

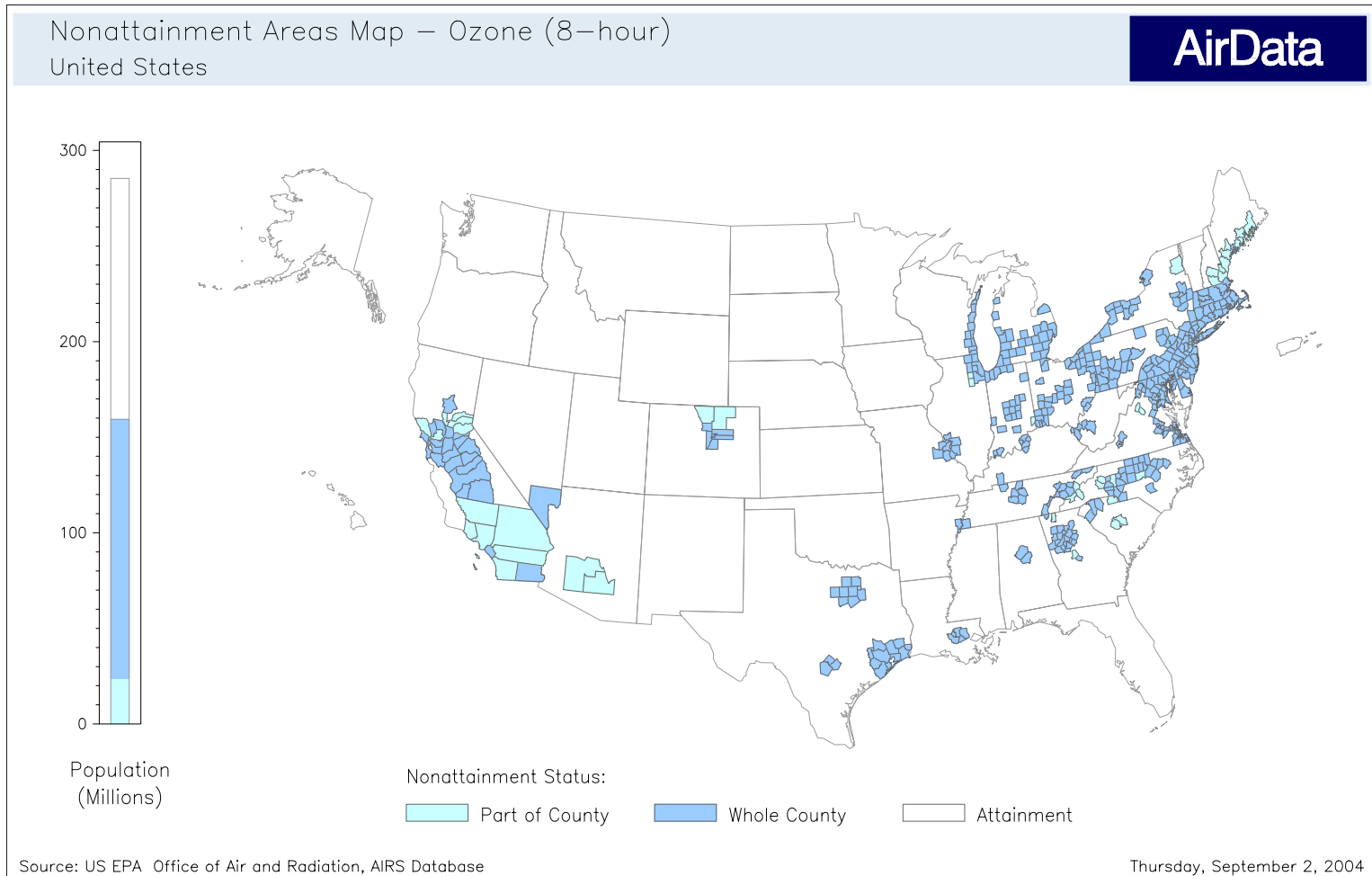
Improving Air Quality, The Freight Railroad Perspective

Mark P. Stehly

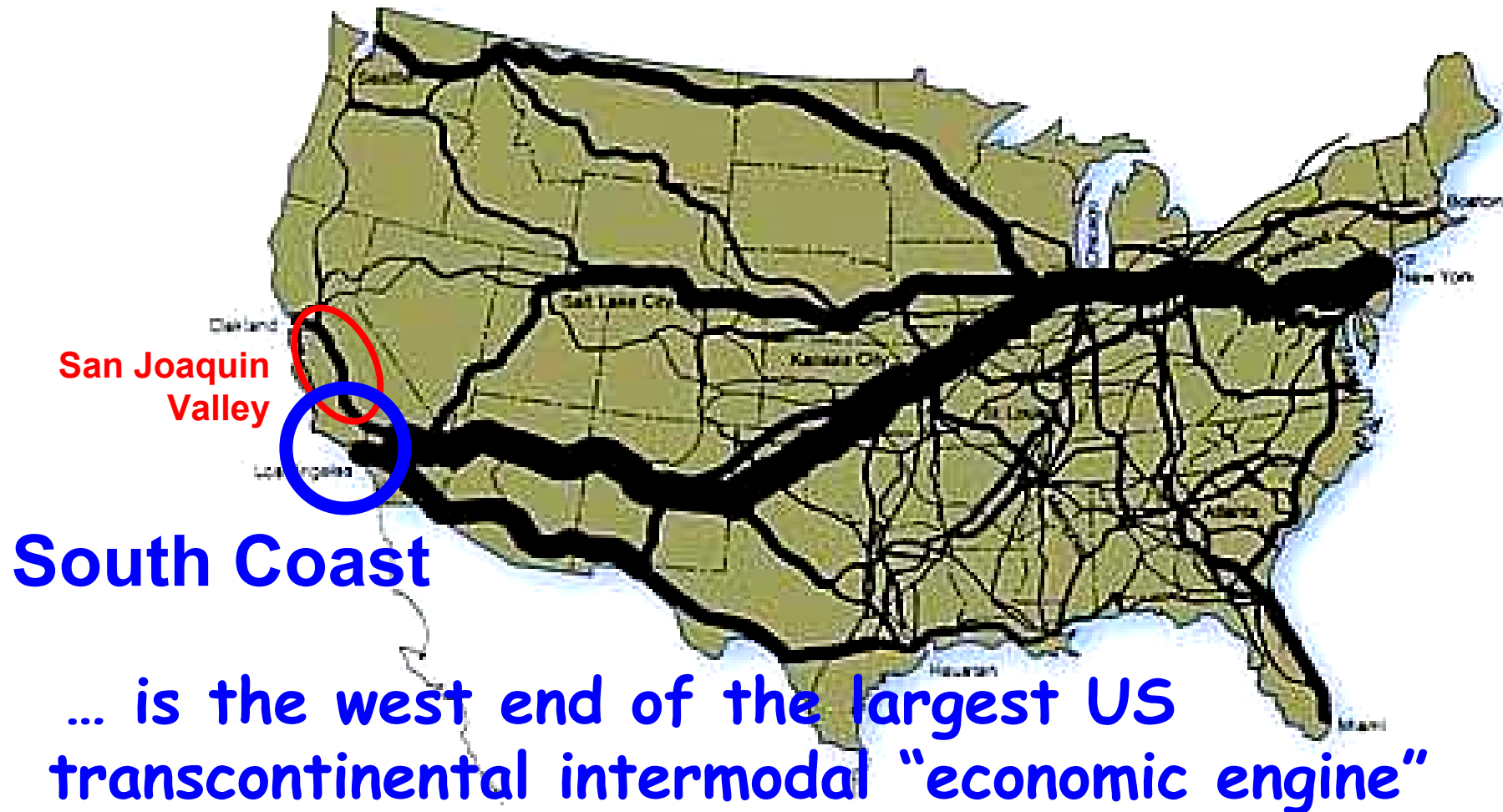
Dec 8, 2004



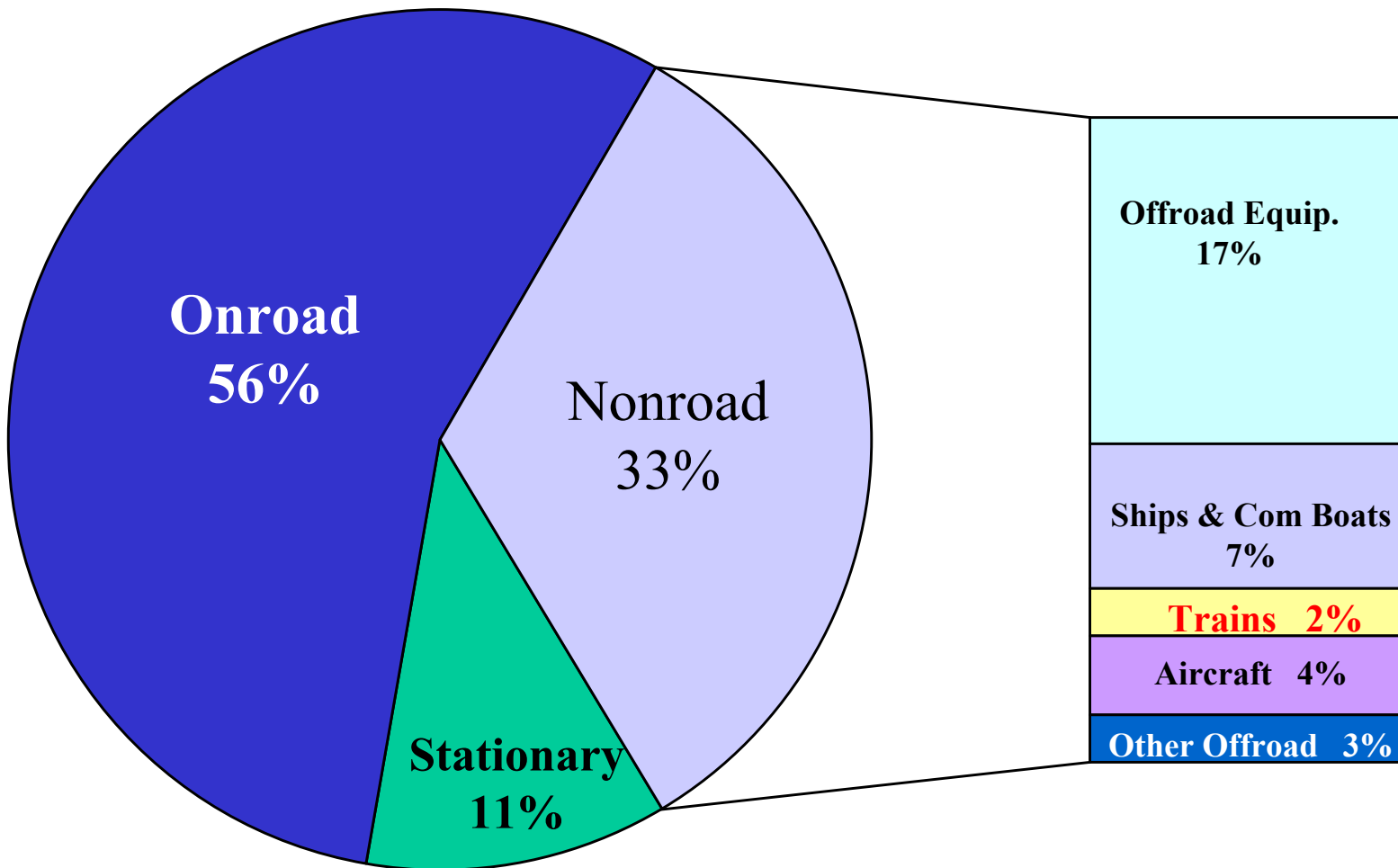
Ozone Non-Attainment Areas



US Railroad Intermodal Flows (car loads) for 2002



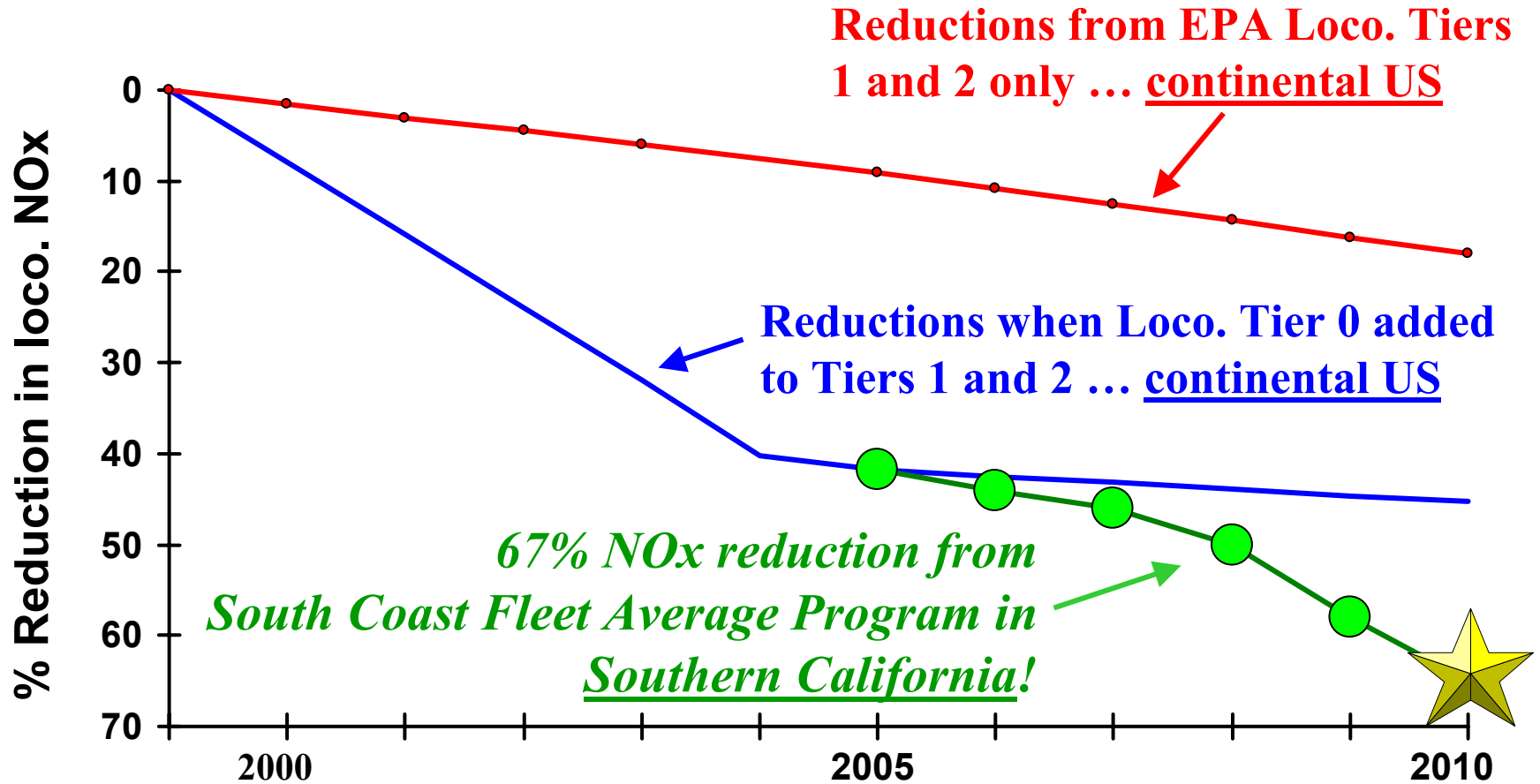
2010 South Coast NOx



What Source is Providing its Fair Share?

	Trucks	Off-Road Equipment	Ships	Aircraft	Urban Buses	Locomotives
2010 NO _x Inventory	21%	17%	7%	4%	2%	2%
Standards for New Units	X	X	X	X	X	X
Retrofit Existing Units					X	X
Rebuild to New Standards						X
In-Use Testing of Emissions						X
Fleet Average for SCAQMD						X

So. Coast Fleet Ave. NOx Reductions



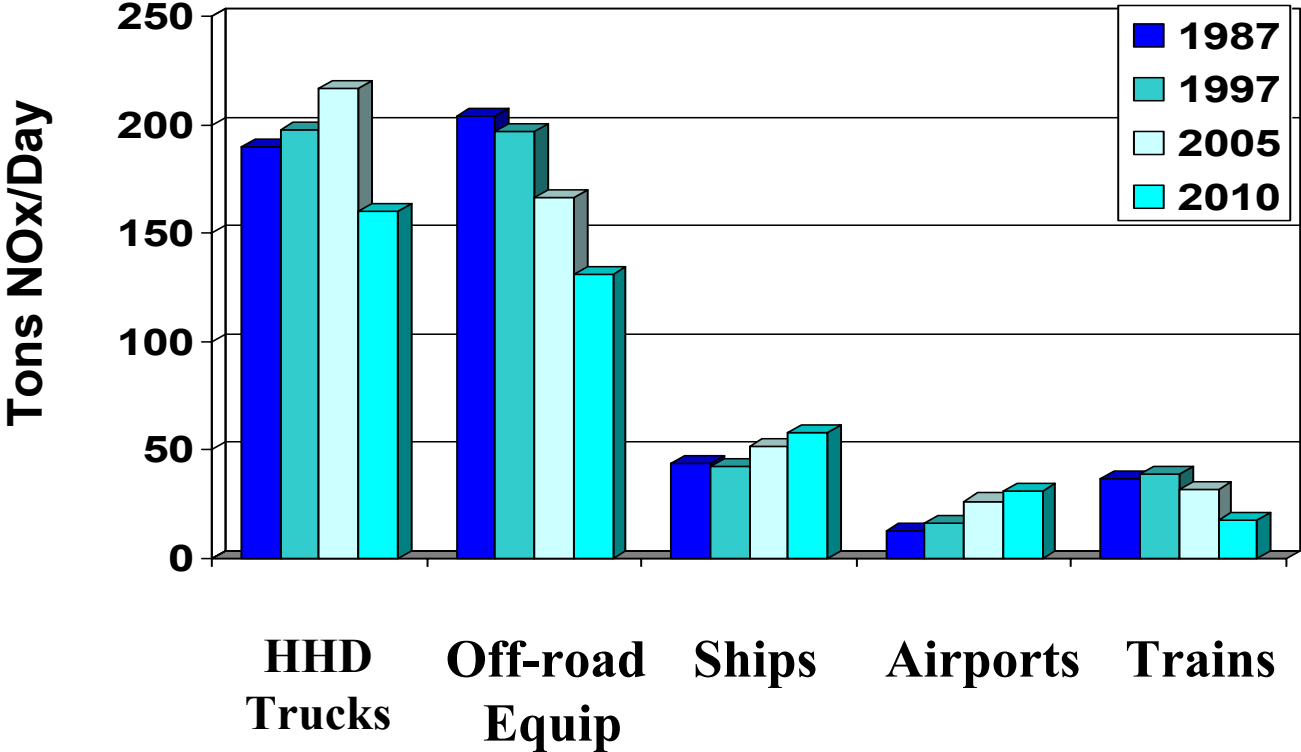
Southern California commitment from the Railroads



BNSF



NOx Emission Trends in SCAQMD



Data Sources: SCAQMD AQMPs & Other Materials

Evolution of Engine Emission Control

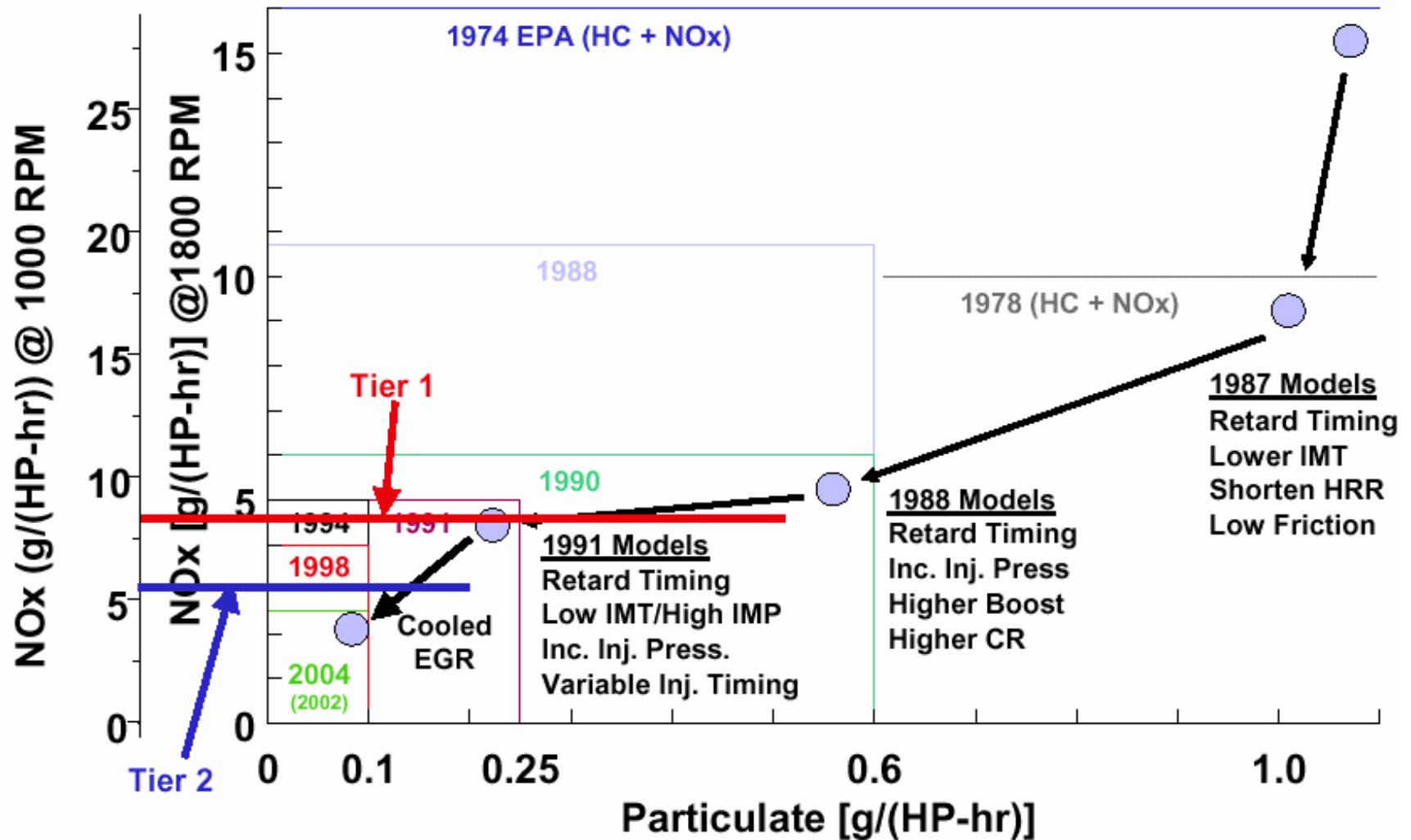
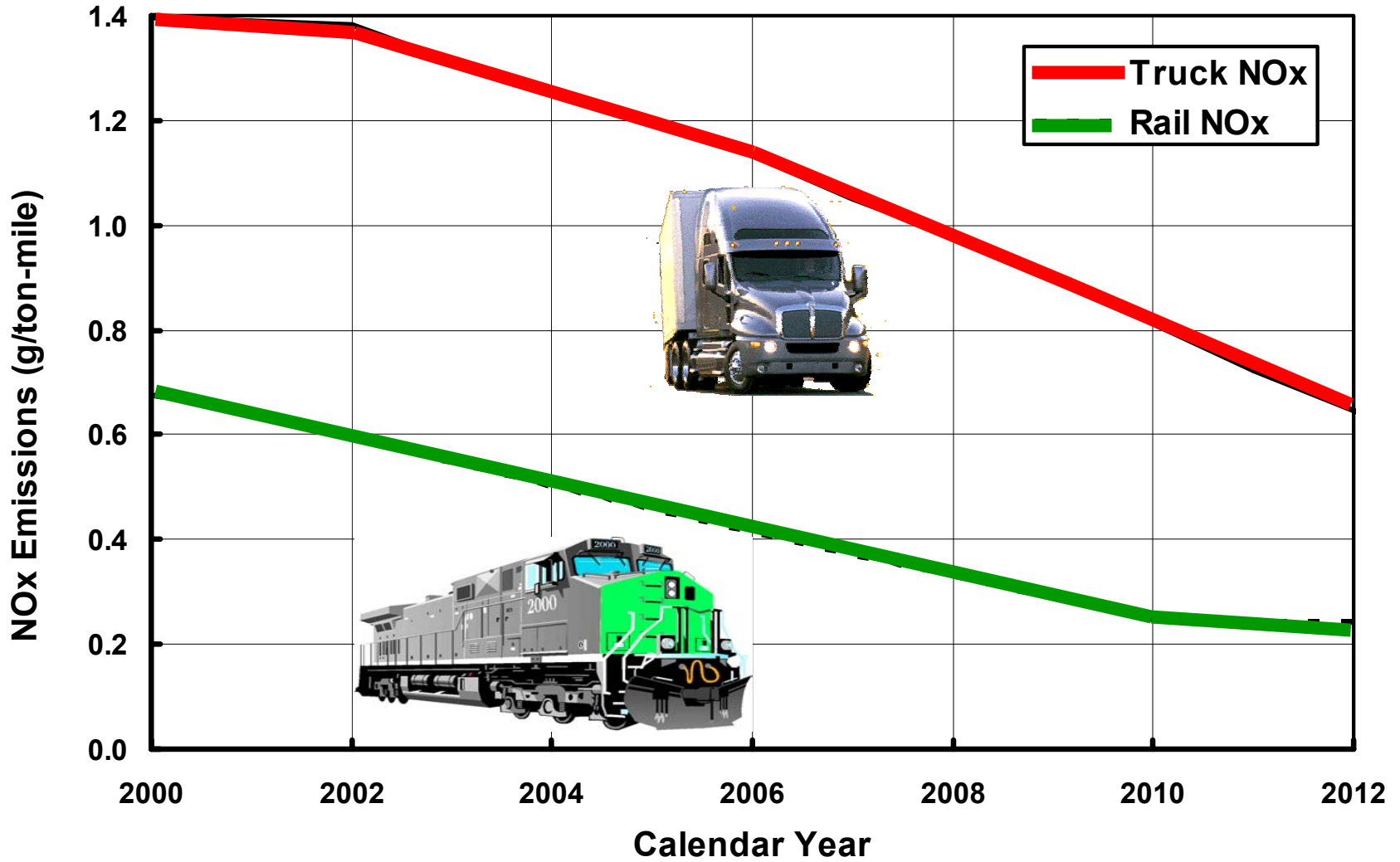
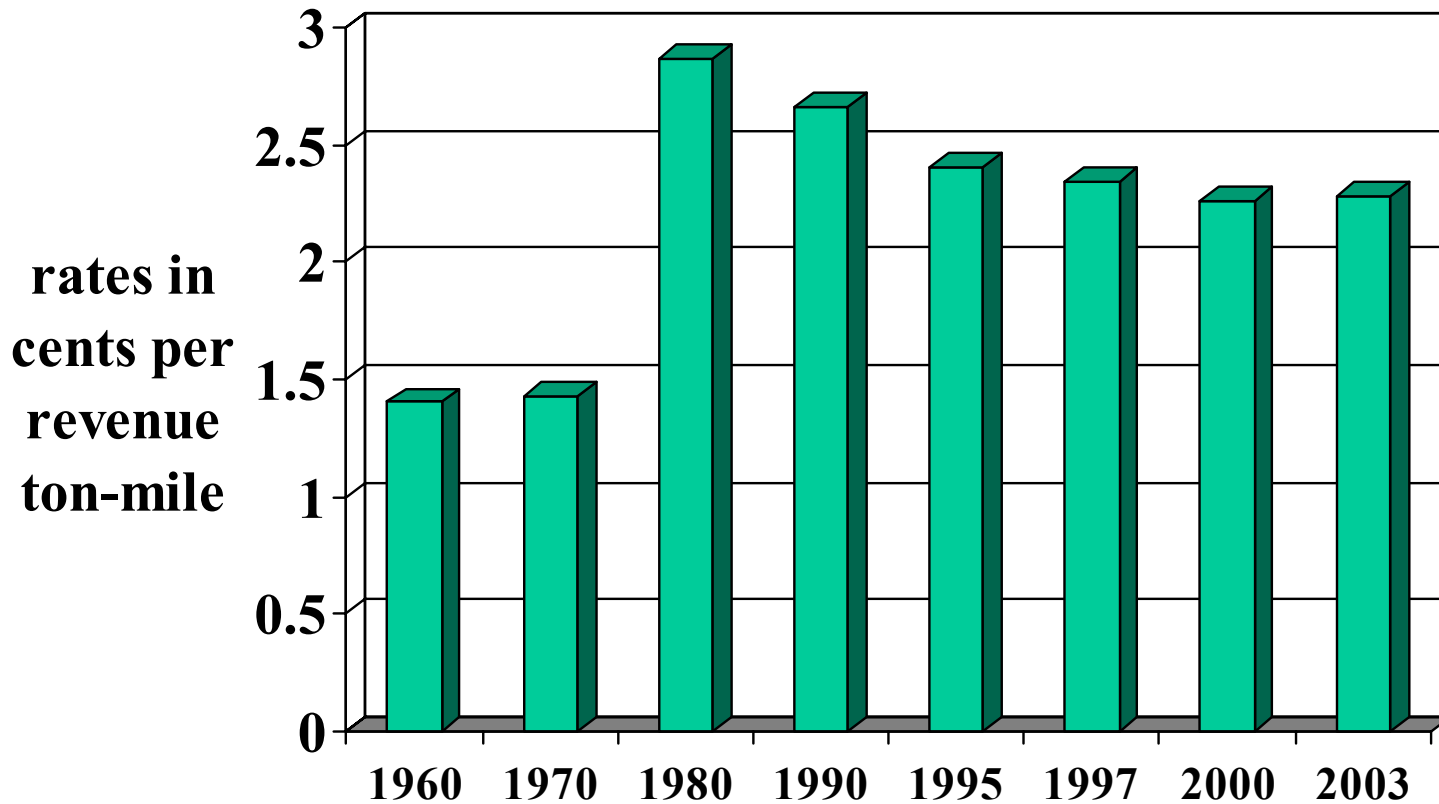


Figure 1 -- NOx Emissions per Ton Mile of Freight
South Coast Air Basin



Railroad Freight Revenue

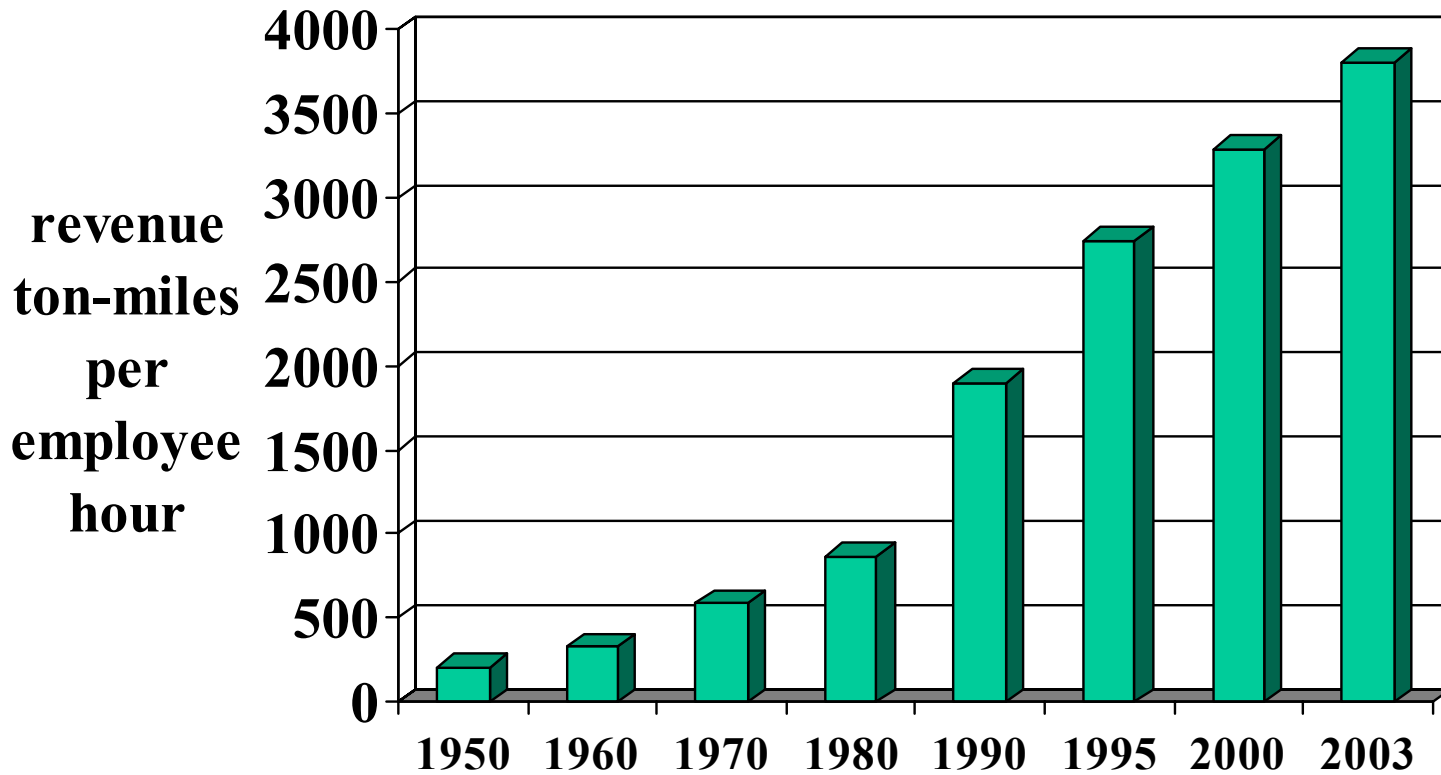
current dollars



BNSF



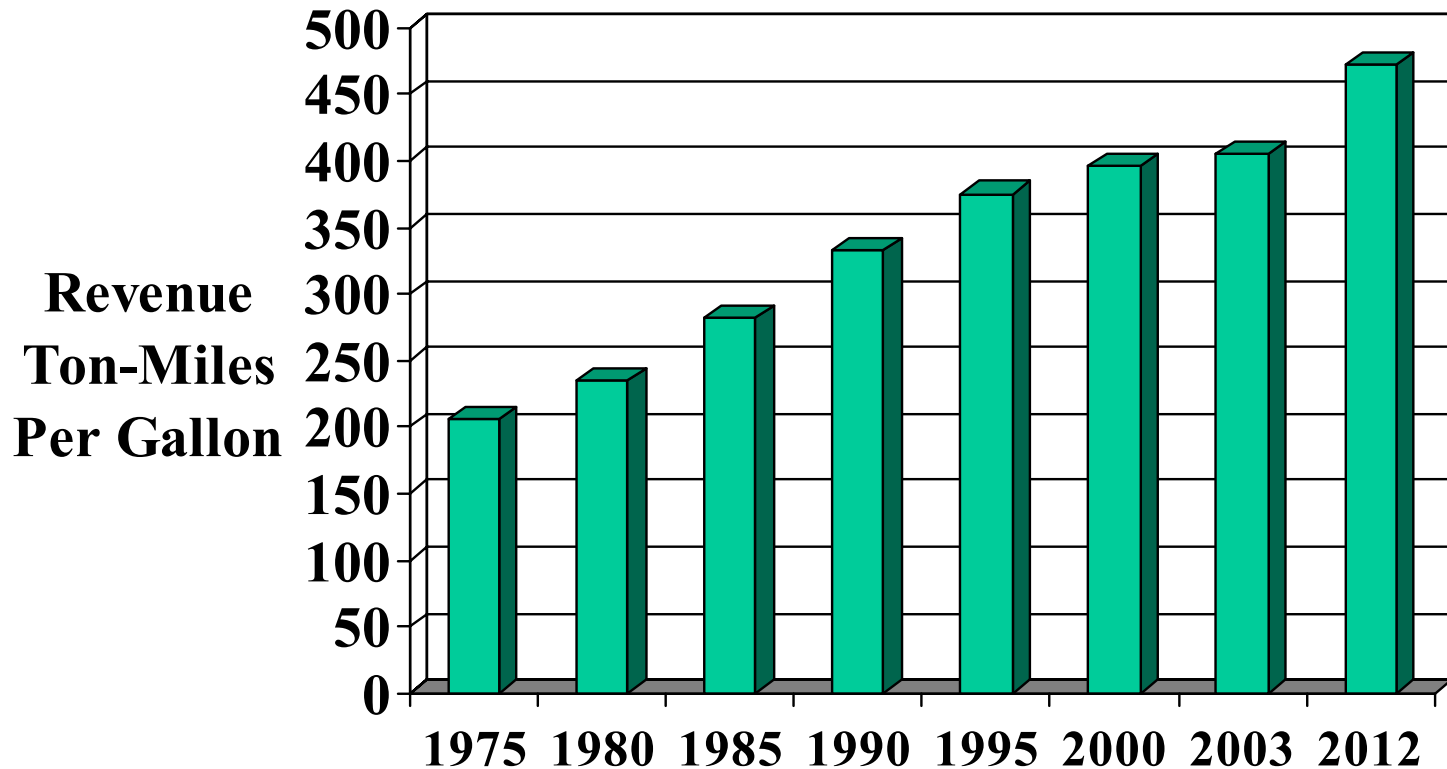
Railroad Employee Productivity



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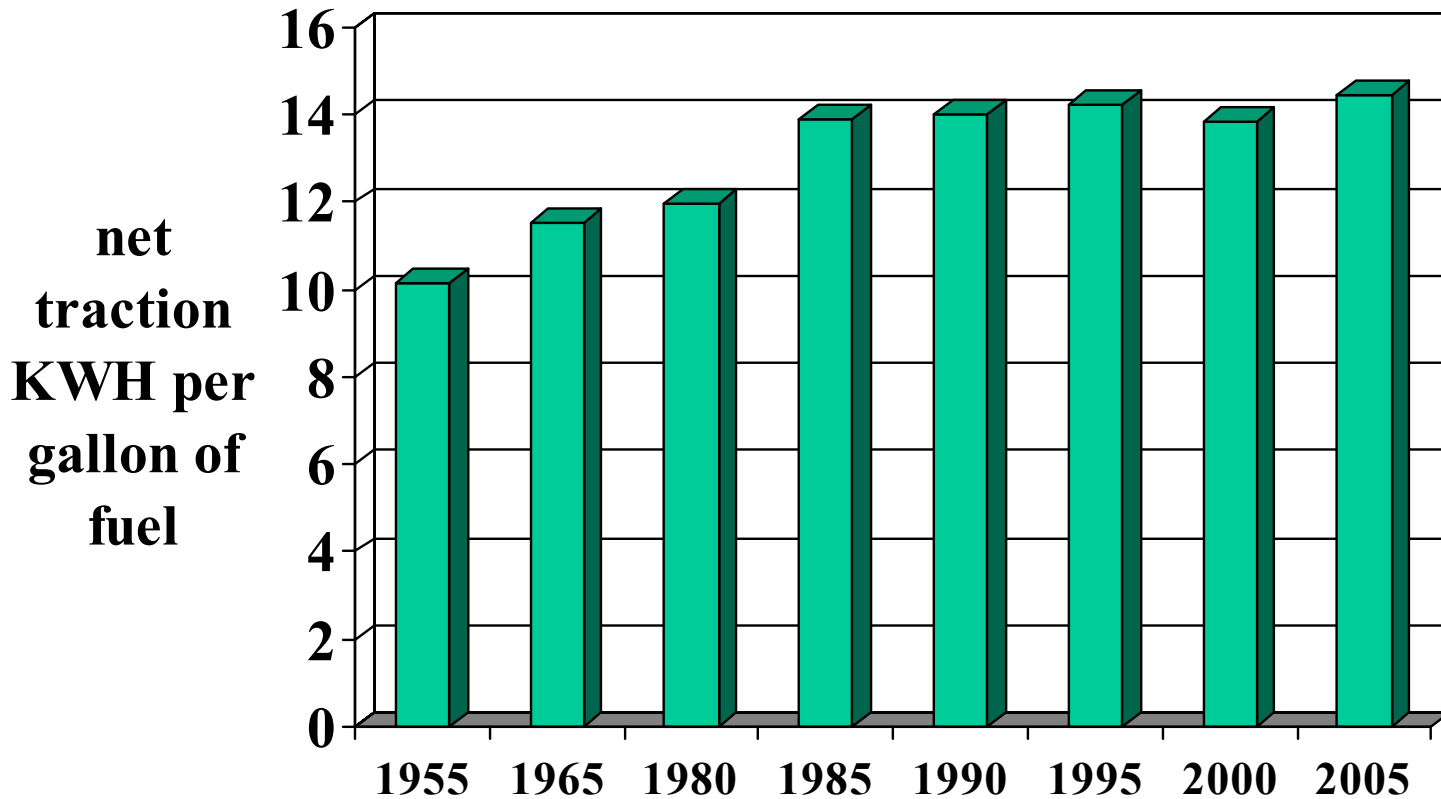
Railroad Industry Fuel Efficiency



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Locomotive Fuel Efficiency, medium duty cycle



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BNSF Locomotive Fleet

- ✓ 388 switch engines, 86% pre 1973, \$310 million replacement cost, 2% of total Nox inventory
- ✓ 942 intermediate power locomotives, 57% pre 1973, \$848 million replacement cost, 6% of total Nox inventory
- ✓ 4500 high horsepower locomotives, 2% pre 1973, 53% since 1995, \$7.2 billion replacement cost, 92% of total Nox inventory
- ✓ Retrofitting to meet Tier 0 will be \$150 million



Latest Improvements By The Railroads

- ✓ Equipping Units with “Smart Start” Idling Controls
- ✓ Funding \$5 million particulate trap research
- ✓ Experimenting with truck engine switchers
- ✓ Assisting manufacturers on hybrid technology
- ✓ Adopting programs to reduce train resistance and improve fuel economy



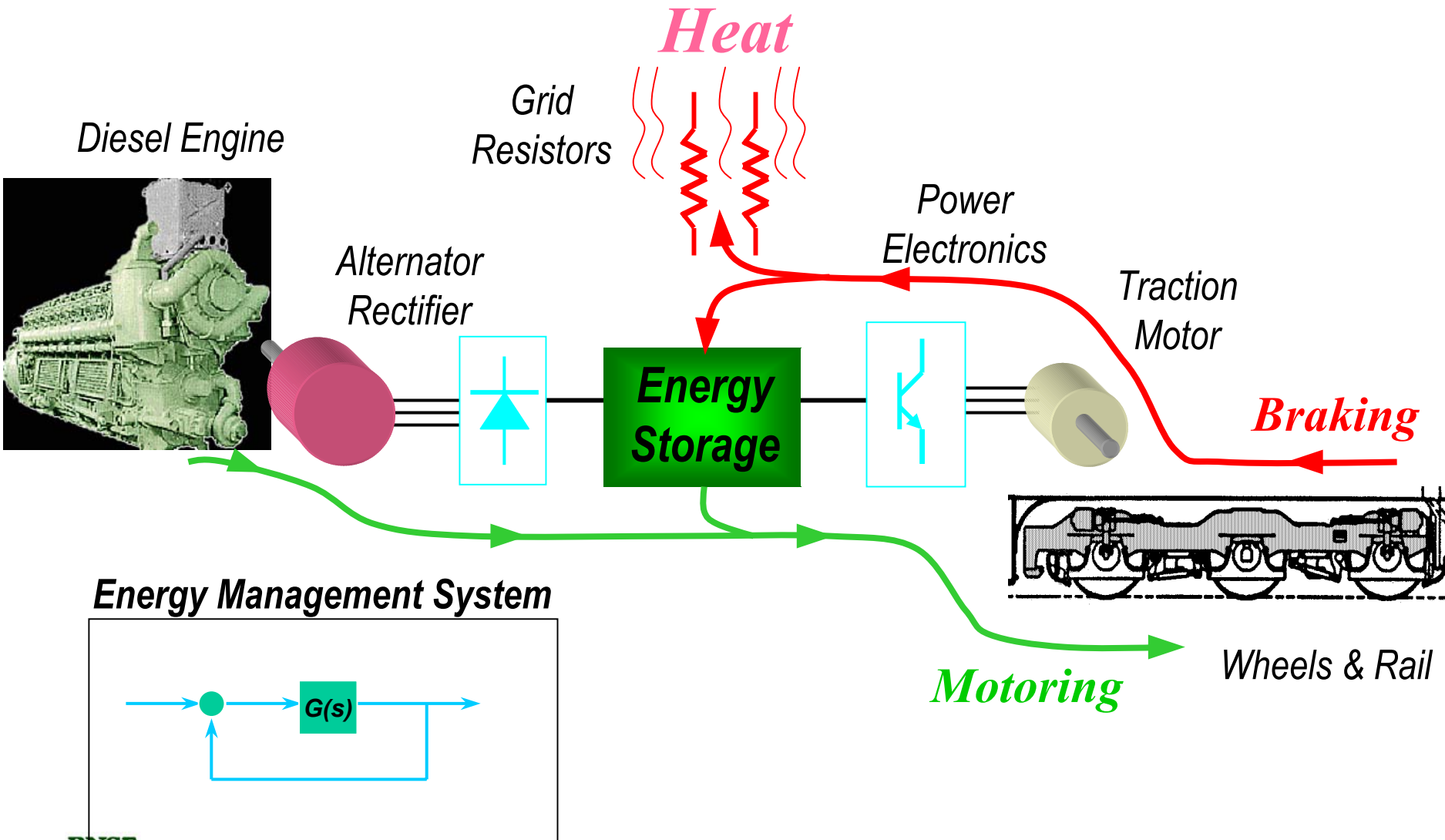
Hybrid Switcher Locomotive



Liquefied Natural Gas Switcher Locomotive



Hybrid Locomotive Concept



Barriers To Greater Air Quality Improvements

- ✓ Technology availability –cascade from trucks to off-road truck-like, then to locomotives
- ✓ After-treatment technology not applied to trucks until 2007 to 2010, then later for off-road
- ✓ Funding, not just financing, of improvements beyond normal business needs because of large capital needs to maintain and improve the railroad for safety and capacity, private infrastructure
- ✓ Durability of the locomotive fleet resulting in slow turnover