



Transportation Seminar Series

Friday, August 29, 2008

4 - 5 p.m. in 240 Bechtel Engineering Center

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An Environmental Life-Cycle Inventory of Passenger Transportation in the United States

Abstract: Energy use and emission factors for passenger transportation modes typically ignore the total environmental inventory which includes vehicles, infrastructure, and fuel production components from design through end-of-life processes. To appropriately mitigate environmental impacts from transportation, it is necessary for decision makers to consider the life-cycle energy consumption and emissions associated with each mode. We created a comprehensive life-cycle energy, greenhouse gas emissions, and criteria air pollutant emissions inventory for the passenger transportation modes of automobiles, buses, rail, and airplanes in the U.S. We find that buses with peak-hour occupancies have the best energy and greenhouse gas performance, followed by rail and air systems, and trailed by automobiles. Air travel is not much worse than rail travel; in some cases even better. Off-peak bus travel is the worst performer.

Inventorying criteria air pollutants yields a different ranking of transportation modes. Total life-cycle energy inputs and greenhouse gas emissions increase by 46% for onroad, 121% for rail, and 24% for air systems over vehicle tailpipe operation primarily due to vehicle manufacturing and maintenance, infrastructure construction, and fuel production. Per passenger mile traveled, total SO₂ emissions are 24 times larger than operational emissions for automobiles. NO_x emissions increase 64% for automobiles, up to 1280% for rail, and 21% for air. Non-tailpipe VOCs are 36% of total automobile and 79% of total rail and air emissions.

Bio: Dr. Chester completed his B.S. at Carnegie Mellon University in 2002 with a double major in Civil Engineering, and Engineering and Public Policy. He went on to complete a M.S. at Carnegie Mellon University the following year in Civil Infrastructure Systems. During his master's program, Dr. Chester performed several research projects including the analysis of cost and scheduling impacts to construction projects and development of a GPS photologging tool for roadway monitoring and construction projects. Additionally, he performed a natural gas fleet-conversion study and cataloged land impacts for U.S. economic sectors for addition to the Economic Input-Output Environmental Life-cycle Assessment tool created by the University. Dr. Chester completed his Ph.D. in Civil Engineering at UC Berkeley on August 15, 2008. The focus of the doctoral work was on energy and environmental performance of transportation systems.

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