Announcing the Final Examination of Burak Sen for the degree of Doctor of Philosophy

Time & Location: March 30, 2020 at 11:00 AM in Online

Title: An Investigation of Life Cycle Sustainability Implications of Emerging Heavy-Duty Truck Technologies in the Age of Autonomy

Heavy-duty trucks (HDTs) play a central role in U.S. freight transportation, carrying most of the goods across the country. The projected increase in freight activity (e.g. truck-miles-traveled) raises concerns regarding the potential sustainability impacts of the U.S. freight industry, marking HDTs as an ideal domain for improving the sustainability performance of U.S. freight transportation. However, the transition to sustainable trucking is a challenging task, for which multiple sustainability objectives must be considered and addressed under a variety of emerging HDT technologies while composing a sustainable HDT fleet. To gain insights into the sustainability implications of emerging HDT technologies as well as how they can be adopted by freight organizations, given their implications, this research employed an integrated approach composed of methods and techniques, grounded in sustainability science, operations research, and statistical learning theory, to provide a scientific means with public and private organizations to increase the effectiveness of policies and strategies. The research has contributed to the scientific body of knowledge in three useful ways; (1) by comprehensively analyzing HDT electrification based on regional differences in power generation practices and price forecasts, (2) by conducting the first life cycle sustainability assessment (LCSA) on HDT automation and electrification, and (3) providing a case study of an machine learning application for sustainability science. Consequently, the research has found that, given the transformation of the U.S. energy system towards renewables, automation and electrification of HDTs offer significant potential for improving the sustainability performance of these vehicles, especially in terms of global warming potential, life cycle costs, gross domestic product, import independence, and income generation. The research has also found that, under the prevailing techno-economic circumstances and except for energy security reasons, natural gas as a transportation fuel option is by almost no means a viable alternative to diesel.

Major: Civil Engineering

Educational Career:
Bachelor's of Environmental Engineering, BS, 2011, Sakarya University
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Approved for distribution by M. Omer Tatari, Committee Chair, on March 3, 2020.

The public is welcome to attend.