Transport and CO2 Emissions: A New Framework for a New Challenge

Lee Schipper
Senior Research Engineer
Project Scientist, Global Metropolitan Studies, UC Berkeley
and
Precourt Energy Efficiency Center, Stanford University

FUM
Hakodate Japan
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Key Messages: Saving CO2 in Transport

• Transport Matters A Lot for CO2; CO2 Matters Little for Transport
  • Transport fastest rising CO2 emissions source (24% global 2006, “50% urban”)
  • Light duty vehicles at center of urban transport problems and rising emissions
  • High CO2 symptom of poor urban transport in most developing cities
  • Technology improvements to LDV important, but VKT growth the major problem

✓ Frame problem as a transport problem, not a CO2 problem
  • Transport suffers major externalities; congestion, pollution, accidents, noise, CO2
  • This cheap transport stimulates VKT even more, particularly in LDV
  • CO2 (even at $85/tonne) not major determinant – take as cobenefit of good transport
Key Messages: Major Restraint In CO2 Impossible Without Strong Sustainable Transport

✓ Measuring Carbon, Testing andValidating impacts of policies and technologies
  • Measure and monitor to validate measures, strengthen where needed
  • Impacts – Compare with/without a policy or other intervention
  • “ASIF” approach or more detailed travel models/fuel simulation necessary
  • Use models, data to estimate changes in travel, vkt, fuel; time, accidents, CO2
  • Serious problem for Asia – basic data on vehicles, travel, freight, fuel missing

✓ Mitigate CO2 In Urban Transport – The new ASIF is not by tailpipe alone
  • Avoid – Sustainable urban development (Singapore?) served by good transport
  • Shift – Improve access with collective modes, NMT, with restraint on car use
  • Improve – Reduce carbon intensity of vehicles, travel and freight
  • Finance good transport, not just CO2 reductions

✓ The Way Forward with Serious Policies (Leather ADB or Mitric WB)
  • Internalization of externalities – taxes, regulations, oversight and monitoring
  • Efficiency standards on light duty vehicles
  • Reform freight and logistics
  • Financing and demonstration (FAD)
Congestion or Access?
Don't run across the road and confuse the driver.
Transport Most Rapidly Rising CO2 Emission Source
Road Transport ~ 75% of National Transport Emissions
Ratio Road Transport CO2/GDP Falling Only Slowly

Road Transport CO2 Emissions/GDP, 1990
Road Transport CO2 Emissions /GDP, 2006

kg CO2/$ GDP

World | US | Japan | OECD Europe | Africa | Middle East | Non-OECD Europe | Former USSR | Asia (excluding China) | China (including Hong Kong)
Light Duty Vehicle Ownership and Income CO2 Mitigation Must Aim at Cars!

CO2 Mitigation Must Aim at Cars!

Light Duty Vehicles/1000 people

Light Duty Vehicles/$1mn of GDP

GDP/Capita, US$ 2000 PPP
Light Duty Vehicles Dominate Traffic and CO2 Emissions from Road Transport in Cities – Similar Patterns for other Latin American and Asian Cities

*Source: Mexico City Environment Office Bottom-up Emissions Inventory

In much of Asia, 2 wheels contribute more VKT, similar CO2 as cars do in Latin America
Future CO2 Emissions from Transport in Asia
Even After 20% Reduction in Fuel/km, Still Out of control
(Source WBCSD Sustainable Mobility Project)

LDVs out of control

<table>
<thead>
<tr>
<th>Country</th>
<th>2000</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1200</td>
<td>800</td>
<td>1000</td>
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<tr>
<td>Other Asia</td>
<td>600</td>
<td>300</td>
<td>800</td>
</tr>
<tr>
<td>India</td>
<td>400</td>
<td>300</td>
<td>500</td>
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</tbody>
</table>
The CO2 PROBLEM IS A TRANSPORT PROBLEM, PREDOMINANTLY CARS AROUND URBAN AREAS.
“The Road From Kyoto” (2000):
Transport/CO2 Policies in 6 IEA Countries

• Potential Large, Progress Slow, Risks High
  • Technology getting better there but price signals still weak;
  • Political will missing in 2000, stronger now
  • Absence of meaningful initial progress in the US changing now?

• Main Elements Still Important Today
  • Transport sector reform as umbrella for process
  • Voluntary agreements (soon mandatory) on car fuel economy important
  • Fuel pricing also important, particularly for United States

• Hard Lesson: Many Years to See Impacts
  • Countries moved weakly towards better transport policies
  • Voluntary agreements achieved half their goals
  • Threats from distractions (bio-fuels, oil-price fluctuations, CO2 fights)

Oil and CO2 more important in 2009 than before:
Transport Polices Even More Important
Transport- CO2 Mitigation: Avoid and Shift but also Improve/Mitigate

Avoid CO2-Intensive Development:
- Singapore Land Use Planning,
  Congestion Pricing

Shift and Strengthen:
- Mexico City Metrobus

Improve and Mitigate:
- Efficient Vehicles
- True Low Carbon Fuels
### Transport Externalities in US Context

**Range of Costs/km large- Which are Most Important in Asia?**

<table>
<thead>
<tr>
<th>Range External Costs in Cost-of-Driving Studies</th>
<th>Low</th>
<th>High</th>
<th><em>(JEL)</em></th>
<th>Comments on Asian Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pollution</td>
<td>0.6</td>
<td>8.5</td>
<td>1.5 cents/km</td>
<td>Values are probably higher for Asian cities because of higher levels of air pollution, even after adjusting for Quality-adjusted value of life.</td>
</tr>
<tr>
<td>Climate Change</td>
<td>0.2</td>
<td>0.7</td>
<td>0.2-2.1 cents/km</td>
<td>Uncertainty large (Nordhaus 2008; Stern 2006) and certainly dependent on national and local situation. For US 0.2 cents/km = $10/tonne CO2; 2 cents/km= $80/tonne CO2</td>
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<tr>
<td>Congestion</td>
<td>2.5</td>
<td>10</td>
<td>3-4.2</td>
<td>Does not apply to all travel. Depends on value of time (50% of wage rate?). Delays worse in Asia, value of time lower.</td>
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<tr>
<td>Accidents</td>
<td>-0.6</td>
<td>6</td>
<td>1.2-4.2</td>
<td>Depends on valuation of accidents and life. Accident rates and fatalities much higher in Asia</td>
</tr>
<tr>
<td>Energy Security</td>
<td>0.9</td>
<td>1.7</td>
<td>0-1.5</td>
<td>Values depend on local energy supply situation.</td>
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**CO2 is A Small Externality Compared to Others**

**CO2 Will NOT Be A Driving Factor for Transport**
Shift and Reap Co-benefits
Bus Rapid Transit: Mexico’s 1st Metrobus Line
50 000 Tonnes of CO2 without trying
Metrobus CO2 Changes by Component

Larger buses, Mode Shift, Improved Parallel Traffic Almost Equal Parts
Source Rogers 2006, 2009

Before: Emissions from 20 Extra Metrobus
After: Emissions from first 70 Metrobus on Route

- Colectivos and RTP Buses Removed
- Car Users Shifting to Metrobus
- Delays to Cross Traffic
- Additional Distance for Left turns
- Savings from improved parallel traffic
- Remaining parallel traffic
Benefits from Metrobus: Broad Than Just CO2
Transport, Health Benefits >> CO2 Benefits

<table>
<thead>
<tr>
<th>Million $US (2005)</th>
<th>CO2 reduction in parallel traffic</th>
<th>CO2 reduction, mode shift car to bus</th>
<th>CO2 reduction from bus switch</th>
<th>Fuel savings to parallel traffic</th>
<th>Fuel saving, mode switch car to bus</th>
<th>Fuel Savings from bus switch</th>
<th>Air Pollution/Health Benefits from lower air pollution</th>
<th>VKt external costs -- reduction in all traffic</th>
<th>Time Savings of Bus Riders</th>
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Low CO2 Value ($5/tonne)  High CO2 Value ($85/tonne)
MEASURING CARBON FOR GOOD POLICY: YOU CANNOT MASTER WHAT YOU CANNOT SEE

• Analysis of Status Quo and Role of High vs Low C Modes
  – What are the components of “ASIF” today and in the past?
  – What are the current parts undergoing most rapid change?
  – What are key driving factors causing this change?

• Projections -- Looking Forward for Projections
  – How will project or policy affect transport patterns and vehicle use?
  – How will changes in vehicles and traffic affect fuel?
  – What technical changes to vehicles will affect fuel use

• Evaluation of Policies – Looking Back
  – How did urban development change to avoid CO2
  – How have traffic and transport patterns changed from projected
  – How did new vehicle technologies perform compared to promises

Almost no Developing Countries or Cities Have Data and Models Today for this Approach
KEY APPROACH TO EVALUATION
COMPARE BASELINE TO ACTUAL
(WITH AND WITHOUT MEASURES)

Before & after project

Original Baseline: No Project

Difference between with & without project; widening gap

With Project

Revised Actual: Second Project?
“ASIF” Decomposition: Road Map For Saving Road Map for Evaluation

Emissions from Transport

\[ G = A \times S_i \times I_i \times F_{i,j} \]

- **Trips, Land Uses**
- **Fuel Use**
- **Modal Energy Intensity**
- **Emissions per unit of energy or volume or km**
- **Occupancy/Load Factor**
- **Vehicle fuel intensity**
- **Vehicle characteristics**
- **Technological energy efficiency**
- **Total Transport Activity**
- **Veh-km and pass-km by mode**

**Lesson:** Attack all Problems of Transport Not Just Technological Efficiency and Fuels
Use Models, Data to Estimate Transport Changes; Then Count Carbon Changes

- Start with basic L.U and transport models and data
- Estimate from scope and scale zone of influence
- Determine impacts on people and vehicles
- Use fuel model to determine changes in fuel and CO2 emissions
- Track changes in major transport and environmental variables
- Try to model longer-term feedbacks on land use, trip generation
- Data required are needed for good transport and environmental planning and management
Counting Carbs in the Policy Process

**Diagnoses:**
Traffic, congestion pollution, Safety, emissions etc

**Cures:**
Options Analysis And Cobenefits

**Prognoses**
Impacts of measures

**Outreach**
Explain what happened

**Evaluation, Adjustment:**
actual vs expected; then fix

Data are Needed For Good Transport: Same Data Allow Us To Count Carbs
Provoking Changes in Transport Emissions
Intervene with Links Among Driving Forces

**Fuel Use and Emissions from Transport**

\[ A \times S_i \times I_i \times F_{i,j} \]

- **Income, urban form, overall speed**
- **Vehicle characteristics: incomes, new vehicle taxation, fuel taxation, culture**
- **Technological energy efficiency**
- **Load Factors: service levels, security, speed etc**
- **Energy Use per passenger km**
- **For Carbon: relative fuel prices, carbon taxes, low carbon fuel standards**
- **Traffic controls, enforcement of speeding laws, CP and other means to reduce congestion**

From surveys, not from new-vehicle tests

Few Asian Cities or Countries Can Quantify The Links
Policy for Low Carbon Transport: the New ASIF

- **Avoid** – Saving Carbon Through Urban Development
  - Land Use: Building a city or differently (Singapore, Seoul)
  - Internalizing costs at an early stage of development
  - Shifting the balance away from high-carbon transport

- **Switch**: Co-benefits of Transport, Development
  - Bus Rapid Transit and other improvements to transport system, LOS
  - Careful transition from smaller to larger, better managed transit vehicles
  - Congestion pricing and other strategies to reduce externalities

- **Improve by Operations, Technology**: Carbon costs Count
  - Lower fuel use/km with improved traffic flow
  - Higher vehicle occupancy
  - Efficient vehicles, low carbon fuels – Mostly national initiatives

- **Finance**: Local Authorities, MDBs
  - Demonstrations
  - Measurement and evaluation techniques
Saving and De-Carbing in Transport
Opportunities for Intervention?

• Reform for Sustainable Transport
  – Internalization and variabilization of external costs to all modes
  – No more subsidies for fuels, individual vehicles
  – Role for “North” and MDB’s: Demonstration

• Technology for Decarbonized Transport
  – Smaller, less powerful, efficient individual vehicles
  – Low carbon fuels??
  – New role for vehicle and transport industries?

• Policy Framework – Lesson from Singapore?
  – Sustainable (urban) development with all the taxes
  – Slower march of global trade with high carbon price
  – Trust among government, priv. sector, civil society

Measuring Impacts of These Policies Takes Effort
Ignoring Mistakes is Costly
Conclusions: The CO2 Transport Challenge is about Sustainable Transport

- A New Framing of the Issue: NOT “Climate Change”
  - CO2 not a leading transport issue, but transport leading source of CO2
  - Developing countries don’t need to reduce, they need to avoid
  - Current CO2 emissions not the point; address future transport

- Sustainable Development and Sustainable Transport
  - Social, Economic and Environmental Sustainability
  - Transport measures not focused on carbon (avoid the $/ton syndrome)
  - Measure carbon to be sure trends change to lower carbon in transport

- Avoid, Shift, and Improve/Mitigate
  - Avoiding best long-term goal for developing countries
  - Co-benefits from Shift and Strengthen important everywhere
  - Mitigation important, but there is little to “mitigate”, much more to avoid

Political Will and Strong Governance
Key Elements more than Money and Technology
Even with a car that absorbed its own carbon, and needed no oil, we would still need strong transport policies!