

# The Challenge of Sustainable Transport: What Five Years of EMBARQ Have Taught Us About What Knowledge And Political Force It Takes To Make Transport Sustainable



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*Shanghai and New Zealand*  
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# ***EMBARQ***

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- A catalyst for socially, financially, and environmentally sound solutions to the problems of urban mobility



# EMBARQ

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- Established as a unique center within World Resources Institute in 2002, *EMBARQ* is now the hub of a network of centers for sustainable transport in developing countries.
- Shell Foundation and Caterpillar Foundation are *EMBARQ*'s Global Strategic Partners, supporting *EMBARQ* projects worldwide
- Additional *EMBARQ* supporters include
  - Hewlett Foundation
  - Netherlands Ministry of Foreign Affairs
  - BP
  - US AID
  - Asian Development Bank
  - Energy Foundation
  - Blue Moon Fund
  - US Environmental Protection Agency
  - Japan International Transport Institute

# How Sustainable Transport Serves, not Severs, Urban Development

- **Economic Sustainability**

- Affordable to users and authorities
- Attractive as a business
- Each mode bears social costs



- **Social Sustainability**

- Promotes access for all, not just a few
- Makes room for all
- Avoids irreversible binds

- **Environmental Sustainability**

- Leaves no burdens for future generations
- Minimizes accidents and damage to human health
- Reduces greenhouse gas emissions

***Governance - The Roof Over these Pillars  
Make and Keep the Rules, Protect the Weak***

# Which Suggest Sustainable Transport?



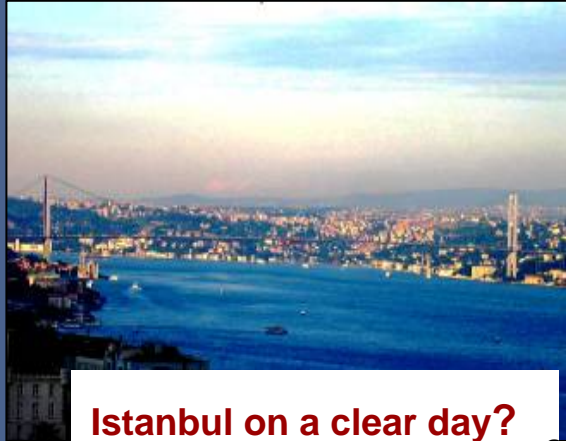
# Is Transport Getting More Sustainable? Yes and No in the OECD/EU World



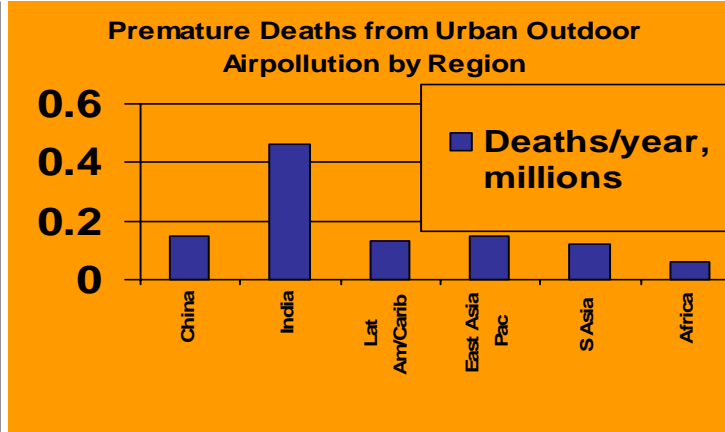
- **Sustainable Transport – Trends not Good**
  - Air cleaner in developed countries , roads safer but clogged, CO2 rising
  - Accession countries motorized with frightening speed
  - OECD is now a model for developing world
- **Technology is Not Enough for CO2 and Fuel Use**
  - US CO2 emissions/km flat, Japan and EU improving only slowly
  - Biofuels may be less bio, more fools
  - Accession and developing countries rushing to motorize
- **The New Model - Small, Slow, Safe, and Sustainable**
  - For OECD, car-flation (power, size, speed) must stop
  - For clogged cities, strong measures to slow car use
  - For accession countries, radical change before EU Membership?

***Where is NZ on Local and CO2 Emissions?  
Fuel Economy? Congestion?***

# Air Pollution: A Real Killer



Istanbul on a clear day?



Source: G. Hughes, W. Bank



Mexico City, on a clear day?

‘Congestion means exposure: being too close to hold your breath’

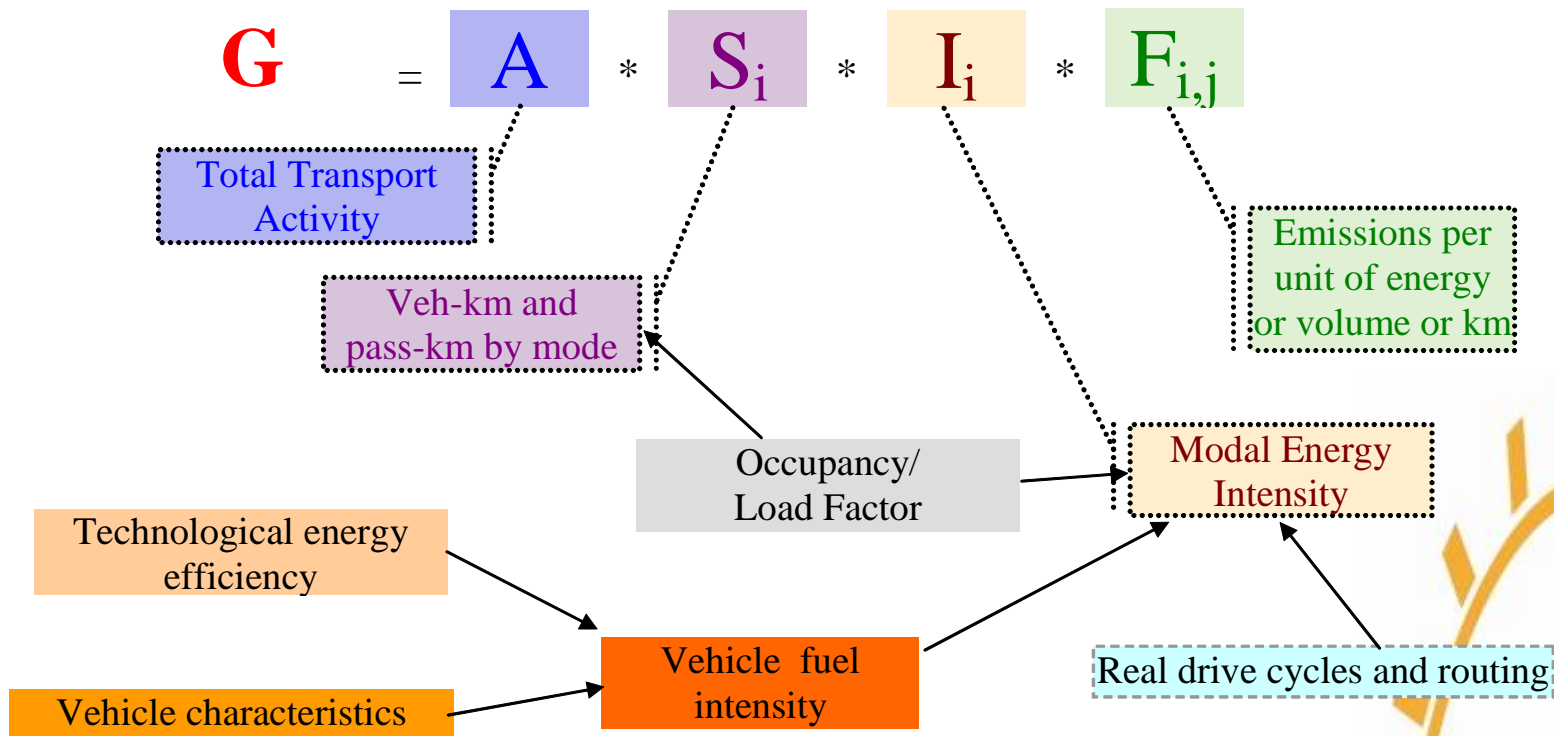


# Integrated View of Transport Problems

## The ASIF Decomposition

<http://www.iea.org/textbase/nppdf/free/2000/flex2000.pdf>

### Fuel Use and Emissions from



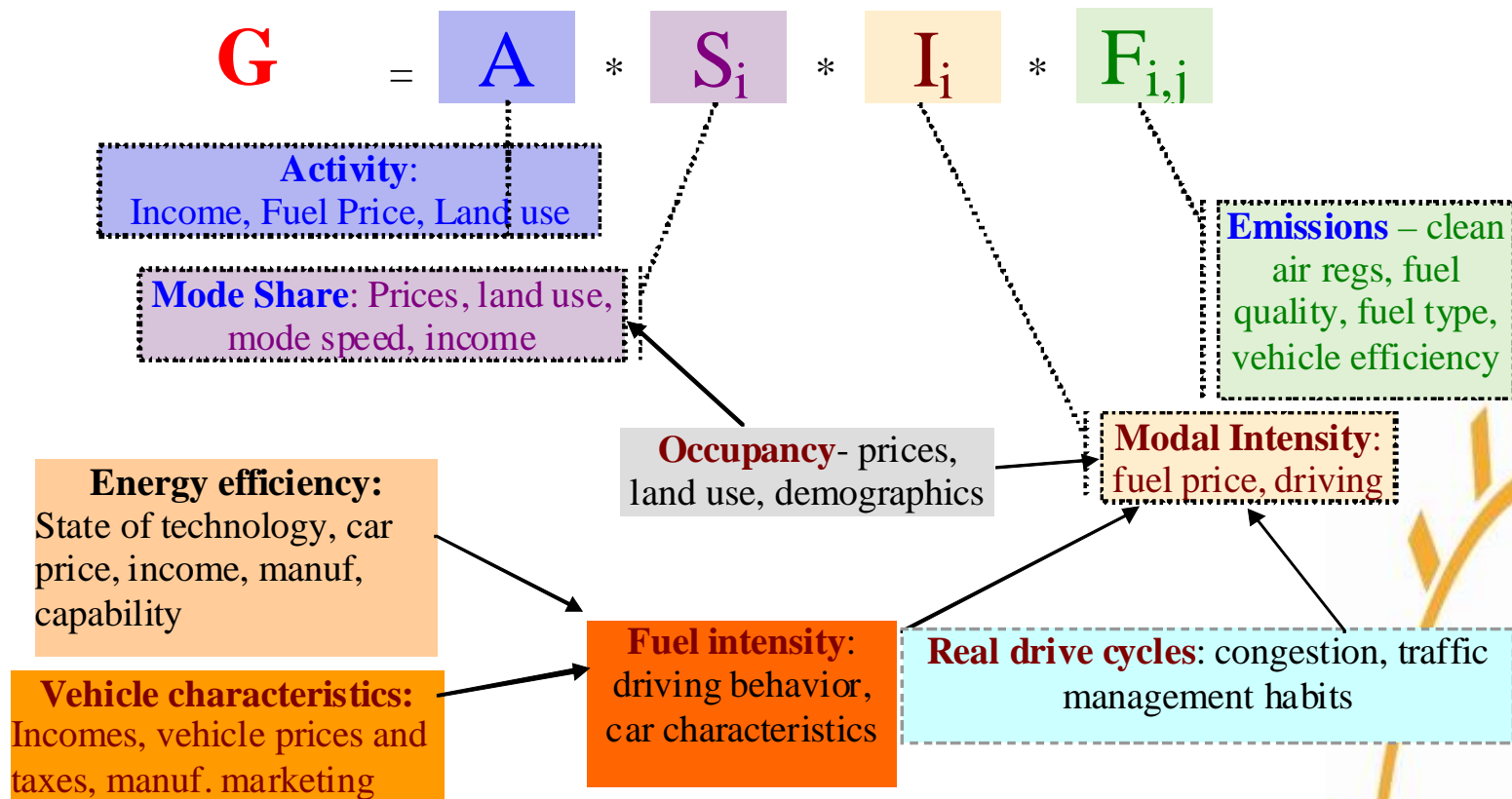
Lesson : Attack All Components of the Problem

# Integrated View of Transport Problems

## The Driving Factors and Forces

<http://www.iea.org/textbase/nppdf/free/2000/flex2000.pdf>

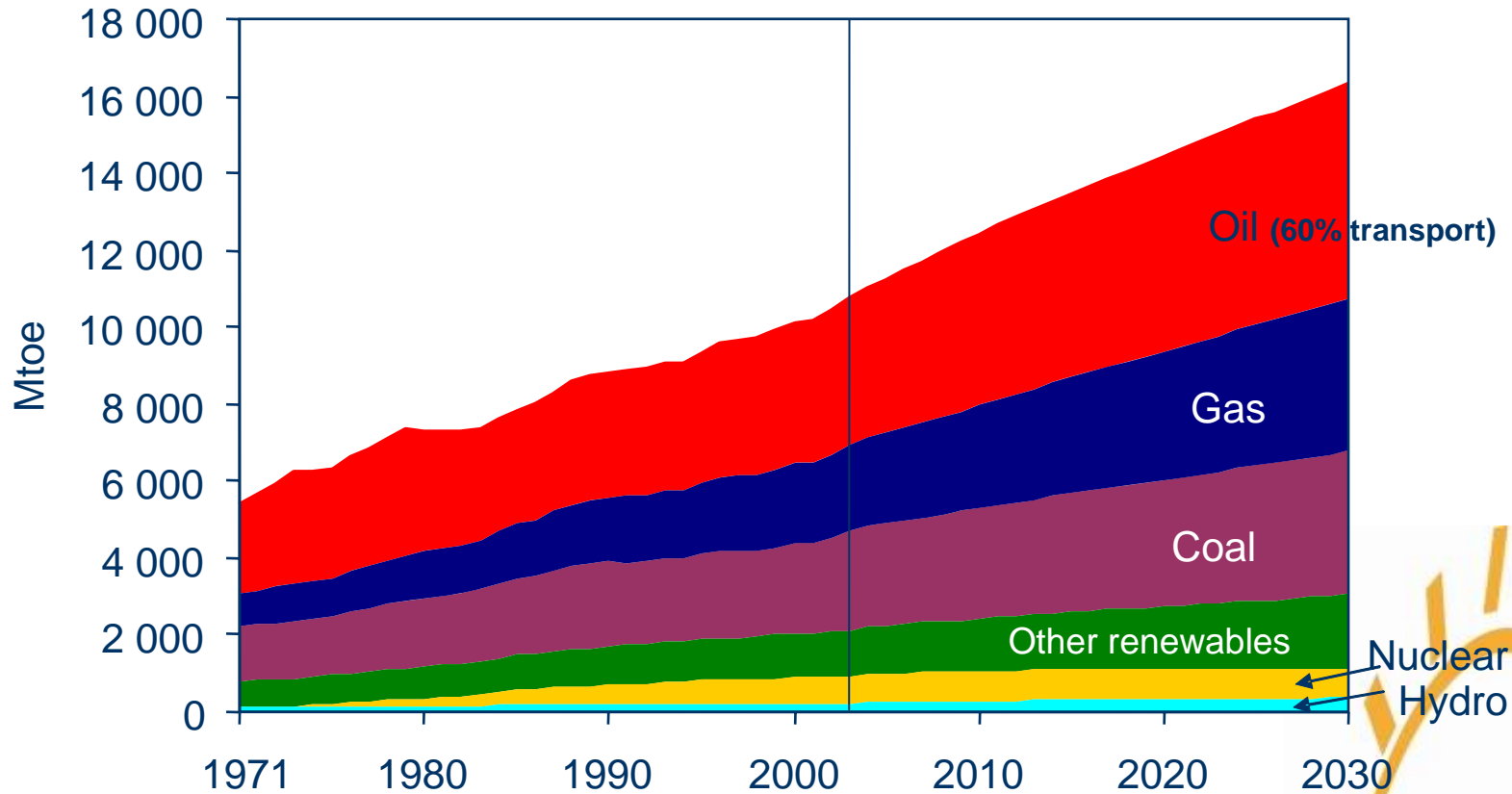
### Fuel Use and Emissions from



Lesson : Be Aware of the Driving Forces and Forces

# IEA World Primary Energy and Oil Demand

## Another Dimension of Unsustainable Transport?



*Oil and gas together account for more than 60% of the growth in energy demand between now and 2030 in the IEA Reference Scenario*



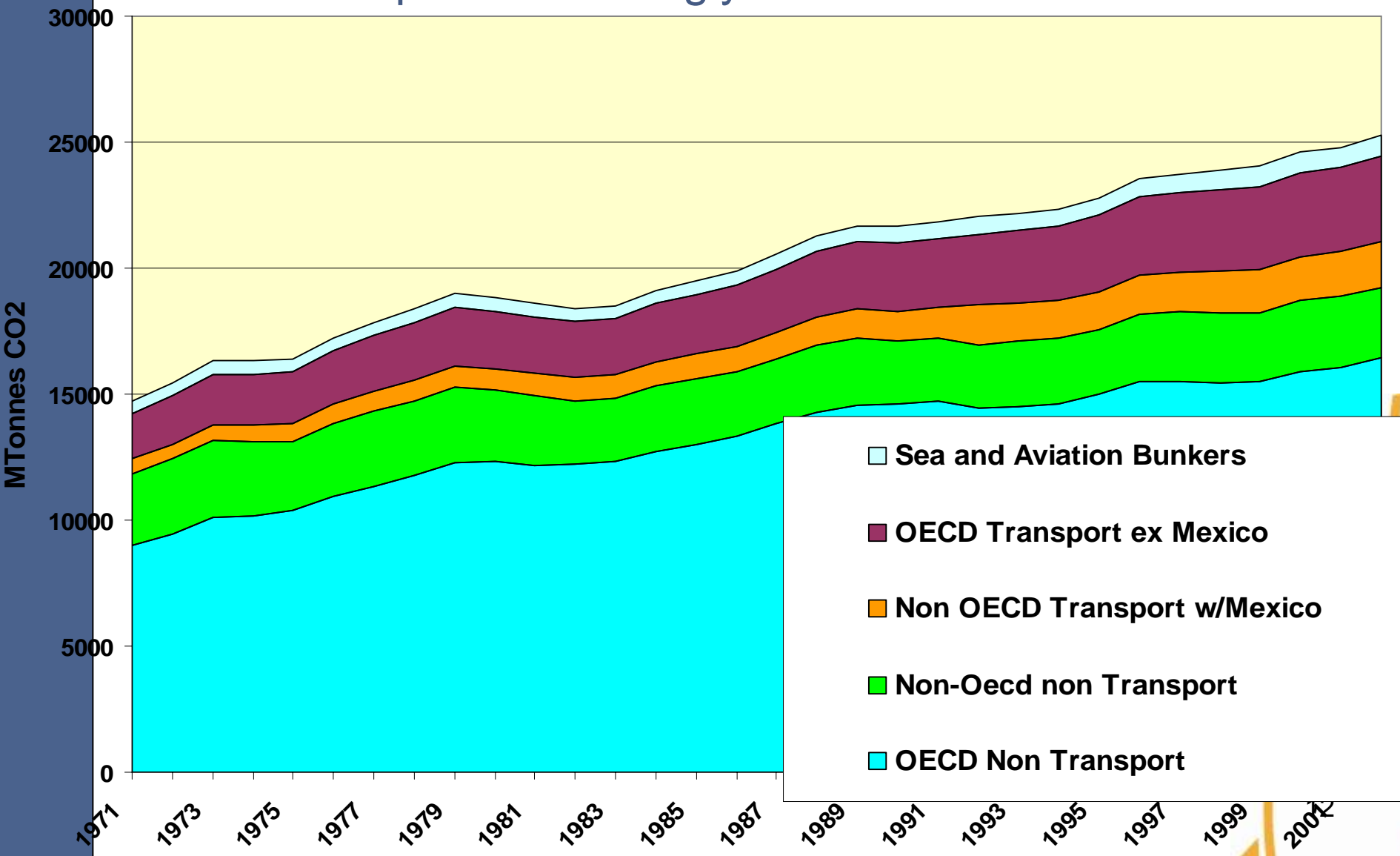
# Global Carbon (and Oil) Problems

- **The US Is Still the Big Bad Boy on the Block**
  - Largest oil user, GHG Emitter, also per capita or per GDP (PPP)
  - Oil worries might help or hinder CO2 worries
  - Little meaningful change under Bush - Backwards to the rear!
- **China, India and others – Unsustainable Transport**
  - Very low emissions per capita, but rising rapidly
  - Cities bogged down in impossible traffic and air pollution
  - CO2 not interesting, but energy and transport woes important
- **The Global Nature – Savings Valuable World Wide**
  - Oil and CO2 are global and fungible – anywhere you save matters
  - Fuels, technology are global – for better or worse
  - Motor vehicles (and US/EU lifestyles) global – for better or worse

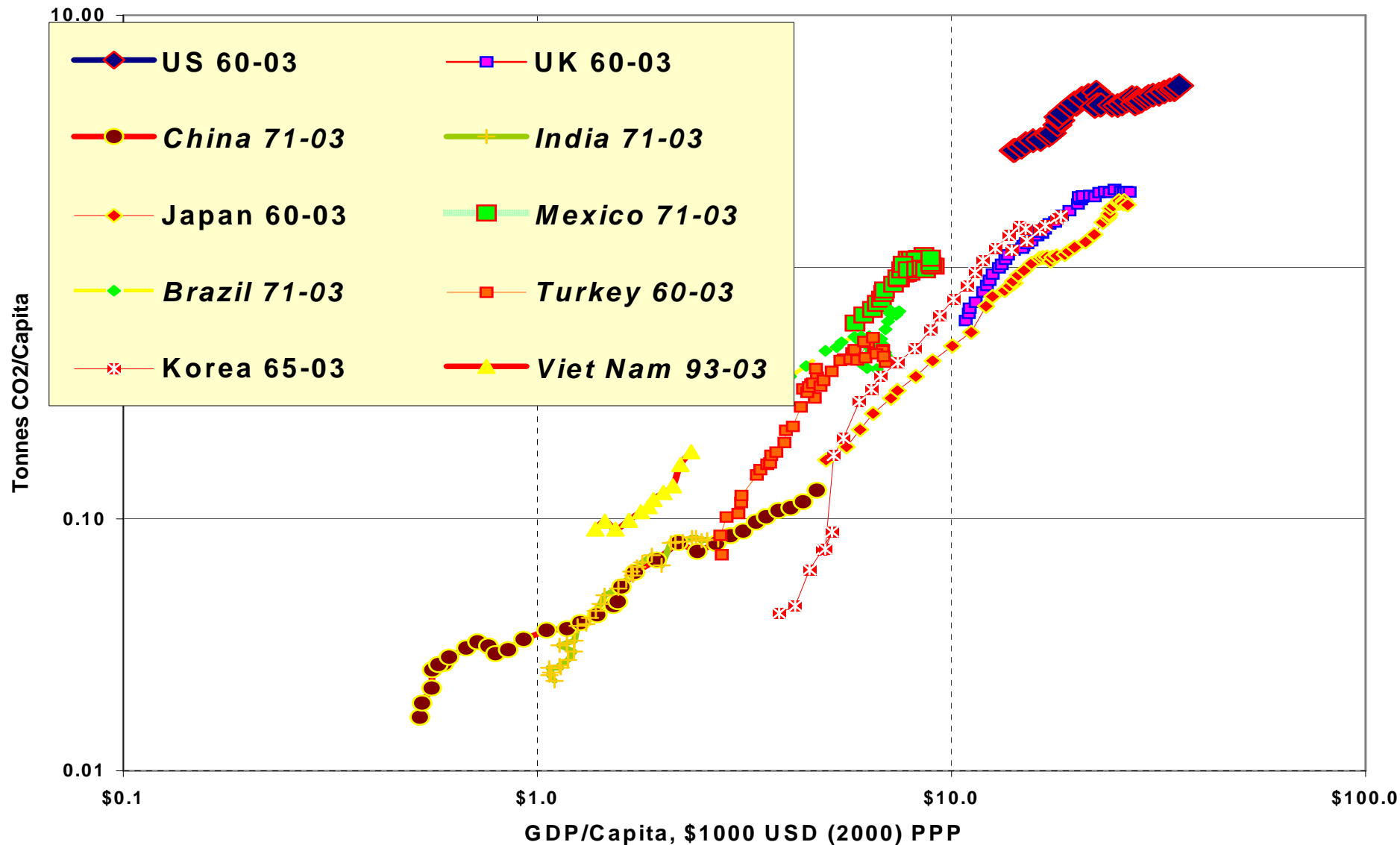
***No Clean, Low CO2 Substitutes for \$60 Oil in Quantity (>5 mn bbl/day) except More Efficient Energy Use or Higher Cost Energy***

# THE CART: WORLD CARBON EMISSIONS PULLED BY TRANSPORT

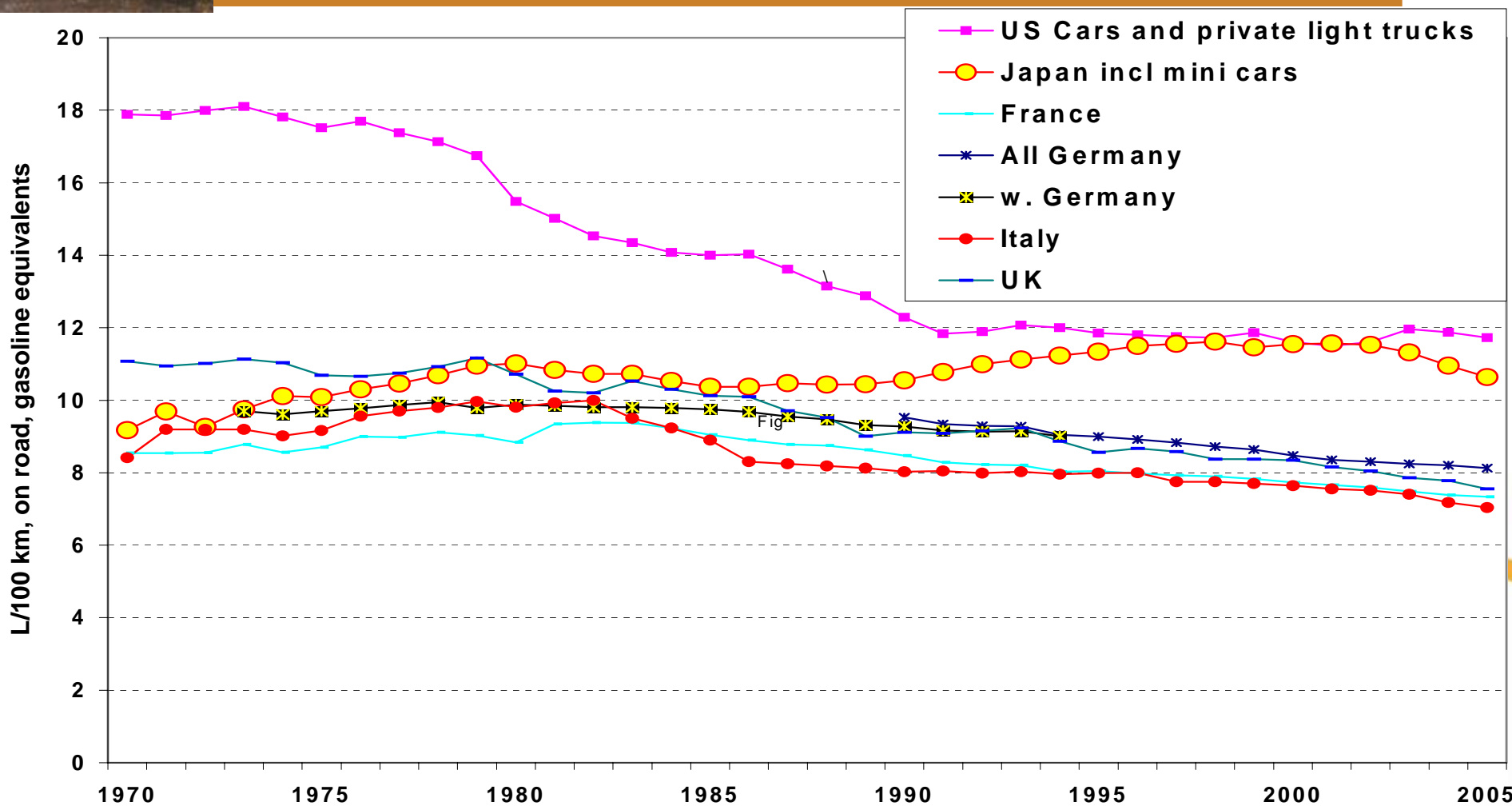
Transport Increasingly Focused in Cities



# CO2 Emissions from Road Transport (roughly 60% is around cities)



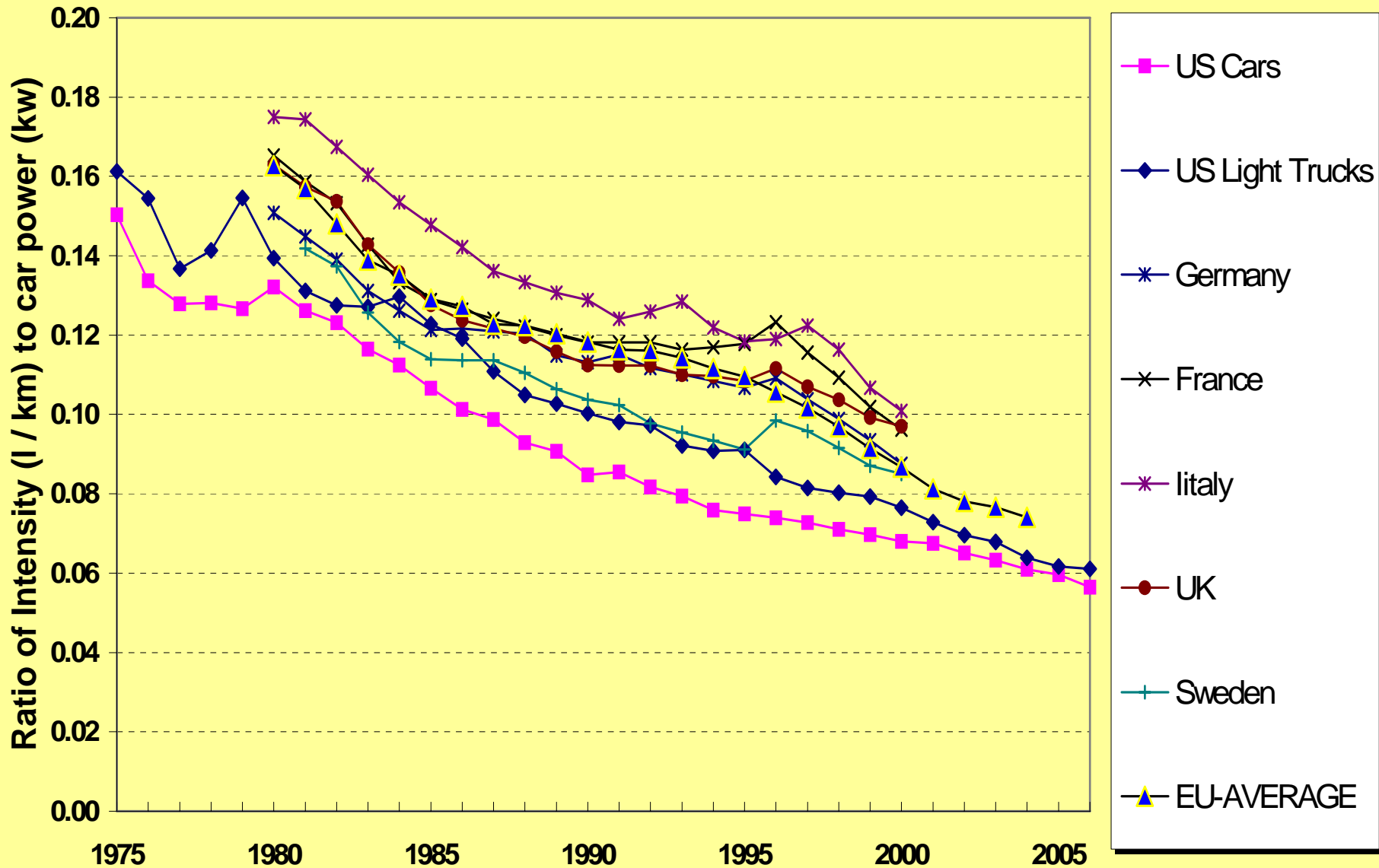
# Real Automobile Fuel Intensity – All Fuels Stagnant in the US; Falling in Europe, Japan



Source, L. Schipper, EMBARQ, based on official national data

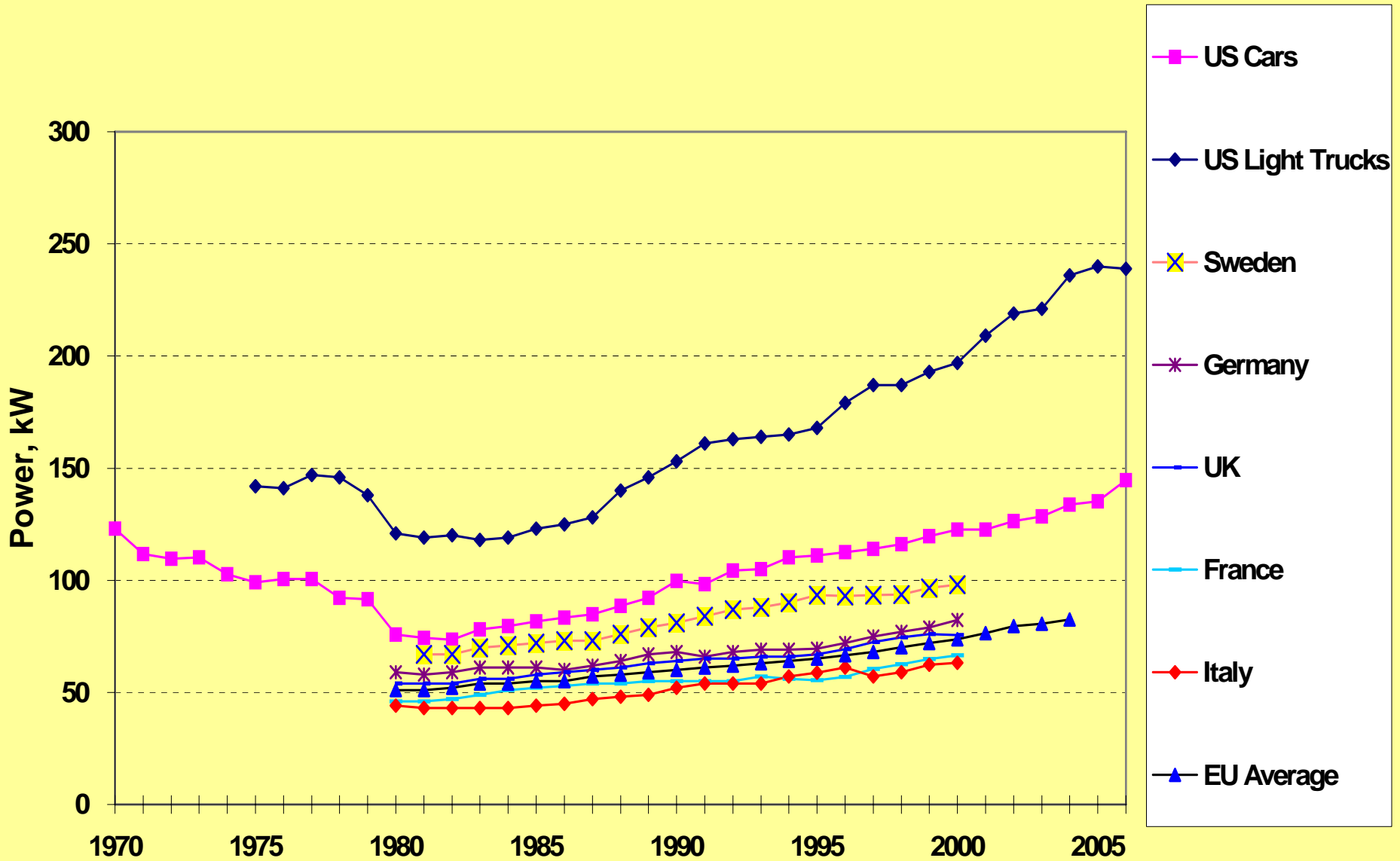


# Technology Gave Greater Efficiency

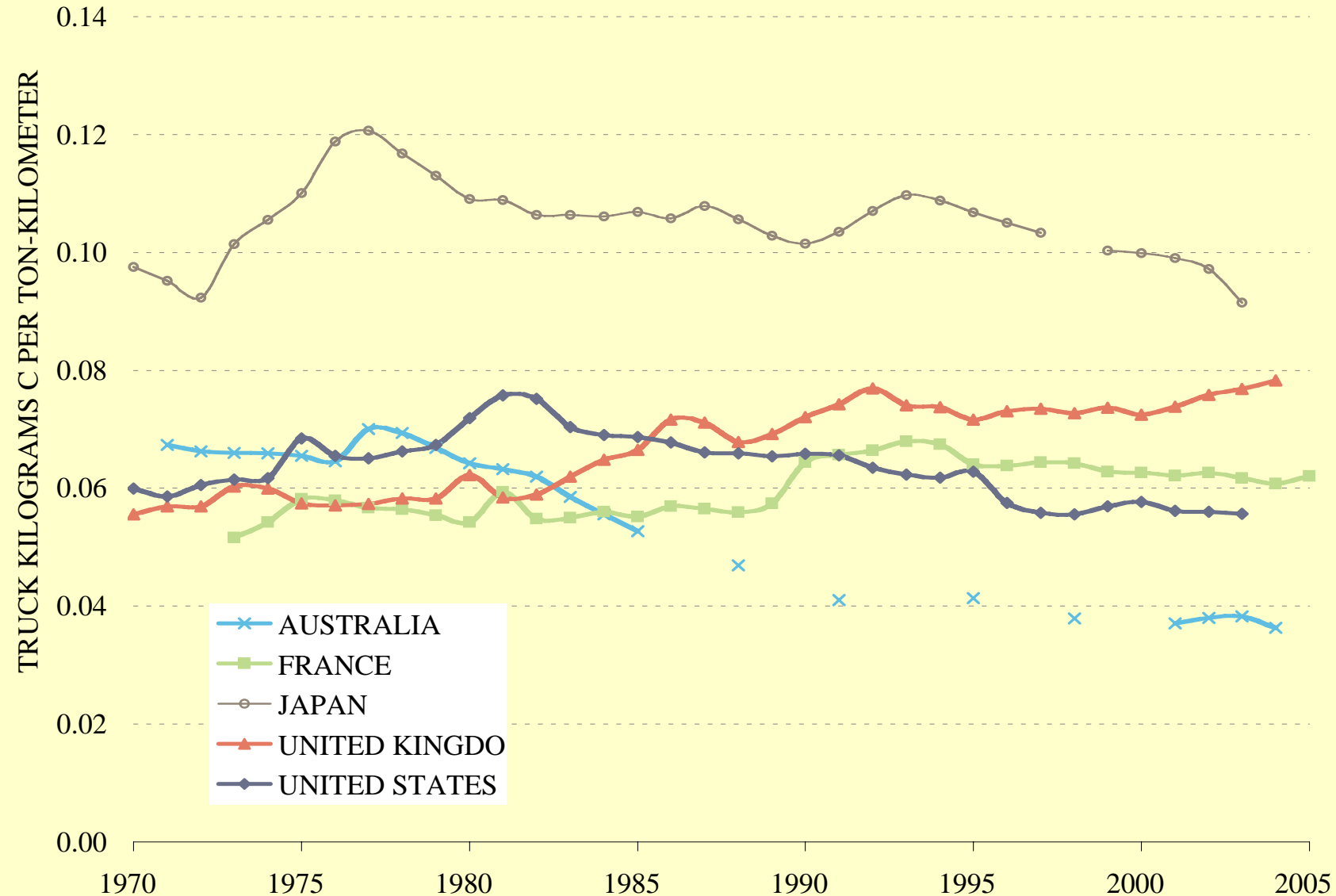




# Efficiency Gave Greater Power, Little Saved Fuel



# Trucking Carbon Emissions Dominate Emissions from Freight



# Key Findings Reinforce Earlier Work: Reducing Emissions a Challenge

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## Freight (tonne-km) Tracks GDP

- Getting Int'l traded goods to ports
- More handling of intermediate inputs?
- Books (Amazon) or computers (Dell) – fewer tonnes, more km

## Energy Intensity of Trucking Is Falling but...

- Most of change likely from improved utilization, larger vehicles, better traffic
- Trucking gaining modal shares – continued desire for speed etc.
- Changes in vehicle loading and traffic - logistics

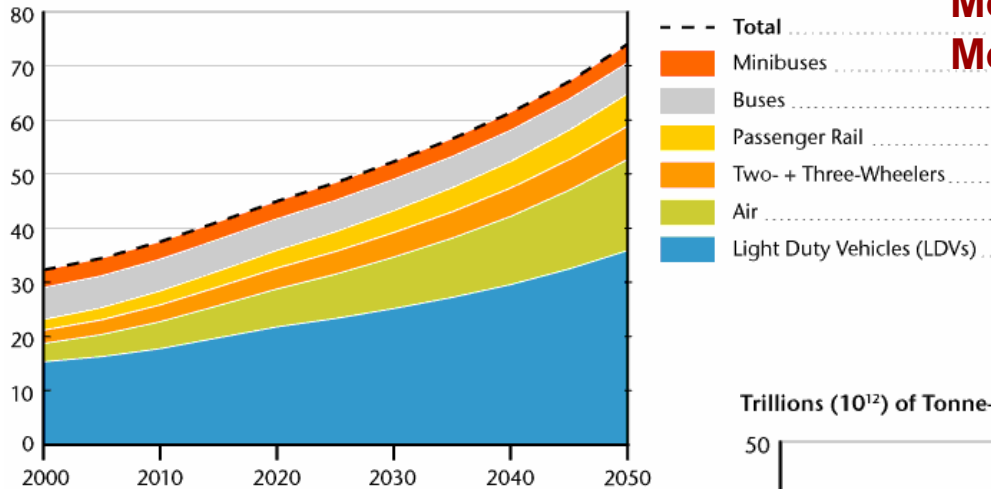
## Restraining Emissions in Freight?

- Higher efficiency vehicles, better loading, low carbon fuels?
- Slow food grown locally: How to change world trade juggernaut?
- Modal shifts back to rail – unlikely in any significant degree

# Unsustainable Transport Demand Growth Source:

World Bus. Council for Sust. Dev.

Trillions ( $10^{12}$ ) of Passenger-Kilometers/Year

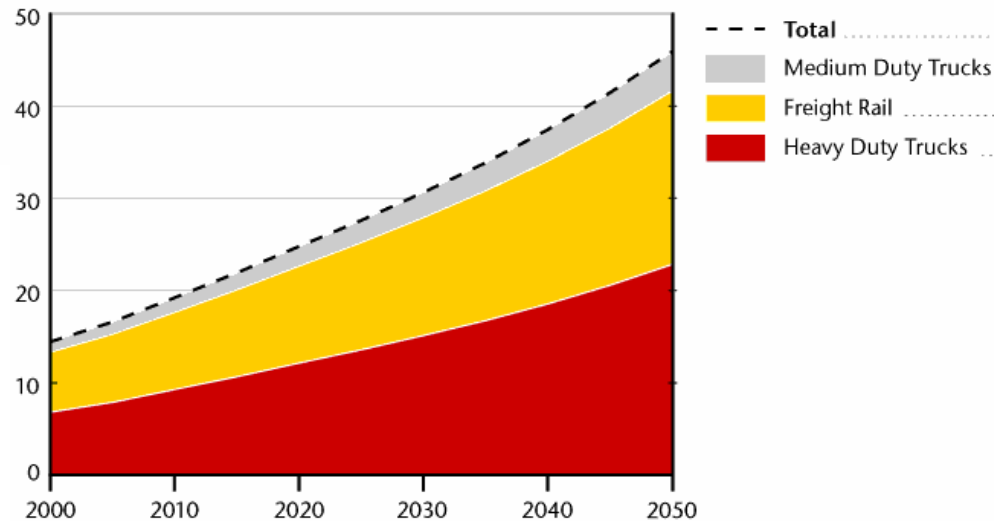


Source:  
Sustainable Mobility Project calculations.

**More money, bigger homes,  
More sprawl, more cars, more travel**

**Bigger economy, larger global share,  
More stuff, more goods shipped**

Trillions ( $10^{12}$ ) of Tonne-Kilometers/Year



Note:  
Excludes air, waterborne and pipeline.

# The Sustainability Challenge: Problems even in New Zealand

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- **Cars and Passenger Transport**
  - Boom in car ownership and use, at expense of public transport
  - Rising congestion in Auckland, Wellington
  - Modest improvements only in fuel economy
- **Large Gains in Trucking Share after 1984**
  - Share rebound from earlier policies
  - Modest decline in energy/tonne-km
  - Efficiency and emissions gains waiting
- **Future depends on Fuel Prices, Regulation**
  - LPG, CNG or Diesel? Pricing is the key
  - Fuel economy regulations or stimuli
  - Monitoring – vehicle use, emissions, fuel economy?

*NZ Is One of the Most Motorized Countries – but Fuel and Emissions Standards lag much of the Wealthy World*

# MEXICO CITY as the Aztecs Saw He

Are we done now?

Not quite...



# I and F: Clean, High Capacity Vehicles Don't Knock 'em 'till You've Tried 'em

- Conventional Technology at Minimal Cost
  - Clean diesel hauling up to 160 passengers in articulated buses
  - Conventional size clean diesel or CNG, even LPG
  - Test buses by Volvo, Scania, Mercedes, Allison, Eletrabus, Chinese
- Advanced Systems – Maybe Now, Maybe Later
  - Hybrid from Allison showed lowest emissions, fuel use, but \$\$\$\$
  - Fuel cells? Feedstock and infrastructure main uncertainties
  - Real issue: How to minimize fuel and emissions with a limited budget
- Retrofit with 15 PPM Sulfur Diesel Encouraging
  - 90% drop in particulate matter on newest buses with filters
  - Modest drop in NOx on older buses
  - Commitment by State Oil Company to bring ULSD sooner



*NZ Is Behind Most of OECD  
On Clean Air Regulations*

# Developing a BRT System: Lessons from EMBARQ's Mexico Program

- **Re-Invigorate or Re-invent the Bus System:**

- Develop new business model for the system
- Aim for true BRT corridor: Speed, safety, and certainty
- Procure buses that can be retrofitted as technologies improve



- **Motivate Stakeholders:**

- Clear branding of the new system
- New fares, tariffs, schedules, stations, etc.
- Attract, not repel existing operators, hawkers, etc



- **Integrate into the City System:**

- Use to strengthen other modes, use other modes for strength
- Use as arm of urban (re-) development
- Show the long range vision quickly



***BRT Brings Economic and Environmental Benefits:  
Coming Soon to Auckland?***

# Creating a New System – Metrobus

260 000 people/day over 20 km for US \$60 mn  
Lower emissions, CO2, reduced car traffic



**Mal-Asia?**

**Jakarta and Dozens of other Asian Cities  
It Can't Go On..but It Is!**



# Congestion Pricing and Car Use: Don't Forget A\*S

## Definition

- Charging for using roads at congested times to encourage travelers to shift to other times, routes and modes
- Alternatives (odd-even) and voluntary approaches fail
- More effective in regulating car use than increases in fuel taxes

## Difference in Prices and Application

- Tolls higher during congested periods and lower or non-existent during un-congested periods
- Tolls based on a fixed schedule, or dynamic
- Tolls can be specific to location, distance traveled, or cordon

## Results

- Proven reduction in car use, higher transit, faster speeds
- More effective in regulating car use than increases in fuel taxes
- Implementation not free, income transfers modest





# Stockholm – Permanent Now

## Tried in 2006 After 15 Year Debate

- Tested January-July 2006
- Vehicles entering the inner city area are charged US\$1.27 – US\$2.54 per trip at 18 entry points
- Voters accepted in Sept 06 - Live now

## Impact

- Traffic volume decreased by 25%, removing 100,000 vehicles during peak hours
- Increasing daily public transit rider-ship by 40,000
- Daily revenue of US\$500,000 to \$2.7 million

## Other Effects

- Lower fuel use, CO2, particulate matter
- Quieter streets
- Overall benefits ~ \$100 mn/year on \$400 mn investment



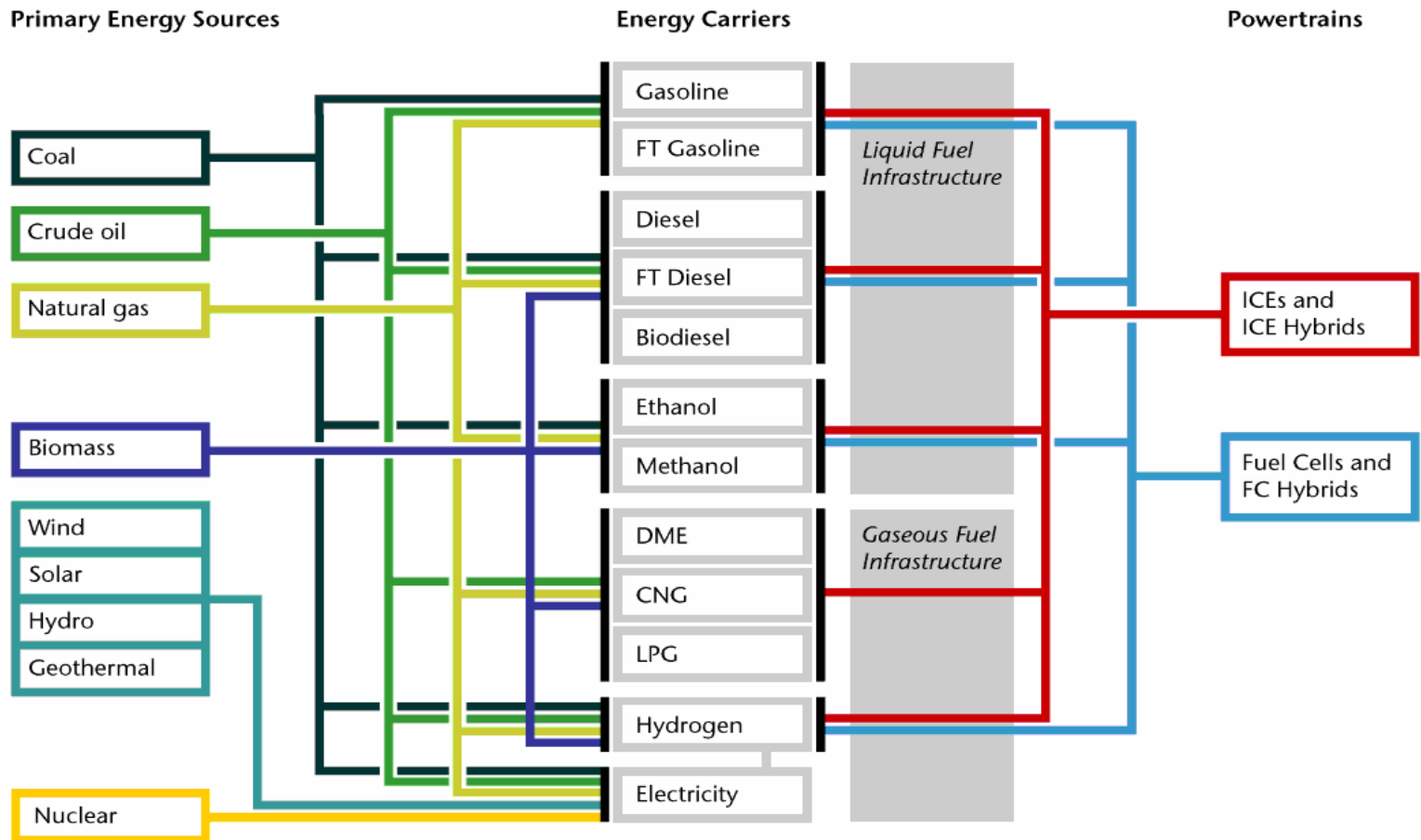
# Energy and Oil Options for Transport

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- **Oil Peak? So What? (85 mn bbl/day)**
  - Problem is running, not running out, in a roller coaster world
  - Little sincere effort to move away from oil – cost and economic risk
  - Oil security a concern – during political speeches
- **Alternative Fuels or Bio-Fuels?**
  - Alternatives exist in modest amounts, but none in large quantities
  - Oil prices must stay high for alternatives to make it
  - Bio-fuels on a large scale a threat more than a promise?
- **Forsaking Freight?**
  - Source of stronger energy and traffic growth than travel
  - Low cost (fortunately) relative to value shipped
  - Considerably flexibility in logistics, little flexibility in fuel

# F: New Fuels and Pathways: Many Options, None Cheap

## Possible Transport Fuel Pathways



# Energy and Oil Options for Transport

## What it Takes

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- Clear International Consensus on CO2
  - Introduction of carbon tax and other measures
  - Development beyond Kyoto, with US on board
  - Strong price signals on fuels, vehicle use
- Moves on Oil – Important, but Unlikely
  - Every previous effort died off – Markets always weaken
  - Alternatives still elusive and expensive
  - Clear decisions reinforced with taxes
- The Key: Urban Transport and 4-S
  - Focus on healthy cities and sustainable transport
  - Moderate vehicle use world wide
  - Cars become **smaller, safe, slow, and sustainable**


# AS IF TRANSPORT POLICY MATTERED

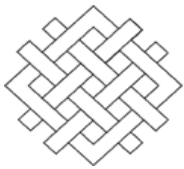
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- **A and S Total travel and modal shares**
  - Land use, congestion pricing reduce need to travel
  - Full cost pricing encourages public transport **S**
  - New business models make public transport thrive
- **I – Fuel and Modal Efficiency**
  - Technological progress and fewer macho-mobiles
  - Higher load factors and less congested traffic
  - Clear decisions reinforced with taxes
- **F – Fuels and emissions**
  - Stronger emissions control and fuel quality standards
  - Taxes for carbon, oil security, lower emissions
  - Taxes on oil, not subsidies, to stimulate off-oil moves

# Saving Energy, Emissions, and Cities – Time Frames

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- **Short Term – Fuel Prices, Car Use and Choice**
    - Introduce green taxation of fuels – tax bads, not goods
    - End to ethanol earmarks and other games
    - Cars should be SSS – Smaller, Slower, Safer
  - **Medium Term – Fuels, Car Efficiency, Location**
    - Business, home construction begin to adjust to new reality
    - Change of heart towards huge vehicles, and huge, dispersed homes
    - Relearning efficiency of cars use, collective travel
  - **Long Term - City Shapes Mobility, not other way 'round**
    - End to flyover fever and metro mania!
    - Places of work, play, shopping serve people, not vehicle travel
    - Property values and land use reflect realities about fuel, carbon
- 



WORLD  
RESOURCES  
INSTITUTE



THE WRI CENTER FOR TRANSPORT AND THE ENVIRONMENT



Kia Ora  
Thank you !  
谢谢



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