1. Where to start:

Understanding transport energy use and the impact of modal choice

Transport: Session 1
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#energyefficientworld
Understanding transport energy use

*Jacob Teter - IEA*

- Global and regional trends in transport energy consumption
  - Transport relies overwhelmingly on products of oil
  - Road transport modes account for the majority of transport energy use
  - The developing and emerging world is consuming more energy
  - Vast disparities remain in terms of average energy use per capita across countries

- Measurements matter, mode matters
  - Introduction to metrics of transport activity and useful services
  - Historic trends in useful activity
  - The impacts of modal choice on energy demand
Energy Consumption in Transport – three decades of progress?

Final energy demand

<table>
<thead>
<tr>
<th>Category</th>
<th>1973</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>23%</td>
<td>29%</td>
</tr>
<tr>
<td>Industry</td>
<td>33%</td>
<td>29%</td>
</tr>
<tr>
<td>Residential</td>
<td>12%</td>
<td>22%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>Services</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>8%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Oil products

<table>
<thead>
<tr>
<th>Category</th>
<th>1973</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>52%</td>
<td>66%</td>
</tr>
<tr>
<td>Industry</td>
<td>22%</td>
<td>8%</td>
</tr>
<tr>
<td>Residential</td>
<td>12%</td>
<td>6%</td>
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<tr>
<td>Other</td>
<td>7%</td>
<td>18%</td>
</tr>
<tr>
<td>Services</td>
<td>7%</td>
<td>2%</td>
</tr>
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<td>Other</td>
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</tbody>
</table>

Source: IEA World Energy Balances, 2018
Energy Consumption in Transport – breakdown by mode

- World transport energy use by mode, 1971-2015

- Road transport modes account for most (about 75%-80%) of transport energy consumption.
- The share of road in total final energy use from oil products grew from 30% in 1971 to more than 50% in 2015.

Sources: IEA World Energy Balances, 2018; IEA Mobility Model, Spring 2018 version
Energy Consumption in Transport – breakdown by global region

• Transport energy use by region, 2000-2015

- Final energy demand from the transport sector demand grew by 44% between 2000 and 2015.
- The share of global energy demand among non-OECD countries increased from 30% to more than half.

Sources: IEA World Energy Balances, 2015; IEA Mobility Model, Summer 2016 version
Energy Consumption in Transport – breakdown by country and fuel

- Per capita transport energy use by country and by fuel, 2015

The average national ratio of transport energy use per capita varies widely across countries.

Source: IEA Energy Technology Perspectives 2016.
Transport activity: how do we measure it?

- Key parameters: vehicle-kilometres (vkm)

\[ \text{Number of vehicles} \times \text{kilometres per vehicle} \]

\[ \text{(Stock)} \times \text{(Mileage)} \]

Vehicle kilometres (vkm)
Transport activity: what do we get out of it?

• Key parameters: passenger-kilometres (pkm)

Vehicle kilometres x passengers per vehicle

(vkm) (Occupancy rate)

Passenger kilometres (pkm)
Transport activity: what else do we get out of it?

• Key parameters: tonne-kilometres (tkm)

Vehicle kilometres x tonnes per vehicle

(vkm) (Load factor)

Tonne kilometres (tkm)
Transport activity: Travel growth

- Passenger and freight transport by region, 2000-2015

- Transport activity grew by 86% (pkm) and 75% (tkm) between 2000 and 2015.
- Growth in non-OECD countries is faster than in the OECD.

Source: IEA Energy Technology Perspectives 2017.
Transport activity: useful energy intensity, by mode

- Passenger and freight transport by region, 2000-2015

- Air and light road passenger modes (cars) are more energy intensive than public transport.
- Light road freight is more energy intensive than large road vehicles, rail and shipping.

Source: IEA Energy Technology Perspectives 2017.
Transport activity: mode matters

- National transport activity by mode, 2015

1 trillion pkm
3 trillion pkm
5.5 trillion pkm

6.3 trillion
9.3 trillion

This map is without prejudice to the status of or sovereignty over any territory, city or area. The delineation of international boundaries is based on the United Nations and to the name of any territory, city or area. Source: IEA Energy Technology Perspectives 2016
Transport activity: mode matters → fuel use

- Transport energy use by country, 2013

[Map showing transport energy use per country with pie charts indicating the share of different fuels.]

Source: IEA Energy Technology Perspectives 2016.
Transport activity: mobility patterns vary

Passenger travel by mode in selected countries, 2015

- Modal split varies at the national and regional level

Source: IEA Mobility Model, Spring 2018 version.
Transport activity: variation is even greater at a city level

- Modal split varies at a city level
- Patterns emerge when comparing modal shares in different cities

Source: IEA analysis using data from the *Millennium City Databases* – Union internationale des transports publics (UITP) (2015), Millennium City Databases for Sustainable Transport, database, UITP, Brussels.
Key messages

• Transport is among the major energy-consuming sectors
• Transport relies overwhelmingly on oil products
• Large shares of oil products go to transport
• Oil is critical for energy security / energy exports
• Road modes are the major consumers of transport energy
• Energy intensity varies widely by mode
• Modal split varies widely, both among countries and cities
Negative Impacts of Transport
Transport and Energy Policies: Why are they needed?
Implications of transport activities

Negative externalities

- Local air pollution: PM, NO\textsubscript{x}, SO\textsubscript{x}, O\textsubscript{3}, VOCs

- CO\textsubscript{2} emissions: 80% of total transport emissions from road transport emissions (1,800 million tonnes out of 2,150 million tonnes in 2012 in Asia Pacific region)

- Road safety

- Access to mobility and growing inequality

- Noise pollution
Transport and Energy Policies: Why are they needed?

• To weaken negative impacts of transport activity on others (externalities)
  - Damage to the environment – GHG, local pollutants
  - Health related issues – Local pollutants, noise
  - Time loss - Congestion / Queuing / Waiting

• To try to provide equal access to mobility
  - Basic principle that individual should be able to move freely
  - Social equity

• To have safe and secure trips – reduce accidents
Activity and Group discussion

• Quiz on transport, energy use, and emissions

• What are the main limitations of transport services, and other negative impacts, in the city and country where you live and work?