Achievements, strategies and further needs in (global) political discussions

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Agenda

- Global trends

- Strategies for climate mitigation

- Policy measures for climate mitigation of transport

- What about the changing mobility behaviour?

- Turning the right corner – developing world
Study expectations of global mobility until 2030

- Doubling of number of annual air passengers from 2.7 billion in 2011 to more than 6 billion in 2030 (ICAO)

- Doubling of annual flights from 30 million to 60 million until 2030 (ICAO)

- More than doubling of the global fleet of automobiles to 2000 million vehicles up from 700 million ("2 Billion Cars")

Source: Sperling/Gordon 2009.
Strategies for climate mitigation
The EU27 GHG emissions of transport

All originating transport

Only domestic transport

Source: GHG-TransPoRD after EEA 2011
Theoretical technical GHG mitigation potentials

Analytic approach:

- Common energy framework
- Long list of potential measures
- Short list of promising measures
- GHG reduction potentials by mode:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Type of measures</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>Technical cars*</td>
<td>-40 to -45%</td>
<td>-60 to -68%</td>
</tr>
<tr>
<td></td>
<td>Technical trucks</td>
<td>-30 to -36%</td>
<td>-57 to -63%</td>
</tr>
<tr>
<td></td>
<td>Urban measures**</td>
<td>-43%</td>
<td>-70%</td>
</tr>
<tr>
<td></td>
<td>National policies***</td>
<td>-40%</td>
<td>-70%</td>
</tr>
<tr>
<td>Rail</td>
<td>Technology non-urban traffic</td>
<td>-10%</td>
<td>-42%</td>
</tr>
<tr>
<td></td>
<td>Technology urban traffic</td>
<td>-8%</td>
<td>-55%</td>
</tr>
<tr>
<td>Air</td>
<td>Technology &amp; policy</td>
<td>-15%</td>
<td>-41%</td>
</tr>
<tr>
<td>Shipping</td>
<td>Technology &amp; policy</td>
<td>-5%</td>
<td>-20 to -25%</td>
</tr>
<tr>
<td>Biofuels</td>
<td>Technology****</td>
<td>-20%</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Source: GHG-TransPoRD D2.1, http://www.ghg-transpord.eu
GHG-TransPoRD assessment approach

- Model-based integrated assessment – quantitative:
  - ASTRA-POLES (linked transport-energy system until 2050)
  - TREMOVE (details until 2030), MARS (urban transport)
- Stepwise scenario building and testing
  - Technology based scenarios
  - Classical transport policies added (e.g. pricing)
  - Ambitious regulation added (e.g. ban conventional cars 2035)
- In 2050 electricity system must be built on >80% renewable electricity share
Recommended EU Policy strategy (GHG-TransPoRD)

- First, capture fast the energy efficiency potentials and then focus on the carbon-free energy potentials.
- Fast development of efficiency technology - NOW
- Alternative engine technologies able to use renewable electricity – test now, massive deployment 2020+
- Ambitious policy-making in terms of pricing
  - to counterbalance rebound effects
  - to maintain financial stability of government transport revenues
- Regulation phasing out fossil fuel cars around 2035
- Moderate modal-shift from road towards more energy efficient modes
- Adaptation of the electricity system to become largely renewable based
Impacts of policy strategy - decomposition

ASIF decomposition analysis

European car fleet by technology

Source: Fraunhofer ISI, GHG-TransPoRD analysis
Feasible transport GHG mitigation targets in EU (www.ghg-transpord.eu)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Compared with reference scenario</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2020</td>
<td>2030</td>
<td>2050</td>
</tr>
<tr>
<td>Road</td>
<td>Passenger</td>
<td>-20% to -30%</td>
<td>-40% to -55%</td>
<td>-70% to -85%</td>
</tr>
<tr>
<td></td>
<td>Freight</td>
<td>-10% to -20%</td>
<td>-30% to -45%</td>
<td>-40% to -60%</td>
</tr>
<tr>
<td>Air</td>
<td></td>
<td>0% to -5%</td>
<td>-10% to -20%</td>
<td>-40% to -55%</td>
</tr>
<tr>
<td>Ship</td>
<td></td>
<td>(+15% to 0%)</td>
<td>(+30% to 0%)</td>
<td>(+50% to -20%)</td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td>+10% to -10%</td>
<td>0% to -20%</td>
<td>-10% to -35%</td>
</tr>
<tr>
<td>Transport (excl. ship)</td>
<td></td>
<td>-10% to -20%</td>
<td>-40% to -50%</td>
<td>-70% to -90%</td>
</tr>
</tbody>
</table>

Compared with 1990 GHG emission level

| Transport | +10% to +5% | -20% to -30% | **-60% to -70%** |

Source: GHG-TransPoRD D7.1
Acknowledgements: ISI, TRT, TML, IPTS, ITS
Policy process and policy measures for GHG mitigation in Germany (and the developed world)
Policy scenarios for climate mitigation IV (also reporting to UNFCCC)

<table>
<thead>
<tr>
<th>Policy Measure</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Savings of CO2 against reference scenario [Mt CO2]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eco-tax escalator 1999-2003 (+3ct/l/year)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Commuting subsidy only for commute distances above 20 km (i.e. no tax deduction below 20 km)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Voluntary agreement of average CO2 emissions of new cars in Europe: 140 gCO₂/km until 2008</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Heavy goods charge on German motorways (HGV &gt; 12t)</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Binding use of low resistance tyres and ultrafluid lubricants in cars (100% use in new cars by 2010, 100% use in fleet by 2020)</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Binding CO2 standards for EU new car fleet: target 2012 130 gCO₂/km, target 2030 100 g CO₂/km bis.</td>
<td>1</td>
<td>7</td>
<td>11</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

Source: Fraunhofer ISI estimates
## Policy scenarios for climate mitigation VI (also reporting to UNFCCC)

<table>
<thead>
<tr>
<th>Policy Measure</th>
<th>Start Year</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclusion of air transport into EU-ETS (EU directive)</td>
<td>2012</td>
<td>0.5</td>
<td>0.6</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>German ticket tax on flights from / to German airports</td>
<td>2011</td>
<td>1.7</td>
<td>1.9</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>ICAO efficiency target (1.5% p.a., up from 1% p.a.)</td>
<td>2011</td>
<td>0.8</td>
<td>1.8</td>
<td>3.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Kerosene tax of 30.2 ct/l on all flights starting in Germany (PSz-IV)</td>
<td>2013</td>
<td>11</td>
<td>14</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>German strategy e-mobility (1 mill. EV in 2020, 6 mill. In 2030)</td>
<td>2011</td>
<td>0.3</td>
<td>0.7</td>
<td>1.8</td>
<td>4.5</td>
</tr>
</tbody>
</table>

**Savings of CO2 against reference scenario [Mt CO2]**

Source: Fraunhofer ISI estimates

Changing mobility behaviour - new mobility concepts
Changing mobility behaviour – not only niches!

OLD Behaviour

MONOMODAL MOBILITY

Day 1

Day 2

Day 3

NEW Behaviour

MULTIMODAL MOBILITY

Day 1

Day 2

Day 3

INTERMODAL MOBILITY

Day 1

Day 2

Day 3

Day 3

Day 2

Day 1
Innovation Indicator: market formation (Germany)
Exponential growth of car-sharing

Quoted in Schade/Krail/Kühn 2014
Innovation indicator: entrepreneurial activity – competition

- Berlin: competition of 10 car-sharing operators (examples)

- Paris: AutoLib/Bolloré versus Car2Go/Daimler (competing tenders)
When will mobility services replace 25% of private car sales?

Experts DNA digital
- Until 2014: 5%
- 2015 to 2019: 31%
- 2020 to 2024: 17%
- 2025 to 2030: 9%
- Later than 2030: 16%
- Never: 13%

Further experts
- Until 2014: 1%
- 2015 to 2019: 7%
- 2020 to 2024: 24%
- 2025 to 2030: 18%
- Later than 2030: 13%
- Never: 6%

Experts USA
- Until 2014: 0%
- 2015 to 2019: 19%
- 2020 to 2024: 16%
- 2025 to 2030: 6%
- Later than 2030: 67%
- Never: 43%

Experts EU
- Until 2014: 0%
- 2015 to 2019: 10%
- 2020 to 2024: 25%
- 2025 to 2030: 15%
- Later than 2030: 52%
- Never: 31%

Experts Germany
- Until 2014: 0%
- 2015 to 2019: 25%
- 2020 to 2024: 16%
- 2025 to 2030: 6%
- Later than 2030: 19%
- Never: 16%

Quoted in Schade/Krail/Kühn 2014
Fifth Mode: multi-modal, integrated, seamless transport (VIVER vision)

New electric personal transporters (PT)

Reservation Usage Information Billing

SmartPhone Tablet-PC

Roaming between providers

PT / Bike-sharing

Car-sharing

Electric city, vehicles

Ride-sharing

Modern public transport

Quellen: privat, Unternehmens-Website
Market expectations on new mobility services

Global market of mobility services 2020 (car related)

- Product Focused Manufacturer (PFM): 35%
- Service Focused Manufacturer (SFM): 10%
- Basic Mobility Provider (BMP): 44%
- Mobility Service Provider (MSP): 11%

Source: A.D.Little, Zukunft der Mobilität 2020
Global vehicle sales affected by new mobility concepts

TRIAD

BRICS

Global sales (mio.)

Source: Schade et al. „Sieben Herausforderungen für die deutsche Automobilindustrie“ (2014)
What about the developing world?
Commonalities and differences of developing world

Common measures:
- Efficiency standards
- Public transport – possibly also new mobility concepts (sharing bus rides is common, yet)
- Electric vehicles – maybe in future low cost 4-seater Evs (today electric scooters)

Specific measures (more in World Bank: turning the right corner):
- Abolishing fuel subsidies
- Make use of substantial co-benefits of transport measures (air pollution, GHG and noise)
- Lower path dependence on existing infrastructure (leapfrog)
Conclusions and outlook

- Measures for GHG mitigation are there – barriers are also there

- Ambitious global vehicle standards most important – not race to the bottom
- A realistic measurement cycle for vehicle emissions / efficiency

- New mobility concepts will make a contribution – but how much?

- Air transport – global cooperation needed for real progress – unilateral steps possible

- Shipping – not to be forgotten – slow steaming = low hanging fruit

- Alternative: mitigation by the next global economic crisis – we can not want that
Contact

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Fax: +49 721 6809 135
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## Measuring the functions of TIS

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge Development &amp; Diffusion</strong></td>
<td>Desktop/Assessment/Feasibility studies on the technology, Workshops, Conferences</td>
<td>R&amp;D projects; patents; R&amp;D investments, no.of workshops; conferences</td>
<td>Bibliometrics; number, size and orientation, patents; learning curves</td>
<td>Studies, laboratory trials, pilots, prototypes developed, Conferences, workshops, alliances between actors, joint ventures</td>
</tr>
<tr>
<td><strong>Guidance of the Search</strong></td>
<td>Positive expectations of the technology; Government regulations, Negative expectations of the technology; Expressed deficit of regulations</td>
<td>Targets set by governments; no. press articles that raise expectations</td>
<td>Belief in growth potential; incentives from taxes (factor prices); regulatory pressure; expression of interest of leading customers</td>
<td>Expectations, promises, policy targets, standards, research outcomes</td>
</tr>
<tr>
<td><strong>Entrepreneurial Experimentation</strong></td>
<td>Project started/stopped</td>
<td>No. new entrants; no. diversification activities of incumbents; no. experiments</td>
<td>No of new entrants, number of different types of applications, breadth of technologies used, character of complementary technologies employed</td>
<td>Projects with a commercial aim, demonstrations, portfolio expansions</td>
</tr>
<tr>
<td><strong>Market formation</strong></td>
<td>Specific favorable tax regimes and environmental standards</td>
<td>No. niche markets; specific tax regimes; environmental standards</td>
<td>Market size; customer groups; actor strategies; role of standards; purchasing processes; lead users</td>
<td>Market regulations, tax exemptions, events supporting niche markets</td>
</tr>
<tr>
<td><strong>Legitimation</strong></td>
<td>Lobby activities for the technology; Support of technology by government, industry, Lobby activities against the technology; Expressed lack of support by government, industry</td>
<td>Rise and growth of interest groups and their lobby actions</td>
<td>Alignment with current legislation; standards; visions and expectations; depiction in newspapers</td>
<td>Coalitions, Lobbies, advice</td>
</tr>
<tr>
<td><strong>Resource Mobilization</strong></td>
<td>Subsidies, investments for the technology; Expressed lack of subsidies, investments</td>
<td>Whether or not inner core actors perceive resource access as problematic</td>
<td>Rising volume of capital, increasing volume of seed and venture capital, changing volume and quality of human resources, changes in complementary assets.</td>
<td>Subsidies, investments, infrastructure development</td>
</tr>
<tr>
<td><strong>Development of positive externalities</strong></td>
<td></td>
<td></td>
<td>Political power; resolution of uncertainties; pooled labor market; specialized intermediaries; information flows</td>
<td></td>
</tr>
</tbody>
</table>
What do we need for this system transition? (not a prioritisation)

- Technology
  - New types of vehicles – small, silent, efficient electric urban vehicles
  - New ICT front-end technology – Apps and smartphones/wearables
  - New ICT back-end technology – time tables, payment systems, interfaces, big data

- Infrastructure
  - True multi-modal hubs
  - Space for public sharing stations

- Organisation
  - Sharing economy – car-sharing, bike-sharing, ride-sharing
  - New business models – Automotive industry, public transport, insurances, etc.

- Behavioural change
  - Multi-modal behaviour – flexibility and comfort
  - Social media – mass trust

- Regulation
  - Privacy, roaming, public-restricted parking, etc.
Berlin: diversity of car-sharing!

Innovations