. In this setting, data on the electricity consumed by the city bus company and at public electric vehicles' charging points were considered. These data were retrieved both from the bus company's annual reports and from the Portuguese Electric Mobility Management Entity (MOBI.E)²⁷, which provides information on public EV charging at the municipal level. For railways, DGE data were considered, as well as the annual reports²⁸, the consumption data of the city tram²⁹. As these services are fully electric, scope 2 (grid-supplied energy consumed in the city for railways) was assumed. A residual consumption of electricity and diesel oil was also registered for waterborne navigation and aviation purposes. These data were also obtained from the DGE public database.

Concerning Waste, both solid waste and wastewater data were analysed. As Porto is a residential and service city, the solid waste produced is classified as municipal solid waste (MSW), since it mainly includes food waste, garden and park waste, paper and cardboard, wood, textiles, disposable diapers, rubber and leather, plastics, metal, glass, etc. Municipal solid waste is collected by the municipal company Porto Ambiente³⁰. Thus, the consumption of electricity, natural gas, and lubricants (DGE

²¹ <https://www.dge.gov.pt/pt/estatistica/energia/>

²² <https://e-redes.opendatasoft.com/explore/?sort=modified&exclude.keyword=internal&refine.perfis-de-utilizacao=Mun%C3%ADcio>

²³ <https://datahub.ren.pt/en/publications/>

²⁴ Losses were only assessed for Electricity consumption provided by the grid. PV production was considered as self-consumption and, therefore, losses in T&D power grids were not considered.

²⁵ <https://www.stcp.pt/pt/institucional/governo-societario/relatorio-e-contas/>

²⁶

https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=349495406&PUBLICACOESmo=2&xlang=pt

²⁷ <https://www.mobie.pt/mobidata/data>

²⁸ <https://www.metrodoporto.pt/pages/338>

²⁹ <https://www.cp.pt/passageiros/pt/como-viajar/urbanos-porto#:~:text=Os%20Comboios%20Urbanos%20do%20Porto%20permitem%20efetuar%20liga%C3%A7%C3%B5es%2C,de%20transporte%20e%20acesso%20a%20zonas%20de%20estacionamento.>

³⁰ <https://www.portoambiente.pt/>



data) has been included as scope 1. However, solid waste disposal and treatment is done outside the city boundaries (scope 3) by LIPOR³¹, a waste management company responsible for the disposal and treatment of waste in Porto region. In its Waste Observatory³², LIPOR provides data on the amount of waste produced in the city and treated through each type of process (disposal in landfills or open dumps, biologic treatment, or incineration). Missing information can also be retrieved from the company reporting section. For wastewater, the CIRIS' wastewater calculator was used to estimate the concentration of methane (CH₄) and nitrous oxide (N₂O) from the treatment of domestic, commercial, and industrial wastewater. This tool requires the upload of data on the city (including the number of inhabitants, the type of climate, the country for an estimation of the diet, etc.), as well as data on the type of process used in wastewater treatment plant (effluent's organic load, organic component removed as sludge, etc.). These data, gathered from the city, made it possible to estimate the corresponding emissions.

Lastly, the IPPU emissions generated in the city were also estimated, based on data from the DGEG. As a result of the shift observed from industry to the tertiary sector observed in the last century, the city of Porto does not have many emissions reported in the IPPU sector, limiting it mainly to the utilization of bitumen in the construction industry, which accounts for more than 70% of the total emissions reported in this sector. Other products include the use of lubricants for transformation purposes in different industries and bitumen and paraffin wax in the chemical industry.

³¹ <https://www.lipor.pt/pt/>

³² <https://portal.lipor.pt/pls/apex/f?p=2020:1:0>