DE.CA.rbonize Transportation

The German-Californian Conference for Zero Emission Transportation

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Executive Director, Agora Verkehrswende

Berlin, January 30, 2018
The former State Council Building already observed a couple of revolutions...
'Dieselstraße‘ in Berlin: A Symbol for the Transport Transformation in Germany?
What happens, if nothing gets done.
The G20 is responsible for the lion’s share of energy consumption and transport related greenhouse gases

CO2 emissions from the transport sector 1990 – 2014

Source: Own illustration based on data from IEA
The G20 is responsible for the lion’s share of energy consumption and transport related greenhouse gases

G20 per capita emissions and change in the transport sector

Note: the size of bubbles indicates total emissions from the transport sector

Source: Authors’ figure based on data from IEA (2016) and World Bank (2017)
Transforming Transport is key to delivering on the Paris Agreement

Transport sector emissions: business-as-usual and required reductions under 2°C and 1.5°C scenarios

Source: Authors’ figure, historic emissions based on data from IEA (2016), projections based on data from Gota et al. (n.d.).

Note: Simplified illustration based on historic levels and projected 2050 levels. Individual scenarios are likely to peak around 2020 and then decrease emissions at higher rates afterwards.
Transforming the transport sector is crucial for the success of the clean energy transition.
In the past 25 years the Transport Sector in Germany could not contribute to CO₂ Emission Reductions.

Relative Development of Greenhouse Gas Emissions for different Sectors since 1990

Source: Agora Verkehrswende
Federal Climate Protection Plan 2050: The *Verkehrswende* is an official goal of the Government.

For the first time ever the German transport sector has an own ambitious emission reduction target.

### National Sectoral Climate Protection Goals

*Emission reduction since 1990 and plan for the next 14 years (in mio. tons of CO₂)*

<table>
<thead>
<tr>
<th>Sector</th>
<th>1990</th>
<th>2014</th>
<th>2030</th>
<th>2030 min</th>
<th>2030 max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1248</td>
<td>902</td>
<td>543–562</td>
<td>175–183</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>446</td>
<td>358</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>209</td>
<td>119</td>
<td></td>
<td>70–72</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>163</td>
<td>160</td>
<td></td>
<td>95–98</td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>283</td>
<td>181</td>
<td></td>
<td>140–143</td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>88</td>
<td>72</td>
<td></td>
<td>58–61</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Agora Verkehrswende*
The potential contribution of the EC proposal for the CO₂ car regulation beyond 2020.

Source: Agora Verkehrswende
The ‘Verkehrswende 2050’ will be enabled by the Mobility Transition and the Energy Transition in Transport.

TRANSPORT TRANSFORMATION
This large-scale transformation will ensure that transport is carbon neutral by 2050.

MOBILITY TRANSITION
The transition to sustainable mobility will reduce energy consumption without limiting mobility.

ENERGY TRANSITION IN TRANSPORT
The transition to clean energy in the transport sector will cover remaining demand with carbon-neutral energy.

Source: Agora Verkehrswende
In cities, the mobility transition has already begun.
Shanghai between 1985 and 2010. Makes you humble...
The Challenges of Sustainable Urban Transport go far beyond Decarbonisation.

Traffic Tetris in Metropolis around the World.

→ Reduce **Land Consumption**.
→ Improve **Air Quality**.
→ Reduce **Congestion**.
→ Improve **Road Safety**.
→ Reduce **Noise**.
→ Secure **Energy Supply**.

*Picture: Christian Hochfeld*
The Mobility Transition has already started in cities around the world...

- The interlinked public transport is the backbone of urban transport.
- Private transport becomes more public, public transport becomes more private.
- Fewer cars leave more space for other land use.
- Walking and cycling comes with high benefits for the city at lowest costs.
- Sustainable urban transport policy receives more political support.
The Mobility Alliance

- Public Transport
  - Suburban train
  - Underground
  - Tram
  - Bus
  - Taxi

- Non-motorised Transport
  - Bicycle
  - Pedestrians

- Collaborative Mobility
  - Carsharing
  - Ridesharing
  - Bikesharing

Source: Agora Verkehrswende
„What would Jesus Drive?“

It seems that he has already decided...

Source: Agora Verkehrswende
The bike is back in the kingdom of cars.
Driverless vehicles are ideal for shared use.
Trends and Potentials of Digitalisation in Transport

Optional Synergies between Automatisation, Collaborative Mobility and Connectivity

- Fuel consumption
- Space consumption
- Vehicle stock
- Traffic accidents
- Cost of mobility
- Vehicle kilometers traveled
- Emissions

Source: Agora Verkehrswende
Shared Mobility and Penetration of New Technologies goes hand in hand!

Autonomous vehicles need collaborative mobility.

Even a Small Number of Driverless Cars Can Increase Traffic.

Usage forms and possible effects of vehicle automatisation

Source: Agora Verkehrswende
Electrification is key to an energy transition in transport.
Options for the 'post fossil' future of transport

Renewable energy from sun and wind replaces fossil fuels.

Source: Figure by INFRAS
The direct use of Electricity in LDV is the option with the lowest cost of decarbonisation for the national economy.

Accumulated Difference Costs for Technology Options 2050 compared to BAU.

Source: Öko-Institut, INFRAS, DVGW, im Auftrag UBA
The uncertain future of the Internal Combustion Engine

India to sell only electric cars by 2030
CNN, 03. Juni 2016

Norwegen will Benzin- und Dieselautos verbinden
SPIEGEL ONLINE, 16. August 2016

China schickt Benziner und Diesel auf den Schrott - offen ist nur noch der Zeitpunkt
stern, 11. September 2017

Frankreich will bis 2040 weg vom Verbrennungsmotor
ZEIT ONLINE, 06. Juli 2017

Österreich will ab 2030 keine Diesel- und Benzinautos mehr neu zulassen
FOCUS MONEY ONLINE, 07. August 2017

Auch Briten wollen Diesel und Benziner ab 2040 verbieten - und was macht Deutschland?
MANAGER MAGAZIN, 26. Juli 2017

Scotland to 'phase out' new petrol and diesel cars by 2032
THE INDEPENDENT, 05. September 2017

ZWEI ONLINE
Niederlande wollen Verkauf von Diesel- und Benzinautos verbieten
FOCUS ONLINE, 15. April 2016
Annual Electric Vehicles (EV) Sales by Country/Region.

In comparison: In total in 2016 ca. 81.5 Mio. LDV were sold. In China more than 250 Mio. E-Scooter are on the road.

20 Cities only account for 40% of the EV Sales worldwide.

These Cities represent 3% of the population and 8% of annual vehicles sales.

Tackling stock on G20 Sectoral Ambition

Development of gasoline prices in G20 countries 1995–2016

Source: Authors’ figure based on data from GIZ
Core options for the Energy Transition in Transportation (until 2050)

Core options for the Energy Transition in Transport by mode (until 2050)

- **LDV**
  - BEV as benchmark

- **HDV**
  - Preferential technology open

- **Bus**
  - BEV as benchmark

- **Aviation**
  - Power-to-Liquid as alternative to Biokerosene

- **Maritime**
  - PtX indispensable

- **Rail**
  - Complete electrification

Source: INFRAS/Quantis 2015.
Carbon-neutral fuels can supplement electricity from solar and wind.
Process steps for the production of hydrogen, PtG-methane and PtL-fuels from renewable energies

Source: Agora Verkehrswende
Electricity demand from renewable energies for different propulsion and fuel combinations (per 100 km/passenger car)

<table>
<thead>
<tr>
<th>Energy Demand</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 kWh</td>
<td>Battery electric vehicle + direct use of electricity</td>
</tr>
<tr>
<td>31 kWh</td>
<td>Fuel cell electric vehicle + hydrogen</td>
</tr>
<tr>
<td>93 kWh</td>
<td>Combustion engine vehicle + “Power-to-Gas”</td>
</tr>
<tr>
<td>103 kWh</td>
<td>Combustion engine vehicle + “Power-to-Liquid”</td>
</tr>
</tbody>
</table>

Source: own calculation and illustration, DLR, Ifeu, LBST, DFZ (2015), p. 15
Sustainable Logistics: Means more than clean vehicles!

Picture: nullplus/photocase.de
Food for thought: How to decarbonize aviation?
Thank you very much for your attention!

Comments or Questions? – Please do not hesitate to contact me:

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