Energy and Environmental Life Cycle Assessment of Asphalt Pavements: A Scenario Analysis for Urban Roads

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Abstract
Climate change calls for significant actions to match sustainable development goals, targeting energy consumption and environmental impacts.
In this context, road construction and management play a relevant role. The European Commission document 'EU Green Public Procurement Criteria for Road Design, Construction and Maintenance' proposes a set of environmental criteria to use in public procurement and road constructions.
In Italy, the Minimum Environmental Criteria (CAM, in Italian) are under definition and aim at applying the Green Public Procurement (GPP) to the road sector.
The Growing relevance of *green products* is confirmed by the rising number of published Environmental Product Declarations - EPD®, which aim at providing experts and scientists with information on the environmental impacts of a road, according to a life-cycle approach.
To this end, the role of the Life Cycle Assessment (LCA) methodology is broadly recognized, in order to assess resource use, energy, and environmental burdens related to the full life-cycle of roads.
Based on the above, this study aims at calculating the life-cycle energy and the environmental impacts pertaining to roads management, including materials production, transportation, construction, maintenance, and rehabilitation.
LCA approach is applied to assess energy and environmental impacts of a typical Italian urban road, according to the ISO 14040 series. In more detail, starting from a reference case, involving the use of standard paving materials and traditional technologies in plant, the Authors assess the energy and environmental profile of two alternative scenarios of bituminous mixtures, containing recycled materials, such as reclaimed asphalt pavement (RAP) and waste plastics. A scenario analysis is carried out in order to identify the less impacting scenario from an energy and environmental point of view. For each analysed scenario, the contribution of each life-cycle step to the total impacts and the energy and environmental hotspots are identified in order to define suitable options of improvement.
Authors hope that their contribution could provide a systemic approach for energy and environmental assessment for the sake of all stakeholders, in order to support the development of new models of low-carbon and low-energy consumption and innovative production models.