5. Energy Efficiency and Environmental Benefits

- Most of the energy consumed in American transportation is fossil fuel (98 percent) and its consumption is vastly skewed to highway vehicle travel.[1]

- The Intergovernmental Panel on Climate Change blames fossil fuel for increasing carbon dioxide concentration in our air.[2]

- Amtrak is 17 percent more energy efficient than either commercial airlines or automobiles. Air travel has an additional disadvantage of radiative forcing, which increases the climate effect of air travel by 2 to 4 times as compared to surface travel.[3]

* BTU stands for British Thermal Unit, a standard unit of energy. Figures listed refer to BTUs used per passenger mile from 2005, the most recent year for which data is available for all three modes.

- Even as it has increased train miles and frequencies in various states (such as California and Illinois), Amtrak has been consistently reducing its consumption of diesel fuel, thanks to improved operating practices and conservation measures. Amtrak's BTU per passenger mile improved from 2,800 in 2003 to 2,760 in 2004, 2,709 in 2005, and 2,650 in 2006. New energy efficient equipment is further improving conservation (e.g., in addition to Acela Express trains' regenerative braking system, Amtrak has acquired new more energy-efficient Auto Train vehicle carriers and is evaluating more fuel efficient switching locomotives).[4]

- Amtrak electrified 156 miles of the Northeast Corridor between New Haven and Boston in 2002, and restored electrified service to the 104-mile Philadelphia-Harrisburg line in October 2006 following a $145 million investment by Amtrak and the Commonwealth of Pennsylvania. The Pennsylvania upgrades replaced 9 diesel powered roundtrip trains per weekday with 12 roundtrip trains powered by electricity; the New England upgrades enabled the introduction of high speed rail service with increased speeds and service frequencies. Most of the the electric power Amtrak uses between New York and Washington is generated from non-fossil fuel sources.

- Passenger rail-driven improvements have helped increase rail line capacity, which benefits freight trains that use the same tracks. Freight rail has a fuel consumption rate 11.5 times more energy efficient on a BTU per ton mile basis than trucks.[5] According to the U.S. Department of Energy, locomotives added at a "record number" in recent years by American freight railroads are significantly improving capacity and business efficiency.[6] A freight locomotive

[1] "Issues in Focus", part of the Annual Energy Outlook 2007, U.S. Department of Energy, Energy Information Administration, p. 44.
[2] Intergovernmental Panel on Climate Change: "Climate Change 2007: The Physical Science Basis." From Summary for Policymakers, formally approved at the 10th Session of Working Group 1 of the IPCC in Paris in February 2007, p. 2.
[3] "Issues in Focus", part of the Annual Energy Outlook 2007, U.S. Department of Energy, Energy Information Administration, p. 44.
[4] Transportation Energy Data Book, Edition 26, 2007, U.S. Department of Energy, Oak Ridge National Laboratory, Table 2.14 for 2003-2005 data; 2006 data is from Amtrak.
[5] "Issues in Focus", part of the Annual Energy Outlook 2007, U.S. Department of Energy, Energy Information Administration, p. 44.
[6] Ibid., p. 40.

moving a ton of freight at an average of 235 miles per gallon in 1980 today moves more than 414 miles per gallon – a fuel efficiency improvement of more than 75 percent.[1]

- While airlines have also seen significant energy-efficiency advances in equipment design, the industry has been forced to meet consumer demand for flight destination and availability with an increasing use of regional jets, which are 40 percent less efficient than narrow-body jets and carry fewer people.[2] The FAA predicts that both large established airlines and their discount competitors will continue to turn to smaller narrow-body aircraft to boost frequency and improve profitability.[3]

- The Texas Transportation Institute found in 2005 that in the 85 urban areas across America it studied, 2.3 billion gallons of fuel were wasted solely due to congestion – enough to fill 46 supertankers or 230,000 gasoline trucks.[4]

- By diverting traffic from highways and the air to a more efficient alternative, railroads save fuel. Amtrak removes 8 million cars from the road and eliminates the need for 50,000 fully-loaded passenger airplanes each year. Passenger rail improvements also benefit freight trains that share the same tracks. A single intermodal freight train can take up to 280 trucks or 1,100 cars off of the highway.[5] Without rail as an option, freight shippers would have to add 50 million additional trucks on the roadways.[6]

- Encouraging cluster development in high-density corridors, Amtrak helps mitigate both identified and indirect sources of air pollution.

- In 2002, transportation vehicles emitted 58 percent of the nation's carbon monoxide pollution, 45 percent of nitrogen oxides, 36 percent of volatile organic compounds, 4 percent of

Railroads: The Best Choice for the Environment
(Emissions Per Ton-Mile)

Rank (1 = Most Desirable)	Oxides of Nitrogen	Volatile Organic Compounds	Particulate Matter	Carbon Monoxide	Carbon Dioxide
1	Rail	Rail	Air	Rail	Rail
2	Water	Water	Rail	Water	Water
3	Truck	Air	Water	Air	Truck
4	Air	Truck	Truck	Truck	Air

Source: Envirotrans [7]

[1] "Overview of U.S. Freight Railroads", Association of American Railroads, January 2007. Page 7.
[2] "Issues in Focus", part of the Annual Energy Outlook 2007, U.S. Department of Energy, Energy Information Administration, p.44.
[3] "FAA Aerospace Forecasts: Fiscal Years 2007-2020," U.S. Department of Transportation, Federal Aviation Administration, p. 32.
[4] "Urban Mobility Information: 2005 Annual Urban Mobility Report," Texas Transportation Institute. From Q&As on the website at http://mobility.tamu.edu/ums/report. See the Q&A "What does congestion cost us?" for both the figures and the analogy.
[5] "Overview of U.S. Freight Railroads", Association of American Railroads (Jan. 2007). Page 6 – it also notes that "a train carrying other types of freight can take up to 500 trucks off of our highways."
[6] STPP "State of Nation's Intercity Rail", Decoding Transportation Policy & Practice #12 (Feb.11, 2004). www.transact.org p. 1.
[7] Association of American Railroads: "Overview of U.S. Freight Railroads" (Jan. 2007), p. 7.

particulates, 78 percent of ammonia, and 5 percent of sulfur dioxide. Highway vehicles accounted for almost all of those carbon monoxide emissions, 78 percent of the nitrogen oxides, and 77 percent of volatile organic compounds.[1]

- Amtrak was an early member of the Chicago Climate Exchange, the world's first and North America's only voluntary, legally binding integrated greenhouse gas reduction and trading system for all six greenhouse gases. Amtrak is trading carbon dioxide credits and committed to a greenhouse gas reduction of 1 percent per year between 2003 and 2006, with an additional 0.5 percent per year between 2007 and 2010.

CARBON EMISSIONS (per passenger mile)	
Rail	.21 kg
Car	.35kg
Air	.48 kg

Emissions factors based on calculations from the World Resorces Institute (WRI) and Carbonfund.org. Calculations assume single-occupant car and the added impact of high-altitude emissions for air.

- Many state investments on behalf of passenger rail have served to benefit freight rail as well. Freight trains are responsible for 6-12 times less pollution per mile than trucks. The EPA estimates that for every mile, a typical truck emits three times more nitrogen oxides and particulates than a locomotive, and much more greenhouse gas.[2]

- Railroads reduce the amount of impervious surface (paved roads, parking lots, and interchanges) required for transportation. Paved surfaces hasten erosion, wash toxic chemicals (including lead, copper, cadmium and zinc) into waterways, alter water temperature and thereby threaten aquatic life, and prevent filtration and recharge of groundwater supplies.[3] Studies have noted that when more than ten percent of the acreage of a water-shed is covered in impervious surfaces, rivers and streams within the watershed become seriously degraded, but damage can be detected with as little as five percent coverage.[4]

- 125 million people in the U.S. lived in areas of non-attainment for national ambient air quality standards in 2003 (non-attainment measures exposure to ozone, carbon monoxide, nitrogen dioxide, lead, sulfur dioxide, and particulate matter).[5] Smog and acid rain damage agricultural crops and damage buildings at a cost of between $2 and $3 billion each year.[6]

Amtrak is an early participant in North America's only legally binding greenhouse gas reduction and trading system, the Chicago Climate Exchange.

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[1] "Transportation Statistics Annual Report", U.S. Department of Transportation, Research and Innovative Technology Administration. Bureau of Transportation Statistics, November 2005, p. 15 "State of the Nation's Intercity Rail," Surface Transportation Policy Project, part of its Decoding Transportation Policy & Practice series (#12), February 11, 2004, p. 2

[2] "Overview of U.S. Freight Railroads", Association of American Railroads, January 2007. p. 7 The U.S. Environmental Protection Agency estimates that for every ton-mile, a typical truck emits roughly three times more nitrogen oxides and particulates than a locomotive."

[3] "Coastal Sprawl: The effects of Urban Design on Aquatic Ecosystems in the United States", by Dana Beach, prepared for the Pew Oceans Commission, 2002, p. 9-10.

[4] Ibid., p. 7

[5] "Table 4-48: Areas in Nonattainment of National Ambient Air Quality Standards for Criteria Pollutants," National Transportation Statistics, U.S. Department of Transportation, Bureau of Transportation Statistics, www.bts.gov/publications/national_transportation_statistics , citing U.S. EPA figures.

[6] "Transportation and the Environment", Surface Transportation Policy Project, undated fact sheet, downloaded March 12, 2007, www.transact.org/library/facthseets/environment.asp