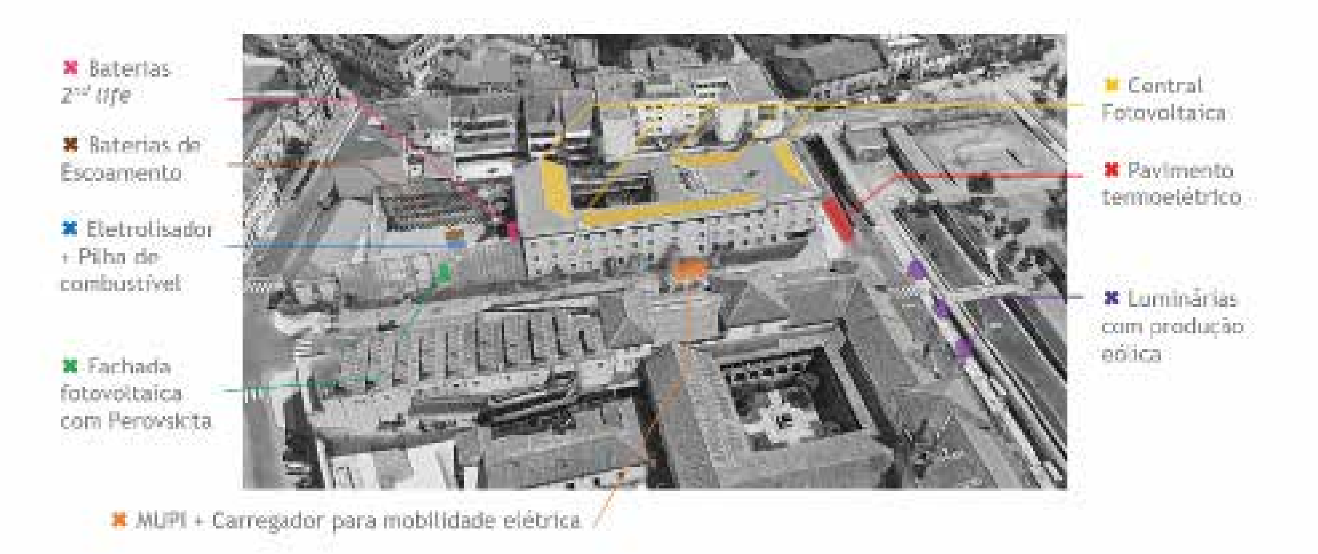
BATERIAS 2030



In the scope of Baterias 2030 project, joint efforts between academia and industry have the ambitious objective of setting a functional urban green power laboratory in Braga, to prove that cities can play an active role in the renewable production of their own energy. A way to achieve this ambitious goal is to store wind/solar-produced electricity as hydrogen via water electrolysis, with oxygen being produced as the only by-product. Hydrogen can be used as an energy vector and as a green alternative to natural gas or oil, since, upon usage, it only releases H_2O as exhaust instead of CO_2.

The Nanomaterials for Energy Storage and Conversion (NESC) group, in tight collaboration with the Laboratory for Process Engineering, Environment. Biotechnology and Energy (LEPABE - FEUP), are working to develop catalytic materials for polymer electrolyte membrane (PEM) water electrolysers, which are essential components governing the electrochemical performance of the electrolyser.

The main obstacle for the widespread deployment of PEM water electrolysers is the use of platinum group metals (PGM) catalysts on the electrodes. Platinum (Pt) is normally employed as hydrogen evolution catalyst, while iridium (Ir) composites are commonly used as oxygen evolution catalysts. Due to the limited availability and high price of PGM, the EU's target for PEM electrolysers is to reduce PGM loading on the electrodes below 400 µg cm-2 by 2030. Apart from maximizing PGM utilisation, a major challenge is to develop materials that can operate for the expected lifetime of the PEM water electrolysers (15-20 years) without a considerable decay in their activity.

Since the kick-off of the project, the NESC group has been working on the development of materials with reduced PGM loading to comply with EU targets, whereas FEUP is responsible for the fabrication and characterization of membrane electrodes assemblies (MEAs). Preliminary results on oxygen evolution catalysts showed that, by dispersing IrOx nanoparticles on electrically conductive metal oxide supports (ATO), the Ir loading on the electrode can be drastically reduced and the catalytic stability remains with no signs of decay compared to the commercial counterpart.

The next step, led by FEUP, is to test the long-term stability of developed materials through accelerated stress tests and to use the oxygen evolution catalysts to fabricate MEAs with ultra-low PGM loadings. The best formulation will be employed in a PEM electrolyser stack to integrate into a 10 kW H2 pilot-scale demonstration unit by the end of Baterias 2030 project.

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