

Worldwide Emissions Overview

Overview of International Goods Transport

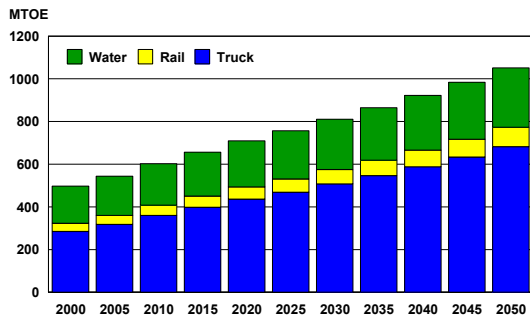
Haagen Smit Symposium 2005

Michael P. Walsh

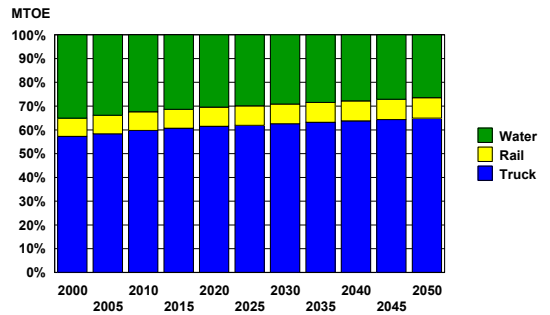
Overview

- Freight Delivery by Mode
- Heavy Truck Emissions Controls
- Marine Emissions Trends
- Locomotive Emissions Trends

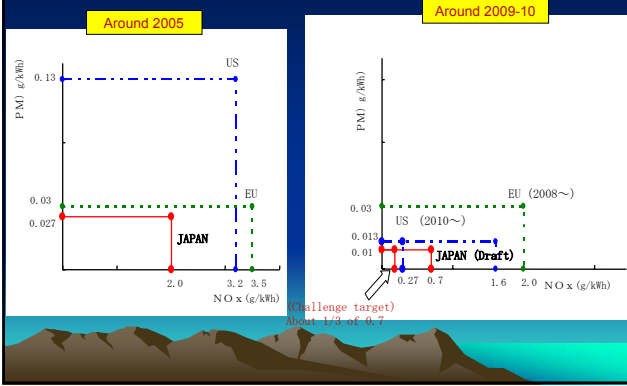
Global Freight Energy Use



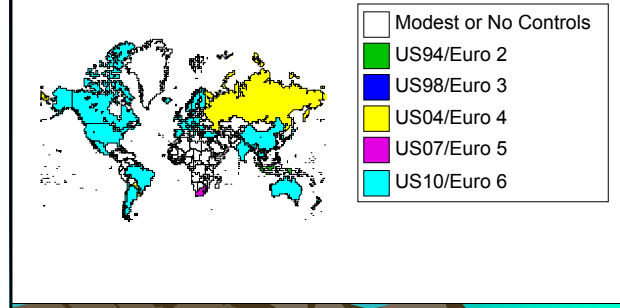
Global Freight Energy Use



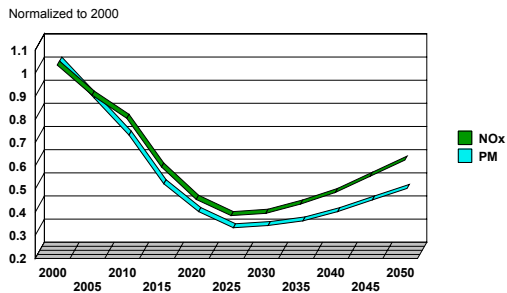
Comparison of Future Emission Standards on HD vehicles



Heavy Trucks in 2020

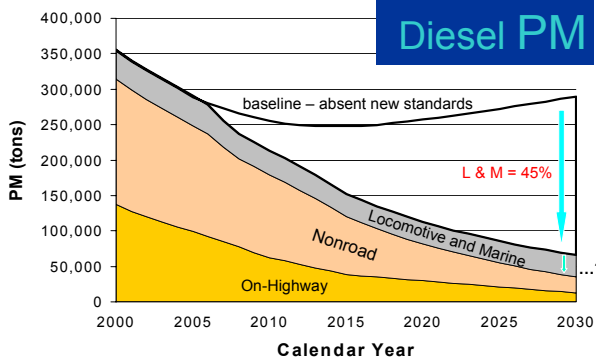


Heavy Duty Diesel Vehicle Emissions Trends



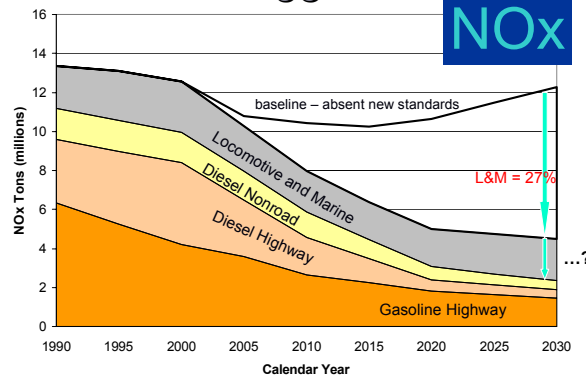
Long-Term Emissions Trends in the US

Diesel PM

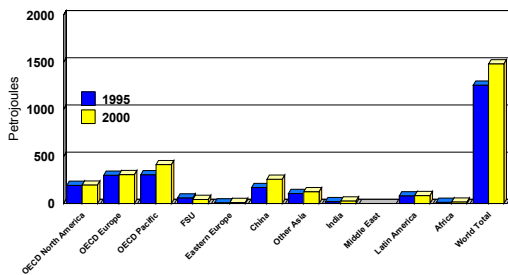


Long-Term Emissions Trends in the US

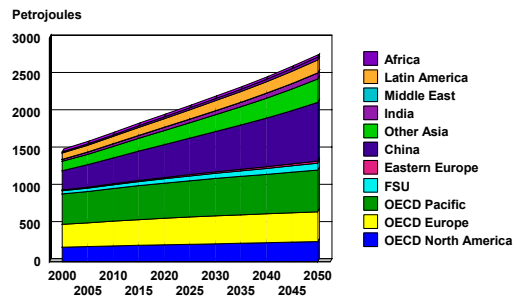
NOx



Internal Water Navigation Fuel Use

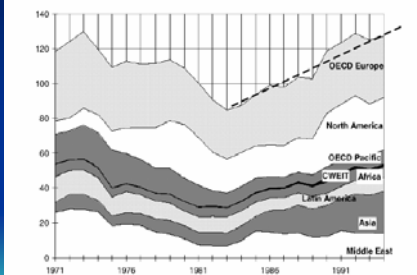


National Water Borne Travel



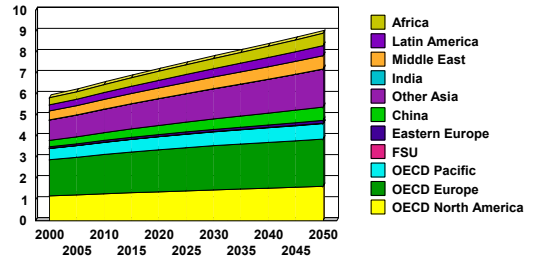
World Sales of Marine Bunker fuels

Source: IMO 2000

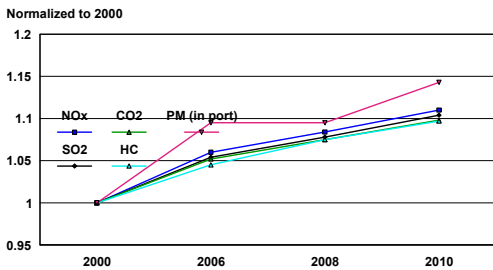


International Water Borne Travel (Bunker Fuel)

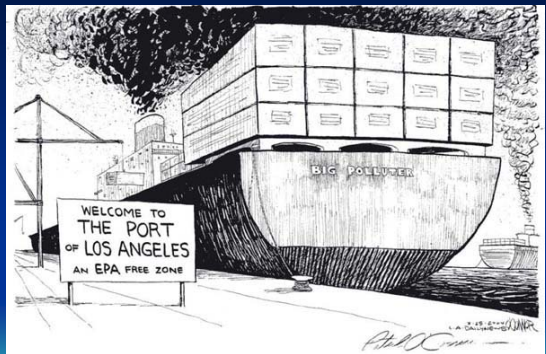
Energy Use - Petajoules
Thousands



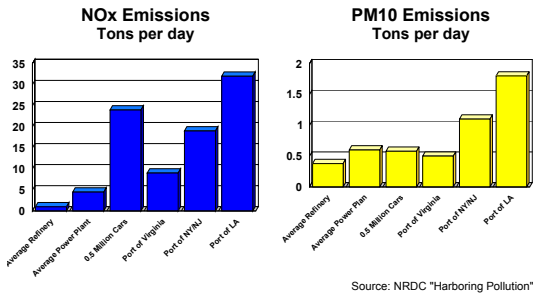
Marine Vehicle Emissions Estimates Under Business as Usual



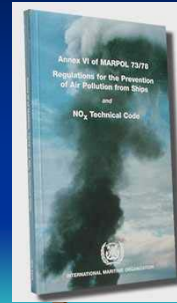
Source: Entec Study for EU



Pollution From Ports Compared To Other Sources

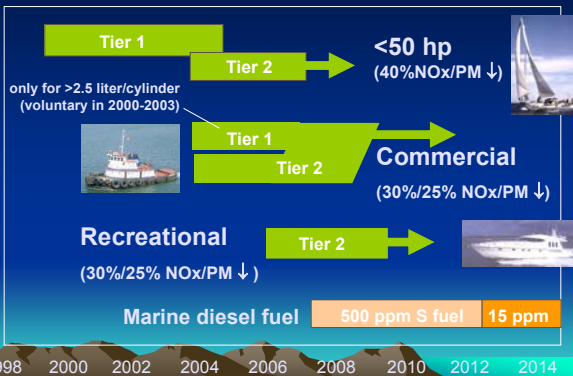


MARPOL Agreement



- Annex VI Enters Into Force on 19 May
- Global cap of 4.5% Sulfur
- Special SOx Control Areas Limited to 1.5% or SOx limits
 - Baltic Sea
 - North Sea
- Ozone Depleting Substances
- NOx Limits
- Restricts PCB Incineration

Key Elements of Current Marine Diesel Program (only applies to U.S. vessels)



The EU Is Following A Similar Path

- The amendments 2004/26/EC tightened the emission limit values for gaseous pollutants and particulate matter and extended the scope of the Directive to also cover

Engines for inland waterways vessels and railway, Locomotives and railcars. European Commission policy is to encourage a shift of transport away from roads and towards other more environmentally friendly modes including inland shipping. Thus, these modes must address their own environmental impact, and the present proposal is a part of that.

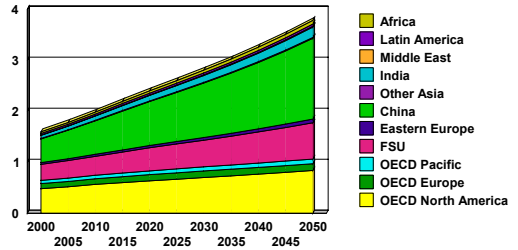
The cap of 560 kW for propulsion engines on the above (main engines, bow propellers etc.) has been removed.

EU Parliament Adopts Sulfur Limits

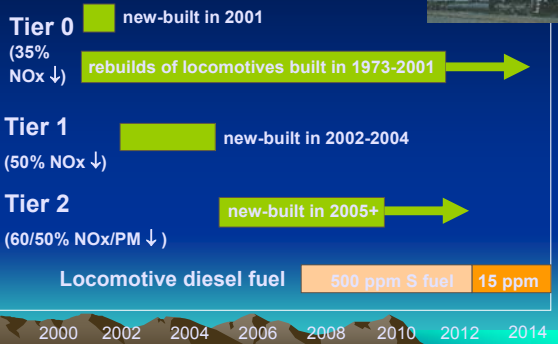
- 1.5% Sulfur Limit in Baltic Sea (19 May 2006) & North Sea and Channel (autumn 2007)
- 1.5% Sulfur Limit for passenger vessels between EU Ports (19 May 2006)
- 0.1% Sulfur Limit for inland vessels & seagoing ships at berth in EU ports (1/1/2010)
- 2008 Commission Review of second phase limit of 0.5%
- Current Marine fuel Spec is 5.0 percent, or 50,000 parts per million
- Will reduce SO₂ emissions by 500,000 tons annually, according to Commission estimates
- 2000 fewer life years lost from long term exposure and 750 fewer deaths from short term exposure

Rail Freight Movement

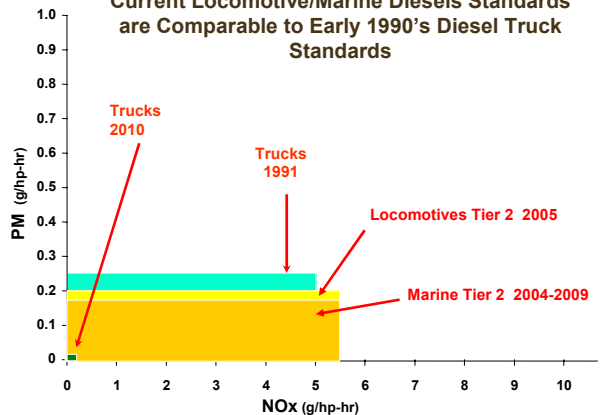
Energy Use - Petajoules
Thousands



Key Elements of Current Locomotive Program (only applies to U.S. railroads)



Current Locomotive/Marine Diesels Standards are Comparable to Early 1990's Diesel Truck Standards



Conclusions

- Freight Movement is Continuing To Grow Rapidly
- Heavy Trucks Are Increasingly Dominant
- PM & NO_x From Heavy Trucks Are Declining Rapidly
- Marine Pollution is Increasingly Important
 - Globally
 - Coastal Regions
 - In Ports
- Locomotive Controls Also Very Modest To Date