National Center for Sustainable Transportation

Project Information Form

Project Title	21st Century Rail Propulsion: A Case Study-Based Analysis and Comparison of Cost and Emissions Across Motive Power Technologies
University	University of California, Davis
Principal Investigator	Raphael Isaac
PI Contact Information	Email: risaac@ucdavis.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	National Center for Sustainable Transportation
Total Project Cost	$ 25,000
Agency ID or Contract Number	
Start and End Dates	Fall 2016 – Fall 2018
Brief Description of Research Project	Simulations of U.S. trains on a number of different fuels have been limited in specificity of route characteristics, in breadth of fuels analyzed, in general transparency, and in comprehensiveness of the emissions analysis. Using actual domestic train route characteristics combined with an advanced single train simulator tool and a bottom-up approach, this study will examine how effective a given fueling technology or technologies-for rail-may be in reducing life cycle (i.e. both fuel cycle and fuel-related vehicle cycle) GHG and pollutant emissions. A cost analysis will then examine the likely costs of ownership to the equipment owners, based on key targets set by government agencies, past cost trends, supply/demand impacts, economies of scale, and incorporation of physical limits on fuel or equipment production. Mid-term and longer term technology options will be considered, general challenges to specific fuels will be discussed, and fuel infrastructure requirements of the various options will be explored. Results will be presented by region and other route characteristics, noting any significant geographical variations in cost/emissions. Expected results may lead to the recommendation of more than one fuel technology, taking into account that the technology choices should be minimal and the recommended technologies able to work in synergy and with minimal time and cost impacts to the rail industry and to government. Analyzed fuels include: diesel-electric with after treatment, natural gas (internal combustion engine) with after treatment, hydrogen fuel cell, electricity via catenary, biofuel (i.e. liquid FT), ammonia (internal combustion engine), and hybridized diesel-electric and hydrogen powertrains.

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Describe Implementation of Research Outcomes (or why not implemented) (Attach Any Photos)	
Impacts/Benefits of Implementation (actual, not anticipated)	
Web Links • Reports • Project website	https://ncst.ucdavis.edu/research/dissertation/