

## Methods of Analyzing and Comparing the Energy Efficiency of Passenger Rail Systems to Competing Modes

Tyler Dick & Giovanni C. DiDomenico – University of Illinois - RailTEC

Due to growing concerns about the future environmental impact of passenger travel, modal energy efficiency is increasingly important when evaluating benefits and costs of transportation system investment. Since passenger rail systems are often cited as being relatively more energy efficient than other modes, reduced environmental impact is one justification for investment in new commuter rail projects. It is important that studies of purported environmental benefits analyze the energy efficiency of passenger rail systems and competing modes accurately and fairly by clearly defining boundaries that consider the flow of energy through each transportation system. Furthermore, operational practices and constraints of the railway environment can complicate the analysis of energy efficiency, making it important to choose metrics that accurately describe the situation of interest. This research identifies and describes four methods for analyzing the energy efficiency of passenger rail systems. Each analysis method applies to a different stage along the energy flow path to satisfy different objectives for comparison. All four methods are used independently to analyze the energy efficiency of 25 commuter rail systems in the United States. The results obtained via each energy efficiency calculation method are then compared to illustrate how the relative attractiveness of each system can change based on the selected analysis approach. By better understanding the challenges of conducting energy efficiency analyses involving different energy sources and fair comparison methods, industry practitioners can make more informed decisions regarding the most appropriate analysis method for drawing accurate comparisons between rail technologies and competing passenger transportation modes.