

DECARBONIZATION OF URBAN CENTRES THROUGH SMART ENERGY MANAGEMENT AND ELECTRIC MOBILITY STRATEGIES: A CASE STUDY IN GUIMARÃES, PORTUGAL

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Summary: There is no deny that the carbon neutrality goals imposed by governmental agencies are increasingly more important to address the problems inherent with the climate crisis registered across the world. In urban centres, this matter is even more challenging, with a constant demographic migration from rural to urban areas, resulting in the overload of the energy infrastructures of cities and, consequently, inducing a greater energy consumption and greater levels of GHG emissions.

From the general carbon footprint registered in the city, the transport sector contributes to around 30% of total registered emissions in Europe, of which 70% are related to road transportation methods (public and private), due to the continuous use of internal combustion engines to allow for the transportation of individuals across multiple points of interest in an urban area.

Therefore, the use of electric solutions to address the emissions in the transport sector have become the focus of governments, by imposing its usage and dissemination at a larger scale, due to their zero tailpipe emissions characteristics. However, the sole usage of these drivetrains to mitigate emissions in cities is not enough to fully address the problem, due to sectors such as the building sector, that overcompensates the benefits of such systems in the overall scenario on carbon emissions reductions.

As such, the implementation of Vehicle to Everything systems (V2X) in urban centres has proven to combine the benefits of the electric mobility into the building sector, by transforming the vehicle into an energy storage systems that can provide energy to buildings in non-use periods, thus eliminating the necessity to draw energy from the electrical grid to power electrical systems in the building itself, reducing the overall carbon impact of the system.

As such, this work aims to address the energy benefits of a V2X system in the city of Guimarães, focused on the city centre, with areas with different socio-economic and demographic aspects. The characterization of the urban mobility in the designated areas will be made, in both public and private road transportation, to address the impact of current mobility systems in the overall efficiency of the system. This will enable an integrated framework of building energy models to evaluate implementation of passive and active solutions with electric mobility adoption assessment, towards reductions in energy consumption across the neighbourhoods and, consequently, GHG emissions. Amongst the various solutions, the adoption of Renewable Energy Systems will be considered for the building sector, as well as the adoption of public energy storage systems to store excess energy, combined with the sue of electric vehicle, when adequate. This integration will rely on an energy consumption optimally managed between the various sectors.

The results drawn from this work will be provide a framework for both users and governmental agencies to make decisions on energy management of urban infrastructures, paving the way for future decisions regarding energy saving and GHG emissions mitigation.