

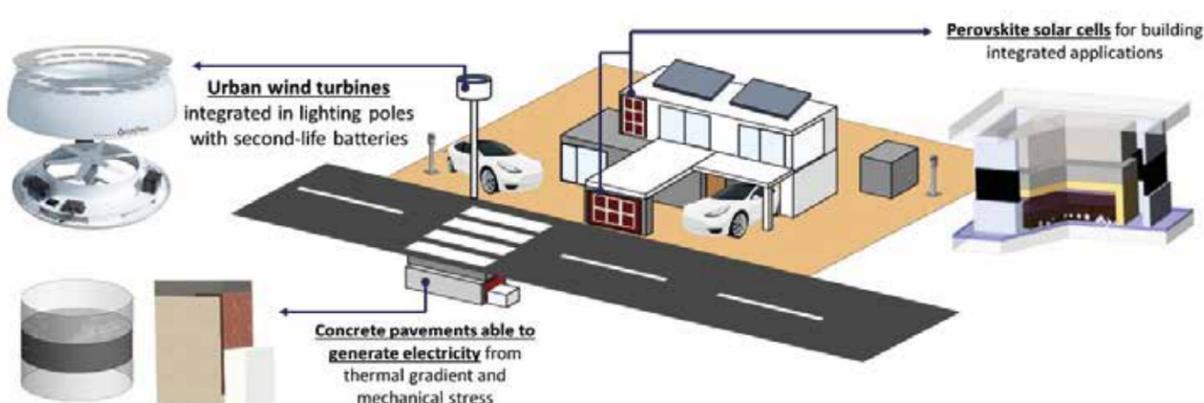


BATERIAS 2030

Technologies for decentralized production

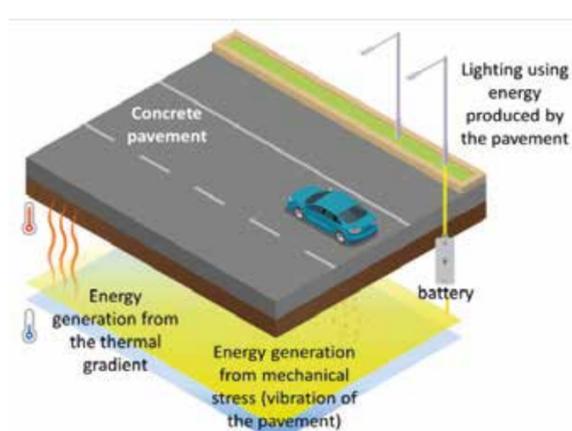
Our society faces the enormous challenge of decarbonisation, aiming to achieve sustainable development and ensure proper life quality standards for future generations. The accelerated global warming has resulted in extreme and unpredictable weather events, with Portugal being seriously affected by heat waves, droughts, and wildfires. As the global energy demand is planned to continue increasing, it becomes imperative to raise the share of renewables in the energy mix. Also, the recent brutal rise in energy prices has demonstrated how important energy resilience and independence are, especially for European countries, where imports of fossil fuels remain a heavy burden. Portugal is quite exposed to this situation, given the vulnerability of its industry and household sectors. Hence, decentralized energy production from renewable sources and emerging technologies is a unique opportunity for Portugal to become more competitive and resilient.

Within Baterias 2030, dst solar, INL, LNEG, UPorto, bysteel, Omniflow, CeNTI, Secil and UMinho are working on the scientific and technological development of decentralized energy production technologies, based on renewable sources, capable of generating electricity for low consumption components. This strategy focuses on three main technologies: perovskite solar cells, urban wind turbines integrated in smart IoT lampposts, and concrete pavement systems capable of generating electricity from mechanical stress and/or thermal gradients.



Perovskite solar cells (PSCs) are one of the most promising emerging photovoltaic technologies. The light to power conversion efficiency of laboratory devices has increased from 3% in 2009 to 25.5% in 2019, the highest value for thin-film photovoltaics, demonstrating a remarkable advancement over 10 years. Also, these cells have a great potential for building integrated applications, a key element for decentralized production. Unfortunately, there are several factors delaying their arrival in the energy market, namely the lack of stability, the need to replace and/or mitigate lead and the upscaling without losses in efficiency. Baterias 2030 is working on the advanced characterization and optimization of key layers of these cells and on the chemical neutralization and replacement of lead, while improving manufacturing processes, to build a 1 x 1 m2 panel comprising highly stable laser-encapsulated perovskite solar cells.

In the urban context, it is essential to integrate decentralized production technologies into completely transversal, consensual and widely used elements, such as lighting poles. Baterias 2030 is exploring the incorporation of second-life batteries in smart IoT lampposts equipped with urban wind turbines and solar cells, making them independent from the grid. Hence, lampposts can be charged during daytime with the energy produced from bidirectional wind turbines and solar panels and then light the street during the night using green energy. Better still, other functional elements can be added to these lampposts, such as video surveillance cameras, charging stations and 5G WiFi.



Cities have vast paved areas, which did not pass unnoticed for Baterias 2030. The consortium found this to be an excellent opportunity to explore microgeneration in pavement blocks for decentralized production capable of supplying signage, emergency equipment, etc. The consortium is studying and building prototypes with different configurations of concrete blocks that incorporate thermoelectric and piezoelectric generators, capable of producing electrical energy from the thermal gradient or mechanical stress, respectively.