CERIS : Civil Engineering Research and Innovation for Sustainability

Optimization of urban railway stations on energy, resources and air quality management

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Summary

The United Nations 2030 Agenda for Sustainable Development establishes goals for reversing the increase in environmental pressures, air pollution and Climate Change derived from human activities such as transportation. The outlining of these targets, alongside the new concerns regarding human health and safety which followed the COVID-19 pandemic, created the need to re-think urban infrastructures, such as railway stations, to improve sustainability, create high-quality indoor environments and optimise use of resources. However, decisions on such transformations carry a high degree of uncertainty, as they are dependent upon context. The Thesis intends to tackle this problem by presenting a methodology and a set of guildelines to assist decision-making in the improvement of energy, resources and air quality management in urban railway stations.

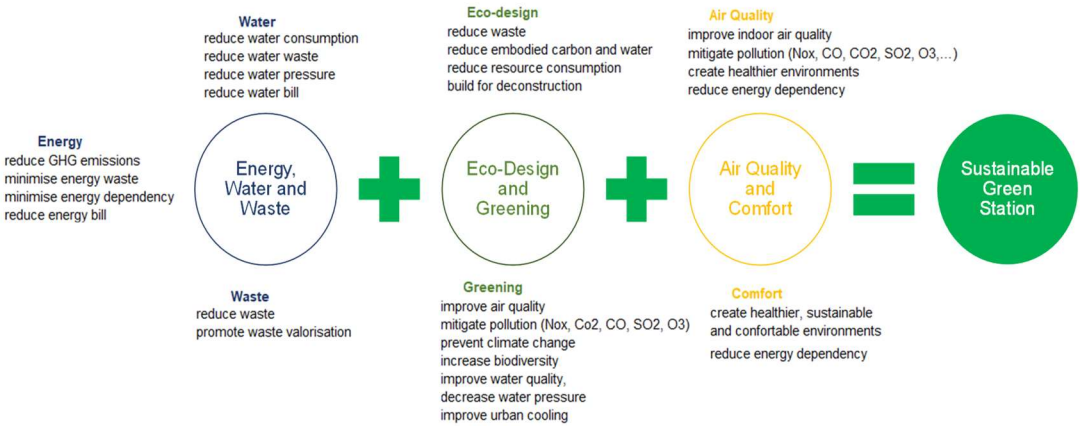
The methodology will be structured in three steps: the first step will focus on characterising the background in which stations are settled and identifying the key stakeholders to consider in decision-making. The second step will perform a Sustainable Performance Assessment, to analyse a series of pre-established parameters related to energy, water, waste, eco-design, greening, air quality and comfort inside the stations, assessing their current strenghts and weaknesses. The third step will involve testing alternative scenarios to select optimal solutions for improvement, combining Multi-Criteria and Cost-Benefit Analysis to identify the strengths, weaknesses, costs and benefits associated to each alternative.

A case-study is being performed in an urban railway station located in Lisbon, Portugal. Preliminary results, based on field observations and surveys to station's users, confirmed the station has an important distributional role within the city and can therefore be efficient in promoting a shift from road to rail, which is important to fulfil the sustainable mobility targets; however, in order to maximise its potential, the comfort and sustainability, the conditions inside the building need to be highly improved.

Final results are expected to deliver a case-by-case performance assessment and provide the best-fit, most cost-effective solution for improvement, taking into account the station context and stakeholders' needs. This is expected to reduce the time and cost associated to such processes and promote the creation of more sustainable and healthier indoor environments, increasing the attractiveness of railway transport and helping achieve the targets set out by the United Nations.

Keywords

Railway stations, greening infrastructures, wellbeing, sustainability, air quality, optimisation.



Guidelines to build a Sustainable Green Station.