Transport’s Role in the Decarbonization Process

Implications of Paris Research and Workshop Series
Trondheim, Norway
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David McCollum (IIASA)
Mitigation burden of transport sector impacts, and is impacted by, mitigation elsewhere in the system.

~2 °C || including CCS

450 ppm CO₂(eq) with Carbon Dioxide Capture & Storage

Source: IPCC AR5 WG3, Figure SPM.7
Transport mitigation burden could either be light or heavy before 2050.

~2 °C || no CCS

450 ppm CO$_2$eq without Carbon Dioxide Capture & Storage

Source: IPCC AR5 WG3, Figure SPM.7
Breakdown of global transport GHG emissions

Source: IPCC AR5 WG3, Figure 8.1

Road transport
(mostly passenger, but freight growing quickly)

Rail transport

Air transport

Water transport

Source: IPCC AR5 WG3, Figure 8.1
The ‘legs of the stool’ represent the different ‘levers’ available for reducing transport GHGs.

Source: https://www.fhwa.dot.gov/environment/sustainability/energy/workshops_and_peer_exchanges/seattle_10_2008/gccseattle.cfm
Which ‘levers’ hold the biggest potential, or could/should be pulled hardest? …not entirely clear…

Results from the iTEM global transport-energy model comparison (Yeh et al., 2016)

- ‘Economics-based’ IAMs (GCAM and MESSAGE) favor low-carbon fuels. [endogenous]
- ‘Expert-based’ transport-only models (MoMo and Roadmap) favor vehicle efficiency improvements. [exogenous]
- Changes in activity / behavior (mode-shifting, demand avoidance) are more pronounced in MoMo and Roadmap.
- MoMo and Roadmap see the transport sector bearing a greater mitigation burden than GCAM and MESSAGE.
Are efficiency standards for passenger LDVs stringent enough? … perhaps so …

Results from the iTEM global transport-energy model comparison (Yeh et al., 2016)

- **USA fleet (iTEM, 2030):** 2.2 MJ/km (1.8 – 2.8)
- **China fleet (iTEM, 2030):** 1.7 MJ/km (1.5 – 2.0)
- **USA fleet (iTEM, 2050):** 1.7 MJ/km (1.3 – 2.3)
- **China fleet (iTEM, 2050):** 1.4 MJ/km (1.1 – 1.7)

Solid lines: historical performance
Dashed lines: enacted targets
Dotted lines: proposed targets or targets under study

[1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered.
[2] The U.S. standards are fuel economy standards set by NHTSA, which is slightly different from GHG standards due to A/C credits.

**Source:** the ICCT: „Global Comparison: Light-duty Fuel Economy and GHG“ (May 2014 update, http://transportpolicy.net/)
Trump to Undo Vehicle Rules That Curb Global Warming

By CORAL DAVENPORT  MARCH 3, 2017
Electric-drive vehicles (BEVs, PHEVs, FCVs) are a means for getting low-carbon e- and H₂ into the mix

- Governments across the world have set ambitious targets for EVs. (Collectively, by 2025, sales of ~7 million per year, or ~30 million cumulative stock … compared to >1000 million passenger vehicles globally at present)
- Automakers also have big plans. (e.g., VW Group has pledged that BEVs will comprise 20-25% of its annual sales by 2025; 2-3 million per year.)
- A consortium of companies, governments, and other organizations announced at the 2015 United Nations Climate Change Conference (COP 21) the “Paris Declaration on Electro-Mobility and Climate Change and Call to Action”.

Paris Declaration on Electro-Mobility and Climate Change
& Call to Action
Lima – Paris Action Agenda

Transport contributes almost one-quarter (23 percent) of the current global energy-related greenhouse gas (GHG) emissions and is growing faster than any other energy end-use sector. GHG emissions from transport are anticipated to rise from today’s levels by nearly 20 percent by 2030 and close to 50 percent by year 2050 unless major action is undertaken.

Limiting the global temperature increase to below 2 degrees Celsius requires changing this transport emissions trajectory, which involves the development of an integrated electromobility ecosystem encompassing various transport modes, coupled with the low-carbon production of electricity and hydrogen, implemented in conjunction with broader sustainable transport principles.

Stated targets:
- 100 million electric-drive LDVs by 2030 (~2 million today)
- 400 million electric-drive 2/3-wheelers by 2030 (~230 million today)

Source: http://newsroom.unfccc.int/media/521376/paris-electro-mobility-declaration.pdf
75% of NDCs explicitly identify transport as a mitigation source (among 160 NDCs, 2016-Aug-01)
63% propose transport mitigation measures
9% include transport emission reduction targets
12% include assessments of country-level transport mitigation potential
Strong bias toward passenger transport: included in 91% of NDCs identifying specific transport modes, while freight is only in 29%.
High-speed rail (2%), aviation (5%), and walking and cycling (14%) receive less attention.
High-income countries => vehicle eff. standards and biofuels/elec/H2
Low/middle-income countries => [eff./fuels] + public transport, vehicle import restrictions, ‘green’ freight

Source: http://www.ppmc-transport.org/overview_indcs/
Based on analyses by SLoCaT, Ricardo, GIZ, and German BMUB
Transport and the UN’s Sustainable Development Goals (SDGs)

1. No Poverty
2. Zero Hunger
3. Good Health and Well-Being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals

Road traffic accidents
Air quality
Energy efficiency
Public transport
Reliable/resilient infrastructure
Transport (fossil) fuel subsidies

Source: https://sustainabledevelopment.un.org/
Potential topics for discussion

• Electrification of transport
• NDCs
• SDGs (multiple objectives)
• Travel activity and behavior
  – Urban planning and land use
  – Sharing economy and autonomous vehicles
• Non-LDV sectors
• Freight transport
• Emerging/developing country considerations
• Policy and financing
  – What to subsidize? How much? And for how long?
“The automobile has been perfected. No further improvements are necessary.”

-- Allgemeine Automobil Zeitung of Berlin, 1921

Flying cars courtesy of a Dutch manufacturer (reserve yours now)

Flying (drone) taxis in Dubai (coming July 2017)
Questions?
Comments?

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