Transport Models as Climate Policy Evaluation Tools

COP 22, Marrakech, Morocco
12 November 2016

Jean-François Gagné
Energy Technology Policy Division Head
International Energy Agency
IEA supports the low-carbon transition

IEA: the global energy authority

- Part of the OECD family
- Founded in 1974 to co-ordinate a response to oil supply disruptions
- 2015: IEA Modernisation grounded on three main pillars
  - global energy security
  - energy cooperation and global dialogue
  - promoting an environmentally sustainable energy future
- Build on a decade of analysis on what we need to do to keep temperature increase below 2°C
- Now developing analysis on faster and deeper energy-sector decarbonisation
Sizing the scale of the challenge... ... and its solutions

The carbon intensity of the global economy can be cut by two-thirds through a diversified energy technology mix.
But the challenge increases to get from 2 degrees to “well below” 2 degrees.

Energy- and process-related CO₂ emissions by sector in the 2DS

Industry and transport account for 75% of the remaining emissions in the 2DS in 2050.
Systems thinking and integration

Today’s energy system paradigm is based on a unidirectional energy delivery philosophy
A sustainable energy system is a smarter, multidirectional and integrated system that requires long-term planning for services delivery.
ETP model finds cost-effective investment and operation of energy technologies to meet energy demands from now to 2050
Understanding transport impacts: Mode matters

Well-to-wheels GHG emissions in 2015, by mode

Transport is the least diversified energy demand sector

Solutions need to be adapted transportation modes
Passenger transport activity: Mode matters

National passenger transport activity (pkm) in 2015, by mode

While activity is almost 50% higher in China than in the US...
Passenger transport energy use: Mode matters

National passenger transport energy use in 2015, by fuel

While China’s activity is almost 50% higher than in the US... Its total energy use is only a bit more than half that of the US
Need to decouple activity & emissions
Avoid/shift, vehicle efficiency, low carbon fuels

GHG Emissions in the 2DS, 4DS, and 6DS – 2010 to 2050

OECD transport emissions have peaked, while Non-OECD transport emissions can be brought back to current levels in 2050.
Transport energy demand projections

Policy and technology have great potential

Global Energy for Transport in 2015 & in 2050 in the ETP Scenarios

2DS sees a net global decline in transport energy demand, but not in all regions
Moving below 2DS reductions in transport will require action in all transport modes.
IEA 2DS level of ambitions – How can we move beyond?

**Cars and LCVs**

- **2DS**
- **4DS**

2050 4DS-2DS emission cuts over 4DS baseline: **62%**

**2-3 Wheelers**

- **2DS**
- **4DS**

2050 4DS-2DS emission cuts over 4DS baseline: **82%**
IEA 2DS level of ambitions – How can we move beyond?

**Trucks**

- **2DS**
- **4DS**

- **Gasoline ICE** (urban)
- **Diesel ICE** (urban)
- **CNG/LPG** (urban)
- **Hybrids** (urban)
- **Plug-in electric** (urban)
- **Electric** (urban)
- **Fuel cell** (urban)

2050 4DS-2DS emission cuts over 4DS baseline: **36%**

**Maritime transport**

- **Avoided demand**
- **Larger ships**
- **High efficiency: new ships**
- **High efficiency: Retrofits**
- **Switching to LNG (25% by 2050)**
- **Switching to biofuel (25% by 2050)**

Preliminary results of updated projections (higher 4DS, stabilization in 2DS)

2050 4DS-2DS emission cuts over 4DS baseline: **63%**

© OECD/IEA, 2016
IEA 2DS level of ambitions – How can we move beyond?

**Aviation**

“the only global industry-wide body to bring together all aviation industry players so that they can speak with one voice”

**Stabilise**

From 2020, net carbon emissions from aviation will be capped through carbon neutral growth.

**50%**

By 2050, net aviation carbon emissions will be half of what they were in 2005.


IEA 2DS reflects ATAG goals without taking into account of any offset

2050 4DS-2DS emission cuts over 4DS baseline: **78%**

**Cross-cutting Technologies**

- Biofuels
- Hydrogen

**Non-Technology Options**

- Modal Shifts
- Urban Design/Logistics
## Implementing actions

<table>
<thead>
<tr>
<th>Scope</th>
<th>Policy category</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Avoid/Shift Vehicle efficiency Low carbon fuels</td>
</tr>
<tr>
<td>Local</td>
<td>Pricing (congestion charges, tolls parking fees)</td>
<td>Possible</td>
</tr>
<tr>
<td></td>
<td>Regulatory (access &amp; parking restrictions, low emission zones)</td>
<td>Possible Minor</td>
</tr>
<tr>
<td></td>
<td>Public transport investments</td>
<td>Possible</td>
</tr>
<tr>
<td></td>
<td>Compact city</td>
<td>None</td>
</tr>
<tr>
<td>National</td>
<td>Fuel taxation</td>
<td>Possible</td>
</tr>
<tr>
<td></td>
<td>Fuel economy regulations</td>
<td>Possible</td>
</tr>
<tr>
<td></td>
<td>Vehicle taxation, feebates</td>
<td>Possible Possible</td>
</tr>
<tr>
<td></td>
<td>Low carbon fuel standards</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Alternative fuel mandates</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>RD&amp;D support</td>
<td>None</td>
</tr>
</tbody>
</table>
Sustainable Transport Systems analysis: the IEA Mobility Model and ETP

- Foundation of transport-related analysis in the IEA
- Projections to 2050+, 29 global regions (including most of G20), all transportation modes except pipelines
- Assess urban and non-urban activity, energy use, emissions (GHG, pollutants), infrastructure and materials demand
- Shared with OECD Directorates (TAD), ITF
- Developed in the framework of a partnership with major industrial and governmental stakeholders, some academic institutions and NGOs (MoMo partnership)
Sustainable Transport Systems analysis: the IEA Mobility Model and ETP

- **ETP uses ASIF (activity–structure–intensity–fuel) methodology**
  - Activity = Distance travelled
  - Structure = Vehicle Stock
  - Intensity = Fuel Economy

---

**Activity**: Distance travelled
**Structure**: Vehicle Stock
**Intensity**: Fuel Economy
IEA data coverage and transparency – Understanding energy use patterns

Fuel use in Argentina

Diagram showing trends in road transport energy use from 1970 to 2009 for different fuel types: Energy Use (ktoe), Gasoline, Diesel, CNG, ESD official Stats.
IEA data coverage and transparency – Understanding energy use patterns

Fuel use in China

- Energy Use (ktoe)
- Gasoline
- Diesel
- CNG
- LPG
- Biogasoline
- Biodiesel
- Electricity
- ESD official Stats
- Gasoline
- Diesel
- CNG
- LPG
- Biogasoline
- Biodiesel
- Electricity

© OECD/IEA, 2016
The IEA works around the world to support an accelerated clean energy transition that is enabled by real-world SOLUTIONS supported by ANALYSIS and built on DATA.
Thank you

Explore the data behind ETP

www.iea.org/etp  www.iea.org/statistics
Looking at interactions between energy technologies

- **Flexible uses in conversion sector**
  - Fuel supply
    - Fossil supply
    - Nuclear supply
  - Renewable supply
  - Electricity plants (only)
    - Fossil
    - Nuclear
    - Variable renewables
    - Dispatchable renewables
  - Public CHP & heat plants
    - Fossil
    - Renewables
  - Autoproducer CHP and heat plants
    - Fossil
    - Renewables
  - Energy storage
    - Pumped storage
    - CAES
    - District heat storage
    - Process heat storage
    - Elec. DH boilers
    - H2 electrolysis + storage

- **Technical and economic characteristics**
  - Fuel costs
  - Potential
  - Fuel demand
  - Generation mix
  - New capacities
  - Emissions
  - Electricity prices
  - Average generation costs

- **Demand side management**
  - Transport DSM
    - Rail
    - EV/PHEV
  - Buildings DSM
    - Elec. appliances
    - Elec. water boiler + storage
    - Heat pumps
  - Industry DSM
    - Chloralkali electrolysis
    - Aluminium electrolysis
    - Electric arc furnace
    - Compressed air

- **Load curves**
  - Electricity and heat demands