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 a 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
Master's of Industrial Ecology, MS, 2014, University of Graz & Chalmers University of Technology (Joint Degree)
Master's of Industrial Engineering and Management System, MS, 2, University of Central Florida

Committee in Charge:
M. Omer Tatari, Chair, Civil, Environmental, and Construction Engineering
Amr Olouga, Department of Civil, Environmental, and Construction Engineering, University of Central Florida
Naveen Eluru, Department of Civil, Environmental, and Construction Engineering, University of Central Florida
Qipeng Phil Zheng, Department of Industrial Engineering and Management Systems, University of Central Florida

Approved for distribution by M. Omer Tatari, Committee Chair, on March 3, 2020.

The public is welcome to attend.