Agora Verkehrswende: Transforming Transport to Ensure Tomorrow’s Mobility.

12 Insights into the Verkehrswende

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Executive Director, Agora Verkehrswende

Climate Action in Transport Conference
September 19, 2017
Die Dieselstraße in Berlin-Neukölln: Symbol for the *Verkehrswende* in Germany?
The German Transport System in a World of Climate Change

Berlin (Gleimtunnel), July 2016

Foto: Jörg Carstensen, PictureAlliance
Agora Verkehrswende – Transforming Transportation

Who we are.

→ Initiative by Stiftung Mercator and European Climate Foundation
→ Independent Think Tank and high-level Council of Agora
→ Project Duration: 2016 – 2018
→ Mission: Scenarios, Discourse and Strategies for the Decarbonisation of Transport until 2050
→ Focus: starting with national land-based transport in Germany in an European context
Agora Verkehrswende – Transforming Transportation

How we work.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Team of Agora Verkehrswende</th>
<th>Council of the Agora</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Director</td>
<td>Impulse</td>
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<td></td>
<td>Mobility Revolution</td>
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<td>Energy Transition in Transport</td>
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<td></td>
<td>Central Services</td>
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</tbody>
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Regular exchange on projects with temporary task forces

Studies, Events etc.

Internal exchange with standing members of the Council of Agora Verkehrswende

Source: Agora Verkehrswende
The Council of Agora Verkehrswende

The Council is chaired by Achim Steiner, former Under Secretary General of UN and former Executive Director of UNEP.

**Policy:**
- EU-COM; 5 national ministries; main parliamentary groups; 2 federal states; 2 city mayors; 2 Governmental agencies

**Economy:**
- BMW; DB; DP-DHL; innogy; Robert Bosch; Siemens; VW; VDV

**Civil Society & Science:**
- German Automobile Association; Consumer Association; 3 environmental NGOs; Labor Union; 3 academics

*The full list of the council members under:*
www.agora-verkehrswende.de
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
From Laboratory to Road: Missing Link for Climate Protection in Road Transport

Divergence between real-world and manufacturers# type approval CO2 emissions values

Source: ICCT 2016.
For the first time ever the German transport sector has an own ambitious emission reduction target.

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

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

Source: Agora Verkehrswende
The *Verkehrswende* will be enabled by the Mobility Revolution and the Energy Transition in Transport.

**Verkehrswende**

The *Verkehrswende* enables the German transport sector to be carbon neutral by 2050.

**Mobilitätswende**

The *Mobility Revolution* reduces the energy consumption of the German transport sector based on Avoid, Shift and Improve.

**Energiewende im Verkehr**

The *Energy Transition in Transport* covers the remaining energy demand of the German transport sector with renewable energy.

Source: Agora Verkehrswende.
In Cities, the Mobility Transition has already begun.
Agora Network Urban Verkehrswende (Transport Transformation)
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
Shared Mobility and Penetration of New Technologies goes hand in hand!

Autonomous vehicles need collaborative mobility.

intense use  ➞  shorter life cycle  ➞  rapid fleet renewal  ➞  new technologies  ➞  less CO₂ emissions

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
Even a Small Number of Driverless Cars Can Increase Traffic.

Usage forms and possible effects of vehicle automatisation

**Autonomous vehicles**

- **Shared use**
  - Autonomous vehicles are used in car-sharing and ridesharing fleets. Car occupancy increases.

- **Multimodal use**
  - Autonomous fleets complement public and non-motorised transport.
    - Vehicle kilometres traveled
    - Vehicle ownership
    - Space consumption
    - Emissions

- **Monomodal use**
  - Autonomous fleets substitute public and non-motorised transport.
    - Vehicle kilometres traveled
    - Vehicle ownership
    - Space consumption
    - Emissions

- **Private ownership**
  - Autonomous vehicles are used more frequently and over longer distances. Car occupancy decreases.
    - Vehicle kilometres traveled
    - Vehicle ownership
    - Space consumption
    - Emissions

*Source: Agora Verkehrswende*
Autonomous vehicles will have to be shared vehicles.

Scenarios for monomodal and multimodal usage of autonomous vehicles

**Business-as-Usual Scenario**
20th Century Technology
Through 2050, we continue to use vehicles with internal combustion engines at an increased rate, and use transit and shared vehicles at the current rate, as population and income grow over time.

**2 Revolutions (2R) Scenario**
Electrification + Automation
We embrace more technology. Electric vehicles become common by 2030, and automated electric vehicles become dominant by 2040. However, we continue our current embrace of single-occupancy vehicles, with even more car travel than in the BAU.

**3 Revolutions (3R) Scenario**
Electrification + Automation + Sharing
We take the embrace of technology in the 2R scenario and then maximize the use of shared vehicle trips. By 2030, there is widespread ride sharing, increased transit performance—with on-demand availability—and strengthened infrastructure for walking and cycling, allowing maximum energy efficiency.

**Number of Vehicles on the Road by 2050**
- 2.1 billion
  - 250 million vehicles

**CO2 Emissions by 2050**
- 4,600 megatones
- 1,700 megatones
- 700 megatones

Source: ITDP, UC Davis
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
Cumulative sales are now at 2.5 million and 3 million is looking to be likely by the end of 2017.

Source: ZEV Alliance 2017
From a National Economy Perspective Battery Electric Vehicles are the Option with lowest Transformational Costs.

Cumulative cost differences of technology options for decarbonisation in comparison to business-as-usual.

Source: Öko-Institut; INFRAS; DVGW, commissioned by UBA
Electricity demand from renewable energies for different propulsion and fuel combinations (per 100 km/passenger car)

- 15 kWh: Battery electric vehicle + direct use of electricity
- 31 kWh: Fuel cell electric vehicle + hydrogen
- 93 kWh: Combustion engine vehicle + “Power-to-Gas”
- 103 kWh: Combustion engine vehicle + “Power-to-Liquid”

Source: own calculation and illustration, DLR, Ifeu, LBST, DFZ (2015), p. 15
Process steps for the production of hydrogen, PtG-methane and PtL-fuels from renewable energies

Electricity from renewable energies → Electrolysis → Hydrogen (H₂) → Methanation → RE-methane

- RE-methane
- RE-petrol
- RE-diesel
- RE-kerosene

Source: Agora Verkehrswende
Core options for the Energy Transition in Transportation (until 2050)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Option</th>
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<tbody>
<tr>
<td>LDV</td>
<td>BEV as benchmark</td>
</tr>
<tr>
<td>HDV</td>
<td>Preferential technology open</td>
</tr>
<tr>
<td></td>
<td>?</td>
</tr>
<tr>
<td>Bus</td>
<td>BEV as benchmark</td>
</tr>
<tr>
<td>Aviation</td>
<td>Power-to-Liquid as alternative to Biokerosene</td>
</tr>
<tr>
<td>Maritime</td>
<td>PtX indispensable</td>
</tr>
<tr>
<td>Rail</td>
<td>Complete electrification</td>
</tr>
</tbody>
</table>

Source: INFRAS/Quantis 2015.
The decarbonisation of freight transport requires more cooperation between rail and (decarbonised) trucks!

Maximum potential in Germany to shift freight transport from road to rail.

Power Sector and Transport benefit from Sector Coupling.
The Transport Transformation will be driven by its Benefits to Society.
Transforming Transportation requires cooperation on the national and international level.

- Transforming Transportation is a joint effort.
- The increasing pressure on urban transport in emerging markets and developing countries drives innovation.
- Exchanging strategies and mutual learning can reduce the costs of the transformation.
- Emerging markets and developing countries can profit from new vehicle and fuel technologies.
Transforming Transport to Ensure Tomorrow’s Mobility
12 Insights into the Verkehrswende

Download link:
www.agora-verkehrswende.de/12-thesen/

English version available as of September 2017
Thank you very much for your attention!

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

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Agora Verkehrswende is a joint initiative of Stiftung Mercator Foundation and the European Climate Foundation (ECF).