Better Mobility

White Paper

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TECH4 Sustainability

Better Mobility: Innovation and sustainability in Porto

TECH4 Sustainability strengthens the **connection between academic research and concrete projects in the city of Porto**, highlighting the **real impact of science and technology on urban life** – often underestimated. This **first edition** focuses on three key areas: **Greater Circularity, More Clean Energy, and Better Mobility**. These **themes are crucial for Porto's goals as one of the 100 Climate-Neutral and Smart Cities**, driving **collaboration between public and private entities for the benefit of citizens**.

"Better Mobility" reflects the **urgency of transforming urban transport systems and highlights the contribution of science and technology** to this change. The solutions explored prioritise the **expansion and accessibility of the public transport network, promoting decarbonised mobility, vehicle electrification, and the development of innovative technologies**.

Sustainable mobility is a **key element for physical and environmental well-being, reducing traffic and pollutant emissions**. In Porto, infrastructure has been implemented to enable **new formats of urban mobility, aligned with the goal of carbon neutrality**. One example is the **Rede 20 project**, which aims to return public space to citizens and **encourage healthier and more sustainable modes of transport**. The initiative focuses on pedestrianisation and reducing car traffic in over a hundred streets, promoting a **safer, more accessible, and people-centred urban centre**.

In **research**, many solutions have been designed for cities, such as the **BooST project**, which aims to develop a **roadmap to encourage cycling, available in both a manual and interactive digital platform**, in partnership with local authorities and stakeholders. Cycling is widely recognised as an **essential means of sustainable urban mobility**, and this project provides technical guidelines to make it more accessible and **integrated into daily life**.

Technological innovation plays a central role in this transition, as demonstrated by Addvolt, which developed a patented Electric Plug-in system, eliminating the need for diesel in the distribution of fresh and frozen products.

The technology allows for the **recovery, production, and storage of energy onboard trucks, significantly reducing CO_2 emissions and noise**. In parallel, **Porto Ambiente reinforces the municipality's commitment to carbon neutrality by 2030, modernising its urban cleaning and waste collection fleet.** The introduction of **natural gas vehicles and the incorporation of biomethane** – a 100% renewable gas produced from organic waste – will enable the **fleet to operate with zero emissions**, positioning the city at the forefront of urban sustainability.

Railways play a crucial role in **structuring modern cities, promoting territorial cohesion and environmental sustainability**. In Porto, the **Campanhã station** is preparing to become a **strategic intermodal hub**, driven by the **future National High-Speed Project, which will connect Lisbon, Porto, and Galicia**, significantly reducing travel times and offering a more **sustainable alternative to air transport**. In addition to passenger transport, the **railway sector plays a key role in the logistics and distribution of goods, reducing costs and strengthening national competitiveness**. The creation of a robust railway network could **drive industrial development and contribute to reducing reliance on more polluting road transport**.

Research in the field of **hydrogen (BioH2) and biomethane (BioCH4)** represents an innovative solution to **reduce dependence on fossil fuels, as seen in the Move2LowC project, which focuses on producing sustainable biofuels for air and heavy road transport. The modernisation of the STCP fleet** also reinforces investment in electric mobility, aiming to ensure **greater autonomy and performance**.

The **transition to sustainable urban mobility** is essential in **combating climate change and improving quality of life**.

In Porto, this transformation is being **driven by innovative solutions** that integrate technology and sustainability, promoting eco-friendly transport **alternatives and consolidating the city's commitment to a greener and more resilient future**.

Explore the project

The Future of Railway in Portugal:

The opportunity of high speed

The **railway** plays a **crucial role in the structuring and organization of modern cities**, driving **profound transformations in the social, economic, and territorial spheres**. In Portugal, the urgency to revitalize this sector becomes evident in light of the current challenges of mobility, territorial cohesion, and environmental sustainability.

Since 2004, Portuguese railways have faced stagnation due to a lack of investment in infrastructure and rolling stock, as well as the closure of railway lines from north to south. The lack of renewal in the sector led to the **creation of the Railway Competence Centre (CCF)**, aiming to recover accumulated knowledge and **introduce technological innovations**. Meanwhile, strengthening the railway sector depends on cooperation between national and international entities. Scientific production dates back to the 1990s, and the **Spanish model that connected Madrid and Seville served as an inspiration for the development of new railway projects in Portugal.**

The **introduction of high-speed rail** is seen as a transformative opportunity, capable of reshaping mobility in the country. The **National High-Speed Rail Project**, which aims to **connect Lisbon, Porto, and Galicia, promises to reduce travel times to under an hour,** directly competing with air transport. This is considered a **"once-in-a-century" opportunity**, enabling **Campanhã station to become an intermodal hub** with two fronts, increasing urban density and dynamism.

In addition to passenger transport, rail freight also deserves attention. **Railways are more efficient and cost-effective for the transportation of goods, reducing import costs and strengthening national competitiveness**. The creation of a robust network could drive **industrial and logistical development in Portugal, combat desertification, and promote territorial cohesion**.

Railways occupy a central role in the transition to carbon neutrality. The expanded use of rail transport can significantly **reduce the dependence on private cars,** promoting **smoother and more integrated mobility**.

In **Porto**, the inclusion of the city by the European Commission as one of the **100 leading cities in the climate transition and carbon neutrality** highlights the **local commitment to sustainability**. Projects like the **reactivation of the Campanhã-Alfândega** line exemplify how **leveraging existing infrastructure** can contribute to this goal.

Swiss experience provides valuable examples of efficient integration between national and international railway networks. In Portugal, this integrated vision would allow for the **connection of regional capitals and facilitate intermodal mobility, offering sustainable and competitive options for users**.

High-speed rail does not only connect distant cities, but also **transforms urban and local dynamics**. In Porto's case, **Campanhã station will become a development catalyst, encouraging new land uses and urban functions.** Furthermore, the **reduction in travel times** strengthens **Porto's role as the center of the Galicia-North Portugal Euroregion, promoting greater economic and cultural integration**. In areas with lower population density, r**ailways can reverse desertification trends, offering mobility opportunities and access to services**.

The Role of Mobility in Carbon-Neutral Cities of the Future

The **CEiiA – Centre for Engineering and Development** presents itself as an **institution focused on innovation, engineering, and the design of technological solutions, with an emphasis on sustainability and the decarbonisation of cities.** Maintaining a citizen- and community-oriented approach, CEiiA leverages **technology as a strategic tool to address and solve global challenges, particularly in the areas of mobility, the environment, and renewable energies.**

Regarding the theme of **sustainable mobility**, noteworthy initiatives include the **X4Us platform**, which integrates connected devices with digital data platforms, working in conjunction with the **BEN vehicle to offer advanced urban mobility solutions**. Another significant innovation is the **AYR platform, designed to track and analyse the greenhouse gas emissions that can be "saved" through citizens' daily choices**. Each sustainable decision is recorded as a credit in a virtual account, encouraging **active user participation in reducing their carbon footprint**.

Along the same lines, the **BEN4Us service** is aimed at communities and environments, with the goal of **accelerating the development and industrialisation of innovative mobility solutions, while also contributing to zero-carbon initiatives**.

These initiatives are part of the **Be.Neutral project – Mobility Agenda for Carbon Neutrality in Cities**, which seeks to **accelerate the transition towards carbon neutrality in the Northern region by developing and industrialising new zero-carbon mobility products and services from Portugal**.

STCP:

Explore the project

Sustainability and innovation in public transport mobility

The **Sociedade de Transportes Coletivos do Porto (STCP)** is a remarkable example of **adaptation and innovation in the road public transport sector in Portugal.** With over 150 years of history, STCP is **leading the way in modernizing its fleet, promoting an accelerated energy transition, and contributing significantly to the decarbonization of urban mobility**.

An ambitious energy transition

STCP has a **strong commitment to social, economic, and environmental sustainability**. The company has been working to **replace a predominantly diesel fleet with cleaner technological solutions such as natural gas and electric power**. Currently, the fleet totals 454 buses, of which 73,1% (332 vehicles) operate on compressed natural gas, 11,97% (68vehicles) are electric, and 11,89% (54 vehicles) still run on diesel. **Within the natural gas sector, 11,5% of the fleet already operates with biomethane, significantly contributing to the reduction of carbon emissions**. This composition reflects **STCP's strong investment in transitioning to cleaner energy**, consolidating its position as an **example of sustainable mobility**.

STCP's vision is clear and ambitious: **eliminate all diesel vehicles by 2027** and achieve a fleet composed of 60% natural gas vehicles and 40% electric vehicles by 2028. This plan strengthens the company's position as a **leader in the transition to more sustainable mobility in the Greater Porto area**.

Innovation in urban mobility

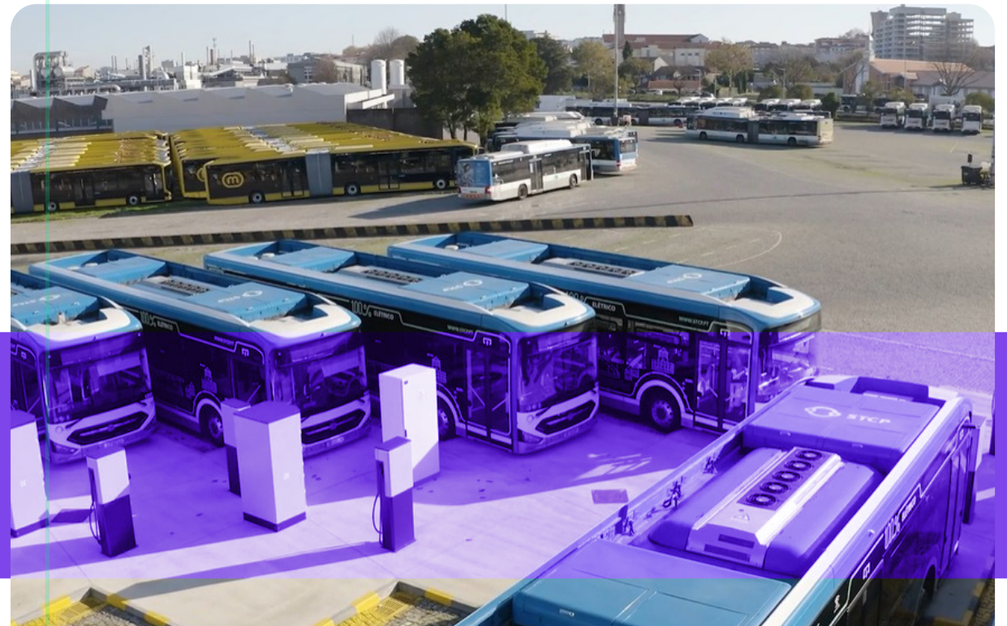
STCP also stands out for its **investment in cutting-edge technologies**. It was the **first public transport company in Portugal to introduce a hydrogen-powered bus**, establishing itself as a pioneer in adopting innovative solutions to **reduce environmental impact**.

Modernizing the fleet and adapting to the demands of a continuously transforming sector are constant challenges. However, the intermunicipalization of management in 2021 helped strengthen the investment strategy. With an obligation contract signed in 2024 for the next 10 years, the **necessary resources are secured to renew the fleet, improve the transport network, and place the customer at the center of operations**. This framework ensures the continuation of efforts toward **more accessible, efficient, and environmentally friendly urban mobility**.

Connecting the past, present, and future

In addition to technological innovations, STCP focuses on **raising awareness among the population**, especially younger generations, about the **importance of sustainable public transport**. The **Museum of the Electric Car** plays a central role in this mission, serving as a **space for debate on urban mobility.** Connecting the glorious past of Porto's transportation to the future, the **museum inspires new generations to value sustainable solutions and adopt public transport as a viable, efficient, and essential alternative for the future of cities**.

Through these initiatives, STCP not only strengthens its role as the **leading public transport operator in Greater Porto but also actively contributes to carbon neutrality goals**, inspiring other cities and operators to follow the same **path of sustainability and innovation**.



Porto Ambiente:

Nelson Pinto

Leadership in the sustainable transformation of the waste truck fleet

Porto Ambiente has established itself as an **example of innovation and commitment to climate transition in the Municipality of Porto.** Since its creation, the company has demonstrated a clear and ambitious strategy, focused on **modernizing its operational resources and promoting sustainability**. This journey reflects a strategic vision that combines **efficiency with environmental responsibility, highlighted by the transformation and renewal of its fleet**.

With a fleet of more than 50 vehicles, of which between 44 and 46 are operational daily, Porto Ambiente ensures the collection of **urban solid waste across four daily shifts**. This intensive operation, which involves covering thousands of kilometers per day, is **already carried out with a strong commitment to sustainability, using vehicles powered by natural gas**, a less polluting alternative. Additionally, the **incorporation of biomethane into the fleet strengthens the logic of minimizing the environmental impact of daily operations.**

Explore the project

The commitment to sustainability is reflected in a **fleet renewal** strategically designed to **reduce emissions and noise levels, promoting a better urban quality of life.** In 2020, 26 new waste collection **trucks with greater loading capacity were introduced, ensuring a more efficient and environmentally responsible operation**.

In 2023, Porto Ambiente took an **additional step in its decarbonization strategy by internalizing urban cleaning operations and introducing 20 new street sweepers, mostly electric**. This investment, valued at 6 million euros, **marked a milestone in urban cleaning in Porto, as it incorporated CO2-zero emission vehicles for the first time.** This renewal reinforces the company's clear policy of sustainable modernization and innovation.

The adoption of electric and natural gas-powered vehicles is perfectly aligned with the Municipality of Porto's sustainability policy, resulting in tangible benefits for the city and its residents. The **incorporation of biomethane into the natural gas fleet** significantly contributes to the **reduction of greenhouse gas emissions, reinforcing Porto Ambiente's commitment to carbon neutrality goals**. Moreover, the operation of these vehicles results in reduced acoustic impact, promoting a quieter urban environment, especially during nighttime shifts, which significantly improves the quality of life in urban centers. On the other hand, the f**leet modernization has also brought operational efficiency gains**. The new vehicles ensure **better maneuverability in difficult access areas, reducing intervention time and increasing the productivity of daily collection and cleaning operations**. This balanced approach reflects a combination of **innovation and environmental responsibility**, positioning Porto Ambiente as a **benchmark in urban sustainability**.

With only a few years of existence—created in 2017—Porto Ambiente has already built a path of excellence, establishing itself as a **reference in sustainable waste management and urban cleaning practices**. The renewal of its fleet, guided by a strategic vision of sustainability, reflects the daily **commitment to covering thousands of kilometers with the least possible environmental impact**. This ongoing work positions Porto as a resilient, innovative city, increasingly closer to carbon neutrality.

Rede 20:

Explore the project

Smooth mobility and sustainability in the heart of Porto

The **city of Porto,** with a history shaped by the slow accumulation of urban fabric, still **preserves much of its medieval structure, visible in the historic center, which is classified as a UNESCO World Heritage site**. This historical heritage, along with the urban expansion of the 18th and 19th centuries, has **shaped the city's center into a compact and dense space**, where large avenues and boulevards are virtually non-existent. This **unique configuration**, while rich in historical and cultural value, **presents significant challenges for urban mobility, requiring innovative solutions adapted to the characteristics of the territory**.

The solution for mobility lies in the **promotion of public transport and soft mobility, especially pedestrian mobility**. The **Rede 20 (Network 20)** emerges as a response to the need to **promote more sustainable and safer mobility, gradually reducing the reliance on private cars.** Inspired by the concept of the "Superblocks" in the city of Barcelona, the Rede 20 of Porto aims to **hierarchize road spaces between those essential for smooth car traffic without restrictions,** while creating other quieter areas with urban streets on **shared routes that are friendly for pedestrians and cyclists, limiting vehicle speed to 20 km/h.**

The logic of Rede 20 is based on the equitable **sharing of public space, subordinating cars to the slower speeds of pedestrians and cyclists.** In this way, Porto focuses on **humanizing neighborhoods and fostering harmonious coexistence between different modes of transport**. To ensure this transformation, measures such as **specific signage, speed bumps, raised pavements, and the creation of Zones of Restricted Automobile Access (ZAAC)** have been implemented. These interventions ensure a safer, more inviting, and comfortable public space for pedestrian and cycling mobility, **encouraging the use of more sustainable modes of transport.**

The Rede 20 covers approximately 30 kilometers of streets, encompassing the historic center and downtown Porto. The implementation is being carried out gradually, with **completion expected to coincide with the end of the construction of the new Pink Line of Metro do Porto**. This project reflects an innovative mobility strategy that **prioritizes people, promoting sustainability and safety in the urban space**.

With Rede 20, Porto reaffirms its commitment to soft mobility, responding to the challenges of a historic and compact territory, while transforming the city into an **example of balanced coexistence between heritage, innovation, and sustainability.**

Explore the project

BooST

Cecília Silva

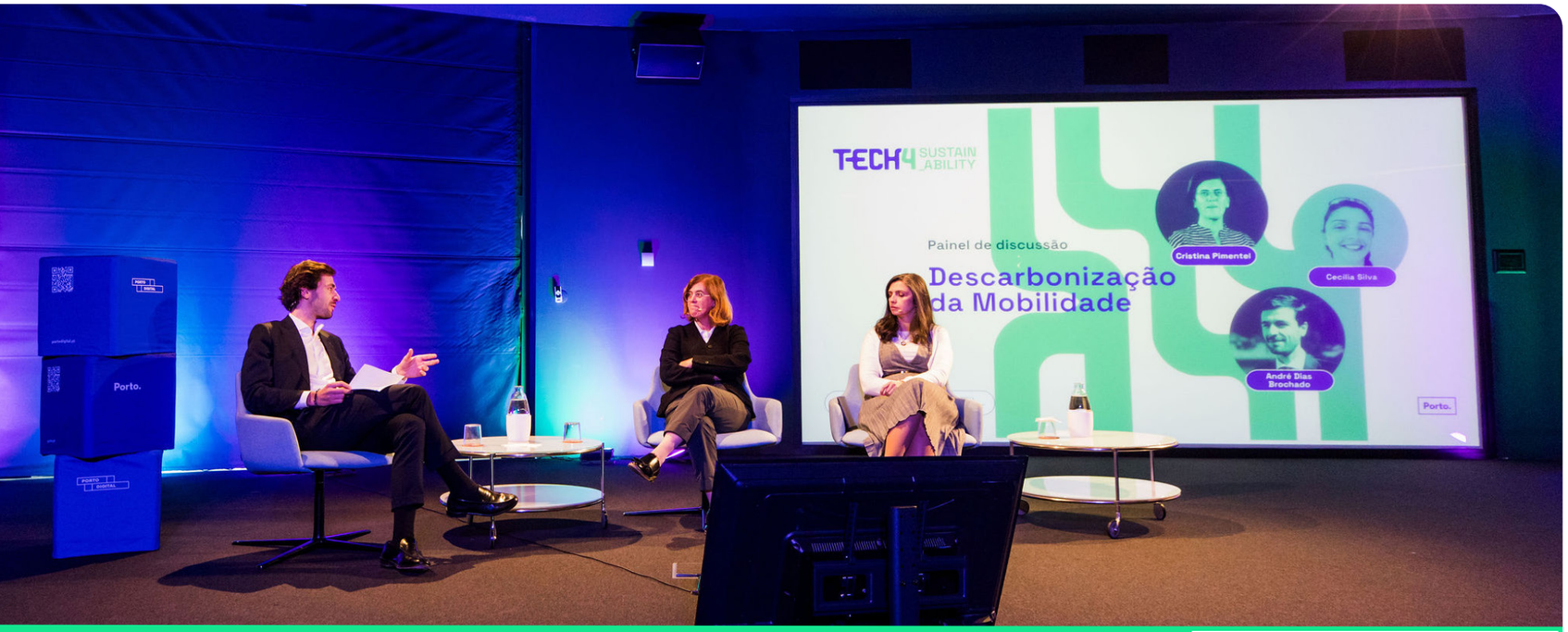
In recent years, there has been an **increasing political emphasis on the use of bicycles in urban areas**, driven by the need for more **sustainable mobility and healthier behaviors**. At the same time, there has been a rise in research focused on the **use of bicycles to encourage modal shift.** So far, research has focused on "champion cities" (those with a modal share of cycling above 20%). On the other hand, "beginner cities" seem to be in a particularly unfavorable situation, lacking a cycling culture or technical knowledge, with limited research specifically addressing their problems and solutions. In this context, the **"BooST – Boosting Bicycles in Beginner Cities"** project focuses on beginner cities and **aims to provide specific technical knowledge to help kick-start bicycle usage.**

The project has developed a **Roadmap for Beginner Cities** on bicycle use, which **provides a set of planning tools,** including a **model for assessing the Gross Potential for Cycling (GPC), a model for assessing the Economic Value of Cycling (EVC), and a model for Selecting the Most Suitable Bicycle Measures (SMB)** for beginner cities.

The **Gross Potential for Cycling** helps **identify geographical areas with the highest potential for bicycle** use (both due to the concentration of population more likely to adopt cycling and the presence of favorable physical conditions for cycling). **The Economic Value of Cycling provides a simulator that allows exploration of the economic value of increasing the modal share of cycling in terms of environmental, energy, and health benefits**, among others. Lastly, **the bicycle measure selector assists in identifying the most suitable mobility management measures to promote cycling** in beginner city contexts.

The **Roadmap for Beginner Cities** and its tools have been made available in the form of a **manual**, an **interactive website**, and through **various workshops involving local authorities and other stakeholders**. Along with a ranking of national beginner cities (based on gross potential), **the project aimed to empower local policy with technical knowledge and arguments to counter more skeptical attitudes**.

The **project brings together several experts in the field** and capitalizes on previous research in **mobility management at the Center for Territory, Transport, and Environment Research (CITTA), on bicycle promotion at the University of Aveiro (UA)**, with various ongoing projects and activities implemented on the ground, as well as the **extensive experience of the European Cyclists' Federation (ECF)**.



Decarbonising Mobility

What happened at the conference

André Brochado

Cristina Pimentel

Cecília Silva

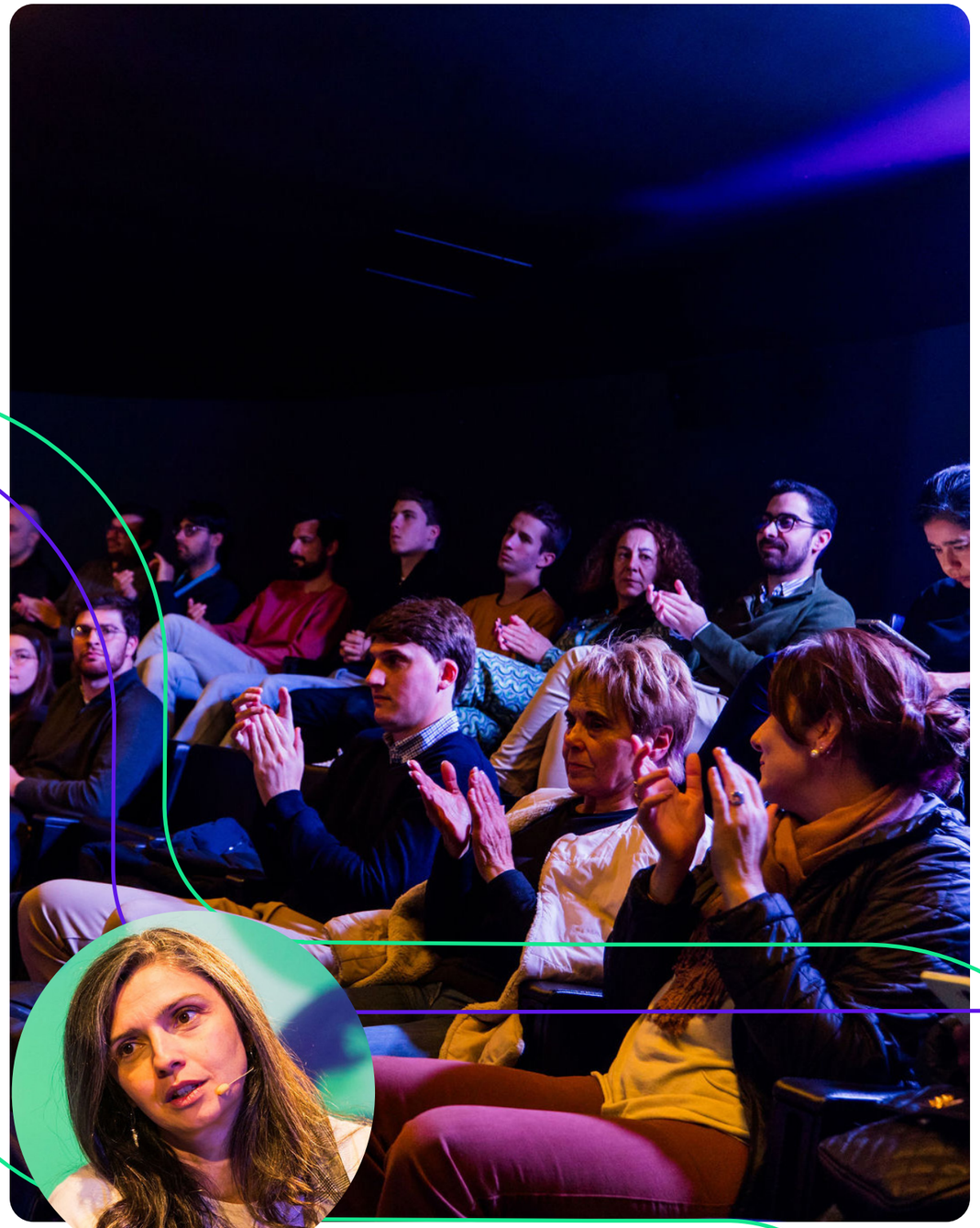
The **panel on Decarbonising Mobility, moderated by André Brochado (Porto City Council)**, featured **Cristina Pimentel (STCP) and Cecília Silva (FEUP/CITTA)**, who discussed **strategies and projects to accelerate this climate transition and foster new sustainable mobility habits**.

During the discussion, **Cristina Pimentel, President of the Porto Public Transport Company (STCP)**, highlighted the **company's fleet renewal plan, which includes new electric vehicles as well as some running on natural gas**, with an increasing share of biomethane. She emphasised that, since 2021, **STCP has been managed under an inter-municipal model**, with multiple municipalities as shareholders.

This model facilitates cooperation in defining **solutions tailored to urban realities and addressing the challenges of modernisation and carbon neutrality**. According to Cristina Pimentel, the goal is to **reaffirm STCP as a leading transport operator, investing in innovation and making public transport a viable alternative to private cars**. For the STCP President, it is "crucial to prioritise the customer, making public transport more attractive and efficient."

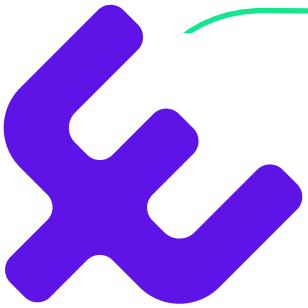
Cecília Silva, in turn, brought different perspectives to the discussion, **exploring the challenges faced by cities that are still in the early stages of bicycle-friendly policies, such as Porto**, where cycling accounts for less than 1% of transport use. The experience of countries like the Netherlands and Germany, which reversed car-centric policies and reached 20% bicycle use, demonstrates that **reducing car dependency is achievable**. Cecília stressed the **need to rethink mobility in Porto to follow this path**. She also emphasised that "statistics alone do not change behaviours. **It is essential to transform and create the necessary infrastructure so that people have real alternatives."**

The panel also addressed the **importance of involving local communities and the social sector in finding solutions.** According to Cecília Silva, **cities have historically been designed around cars, and reversing this reality requires gradual and consistent investment, prioritising more sustainable modes of transport**. One initiative working towards this shift is the **Boost project**, which is **rethinking mobility through cycling**.



The Electric Tram Museum was also **highlighted by Cristina Pimentel, who described it as a space for reflection and education.** She mentioned the **creation of the Bridge Observatory**, which will accompany the construction of the **new Rubi Metro Line bridge**. This museum is not just about preserving history but also serves as a platform for dialogue with younger generations. **"We want to showcase how the electric tram shaped Porto and how public transport can define the cities of the future,"** she stated.

The panel reinforced that **decarbonising mobility in Porto requires more than technological innovation—it is a cultural and social transformation. Modernising public transport, promoting cycling, and engaging the population** are key to building a **more sustainable city, ready for the future.**



Better Mobility

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