CERIS Civil Engineering Research and Innovation for Sustainability

Toward sustainable urban transportation; models and methods for optimizing fleet structure in urban transportation

PhD student
Parisa Ahani

PhD program
Sustainable Energy Systems (IST, University of Lisbon)

Supervisor
Amilcar Arantes (CERIS, IST, University of Lisbon)

Co-supervisor
Sandra Melo (CEiiA, Center of Engineering and Development, Matosinhos, Potugal)

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Summary

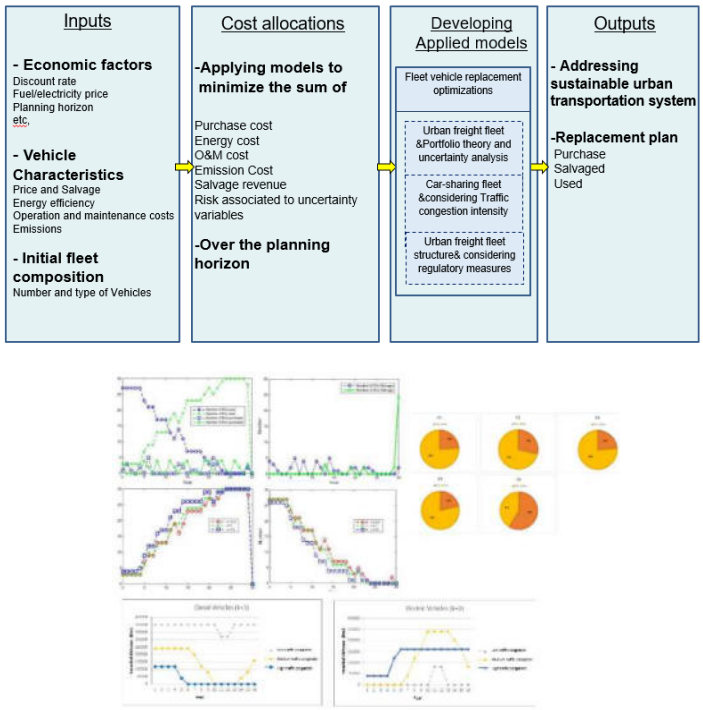
Due to the growth and high fluctuation of oil price over the last two decades, planning and management of urban logistics are of central importance. Also ever-growing mobility and traffic congestion within urban areas make the need for a sustainable form of transport inevitable. Congestion level has a significant effect on the amount of energy consumption of a vehicle and as a result on its associated environmental impacts.

A shift toward sustainable modes of transportation such as electric vehicles can ease the negative impacts associated with conventional vehicles. Unsustainable transportation issues can be solved not only by technological changes, but through a combination of different policies of urban planning, transport planning, urban design, and technological changes. In this regard, fleet replacement management as one of the main components of transportation management, along with other transportation management functions (such as supply chain management, fuel management, traffic management, and so on), allows transportation companies to minimize the risks associated with vehicle investment, improving efficiency, productivity, and lowering overall transportation costs.

The focus of the thesis is to assist a decision-maker to make optimal decisions for structuring its fleet using vehicles of different types and sizes while minimizing the total cost and maximizing profit. And any decision-making regarding structuring a fleet without taking into account the traffic congestion level will lead to a less sustainable fleet with higher environmental and economic costs. Optimization frameworks are developed along with analysis of the risk associated with uncertainty in some of the decision variables. The developed models determine the best combination of vehicles for an urban transportation operator over some planning horizon, while benefiting both private and public stakeholders.

Keywords

Sustainable transportation system, sustainable city, developing optimisation models, urban freight transportation, regulatory measures, traffic congestion intensity, portfolio theory, risk analysis, replacement decision.



Structure of process for developing different optimization models for vehicle replacement and composition problem.