

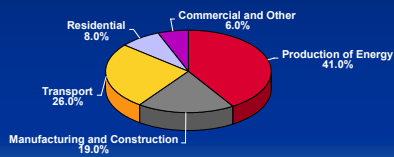
# International Experience in Improving Fuel Efficiency and Reducing Greenhouse Gases

Workshop on Fuel Efficiency Opportunities in São Paulo  
2 December, 2004

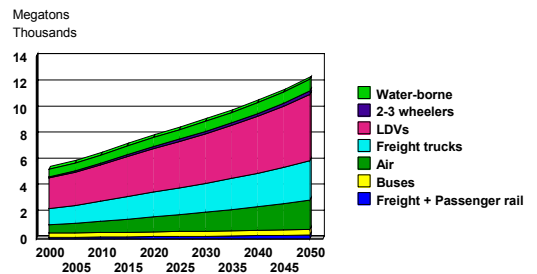
## Outline

- Vehicles Are Important
- Countries Have Different Motivations
- Many Different Policy Instruments Are Being Used
- A Variety of Technologies are Already Available

## Share of worldwide CO<sub>2</sub> emissions from the combustion of fuel, by sector



## World Transport Vehicle CO<sub>2</sub> Emissions By Mode

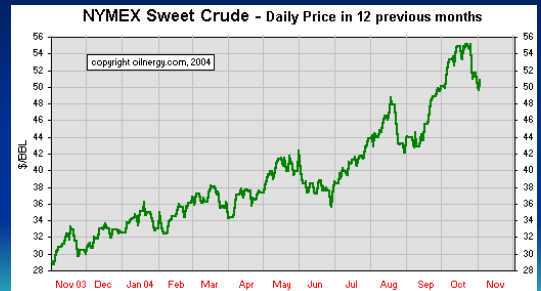


WBCSD

## Various Motivations For Countries

- Reduce Climate Change
- Reduce Oil Imports
  - Energy Security
  - Balance of Payments
- Sustainability

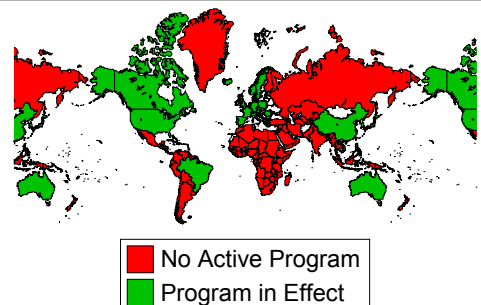
## High Oil Prices Are Increasing Urgency in Many Countries



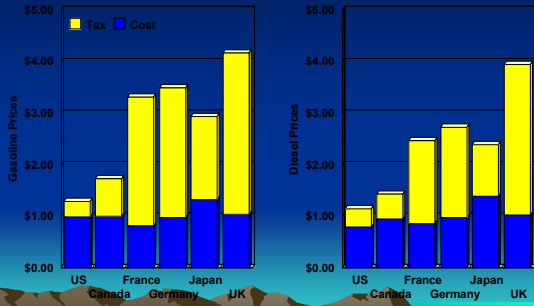
## Approaches To Reducing Fuel Consumption - Greenhouse Gases Around The World

- Tax Policy
- Fiscal Incentives
- Traffic Incentives
- Fiscal Penalties
- Regulation
  - Fuel Economy/Consumption
  - CO2 Emissions
  - Greenhouse Gases
- Voluntary Agreements
- Renewable Fuels Requirements/Incentives
- Vehicle Technology Mandates/Incentives
- Joint Government/Industry Research

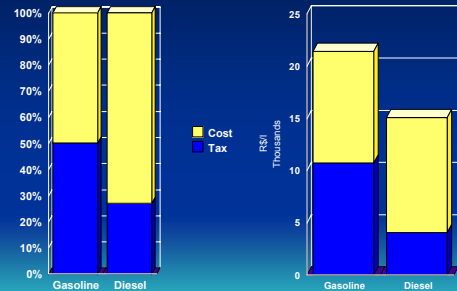
## Selected Programs Around the World To Reduce Fuel Consumption and/or Greenhouse Gases



## Fuel Prices in Selected Countries (2002\$/Gal)

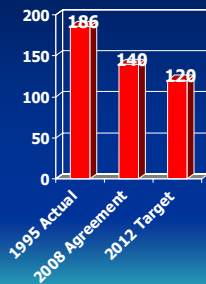


## Pump Prices in Rio



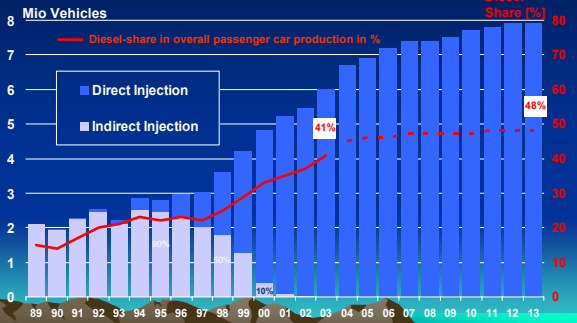
## European Agreement (g CO<sub>2</sub>/km)

- Some 120 g/km Cars in 2000
- Target Range of 165-170 g/km in 2003
- Review Feasibility of 120 g/km for Average car by 2012 in 2003



## Production of Diesel Passenger Cars

### Western Europe



## Vehicle Climate Change Emission Sources



Black Carbon  
Ozone

CO<sub>2</sub>

Methane

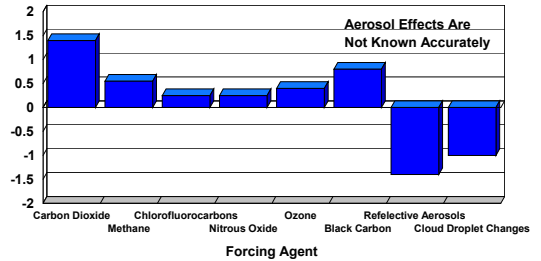
Nitrous Oxide

HFC

CO<sub>2</sub>

## Climate Forcings

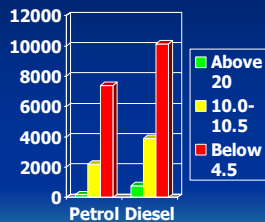
Watts Per Square Meter



Source: Hansen, Scientific American, March 2004

## Yearly Car Tax in Denmark

- 24 Different Car Classes Based On Kilometers Per Liter of Fuel
- Diesel Taxed More Than Gasoline
- Annual Increase with Inflation Plus 1.5% Per Year



## Tax Incentives for Low Emission Vehicles and High Fuel Economy Vehicles in Japan

Emissions+	***: 50% lower emission vehicles	****: 75% lower emission vehicles
Fuel economy		
Vehicles: achieving fuel economy standard in 2010	No incentives	*25% annual tax reduction *200,000 yen purchase tax deduction
Vehicles: 5% higher fuel economy than the standard in 2010	*25% annual tax reduction *200,000 yen purchase tax deduction	*50% annual tax reduction *300,000 yen purchase tax deduction

+: compared to the new long-term standard in 2005

A technical committee has been organized in Japan by METI and MLIT to discuss the possibility of a fuel economy standard on heavy-duty vehicles.

- The purpose is to reduce fuel consumption and eventually CO<sub>2</sub> emission of heavy-duty trucks and buses, starting in 2015 or later.
- Fuel economy will be evaluated based on engine test data and numerical simulation models, taking into account a variety of vehicle types.
- It is expected that diesel engine and vehicle technologies will be enhanced to meet the regulation.

## Engine Technologies with Potential to Improve Vehicle Fuel Economy

- 5,4 or 3 valves per cylinder
- variable valve timing
- idle stop/start
- cylinder deactivation
- variable compression ratio
- variable displacement
- advanced IC engines (diesel, DI gas)



## Additional Technologies with Potential to Improve Vehicle Fuel Economy

- Transmissions
  - lockup 6/5/4 speed
  - automatically shifted manuals
  - CVTs
- Advanced Powertrains
  - integrated starter alternatives
  - hybrids
  - fuel cells

## Summary and Conclusions



- Many Technologies to reduce mobile source fuel consumption and GHG emissions available today
- The technology is evolutionary – not revolutionary
- Some already in use or in product plans; others under development and available soon
- Technology costs could be paid for through fuel savings
- Reducing fuel consumption does not require sacrifices in performance and other attributes that consumers value
- Reducing fuel consumption does not require compromises in vehicle safety or emission regulations
- Starting To Look Beyond Cars