

SETTING A CITY STRATEGY FOR LOW CARBON EMISSIONS: THE ROLE OF ELECTRIC VEHICLES, RENEWABLE ENERGY AND ENERGY EFFICIENCY

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ABSTRACT

One of the European policy objectives, as envisaged by the EC Transport White Paper, is to reduce Europe's dependence on imported oil and to cut greenhouse gas emission (GHG) from transport by 20% by 2030 and by 70% until 2050 (with respect to 2008 levels). For achieving this goal, the role of integrated energy and urban mobility systems are explored as part of a city's strategy towards sustainability (2011-2020). For developing future scenarios, we used best practice foresight analysis methods, where the desirable future relates to European policy goals. In this research we adapt the extended metabolism model of a city developed by Newman (1999) and the material and energy flow accounting by Sheeri (2002) to assess the future role of electric vehicles, renewable energy use for mobility needs and energy efficiency increases for households living in the city of Aveiro, a medium-sized city of 78450 inhabitants in Portugal. The social costs of carbon related to alternative vehicle technologies (electric vehicles) are assessed, along with the integration of renewable energy. Several energy sources were considered: hydric, wind, solar (thermic and photovoltaic) and solid waste (incineration and biogas). A Life-Cycle Assessment (LCA) analysis was performed for this estimation, where a share of 56% of renewable energy was assumed to be achieved until 2020. It was found that each battery electric vehicle (BEV) and use of renewable energy has an external cost associated to climate change of 0.032 €/1000pkm in 2011 and 0.012 €/1000pkm in 2020. For the city of Aveiro, this represents an external cost of 7094 € in terms of CO₂ related emissions in 2020. If all conventional fuelled vehicles were replaced by electric bicycles (EBs), an energy reduction of 98.1% and an emission reduction of 3893 kg CO_{2eq} per year (avoided CO_{2eq} external costs of 5.96M€) could be achieved.

Keywords: battery electric vehicles and electric bicycles, renewable energy, energy efficiency, European transport policy and planning, CO₂ emissions, climate change costs, traffic calming measures.