Looking Before You Leap into A Model:
w Climate for Seeing Transport Energy Futures?

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Precourt Energy Efficiency Center

Precourt Energy Efficiency Center
Stanford University

- **A research and analysis institute at Stanford**
- **Established in October 2006**
- **Initial funding: $30 million pledge by Jay Precourt**
- **Mission**
  - **To improve opportunities for and implementation of energy efficient technologies, systems, and practices, with an emphasis on economically attractive deployment**
  - **Focus on the demand side of energy markets**
  - **Energy efficiency: economically efficient reductions in energy use (or energy intensity)**

Transport Energy Futures

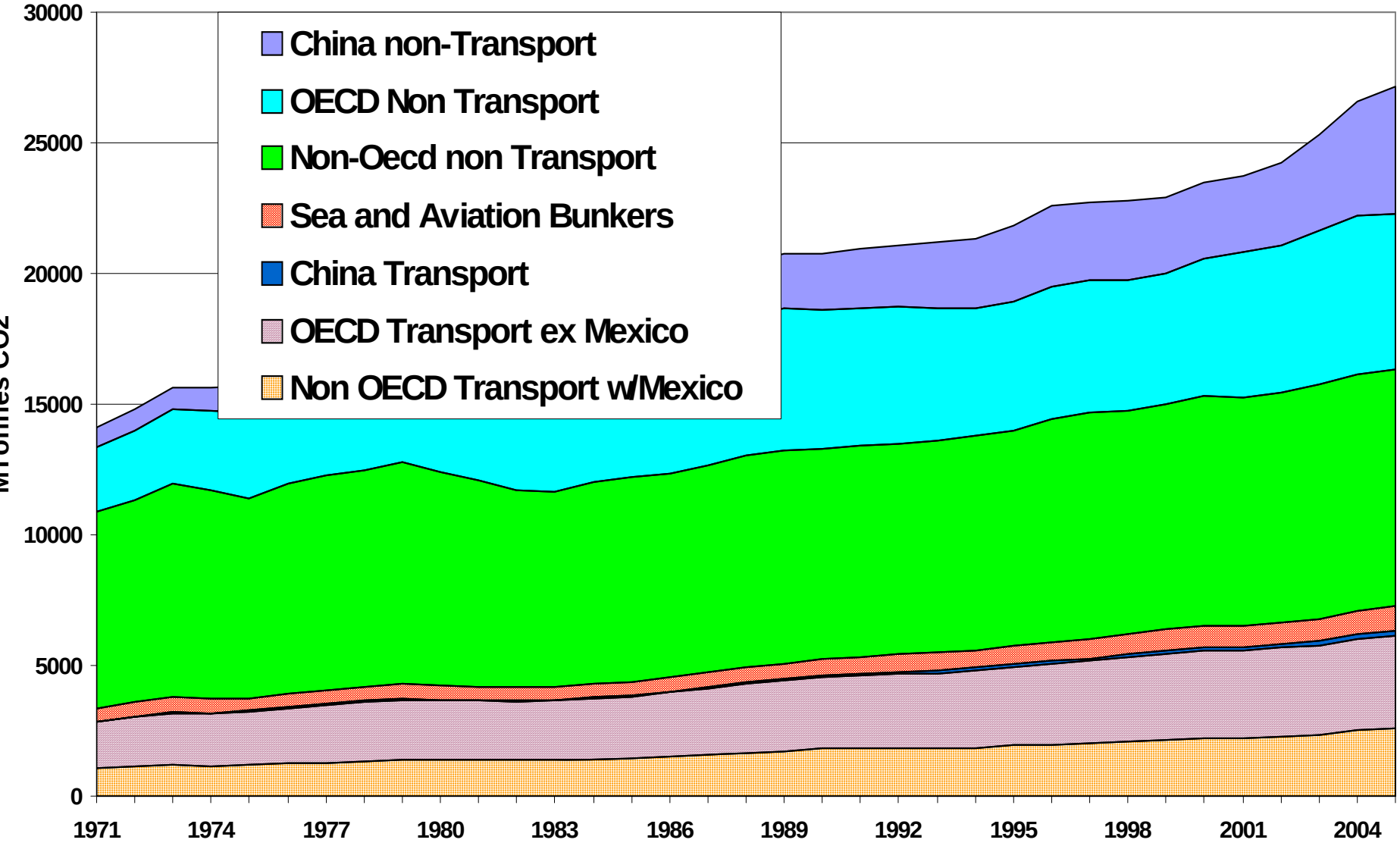
- The Traditional Approach – Less Helpful for Seeing
- The ASIF Approach
- Data Nightmares
  - Our Own US Problems: We can't count
  - What savings from dieselization in Europe
- The Blind Side – Transport Futures Trump Oil Futures
  - Mexico City CO_2 Benefits – Oil and CO_2 Savings No One Saw
  - Two Wheeler World in Hanoi – Sustainable Transport
  - Hyper-motorization in China (and India); Room on the Road?
- Conclusions
  - Tools and approaches for better views of the future

Congestion or Access?

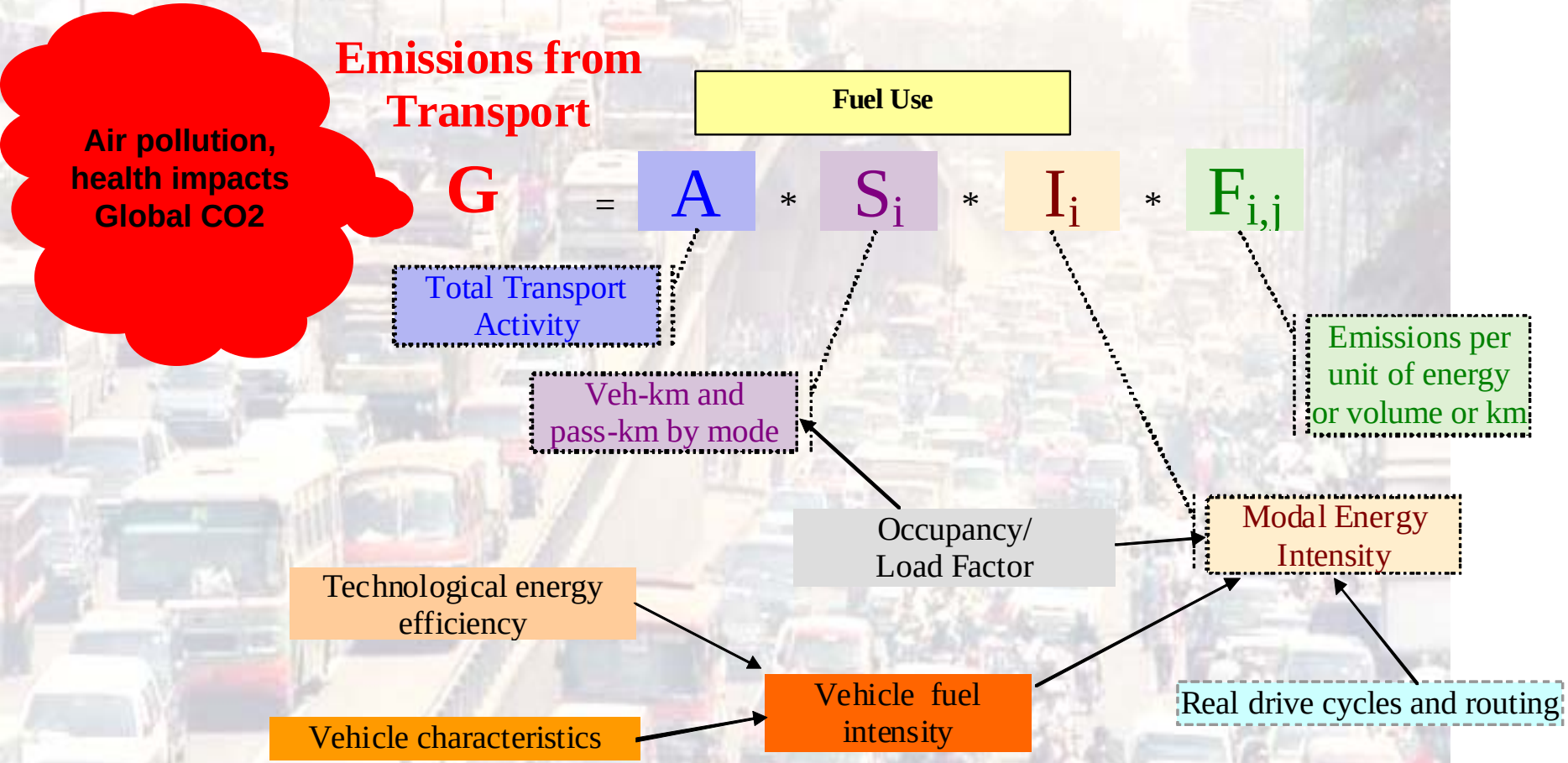
Is Our View of the Future Stuck?

WORLD CARBON EMISSIONS: TRANSPORT

Roughly 35% of Transport Emissions in/around Cities



"ASIF" Decomposition: Road Map For Saving



Lesson : Attack All Components of Fuel Use and CO2-
How Much Do we Even Know about the DC Metro Area?

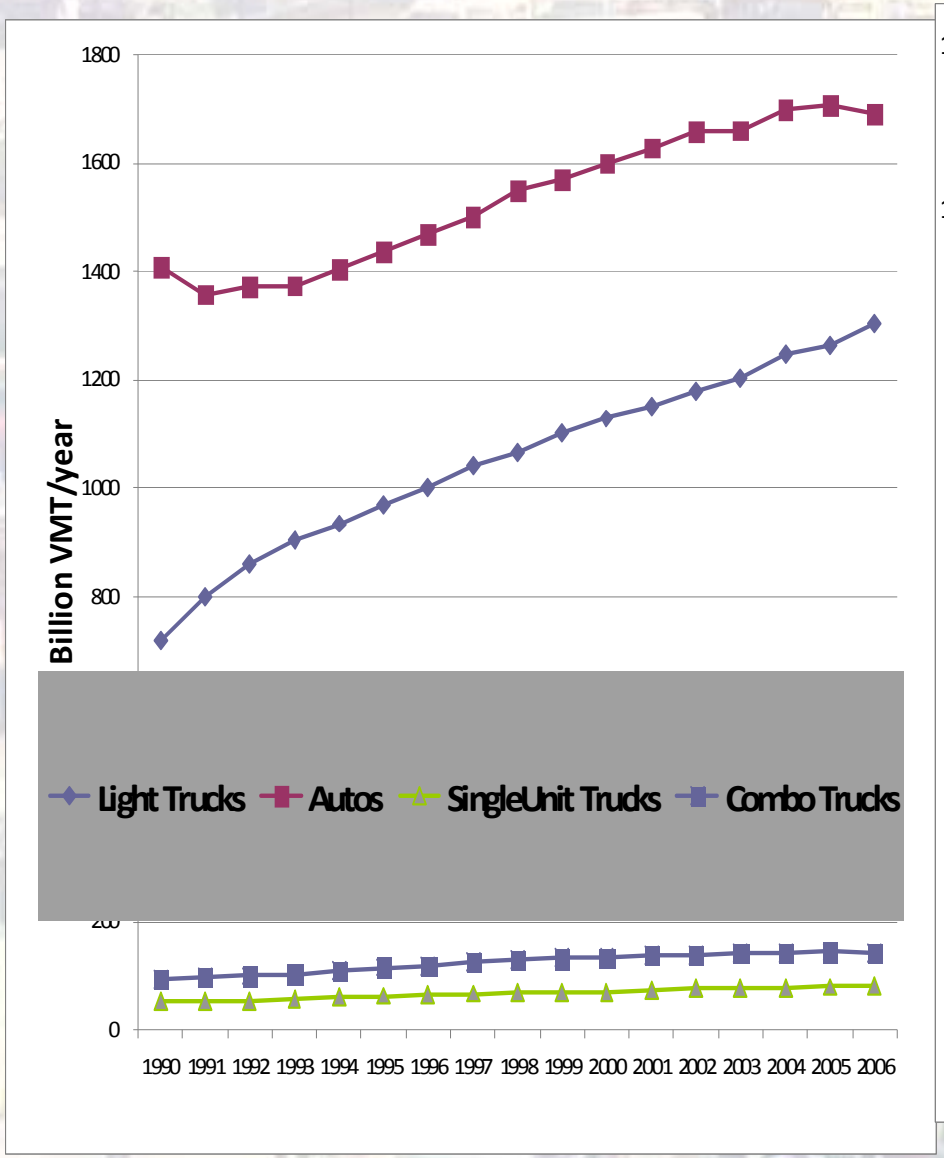
Key Issues in US Road Transport Models Activity And Fuel Economy Data

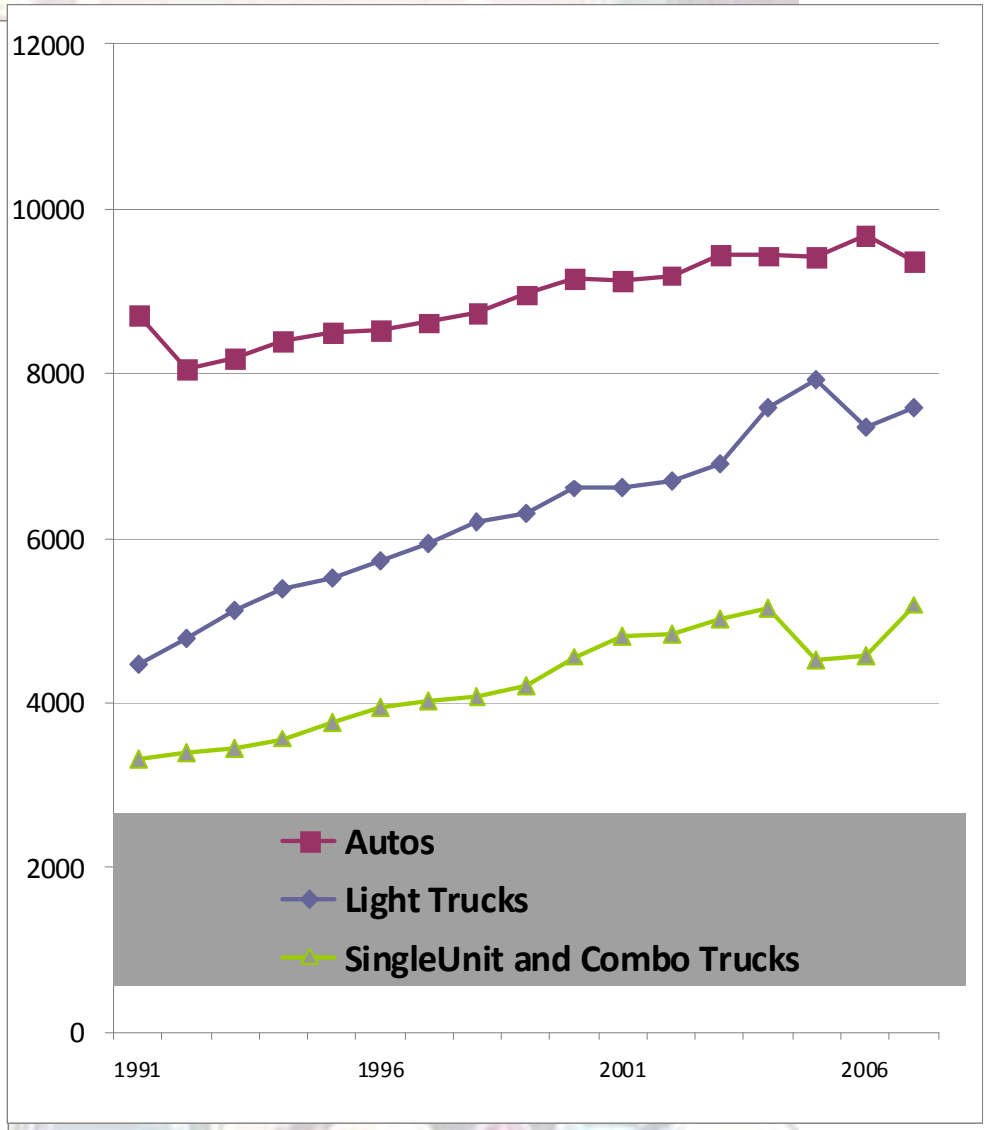
- Cars and Household Light Trucks – How are Numbers Made Up?
  - Nat Household Travel Survey every (X) years – No fuel data
  - DOT Table VMT-1 (by state) – how accurate are fuel sales and VMT?
  - DOE Household Energy Consumption Survey- VMT but no fuel
- Trucking
  - Table VM 1 Data on VMT and fuel by truck type – How collected?
  - No medium or short haul ton mile data
  - VIUS/TIUS Died in 2002 – how will we understand light trucks
- Why Is This a Problem?
  - No on-road fuel economy data when they are subject of public policy
  - Difficulties measuring short and long term changes in VMT
  - Rising interest in VMT Tax as part of way to pay for roads

It Could Be Worse: No VMT, Fuel Economy, or Consistent "Active Vehicle" Fleet Data for LDCs!

Where Did the Fuel Go?

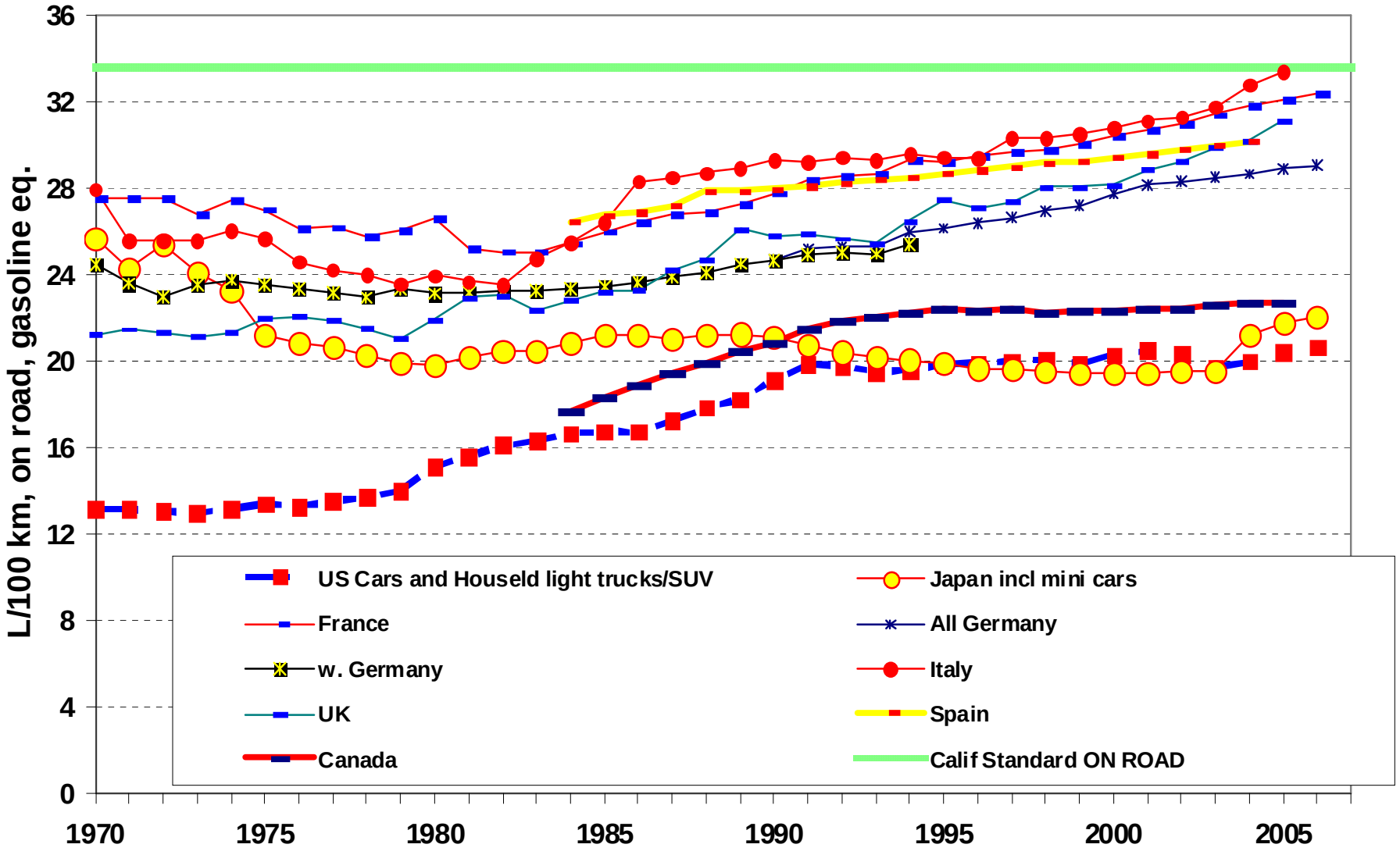
Our Own VMT and Fuel Accounts Don't Match





Where Is the US in On-Road Fuel Economy?

Hard To Tell What the Trend Is!



Saving Emissions From Transport – It Rarely Comes Down to Just Technology

- Traditional Technology – 40-60 MPG or 2.5-4 l/100km?
  - Less power, lighter materials, lower drag, CVT, cold cylinders
  - Gasoline or clean diesel hybrids
  - End to the power and weight chase?
- Other Approaches - Cost, Time to Deploy
  - City cars vs. long distance cars?
  - Plug in hybrids – most driving is for local, short trips
  - Fuel cells? Many cost, feedstock, materials challenges
- Alternative or Bio-Fuels – What are They Worth?
  - US Corn ethanol a dead end, other biofuels increasingly uncertain
  - True low carbon fuels not here, won't arrive under present policies
  - Non-oil always possible, but always expensive and higher CO2

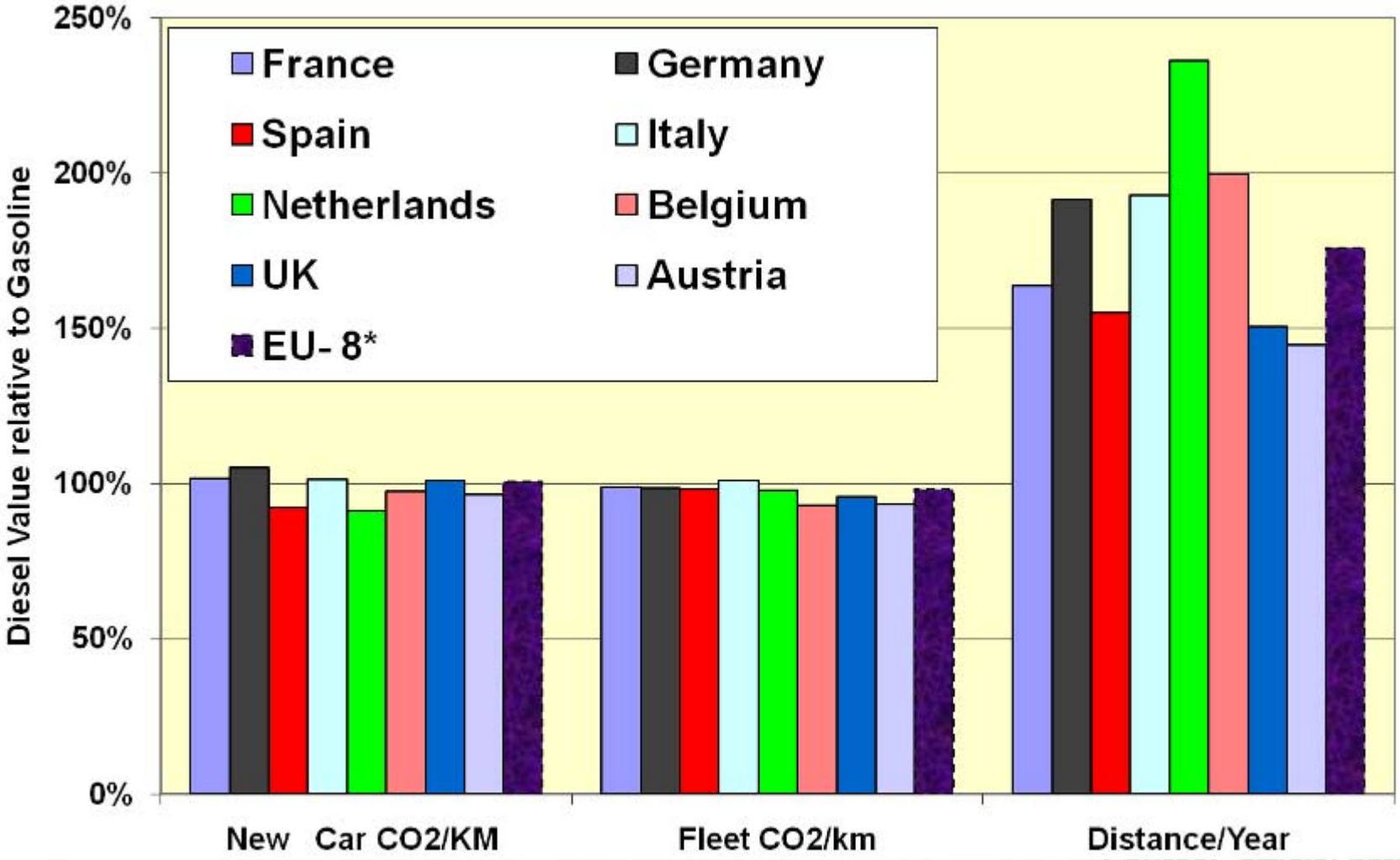
Do We Know How these Technologies will Perform?

Do We Know How To Put These Technologies into Models?

Dieselization in Europe: Where are the Savings?

Relative to Gasoline, Diesel Shows Little Energy or CO2 Savings Moreover, Driving Distances Larger

(Schipper and Fulton TRB 2009)



Source: official national data

Opportunities in Other Modes Overlooking the System Effects?

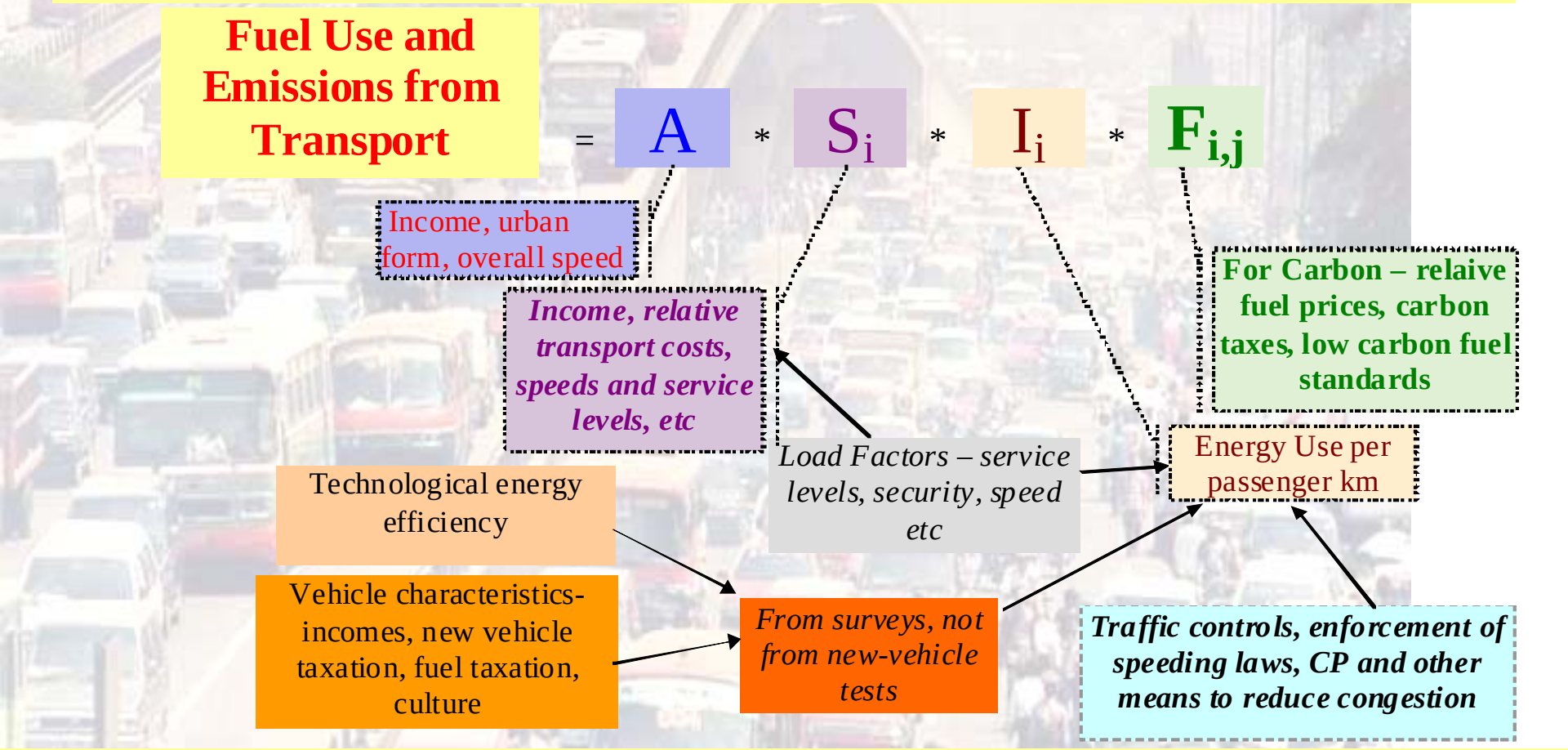
- BRT – High Speed, Low Emissions
  - Articulated buses running in dedicated BRT lines
  - Parallel hybrid drive trains using diesel propulsion
  - Fill them up!
- Trucking – Important Globally
  - Improve freight logistics, reduce empty running
  - Promote inter-modalism
  - Improving efficiency of trucks
- Rail?
  - Building or strengthening freight networks - uncertain
  - Consider low-cost, medium speed intercity rail (tilt trains)
  - Improve intermodal access around rail facilities to boost usage

Opportunities Are Great, but mostly from Transport System Improvements, not Technology

All Modes of Transport Will Evolve:
How Many Of These Components are in Models?

Changes in Transport Fuel and Emissions: Improving Fuel Economy Not Enough

What Shapes Each Component?



Most Components Related to Transport Policy, NOT Oil or CO2

Best Practices for Sustainable Transport: Little Money, but Pricing and Political Will

–Congestion Pricing Singap

Honda Accord Hybrid

Two-Wheelers in Hanoi??

–Bikes in Copenhagen

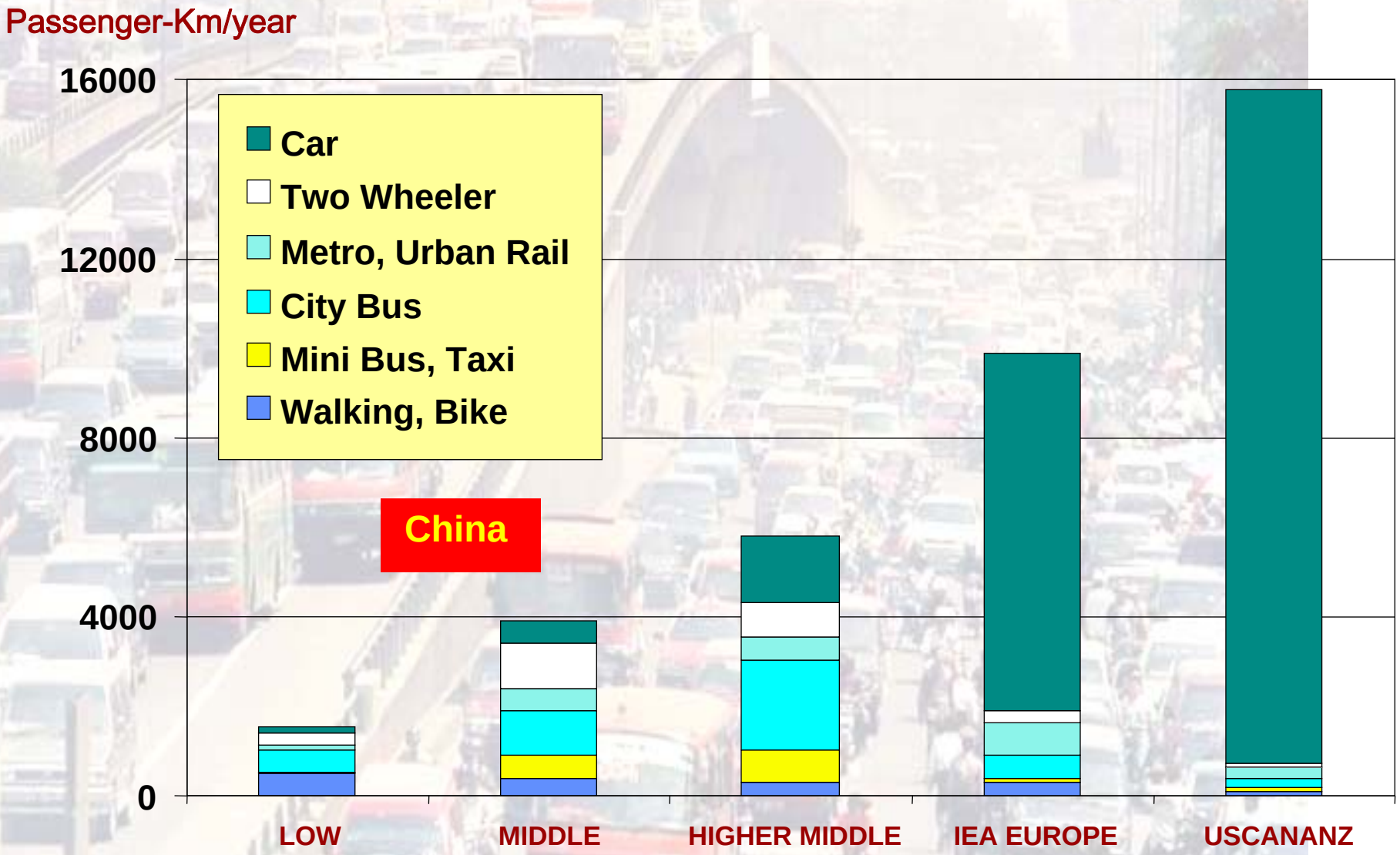
–Bikes at Bangalore Bus Sta.

Mexico City Clean Bus

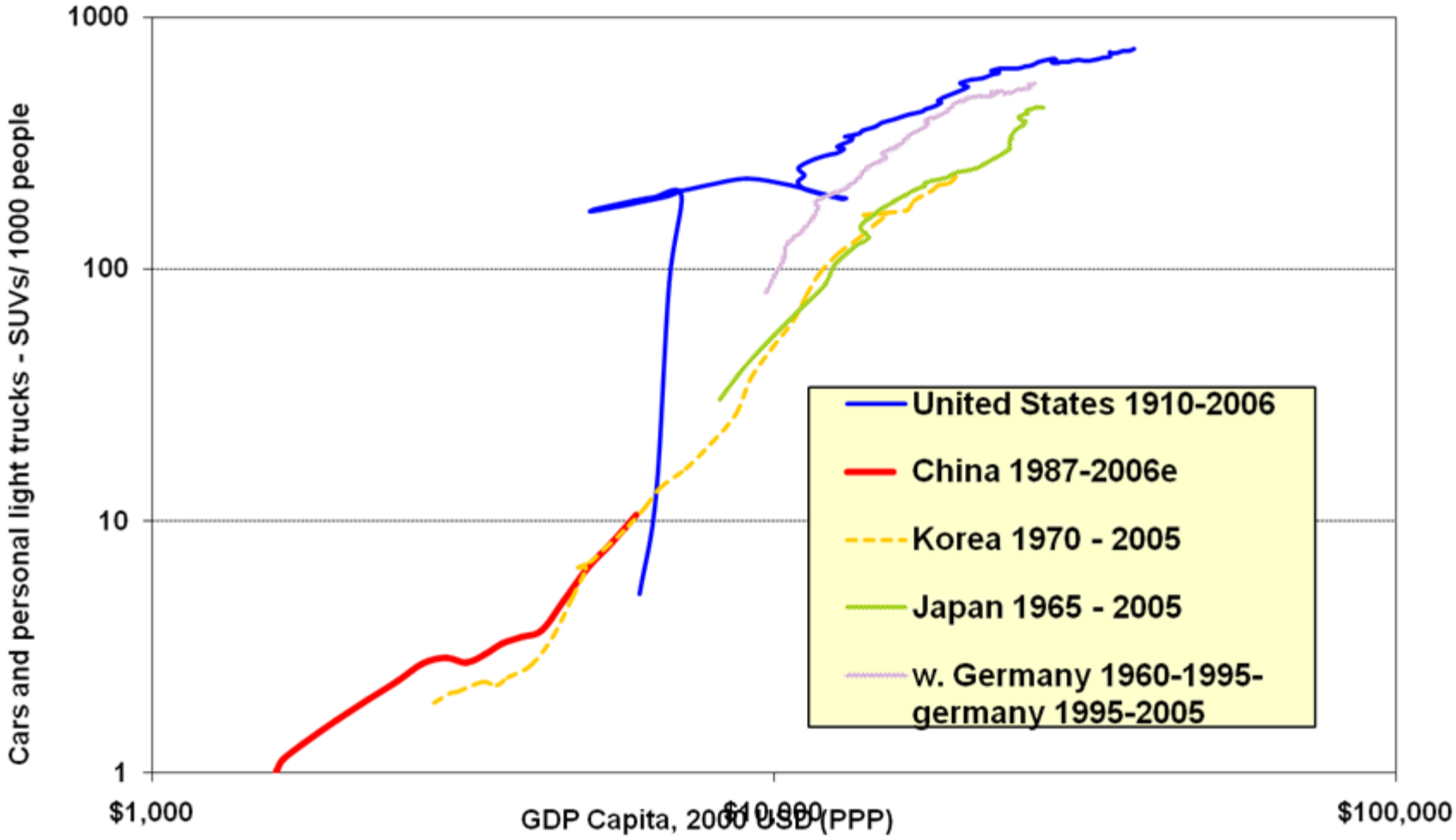
Bus Platform Curitiba

Mexico City Metrobus

Urban Mobility Patterns
The Mobility Ladder



Motorization and Economic Growth: The China Syndrome?



Key Question: Is this path of motorization good? Inevitable or avoidable?

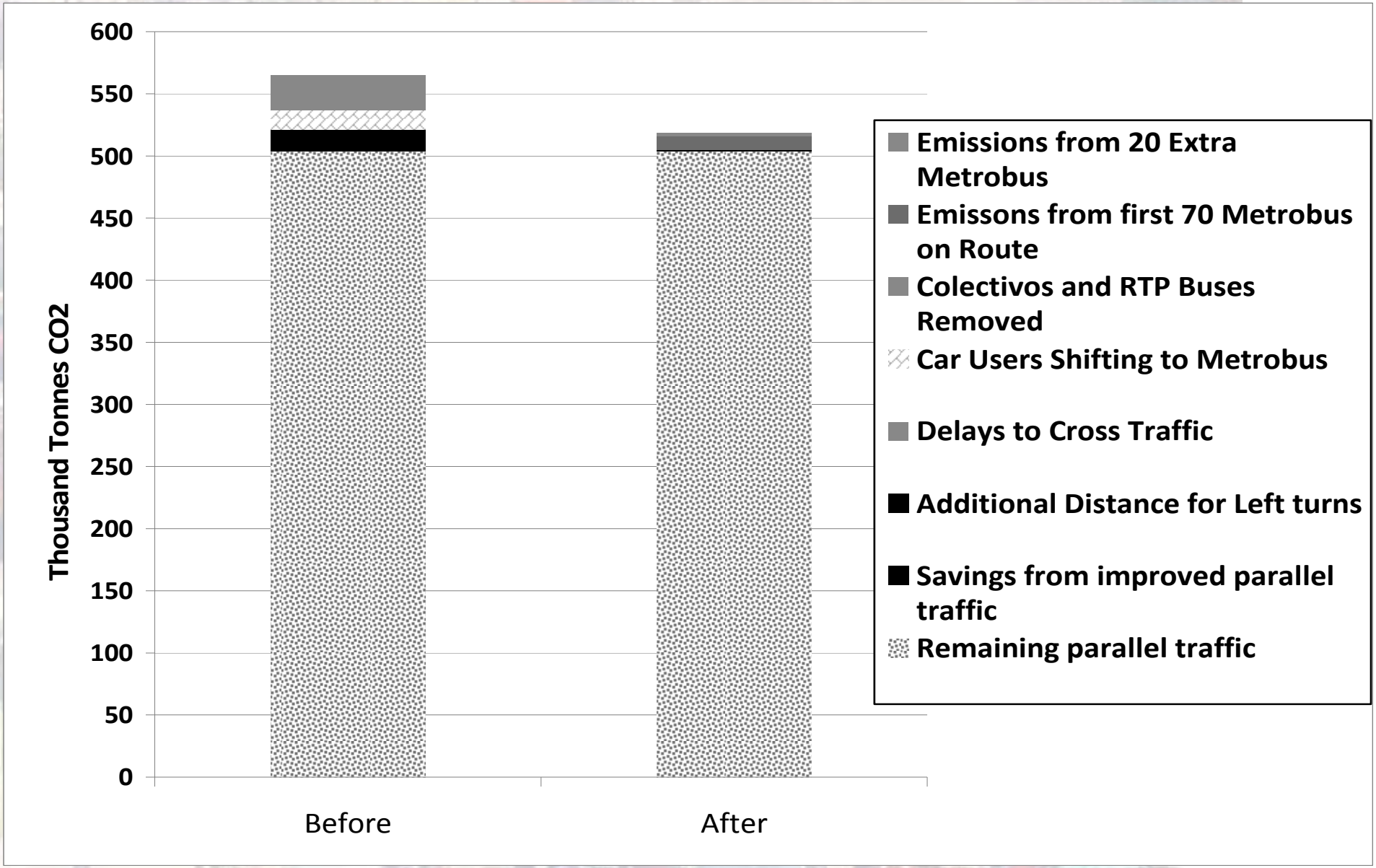
Creating Comfort from Chaos in Mexico City From South to North?

Bus Rapid Transit – Mexico's 1st Metrobus Line

260,000 people/day over 19km for US $80mn
Lower emissions and CO2, reduced car traffic

Metrobus CO2 Changes by Component

Source Rogers 2006, 2009

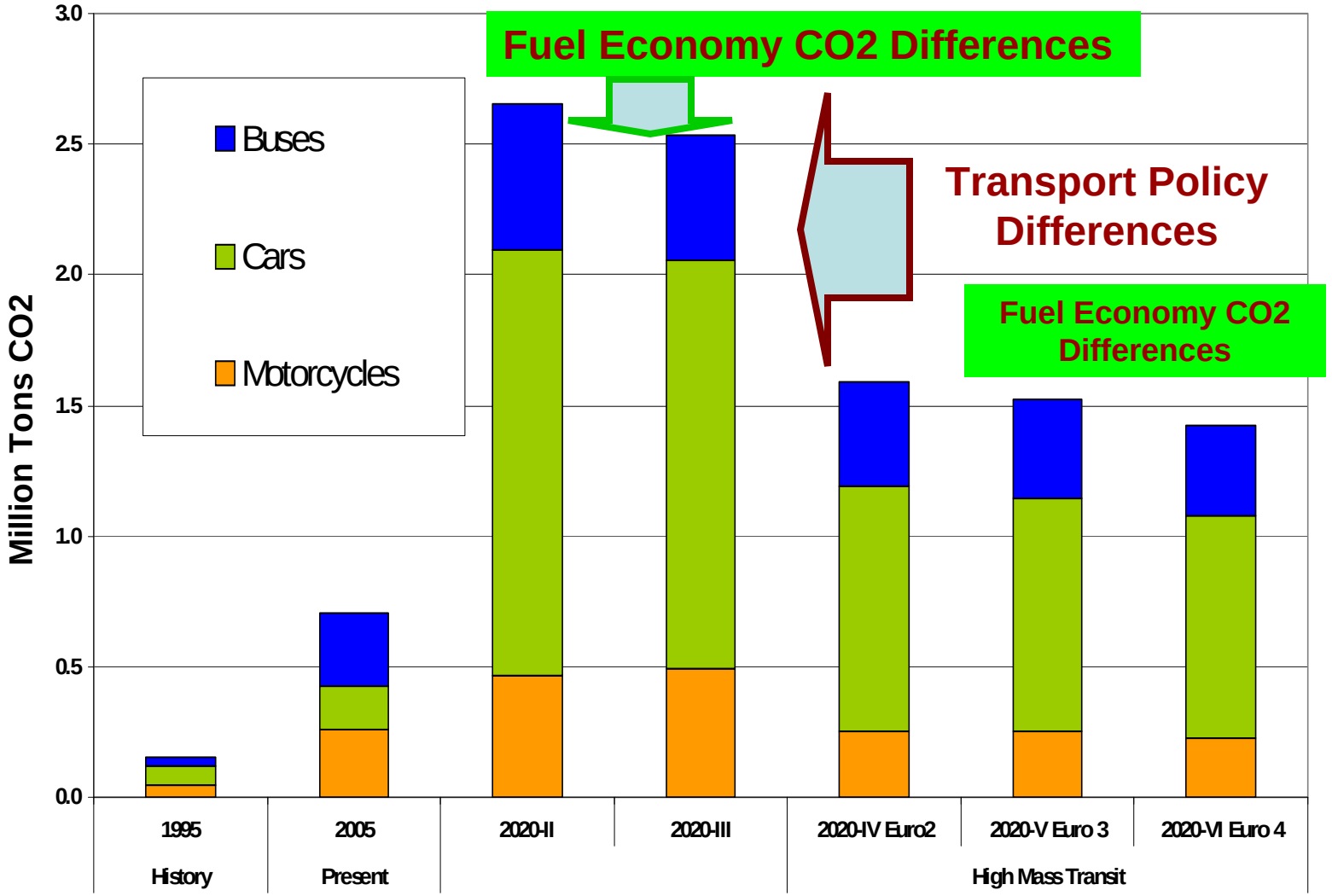


Mal-Asia?
Jakarta and Dozens of other Asian Citi

Scenarios for Hanoi-JICA and *EMBARQ*

Year	1995	2005	2020					
Transport policy (JICA)	History	Present	Let trends continue			High Mass Transit		
Transport system (JICA)	History	Present	Trends			BRT, Tram, etc.		
Public transport share	1%	6%	14.5%			30%		
Environment Emissions policy *(EMBARQ)*	History	Present	Do nothing		Medium	Do nothing	Medium	Ambitious
Emissions CoefficientCases *EMBARQ*	**1995**	**2005**	**2020-I 1.35 x today**		**2020-I1 1.35 x Euro2**	**2020-IV Euro 2**	**2020-V Euro 3**	**2020-VI Euro 4**

Resulting CO2 Emissions



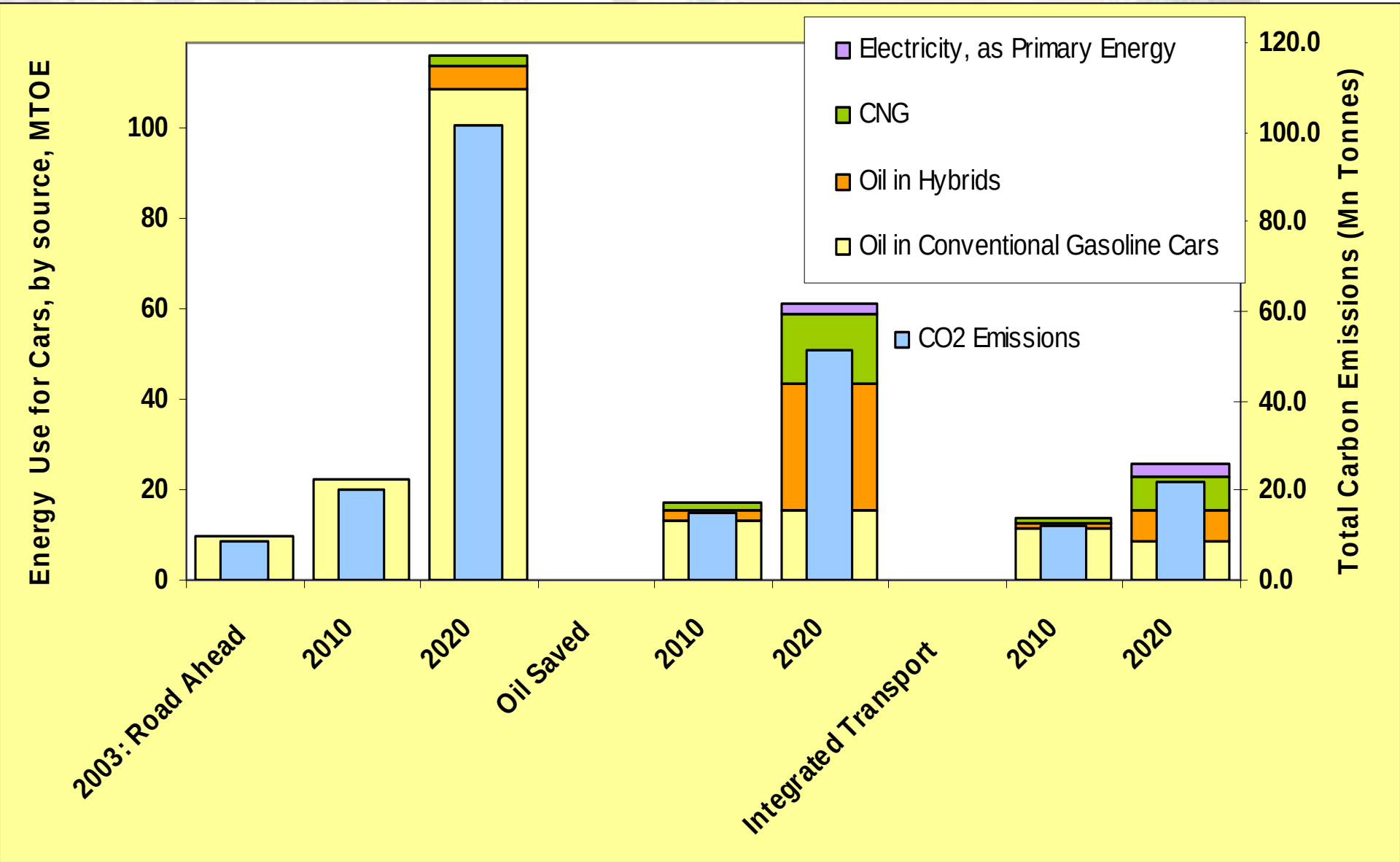
Introduction: Basic Thesis About (Hyper)-Motorization in China

- Speed of Motorization leaving officials, walkers behind
  - Incomprehensible growth rate in car ownership
  - Very poor data on use, fuel consumption, etc
  - Even word “car” in Chinese poorly understood
- Little Policy Competency to Slow or Control
  - Glory of modern motorization trumping other concerns
  - Whole city sections rapidly transformed into asphalt
  - Over-reliance on “technology” – human beings not in picture
- “Unintended” (or unknown?) Consequences
  - Burgeoning road fatalities (over half walkers, cyclists)
  - Air Pollution from vehicles rapidly replacing that from coal
  - Congestion now major threat to productivity, well being

EMBARQ's Scenarios for China

- **Base Case – China has Korean car/GDP ratio in 2020**
  - 120-160 million cars, 12,000 km/car
  - 8-8.5 L/100 km if no new measures
  - Closer to 2 mn bbl/day oil in 2020
- **Oil Saving Scenario – 40% as much oil, some CNG**
  - Japanese/Euro level of fuel prices
  - 110-130 million cars, but less driving/car
  - Fuel economy standards, some hybrids and CNG
- **Integrated Transport - Livable cities with good transport**
  - Much lower car ownership and use– avoiding the plague
  - Very small cars (incl. slow electrics, hybrids) to avoid space and congestion problems in cities
  - Serious BRT, car-use restraint, land-use planning

Sustainable Transport for China: Cars and CO_2 Emissions in 2020



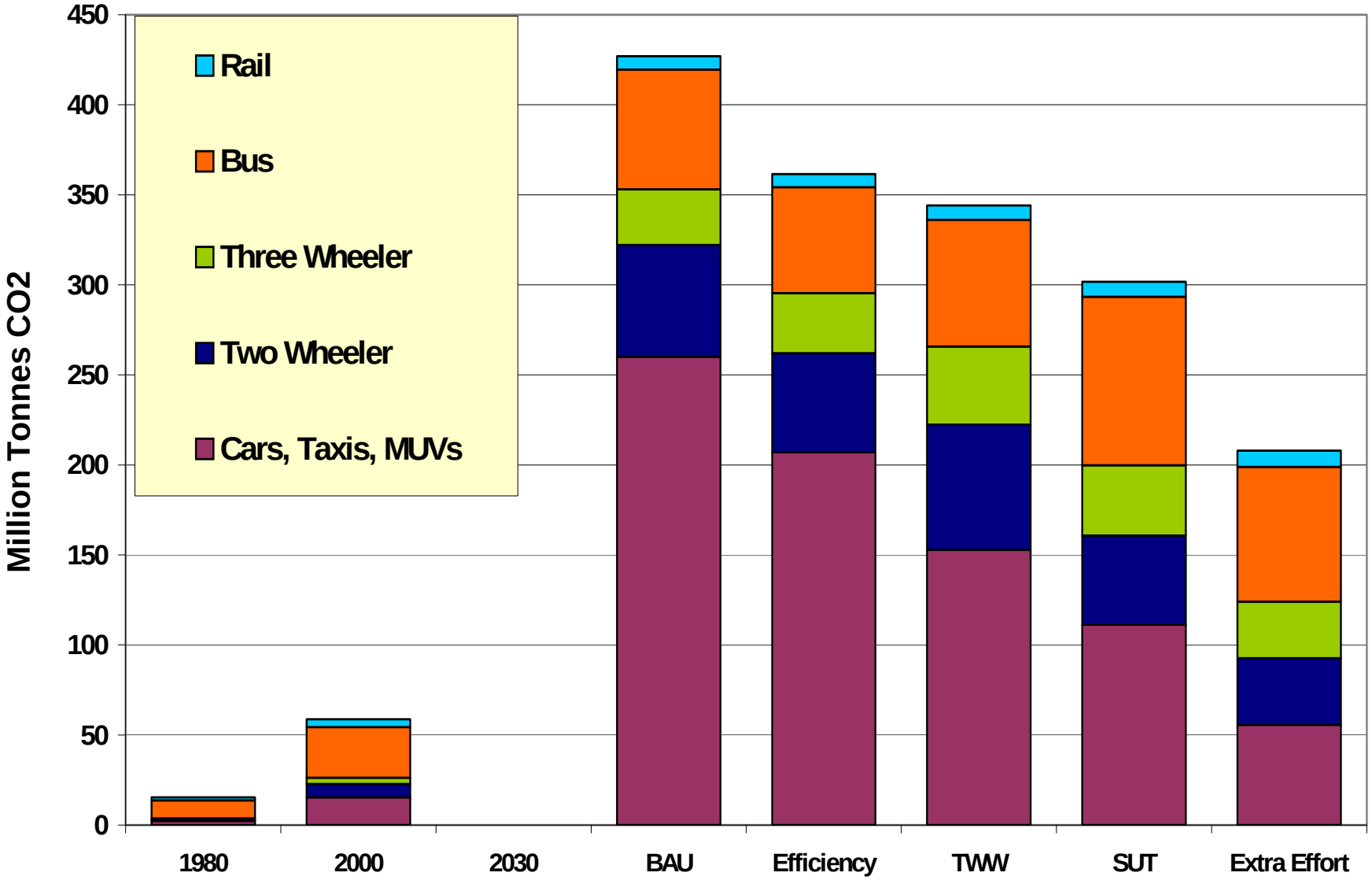
Cheap Two Wheelers, but No Sidewalks

And Now The Peoples' Car

Scenarios and Assumptions for India (*Transport Research*, forthcoming)

- **Business as Usual (BAU)**
  - Unconstrained development of road traffic and vehicle demand
  - Infrastructure is assumed to not be a constraint
- **Energy Efficiency**
  - Higher fuel efficiency
- **Clean Two and Three wheelers**
  - Cleaner fuels and two and three-wheelers
  - Increases in two and three wheeler modal shares
  - Reduction in all other types of private transport modes
- **Sustainable Cities/Urban Transport (SUT)**
  - Demand management and modern mass transit
  - Regulation of private car use reflected by reduction in modal share
  - Widespread implementation of BRT systems
- **Extra Effort -- All of the above**

India: CO_2 Emissions by Transport Mode



Lesson: Transport a Powerful Force Focusing on Fuel Misses Real Changes

- **Cities, Transport and Land Use Changing**
  - 500 million more people expected in Asian cities by 2030
  - American model of sprawl being tried, but not working well
  - Real space constraints more important than fuel prices?
- **Private Motorization- Trends Continued?**
  - Hanoi model (two wheelers), Nano, Hummer or? Depends on Policy
  - Future of freight levels, systems also very uncertain
  - Present models too influenced by American experience
- **Where Energy/Fuel Enters the Picture**
  - Fuel prices important to fuel efficiency, vehicle use
  - Fuel economy standards an unknown but rising influence
  - Fuel choices can be important if true, large scale bio-fuel emerges

Conclusions: Reframing the Transport-Energy Future
Challenge is About Sustainable Transport

- A New Framing of the Issue
  - Oil and carbon externalities less than clean air, congestion, safety
  - Developing countries now in serious mobility trouble – oil 2nd problem
  - CO2 is not a transport problem, but transport causes CO2 problems
- How to View CO2 and Energy Saving
  - Avoiding carbon intensive transport – a development issue
  - Developing good transport w CO2 co-benefits – not today's mess
  - Then and only then estimate of reduced fuel or CO2/veh kilometer
- Tools and Data
  - Reasonable vehicle stock, use, pass- and tonne-km data (not easy)
  - Models of urban/rural, demographic, and income evolution
  - New approach to estimating "CO2 and Energy Saving"

Thank You

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Car that absorbs its own carbon and needs no oil?

http://piee.stanford.edu

In Future:

http://peec.stanford.edu