

The Carcavelos Pilot, Portugal

AdEPorto/ EDP New, Matosinhos, Portugal

<https://www.prolight-project.eu/demo-case/matosinhos-portugal/>



Overall summary:

The Portuguese pilot, located in the municipality of Matosinhos, a coastal city in the district of Porto, Portugal, will focus on the Carcavelos social housing district. Carcavelos is divided into two building blocks, including 278 dwellings and several small businesses (ground floor), and was built on the decade of 1980. These buildings were deeply refurbished in 2021 in an investment of almost four million euros, considerably improving the housing conditions. The overall goal is to take advantage of the extensive rooftop areas of several municipal buildings in the area, produce renewable electricity for self-consumption and share surpluses with nearby entities, taking advantage of the existing mobility charging infrastructure, exploit local demand-side management options and evaluate storage possibilities.

As for the surrounding urban context, Carcavelos is located in the central and multifunctional area of the city of Matosinhos, which integrates housing, commerce, public equipment and public spaces and where the Matosinhos Living Lab is located. The overall objective of the city living lab is to create a smart neighbourhood, as a low carbon space, resilient, accessible, participated and connected. It aims at testing technological solutions for low-carbon, energy efficient and reducing pollutant emissions. It acts in areas such as



mobility and transport, buildings, environmental innovation, and the promotion of circular economy, to decarbonize the city. Real context tests are performed for challenges like parking management, bike sharing, electrification of the fleet, traffic monitoring. Besides decarbonizing the city, the project's goals include decreasing energy consumption, providing a testbed for solutions that can be scaled to the whole city, to other cities and eventually to other countries, having a more comfortable and sustainable mobility, and promoting the use of renewable energies. Building on this already existing initiative, a positive energy district is being developed in this area including several major facilities, including the Carcavelos neighborhood.

ProLight Demo district – GENERAL DATA

Pilot description and expected performance results (incl. No. of buildings, Building type, Renewables, Others):

Social housing district in an urban location – centre of the city of Matosinhos – with 24325 m² of living area. It accounts with 690 residents spread over 278 dwellings, in 2 blocks, including residential and commercial uses. The preliminary technical studies foresee 212 kWp of solar PV capacity to be installed in the neighbourhood, corresponding to 335 MWh/year of renewable energy production, from which 235 MWh would be self-consumed with the remaining 100 MWh as surplus. The surplus will be shared with nearby entities, taking advantage of the existing mobility charging infrastructure, exploit local demand-side management options and evaluate storage possibilities.

This installation is part of a broader project from the city, which includes the development of a PED.

Climate area, Location urban/suburban, Energy performance [kWh/m²*a]

The Carcavelos' social housing district is located and thoroughly integrated in a central and urban environment, roughly 200m from the City Hall.

The local climate conditions are characterized by low annual temperature ranges, mild summers and winters (ranging from 7°C to 24°C throughout the year, rarely below 2°C or above 30°C). The climate is classified as "Csb" according the Koppen classification.

Carcavelos' buildings already had energy efficiency measures implemented, which improved their energy performance to 140 kWh/m².y (considering indoor heating and cooling and hot water system) of primary energy use, estimated under the Portuguese Energy Certification System following EPBD.



Overview of site specific economic, energy & environmental related indicators of pilot districts.

Key Performance Indicators	Lighthouse district	Expected results
Number of dwellings	278	2 social housing building blocks
Primary energy savings [MWh /year]	235	Energy savings come from self-consumption
Renewable energy production [kWh /year] -> KPI5 in the project	35 MWh/y	212 kWp solar PV panels
GHG emission savings [TnCO ₂ eq/year]		60
Number of TRL 6 to TRL 8 technologies	7	
KPI7: Investment costs [Euro/m ²]	Technical studies are still under analysis. Estimated investment costs: 255 000 € (around 9,25 €/m ² ; only for Carcavelos)	For PV, an average cost of 1200€/kWp was considered. This value can be reduced if the tender is developed for all PED facilities.



ProLight figures for the New European Bauhaus

Carcavelos, Portugal

278 dwellings

690 residents

Integrated Renovation Status: Energy efficiency measures were implemented prior ProLight, including wall insulation, windows replacement, roof insulation and electric water heaters replacement. A 212 kWp PV system is foreseen to be implemented, as well as further measures already discussed in the current template.

Livability: Energy efficiency measures improved significantly the thermal performance of buildings and the comfort of the residents. In top of that, renewable energy production will help these citizens (in already deprived social conditions) to reduce their energy bills, which will allow them to improve their overall economic and social conditions.

Technological advancement: Carcavelos will be part of a large-scale REC built on the already existing city living lab, contributing to the creation of a positive energy district in Matosinhos' city center. Short-, medium-, and long-term city strategies are being outlined based on this project.

Social Innovation/Business Models: Developed tools will also help to raise awareness & promote individual behavioural change in both residents and public buildings users, taking advantage of the co-creation & integration initiatives. This project is especially relevant in supporting and generating valuable information in evaluating the solutions scaling up in the social housing stock of the Municipality of over 4607 dwellings at 53 different sites.

Which business model is used (e.g. ESCO, PPP, one-stop shop, others)?

Technical and economic studies are still being developed. Still, two business models are currently on the table. The first one consists of the municipality as investor. In this option, the municipality uses part of the city's budget to fund the installation, self-consumes part of the energy generated in municipal buildings and social housing and trade (sell) the surpluses to local entities (other private buildings), to last resort operators or to electric mobility operators operating within the coverage area of the project. While it could be an interesting model for the city, public procurement rules could hamper it. The second option (more likely) consists of a PPA-type model in which a private entity (external to the municipality and selected based on a public tender) makes the investment in the systems and infrastructure and provides part of the energy generated to the municipality, at a reduced price. In addition, this entity can commercially exploit surplus production, making profit from it.

Utilised financial supporting instruments:

Own funds or private funds (PPA).



Main economic activities in your city/region:

Up until recently, Matosinhos was predominantly an industrialized city with special focus on the fishing industry and sector, petrochemistry and textile. Lately, it has increasingly transitioning to be mainly dedicated to the tertiary sector.

Envisaged local dissemination activities:

Local dissemination activities will be carried out by promoting capacity building and informative sessions with local residents to explain them the advantages of PV systems and the energy usage adjustments they can make in order to maximize the benefit of PV production (e.g. time shifting the operation of washing machines to periods of sun availability).

LEGISLATION

How are energy communities regulated in your country/region?

Renewable Energy Communities (REC) are regulated by the Decree-Law 15/2022 (DL15/2022), that follows and transposes the EU Directive 2018/2001. According to this document, Portuguese REC have the possibility to:

- Produce, consume, store, buy and sell renewable energy with their members or with a third party;
- Share or commercialize between their members the energy generated within their premises;
- Access every energy market, including the system's services, both directly and through aggregation.

Moreover, DL15/2022 introduced the definition of Citizens Energy Communities

MAIN ACTORS INVOLVED, STAKEHOLDERS

Local stakeholders and partners:

AdEPorto – facilitator among the parts and responsible for the PV studies, EDP-New – R&D and technical consultant, MatosinhosHabit (Municipality services) – social housing managing entity - and Residents, interested parties as final recipients of the implemented solutions.



What are the advantages that the stakeholders may have when they contribute to or are involved in the project?

The exploration of a large-scale REC serving as a fundamental layer for the development of a Positive Energy District comes out as a very good opportunity to deploy new technical knowledge and business models with a mix of public and private entities that would enrich the output solutions. Also, the fruitful collaboration between the stakeholders presents as a very good opportunity to obtain experience and knowledge on working in such a hot topic that would enable replicability opportunities in other projects. Further advantages are the development of the community's energy sustainability awareness, engagement and contribution, while also reaping the potential savings and increasing indoor environmental quality.

REQUIREMENTS

Energy poverty (redistribution of benefits)

- How do you address energy poverty?
- How do you redistribute the benefits generated by the project to the tenants?
- How do you prevent gentrification after the renovation?

Response: The project intends to address energy poverty through capacity building sessions, which intend to improve the energy literacy of its participants, as well as to shift their day-to-day behaviour to consume energy in an efficient way. Moreover, it foresees the implementation of solar PV panels, which will enable energy and financial savings to residents. The business model is still under analysis, however, from the analysis of other similar projects, the benefits distribution should be fixed, meaning that the energy generated in the PV system is shared according to a fixed allocation coefficient (an equal amount of energy is provided to each dwelling).

As for the possible gentrification issue, it should be noted that Carcavelos is a social housing neighbourhood owned by the municipality and the families allocated to occupy these buildings were not chosen based on their age, gender, sexual orientation, or race, but rather the family's income and composition, prioritizing the ones in most need. Thus, it is assumed that there's little to no risk of gentrification.

Energy communities (ict and/or social driven)

- How your project promotes the activation of energy communities based on ICT and Social Innovation?

Response:

- The project promoted the activation of energy communities based on ICT since a comprehensive ICT infrastructure (e.g. smart metering network) is required in order to keep track of energy flows;
- Regarding the social side, the project intends to contribute to the mitigation of potential energy poverty issues, reduction of energy literacy levels and improvement of the sense of belonging.



New European Bauhaus

How your city – or local context hosting the project – is promoting the New European Bauhaus concept?

1. sustainability, from climate goals, to circularity, zero pollution, and biodiversity
2. aesthetics, quality of experience and style, beyond functionality
3. inclusion, from valorising diversity, to securing accessibility and affordability:
 - a. reconnecting with nature:
 - b. regaining a sense of belonging:
 - c. prioritising the places and people that need it most:
 - d. fostering long term, life cycle and integrated thinking in the industrial ecosystem

Response:

1. The Portuguese lighthouse district will form a REC, which will be a part of a PED. These new structures will enable its participants to save energy, reducing the GHG emissions.
2. Some residents of the Carcavelos neighborhood will be a part of the demand response activities, which will not only improve their energy literacy, but also influence their behaviors towards more efficient utilization of energy. This experience and acquired knowledge will contribute to the quality of experience.
3. As the project will be implemented without the investment of residents, in addition to not being excluded from an initiative that could be denied to them due to the lack of investment capacity (accessibility), the residents of the neighborhood of Carcavelos also benefit financially from the installation to be made by reducing their electricity bills.
 - a. Not applicable.
 - b. Residents from social housing neighborhoods were, since their beginning, subjected to social exclusion from several factors, including: the people's unattachment to the location generate uprooting; lack of intervention at a social action level; architecture homogeneity and lack of quality of the construction materials; and lack of maintenance. We believe that this unattachment and lack of sense of belonging will be improved by tackling some of these factors: 1) the energy efficiency measures recently implemented will contribute to the comfort and reduction of energy poverty; 2) the participation of some residents in the demand response activities will improve the energy literacy and influence the behavior of the participants, improving the quality of life; the notoriety of the project will contribute to the sense of proudness to the neighborhood's residents.
 - c. The very basis of the project is the improvement of the quality of life of the Carcavelos' residents, while serving as a replicability example to other similar neighborhoods.
 - d. By participating in the project, the Technical partners will gain integrated insights regarding the relationship between their technical solutions and the real time impact or eventual barriers they might have in the demo district's community.



AMBITIONS

What are the demos' visions?

Matosinhos' demo is part of a broader strategy of the Municipality which has the ambition to become carbon neutral by 2030. Thus, this implementation is the beginning of a city-wide plan which aims to expand to other parts of the city, transforming all municipality-owned buildings and facilities into renewable energy production hubs. This ambition and long-term vision is reflected in the municipality 2030 SECAP.

Do you have a statement, which?

First big-scale municipal REC in the municipality.





ProLight

ProLight – Better quality of life and affordable housing: Our smart neighbourhood approach will be demonstrated in 6 European Lighthouse and pocket districts, and the results will provide blueprints for replication.

Analysed districts include:

- Building and renovating in an energy and resource efficient way in [Austria](#), [Finland](#) & [Greece](#).
- Energy communities in [Spain](#), [Italy](#) & [Portugal](#) combined in so-called Innovation clusters

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