Re-Value

Detailed Roadmap for the Waterfront Pilot in Cascais

Re-Value Deliverable D6.4

Report information

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Executive Summary

Coastal zones represent dynamic and complex environments where natural systems and human activities intersect. In Cascais, a municipality located on the Atlantic edge of the Lisbon Metropolitan Area, this intersection is particularly pronounced.

The region's coastline is not only a symbol of its identity and heritage, but also a key driver of social well-being and economic prosperity thanks to its natural diversity, scenic beauty, recreational opportunities, and enhanced bathing conditions achieved through strategic planning.

However, this area is increasingly threatened by both human activity and environmental pressures, compounded by the impacts of climate change, including sea-level rise, biodiversity loss, and coastal erosion — which together challenge its long-term sustainability.

With the Re-Value project, Cascais aims to involve the local community in testing innovative solutions to support urban planning and energy transition in waterfront areas, ensuring inclusivity and incorporating residents' voices and needs to improve urban design. This project emphasises participatory story-building, data-driven scenarios, and robust financial and partnership models for integrated urban planning and design. Therefore, Cascais is reviewing its climate policies and adopting new governance models to involve stakeholders in decision-making processes. This collaborative approach aims to benefit from synergies with other projects and ensure a more inclusive perspective, inspiring and motivating locals, visitors, and stakeholders towards climate neutrality.

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1 The Cascais Waterfront Pilots

The Municipality of Cascais is on Europe's West coast, in Portugal, 25 km West of Lisbon. The Municipality has a total area of 97.4 km^2, a green area of 4 467 ha, 19 parks and gardens, 17 beaches, a coastline of 30 Km and lies between the Atlantic Ocean and Sintra-Cascais Natural Park. It has a resident population of 214 124 inhabitants and is divided in four parishes, Alcabideche, Cascais and Estoril, Carcavelos and Parede, and São Domingos de Rana. **Figure 1** shows Cascais location in Portugal.

Figure 1: Cascais location[1].

Cascais, as a Re-value Project Replication City, aims to align climate neutrality with urban quality by enhancing the connection to the waterfront and maximising co-benefits while minimising adverse impacts. This project focuses on making the urban transition appealing to both citizens and professional stakeholders.

[1] Freire, J.V. Maritime Cultural Landscape: A New Approach to the *Cascais* Coastline. *J Mari Arch* **9**, 143–157 (2014). https://doi.org/10.1007/s11457-013-9122-4

To support this ambition, Cascais has developed its strategic Roadmap for two key Waterfront Pilots: Guia Road and Carcavelos Beach. The knowledge gained from the development of the Detailed Roadmap and the implementation of the Re-value project initiatives will be integrated into Cascais' long-term Territorial Transformation Plan (TTP), drawing on insights from the two pilot areas.

Initially, Cascais scaled its Re-Value efforts across three pilot areas: Guia Road, Carcavelos Beach, and the Vinhas Stream. However, following a more detailed assessment of the project's strategic direction, it was determined that consolidating efforts would increase the likelihood of delivering tangible and high-impact outcomes.

Since the proposal phase, many of the planned improvements for the Vinhas Stream have already been addressed by other initiatives. This overlap significantly reduces the added value of continuing Re-Value interventions in that area. Additionally, the trail's designation as a protected natural landscape prone to flooding introduces considerable legal and regulatory constraints, further limiting the feasibility of new actions.

To maintain the city's commitment to meaningful coastal transformation and to ensure a cohesive local narrative, Cascais is now focusing exclusively on the two remaining coastal pilot sites: Guia Road and Carcavelos Beach. The waterfront redesign emphasizes accessibility and inclusivity, aiming to broaden the range of social and cultural activities while improving access for vulnerable groups and underserved areas. Furthermore, given the substantial role of tourism in the local economy, achieving carbon neutrality will require a transition to a more sustainable tourism model.

As outlined in the project's Grant Agreement, the Municipality of Cascais is committed to engaging local stakeholders — including schools, residents, commercial entities, environmental associations, and cultural/sports organizations — in a participatory co-creation process. The goal is to **transform the waterfront into a climate-neutral catalyst**, contributing to net-zero emissions by 2050.

Key Proposed Initiatives Include:

- **Establish Local Energy Communities to address energy poverty**. This is being advanced through the energy literacy workshops "Energy Café" (Chapter 1.2.4), and Cascais also aims to integrate and improve the results from the Nova SBE energy community, creating synergies with the CASCAIS SMART POLE project (Chapter 1.1.2.5).
- **Promote renewable energy generation and electric mobility**, including photovoltaic systems and e-mobility networks. This is being developed through scenario planning for the Cascais pilots (Chapter 1.3.2).
- **Improve walkability and bikeability**, notably through the Cascais-Guincho bike lane, coastal walking routes, and enhancements around Carcavelos Beach, impacting approximately 25 000 people (Chapter 1.3.2).
- **Enhance resilience and biodiversity with nature-based solutions**. While originally linked to the Vinhas Stream pilot, nature-based strategies are also incorporated in the other pilot scenarios (Chapter 1.3.2).
- **Advance social inclusion and accessibility** by upgrading public spaces and infrastructure, ensuring equitable access for vulnerable and underserved groups (Chapter 1.3.2).

- **Strengthen co-creation and civic participation**. Despite some engagement fatigue due to multiple ongoing initiatives, Cascais remains committed to deepening citizen involvement. As described in Chapter 1.2
- **Drive forward local policy change**.

The expected outcomes are:

- **Development of scalable investment models**, aligned with European and national funding strategies. Cascais is exploring public-private partnerships for the deployment of energy communities and electric mobility solutions. These efforts aim to empower over 100 families and support regulatory change at the national level. Early steps toward these partnerships are described in Chapter 2.3.
- **Strengthened Mediterranean city network** for regional knowledge sharing. Cascais is actively engaging with other cities within the Re-Value framework, contributing to the Community of Practice for mutual learning and regional replication. Recent collaboration includes knowledge-sharing with Písek on the Artistic Mission (Chapter 2.1.6). Cascais also plans to collaborate with Rimini, drawing inspiration from their "Parco del Mare" project.
- **Expansion of data-driven co-creation practices** to inform and guide effective urban transformation (Chapter 1.2.2).
- **Cascais Roadmap** based on local feasibility studies, co-benefit assessments, and community input.
- **Updated Territorial Transformation Plan** for long-term climate neutrality.

1.1 The Waterfront Pilots

1.1.1 Guia Road Pilot

1.1.1.1 Location and Classification

Guia Road Pilot is a 3 km stretch of Cascais coastline in a cliff area that offers a stunning view of the Atlantic Ocean. A road, a cycle lane and a walking path run alongside it, allowing the citizens to enjoy the area.

This pilot is located on the Rei Humberto II de Itália Avenue and runs from the Cascais Marine to the intersection with the República Avenue, as shown in **Figure 2**. This Avenue is classified as "Urban" and falls under the Alcobaça - Cape Espichel Coastal Zone Programme (POC-ACE) and Sintra-Cascais Natural Park area. Its National Ecological Reserve (“Reserva Ecológica Nacional” REN) typology designation is “Cliffs and their respective protection strip”. This provides a strict environmental management framework which must be respected. The road is entirely maintained by the municipality, but management always requires authorisation from the National Environment Institute.

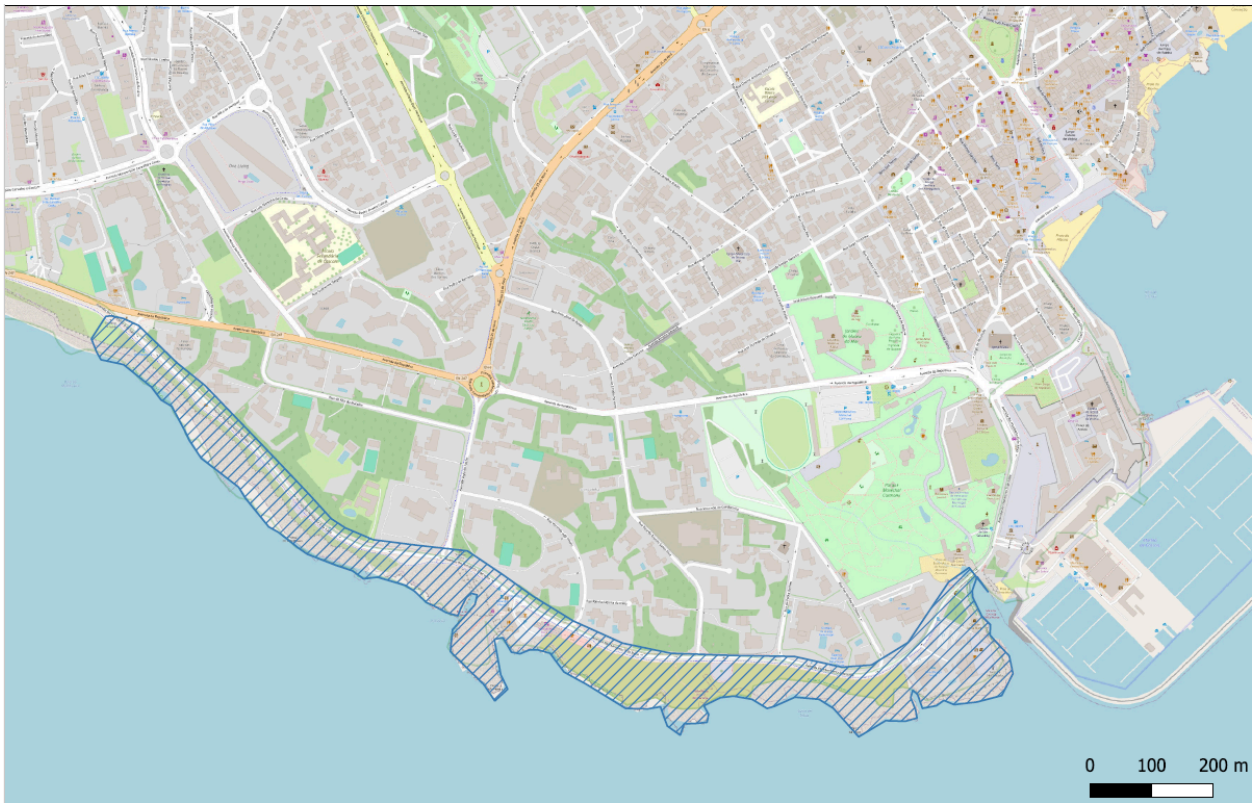


Figure 2: Map of Guia Road Pilot[2].

1.1.1.2 Tourism

Guia Road is highly popular throughout the year for residents and tourists. There are many natural and cultural attractions along this cliff coastline. The most famous are “Boca do Inferno” rock formation, Guia Lighthouse and “Casa da Guia” with their popular restaurants, cafés, stores, terraces and an open-air amphitheatre with a beautiful view to the sea.

“Casa da Guia” (**Figure 3**) is a place of reference in Cascais. Located on the former “Quinta dos Condes de Alcáçovas”, it still preserves its emblematic 19th century palace, which was completely restored by the architect Cláudio Wanderley, in 1999. Just outside Cascais downtown, “Casa da Guia” is easily accessible on foot or by bus or car. It is served by a bicycle and pedestrian lane that connects Cascais Marine to Guincho beach, passing by the “Conde de Castro Guimarães” Museum and the “Boca do Inferno” rock formation.

[2] Created using QGIS (Author: Casimiro Monteiro).

Figure 3: Casa da Guia. Photo: Ema Gonçalves.

The Guia lighthouse (**Figure 4**) is an active lighthouse located at Cabo da Guia, about 2 km west of the centre of Cascais and has a range of 18 nautical miles, over an arc of 240 degrees. As a result of its position on the estuary of the Tagus River, Guia Cape had always been important for navigation.

From 1523, this point on the Portuguese coast was illuminated by the chapel of the hermitage of "Nossa Senhora da Guia". In 1537 this hermitage raised a tower where a group of oil lights were lit and maintained for about eight months of the year.

Figure 4: Guia Lighthouse. Photo: Ema Gonçalves.

During the 1755 Lisbon earthquake the tower was damaged, requiring major reconstruction works and equipment replacement. To illuminate various points along the coast, the Marquis of Pombal ordered the construction of six lighthouses, including the Guia lighthouse (1761). The lighthouse was then electrified in 1957 and automated in 1982.

"Boca do Inferno" cliff formation was formed by the erosion of a vein of limestone in the cliff edge (**Figure 5**). This initially led to a cave, which slowly expanded over time. The tougher outer rock remained while the weaker rock was eroded to such a stage that the roof of the cave collapsed forming the unique "Boca do Inferno". This 45 m high rock formation comes to life when the ocean waves get rough and crash against the cliff. In the summer these waves merely splash around in the open cave but during winter storms the full force of the ocean is funnelled into the cave. Nearby there is a viewing platform, a seafood restaurant and a small handicraft market (**Figure 6**).

Figure 5: "Boca do Inferno" belvedere. Photo: Ema Gonçalves.

Figure 6: "Boca do Inferno" handcraft market. Photo: Ema Gonçalves.

1.1.1.3 Sustainable Wastewater Treatment Plant in Guia

The domestic wastewater produced in Cascais is sent to the Guia Wastewater Treatment Plant (WWTP) (**Figure 7**), which also receives wastewater from the nearby municipalities of Amadora, Oeiras and Sintra, treating an average of 57 million m^3/year of domestic wastewater. The liquid phase facilities of the WWTP are entirely underground, minimizing environmental impacts. The solid-phase facilities are geographically separated from the liquid-phase facilities, located approximately 4 km apart and interconnected by a pipeline.

The Guia Wastewater Treatment Plant, one of the largest wastewater treatment infrastructures in the country, produces enough energy for its needs, making it the first wastewater treatment plant in Portugal to achieve full energy self-sufficiency. As part of a 2016 pilot project, its cogeneration process was optimized to generate electricity from the biogas produced during the anaerobic digestion of sludge. This advancement has transformed the WWTP from a major energy consumer to a self-sustaining facility, saving around one million euros per year and avoiding the emission of six thousand tons of equivalent CO_2.

Additionally, the integration of treated wastewater into local circular economy initiatives – such as irrigation – offers a valuable opportunity to promote water reuse and reduce pressure on freshwater sources.

While the Guia WWTP represents a national benchmark in wastewater treatment, it also presents opportunities for further innovation and improvement. Like any major infrastructure, it faces environmental and operational challenges, particularly related to emergency discharges. These discharges, though managed, may pose risks to nearby ecosystems and water quality standards.

To enhance resilience and sustainability, a multi-faceted strategy is recommended. Upgrading or restructuring the existing pipeline system can help reduce the likelihood of emergency discharges and ensure more reliable wastewater transport. Expanding the plant's capacity will better equip it to

manage peak inflows during periods of high demand.

Figure 7: Guia Wastewater Treatment Plant – Liquid Phase[3].

1.1.2 Carcavelos Beach

1.1.2.1 Location and Classification

The Carcavelos Beach Pilot includes both Carcavelos Beach and the adjacent Marginal Road (EN6) (**Figure 8**). Marginal Road is classified as an "Urban" area and is part of the Alcobaça - Cape Espichel Coastal Zone Programme (POC-ACE).

Stretching for 1.25 km along the Atlantic Ocean, Carcavelos Beach is located on the south-facing coastline of the municipality. The beach is easily accessible by public transport, including a 10-minute walk from the nearby Carcavelos railway station. It can also be reached by bus or car via the Marginal Road (EN6), which runs along the coastline and provides several parking options. As a pilot site, Carcavelos Beach offers an opportunity to showcase how targeted actions can enhance the experience of beachgoers while addressing the seasonal variations in beach use.

[3] aguasdotejoatlantico.adp.pt

Figure 8: Map of Carcavelos Beach Pilot[4].

1.1.2.2 Tourism

Carcavelos Beach is a popular tourist destination, known for its lively atmosphere and year-round appeal. This urban beach draws visitors for sunbathing, swimming, and surfing, making it one of the region's most frequented coastal spots.

The beachfront is lined with a variety of restaurants, cafés, bars, and clubs. Small areas of the beach are designated for the customers of these establishments, offering amenities such as shaded umbrellas, beach huts, and lounge chairs (**Figure 9**). However, much of the beach remains open to the public.

Visitors can also enjoy a range of facilities, including a medical centre, showers, foot wash stations, drinking fountains, public restrooms, and urban seating. A children's playground, two beach football fields and three beach volleyball fields add to the beach's family friendly appeal. For safety, lifeguards are on duty from May to October, patrolling the entire stretch of the beach and equipped to respond to emergencies.

[4] Created using QGIS (Author: Casimiro Monteiro).

Figure 9: Concession area of Carcavelos Beach. Photo: Cascais Municipality.

1.1.2.3 Sport

Cascais hosts a wide range of international sea-related sporting events, including sailing, surfing, bodyboarding, and kitesurfing. These competitions not only showcase the region's dynamic coastal environment but also reinforce the strategic role of surf tourism in Portugal's broader tourism development.

Carcavelos Beach offers exceptional conditions for sliding sports (**Figure 10**). Its consistent, high-quality waves and favourable weather make it a standout destination on the world stage. The beach is home to several surf and windsurf schools that operate year-round, providing training and support for both beginners and experienced athletes.

Figure 10: Surfers in Carcavelos beach. Photo: Cascais Municipality.

1.1.2.4 Beach Water Quality

The quality of bathing water is monitored throughout the bathing season by the Portuguese Environment Agency (APA) and by the Waters of Portugal (AdP), under a protocol established with Cascais Town Council. The APA's campaign is carried out monthly on the bathing beaches, complemented by AdP's weekly campaign on all the beaches. Both campaigns aim to demonstrate compliance with the quality requirements laid down in national legislation transposing European Directive 2006/7/EC, according to the two microbiological parameters, *Escherichia coli* and *Enterococcus faecalis*. The bathing water quality in Carcavelos, as in most of Cascais' beaches, is labelled Excellent. In the bathing season of 2022 Cascais had 11 of its beaches classified with the blue flag from the European Environment Agency and Carcavelos was among them.

1.1.2.5 Stabilizing the cliffs on Cascais coastline

As part of the municipality's coastal risk prevention mission, stabilizing interventions are made for the mitigation of the risk of cliff falls and to safeguard the safety of users of urban and heavily used beaches, as has already been done on the crest of the cliff at Bafureira (Parede), Poça (Estoril) and Carcavelos beaches.

Although it is a natural phenomenon caused by erosion, the crumbling of rocky blocks on the cliffs and the consequent fall onto the sand is a risky situation for beach users. Counteracting the effects of this phenomenon and guaranteeing the safety conditions required for people to circulate and stay in the areas at risk is the aim of stabilisation interventions, which were organised following inspections carried out in partnership with the Portuguese Environment Agency (APA) and the Maritime Authority through Cascais Port Authority. The interventions aim to implement protection and maintenance solutions such as drainage of the cliffs and collapse of unstable blocks. This way it is

possible to guarantee a safety perimeter, but also to control the moment of the fall and, if necessary, immediately remove the blocks.

Sea level rise

The tide gauge records for Cascais from 1882 to 1985 show a trend of average sea level rising, essentially related to the thermal expansion of the ocean, and characterised by an average rate of rise of 1.3 ± 0.1 mm/year until the 90s. Since then, the results point to higher rates of rise (of 2.5 mm/year in the 2000s), compatible with the global average rise of the ocean. Although there is consensus in the scientific community that the average sea level will continue to rise, opinions are divided on the pace of this evolution and its magnitude in the 21st century, due to the enormous complexity of the phenomena involved. The most recent estimates point to a total rise above the 1990 level of approximately 0.25 metres by 2050 and 0.5 to 1.4 metres by 2100. As the data for Cascais is compatible with the average rise in the global ocean, these are the projections adopted by the city.

For Carcavelos Beach, these sea level rise projections are particularly concerning. Adding the very high visitor pressure, this beach is especially vulnerable to erosion and loss of recreational space. As the sea levels rise, the risks to infrastructure, safety, and ecological integrity, will increase, highlighting the urgent need for improved coastal management strategies tailored to this high demand area.

Marine Biodiversity

At Carcavelos Beach, where urban development tightly borders the coastline, the impacts of sea level rise and ocean acidification pose a direct threat to the rocky intertidal zones present in the area. These habitats, already under pressure from high human activity, are crucial for supporting local marine biodiversity, particularly *algae species* that play a foundational role in coastal food webs.

As sea levels rise and upper intertidal zones are submerged or lost due to the absence of natural inland retreat space, Carcavelos beach could experience a reduction in biodiversity. Sensitive species – especially those vulnerable to changes in ocean chemistry – face a higher risk of local extinction, further underscoring the need for site-specific conservation measures.

Nova School of Business and Economics Campus

Nova School of Business and Economics (Nova SBE) Campus is located adjacent to Carcavelos Beach. This campus consists of a multifunctional space that integrates housing, commerce, facilities and public spaces, and an area of 4.2 ha of green spaces, integrating the “Quinta de São Gonçalo” Urban Park.

This top university in higher education in the areas of business, economics and finance, hosts over 5000 students and members. Therefore, the academic community daily enjoys this connection of the campus to the beach, using it as a leisure space.

Nova SBE's sustainable vision has made it a partner of the CASCAIS SMART POLE EEA Grants project, now finished. The University and the municipality want to lead a generation of change makers along the path of innovation combined with carbon neutrality. CASCAIS SMART POLE set up the first decarbonization living lab in Cascais, focusing on urban waste solutions, green spaces management, and water and energy efficiency. This project also established the first Renewable Energy Community in Cascais (**Figure 11**).

Figure 11: Nova SBE Photovoltaic System[5].

1.1.3 Existing Policy and Regulatory Framework

1.1.3.1 Cascais Coastline Protection Plan

Cascais Coastline Protection Plan identifies risk sites along the Cascais coastline, with particular emphasis on those where there is more human occupation; to ensure careful and correct monitoring of existing cliffs, to implement an effective signage network and to propose interventions to consolidate unstable cliffs. In the imminence or occurrence of maritime agitation phenomena, overtopping is common.

The following points are specified in this plan:

- Identifying risk sites.
- Signposting identified risk sites.
- Systematization of risk areas and POOC (Coastal Zone Management Plan) and PDM (Municipal Master Plan) protection strips, through georeferencing.
- Drawing up proposals for intervention and mitigation of the associated risks.

[5] smart-cities.pt

- Repairing unstable cliffs.
- Implementation of risk area monitoring systems.
- Adaptation of a system of warnings and alerts to the population in the context of coastal risks.
- Drawing up a study to forecast the evolution of coastal erosion in the context of climate change for the Municipality of Cascais.

1.1.3.2 Alcobaça - Cape Espichel Coastal Zone Programme (POC-ACE)

The Coastal Zone Management Plan (POOC) of POOC Sintra - Sado, up to Cape Espichel, gives rise to the approval of a single spatial planning plan, POOC Alcobaça - Cape Espichel, known as the Alcobaça - Cape Espichel Coastal Zone Programme (POC-ACE). The solutions contained in the POC-ACE comply with the strategic context and territorial options for the Lisbon and Tagus Valley region defined in the National Spatial Planning Policy Programme, as well as the recommendations contained in the National Strategy for Integrated Coastal Zone Management and the Strategy for the Sea, both, approved by the Resolution of the Council of Ministers, namely to promote the integrated valorisation of coastal resources and to manage the urban-tourist pressure on the coastal strip/coastline, to ensure the sustainable exploitation of natural resources, the qualification of the landscape and adequate risk prevention. As a water resource planning instrument, the POC-ACE also complies with the provisions of the Law of the European Parliament and the Council, establishing the bases and institutional framework for sustainable water management, and therefore includes appropriate measures for protecting and enhancing water resources in its intervention area.

The territorial scope of the POC-ACE, covering 224 kilometres of coastline, includes coastal and inland maritime waters and their beds and banks, as well as maritime and terrestrial protection strips, within the territorial area of the Administration of the Tagus and West Hydrographic Region, of the Portuguese Environment Agency, which includes the pilot zones laid out for the carbon neutrality roadmap for the Re-Value Project: Guia coast and Carcavelos Beach.

This coastline is one of the national coastal areas where integrated management faces the most significant challenges in terms of making the various specific uses and activities compatible, protecting and enhancing ecosystems and respecting the precautionary principle in the face of coastal risks. In this territory, extensive areas of great ecological value need to be conserved, which are very vulnerable to coastal erosion, both on the low and sandy stretches of coastline, and strong building pressure resulting from the metropolitan context and urban and tourist dynamics. Recent occupation, urban expansion in the studied and adjacent areas, and growing tourist development are some of the main vulnerabilities characterising this territory. In addition, the sandy nature and low heights of the coastline contribute to its marked vulnerability, and it is foreseeable that these risks will be progressively exacerbated by the effects of climate change, expected rise in the average sea level and changes in the sea wave regime.

The POC-ACE aims to ensure a coastline that is prepared for climate change and safe enjoyment, with a preserved natural, landscape and cultural heritage, with water bodies in good conditions, promoting development opportunities based on the differentiation and valorisation of territorial

resources and the ability to make competitive and sustainable use of land, marine and maritime potential.

The identification of highly complex situations arising from the use and occupation of the territory in application of the POC-ACE, where the levels of demographic and economic pressure are the highest, led to the establishment of exceptional rules on permissible uses and the respective conditions compatible with the objectives of the Programme.

The development of the Alcobaça-Cabo Espichel Coastline Programme (POC-ACE) was determined by the fact that it corresponds to the revision and merging into a single special programme of the three Coastline Management Plans (POOC), which includes the Sintra-Sado POOC section. The Programme aims to achieve objectives considered indispensable for protecting public interests and resources of national importance with territorial repercussions, exclusively establishing regimes for safeguarding natural resources and values through rules that establish actions that are permitted, conditioned or prohibited depending on the objectives, taking precedence over territorial plans at inter-municipal and municipal level. The drawing up of coastal programmes as territorial management instruments for the coastal zone is regulated by Decree-Law nr. 159/2012, in its current wording, which defines the framework of principles to be observed in coastal zone management: sustainability and intergenerational solidarity, cohesion and equity; prevention and precaution; subsidiarity; participation; co-responsibility and operationality.

The pursuit of these principles, which affect both the way coastal programmes are drawn up and their purposes, is materialised through the achievement of six general objectives:

- Safe public enjoyment of the maritime public domain.
- Protecting the biophysical integrity of the area and conserving environmental and landscape values.
- Valorisation of existing coastal resources.
- Flexibility of management measures.
- Integrating local specificities and identities.
- Creating conditions for the maintenance, development, and expansion of activities relevant to the country, such as port activities and other socio-economic activities dependent on the sea and the coastline, as well as emerging activities that contribute to local development and counteract seasonality.

Additionally, the POC-ACE also complies with various instruments relevant to coastal planning as a programmatic instrument for water resources planning and with the provisions of Law 58/2005, which transposed into national law Directive 2000/60/EC of the European Parliament and of the Council of the 23rd of October 2000, establishing the bases and institutional framework for sustainable water management [6].

In this context, the Programme includes appropriate measures for protecting and enhancing water resources in its area of intervention.

[6] Diário da República, 1.ª série - N.º 72 - 11 April 2019

The territorial scope of the POC-ACE includes coastal and inland maritime waters and their respective beds and banks, as well as the maritime and terrestrial protection strips within the area of territorial circumscription of the Administration of the Tagus and West Hydrographic Region, including the municipality of Cascais. The POC-ACE intervention area is subdivided into two fundamental areas: the Maritime Protection Zone (ZMP) and the Territorial Protection Zone (ZTP).

The area of the intervention covers the Cascais-São Julião da Barra Fortress section, which is one of the main urban development axes of the Lisbon Metropolitan Area (AML), structured by the railway and the marginal avenue and is highly consolidated in an urban continuum where the tradition of localised tourist functions continues to be evident despite the prevalence of residential uses. In the last decade, this coastline has seen positive population growth in all the municipalities, with coastal settlements growing by 37.8 %. The increase in the number of dwellings was also very high (41.3 % between 2001 and 2011), with 31 699 new dwellings being built.

1.1.3.3 Fit-for-55 Objectives and Cascais Plans

The European Climate Law[7] established the 2030 target of reducing net GHG emissions by at least 55% compared to 1990. To this end, the “Fit for 55” legislative package has been prepared with a wide range of focuses, from sustainable mobility, the third industrial revolution, clean energy, building renovation, green lifestyles, restoring nature, among others.

Ambitious climate change mitigation goals have also been set at national level. From a long-term perspective, the Roadmap to Carbon Neutrality 2050[8] sets out the strategy for the Portuguese economy to achieve a carbon-neutral balance by 2050. For the 2030 horizon, the National Energy and Climate Plan 2030[9] is the main policy instrument with concrete measures to achieve the short-term targets.

Municipalities are also emerging as vital units in the response to climate change. Having more direct contact with local communities and economies, they enable the establishment of inclusive planning processes adjusted to local contexts.

Cascais has been giving due attention to the issue of climate change from an early stage and is at the forefront of Portuguese municipalities in the search for innovative solutions. Since 2010, with the adoption of Cascais' Strategic Plan for Climate Change, the municipality has been paving its way towards a sustainable future for all its inhabitants. Since then, the municipality has been promoting cycles of planning and implementing climate action policies (**Figure 12**) complemented by progress assessment of emissions through energy and carbon matrices (published in 2019 and 2023).

[7] The European Climate Law, 2021
[8] Roteiro Municipal para a Neutralidade Carbónica 2050, EMAC 2019
[9] Plano Nacional Energia e Clima 2021-2030, 2024

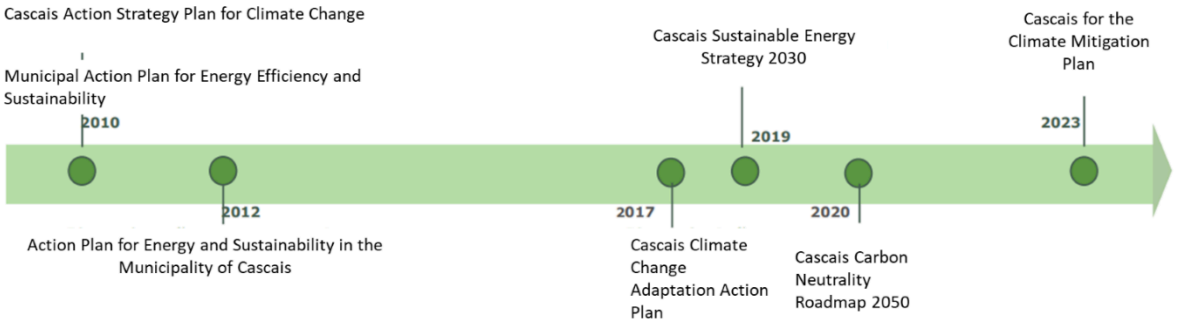


Figure 12: History of decarbonisation policies in Cascais.

The "Cascais for the Climate Mitigation Plan" is an update of the municipality's strategic vision. It is more operational in the short term and aims to achieve the 2030 target, providing for the implementation of the measures stipulated in the "Sustainable Energy Strategy 2030".

The "Cascais for the Climate Mitigation Plan" includes 40 decarbonisation measures. It is estimated that these measures will reduce annual emissions by 69 $ktCO_2e$. Of this total reduction, 56 $ktCO_2e$ corresponds to stationary energy and transport, with a direct impact on the municipality's GHG emissions.

The investments that the municipality needs to allocate to implement the measures associated with transport and stationary energy totalled 39 million euros. It should be noted that some of these investments are also aimed at attracting private investment. There is therefore a commitment on the part of the municipality to provide favourable conditions for private investment.

1.1.3.4 Assessment of Cascais' Energy Matrix and GHG Emissions

In May 2012 an assessment of Cascais Energy Matrix[10] was done, and it provided a quantitative analysis of all the municipality's energy consumption and dependency to manage the environmental, economic and social impacts inherent in the different energy sources used. The reference year considered was 2010. The main findings can be summarized as follows:

- Annual per capita consumption in the municipality was 10.86 MWh/year, lower than the average for mainland Portugal. Fossil fuels were the most important source of final energy, accounting for 46% of total consumption in the municipality, followed by electricity with 32%.
- Total electricity consumption was 721 466 MWh, with the domestic sector and the services sector standing out with a weight of 49% and 41% respectively.
- 83 418 tons of fuel were consumed, with the transport sector being largely responsible for fuel consumption in the municipality, contributing with 865 of total consumption.
- Natural gas consumption totalled 16 470 MNm^3, with the domestic sector accounting for 56% of total consumption.

[10] Matriz Energética de Cascais, Energia Própria S.A. & Cascais Próxima EM S.A.

- The total greenhouse gas emissions in Cascais were 565 382 tCO_2e. Transport, the domestic sector and services were the sectors that mainly contributed for these emissions.
- In Cascais Municipality's consumption matrix, electricity is the energy source with the highest percentage (67%) in the total final energy consumption, with Public Lighting and Traffic Lights accounting for around 73%. In terms of fuel, the fleet of EMAC consumed 858 tons, while the municipality's fleet consumed 303 tons. The total emissions caused by the municipality's activities were 14 443 tCO_2e, representing 2.5% of the total emissions in Cascais.

The following measures were suggested for rationalising energy consumption in Cascais municipality: Active policies to increase the implementation of renewable energies, especially in the "Leisure Activities and Events" sub-sector, where there is a high consumption of DHW (Domestic Hot Water); Adoption of energy efficiency and rational energy management measures; Installation of trigeneration systems in buildings with high thermal energy needs; Construction of sustainable buildings and rehabilitation of existing ones, in order to reduce extra energy consumption; Car parking and energy mobility policy - implementation of modal car parking, which allows individual vehicles to be used combined with public transport, avoiding the widespread use of only individual vehicles and the consequent emission of GHGs.

Cascais carried out its municipal inventory several times, but emissions were only calculated for the energy and transport sectors. For the first time in 2019, Cascais municipality has drawn up its GHG inventory at municipal level[9], considering the Energy, Transport, Waste and Wastewater sectors and the Forestry and Other Land Use sub-sectors.

The gases considered in the Cascais municipality's GHG 2015 inventory (reference year) are the main Kyoto Protocol GHGs that occur within the municipality's geographical boundaries, as well as the emissions that occur outside these boundaries, but which result from the city's activities.

Thus, the Kyoto Protocol gases considered in the inventory are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)

The 2015 GHG emissions of the Municipality of Cascais were estimated without accounting for emissions from Land Use, Land Use Change and Forestry (LULUCF), totalling 533.7 $ktCO_2e$ and with their inclusion, bringing the total value of emissions to 529.3 $ktCO_2e$. Regarding the distribution of emissions by sector, 49% were due to the Stationary Energy sector (262.5 $ktCO_2e$), 48% in the Transport sector (253.8 $ktCO_2e$) and 3% of emissions are related to the Waste and Wastewater sector (17.4 $ktCO_2e$). In view of these results, the Stationary Energy and Transport sectors were considered priorities when defining decarbonization options for Cascais' 2050 Carbon Neutrality Roadmap, since they represent around 96% of the municipality's GHG emissions.

In its 2019 Roadmap for Carbon Neutrality Cascais Municipality thus estimated the evolution of GHG emissions up to 2050 considering 2015 as the reference year, with the aim of determining the gap towards carbon neutrality (**Figure 13**).

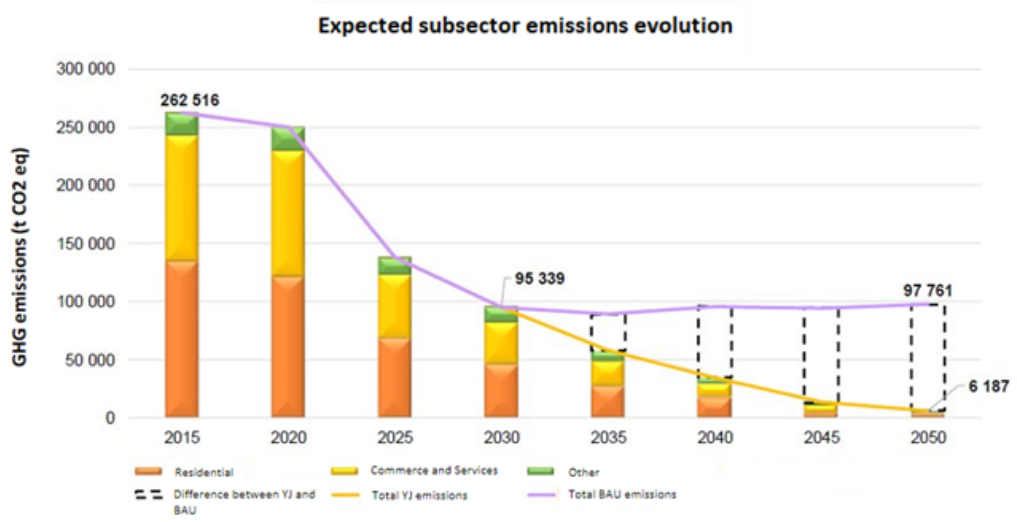


Figure 13: Expected evolution of emissions in Cascais until 2050 according to YJ and BAU scenarios.

Two evolution scenarios were considered: (1) the Business-as-usual (BAU) Scenario where there are no structural changes in the different sectors and therefore only technologies that are available on the market are considered, sector trends are maintained, and the current legislation is taken into account; and (2) the Yellow Jersey (YJ) Scenario considers socioeconomic evolution compatible with carbon neutrality, characterised by a structural and transverse change in production chains, made possible by the combination of a series of new generation technologies. This scenario will consider, for example, energy efficiency measures, new production processes and fuel substitution (e.g. introduction of H_2) and foresees a more effective incorporation of circular economy models. Considering a BAU scenario, a gap of 249.5 ktCO_2e was obtained. In the YJ scenario, Cascais comes

close to carbon neutrality (14.9 $ktCO_2e$) in 2050, as can be seen in **Figure 14**.

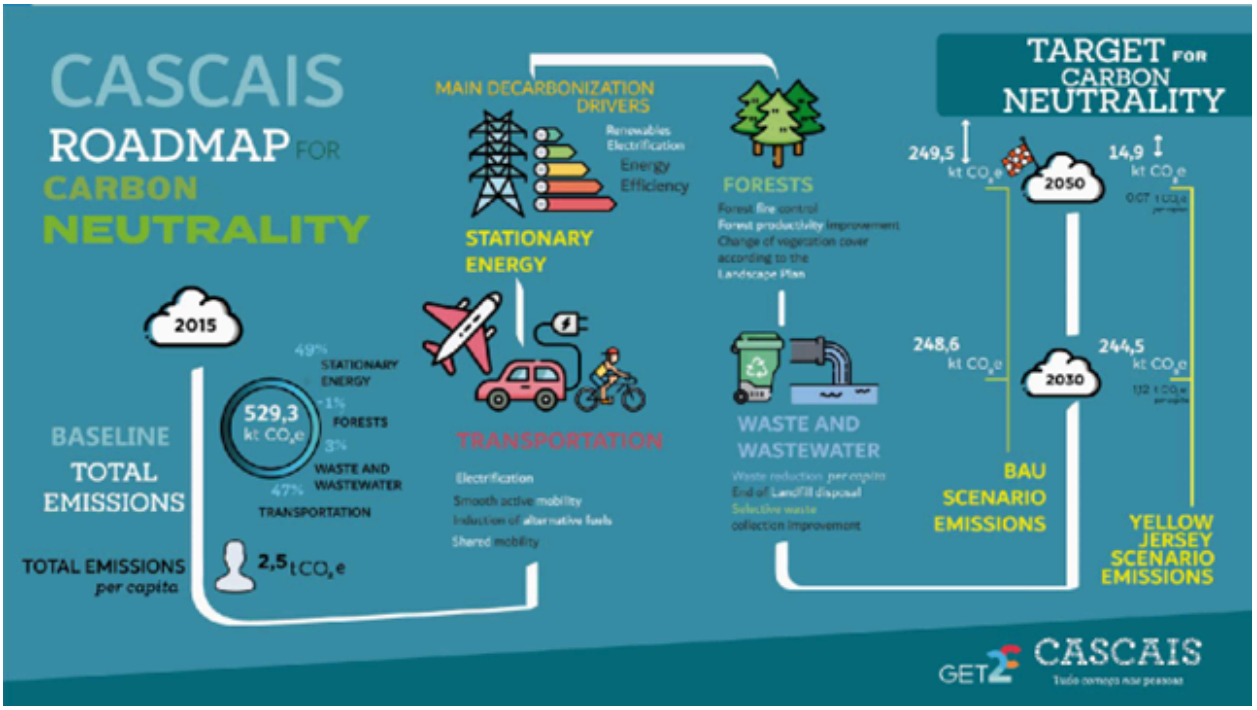


Figure 14: Summary of Cascais Roadmap for Carbon Neutrality in 2050 (2019).

Achieving the goal of carbon neutrality implies matching the level of GHG emissions with the sink capacity by the year 2050, translating into net emissions of zero (or very close to zero). According to the results of the 2015 Baseline, Cascais' sink capacity was 4.5 $ktCO_2e$, which is therefore the value to which the municipality will have to reduce its emissions by 2050 to achieve carbon neutrality.

In a carbon neutral scenario, it is expected that by 2050, more than 80% of primary energy consumption will come from endogenous renewable resources (2/3 of which are solar and wind energy)[11] and between 66% and 68% of final energy consumption will be met by electricity.

1.1.4 Assessment of Renewable Energy Production Potential

One of Cascais' ambitions is the adoption of decentralised renewable energy generation to meet the carbon neutrality objective in 2050. With this objective, an assessment of the potential for wind energy production through small wind turbines and solar photovoltaic energy production in rooftops, along with the wave energy potential assessment throughout the coast, was done[12].

Map 1 shows the average wind speed at a height of 10 m above the ground level and the buildings for Cascais municipality (**Figure 15**), where the highest wind speed obtained is 9.7 m/s and the lowest 3.8 m/s.

[11] RNC2050

[12] Aelenei, Laura and Viana, Susana and Simões, Teresa and Amorim, Filipa and Simoes, Sofia G. and Barbosa, Juliana and Justino, Paulo and Dinis, João and Fernandes, Gabriela, Towards Climate Adaptation: A Case Study of a Coastal City in Portugal. Available at SSRN: https://ssrn.com/abstract=5212830 or http://dx.doi.org/10.2139/ssrn.5212830

This lowest velocity is approximately the cut-in velocity for most small wind turbines, and that is the wind velocity at which the turbine starts generating electricity. Map 2 shows the solar resource considering the terrain altimetry and the buildings' influence (**Figure 16**). The highest values correspond to a yearly Global Horizontal Irradiation (GHI) of 1422 kWh/m^2 (dark orange) and the lowest values to 783 kWh/m^2 (light green). To evaluate the wave energy potential along Cascais' coast, data was collected for 4 locations that are shown in Map 3 (**Figure 17**).

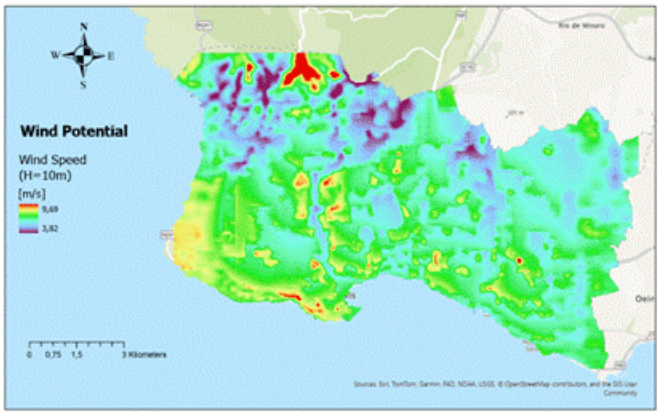


Figure 15: Cascais' average wind speed at a height of 10 m above the ground and the buildings.

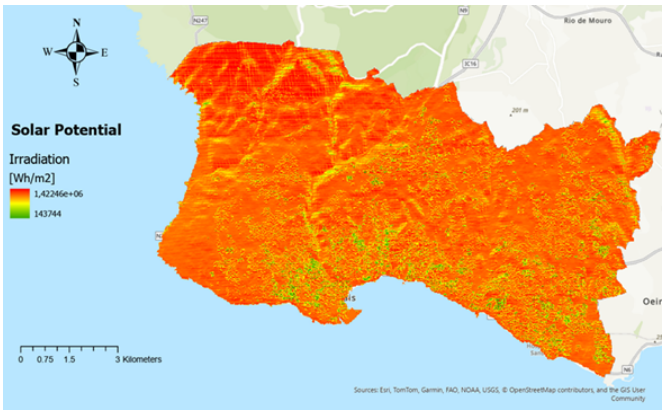


Figure 16: Cascais' average yearly GHI considering the terrain altimetry and the buildings' influence.

The depth along the coast was also considered and is depicted in the green isobarimetry lines for 8, 16 and 30 m of depth, were the influence of the mouth of Tagus River can easily be seen.

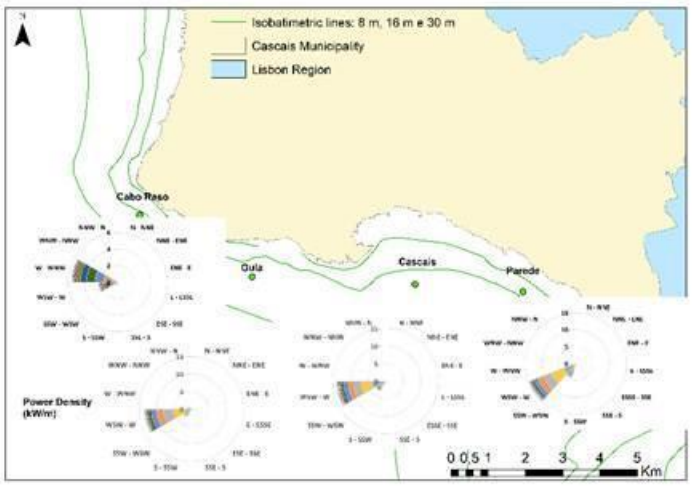


Figure 17: Cascais' coast wave energy potential assessment locations.

The average annual power density for the wave energy at each location was obtained using the bivariate probability density function of power density and power direction, leading to a value of 26 kW/m for Cabo Raso, 19 kW/m for Guia, 26 kW/m for Cascais and 15 kW/m for Parede. The radial graphs corresponding to the 4 locations are shown in Figures 18 to 21.

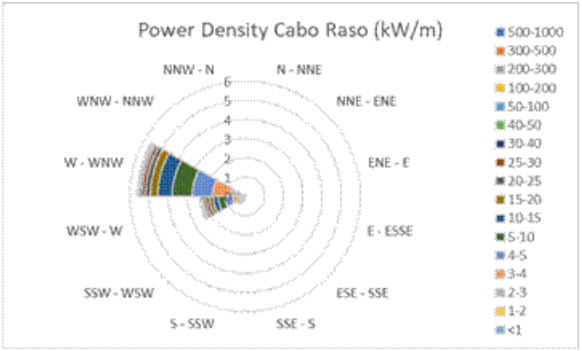


Figure 18: Wave power density at Cabo Raso.

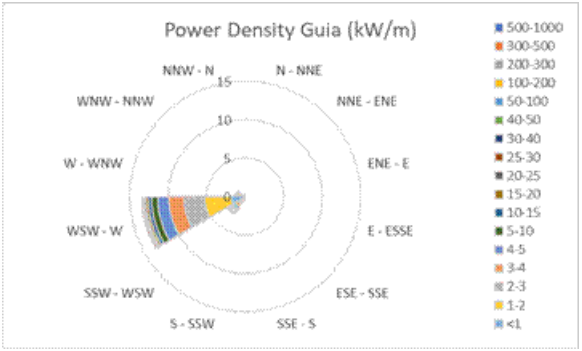


Figure 19: Wave power density at Guia.

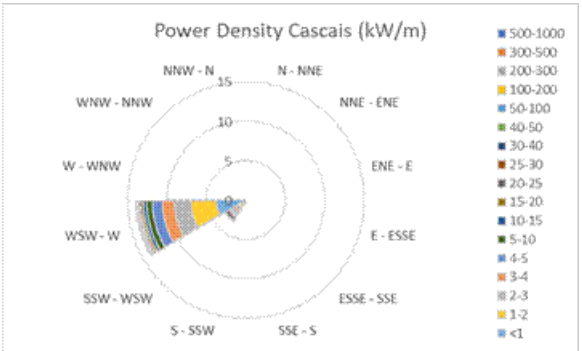


Figure 20: Wave power density at Cascais.

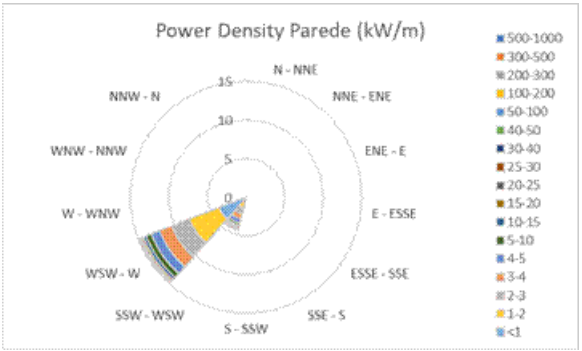


Figure 21: Wave power density at Parede.

1.1.5 Building Stock Energy Efficiency Evaluation

The Stationary Energy sector was responsible for 262.5 $ktCO_2e$ of GHG emissions in 2015 and within that sector the residential sub-sector contributed to 51% of the emissions. With such a weight in Cascais' emissions, it is worthwhile to evaluate the building stock energy efficiency to verify what is the predominant Energy Class in Cascais' buildings and to identify which measures can be taken that can lead to more efficient buildings in the long run.

According to the revision of the European Energy Performance of Buildings Directive (EPBD) in 2024, that is now being translated to EU countries national legislation, the aim is to achieve a fully decarbonised building stock by 2050. Portuguese legislation follows this directive making this objective also a national objective. In Portugal there is a buildings' certification system since 2006 called SCE (Energy Certification System), using this system, buildings are classified according to their primary energy consumptions and equivalent CO_2 emissions, among other parameters, and these values are compared to reference values for different Portuguese regions. From this comparison results a classification of the buildings' performance according to 8 different categories, A+ is the most efficient and F is the least efficient.

The Portuguese Energy Agency (ADENE) shared the information about Cascais' buildings energy certificates issued between 2014 and 2023. For confidentiality reasons we could not have access to the location of the buildings but only to the information about the parish a certain building belongs to. The information was analysed and was then divided between residential buildings and commercial and services buildings considering two factors, an age factor – *construction year* and a location factor - *parishes*. It is important to emphasize that not all buildings have energy certification, only the buildings that will be sold, rented or newly constructed are required to have the certification. So, this information only gives a sample of the energy efficiency of Cascais building stock.

1.1.5.1 Residential Buildings

In the residential buildings sector, there is a larger number of energy certificates for buildings constructed from 1971 onwards and the newer buildings have a higher energy efficiency level (**Figure 22**).

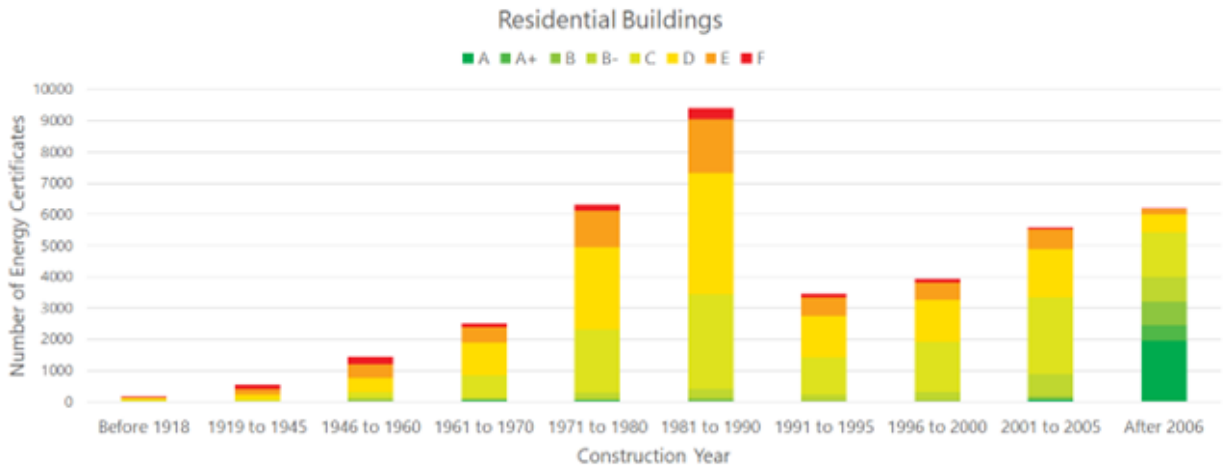


Figure 22: Residential buildings' energy certificates according to construction year.

As for the distribution of the certificates among parishes (**Figure 23**), most of them represent buildings located in the Cascais and Estoril parish that has 64 192 inhabitants, followed by Carcavelos and Parede parish, with 46 529 inhabitants. Just for comparison, Alcabideche parish has 44 165 inhabitants and São Domingos de Rana has 59 238 inhabitants. So, although São Domingos de Rana has more inhabitants than Carcavelos and Parede parish, it has less energy certificates issued until the end of 2023. That could mean that there is less construction and transaction of buildings in São Domingos de Rana when compared to Carcavelos and Parede.

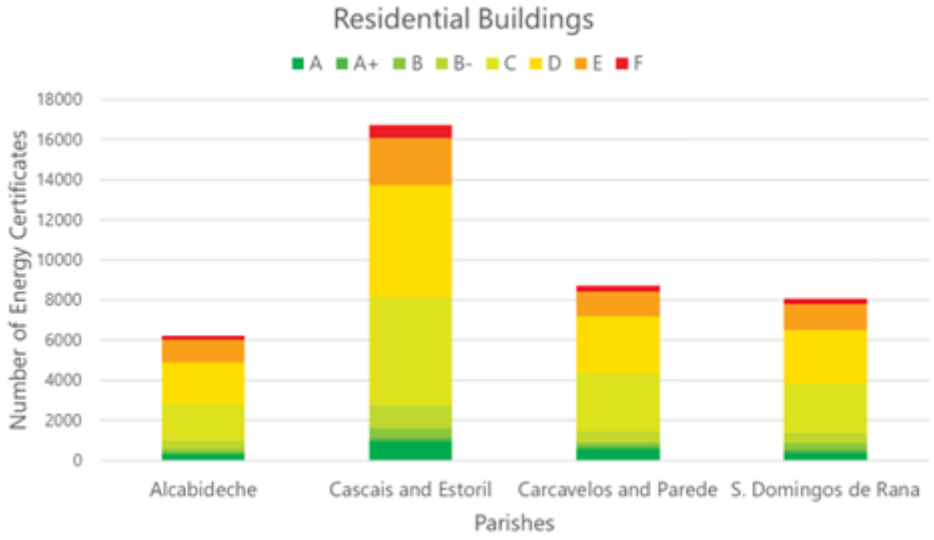


Figure 23: Residential buildings' energy certificates according to their parish.

1.1.5.2 Commercial and Services Buildings

In the commercial and services sector there are fewer buildings with lower classes of energy efficiency than in the residential sector, independently of the construction year. There is also an increase of issued certificates for buildings constructed after 1981 (**Figure 24**).

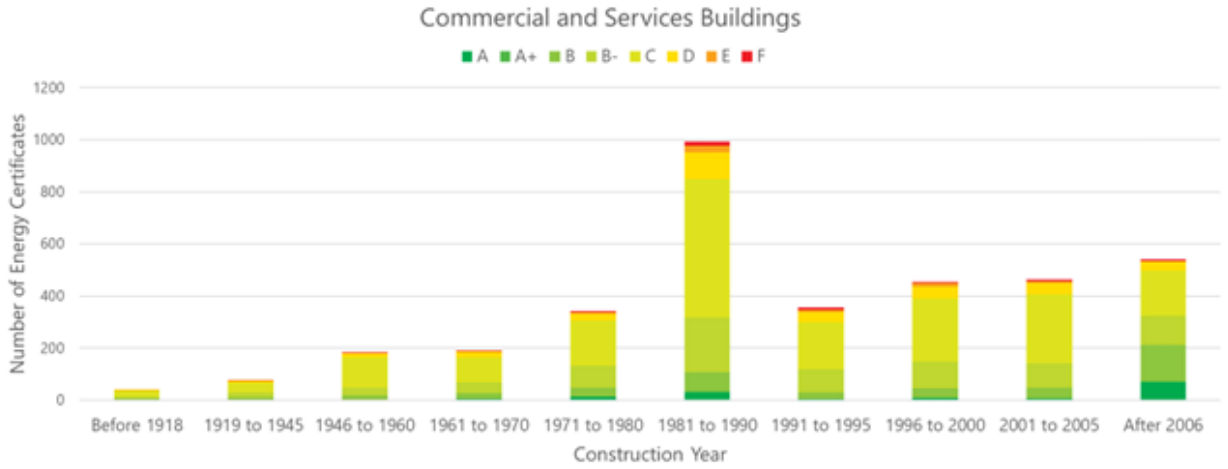


Figure 24: Commercial and services buildings energy certificates according to construction year.

With no surprises, Cascais and Estoril parish have a lot more energy certificates in this sector than the other parishes, because this is the parish with more hotels, restaurants, tourist attractions and museums (**Figure 25**). The energy efficiency classification is well distributed among the parishes with B- being the predominant class.

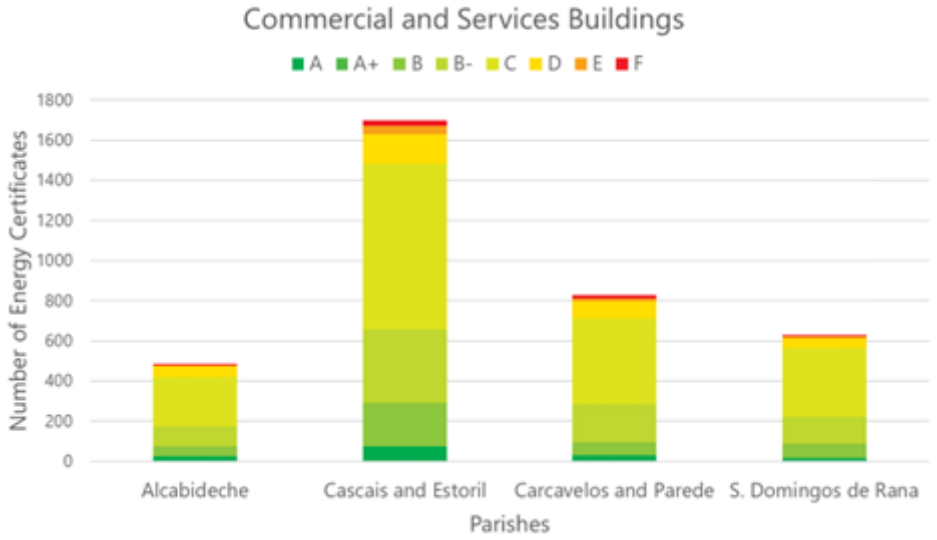


Figure 25: Commercial and services buildings energy certificates according to their parish.

1.1.6 Mobility and Transportation

The strategy for the development of the Cascais Urban Travel Plan (UTP) considers the guidelines and strategic objectives of the Urban Ecological Transition defined by the municipality:

- Increasing the sustainability of the municipality's populations and territory.
- Decrease in 'hidden costs' due to urban sprawl.
- Reducing GHG emissions and energy dependence on fossil fuels.
- Strengthening the guidelines for the contractual bases of the future Public Service Operators (PSO) transport network.
- Valuing the territory through Gross Fixed Capital Formation (GFCF) of infrastructures and collective transport equipment, using new technologies.
- Adding value to the urban economy through the impact of improved accessibility and mobility and sustainable growth.

Another of the central objectives to be considered in the development of the Cascais UTP is the pursuit of quality of life regarding accessibility and transport to the different areas of the municipality of Cascais. In addition, the development of the Cascais UTP also considers the objectives of transport decarbonization and climate change mitigation. Cascais was obliged to reduce its GHG emissions by around 10% in 2023 (for the base year of 2012) within the framework of the Lisbon's Metropolitan Area (LMA) Sustainable Urban Mobility Action Plan (SUMAP 2020). As a signatory of the Covenant of Mayors, this commitment is much more demanding, implying a 40% reduction in emissions by 2030.

For this reduction to take place, it will be necessary to guarantee an effective modal shift of car journeys (powered by fossil fuels) to sustainable modes, in this process, the conditions will have to be created to guarantee a significant modal shift towards light modes and public transport, not neglecting any distance range (short, medium and long distance journeys) in this process, nor any group of citizens (young people, people of working age, senior citizens and tourists).

On the other hand, and in the wake of the international summits and conferences that have taken place (Paris Agreement, etc.), the guidelines for ''Zero accidents", "Zero Emissions" or "Zero congestion" should be kept in mind, which extends the challenge to fundamental areas of intervention.

The main goals of the UTP are listed below:

- Solidify the Functional Hierarchy of the Road Network.
- Improve Road Safety and Enhance Public Spaces.
- Promote Light Mobility.
- Improve Public Transport and Parking Facilities.
- Plan and Manage Mobility, Inform and Raise Awareness Among Citizens.
- Optimise Urban Logistics.

This plan can be divided by the strategic axis as shown in **Figure 26**.

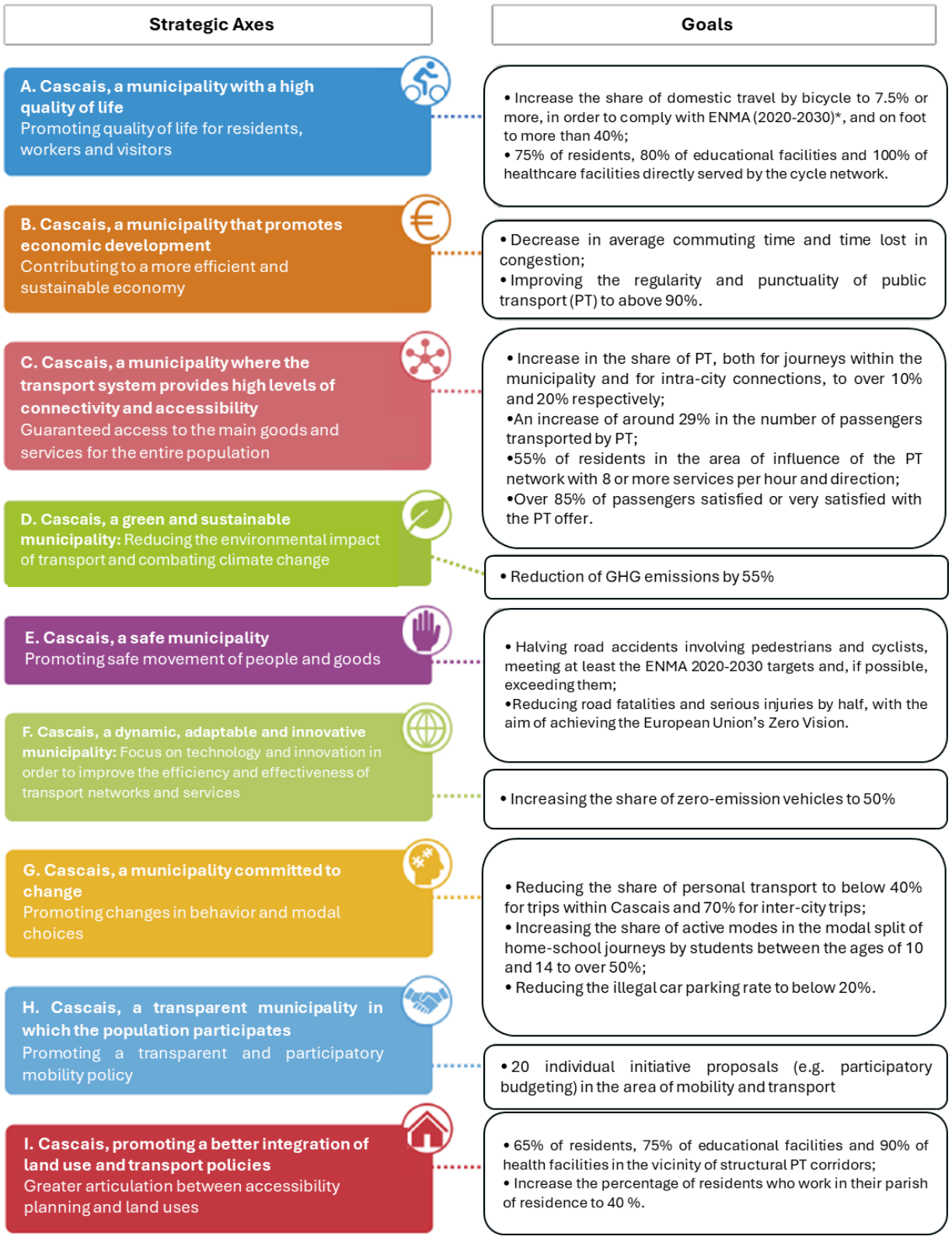


Figure 26: Strategic Axis and detailed Goals of the Cascais UTP 2030.

Additional transport mitigation policies and measures to be implemented:

- Better and more efficient public transport.
- Greater use of light mobility modes.
- Building a reliable road safety system.
- Avoiding non-essential travel: digitalisation, teleworking, teleconferencing, home shopping, *etc*.
- Neighbourhood planning.
- More Innovation and new technology.

1.1.6.1 Mobi Cascais Mobility Programme

MobiCascais is Cascais' integrated sustainable mobility management system, based on a platform that integrates various transport service operators and a network of infrastructures and equipment. Its aim is to offer a diverse and flexible set of mobility solutions and services that meet the needs of the municipality's inhabitants, workers, entrepreneurs and visitors.

The creation of MobiCascais was based on the publication of the Legal Framework for the Public Passenger Transport Service, approved by Law no. 52/2015, of 9th June, which allowed Cascais Municipal Council (CMC) to assume the powers of Transport Authority for the Municipality of Cascais in 2016. In the same year, Cascais Municipality gave the municipal company Cascais Próxima the powers to develop and operate Cascais' transport system. MobiCascais was initiated on 7 July 2016.

Since its inception, MobiCascais has sought to promote the use of public transport and light mobility solutions and has become a national and international example of an integrated, economical, efficient, and sustainable mobility system. This system offers a diverse and complete package of options for travelling within the municipality, as seen in **Figure 27**.

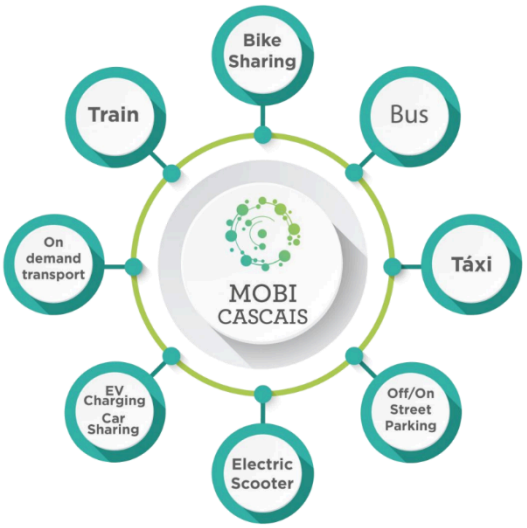


Figure 27: MobiCascais Ecosystem.

Eight years after its creation, the 210 000 residents and 1.2 million tourists who visit Cascais have bicycles, Cascais buses, scooters, parking spaces (indoor and on-street) and electric chargers at their disposal. All these services in a single, intuitive application – MobiCascais (**Figure 28**).

Figure 28: Mobi Cascais within "Viver Cascais" (Live Cascais). Photo: Cascais Municipality.

MobiCascais app gives access to a wide range of functionalities related to mobility in the municipality. It has completely revolutionised the way citizens move around Cascais by concentrating all the available means of mobility on a single, simple and intuitive platform. The MobiCascais app also has a feature that allows users to calculate their individual carbon footprint by counting the emissions produced during a public transport journey, compared to those emitted during the same journey using individual transport.

1.1.6.2 Mobi Cascais Municipal Bus Network

Cascais was a pioneer in Portugal when, in January 2020, it provided free municipal bus transport for all residents, workers and students by using the Viver Cascais card. The MobiCascais buses are state-of-the-art vehicles that comply with all environmental standards[13]and provide passengers with a more comfortable, safe, accessible and connected travelling experience. To create awareness among children about the advantages of using public transportation, Cascais promoted a drawing exhibition for students between 9 and 12 years called "Let's go Mobi", one of the drawings is shown below (**Figure 29**). Maybe in the next generation the modal distribution in the municipality will become more sustainable due to the work done with children today.

[13] Mobi Cascais bus fleet has been classified with the energetic certification class B, and the classes go from A+ to F.

Figure 29: Drawing from the schools' exhibition about mobility in Cascais.

There are 44 municipal lines that reach all parts of the municipality. Three of these lines, line 38, 43 and 44 use hydrogen-powered buses. Now they are still using grey hydrogen but a project to produce green hydrogen was already approved and is in construction phase, it will produce 389 kgH_2/day. Note that the low emission buses M43 and M44 serve the Guia Coast pilot that is within a national park area. **Figure 30** shows a typical Mobi Cascais bus and in Map 1 of Annex I Mobi Cascais routes are depicted.

Figure 30: Mobi Cascais bus. Photo: Cascais Municipality.

Accessibility has also been thought of in this project and **Figure 31** (a) and (b) show the accessibility in these buses. Some of the buses also allow for the transportation of bicycles.

(a)

(b)

Figure 31: Mobi Cascais bus: (a) access ramp and (b) accessibility options information. Photos: Cascais Municipality.

1.1.6.3 First Hydrogen Production Unit

Cascais Municipal Council (CMC), through the municipal company Cascais Próxima, responsible for managing mobility, urban spaces and energy, is building the first production, storage and supply unit for hydrogen-powered vehicles (**Figure 32**), putting the municipality of Cascais one step ahead on the road to innovation and sustainability. Aiming to invert the paradigm Cascais is facing and aligned with the H_2 national strategy, production is due to start in 2025.

Figure 32: Vision of the Hydrogen production, storage and supply unit[14].

2030 targets of the Hydrogen National Strategy**:**

- 5% green hydrogen in final energy consumption, road transport and industry.
- 15% of green hydrogen injected into natural gas networks.
- 50 to 100 hydrogen refueling stations.
- 2 to 2.5 GW of production capacity (electrolysers).

Green hydrogen is produced exclusively from processes that use energy from renewable sources. For this reason, green hydrogen must be understood as renewable hydrogen, whose GHG emissions throughout the life cycle of its production must be zero or very close to zero.

In Cascais, around 50% of greenhouse gas emissions come from transport, making sustainable alternatives a top priority. Electric vehicles, biofuels, and hydrogen are key to creating a greener future. Hydrogen plays a central role in Cascais' plan to become carbon neutral by 2050. As part of this effort, Cascais Ambiente is working on producing hydrogen from urban waste. Cascais is also the first municipality in Portugal to build its own hydrogen production, storage, and supply unit. It will

14 https://cpsa.pt/wp-content/uploads/2024/06/Apresentacao-Pedro-Marques-MobiCascais-19-Jun-2024.pdf

support four hydrogen-powered buses already in service (**Figure 33**) and will make the city self-sufficient in hydrogen, with plans to eventually open the facility to the public.

Figure 33: Bus M43 driving along Guia Coast. Photo: Cascais Municipality.

Key highlights:

- Investment: €1.7 million.
- Production capacity: Up to 389 kg of hydrogen per day; 100 kg meets daily public transport needs.
- Environmental benefits: Efficient use of energy and water, reduced waste production.
- Refuelling: Two dispensers (350 bar and 700 bar).
- Operational advantages: Hydrogen buses offer ~600 km range vs. 300–350 km for electric buses and refuel in 10 minutes compared to 4+ hours for charging electric buses.

The experience gained over the years has shown that decarbonising public passenger transport must include the use of hydrogen as an effective solution, both for its environmental and operational advantages.

This project responds to 4 Sustainable Development Goals (SDGs):

- 7. Affordable and clean energy
- 11. Sustainable cities and communities
- 12. Sustainable production and consumption
- 13. Climate action

1.1.6.4 Bicycles and scooters

Light mobility comprises a range of small, energy-efficient transport modes such as bicycles, electric scooters, e-bikes, and other compact electric vehicles. These options offer a sustainable and flexible alternative to traditional car-based transport, especially in urban environments. With growing concerns about traffic congestion, air pollution, and greenhouse gas emissions, light mobility is

becoming an essential part of modern urban planning. It promotes a cleaner city, reduces dependence on fossil fuels, and supports healthier lifestyles by encouraging active transport. Therefore, light mobility plays a crucial role in shaping a greener, more efficient future. Bearing this in mind, Cascais has been growing its cycling network to encourage citizens to switch to light mobility or use combined means of transportation, taking advantage of the available intermodal stations. In Map 2 and 3 of Annex I, the hierarchy of the cycling network proposed in Cascais' Strategic Cycling Plan and the location of the bicycle sharing stations within Cascais municipality are shown.

Light mobility ongoing developments:

- Completion of the cycling network in the municipality
- Data collection
- Cycle path support equipment
- Closing loops
- Standardisation of vertical signs and road markings
- Directional signalling

Cascais has also been collecting data related to light mobility, to better understand the behaviour and needs of light mobility users. One example is the installation of several bicycle counters on the side of the main cycle paths. **Figure 34** depicts the counter installed in the Guia Coast cycle lane, it registered the passage of an average of 7400 cyclers per month in 2024.

Figure 34: Cycle lane and bicycle counter in Guia Coast[15].

There are 5 MobiCascais kiosks in the municipality of Cascais, where a traditional or electric bike, or an electric scooter can be hired for periods ranging from 30 minutes to 4 hours (scooters) and 1 day (bicycles). The map in Annex I shows their locations and **Figure 35** depicts the kiosk on the Guia Coast.

15 https://cpsa.pt/wp-content/uploads/2024/06/Apresentacao-Pedro-Marques-MobiCascais-19-Jun-2024.pdf

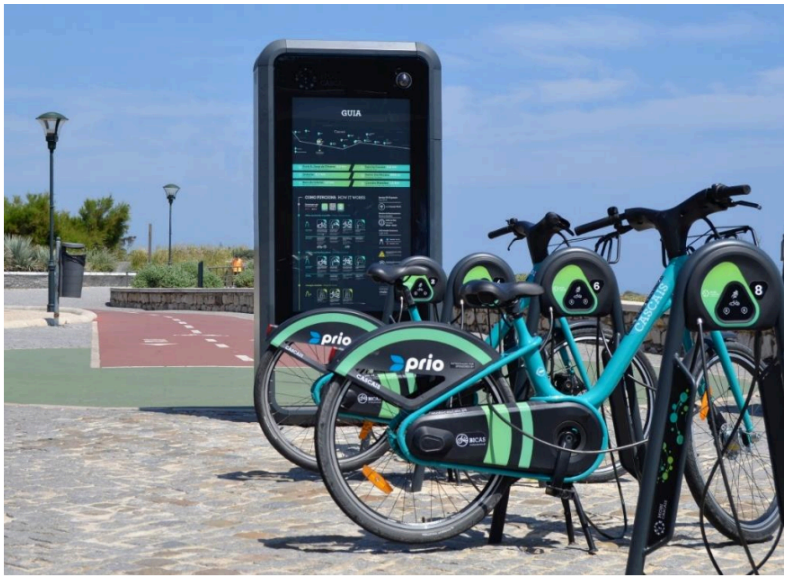


Figure 35: Kiosk in Guia Coast[16].

1.1.6.5 Available Car Parking Options

Indoor Car Parks**:** Cascais Próxima, the municipal company that owns MobiCascais, is responsible for 14 indoor car parks throughout the municipality, see Map 4 in Annex I. These car parks total more than 1 850 spaces available to all those who pass through Cascais daily. With the MobiCascais App any user can check how many spaces each car park has available at a certain moment in time.

Outdoor Car Parks**:** In Cascais there are 6 993 on-street parking spaces, divided into 25 areas and 3 historic centres, see Map 5 in Annex I. Paying for street parking is feasible through the MobiCascais App. Not only does it offer advantages, but it also simplifies the payment process by allowing for secure digital payments without the need for coins.

The car parks near the pilots are, for Guia Coast, the outdoor park near Boca do Inferno and along Guia road and near Carcavelos Beach, there is the indoor Nova School of Business and Economy (Nova SBE) park and an outdoor park on the sea side of marginal road.

How many vehicles are there in the municipality?

According to the mobility survey, IMob 2017, done by the National Statistics Institute (INE), the motorisation rate in Cascais was around 531 vehicles per thousand inhabitants. Considering a population of 214 124 inhabitants, about 113 700 vehicles are driven in the city.

16 https://cpsa.pt/wp-content/uploads/2024/06/Apresentacao-Pedro-Marques-MobiCascais-19-Jun-2024.pdf

1.1.6.6 Electric Vehicles and Electric Charging

At the moment there is no specific data about how many EV (Electric Vehicles) and Plug-In Hybrid Electric Vehicles (PHEV) circulate in Cascais municipality. According to the Portuguese Association of Electric Vehicle Users, at the end of 2024, the total number of EVs was 190 665 and of PHEV 134 789[17]. Dividing these numbers according to the population percentage of Cascais, we can have an idea of the number of electric and hybrid vehicles in this area. The total Portuguese population in 2021 (last census[18]) was 10 343 066 and the population in Cascais was 214 124, which meant that 2.07% of the Portuguese population lived in the municipality. This percentage leads to an estimate of 3947 EVs and 2790 PHEVs in Cascais.

In Annex I, Map 6 shows the availability of public EV chargers in the municipality. There are currently 12 charger operators, with 232 charging stations and 473 charging plugs[19]. Recently there was a public tender for the installation and operation of 300 new medium-power dual charging stations for Electric Vehicles.

MobiCascais electric chargers contribute to a better and more sustainable mobility by ensuring that anyone who wants to opt for more environmentally friendly vehicles has a vast network of solutions in the municipality for charging them. These chargers are connected to the Mobi.e national electric chargers' network and work via a card from any energy supplier for electric mobility, just like the other chargers in public spaces. Each user pays for their electricity consumption at these chargers, but Cascais Próxima does not charge any operating fees.

1.1.6.7 Transport Modal Distribution

Public transport in Cascais is managed by Cascais Próxima, which operates the municipal bus services, the bike-sharing programs, and parking facilities. Additionally, Carris Metropolitana provides intermunicipal bus connections, and Comboios de Portugal (CP) offers rail services that connect Cascais to Lisbon, passing through Oeiras municipality. The railway serves only the locations closest to the coast and it also uses an outdated infrastructure, that is why it has a low percentage of usage in Cascais' modal distribution[20] (11.3%), as seen in **Figure 36**. It is being refurbished by Infraestruturas de Portugal (responsible entity for the National Railway Network) since March 2024. It is expected that with new tracks, new electric equipment and new carriages, the use of this means of transport will become more attractive.

[17] https://www.uve.pt/page/parque-ve-2024/
[18] https://tabulador.ine.pt/indicador/?id=0011609
[19] Data from Mobi.data (https://www.mobie.pt/mobidata/data) for Cascais municipality, retrieved in 03/06/2025.
[20] Strategic Urban Development Plan (PEDU Cascais 2015) - https://www.cascais.pt/sites/default/files/anexos/gerais/new/pedu_cascais_1.pdf

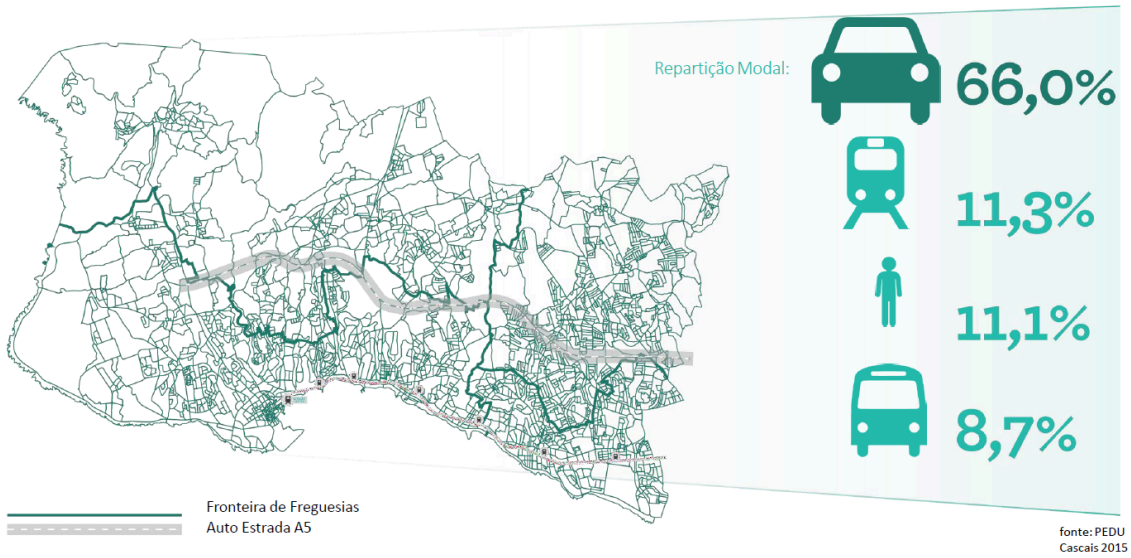


Figure 36: Cascais modal distribution (PEDU Cascais 2015).

The most common means of transport used by Cascais residents on a daily basis is the car, which is used by 66% of the resident population (workers or students), and accounts for 12% of car journeys in Greater Lisbon. Within car journeys, a distinction can be made between those made as a driver (67%) and as a passenger (31%), and it should be noted that this figure has risen considerably since 2001, when car usage for commuting stood at 53%. At the same level are journeys on foot, which account for 11.1% of the resident population and bus journeys with 8.7%.

The proximity and relationship with Lisbon, as an important economic and services centre, generates a significant number of population flow in the municipality of Cascais. It was verified that around 24% of the total resident population travels to other municipalities daily to work or study. Residents employed outside the municipality mostly work in Lisbon (53%), Oeiras (23%) and Sintra (11%) municipalities.

In 2024 Cascais performed a survey with all schools within the municipality regarding the means of transportation used by the students to go to school, “Hands Up Cascais 2024”. The responses correspond to approximately 518 classes from the 1st, 2nd, 3rd cycles and secondary education, covering a total of 10 773 students from public and private schools. Around 60% of students in the municipality of Cascais go to school by car, approximately 19% walk, around 15% take the bus and only 1.6% use the train. The percentage of students who travel to school by bicycle or scooter is less than 1.2%. **Figure 51** of Annex I depicts these results.

1.1.6.8 Transversal Mobility Innovations

Smart Traffic Light Monitoring and Control System: This smart management system aims to implement a traffic light network system that allows remote monitoring and execution of commands. It is being implemented at critical points in the municipality of Cascais, in terms of traffic constraints and the generation of pollutant emissions and allows public transport to be prioritised through GPS

vehicle recognition (**Figure 37**). It comprises the installation of an intelligent centralised monitoring, command and control system for the municipality's traffic light systems, made up of three components:

i. A monitoring system for the current traffic light systems, which provides real-time knowledge of their operating status, as well as alarm analysis, and transmits these signals in real time, receiving the inputs that enable basic control actions to be carried out.
ii. Advanced traffic light controllers that include, among other features, a prioritisation system based on the GPS location of public passenger transport vehicles.
iii. Central management system that allows not only monitoring but also effective command and control of traffic light systems.

Figure 37: Vision of the new traffic light management system[21].

Cascais Control Centre: Cascais has also invested in the creation of an integrated operations centre (**Figure 38**), with technicians specialised in data collection and analysis, allowing for better planning and smart management of the territory. The aim of adopting this type of solution is to respond to the city's challenges by speeding up services, such as civil protection in disaster situations, managing traffic constraints, etc. The Cascais Control Centre integrates all the information relating to the management of the municipality's daily life and helps the council to manage services to the minute in an automatic and more efficient way.

[21] https://cpsa.pt/wp-content/uploads/2024/06/Apresentacao-Pedro-Marques-MobiCascais-19-Jun-2024.pdf

Figure 38: Cascais control centre[22].

1.2 Engagement

1.2.1 Engagement Goals

Cascais' decision-makers have prioritised sustainability to enhance the well-being of the local population, supporting the city's ambitious climate action goals. It is therefore extremely important to focus on climate change mitigation, digitalization, sustainable urbanism, Nature Based Solutions (NBS) and Energy transition, but also co-creation with citizens, participatory governance, diversity and inclusiveness. Cascais main goals for citizens involvement and social measures are:

- Governance, Regulatory Structures and Advocacy and Energy and Mobility systemic challenges:
    - Creating public-private partnerships for Energy Communities to empower citizens and fight energy poverty in vulnerable waterfront areas and correspondingly increase PV energy production.
    - Using digital tools to process data and make it accessible to citizens, enhance transparency and community engagement, reward citizens for sustainable actions and provide valuable data on community practices.

- Cultural and Spatial Quality systemic challenge:
    - Actively involving citizens through participatory processes and social measures to ensure community buy-in and support for sustainable initiatives.
    - Developing co-creation activities with residents' associations and schools with increased emphasis on art and culture.
    - Implement educational programs and workshops to raise awareness about climate action, good environmental practices and their benefits.

[22] https://cpsa.pt/wp-content/uploads/2024/06/Apresentacao-Pedro-Marques-MobiCascais-19-Jun-2024.pdf

1.2.2 Tools for Engagement: Story-Building and Data-Driven Approaches

To achieve these engagement goals, Cascais leverages a combination of creative communication strategies and advanced digital tools that foster transparency, inclusivity, and active participation. Two central components of this strategy are story-building and a data-driven approach—each playing a complementary role in building trust, inspiring action, and facilitating citizen involvement.

Story-building

Story-building is a key mechanism to communicate the city's climate objectives. By framing the transformation of waterfront and urban areas as a shared journey towards climate neutrality, Cascais aims to create compelling narratives that connect emotionally with citizens, policymakers, and investors. This approach helps translate complex technical goals into relatable stories, making it easier to encourage participation and inspire co-creation. This narrative approach is not only central to the Re-Value project but also serves as a strategic tool across other municipal initiatives to foster ownership of the city's sustainable transformation.

Data-Driven Approach

Cascais has made significant investments in digitalization to enhance transparency and communication with the community and to provide evidence-based insights for securing funding and policy support. The municipality emphasizes several key digital tools, including MobiCascais app (previously described in 1.1.7), GeoCascais platform, data portal DataCascais, FixCascais app and WEGENERATE platform[23].

GeoCascais platform (**Figure 39**) serves as Cascais' Geographic Information System (GIS), offering citizens open access to geographic data. Meanwhile, the data portal DataCascais combines information, innovation and technology to foster participative-collaborative models and intelligent territory management under a Smart City approach that shares information and engages citizens to find appropriate solutions for urban challenges. All data is available for consultation and download in different formats, supporting monitoring processes and informed decision-making.

[23] This platform will have its beta version by the end of 2025, and its goals are to engage citizens with renewable energy communities and provide information to increase energy literacy.

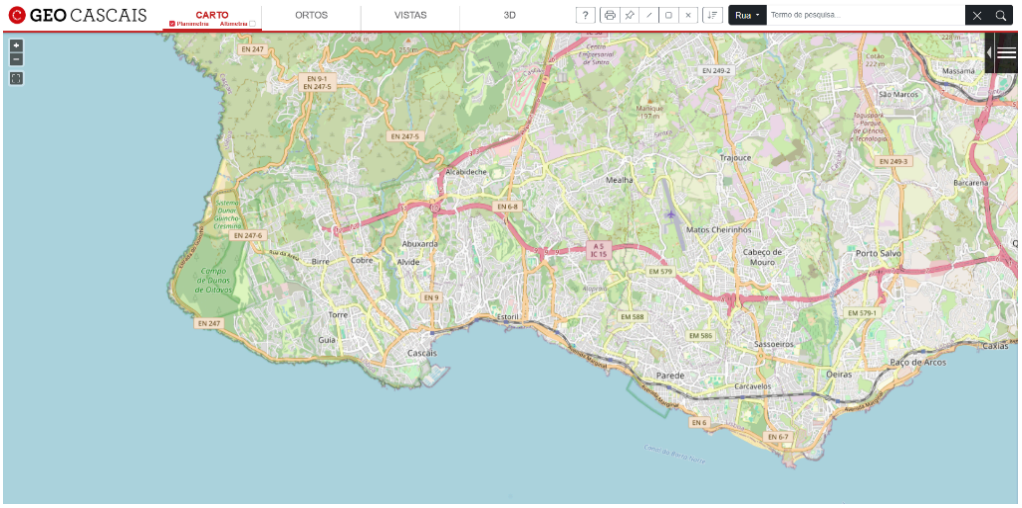


Figure 39: GeoCascais platform.

Fix Cascais (**Figure 40**) is an app designed to empower citizens by enabling them to report issues related to public space, traffic, or the cleanliness of public areas. Through the app, citizens can share geolocated images of the situation, facilitating direct communication between residents and the municipality. This streamlined process contributes to the efficient resolution of reported problems.

Figure 40: Fix Cascais App. Photo: Cascais Municipality.

Cascais is also developing a platform (WEGENERATE project) that uses actual renewable energy production data from Alcabideche renewable energy community, and other energy communities within the municipality, to calculate savings and avoid GHG emissions. It will also show the location of the energy communities, so the user can see to each one he will be able to connect, and the potential energy production of a PV system mounted in his own roof. By comparing and sharing real

production figures and other data related to renewable energy, the initiative will boost energy literacy and demonstrate the tangible advantages of joining an energy community.

While Cascais has implemented various projects and tools focusing on digitalization and citizen empowerment, there is an ongoing effort to refine indicators related to climate neutrality, specifically those that support the development of energy communities. The refinement of these indicators is crucial for aligning with Cascais' overarching goals and enhancing its capacity to achieve climate-related targets.

1.2.3 Stakeholders Landscape

Re-value project requires the involvement of stakeholders from multiple sectors and levels of influence. It includes both institutional actors and members of the local community, whose participation is essential to ensure the relevance, acceptance, and long-term sustainability of the project. Key stakeholders include:

- **Municipal Departments**: Strategic Planning, Urban Rehabilitation, Public Transport, Transport Authority, Environmental and Territorial Assessment and Monitoring, Circular Economy, Ecological Structure, and Citizen Service and Communication.
- **Municipal Companies**: Cascais Ambiente, MobiCascais, and DNA Cascais.
- **Local Governance**: Carcavelos Parish Council and Cascais-Estoril Parish Council.
- **Community and Civil Society**: Residents, tourists, and “Tutores do Bairro” (neighbourhood tutor).
- **Private Sector and Concessionaires**: surf schools’ owners, restaurant and coffee shops owners, beach concession holders.
- **Academic Community**: Students and professors from Nova SBE (Carcavelos Beach Pilot).

Engaging this diverse group of stakeholders has been both enriching and complex. The different expertise and perspectives have enhanced the understanding and analysis of the pilot areas, enabling a more holistic approach to the design of future urban scenarios. However, mobilizing stakeholder interest has been challenging. One key difficulty lies in the saturation of initiatives and public engagement processes already present in the area. The municipality and its citizens are frequently approached by multiple projects, which led to a sense of fatigue and disengagement. This makes it crucial to clearly communicate the added value of the Re-Value project and to discover meaningful and interesting opportunities for involvement.

1.2.4 Climate Action Activities

In Cascais climate action initiatives are integrated in the Cascais Climate Action Agenda #CascaisPeloClima, that promotes climate literacy and encourages participatory governance, focusing on training, raising awareness and disseminating tools for adapting to and mitigating climate change. #CascaisPeloClima’s key initiatives within the Re-Value scope of action, involving 362 citizens, are described in **Table 1**.

Table 1: Agenda #CascaisPeloClima's key initiatives within Re-value scope of action.

Initiative Name	Description	Date	Estimated Reach
Companies for Decarbonization	Climate action workshops were held, focusing on Energy Communities and decarbonization. The first session was organized under the scope of the LIFE CLIVUT project, while the other sessions were part of the COMMUNITAS project.	28/04/23	15
Stakeholders and Citizens for Decarbonization		28/04/23	22
Energy Community Presentation		02/05/23	40
Speaking for the Climate	Informal community meeting to co-create solutions for climate resilience. By focusing on inclusive climate action, the initiative aims to ensure a just transition and equitable benefits for all members of the community.	16/02/24	10
Energy Café	Workshops for the promotion of energy literacy that address key topics such as the importance of energy saving, energy efficiency measures, understanding electricity bills, and how to access the social energy tariff. As part of the DATA CELLAR project, this initiative provided free energy-saving advice and distributed energy efficiency kits to the local community.	28/02/24	30
		15/03/24	20
		21/03/24	5
		14/05/24	20
		20/06/24	20
		02/10/24	35
Positive Energy for Homes and Companies	Working group for energy-saving, and renewable energy strategies discussion. Using an innovative platform, it was possible to automatically analyse consumption data in real time.	25/03/24	5
Demonstration Webinar on Energy Communities, Energy Cafés and Cooperatives	As part of the COST ACTION initiative, this webinar facilitated a discussion on the potential of energy communities and explored effective strategies for engaging citizens in the topic.	20/06/24	30
The urban transition to climate neutrality in coastal zones – LNEG	Webinar that covered the work being done under the Re-Value project, analysing the 2 pilot coastal zones and participatory intervention measures in urban spaces to improve resilience and biodiversity through nature-based solutions, increase accessibility, and contribute to climate change mitigation. Available online[24].	23/09/24	80
Capacity Development and exchange programme - Cascais Round: Energy Transition	A webinar was held to explore how the energy transition can be advanced through the integration of technology, environmental best practices, and climate	11/12/24	30

[24] https://www.youtube.com/watch?v=ENhtqY2B4oU

	literacy - key elements in building more resilient cities.		

These initiatives are associated with an innovation hub which comprises several international and local projects that complement each other strategically, allowing to create a more resilient city. This allows for continuous investment, transversality between topics and a vast network of partnerships, enabling Cascais to achieve dynamic, innovative and collaborative results, focusing on science, politics and commitment to the citizens. Some examples of other projects belonging to this innovation hub that are interlinked with Re-Value are:

- DATA CELLAR Horizon Europe project, that aims to create certified public databases for the development of energy efficiency technologies, applications and infrastructures within the European Union, including Renewable Energy Communities. One of the tangible results is a detailed analysis of the municipality's energy consumption (500 buildings), illustrated by a load diagram as well as templates for solar installations or the purchase of sustainable local energy. In addition, 100 Cascais families will take part in the project, making it possible to build a blockchain database that respects anonymity and builds trust between partners. This database will provide valuable information, enabling companies in the sector to offer solutions and products that are better suited to real needs.
- COMMUNITAS Horizon Europe project complements DATA CELLAR, concentrating on creating governance models to promote energy literacy. It aims to bring together the municipality, citizens and entrepreneurs of Cascais, providing information on Energy Communities, citizen participation means and the potential for savings in real contexts. One of the aims of this project is to demonstrate the advantages of decentralised energy models, based on local renewable production, thus enabling the role of the producer-consumer (prosumer) to be valued, creating a more sustainable and engaging approach for the community.
- WEGENERATE Horizon Europe project integrates and materialises the principles of the DATA CELLAR and COMMUNITAS. This project aims to fight energy poverty in a social neighbourhood owned by the municipality by including it in an active energy community with other public buildings in the surroundings. The project's objective is to enhance comfort, quality of life, and environmental sustainability while promoting the use of renewable energy for urban decarbonization in the social housing community. Additionally, the project aims to foster public-private partnerships to create active energy communities and engage a significant number of residents and users.
- INVEST4NATURE Horizon Europe project aims to demonstrate the financial viability of Cascais' investments in promoting biodiversity and recovering ecosystem services that respond to the challenges of climate change. In Cascais, the project will be focussed on the work carried out for the requalification of Vinhas Stream and the recovery and protection of the Cresmina-Guincho dune system (near Guia Pilot), validating the implementation of NBS as environmentally and financially more advantageous solutions.

1.2.5 Innovation Camps

Youth and Schools engagement was promoted, within the Re-Value project, through a series of Innovation Camps developed in partnership with Junior Achievement Portugal. These events have proven to be powerful tools for connecting with younger generations, fostering environmental awareness and climate action, and incorporating fresh perspectives into the city's climate action strategies.

The Innovation Camps use a challenge-based, hands-on approach to involve students in the co-creation of innovative solutions for local sustainability issues. Each workshop follows a Design Thinking methodology, guiding students through problem analysis and solution development in a one-day intensive format. With the support of mentors from the municipality and partner institutions, students work in teams and present their final proposals to a panel of judges.

The first Cascais Innovation Camp took place on December 13, 2023. Fifty students from four local high schools were challenged to answer: "How can we improve the quality of life in the centre of Cascais through sustainable mobility?". As part of the challenge, they also developed prototypes to support their pitch presentations. The winning team, Team 9 (Bus Tracker), proposed a mobile app designed to enhance public transport efficiency and user experience, helping to promote sustainable mobility in the city. **Figure 41** shows the students and other participants of this Innovation Camp.

Figure 41: Group photo of the students and participants in Cascais' 1st Innovation Camp. Photo: Junior Achievement Portugal (JAP).

On 21st November of 2024 Cascais held the second Innovation Camp (**Figure 42**). Another fifty students from two schools participated in this second edition, focused on the challenge: "How can we promote intelligent water consumption, increasing savings between us and the city?", where

students developed creative water-saving solutions using a business canvas model. Team 10 (RainFlow) won the challenge with a proposal to reuse rainwater collected on lawns for irrigation.

Figure 42: Group photo of the students and participants in Cascais' 2nd Innovation Camp. Photo: Junior Achievement Portugal (JAP).

The Innovation Camps have not only provided space for youth engagement but also served as valuable moments of environmental education and participative governance. By involving young people in discussions about resilient urban development, the city gains insight into the concerns and aspirations of future generations. These initiatives reinforce the importance of youth involvement in shaping inclusive climate strategies, where the ideas generated by students can influence municipal planning.

In Cascais, the focus of the camps evolved from design prototyping in the first round to a business model canvas approach in the second. Feedback from teachers suggested that combining both methods could create a more balanced and effective experience. A hybrid model has the potential to deliver stronger outcomes by integrating creativity with practical business thinking.

Introducing a business-oriented perspective equips students with real-world tools and frameworks, helping them translate ideas into actionable solutions. Just as important is the follow-up on student proposals - demonstrating to young participants that their contributions matter and can lead to tangible impacts in the municipality.

1.3 Impact Model Workshop Insights

On 27 November 2024, Cascais hosted a Re-Value Impact Model Workshop, applying the methodology to the two pilot sites: Carcavelos Beach and Guia Road. The following day, the

participants joined a study visit to both locations, enriching their insights through on-site observation (Figure 43).

Figure 43: Impact Model study visit to the Carcavelos Beach pilot. Photo: Cascais Municipality.

1.3.1 Participants

A broad range of entities were invited to participate in Cascais Impact Model Workshop, including representatives from:

- Municipal companies (Cascais Ambiente, Cascais Próxima and Cascais Dinâmica) and municipal departments (Cascais Municipality): Strategic Planning; Urban Rehabilitation; Public Transport and the Transport Authority; Environmental and Territorial Assessment and Monitoring; Circular Economy; Ecological Structure Management; Environmental Transition and Sustainable Development; Infrastructure and Urban Spaces; Citizen Service and Communication; Youth, Education, Sport, Health, and Social Services; Nature and Biodiversity, Environmental Awareness, and Nature and Tourism.
- Private sector: Carcavelos Surf School and “Casa da Guia” stores, bars, and restaurants.
- Civil society and local associations: “Quinta dos Lombos” Sport Club; Cascais Beach Concessions Association and “D. Luís I” Foundation.

In total, the workshop gathered 14 active participants representing various departments of Cascais Municipality and Municipal companies. This multidisciplinary group offered a wide range of expertise and perspectives, enriching the analysis of the pilot areas. However, the workshop didn’t have

representation from civil society, local associations, and the private sector - highlighting the need for broader engagement in future sessions.

Bringing together a multidisciplinary team of stakeholders was enriching for the project and made it possible to analyse the pilot areas from different perspectives and backgrounds. The session was dynamic and well-received. Participants were actively engaged from the beginning, with the Domino game proving to be effective (**Figure 44**). There was interest in reading all the concepts and integrating them into the conversation. In fact, this tool was very important for the session, promoting debate, helping to connect ideas and to identify positive and negative impacts on the pilot areas and to easily develop the future steps to be taken and viable solutions to the problems identified.

Figure 44: Impact Model participants engaging with the Domino cards. Photo: Cascais Municipality.

Despite the limited time, the workshop successfully led to the identification of real, feasible, and coherent solutions. All suggestions from the session were compiled and analysed by the Cascais team. As a result, it was possible to envision three future scenarios for the development of the pilot areas, shaped by the diverse inputs and ideas shared during the workshop.

1.3.2 Scenarios Shaped by the Workshop

Cascais is often promoted as “the best place to live a day, or a lifetime”. To help make this vision a reality in the two pilot areas — Carcavelos Beach and Guia Road — Cascais is developing a set of forward-looking scenarios through the WP1 processes. These scenarios are grounded in five fundamental “P’s”: “Pessoas” (People), “Projetos” (Projects), “Parcerias” (Partnerships), “Partilha” (Sharing), and “Pertença” (Belonging). At the core of this approach is a collaborative governance

model, essential for ensuring cohesive management, inclusive decision-making, and long-term sustainability in the municipality.

Guia Road Pilot

A. Yellow Jersey Scenario

In the Yellow Jersey Scenario, the section of Rei Humberto II de Itália Avenue that runs from the Cascais Marine to the intersection with República Avenue will be closed to traffic. The entire area will be redesigned, creating a living-street, promoting biodiversity in the urban area, reducing the urban heat island effect and mitigating the impacts of climate change.

Traffic will be diverted to the inner Republica Avenue; therefore, the pedestrians will be able to move freely and safely on site. The existing cycling lane will be improved, providing an extra space for joggers and pedestrians. These measures will support the municipal decarbonization goals, fostering light mobility and promoting a healthy lifestyle, with a consistent focus on community wellbeing and climate action.

This area will also include a thoughtful design that integrates human elements with nature, ensuring the incorporation of shading areas, benches, clear biodiversity signage and modern public lighting systems with energy-efficient technologies. This will promote sports practice and social interaction, encouraging the community to stay outdoors.

The municipal tourism strategy is committed to developing the city, always bearing in mind the involvement of the citizens and the growth of the local economy. The redesign of this pilot area into a living-street will be in line with this strategy, integrating existing local businesses with the Sintra-Cascais Natural Park and promoting the connection between the citizens and visitors with nature.

A collaborative governance model will be implemented to ensure cohesive management and decision-making in this pilot area. Shared goals and a transparent process will enable to align efforts for sustainable development and decarbonisation on the coastline.

Figure 45: Representation of Yellow Jersey Scenario for Guia Road Pilot.

B. Middle Way Scenario

In the Middle Way Scenario, the designated section will be closed to traffic on weekends. This gradual measure supports the municipality's decarbonisation goals by progressively promoting lifestyles that prioritize light mobility.

The existing cycling lane will be upgraded, and the pavement of walking paths, now with typical Portuguese cobblestone, will be changed to a more ergonomic material, to improve accessibility, safety and comfort. The integration of human elements with the surrounding nature will be ensured, incorporating shading areas, benches, clear biodiversity signage and modern public lighting systems with energy-efficient technologies. As in the previous scenario, this will promote sports practice and social interaction, encouraging the community to stay outdoors.

Improving the area and closing the road at weekends will ensure support for the local economy, pedestrians' safety and promote the connection between the citizens and visitors with nature. A collaborative governance framework will be developed to ensure cohesive management and decision-making in this pilot area. By fostering shared objectives and maintaining a transparent process, efforts will be aligned with the mitigation goals of the city.

C. Smooth Sailing Scenario

In the Smooth Sailing Scenario, a Shared Mobility Hub will be promoted. The existing cycling lane on this road will be upgraded to enhance its usability, while the pavement of walking paths will be changed to a more ergonomic material, to improve accessibility, safety and comfort. These upgrades will align with municipal decarbonization goals but also promote sustainable mobility and encourage a healthier lifestyle, prioritizing community well-being and climate action.

A collaborative governance framework will be developed to ensure cohesive management and decision-making in this pilot area. The integration of human activity with the surrounding natural environment will be ensured, incorporating shading areas, benches and clear biodiversity signage to raise awareness of local flora and fauna. A modern public lighting system with energy-efficient technologies will be implemented. These enhancements will promote pedestrians' safety, sports practice and social interaction, encouraging the community to stay outdoors.

Carcavelos Beach Pilot

A. Yellow Jersey Scenario

In the Yellow Jersey Scenario, two of the four lanes of the Marginal Road will be closed to traffic. This area will be redesigned, creating a living-street acting as a green corridor, promoting biodiversity in the urban area, reducing the urban heat island effect and mitigating the impacts of climate change.

Traffic will take place on the two remaining lanes, as well as through the parallel inner roads. Access to the site by public transport will be reinforced. The pedestrians will be able to move freely, and a cycle lane will be built on site. These measures will promote light mobility and encourage a healthy

lifestyle, fostering progress in the city's decarbonisation journey, always with the community wellbeing and climate action on the forefront.

The corridor will integrate sustainable water management techniques, such as dry meadows and permeable pavements that allow rainwater to be absorbed by the soil, reducing runoff. It will also be equipped with benches and shaded areas for recreation, sports practice and social interaction, encouraging citizens to stay outdoors.

Still with a focus on ensuring the municipality's energy transition, investment will be made in the installation of photovoltaic solar systems on existing buildings, aiming to reach positive energy districts and further reduce energy related GHG emissions.

Access to the workplace for local business owners and surf schools will be specifically accommodated. The existing parking area adjacent to the beach will be reserved for their use and for authorized personnel. Half of this parking space will be converted into an urban park fostering local biodiversity. Furthermore, the pavement of the remaining parking area will be upgraded to a semi-permeable material that allows rainwater to be absorbed by the soil.

A Pop-up Innovation Lab will be created on site to promote climate literacy, sports, art and cultural activities. A community vegetable garden could also be included. The aim will be to create a local identity, involving the entire community that uses Carcavelos beach, fostering a sense of belonging, changing mentalities and educating for a sustainable future.

For the programme of activities to be successful, it is important to first ensure the monitoring and collection of data from the different activities already carried out in the area and from the different existing groups.

Figure 46: Representation of Yellow Jersey Scenario for Carcavelos Beach Pilot.

B. Middle Way Scenario

In the Middle Way Scenario, two of the four lanes of the Marginal Road will be closed to traffic on weekends. On this more subtle measure, people will be able to walk freely, cycle and participate in different activities on the closed road area. Public transport will be reinforced to guarantee everyone has access to the site, promoting sustainable mobility and, therefore, decarbonizing the municipality.

Access to the workplace for local business owners and surf schools will be specifically accommodated. In this scenario half of this parking space will also be converted into an urban park and the Pop-up Innovation Lab will be created.

C. Smooth Sailing Scenario

In the Smooth Sailing Scenario, public transport will be reinforced to guarantee access to everyone to the site, promoting sustainable mobility and, therefore, decarbonizing the municipality.

Miyawaki forests with native species will be planted at the roundabout on the Marginal Road and in the flowerbeds in the area nearby the beach. This pioneering Japanese method of tree planting will be used to create small forests improving air quality, biodiversity in urban environments and mitigating the urban heat island effect. As well as contributing to environmental sustainability, these forests will also foster a sense of community by promoting volunteering activities. This way, the entrance to the municipality of Cascais, on Carcavelos side, will also have a greener setting, in line with the municipality's ambitions.

The pavement of the parking area adjacent to the beach will be upgraded to a semi-permeable material that allows rainwater to be absorbed by the soil, reducing runoff.

This scenario also considers the creation of the Pop-up Innovation.

1.3.3 Assessing the Applicability of the Re-Value Impact Model in Local Decision-Making

The Re-Value Impact Model provides a structured framework that supports the design and implementation of more effective, inclusive, and sustainable urban strategies. In Cascais, the application of this model has demonstrated potential to support future planning processes by ensuring alignment between urban development actions and broader municipal goals, particularly those related to climate action.

One of the key strengths of the model lies in its capacity to define clear impact pathways, facilitating dialogue among different stakeholders and ensuring collaborative governance. This is especially valuable in complex urban contexts where interdependencies between climate action, land use, economy, and social equity must be carefully managed.

Despite the clear benefits, the workshop in Cascais highlighted the importance of ensuring broader participation from civil society, local businesses, and other organizations in future applications of the

model. Their inclusion is essential in building legitimacy and ensuring social acceptance of the solutions created.

Looking ahead, the continued use of the Re-Value Impact Model in Cascais can strengthen the city's ability to make data-based, transparent, and replicable decisions, while maintaining a focus on community well-being. As an example, the municipality's Department of Innovation already asked for a set of domino cards translated into Portuguese to use in their project's evaluation.

1.4 Pilot Opportunities, Challenges and Adjustments

The Re-Value project sets a strong foundation for Cascais' transition toward climate neutrality and strategic urban development by focusing on pilot areas with existing policy support and clear municipal objectives. The sensemaking phase (M1–M12) highlighted both the potential and complexity of these pilot areas.

The pilots presented significant opportunities to test climate solutions within urban contexts:

- Guia Road Pilot emerges as a prime location to enhance active mobility and social engagement, with strong potential to increase local commerce through the revitalization of cultural landmarks such as "Boca do Inferno" and "Casa da Guia". Its redesign will promote biodiversity, light mobility, and inclusive public spaces, setting an example for sustainable coastal development.
- Carcavelos Beach Pilot offers a unique opportunity to reimagine a highly frequented coastal area by improving walkability, integrating green infrastructure, and responding to seasonal pressures. To enhance connectivity with the Nova SBE University Campus, the student's engagement in climate action activities must be considered.

Both pilots allow the municipality to advance key objectives around decarbonization, renewable energy, digitalization, and citizen empowerment, serving as models for replication.

Despite the existing policy support and alignment with municipal objectives, integrating climate goals with spatial planning and institutional processes proved to be challenging. One of the main difficulties is navigating fragmented responsibilities across municipal departments and administrative levels, which sometimes leads to delays and coordination gaps. Additionally, ensuring broad and representative community participation is difficult, particularly in engaging harder to reach groups such as informal residents or small business owners. These challenges underline the need for more inclusive engagement strategies in future phases.

Considering these challenges, several key adjustments should be taken into account to ensure a more adaptive approach:

- Phased implementation through flexible scenarios: scenarios such as *"Middle Way"* and *"Smooth Sailing"* represent more gradual alternatives to full-scale interventions. These allow for a phased approach.

- Strengthening collaborative governance: a stronger focus must be placed on developing collaborative governance frameworks to ensure cohesive management, transparency and shared accountability across stakeholders.
- Prioritizing monitoring and evaluation: the importance of robust data collection and impact monitoring is essential to guide future decisions and strategies.

2 Towards Active Experimentation

2.1 Engagement Overview

As part of the Re-Value project, a total of 24 workshops and 3 webinars are planned. In addition to broader climate action initiatives promoted under the municipality's *#CascaisPeloClima* agenda, the following activities have been organized up until now under the Re-Value framework:

- Ten Workshops: "Companies for Decarbonization" (28/04/23), "Stakeholders and Citizens for Decarbonization" (28/04/23), "Speaking for the Climate" (16/02/24), Energy Café (28/02/24, 15/03/24, 21/03/24, 14/05/24, 20/06/24, 02/10/24) and "Positive Energy for Homes and Companies (25/03/24).
- Two webinars: "The urban transition to climate neutrality in coastal zones" (23/09/24) and "Demonstration Webinar on Energy Communities, Energy Cafés and Cooperatives" (20/06/24).

These activities have collectively involved 362 participants, with additional attendance expected in upcoming sessions.

The following section outlines the agenda for the remaining planned activities, as well as other relevant events and engagements that fall within the scope of the Re-Value project.

2.1.1 Further Opportunities for Engagement

This section outlines the agenda for the remaining planned activities, as well as other relevant events and engagements that fall within the scope of the Re-Value project.

2.1.2 Re-value: (Re)Thinking Cascais Waterfront Area

To strengthen community engagement in the Re-Value project, Cascais is planning the summer workshops "(Re)Thinking Cascais Waterfront Area", which will feature 14 co-creation actions –with seven sessions held in each pilot area. The campaign will be carried out in collaboration with Cascais Jovem volunteers (**Figure 45**), with four volunteers assigned to each pilot area (eight in total).

The workshops aim to foster meaningful citizen involvement through the following key activities:

- Participatory Scenario Development: citizens/tourists will be invited to indirectly share their ideas and suggestions for improving the Carcavelos Beach and Guia Road pilot areas. These contributions will support the co-creation of future scenarios and raise awareness about the Re-Value project, helping participants to not only learn about it but also experience it.
- Interactive and Creative Engagement Tools: inspired by the example of Izmir, board models (trees, benches, shading systems, fountains, *etc.*) and maps can foster creative exploration of ideas. Alternatively, Lego® can be used as a playful and flexible tool for design. This hands-on,

visual approach offers a simple and engaging way for people of all ages to participate meaningfully.

- Pilot Postcards: citizens and tourists will be invited to share their thoughts, ideas, and emotions by writing or drawing on specially designed postcards. Each postcard will include a brief description (or some key words) of the Re-Value project and Cascais pilot areas, offering an accessible and creative way for participants to engage with the project.
- Analysis and Reporting of Results: all inputs collected during the workshops will be analysed to identify recurring themes, shared concerns, and priority actions. The focus will be on understanding community needs and translating them into actionable insights for future planning.

Figure 47: Cascais Jovem volunteers. Photo: Cascais Municipality.

2.1.3 Online Engagement Through Webinars

One additional webinar is planned within the scope of the Re-Value project. However, the municipality continues to face difficulties in engaging civil society stakeholders, particularly when events are held online. Participation rates tend to be low, as many individuals prefer to watch the event recordings afterward rather than register and attend live sessions. To improve this, LNEG - which frequently takes part in similar initiatives - will support the organization of the upcoming webinar.

Cascais aims to organize a webinar that not only supports the objectives of the Re-Value project but also resonates with the needs of both municipal pilots. A few potential themes have been considered, such as Citizen Engagement, Circular Economy, or Financing mechanisms. Given the

project's focus on energy and decarbonization, topics like energy communities and sustainable mobility will also be explored. A comprehensive format (“fruit salad” format) can be an option.

2.1.4 Innovation Camp 3

Cascais will host the third edition of the Innovation Camp in October 2025. The exact date is yet to be confirmed because it will have to be coordinated with the beginning of the school year. In this edition, the students’ projects will focus on a question closely related to the pilot areas under study: “How can Praia de Carcavelos and Costa da Guia become leading examples of coastal urban transformation and decarbonization for the well-being of the community?”. The outcomes will be integrated into the project, shared online, and any promising ideas will be further developed in collaboration with the students (**Figure 46**).

Figure 48: Innovation Camp students. Photo: Junior Achievement Portugal. Photo: Cascais Municipality.

2.1.5 Cascais Study Visit

The Cascais Study Visit and Mini Consortium Meeting will take place from 7 to 9 October across three municipal venues: Nova School of Business and Economics (Nova SBE), Quinta do Pisão - Casa da Cal, and Cascais Cultural Centre.

Given its proximity to the Carcavelos Beach Pilot, the day held at Nova SBE will include a site visit to this pilot zone. This day will also feature an interactive activity engaging university students.

Additionally, Nova SBE hosts one of the municipality's Renewable Energy Communities, which presents a valuable opportunity for discussion and learning.

Quinta do Pisão - Casa da Cal, located within the Sintra-Cascais Natural Park, is an ideal venue for NTNU to facilitate a workshop on Nature-Based Solutions (NBS) and to present the Re-Value Impact Pathway. A morning walking tour on the Vinhas Stream green corridor (**Figure 47**) - a prime example of NBS implementation within the municipality – is also planned.

Figure 49: Vinhas Stream green corridor. Photo: Cascais Municipality. Photo: Cascais Municipality.

The Cascais Cultural Centre, located in the city centre near the Guia Road Pilot, offers the opportunity to explore this zone on foot or by bicycle. A presentation about the impacts of climate change along the coastline is scheduled as part of this day.

Throughout the study visit, "Public Engagement" will serve as the overarching theme of the workshops, emphasizing strategies for effective community involvement. Practical approaches to overcome common barriers to engagement will be addressed, helping to ensure that the Re-Value project's outcomes not only reflect expert input but also resonate with the real needs of the citizens.

2.1.6 Artistic Mission

The Re-Value project adopts a holistic approach to urban development by integrating artistic, cultural, and community-driven elements to promote sustainable and inclusive transformations along the waterfront area. Aligned with the New European Bauhaus initiative, artistic interventions act as catalysts for dialogue, reflection, and action, empowering communities to envision and actively participate in shaping sustainable urban futures.

As part of Cascais' Artistic Mission within the Re-Value project, Cascais is planning to align activities with the municipality's Democracy Week. The municipality was selected as the European Capital of

Democracy 2026 (ECoD) (**Figure 48**), a prestigious title that not only recognizes the town's strong democratic practices but also serves as a catalyst for further initiatives that promote civic engagement and participatory governance. The Year of Democracy will feature a diverse programme of events, actions, and projects aimed at strengthening democratic values. Integrating the Re-Value artistic mission into this programme will reinforce the project's core emphasis on inclusive urban transformation and participatory governance.

Figure 50: Mayor of Cascais receiving the European Capital of Democracy 2026 award. Photo: Cascais Municipality. Photo: Cascais Municipality.

Communication with the municipal department responsible for coordinating initiatives under ECoD 2026 has not yet been established. However, some initial ideas are already outlined, including:

- Collaborative Mural: create a participatory mural that invites citizens and visitors to share their visions (with messages and drawings) of a democratic, inclusive, and sustainable future for Cascais.
- Interactive Public Art: create a large-scale art installation using marine litter. Participants write short messages for democracy and sustainability on parts of the sculpture, turning it into living art and reinforcing the link between environmental responsibility, artistic expression, and democratic values.
- Sand Sculpture Contest/Exhibition: Participants create sand sculptures that represent themes of democracy and climate action. The contest celebrates community creativity and environmental awareness, with the possibility of inviting a local artist to build a featured sand sculpture as an inspirational centerpiece. Another potential idea, inspired by the highly creative city of Písek, is to bring artists to the municipality to create long lasting sculptures (up to 6 months) in public spaces and leave instructions (QR code or link) on how to use virtual reality to animate them with mobile phones.

- Scavenger Hunt: Make artistic checkpoints (some of them hidden) with images/drawings/sculptures/messages related to citizenship, the environment and sustainability. Each checkpoint has a QR code that must be scanned to complete it in the map. There will also be a clue to help find the next checkpoint. The winner will be the one that completes the map first. This activity can be done in several weekends so citizens can have more than one opportunity to participate. It can also be adapted/simplified so families with children can make it a fun family activity.
- Animation Studio for Children “Windows to the Future": Using a screen or a tablet, a plastic screen or plastic film in front of it and markers, children can draw whatever they want to change the reality of the image, like in a dream. The image should be related to themes like climate, nature, the sea, friendship, empathy, *etc*.
- Freestyle Wall: Using a white canvas with a main theme related to Re-Value and Democracy over it and spraying cans, allowing citizens to give wings to their imagination and leave their visual message in graffiti.
- Laboratory of the City Caravan: A caravan that stops in several parts of the city and uses art as a means of social engagement makes the assessment of the problems and ideas of the citizens.

2.1.7 Timeline

Cascais is planning to organize these engagement initiatives according to the timeline outlined in the table below. Naturally, adjustments may be made as the project evolves.

Table 2: Planning of Cascais initiatives within the Re-Value project.

Initiatives	2025							2026						Notes
	6	7	8	9	10	11	12	1	2	3	4	5	6	
(Re)Thinking Cascais Waterfront Area		16 & 23	6, 20 & 27	3 & 10										
Webinar														TBC
Innovation Camp 3														TBC
Cascais Study Visit					7, 8 & 9									

Cascais Artistic Mission														During ECoD 2026 - TBC

2.2 Feasibility Studies

As part of the Re-Value project, a feasibility study should be carried out to evaluate the potential implementation of the proposed scenarios in Cascais. This study should consider the available budget and ensure alignment with the standard planning and execution procedures typically followed by the municipality.

Cascais is embracing a forward-thinking and data-driven approach to achieve its carbon neutrality goal by 2050. To support effective decision-making, it is essential that the feasibility study integrates key datasets, including mobility patterns, energy consumption and GEE emissions that allow to demonstrate the impacts of the implementation of the different scenarios.

Special attention should be given to the role of renewable energy within these scenarios. The studies conducted on wind, solar, and wave energy resources, supported by advanced digital terrain models and validated measurement systems, provide a solid foundation for strategic planning and the solar energy assessment reveals considerable photovoltaic potential across the municipality.

It is also important to note that one of the core objectives of this feasibility study is to verify that the proposed scenarios are not only viable for the pilot areas, but also scalable and replicable. This will help ensure that innovative approaches developed through the Re-Value project can be adapted to other areas of the municipality or even to similar urban contexts.

The upcoming steps include:

- Data collection and analysis: compile and analyse relevant datasets on mobility patterns, energy consumption, meteorology, water bodies level, etc.
- Scenario Modelling: test the different scenarios, evaluating their potential impacts on GEE emissions under different conditions.
- Evaluation and recommendations: evaluate the scenarios based on sustainability, cost-effectiveness, and public acceptance, leading to clear and actionable recommendations for implementation.

2.3 Public-Private Partnerships

Strong partnerships are essential for securing funding, expertise, and policy alignment. Cascais fosters collaboration with national and international research institutions, municipal organizations, private sector, and experts to develop innovative urban solutions, namely through EU projects consortiums.

The municipality aims to explore models that strengthen public-private partnerships (PPPs), and the Re-Value project presents a valuable opportunity to initiate and advance these collaborations, particularly to implement the scenarios within the pilot areas.

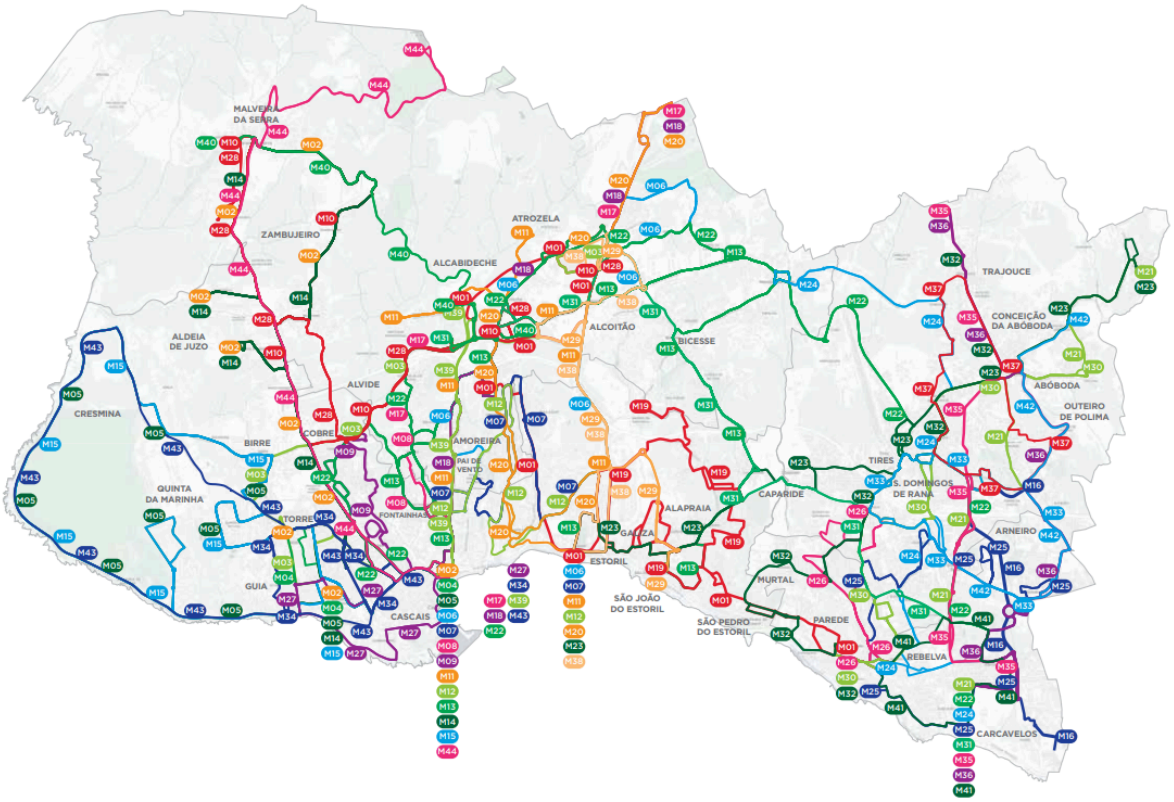
To realize this potential, the next steps involve a comprehensive assessment of the legal and institutional frameworks governing PPPs in Portugal to identify suitable structures that align with local regulations and project goals. Additionally, it is essential to map and engage a broad network of stakeholders - including legal experts, PPP specialists, and financial advisors - to build a robust ecosystem of expertise and support.

By fostering transparent dialogue and shared governance among these actors, Cascais can create resilient partnerships that leverage private sector innovation and investment while safeguarding public interests. This approach not only facilitates effective project delivery but also ensures long-term sustainability and community acceptance of urban transformation initiatives.

Annex I – Mobility Related Maps and Figures

Mobi Cascais Municipal Bus Network

Mobi Cascais bus routes are shown in **Map 1**.

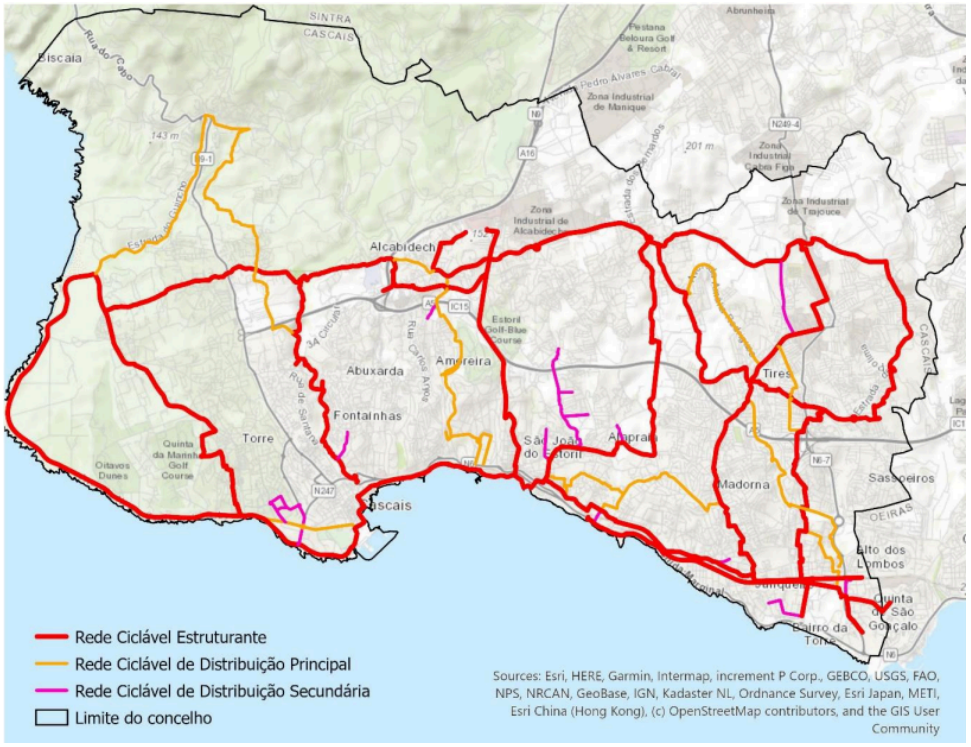


Map 1: Mobi Cascais Bus Network routes[25].

Bicycles and scooters

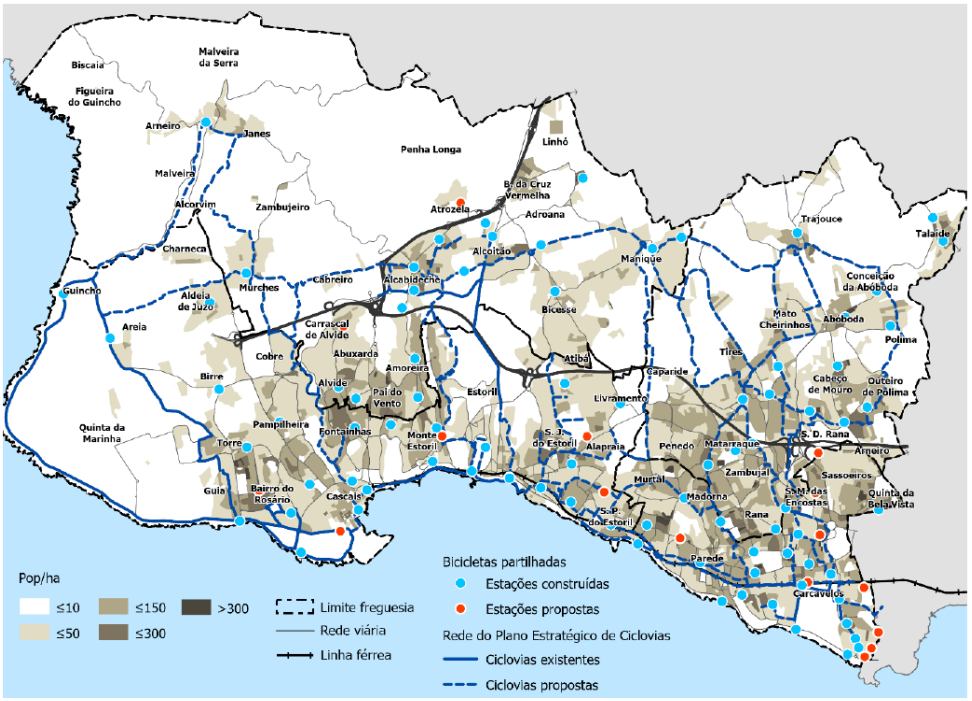
Map 2 shows the hierarchy of the cycling network proposed in Cascais' Strategic Cycling Plan and **Map 3** shows the location of the bicycle sharing stations within Cascais municipality.

[25] https://mobi.cascais.pt/sites/default/files/2022-03/2021_MOBI_MAPA_LINHAS.pdf



*Map 2: Hierarchy of the cycling network proposed in Cascais' Strategic Cycling Plan (**structuring**, main distribution and **secondary distribution**)[26].*

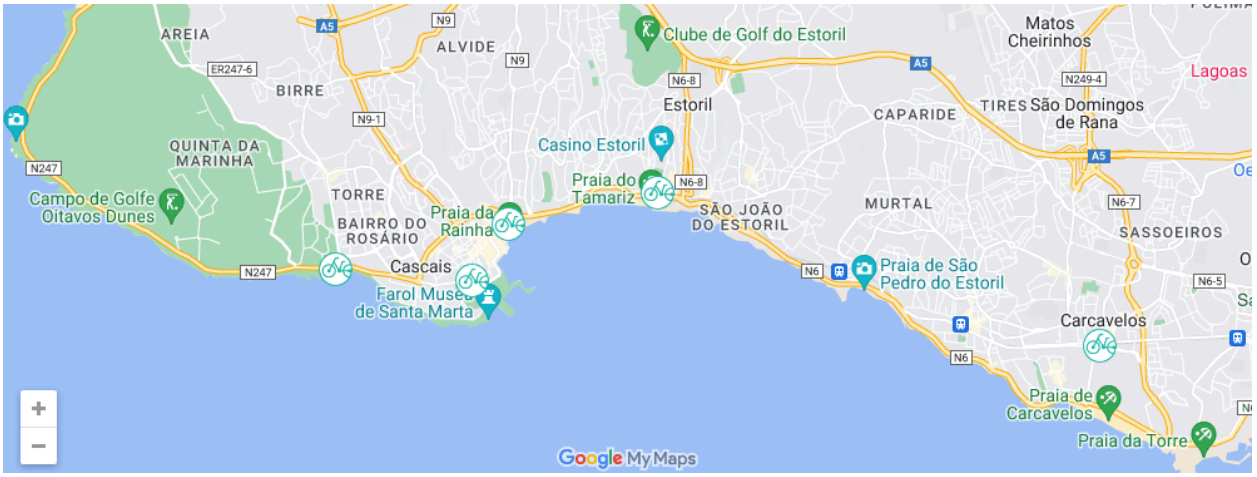
[26] https://www.cascais.pt/sites/default/files/anexos/gerais/new/pdu_cascais_fase_iii.pdf



Map 3: Bicycle sharing stations (constructed and planned)[27].

Map 4 shows MobiCascais kiosks locations.

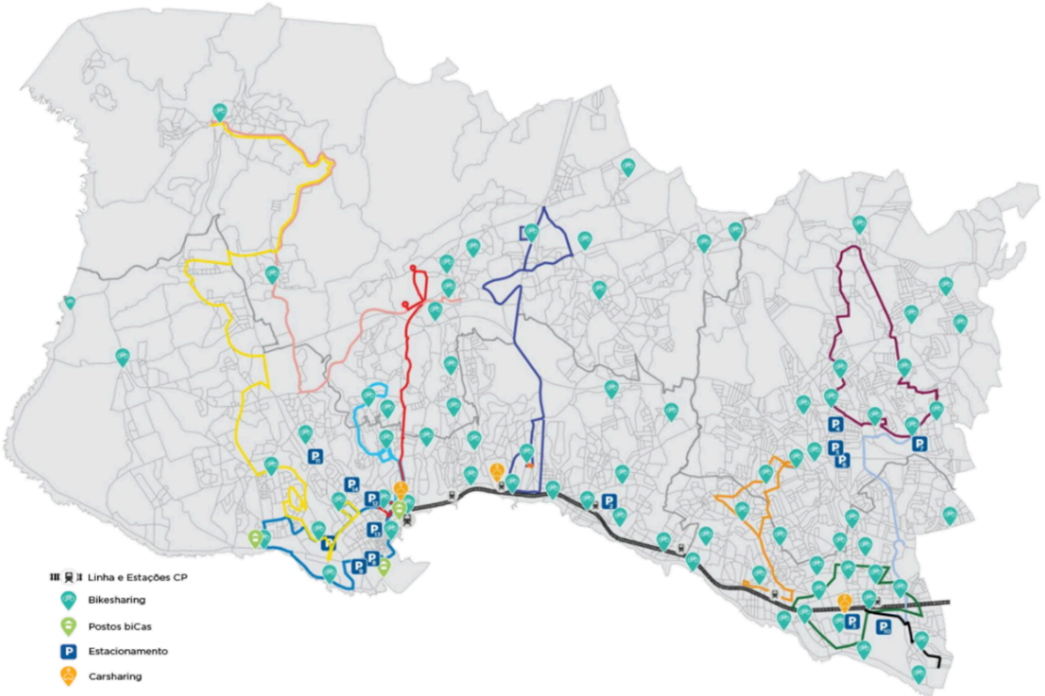
[27] https://www.cascais.pt/sites/default/files/anexos/gerais/new/pdu_cascais_fase_iv.pdf



Map 4: MobiCascais Kiosks Location.

Available Car Parking Options

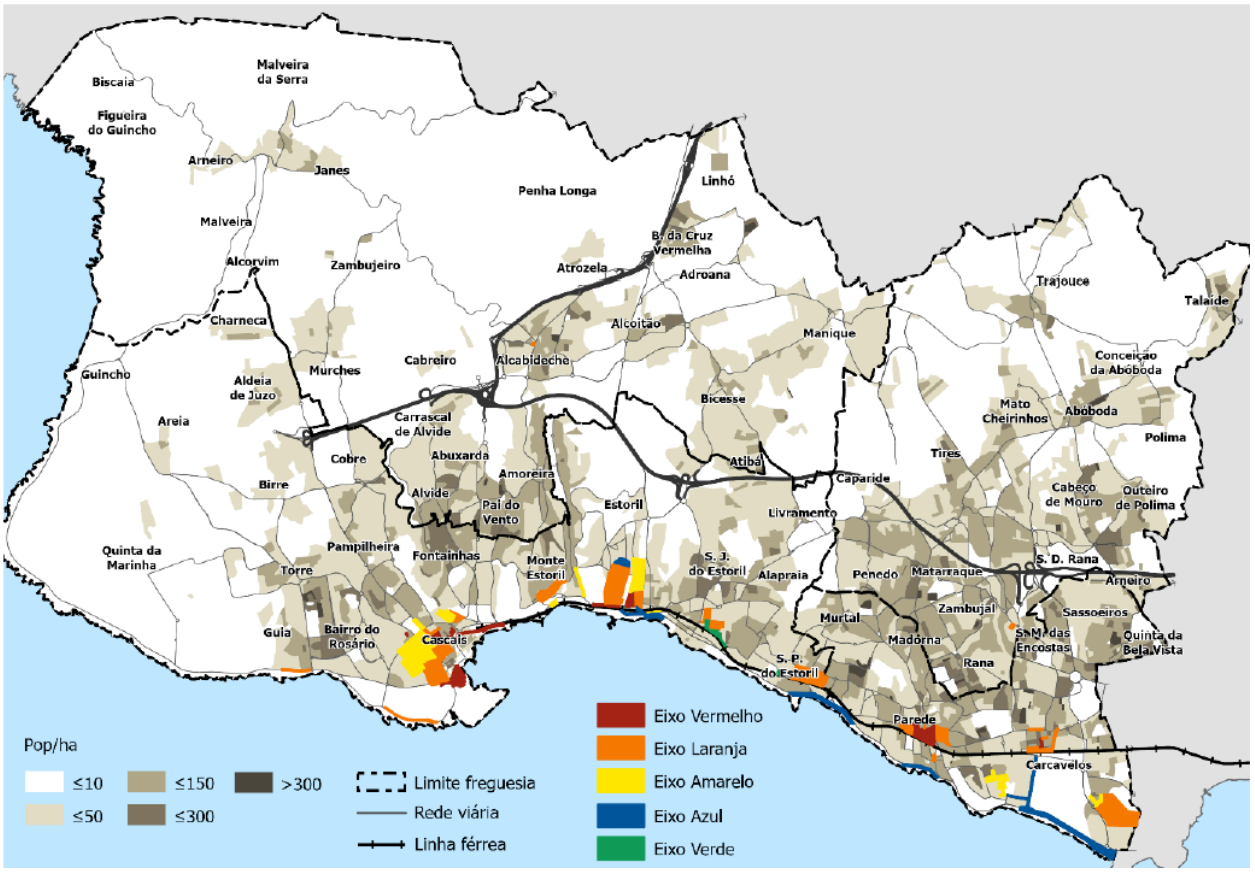
Cascais' indoor car parks are shown in **Map 5**.



Map 5: Indoor car parks[28].

[28] https://www.cascais.pt/sites/default/files/anexos/gerais/new/pdu_cascais_fase_iv.pdf

Cascais' outdoor car parks are shown in **Map 6**.



Map 6: Outdoor car parks[29].

These streetcar parks are divided into 5 axes according to their location, blue, green, yellow, orange and red. The hotter the axis colour, the more expensive is parking on that location. Bellow you can see an image (**Figure 49**) that shows how much should be paid for a certain amount of parking time in each axis. In the blue axis there are different seasonal tariffs.

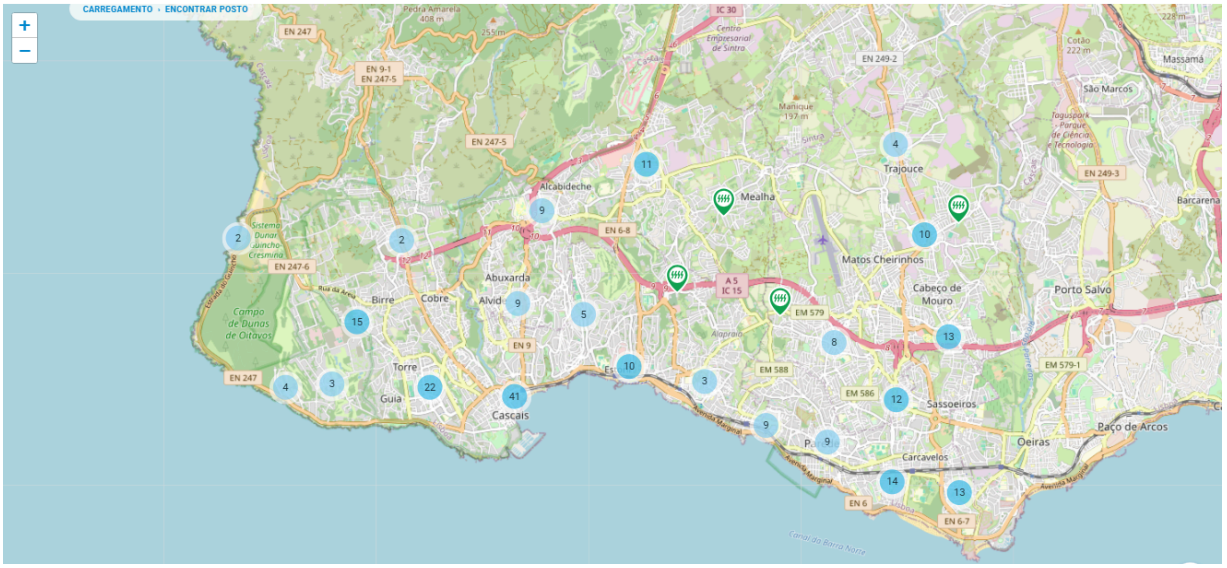
[29] https://www.cascais.pt/sites/default/files/anexos/gerais/new/pdu_cascais_fase_iv.pdf

Figure 51: Open car parks tariffs according to each axis[30].

[30] https://www.aeccascais.org/wp-content/uploads/2018/12/Estacionamento-Controlado.pdf

Electric Vehicles and Electric Charging

Map 7 shows the availability of public EV chargers in the municipality.



Map 7: Charging stations' location[31].

Modal distribution for students commutes in Cascais municipality

The results of "Hands Up Cascais 2024" survey are shown in **Figure 50**.

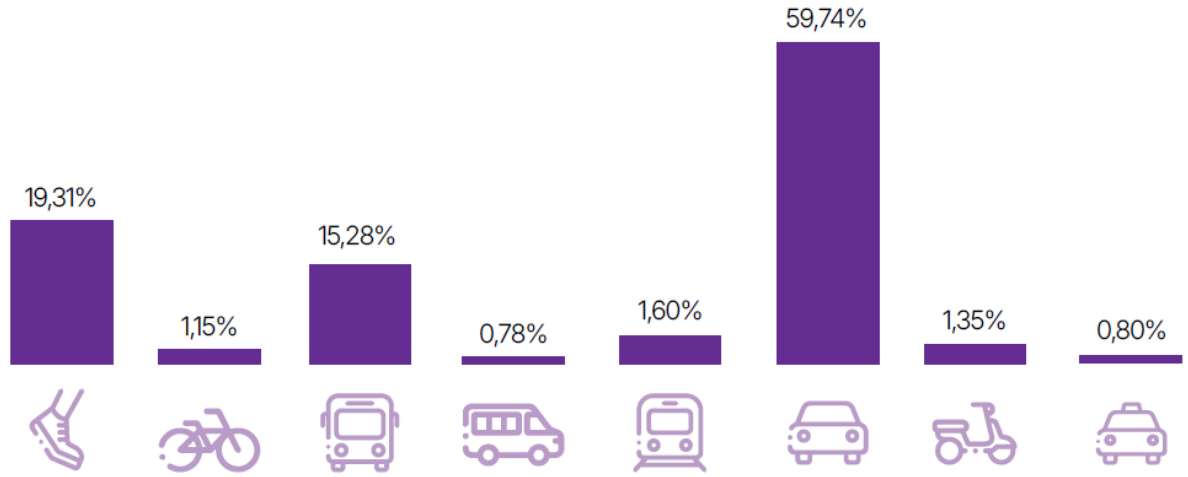


Figure 52: Modal distribution of transports taken to go to school[32].

31 https://mobie.pt/pt/redemobie/encontrar-posto#_com_liferay_iframe_web_portlet_IFramePortlet_INSTANCE_qzmv_=find-station

32 https://www.cascais.pt/sites/default/files/anexos/gerais/new/2025_educacao_maos_ao_ar_resultados_inquerito.pdf

About Re-Value – Re-Valuing Urban Quality & Climate Neutrality in European Waterfront Cities

The Re-Value partnership consists of nine European waterfront cities and selected European organisations that work to make the urban transition irresistible for everyone. This is done by demonstrating how climate neutrality and urban quality can be aligned, by re-valuing the cities' connection to their waterfronts, strengthening co-benefits and mitigating potential adverse impacts.

Ålesund (Norway), Bruges (Belgium), Burgas (Bulgaria), and Rimini (Italy) demonstrate how integrated urban planning and design can be optimally deployed to achieve climate neutrality and significantly reduce GHG emissions by 2030. In addition, Cascais (Portugal), Constanța (Romania), İzmir (Türkiye), Písek (Czechia), and Rijeka (Croatia) learn, replicate and develop their own participatory story-building, data-driven scenarios, and financial and partnership models on integrated urban planning and design to accelerate their journeys to climate neutrality.

The partnership is coordinated by the Norwegian University of Science and Technology (NTNU) and is funded by the European Union's Research and Innovation funding programme Horizon Europe under grant agreement 101096943.

Learn more about the partnership and the outcomes on re-value-cities.eu.

Partners

Funded by the European Union

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